Carnegie-Mellon University
Software Engineering Institute

STARS / Users Workshop: Final Report - Issues for Discussion Groups

Judy Bamberger, Editor

December 1990

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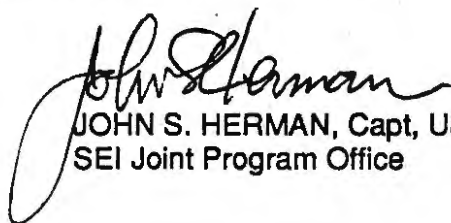Final Report

This technical report was prepared for the

SEI Joint Program Office
ESD/AVS
Hanscom AFB, MA 01731

The ideas and findings in this report should not be construed as an official
DoD position. It is published in the interest of scientific and technical
information exchange.

Review and Approval

This report has been reviewed and is approved for publication.

FOR THE COMMANDER

JOHN S. HERMAN, Capt, USAF
SEI Joint Program Office

This work is sponsored by the U.S. Department of Defense.

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STARS / Users Workshop: Final Report - Issues for Discussion Groups

Abstract. The STARS (Software Technology for Adaptable, Reliable Systems) Program is focused on providing the DoD software community with a software engineering environment, repository technology, and process models. This STARS Workshop was targeted toward increasing the communication between the STARS Program and the builders of software-dependent systems. This was the first of many public discussions hosted by the STARS Program. This workshop was hosted by the SEI.

The primary purposes of this workshop were:

- For organizations building software-dependent systems to review STARS Program goals, objectives, and progress and to provide input into the STARS Program plans.

- For the STARS Program to validate its goals, objectives, and plans.

The goals of the workshop were:

- To begin an on-going dialogue with the intended users of STARS products and technologies toward a shared vision for tools and environments to support large system development effectively.

- To validate STARS assumptions about the needs and requirements of organizations building large software-dependent systems.

The target audience of this workshop was those who specify, buy, and use environments to build and maintain large, operational software-dependent systems.

To this end, this workshop featured:

- A detailed description of the current direction and technical thrusts of the STARS Program, as well as the key issues/challenges facing it.

- Small discussion groups, focusing on current "hot topics" applicable to STARS, such as: reuse, process, software engineering environments, business practices, technology transition, and evaluation of STARS products and technologies.

- A STARS Program response to the issues raised by the workshop attendees during discussion groups.

This final report is the output from the workshop, and includes a written summary of the meeting, including discussion group reports and STARS Program responses.

Acknowledgements

The success of the September STARS/Users Workshop was due to the detailed preparations of the host (SEI) and the presenters, and to the hard work of the participants. The consolidated STARS plan would not have been as complete without the active participation of the three System Architects, Teri Payton (Unisys), Dick Drake (IBM), and Bill Hodges (Boeing), as well as John Foreman (SEI), Jim Henslee (ESD), and David Carney (IDA). Many other individuals, not directly involved in the STARS planning, also contributed significantly to the workshop success. Judy Bamberger, who coordinated the arrangements and schedule and created and managed the working groups, and Shirley Brooks who handled all the responses to the call for participation did an outstanding job. Andy Tsounos, Jo Donatelli, Dan Corletti, Jan Morgan, Dave Vavrek, and many others from the SEI Video studio, copy center, and Events staff are to be complimented for being so professional in spite of the fact that the SEI Affiliates Symposium was being held the same week. The Unisys Reston Publications staff of Micky Palmer, Huyen Bui, Debbie Davis, Rie Killian, Joni Owen, Richard Penergist, John Smith, Donna Stojanovich, and Dory Walker did an outstanding job of preparing the 35mm slides, transparencies, and handouts. Last, I would like to recognize the workshop participants whose participation made the workshop a success, and in particular the discussion group leaders, facilitators, and recorders, who were able to focus their groups and capture the good comments. It is clear that the STARS program will benefit from these efforts.

I. Reader's Guide

The STARS (Software Technology for Adaptable, Reliable Systems) Program of the Information Sciences Technology Office (ISTO) of the Defense Advanced Research Projects Agency (DARPA) hosted a workshop, sponsored by the Ada/STARS Program of the Software Engineering Institute (SEI), 10 - 11 September 1990 at the SEI, Pittsburgh PA. This STARS workshop was targeted toward increasing the communication between the STARS Program and the builders of software-dependent systems. The workshop was attended by about 100 participants from industry, government, and academia.

This final report contains all the material produced for and from the STARS/Users Workshop.

Hard copy and electronic application forms went out to SEI Affiliates, attendees at other environment workshops, SEI-maintained mailing lists relevant to the goals of the workshop, officers of national Ada and software engineering professional groups (AdaJUG and SIGAda); a post was made to relevant Internet and corporate bulletin boards. Applicants were to respond with a description of their interest in STARS and a list of issues they felt appropriate to discuss.

Appendix C contains a copy of the STARS/Users Workshop Application.

As the workshop was not over-subscribed, all attendees were accepted.

Copies of the following information was provided to all workshop attendees:

1. Final workshop agenda (Chapter II.1)
2. STARS Program presentations (Chapter II.2)
3. STARS Newsletters [1(1) and 1(2); *not included*]
4. Issues for Discussion Groups; *this is the basis for Part III of this report*
5. Acronyms (Appendix D)
6. Preliminary STARS Affiliates Program description (Appendix E)
7. List of STARS contact people and ESD contracts people (Appendix F)

Part III contains the issues and questions put to each discussion group, a summary of their recommendations, and the STARS Program response.

Appendix A contains a summary of the workshop critique forms, provided in each attendee's packet, that were returned.

Appendix B contains the list of workshop participants.

II. Information Provided to Attendees

This part of the STARS/Users Workshop final report contains the information presented by the STARS Program to the workshop attendees, both handouts and slides. In this report, each slide is accompanied by a near-transcription of the talk actually given at the workshop.

1. Final Workshop Agenda

STARS / USERS WORKSHOP
Dialogue with STARS Program Office and Primes

Monday - Tuesday, 10 - 11 September 1990
Software Engineering Institute / Mellon Institute
Pittsburgh PA 15213
412-268-7700

STARS/Users Registration and Help Desk

Shirley Brooks and other SEI employees will be staffing the STARS/Users Registration and Help Desk. This will be located in the 1st floor lobby of the SEI Monday morning, and it will move to the 2nd floor lobby of the SEI Monday afternoon and all day Tuesday. If you need extra supplies or local assistance, contact the folks at the Registration and Help Desk.

Messages

If someone needs to get in touch with you:

> Your name
> STARS/Users Workshop Registration
> 412-268-7700
> 412-268-5758 (FAX)

Messages/FAXes will be posted on the message board, located near the STARS/Users Registration and Help Desk.

Phones at the SEI

Two pay phones are available across from the security desk in the SEI 1st floor lobby. There will be an additional phone near the STARS/Users Registration and Help Desk. Please use this only for local, credit card, collect, or other "free" calls.

Facilities at the SEI

Each of floors 2 - 5 is set up the same:

- Bathrooms: Men's and women's bathrooms to the left and right of the elevators (as you face them);
- Copiers: Copy machine in the open area just to the left of the women's bathroom;
- Coffee/Kitchens: Coffee/kitchen area through the copy area and on the right.

First floor bathrooms are to the left and right of the elevators (as you face them). The first floor does not have a copy machine or coffee/kitchen area for general use. If you need any other supplies, please check with someone at the STARS/Users Registration and Help Desk.

Meetings at Mellon Institute, Tuesday, 11 September 1990

Tuesday morning and afternoon meetings are in the Mellon Institute Auditorium. Mellon Institute is shown on the Affiliate Symposium 1990 Session Locator Finder. It is about a 5-minute walk from SEI. From the front lobby of the SEI, on the Fifth Avenue side, go left, cross one street (Dithridge), on the left is a massive building with huge columns. That is Mellon Institute. Enter on the Fifth Avenue side (through the columns); walk straight back to the elevators on the left and right hand sides. Go down to the 2nd floor (the Main Lobby is on the 4th floor). When you leave the elevator, head toward the marble columns; and the Auditorium is right there (there is a sign you should see leaving the elevator).

Lunch, Tuesday, 11 September 1990

Lunch is with the Affiliates Symposium at the Syria Mosque Banquet Hall, lower level. The Syria Mosque is shown on the Affiliate Symposium 1990 Session Locator Finder. It is about a 10-minute walk from SEI. From the front lobby of the SEI, on the Fifth Avenue side, go left four blocks to Lytton; turn right on Lytton and walk up about one half block. The Holiday Inn is on the right; the Syria Mosque is on the left. You must have your badge to get into lunch.

STARS/User Shuttle Bus Schedule

The STARS/Users Workshop is providing free shuttle bus service between the Hyatt Pittsburgh and the SEI according to the following schedule:

> Monday, 10 September
> > Hyatt -> SEI: 7:30am
> > SEI -> Hyatt: 5:45pm
>
> Tuesday, 11 September
> > Hyatt -> SEI: 7:30am
> > SEI -> Hyatt: 4:15pm

MONDAY, 10 September 1990

    8:00am - 8:45am Registration and continental breakfast *[SEI Cafeteria]*

         *** SEI Auditorium ***

    8:45am - 9:00am Welcome and Overview (John Foreman, SEI)
    9:00am - 9:20am DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)
    9:20am - 9:50am STARS Program Overview (Jack Kramer, DARPA/ISTO)
    9:50am - 10:15am Reuse (Teri Payton, Unisys)
  10:15am - 10:45am BREAK *[SEI 2nd floor lobby area]*
  10:45am - 11:10am Process Management (Dick Drake, IBM)
  11:10am - 11:35am Software Engineering Environment (Bill Hodges, Boeing)
  11:35am - 12:05pm STARS Evaluation (John Foreman, SEI)
  12:05pm - 12:30pm Questions and Answers
  12:30pm - 2:00pm LUNCH *[on your own]*

         *** SEI Conference Rooms ***

    2:00pm - 5:30pm Discussion Groups
    4:00pm - 4:30pm BREAK *[SEI 2nd floor lobby area]*

    5:45pm   Busses depart for Hyatt Pittsburgh *[front of SEI]*

    6:00pm - 9:00pm Working dinner - initial feedback to STARS from
                       Discussion Group leaders *[SEI Room 4000]*

TUESDAY, 11 September 1990

         *** SEI Conference Rooms ***

    8:00am - 8:30am Continental breakfast *[SEI Cafeteria]*
    8:30am - 10:30am Discussion Groups (continued)
  10:30am - 11:00am BREAK *[SEI 2nd floor lobby area]*

         *** Mellon Institute Auditorium ***

  11:00am - 12:30pm Discussion Group Reports
  12:30pm - 2:30pm LUNCH *[Syria Mosque, banquet hall, lower level, with*
                       SEI Affiliates Symposium]
    2:30pm - 4:00pm Wrap-up - STARS initial responses to workshop issues

    4:15pm   Busses depart for Hyatt Pittsburgh *[front of SEI]*

**STARS/USERS WORKSHOP
OVERVIEW**

John Foreman
SEI
10 September 1990
(412) 268-6417
jtf @sei.cmu.edu

Good morning, my name is John Foreman. Welcome to the STARS/Users workshop. We're going to start on time, and hopefully, we're even going to be punctual to the schedule this morning.

STARS/USERS WORKSHOP OVERVIEW
TOPICS

- Workshop Purposes and Goals
- Agenda/Overall Workshop Flow
- Discussion Groups
- Workshop Products/Results

This particular session is the overview to the whole workshop, so I'll spend a couple of minutes talki[ng] about purposes and goals, what our overall agenda and flow through the workshop is going to be. W[e'll] talk a little bit about discussion groups, and lastly, I'll talk a little bit about workshop products and re[sults.]

Purposes:

- For organizations building software-dependent systems to review STARS Program goals, objectives, and progress and to provide input into STARS plans

- For the STARS Program to validate its goals, objectives, and plans

Goals:

- To begin an *on-going dialogue* with the intended users of STARS products and technologies toward a shared vision for tools and environments to support large system development effectively

- To validate STARS assumptions about the *needs and requirements* of organizations building large software-dependent systems

As far as workshop purposes and goals, you've seen these before, I hope, if you read through the initial solicitation to attend this particular event. Basically what we're trying to do here today, is to get your feedback on the STARS programs goals, objectives, and progress; and on the round of planning that we have been doing for the last 2 to 3 months. That's basically what the first purpose statement says. The STARS program also wants to validate that its goals, objectives, and plans make sense to you, the prospective users of STARS products and technologies. Going along with that, and Dr. Barry Boehm will talk more about this later, we view this as the first in a series of ongoing workshops, and like the first goal says, we want to establish an ongoing dialogue with the prospective user community. We're also interested in validating STARS' assumptions about the needs and requirements of organizations that build large software dependent systems.

- Workshop Purposes and Goals
- Agenda/Overall Workshop Flow
- Discussion Groups
- Workshop Products/Results

Okay, the next thing I'll do is talk about the agenda and the overall workshop flow, but before I go into detail on this particular slide, let me talk a little bit about the information packet that you received at the registration desk. There is a lot of information in there starting of course with the agenda, and copies of the various slides. In addition to that your working group assignments are specified in there, and maps of the SEI, so that you can find the room you're supposed to go to for your discussion groups. You've got a table tent, so you can write your name on so everybody else in the discussion group can figure out who you are. There is a listing of the questions that we want the various discussion groups to discuss, entertain, dialogue about. There's a critique form in there, an acronym list, a discussion of the envisioned STARS affiliates program, and many other things if you haven't had a chance to look at. It would be a good idea to look at it over the next 2 days.

A couple of administrative announcements that I've been asked to make:

BADGES: those of you who are wearing red badges need to keep wearing them so that people at the SEI will know who you are and you won't be asked what you're doing in the building. Also the red badges are your admission ticket for lunch on Tuesday at the Syria Mosque, which is a couple of blocks from here, so please make sure you wear your name tag. For those folks staying for the SEI affiliate symposium, the red name tags do not apply for the affiliate symposium. You will get another badge when you register for the affiliate symposium.

Portable computers: If anybody has brought in a portable computer and is using it to take notes, and I understand some folks have done that, do not be surprised when you leave this evening if a security guard asks you about that particular device. You'll need to check in with the security desk and just discuss the fact that you've got that machine and who it belongs to and that kind of stuff.

STARS/USERS WORKSHOP OVERVIEW
AGENDA: Monday, 10 Sept 1990

⊕DARPA⊕

8:00 am – 8:45 am	Registration and continental breakfast [SEI Cafeteria]
	*** SEI Auditorium ***
8:45 am – 9:00 am	Welcome and Overview (John Foreman, SEI)
9:00 am – 9:20 am	DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)
9:20 am – 9:50 am	STARS Program Overview (Jack Kramer, DARPA/ISTO)
9:50 am – 10:15 am	Reuse (Teri Payton, Unisys)
10:15 am – 10:45 am	BREAK [SEI 2nd floor lobby area]
10:45 am – 11:10 am	Process Management (Dick Drake, IBM)
11:10 am – 11:35 am	Software Engineering Environment (Bill Hodges, Boeing)
11:35 am – 12:05 pm	STARS Evaluation (John Foreman, SEI)
12:05 pm – 12:30 pm	Questions and Answers
12:30 pm – 2:00 pm	LUNCH [on your own]
	*** SEI Conference Rooms ***
2:00 pm – 5:30 pm	Discussion Groups
4:00 pm – 4:30 pm	BREAK [SEI 2nd floor lobby area]
5:45 pm	Busses depart for Hyatt Pittsburgh [front of SEI]
6:00 pm – 9:00 pm	Working dinner—initial feedback to STARS from Discussion Group leaders [SEI Room 4000]

Let me talk some about the agenda and how the next 2 days are going to proceed. You'll notice that items in asterisks on the slide are indicative of location of events, and as you can see the first events this morning are all going to be held here in the SEI auditorium. In the afternoon starting at 2:00 the discussion groups are going to be held in the various SEI conference rooms, and as I mentioned before in your packets there are maps of the SEI, there's also information that tells you where the various discussions are going to be, so by perusing that you ought to figure out where you need to go.

This morning is organized around a series of successive refinement type briefings. Let me explain what I mean by that. To start things off Dr. Barry Boehm, who is a director of DARPA's Information Science and Technology Office will spend 20 minutes talking about ISTO's programs and how and where STARS fits in to the larger global context of DARPA/ISTO. Dr. Jack Kramer, who is the STARS director, will spend 30 minutes talking about the high level view of the STARS program: where it's going, why it's attempting to do the things it is, that type of stuff. Jack's talk will be followed by 4 successive presentations at significantly increased levels of detail. We've picked 4 areas in the STARS program; reuse, process management, software engineering environments, and lastly STARS evaluation for the detailed level presentations; each of those presentations is 25 to 30 minutes long and will give you a rather deep look at those particular areas of the program. So as I said before, this is successive refinement or successive revealment of what STARS is all about. Now, as a consequence of this approach, we really believe that many questions will be answered in the course of the successive briefings. We're real confident that that's what's going to happen so we're asking that questions be held until the question and answer period which will occur about 12:00.

This afternoon we have discussion groups that run from 2:00–5:30. There is a break scheduled from 4:00 to 4:30. Let me make one point about the break this morning, which is from 10:15 to 10:45. To get to the break area, you go out the back doors of the auditorium, and up the stairway to the second floor.

8:00 am	–	8:30 am	Continental breakfast [SEI Cafeteria]
			*** SEI Conference Rooms ***
8:30 am	–	10:30 am	Discussion Groups (continued)
10:30 am	–	11:00 am	BREAK [SEI 2nd floor lobby area]
			*** Mellon Institute Auditorium ***
11:00 am	–	12:30 pm	Discussion Group Reports
12:30 pm	–	2:30 pm	LUNCH [Syria Mosque, banquet hall, lower level, with SEI Affiliates Symposium]
2:30 pm	–	4:00 pm	Wrap-up—STARS initial responses to workshop issues
4:15 pm			Busses depart for Hyatt Pittsburgh [front of SEI]

One last point I want to make about the successive revealment or refinement approach of the briefings. Each of the STARS primes were assigned a particular area for the sake of this presentation. While reuse is being presented by Teri Payton of UNISYS, that does not mean that UNISYS is totally responsible for the reuse effort in the STARS program. Let me say that if you have not been assigned to a discussion group yet, at the break or over lunch please see Judy Bamberger and she will tell you which discussion group you are going to be assigned to. Judy would you stand up so everybody can recognize who you are?

Tuesday morning schedule includes continental breakfast again from 8:00–8:30, and discussion groups second session from 8:30–10:30. After the morning discussion groups, we're going to ask that everybody move to Mellon Institute which is next door. You all came in the SEI front entrance, Mellon Institute is one block to the left. That's where the various discussion group reports, which are going to be about 8 minutes long, will be held. After lunch at the Syria Mosque, from 2:30–4:00 the STARS program will reply to what the discussion groups have reported earlier in the morning.

DARPA

- **Workshop Purposes and Goals**
- **Agenda/Overall Workshop Flow**
- **Discussion Groups**
- **Workshop Products/Results**

- Each person has been assigned to a Discussion Group; assignments and room location are in registration packet

- Assignment based on interest specified in original workshop applications

- Each discussion group has been assigned a set of questions and issues. These question sets were based on analysis of key areas in the STARS program, PLUS questions and issues that were submitted by attendees.

I've mentioned the word discussion groups a number of times. Let me go into some detail about what's going on here. It was intended that every person be assigned a discussion group before they got here. Those assignments and the room location are in your registration packets. The assignments were based on the interests that individuals specified in their original workshop applications. Now for those of you who registered late, or didn't specify any interest, that kind of thing, it basically comes down to potluck. Each discussion group has been assigned a set of questions to be examined, and a discussion group leader; the discussion group leaders were briefed last evening about the process that we're going to be going through. The individual questions are all in your packets.

- **STARS Program Concerns**
- **Business Practices**
- **Technology Transfer**
- **Reuse**
  - **Technical Barriers to Reuse**
  - **Non-Technical Barriers to Reuse**
- **Process**
  - **Process Management Support**
  - **Process Definition**
- **Software Engineering Environment (SEE)**
  - **SEE Coverage and Effectiveness**
  - **Architecture/Environments**
- **Evaluation (2)**

The discussion groups will very closely parallel this morning's presentations. As you can see, there is going to be discussion groups for reuse, process, environments and evaluation. In reuse, process, and environments we've broken things down into 2 subareas. There are also 3 discussion groups that are more global in their orientation and address program concerns, business practices, and tech transfer.

- Workshop Purposes and Goals
- Agenda/Overall Workshop Flow
- Discussion Groups
- Workshop Products/Results

- **STARS Program Information**
  - Affiliates Program
  - Contact Points
- **Discussion Group Briefings**
- **STARS initial feedback**
- **Workshop summary in next STARS newsletter**
- **Final Report (Dec '90)**

Let me talk a little bit about workshop products and results. For starters we've given you some information about the potential STARS affiliates program. It's in your packet, you should read it and give us some comments about what you think. There's also contact points and information about the primes and various program office officials. As I mentioned earlier, the discussion groups will provide outbriefings on Tuesday morning, STARS will come back with its initial set of feedback to those outbriefings. We will have a workshop summary in the next STARS newsletter, and most importantly the STARS program intends to produce a final report documenting the results of this particular workshop. We're going to use the results of the workshop and factor that into our plan as it is today, use it for feedback purposes and refinement, and all that will be documented in the final report which we expect will be produced and sent to everybody in December 1990.

STARS/USERS WORKSHOP OVERVIEW
AGENDA: Monday, 10 Sept 1990

DARPA

9:00 am – 9:20 am	▶	DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)
9:20 am – 9:50 am		STARS Program Overview (Jack Kramer, DARPA/ISTO)
9:50 am – 10:15 am		Reuse (Teri Payton, Unisys)
10:15 am – 10:45 am		BREAK [SEI 2nd floor lobby area]
10:45 am – 11:10 am		Process Management (Dick Drake, IBM)
11:10 am – 11:35 am		Software Engineering Environment (Bill Hodges, Boeing)
11:35 am – 12:05 pm		STARS Evaluation (John Foreman, SEI)
12:05 pm – 12:30 pm		Questions and Answers

DARPA/ISTO STARS OVERVIEW

Barry Boehm, DARPA
STARS/Users Workshop
10 September 1990

I would like to introduce Dr. Barry Boehm, Director, Information Science and Technology Office of the Defense Advanced Research Projects Agency. Barry will talk about the DARPA Information Science and Technology Office programs, and how STARS fits as part of the ISTO program.

Dr. Boehm.

OUTLINE

- Meeting objectives and approach
- DARPA/ISTO Software program Status
  - Relationships to STARS
- STARS community involvement model
- Opportunities to participate in the STARS process

Good morning, it is a real pleasure to see all of you here. I consider this to be a very important first step by opening up the STARS process and trying to get a wide community involvement in determining where the STARS program is going.

What I am going to try to do, is to give you a feel for where the STARS program fits in the overall set of things that the DARPA Information Science and Technology Office does. First, I will restate what we are trying to accomplish with this workshop. I will then say a little bit about the overall ISTO software program, how STARS fits within that program, how we want to involve the community in what we are doing with STARS and, finally, discuss some specific ideas we have about opportunities for you to participate.

- **Establish community convergence process for STARS Plan**
  - Identify areas needing improvement
  - Identify actions for improving the plan
- **Open, candid approach**
  - Up-front on risk items, resolution approach
- **Plan participation activities**
  - Discussion groups on plan issues
  - Extemporaneous lobbying
  - Post-meeting activities

As John was saying, what we are trying to do is to establish a community convergence process for the STARS plan. So far, we have gotten far enough along with the STARS implementation plan that it is briefable and reasonably coherent, but it is still flexible enough that it can be adapted to any constructive feedback that you can provide us during the workshop.

One of the things you will see from all of the talks this morning, is that this is not a typical dog and pony show. We are very strongly into risk management. We want to be up front about where we think the risks are and not paint a rosy picture of something that never scales up or never performs. The kind of things that we have in mind for these two days are principally focused around the discussion groups, but all of us will be around if you want to catch us in the halls and lobby for something. We want to hear your comments about the STARS plans and directions. We believe that STARS will benefit from continual interaction with the user community, therefore, there are a number of things that we will do after this workshop in order to accomplish this interaction.

DARPA/ISTO SOFTWARE PROGRAM STATUS

- **STARS, SEI, VHSIC, etc. moved to DARPA summer 1988**
  - **STARS, SEI moved to ISTO 11/89**
  - **STARS reformulated, better coupled to ISTO research and SEI**
- **ISTO software plan developed in concert with wider DoD plans**
  - **DoD Software Master Plan**
  - **DoD Software Technology Plan**
  - **Federal High Performance Computing software program**
- **ISTO software plan organized around strategic themes**
  - **Megaprogramming**
  - **Infrastructure/maturity model**

The STARS and the Software Engineering Institute programs were moved to DARPA in 1988, originally with the Defense Manufacturing Office. They've been part of the Information Science and Technology Office since November 1989, which is roughly when I came aboard. ISTO has had a software research program for quite some time. It has worked on things like the Arcadia environment, the common Lisp framework and advanced technology things like that. What we have been trying to do recently is to integrate that ongoing work with STARS and the SEI.

With STARS, we are trying to couple it with the rest of the ISTO software program and what goes on at the Software Engineering Institute. Concurrently, there have been a number of other things going on with respect to software in the DoD. Some of you took part in the DoD Software Master Plan open forum, for example.

What we have been doing with the DARPA ISTO software strategy is integrating that with both the DoD Software Master Plan and the DoD Software Technology plan, which is about 2 months underway. We are also integrating it with the DARPA portion of a federal high-performance computing initiative software component.

The two main strategic themes that we have come up with for the ISTO software program are something we are calling mega-programming and a model of how to build infrastructure and to mature software products.

Component-based software engineering and lifecycle management

- **Component sources**
    - COTS, application generators, reuse libraries, re-engineered systems
    - Develop custom components only when necessary
- **Anticipated benefits of applying megaprogramming**
    - High capability systems through high capability components
    - Improvement in productivity, error rates and flexibility
- **How to achieve megaprogramming**
    - Incremental steps from current practice and systems
    - Capitalize on domain knowledge and architectures
    - Megaprogramming technology: process definitions, module definition and composition, verification, SEE support, education

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Megaprogramming says that if we really want to progress and meet all of the challenges of 30 billion dollars of software in DoD now, and 40 or 50 billion later, we have to stop thinking about writing software one instruction at a time. We need to seriously take on the challenge of building software one component at a time. This means getting components from lots of different places, developing custom software only when absolutely necessary. By starting with high capability components when you do this, then you can get good system capabilities such as reliability and performance. By building systems in a way that assembles them from less components because the components are larger, then you get better productivity.

We are trying to achieve megaprogramming incrementally, so that we can learn as we go. We do not have to have a miracle that instantaneously gets us from where we are to where we want to be. We are emphasizing a number of things that capitalize on domain knowledge, such as that found in vehicle management, communications processing, avionics, and things like that. We trying to build aspects of domain knowledge into our idea of megaprogramming.

Some other things that you need to achieve megaprogramming are definitions of pieces of the software process which emphasize megaprogramming. What is the process of assessing and determining whether to reuse components or not? How do you define and compose modules? How do you verify that they are going to fit together? How do you get a software environment that supports doing megaprogramming? How do you teach people to stop thinking instruction by instruction and start thinking component by component?

DoD Software Applications

Mgmt tools	Process tools	Software engineering tools	Software assets	Domain tools	Specialty engineering tools
Mgmt techniques metrics	Process definitions	Software Engineering Environments	Software reuse libraries	Domain engineering primitives	Specialty engineering
Mgmt science economics	Software engineering, re-engineering, program language, operating systems, database mgmt systems, user interface systems			Domain science	Distributed parallel software

Computer Science Base

Transition

Technology

Science

The infra-structure and maturity model says that DoD software applications are built using a base of tools. These tools are built on a base of infra-structure. The infra-structure is built on a base of Computer Science and systems components. And all of this rests on a science base of such things as algorithms, data structures, and formal methods. If we are going to successfully conquer DoD future software applications, we need to work on all of these. Not just a software environment but process, management, software assets, domains and specialty engineering, like reliability and security and performance.

STARS fits into this model primarily in the shaded areas. Software environments, the processes that the environments support, the processes that are supported by the environments and software reuse libraries. STARS is not trying to do everything. Early 1980's incarnations of STARS were going to take on the entire job. Now STARS has a strategy that says there are other parts of DoD that are working on the rest of the job. STARS will work with those efforts, but will not try and do their job for them.

STARS INTERACTIONS WITH ISTO SCIENCE AND TECHNOLOGY PROGRAM

-DARPA-

Internet Software Exchange

- Software Component Commerce
- Cooperative Work

Software Engineering Institute

- Process Modeling
- Process Definitions
- User Interface Management
- Configuration Management

STARS

Formal Methods

- Configuration Mgt
- Specification
- Integration into SW process

Distributed Systems

- Mach
- National File System

Common Prototyping System

- Prototyping
- Reuse
- Program Generation
- Module interconnect

Advanced Environments

- Process Program
- Environment Architecture
- User Interface Management
- Metrics/Measurement

Domain Specific Software Architecture

- Domain Specific Architectures
- Consensus Process
- Interface Validation

Some of the other activities which are working on the software problem are within DARPA and some are not. This chart goes into the parts that are within DARPA. One thing STARS is doing is importing a lot of technology from the other DARPA/ISTO programs. DARPA is building a distributed file system that looks like it will help support the distribution ideas in STARS asset libraries. ISTO is doing a lot of things in formal methods will help formalize software development and its environment support.

ISTO has a common prototyping system under development that is feeding advanced concepts into STARS, as is Arcadia and our advanced environment work. We have a domain specific software architecture program that is just getting underway, that is intended to feed architecture-compatible domain specific components into the STARS library.

One of the things that STARS is emphasizing is a distributed software environment. This means that you have to have good operating systems support, distributed database support and things like that. Mach and the national file system provide a lot of technology there. The SEI is doing a lot of things in process modeling, process definitions and things like that, which feed in to STARS.

STARS is going to feed these outer activities by providing a nucleus of capability with a set of interface specifications that they can build to. So that, as technology is created in the outer spokes of this wheel, it interoperates with the technology being developed by others. That is the vision.

DARPA ROLE IN DoD SOFTWARE PROGRAM

DARPA: DoD corporate software frameworks	Services, Agencies: Tools and capabilities supporting mission needs
• Software Environment frameworks	• Mission-tailored software environments; tools for life-cycle management
• Prototyping frameworks	• Prototyping capabilities for C^3I, avionics, sensor processing, etc.
• Reuse library frameworks	• Mission-oriented reuse libraries
• Domain software arcbitecture frameworks	• Mission-oriented software architectures, applications generators
• Generic operating systems, database management systems, user interface management systems, network capabilities	• Mission-oriented operating systems, database management systems, user interface management systems, network capabilities
• Process definition, metric frameworks	• Mission-oriented process definitions, metrics

With respect to what goes on outside of DARPA/ISTO, our current model is that DARPA is more or less the DoD corporate software research arm. It focuses primarily on frameworks and generic software. The services and agencies, which have to support the real missions of DoD, are the best place to do things like Service or Agency specific tools and capabilities. Tailored frameworks, like an environment that supports advanced tactical fighter or WWMCCS or things like that, ought to be done by the Services and Agencies responsible for those programs.

Based on this philosophy, STARS will be building open, tailorable software environment frameworks. The services and agencies will then be able to tailor those frameworks to their particular missions, their particular types of requirements, their particular types of development, operational tests and evaluation. Similarly, DARPA will focus on frameworks for prototyping, reuse and domain architectures, generic Mach, and databases. These generic capabilities will then get built into mission oriented systems for whatever particular Service embedded system is being developed.

STARS SUCCESS CONDITIONS	DARPA

Theory W: A program is successful if and only if it makes winners of all of its constituencies.

- DoD software contractors
- DoD O&M organizations
- Services and agencies
- DARPA, OSD, Congress, other government agencies
- STARS Primes, commercial counterparts
- Subcontractors and tool vendors

One of the things that we have tried to do while putting the current STARS program in place, is to figure out how can we do it in a way that makes winners of all the constituencies. Having written a proposal at TRW to be a STARS prime but not being selected, and having been involved to some extent with the other STARS constituancies, I had some feel for what these win conditions were. We used those initial ideas as a starting point. One of the main objectives at this workshop is to try to calibrate these ideas. We are asking you, the attendees, "Have we missed your win conditions in some essential way?"

In terms of DoD software contractors, like the GD's, GE's, MacDac's, Hughes', Rockwells and Lockheeds, I think what I found at TRW and what I 've been told by most people, is that a single aerospace corporation just does not have the critical mass to build, maintain and sustain, over decades, their own private software support environment and the associated framework and tools. What they would like to have is the framework provided and maintained, but to have it done in a way that permits them to put their unique technology into it so they can leverage their software business.

- DoD software contractors: leverage on software business
  - Open architecture, multi-platform, ease of extension
  - Rapid availability, ease of use, reasonable cost
  - Stable evolution, voice in evolution strategy
- DoD O&M organizations: life-cycle software support effectiveness
  - Similar concerns to DoD software contractors
  - Support of software modernization, Ada transition
- Services, Agencies
  - Significant improvement in software productivity and quality
  - Reduced risks of SEE adoption
- DARPA, OSD, Congress, other government agencies
  - All of the above

What a TRW or Lockheed or Hughes would like to do, is to take their own rapid prototyping capabilities, their own test tools and anything else they believe gives them a competitive advantage over other companies, and put them into the framework. This requires that there is an open architecture. If your customer wants something on an HP, a SUN or something like that that, the framework is multi-platform enough so that you can put your capability there, that it is easy to extend so that if your customer has some special configuration management capabilities which are required, you can put those in, it is rapidly available, easy to use, does not cost you a huge amount, evolves stably and you have some voice as to how it is evolving.

DoD Operations and Maintenance organizations have similar concerns to these. They want something that is easy to use, easy to extend, is stable and where they have some control over its evolution. Since they are custodians of huge inventories of old CMS-2, Cobol or Jovial code, they would like to be able to have the environment support modernizing that old software and transitioning it to Ada.

Services and Agencies, in particular the PEO's, want to build systems. They do not want software to be on their critical path, delaying their system delivery and fouling up their operational capability. What they want is productivity, quality and reduced risks of adopting a software engeneering environment. Before they use it, they would like to see that somebody else has already used it in an application that is representative of their's, and has been successful in using it.

DARPA, OSD, Congress, and all of us with our taxpayer's hat on, want all of the above, within a reasonable budget and a reasonable schedule.

- Tailorable asset library mechanisms and tools for reuse
  - Ada bindings to selected standard interfaces
- Programmable process mechanisms
- STARS Software Engineering Environment open architecture definition
- Adaptable environment solutions integrating reuse & process capabilities
- Conforming commercial product solutions

In addition to the interim STARS products that will be available over time, there will be a number of final products. In the area of reuse, there will be tailorable asset libraries, tools for reuse and selected Ada bindings, Ada–X being one of the principle ones that we are currently working on.

In the area of process, we will have selected process building blocks and the abilitiy to define processes using those building blocks. We will also have basic environment capabilities in the area of programmable process mechanisms to allow the automation and measurement of some aspects of those processes. The goal is to permit some process improvement to be carried out.

In the area of Software Engineering Environments, we will have a definition of an open architecture that the three primes have agreed to and, hopefully, users like yourselves have agreed with. We will have three adaptable environment solutions which conform to this open architecture and which integrate reuse and process capabilities as an integral part of the environment. The emphasis will be on conforming commercial solutions in the reuse and process area, in addition to the SEE itself, in order to get the leverage that we need out of the marketplace acceptance of the reuse and process technology.

STARS PROGRAM ORGANIZATION

DARPA

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                    ┌─────────────────────┐
                    │  DARPA Program      │      ┌──────────────────────────┐
                    │  Management         │------│ Joint Advisory Committee │
                    │                     │      │                          │
                    │  ESD, SEI           │      │   DARPA, Chair           │
                    │  other support      │      │      USA                 │
                    └─────────────────────┘      │      USAF                │
                                                 │      USN                 │
                                                 └──────────────────────────┘
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Prime Contracts   Service Working Groups

USAF/ESD Contract mgmt Cooperating prime contractors:			Army	Air Force	Navy
Boeing	IBM	Unisys	Business practices after STARS and reuse SEI, Deputy Chair Services Primes Other support	Process definitions and metrics SEI, Deputy Chair Services Primes Other support	Software Engineering Environment open architecture SEI, Deputy Chair Services Primes Other support

The STARS program is managed by DARPA/ISTO. I am the program manager, and get contractual support from the Air Force Electronic Systems Division (ESD) in Boston and get technical support from the Software Engineering Institute and other federally funded research and development centers like MITRE and IDA. There is a joint advisory committee that is made up of Generals and Admirals from the three Services. In order to bring the Software Engineering Institute and STARS closer together, these are the same individuals that provide that same function to the Software Engineering Institute. They have a technical working group that supports them that is meeting later this week.

The principal work of STARS is done through three prime contractors (Boeing, IBM and Unisys), who work as a set of cooperating contractors. The plan that you are beginning to hear with my presentation, and you will hear in more detail later, is one that the three prime contractors have developed together. It is a plan that recognizes that there is not enough money in the budget for everybody to do things in parallel, therefore it recognizes that some things must be done cooperatively. ESD is the agent for the three prime contracts, and does the contract management for them.

In support of the program and to get the services involved, each of the three Services has agreed to take the lead in one of the three technical areas. The Army's looking at the area of business practices, particularly in the area of reuse. The Air Force is looking at the area of process definitions and metrics and working with SEI in that area. The Navy, through the Next Generation Computer Resources program Project Support Environment Working group, will shortly be taking the lead in the open architecture area. In each of the three working groups, the Software Engineering Institute will provide a deputy chair and provide technical liaison from STARS in those working groups.

STARS PROGRAM
STARS PRIMES INDUSTRY PARTICIPANTS

AETECH	IBM	SofTech
Alsys	Incremental Systems	Software A&E
Boeing	Integrated Software	Software Technology
Contel	ITT	Tartan
CSC	Lockheed	TeleSoft
DEC	Mark V Systems	TIS
DSD Labs	ORA	TRW
Harris	Rational	Unisys
Honeywell	SAIC	Xerox
Hughes	SET	

There are a lot of people currently involved in the STARS program. They range from very small one- and two-person companies, to some very large Aerospace companies. They include both tool vendors and environment users. I would like you to consider, through the STARS affiliates program, ways that we could expand this list. I really do want as much participation in the STARS program as I can get. I would like to see that list of participants grow over the next year or so.
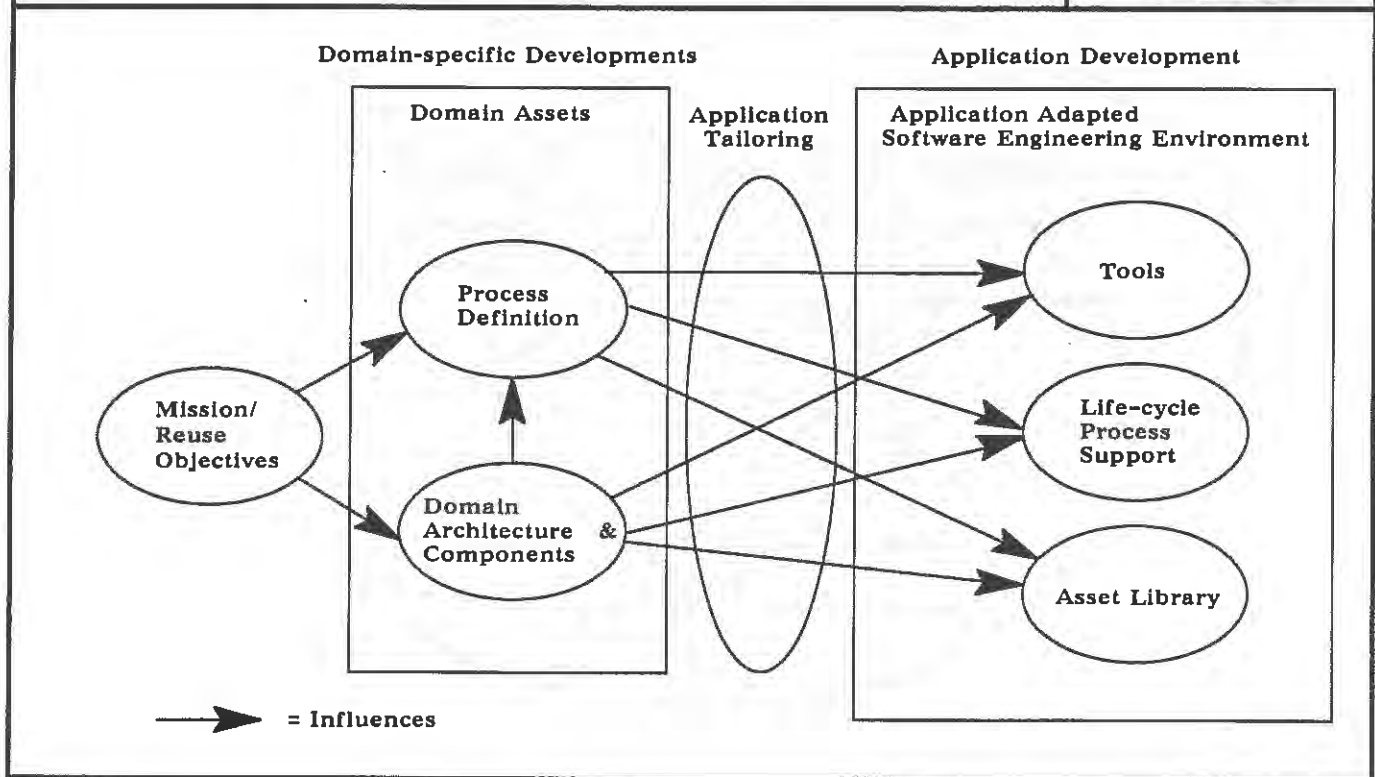
The STARS program technical focus can be represented in this way. What we want is application adaptable Software Engineering Environments. In order to achieve that, we start with mission needs and reuse objectives. From that, we get influences on the particular process definitions that we want and domain architectures and components that we want. Those domain-specific processes and reuse components are used to populate an asset library. When we prepare for an application development, we tailor those assets, including making a particular selection of tools, particular selection of life cycle processes and a particular population of the asset libraries. You will hear a lot more discussion about this particular slide from each of the presentations that follow mine.

REUSE

Reuse assets
Legal issues
. Acquisition issues

PROCESS

Process definitions
Process languages
Metrics

Commercial tools   Standards

SEE
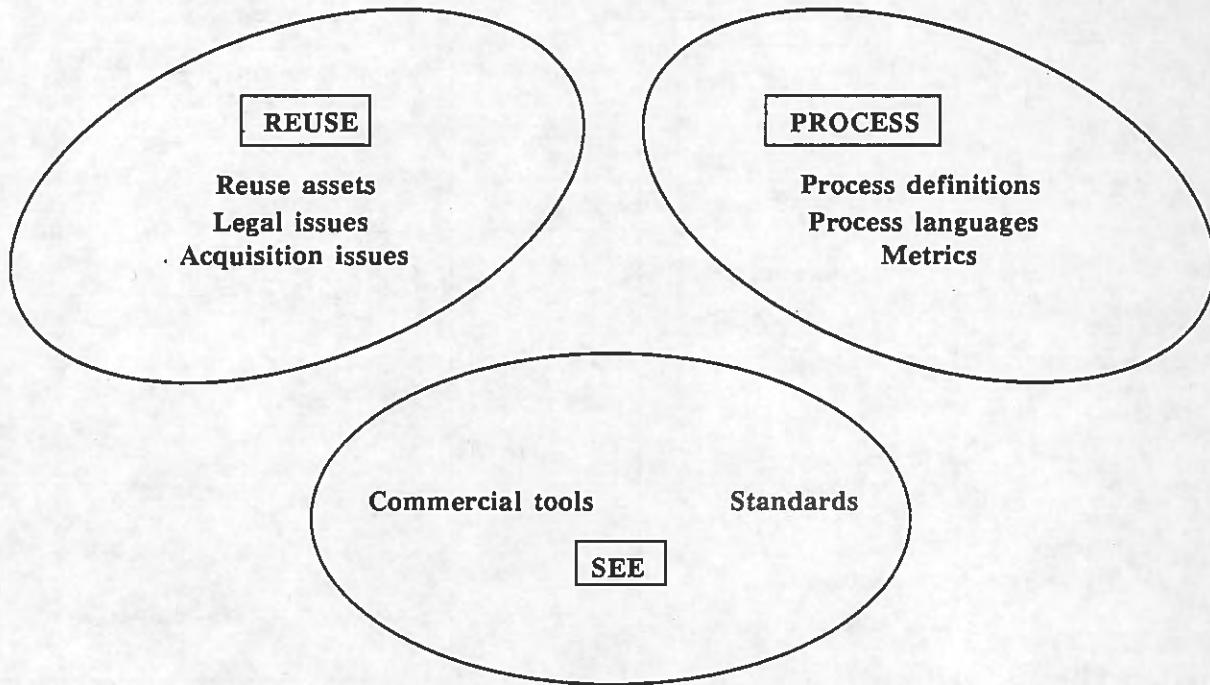
There is a lot of technology being developed in the areas of reuse, process and environments, but it tends to be disjointed. There is on-going work in the development of reuse assets and looking at the legal and acquisition issues. There is a lot of work being done in the area of process and in software engineering environments also. Unfortunately, this disjoint technical work in each of those particular areas does not lend itself well to integration of the three technologies into one solution.

REUSE

PROCESS

Reuse assets
Legal issues
Acquisition issues

Process definitions
Process languages
Metrics

Domain specific SEE's
Domain specific architectures

Domain specific
process definitions

Commercial
tools

SEE

Standards

Areas funded by
STARS
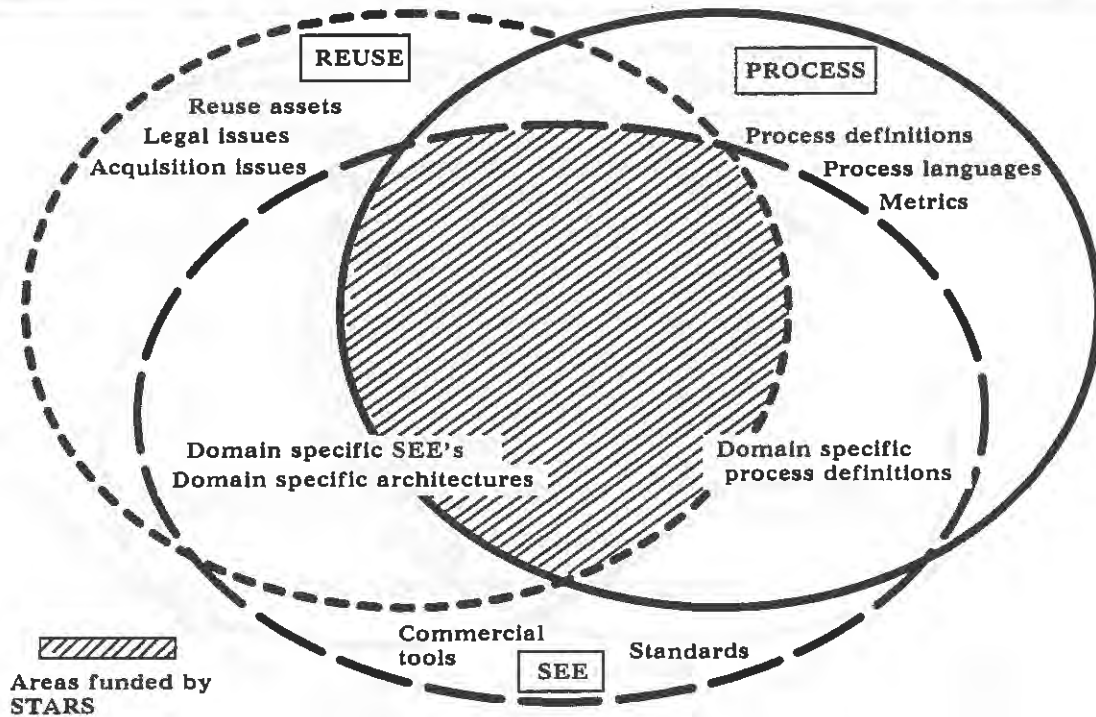
The main benefit will come to the users of those technologies when they are integrated together. We gain a significant leverage when we are able to use the three technologies in one solution and make them complement one another.
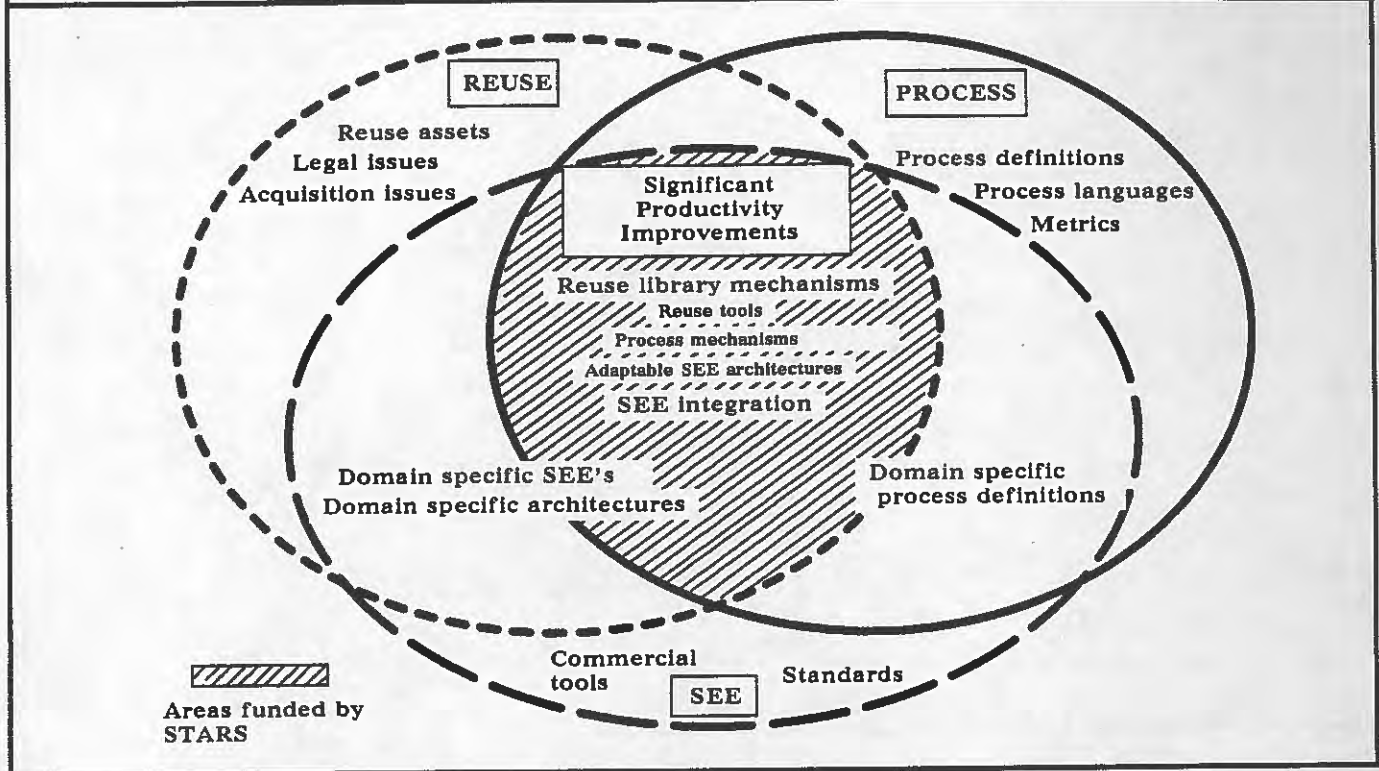
What we are after in STARS is the significant productivity improvements that come from the integration of reuse, process and SEE technologies. We will work principally in the area of reuse library mechanisms, reuse tools, process mechanisms that you need to have in your environments, ways to define your process, adaptable SEE architectures and SEE integration issues.

We are doing some work in domain specific architectures, processes and environments, but are going to leverage activities in those areas that are outside of and not under the control of STARS. We want to leverage what industry is already doing. We do not want a STARS unique solution.

I will now go through each of the four areas of the STARS program: reuse, process, environment and evaluation. I will describe a little bit about what we are doing in each area to give you the big picture. Each of the areas will then be expanded in more detail in the following four presentations.

- Provide support in STARS SEE for reuse-oriented development

  - Support for software architecture development, capture of domain knowledge, and retrieval of domain assets

  - Support for seamless operation across multiple, physically distributed libraries

- Integrate library mechanisms and reuse tools within SEE

- Coordinate STARS reuse work with DARPA DSSA initiative and service efforts

- Rely on outside organizations to provide application architectures and assets

- Army chairing business plan/reuse working group

In the area of reuse, we want to provide support for reuse oriented development. We want to look at seamless reuse development, in other words, transparency to the user of physically disjoint libraries. We are looking at the technology to build and develop software architectures and capture assets, and how you integrate library mechanisms and reuse tools within the SEE. We are coordinating STARS reuse work with the DARPA Domain Specific Software Architecture program, that Barry mentioned earlier, and we are coordinating with service reuse efforts. We are not investing in trying to define all of the possible architectures that somebody might need for any arbitrary program, but are relying on outside organizations to provide particular assets and application architectures. Again, let me point out that the Army working group will be focusing on this area.

- **Prototype multiple approaches to process management**

  - **Experiment with mechanisms for process definition, control, monitoring, and measuring**

  - **Select from existing languages/notations**

- **Integrate selected process mechanisms within SEE**

- **SEI leading community effort to identify and define building blocks to support modern software processes**

- **Adapt and tailor processes for STARS evaluation projects**

- **Air Force chairing process/metrics working group**

In the process area, we are going to look at prototyping multiple approaches, particularly over the next year or so. We will experiment with mechanisms for defining the process and for controlling and monitoring the process within the environment. We will select from existing process definition languages and then integrate those mechanisms within the SEE during the instantiation phase.

We are working with the SEI to identify and define process building blocks that we can use to define modern software engineering processes. We will then adapt and tailor those particular building blocks for use on our evaluation projects. The Air Force is taking the lead in the process and metrics area.

- Specify open architecture
  - Identify candidate industry standards and work with industry to evolve those standards
  - Incorporate "emerging" information model standards supporting data and process integration
- Gain widespread concurrence (STARS primes, DoD software community, CASE vendors, software development community)
- Provide conforming solutions
  - One instantiation per Prime
  - Available on multiple vendors' platforms
- Leverage commercial investment of Primes and their corporate partners to facilitate commercialization
  - Facilitate investment in Ada technology
- Navy chairing open architecture working group in conjunction with NGCR/PSEWG

In the software engineering environment we will specify an open architecture. We are particularly interested in making sure that we understand how industry standards are evolving, and how to work to evolve those standards in a direction that enhances our chances of success. We want to leverage the commercial investment that the primes and their corporate partners are making in order to facilitate that commercialization. We will track and work with emerging information models to see if we can gain some leverage from the data integration that is beginning to happen.

I want to emphasize that we want to make sure that there is good Ada technology available in our environments, and that we want to gain widespread concurrence of the STARS open architecture decisions. You are an important part of our initial attempt to identify people who would be interested in working with us in the open architecture area. We will then provide three conforming solutions, one per prime, available on multiple platforms, and we will demonstrate those solutions on three service applications.

- Prepare for proof-testing of environment on DoD application programs
  - Government produces criteria for selecting programs
  - Early identification of candidate programs
  - Government develops criteria for evaluating STARS

- STARS Primes support SEE usage
  - Tailor SEE and associated reuse and process assets
  - Support process tuning and asset refinement
  - Provide problem assessment, install and reconcile fixes in SEEs

- Government evaluates success of STARS
  - Provide feedback and recommendations to vendors and standards activities

In the evaluation part of the STARS program, we will first prepare for proof-testing the environments on real service applications. We will focus on two main things, the selection criteria for the evaluation programs, and how to evaluate the success of STARS as a program. We are looking at the Government to produce a set of selection criteria for what programs make sense and how we select them, and how to evaluate STARS as a whole. In other words, how do we determine that STARS was successful. We will then identify some candidate programs that satisfy the selection criteria, and the primes will then support the environment use on those applications. Finally, the Government will evaluate the success of STARS, according to the criteria developed, as demonstrated by the application of those environments on real service applications.

STARS PROGRAM
STARS TIMELINE

STARS Primes	90–91	92–93	94–96
Reuse	Prototype asset library mechanisms	Asset library mechanisms and reuse tools	Support use and evaluation
Process	Prototype process mechanisms	Process mechanisms	Support use and evaluation
SEEs	Architecture risk reduction	Instantiate SEE	Support use and evaluation

Evaluation	90–91	92–93	94–96
Services	Identify applications	Plan evaluation process and STARS preparations for it	Trial use to evaluate success of STARS technology
Application Developers	Interact with STARS	Assist in architecture, assets and process models*	Use SEE to develop applications*
STARS Primes	Understand application process	Assist with application SW architectures, application libraries, reuse assets	Asset refinement

Program Coordination	90–91	92–93	94–96
DARPA, ESD, FFRDC	Coordinate open interfaces Metrics for STARS success and application selection	Monitor progress	Evaluate STARS success
Services	Establish Working Groups	Working Groups refine interfaces, process and business plans	Working Groups evaluate impact on applications
SEI	Deputy Chair of WGs Technical support in process, reuse, and environments	Initial technology transfer plan Technical support in process, reuse, and environments	Initiate tech transfer activity Capture lessons learned
Affiliates*	Use of STARS prototypes Participate in Prime decisions	Use of STARS interim products	Use of STARS products
Public Review	Progress reviews, demo-workshops	Progress reviews, demo-workshop	Progress reviews, demo-workshops

*Not funded by STARS

You have a consolidated version of this overall STARS timeline that reflects all of the next several slides that I will show. In order to save your eyes, we broke the timeline up into several slides. The reuse, process, SEE and evaluation timelines will be further expanded by each of the presentations that follow mine. I will go through the whole STARS timeline very briefly.

STARS Primes	90–91	92–93	94–96
Reuse	Prototype asset library mechanisms	Asset library mechanisms and reuse tools	Support use and evaluation
Process	Prototype process mechanisms	Process mechanisms	Support use and evaluation
SEEs	Architecture risk reduction	Instantiate SEE	Support use and evaluation

In the area of reuse for the '90–'91 timeframe, we will principally focus on prototype mechanisms for asset libraries and technology for asset capture and reuse. We will then enhance those and integrate them into our software engineering environments and with the software process. In the '94–'95 timeframe, we will support the use of those mechanisms and assets in the service evaluations.

In the area of process, we will prototype various mechanisms and process languages that are available in the '91–'92 timeframe. We will then select one or more of those for integration within our environments in the '92–'93 timeframe and then support their use during their use on the service evaluations.

In the environment area, we are using the '90–'91 timeframe as a risk reduction and architecture definition phase. Each prime will then instantiate the open architecture in '92–'93 and populate it with tools. In '94–'95 they will support their environment's tailoring and use on the service evaluation projects and in '96 we will evaluate the success of the STARS program and capture any lessons learned.

Evaluation	90–91	92–93	94–96
Services	Identify applications	Plan evaluation process and STARS preparations for it	Trial use to evaluate success of STARS technology
Application Developers	Interact with STARS	Assist in architecture, assets and process models*	Use SEE to develop applications*
STARS Primes	Understand application process	Assist with application SW architectures, application libraries, reuse assets	Asset refinement

*Not funded by STARS

In the area of evaluation, during the '92–'93 timeframe, we will involve the people that have been chosen to do the particular service evaluations. They will assist us in defining the environment needed, adapting the prime's architecture and documenting their process models. We will then use the STARS technology on those applications. During the '94–'95 timeframe, the primes will be in a supporting role. John will go into a lot more detail on this during his presentation.

STARS PROGRAM
TIMELINE
PROGRAM COORDINATION

Program Coordination	90–91	92–93	94–96
DARPA, ESD, FFRDC	Coordinate open interfaces Metrics for STARS success and application selection	Monitor progress	Evaluate STARS success
Services	Establish Working Groups	Working Groups refine interfaces, process, and business plans	Working Groups evaluate impact on applications
SEI	Deputy Chair of WGs Technical support in process, reuse, and environments	Initial technology transfer plan Technical support in process, reuse, and environments	Initiate tech transfer activity Capture lessons learned
Affiliates*	Use of STARS prototypes Participate in Prime decisions	Use of STARS interim products	Use of STARS products
Public Review	Progress reviews, demo-workshops	Progress reviews, demo-workshop	Progress reviews, demo-workshops

*Not funded by STARS

The timeline for program coordination is generally what you would expect. The affiliates program that Barry mentioned, is an important part of the STARS attempt to involve more people in setting the direction that STARS takes. There is a handout in your packet that explains our initial ideas on such a program. It is one of the areas that I would welcome any input that you have as well as any ideas on how it would benefit you to interact with the STARS program.

The Software Engineering Institute has somewhat of a unique role in STARS. We have attempted to bring the SEI and STARS a little closer together by having SEI people participate in STARS. They are working with each of the service working groups, are working on an initial technology transfer plan during '92–'93, and are establishing some tech transfer activities in the '94–'95 timeframe.

PERCEPTIONS	REALITIES
• STARS repositories available/ populated for three application domains	• STARS-produced tailorable library mechanisms and selected STARS assets (e.g., Ada bindings)
• Solving all reuse issues including legal and acquisition policy	• Providing reuse concepts, guidelines and tools

I will now go through some of the perception I hear of the STARS program and what is really being done in each of the four areas. In the area of reuse, there is is a perception that we we are going to build and maintain a single fully populated library for everybody to come to and get all the technology that they need out of it. Within the budget and the assets that we have, we are working on building library mechanisms and a few products, such as selected Ada Bindings that we developed. Those will be in the STARS repositories and available for public use.

There is also a general feeling that STARS is going to solve all the reuse problems, all the legal issues and all the acquisition issues. That is not something that STARS has the resources to do, and in fact, DARPA is not the right place to do those things. We are working very closely with other government activities which should address those issues, such as the DoD Software Master Plan, to make sure that those issues are addressed. What we are doing, is providing reused concepts, guidelines, and tools.

PERCEPTIONS	REALITIES
• Developing software-first process model	• Integrating tailorable mechanisms in SEE for supporting process management
• Developing systems acquisition process	• Assessing adaptability of process definitions
	• Tailored process definition for STARS evaluation

In the area of process, there is a feeling that we are developing a standard software first process model. While we have been working on a software first process, as one of several reuse oriented process models, what we are now doing is working on integrating tailorable process mechanisms into the environment that are capable of supporting that process and other reuse oriented processes that people are working on. We are also looking at mechanisms for supporting process management. One of the interim products that we do have available, is some work on the software first process. We will be looking at how a particular process is influenced by the environment, by the procurement process and by the particular application domain, and seeing how we integrate adapted process with the environment. STARS is not developing a new system acquisition process, but we are assessing the availability of mechanisms to enforce various system acquisition processes.

PERCEPTIONS	REALITIES
• Built from scratch; all in Ada	• Integrate existing technology; new STARS developments in Ada
• Supports only Ada	• Supports Ada
• DoD-mandated and maintained GFE	• Market-driven, commercially maintained
• All public domain	• New developments will be in public domain
• Stimulate commercial industry so that COTS components solve most DoD requirements	• Yes!!

In the area of the SEE, there is a perception that STARS is going to only develop technology totally from scratch, and that it would only be done in Ada. What we are doing, is integrating existing commercial technology into our environments, whether or not it is written in Ada, so that we can have access to the best technology available for developing and maintaining systems in Ada. All new technology that STARS develops and is paid for totally by the government, will be in Ada.

There is a perception that we would only support Ada. In fact, we are supporting Ada very strongly, but we also recognize that a lot of our systems today are integrated with other languages. Therefore, we need to support the maintenance aspects of software in other languages, as well as Ada itself. There was a perception that STARS was going to develop an environment and then government-furnish that environment for use on all DoD contracts. What we are doing, is demonstrating that you can solve the DoD problems with commercial solutions that you can buy off the shelf. We are trying to stimulate the commercial industry so that commercial environments and tools can solve the DoD problems.

There is also a perception that everything the STARS was going to do would be public domain. In reality, what we do ourselves will be in public domain, but we do not expect people who bring technology, for example compilers or tools, to the environment, to give up all rights to those technologies.

PERCEPTIONS	REALITIES
• Demonstrating STARS success by use on STARS itself	• Evaluating STARS via DoD applications

In the evaluation part of the STARS program, we are demonstrating STARS success by the use of STARS on real DoD applications.

- Is it clear what we're trying to do?

- Does it hang together?

- Does it fit your win conditions?

- Are there gaping chasms along the success path?

- Are we missing other big opportunities?

- Are there other mechanisms to encourage your participation?

There are many questions that we have given you to discuss in your working groups. These are some of the high level programmatic issues that I am particularly interested having you dicsuss and provide input to me on. I would like to know if our presentation of the STARS plan is clear so you can tell what we are doing, right or wrong. Is the plan integrated enough so that you can determine if we can stand a good chance of accomplishing what we are trying to do?

Barry mentioned win conditions. We believe very strongly that we need a program that helps everybody, STARS can not go it alone, the time is right to work together. We need the leverage that we get by working together, therefore, we need to make sure we have captured the conditions that make you a winner as a result of the STARS program.

Have we missed whole areas that you think the STARS program should pay attention to? Are there any particular big opportunities that you think we should go after? Are there other mechanisms to encourage your participation, besides meetings like this or the affiliates program, as we have laid it out?

9:00 am – 9:20 am		DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)
9:20 am – 9:50 am		STARS Program Overview (Jack Kramer, DARPA/ISTO)
9:50 am – 10:15 am	▶	Reuse (Teri Payton, Unisys)
10:15 am – 10:45 am		BREAK [SEI 2nd floor lobby area]
10:45 am – 11:10 am		Process Management (Dick Drake, IBM)
11:10 am – 11:35 am		Software Engineering Environment (Bill Hodges, Boeing)
11:35 am – 12:05 pm		STARS Evaluation (John Foreman, SEI)
12:05 pm – 12:30 pm		Questions and Answers

As I mentioned before, the four detailed discussions which you will now hear, will be presented by the three system architects and John Foreman of the SEI. Each of the four is a consolidated summary of the STARS program activities in each of the respective areas of reuse, process, Software Engineering Environment and evaluation. Teri Payton, the Unisys systems architect, will now discuss the consolidated STARS activities in the area of reuse.

STARS REUSE

Teri Payton
Unisys
10 September 1990
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Domain-specific Developments   Application Development

Domain Assets   Application Tailoring   Application Adapted Software Engineering Environment

- Process Definition
- Mission/ Reuse Objectives
- Domain Architecture & Components
- Tools
- Life-cycle Process Support
- Asset Library

———▶ = Influences
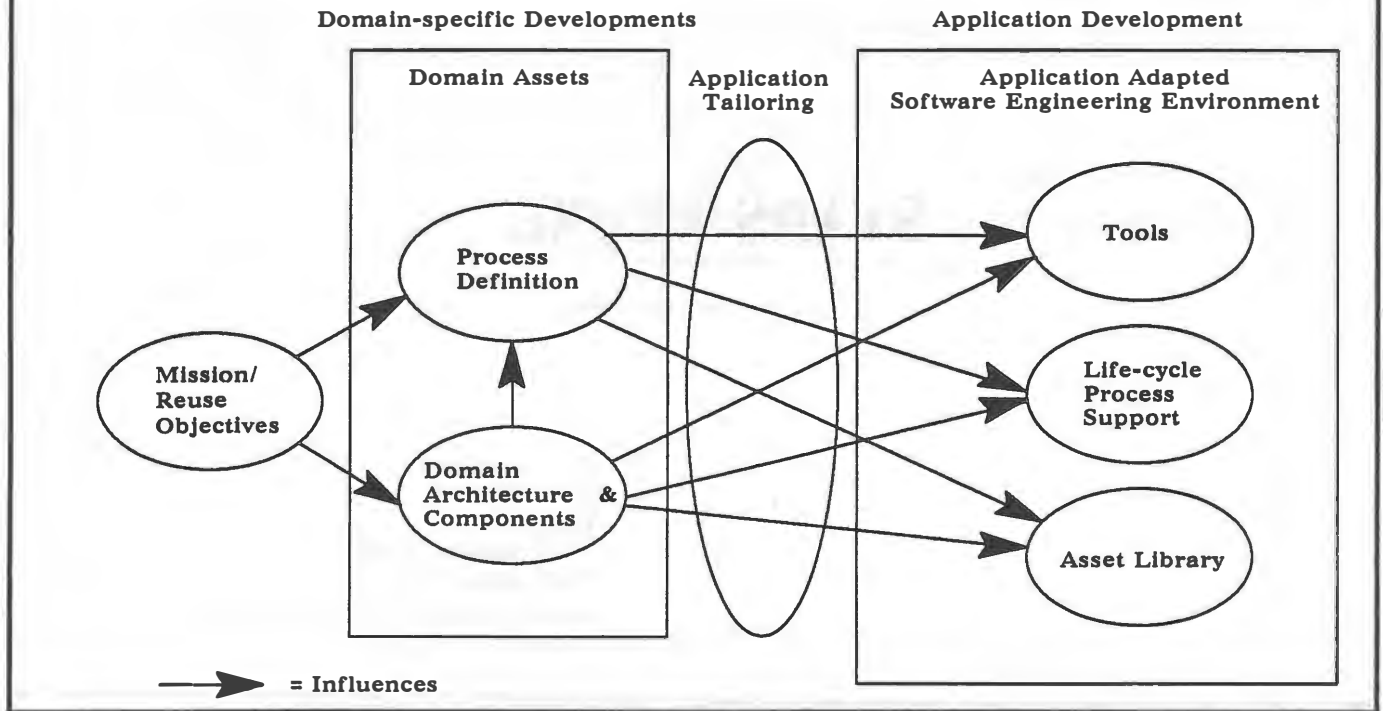
This is going to be a picture that you're going to be very familiar with by the time we're done here today. In the reuse area we are talking from a reuse perspective. Let me first give some definitions. What do we mean by a domain? Domains are application areas that multiple DoD programs are in. For example, tactical battle management, or air defense, or strategic command and control, or MIS; these are all domains. And what we're considering is supporting domain specific development by providing the infrastructure to enable the development of domain assets. The applications then are the particular DoD programs that are developed within the domain areas. One more definition that I want to address is assets. People have talked about libraries of components and libraries of reusable objects. Well, in STARS we instead adopted the term "asset" to try to make it clear that we're talking about lots more than just code components, and indeed things that one doesn't normally even envision as components. For example, lists of telephone numbers or e-mail addresses are all viable assets that can give you information that will help you in a particular domain rather than trying to recreate that for each project.

Going through this picture then, we have reuse objectives and mission objectives in a domain area. From that we can then tailor a process definition so that it can address the inherent risks for that application domain, and that information can be used across mutliple application programs.

In the process area we also need to concentrate on the notion of being able to develop reuse processes. How do we develop domain architectures? How do we get things out of the reuse library? What do we need in our process so that we have the notion of both designing and developing for reuse and being able to reuse the object as we go along in our application development? The mission objectives and reuse objectives help in the formulation of domain architectures and components and interfaces, and as Jack says that they all come together in an asset library. Then the application developer can use that as a base to build on to get an application-adapted SEE—to get instances of the asset library for that application and to create what's needed to support the application development project.

Establish a basis for a paradigm shift to reuse based development

- **Explore reuse processes for:**
  - Capturing domain knowledge (e.g., domain-specific S/W architecture)
  - Supplying, assessing and reusing assets
- **Support a wide-spectrum of assets (e.g., architecture, application generators, requirements, design, test, and documentation)**
- **Provide active support for many aspects of reuse**
  - Analysis of domain
  - Asset acquisition and classification
  - Asset browsing and retrieval
- **Support for interoperability across distributed libraries and SEEs**
- **Ready for use by evaluation projects by 1 October 1993**

Moving onto objectives, the top level objective here is taken directly from the overview presentation—establish the basis for a paradigm shift to reuse-based development. When we take that down into subobjectives what we're looking at is several kinds of capabilities. First—exploring reuse processes. The type of processes to capture information about the domain—domain specific software architectures, domain specific requirements, and so on. We also need to provide candidate processes for supplying new assets, reusing assets, and evaluating assets, if there is any notion of "quality" of the assets that will be available.

The next objective addresses supporting a wide spectrum of assets. As I've said, the sorts of assets that we want to support are definitely much more than just code. We consider the architectures themselves as assets. We consider application generators assets that need to be reusable across projects. Then requirements, designs, tests, documentation. Those are all the sorts of things that we're trying to support within our asset libraries.

STARS objective is to provide active support for many of the different aspects of reuse. This includes active support for how we do the initial analysis of a domain to establish software architectures and requirements. It includes how we acquire assets, classify them, filter them, and certify them if necessary. How we browse and retrieve assets from a workstation regardless of where the asset library is physically located. That addresses the objective of supporting interoperability, across distributed libraries, and between a library and the SEE itself. And everything that we're doing will be ready for use in the evaluation projects by October 1, 1993.

Domain-specific architecture

Reusable life-cycle artifacts

Reuse-based application development

Application generators

Re-engineering
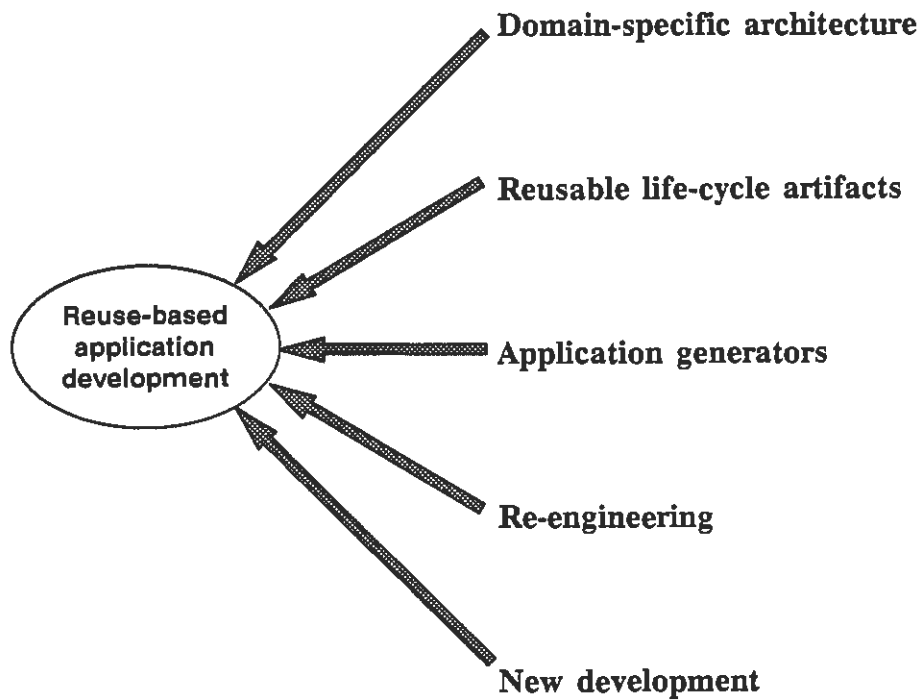
New development

Next, we'd like to give you a view of what we consider a typical reuse-based development scenario might be. A new application would form its base through a combination of reusing a domain specific architecture, picking up many sorts of life cycle artifacts (from requirements, design, code, test), making use of application generators, reengineering parts from existing systems, and also doing new development. So it's a combination of all of those that will formulate the development paradigm in a reuse-based application development.

	STARS REUSE TECHNOLOGY BASE	

STATE OF COTS	• Early metrics tools used in STARS project library • Licensable general, fine-grained parts (e.g., GRACE, Booch) • Emerging reengineering support • Analysis tools/knowledge-based tools provide potential for domain knowledge capture • No library mechanisms
STATE OF DoD PRACTICE	• *Ad hoc* reuse/scavenging/knowledge captured in people's heads • Experimentation with domain-specific component sets • SIMTEL 20 like "as is" parts
STATE OF TECHNOLOGY	• Move towards reuse-in-the-large • Move towards application domain focus/application software architectures • Prototype library techniques/mechanisms (hypertext, faceted, knowledge-based) • Reuse paradigms not integrated into process
STATE OF RESEARCH	• DARPA ISTO megaprogramming focus • Application software architectures (e.g., DARPA DSSA) • Early experimentation in module interconnect languages (e.g., DARPA CPS) • STARS breakthrough task: formal specifications and reuse libraries

What is the state of reuse technology today? With respect to commercial off-the-shelf tools, we have some early metrics tools. For example, AdaMAT is in use today in the STARS project library. There are licensable components, typically general, small fine grain components like the Booch and Grace components. We believe that support for reengineering will become available within the timeframe of STARS. Additionally, there are some basic analysis and knowledge based tools that can help in capturing domain knowledge.

In DoD practice we see some reuse today. But it is mostly on an ad hoc basis, typically where there are individuals who know something about code that has been developed and used on some other system and the knowledge about those reusable parts is typically captured in peoples' heads. There is often no real organization knowledge of what's available to be reused. If you get the people who have done it before, then you often get the reusability. There is experimentation within system houses on domain specific component sets. But for the most part, it's not really in widespread use in application development. And today you see asset libraries like the SIMTEL 20 "as-is" parts, where you really don't get documentation, you don't really get tests. You get something "as-is".

In the technology arena, we see a move towards reuse in the large—towards large application domain specific components with a focus on establishing software architectures as a basis for understanding what the components and interfaces need to be. There are several prototype library mechanisms that are available today but we still have the problem that reuse paradigms are not integrated into the process.

What's the state of research? We heard from Barry about the DARPA ISTO focus on megaprogramming as the means to really make large scale reuse happen, and the (DSSA) Domain Specific Software Architecture's program. There is early experimentation in languages for interconnecting modules in the Common Prototyping System (CPS) program. Within STARS we have a break-through task that ORA is doing to explore the use of formal specifications of component interfaces in reuse libraries.

Incorporate reuse into process

Use, refine, extend asset library mechanisms

Integrate/extend reuse support tools

Reuse Support

Capture and classify reusable assets

Demonstrate support for seamless operations
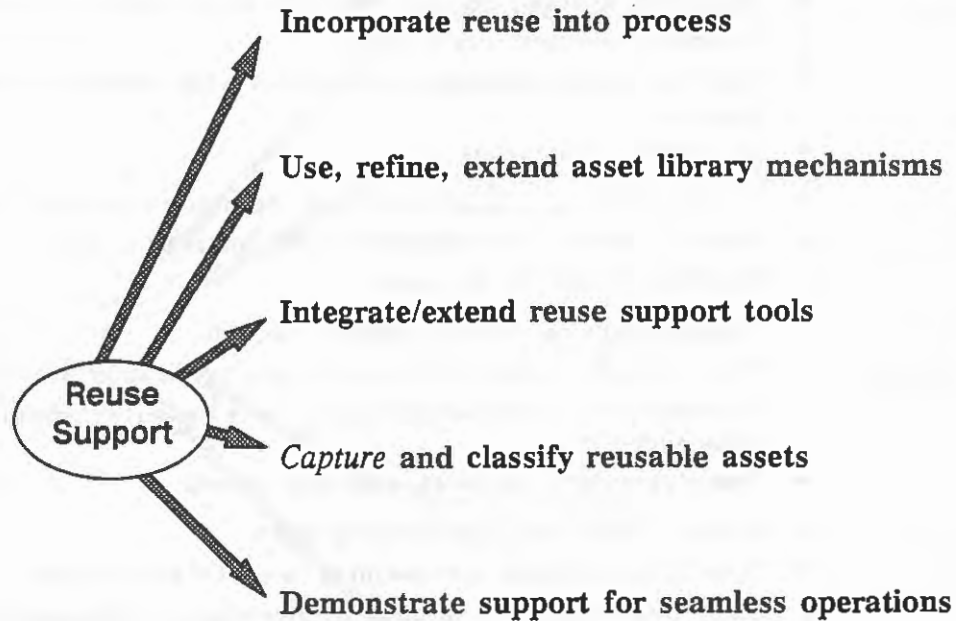
Next, lets look at the activities that we are addressing in STARS? We really have 5 main activities that we're addressing in the reuse area. 1) Incorporating reuse into the process by providing reuse process building blocks. 2) Creating, using, refining, and extending asset library mechanisms. Right now we're focusing on two kinds of mechanisms—faceted and knowledge based. 3) Integrating and extending reuse support tools. 4) Capturing and classifying reusable assets. We've italicized the word "capture" because we're not developing the domain-specific assets for use on the evaluation projects. We're expecting to get them from outside STARS. We'll capture them and filter, classify, and evaluate them. 5) We'll demonstrate support for seamless operations. We envision support for physically distributed libraries from within a SEE. The word "demonstrate" here was carefully chosen as well. Some of the conventions that we'll put together to make this happen might be initial STARS conventions. Over time, there could be industry consensus on conventions. But STARS will be able to demonstrate that it's actually feasible to support multiple physically distributed libraries.

The next few slides will go into details of these activities from several different perspectives. We'll look at some of the more low level activities. We'll look at a split of what is joint versus what the Primes are each doing separately. We'll look at activity flows, and we'll look at timelines.

Incorporate reuse into process
- Primes refine alternative building blocks
- Feed into process working group
- Tailor for evaluation project

Use, refine, extend asset library mechanisms
- Two classes: faceted, knowledge-based
- Enhance support for library administration/operations
- Tailor for evaluation project

Integrate/extend reuse support tools
- Experiment with COTS tools (e.g., metrics, reengineering)
- Potentially common across library mechanisms

Capture **and classify reusable assets**
- Define asset certification/quality metrics
- Load/classify key reusable STARS assets (e.g., Ada bindings)
- Load/classify domain assets for evaluation projects

Demonstrate support for seamless operations
- Define concept of operations for distributed libraries
- Establish conventions for asset description/exchange compliant with industry standards (e.g., CALS)
- Define sample global meta-model
- Demonstrate across heterogeneous distributed libraries
- Demonstrate interoperability with SEE

Reuse Support

In the reuse process area, each of the primes is really refining the reuse processes. This will feed into the work of the process working group. The processes that we develop will be tailored for the evaluation projects.

In the area of asset library mechanisms there are two classes that will be supported—faceted and knowledge based. We have initial prototypes of each available. We'll enhance support for operations and then tailor the library mechanisms for use on the evaluation project.

In terms of reuse support tools, we'll initially be experimenting with some COTS tools early on for metrics and reengineering support.

To capture and classify reusable assets—first, we define asset certification/quality metrics, and then we would load and classify components. First we'll do it with key reusable STARS assets such as Ada bindings. This will ensure that the library mechanisms work, that they support the reuse processes and that the capability is there to support certification and qualification. And then in the later years, we'll load and classify the actual domain assets for the evaluation projects.

With respect to seamless operations we will develop a concept of operations for distributed libraries. What we're envisioning in STARS is that a project might have an asset library that it uses. Then an organization might have another, perhaps it might have an asset library in the domain. And then there might be a government or private industry asset library, etc., applicable to the application project that you're doing. The seamless operations implies that there is a fairly easy way for the engineer to be able to access and browse through the distributed libraries from his workstation regardless of where the particular library is physically located. STARS will establish conventions for describing assets and exchanging assets so that we can begin to support this across distributed libraries. And we'll define a sample global model so that one can browse across distributed libraries. We plan to demonstrate that first on homogeneous libraries and then on heterogeneous distributed libraries. We'll also demonstrate the interoperability with the SEE.
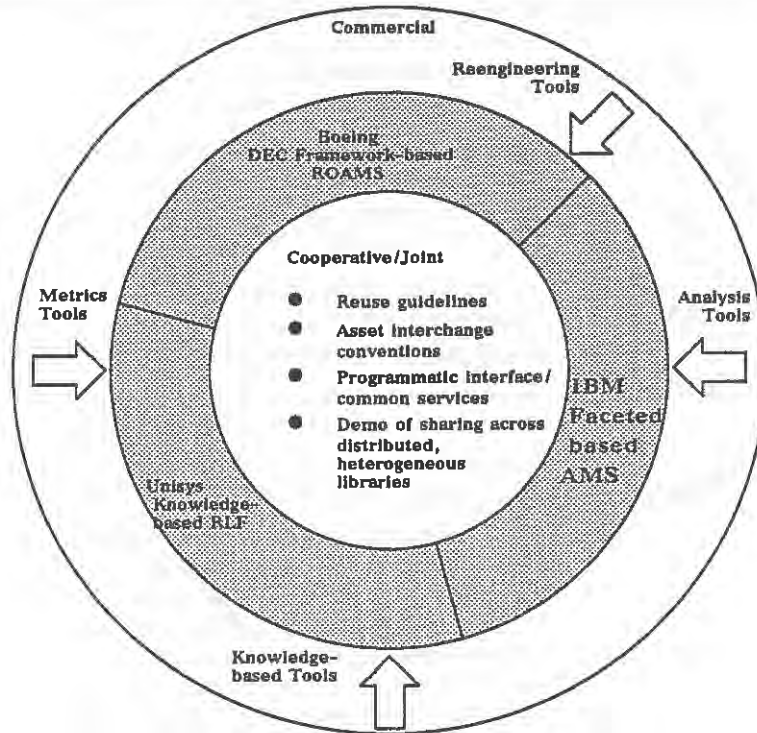
Looking at this from a different perspective—from responsibilities—the circle in the center describes the activities that are cooperative or joint across the Primes. This includes activities where we're trying to establish guidelines, conventions, common interfaces and services, as well as a joint effort to support the demo of sharing across the distributed heterogeneous libraries. Then each of the Primes will provide different instances of the library mechanisms. Boeing's library is going to be DEC framework based. It's called ROAMS, the Reusable Object Access and Management System. IBM's library is based on SAIC's faceted asset library, the Asset Management System, and the Unisys library mechanism is knowledge based, based on the Unisys Reusability Library Framework that's been developed under STARS. We expect a variety of tools to come in from commercial that help support the reuse area, for example, metrics, reengineering, analysis and knowledge based tools.
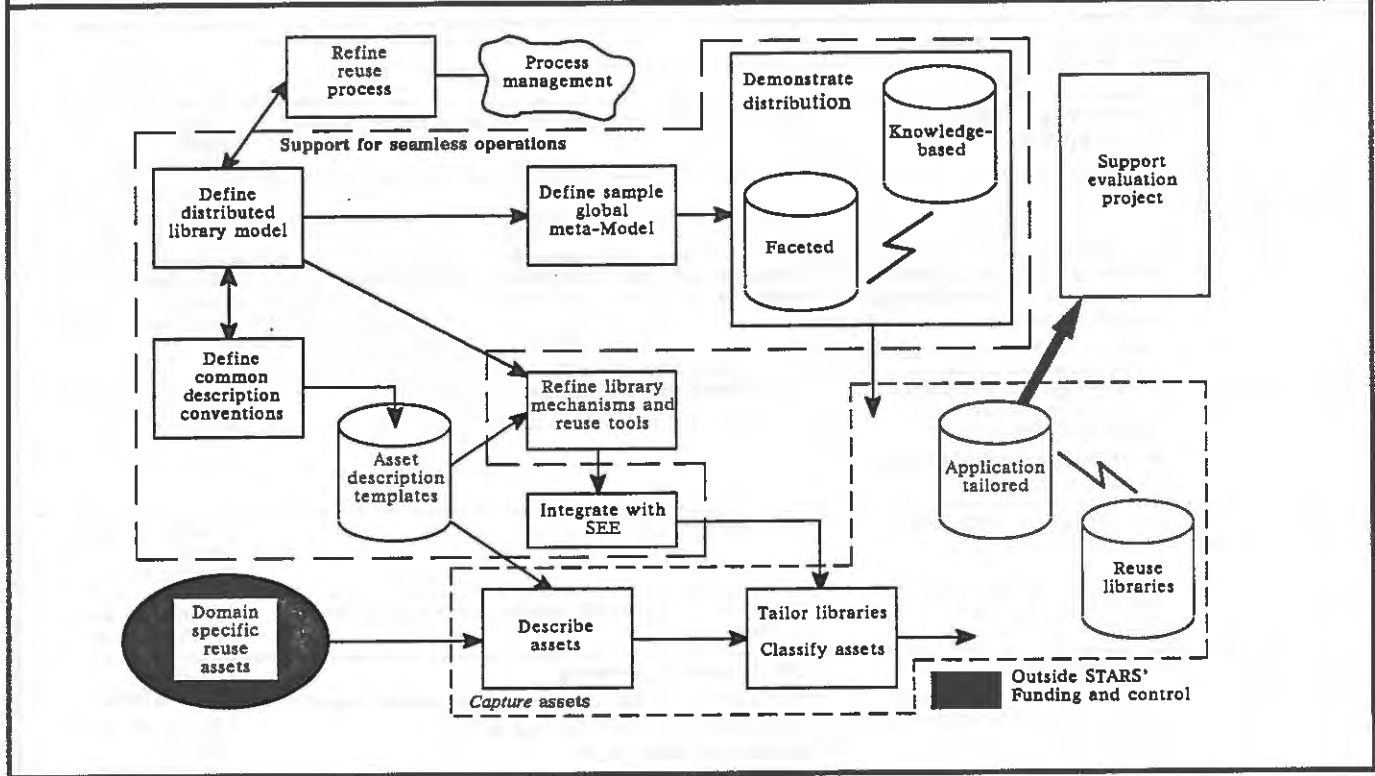
Now looking at this from the perspective of activity flows in a reuse process, we have some aspects of the distributed library model that will impact the reuse process. We will refine reuse processes and pass that off to the process management working group. In support for seamless operations, we'll define the distributed model, define sample global meta-models, demonstrate it, and define common description conventions. Those description templates will be assets to us in the asset library. We will refine our library mechanisms and reuse tools to support all of this. In actually capturing assets for the evaluation project, our ultimate goal is to be able to provide good support for reuse for the evaluation project. We're anticipating reuse assets that come in from outside the program for the particular domains of the evaluation project. Within STARS we'll then describe the assets according to the asset description templates, filter and classify them, store them into libraries and make those asset libraries available for the evaluation project.

From overall program timeline

	90–91	92–93	94–96
Reuse	Prototype asset library mechanisms	Asset library mechanisms and reuse tools	Support use and evaluation

Breakdown

Reuse	90–91	92–93	94–96
Processes	Concept of operations Prototype reuse process building blocks Consolidated reuse guide	Integration into overall evaluation project process	Support reuse process improvement
Asset library mechanisms	Prototype faceted and knowledge-based mechanisms Preliminary administrative support	Pre-COTS mechanisms Enhanced support (e.g., classification)	Support use, evaluation, and maturation
Reuse support tools	Experiment with COTS	Enhance/integrate	Support use and evaluation
Asset acquisition	Validate via capture of key STARS assets	Capture of domain assets for evaluation project	Support asset refinement
Support for seamless operations	Centralized Define asset exchange conventions/programmatic interface	Distributed browsing Support conventions/programmatic interface Demonstrate distributed access Integrate with SEE	Tune operations Support use and evaluation

Now if we look at this from a timeline perspective, lets break it down into the five areas—process, the asset library mechanisms, the reuse support tools, asset acquisition, and support for seamless operations. In the early years, 1990 to 1991, in reuse processes we are focusing on prototyping reuse process building blocks that can be part of the overall process that Dick Drake will talk about. And in 1992 to 1993 we help to integrate that into the overall evaluation project process. During 1994–1995, we support reuse process improvement based on usage in the evaluation project.

For asset library mechanisms we have two prototype asset library mechanisms today, the faceted approach and the knowledge based approach. And they'll be maturing over time so that by the 1993 timeframe they're more of pre-COTS mechanisms. We have preliminary administrative support for those who try and use the libraries today, and that will also be enhanced over time.

For reuse support tools, we're experimenting today with some of the metrics tools that are available. We're also looking at experiments with tools to support the analysis of the domain.

In asset acquisition, in the early years we validate via capture of the STARS assets. We validate that the library mechanisms that are being produced are good mechanisms for capturing, accessing, and retrieving assets. And in the medium timeframe we capture the domain assets for the evaluation project and in 1994 to 1996 timeframe we support the refinements of the assets for the evaluation project.

In terms of support for seamless operations, we see a flow from centralized libraries towards distributed browsing. In the 1991 timeframe we're really in some sense establishing an architecture for the libraries. We are defining common asset exchange conventions across the Primes and common programmatic interfaces for the library mechanisms. Then in the 1992 to 1993 timeframe that will be supported within the various library mechanisms. We will use it to demonstrate distributed access and have the libraries fully integrated with the SEE's. In 1994 to 1996 the libraries will be used on the evaluation programs and we will support the tuning of distributed operations and the use and evaluation of the libraries.

REUSE PROCESS

Reuse process breakdown

	90–91		92–93	
Development Guidelines	Draft reuse guidelines	STARS reuse guidelines		
Reuse-based process building blocks	Reuse process (analyze domain, supply, assess, reuse assets) Conceptual development	Alternative reuse process models defined and provided to process working group Reuse process user interaction concept demo	Reuse process specified in SEE process definition language	Tailored to application project

The next several charts go into a bit more detail about each of the activities listed on the initial timeline. I don't want to go through all of that right now, but I did want to make it available for the reuse discussion groups that will be meeting, so they can really look at some of the details that we've been considering. It also tries to point out some of the things that will be available at different stages for use outside the program.

Reuse process. Each team has developed draft reuse guidelines. By the 1991 timeframe we see consolidating them into a STARS reuse guideline set. And the reuse based process building blocks—the reuse process will address analyzing the domains, supplying, evaluating reusing assets. The conceptual development of that takes place in the early stages and it gets progressively more solid over time and with trial use.

Asset library mechanisms breakdown

	90–91		92–93	
Mechanisms	Prototype asset library mechanisms available for trial-use; demo at Tri-Ada	Prototype asset library mechanisms available for alpha use	Integration with SEE open architecture	Tailor for application project use
Interface	Textual UI	Graphical UI Ada programmatic interface	Demo reuse tools using programmatic interface	
Librarian administration support	Initial operations tools	Enhanced operations: administration	Enhanced classification support	Beta-product operations support

Asset library mechanisms. We have prototype asset library mechanisms available today. By the end of 1991 we envision they will be available for alpha use. The difference between alpha use and trial use is that alpha use would have a bit more documentation and more administrative and classification support and such that we don't quite have today. Then in 1992, the library mechanisms will be integrated with the SEE open architecture interfaces and tailored for the application project use. Over time, we migrate from a textual user interface to a graphical user interface. We will work towards a common Ada programmatic interface that we agree on across the Primes.

Reuse support tools breakdown

	90-91		92-93	
Support for capturing domain knowledge	Demo test support for SW architecture; Experiment with COTS	Support domain developer user view	Alpha test of domain knowledge capture support Support elicitation of domain expertise	Tailor to application domains for evaluation project
Reuse assessment	Experiment with COTS metrics tools (e.g., AdaMAT, ATVS) Prototype peer review tool	Guidelines/metrics	Librarian "guardian" Peer review tool	Certification/ integrity levels supported
Composition/ reuse support		Integrate ASL metagenerator	Integrate COTS reengineering Improved ASL metagenerator	

Reuse support tools. Just pointing out two things, 1) how do we assess the assets we're creating? Well, initially we're experimenting with metrics tools. We hope to produce some guidelines in metrics for STARS and have a concept of a guardian that stands like a gate to the library to evaluate assets as they're being put in. We envision by the end that there might be some notion of certification or integrity levels of the assets that are being stored in the library. We also envision meta-generation tools that will help in creating application generators and application specific languages for the various domains.

Asset acquisition breakdown

	90–91		92–93	
Asset acquisition/ trial usage Internal STARS usage	CDRL delivery/exchange High priority interface assets (Ada binding) identified for capture Demonstrate utility to support domain-specific models	CDRL delivery/exchange Installation of sample assets	Distributed CDRL delivery exchange Increased certification/trust of assets	Capture assets for application project
Internal Primes usage	Unisys prototype Ada asset library Unisys ASW asset library	IBM Ada bindings asset library		

In support for asset acquisition, we move from supporting our own STARS project library by a single library, towards supporting it with a distributed library. And the Primes are each building internal libraries as well that they're using to evaluate the mechanisms.

Support for seamless operations breakdown

	90–91		92–93	
Access support	Centralized/ homogeneous	Distributed, heterogeneous model (human-in-the-loop)	Asset retrieval across distributed heterogeneous libraries	Seamless integration with SEE; transparent access
Asset interchange support	Prototype asset interchange interfaces	Asset interchange interfaces/common services Reuse library mechanisms support SGML	Asset library mechanisms support asset interchange interfaces Demo asset interchange with/similar library models	Demo asset interchange across faceted and knowledge-based libraries

Support for seamless operations. The main thing I want to point out here is moving from centralized access towards a distributed model where there is a human in the loop (where the human still has to connect to the actual library thats been identified as having the asset) and then move towards a more automated asset retrieval, more automatically across distributed heterogeneous libraries.

Risk Issue	Mitigation
• Reuse might not work in domains of interest to DoD	• Build on large scale reuse successes to date in C^3, MIS, process control • Adopt successful approaches (e.g., application generators)
• Lack "ripe" domains with sufficient stability	• Consider focus on sub-domains and demo success for portions of applications
• Providing too much automation before community consensus on reuse process	• STARS reuse work provides inputs to future consensus • Early focus on STARS conventions for asset description, interchange, analysis • Involve community in review
• Domain assets not available for early test of mechanisms	• Use STARS assets for early proof of concept

Lets look at some of the risks that we envision. Reuse might not work in the domains of interest of DoD. People have questioned in systems, for example, that are MCCR, will you really be able to obtain large scale reuse or are they too much of a one-time system? In risk mitigation there are success stories in large scale reuse. In the area of C2, Software A&E has developed the SNAP system. In the MIS database world, we see 4GLs. And in the process control domain, Toshiba, Foxboro and others have demonstrated that large scale reuse can work. So what we want to do is learn from the experiences of those successful large scale reusers and adopt similar approaches. For example, integrate application generators into the way we do reuse on STARS.

Another risk is that the domains we're looking at, the domains of the evaluation projects, might not be quite ripe enough and have sufficient stability to support reuse. Well, in that case we could consider looking at sub-domains within the domain and demonstrating successful reuse on portions of the application rather than on the whole application.

The third risk here is that we're providing too much automation before there is community consensus on the reuse process. Well, we're really taking the first step, an incremental step towards supporting large scale reuse. The work we have will provide capabilities that can actually be measured in the future in helping to support future consensus. We have an early focus in STARS to establishing the conventions that we need so that we will have some reuse process established early. And we can involve the community as much as possible in review.

And the last risk here is that domain assets are not available for early tests for our library mechanisms. To mitigate that, we'll be testing our library mechanisms with use of the assets developed under STARS itself.

DISCUSSION/CHALLENGES

DARPA

- Can reuse-in-the-large work for DoD MCCR systems?

- What experience can you share to reduce STARS reuse risks?

- Are you aware of candidate domain assets and associated software architectures?

- What would encourage your company to initiate a paradigm shift to reuse based development?

- What cultural impediments exist within DoD that are barriers to a paradigm shift to reuse based developments?

Here are some of the questions and challenges we'd like to leave all of you with, even though there's more detailed lists of questions for the discussion groups. Can reuse in the large work for DoD MCCR systems. Do you have experiences—there's a broad base of experience in the audience here—do you have experiences that can reduce the risks that we've identified? Are you aware of candidate assets and associated software architectures? Is our plan something that would encourage your company to initiate a paradigm shift to reuse-based development? Or what would encourage your company to do that? And what impediments are there, cultural impediments within DoD, that are barriers to affecting real reuse?

9:00 am – 9:20 am		DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)
9:20 am – 9:50 am		STARS Program Overview (Jack Kramer, DARPA/ISTO)
9:50 am – 10:15 am		Reuse (Teri Payton, Unisys)
10:15 am – 10:45 am		BREAK [SEI 2nd floor lobby area]
10:45 am – 11:10 am	▶	Process Management (Dick Drake, IBM)
11:10 am – 11:35 am		Software Engineering Environment (Bill Hodges, Boeing)
11:35 am – 12:05 pm		STARS Evaluation (John Foreman, SEI)
12:05 pm – 12:30 pm		Questions and Answers

STARS PROCESS MANAGEMENT

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Dick Drake is the systems architect for IBM and will be covering the STARS activities related to process management.
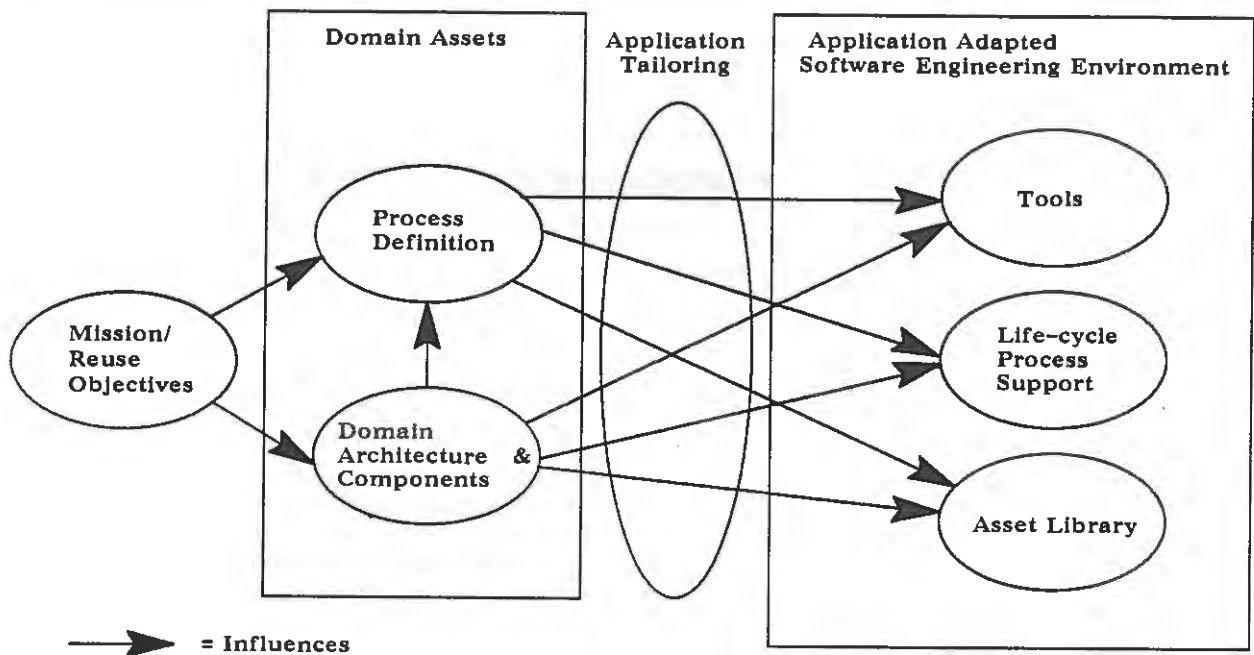
From the perspective of process management, we see that processes supporting the software life-cycle are influenced by the intended application domain and the reuse objectives.

There are many unique aspects of an application domain which will affect the processes used for developing applications in that domain. For example: security considerations, life critical systems, percentage of COTS software in the application, unique test requirement and so on. Reuse, on the other hand, will be pervasive throughout the life cycle.

Based on the unique domain aspects and the potential for reuse in the domain, a generic set of process definitions can be accumulated. Those process definitions then will be tailored to form the life-cycle process for the specific applications. This is really a domain asset that can be reused for specific applications within that domain.

This tailored life-cycle process will influence the selection of tools used for development of the specific application. So when you hear the phrase "instantiation of the STARS Environment" you can now see that we mean to consider the process to be carried out by the environment before assembling the capabilities or tools within the environment, in other words a process driven environment.

Software Process: The sum of all activities, methods and practices involved in the production and evolution of a software product throughout the software life cycle [SEI].

Process Building Blocks: Reusable subcomponents of software process which can be adapted and combined to form life cycle processes. Examples:

- Requirements change process

- Code inspection process

- Prototype construction process

- Reuse assessment process

Process Mechanism: Automated support for defining, controlling, monitoring and measuring the process.

Before we get into the specifics of our plans in the area of process management, let me define a few terms.

This first definition I have borrowed from Wats Humphery of the SEI and it basically defines Software Process as the sum of the activities throughout the life cycle.

I will use the phrase Process Building Block to mean reusable subcomponents of software process which can be adapted and combined to form life-cycle processes for a specific application. You can think of these as reusable components of process. Pieces of the process that can be directly reused or be tailored. For example: requirements change process or code inspection process. Now in more modern life cycles, we will be talking about things like prototype construction process and reuse assessment process. These are just examples of process building blocks that we will be focusing a lot of our efforts on.

I'll also talk about a process mechanism which is that capability in the environment which facilitates process management. The process mechanism will provide automated support for defining, controlling, monitoring, and measuring of the process.

(ETVX View)

ENTRY	TASK	EXIT
– Preliminary high level design complete	– Dependency identification	– Successful compile Ada PDL
– Module approved for low level design	– External interfaces refined	– Passing score from design inspection
	– Ada PDL produced	– Inspection report logged in project data base

VALIDATE
- Design compilation
- Design inspection
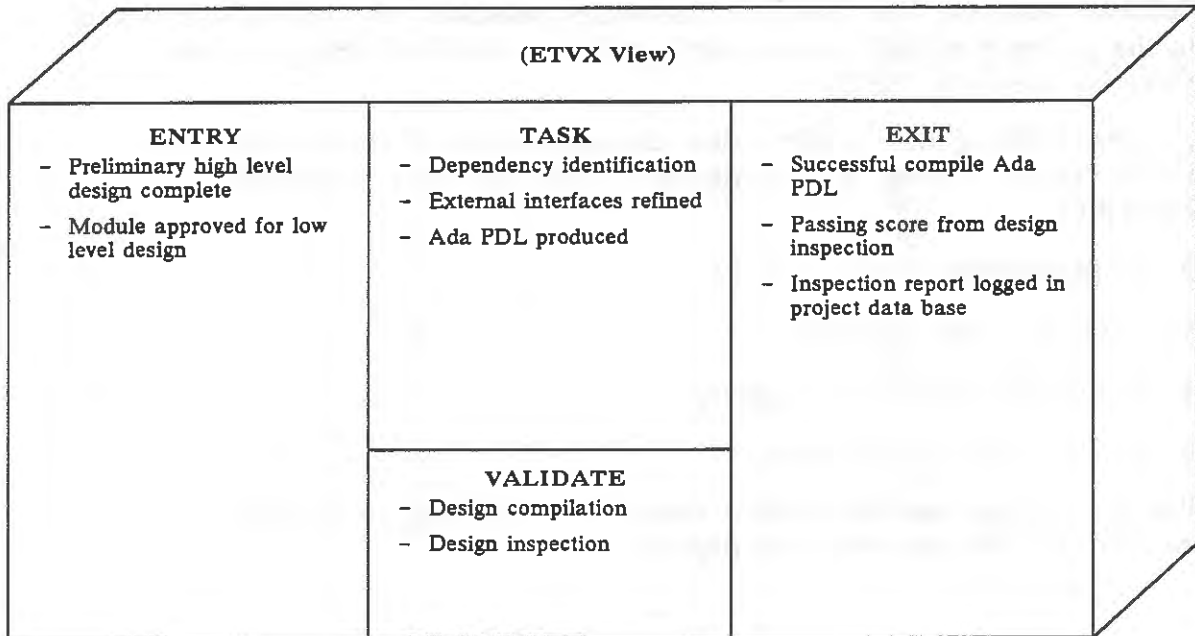
I have included here an example of a process building block for a "low level design subprocess" using an ETVX paradigm (Entry criteria, Task, Validation, Exit criteria). This is just one example of a technique to provide a very high level abstraction for defining a process building block.

You can also see if you look at this that the various tasks and validations could become subprocesses in themselves. For instance, the design inspection could be a new subprocess. This gets into the issue of the level of granularity for the process definition.

Establish capabilities for tailorable process definition and management

- **Support modern process definitions**
  - Reuse, prototyping, concurrent engineering . . .

- **Support continuous process improvement**
  - Definition (SEI level 3)
  - Measurement (SEI level 4)
  - Feedback (SEI level 5)

- **Demonstrate ability to tailor processes to specific projects**

- **Automate process description, control, monitoring and measuring**

- **Support evaluation project by October 1, 1993**

The overall objective for the process management area is to establish capabilities for tailorable process definition and management. The process definition can take many forms from straight English, to various graphical techniques like you saw on the previous slide to a more rigorous language or notation for describing process. That more rigorous definition of a process would be the thing used by a process mechanism to help automate the process management.

The sub objectives we have in this area include the ability to support modern process definitions. This includes such things as reuse, prototyping and concurrent engineering.

We want to support continuous process improvement which implies definition, measurement and feedback. These are all aspects of process we plan to support.

We intend to demonstrate the ability to tailor processes to specific projects. Each application is unique and unless we can show that it is reasonable to create this tailored definition, none of the support provided will be used.

We also need to automate process description, control, monitoring and measuring in recognition that this is not a trivial task.

And finally our objective is to use this process management technology to support an evaluation project by October 1, 1993.

In summary our objective is to demonstrate the potential of process management.

STARS PROCESS MANAGEMENT
TECHNOLOGY BASE

STATE OF COTS
- Some first generation capabilities available
  - ADPS, SADT

STATE OF DoD PRACTICE
- Informal to non–existent process definition
  - SEI assessment (level 1 and 2 predominate)
- Little automation except in CM area
- Concept of process management not well understood

STATE OF TECHNOLOGY
- KI–Shell: Universal Energy Systems
- SPMS: Lockheed
- Frameworks support process primatives: PCTE, ATIS, CAIS–A

STATE OF RESEARCH
- Appl/A, Amadeus: Arcadia process programming/metrics
- TAME: University of Maryland
- STARS Breakthrough Tasks
  - Process Management: Lockheed
  - Transaction Management: Xerox

State of COTS: Looking at the technology base, we see some first generation COTS capabilities. IBM has, in its AD/Cycle product line, a thing called ADPS supporting application development process support and there have been uses of SADT using commercial support tools for SADT.

State of DoD Practice: In the DoD we really find process definition being fairly informal activity, maybe nonexistent. This is born out by the fact that initial SEI assessments say that most of our organizations are running more at a one and two level based on the SEI process assessment (probably more at a one level). This means we really don't have much in the way of process definition.

There is little automation going on out there, other than, of course, in the area of CM, in which we have had long experience. We also find that the concepts of process management really aren't well understood, until the SEI started coming up with measurements. Numbers were well understood, but the concepts weren't. This has at least gotten the right attention on process.

State of the technology: There is some interesting technology work going on and, by the way, if I have forgotten your favorite activity, I apologize, but I really am just throwing out some examples here. KI Shelf from Universal Energy Systems and Lockheed's work on Software Process Management systems are both good examples. The environment framework activities that most of you are reasonably well aware of like PCTE, ATIS and CAIS–A all provide a good base of primitives for the development of process management capabilities, They provide for things such as transactions, roles, the object management capabilities.

State of Research: In the research area, the Arcadia process programming, and metrics activity (Appl/A and Amadeus) are good examples and Tame out of the University of Maryland, represents some good work. STARS has two breakthrough tasks in the area of process. Lockheed is doing one, focusing on process management, and one from Xerox on transaction management.

Process management support capabilities

Process definition

Process Management

Process adaptation and tailoring
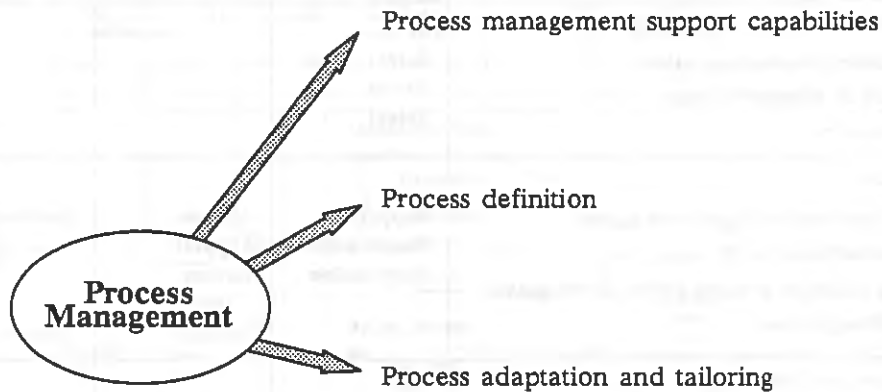
Now, as in the other presentations, I'm going to talk about activities and try to describe the approach to process management we are taking in STARS. There are three primary activities.

The main thrust of the primes activities will be on the process management support capabilities (the tooling, the capabilities, the mechanisms in the environment to support process management).

We will be working with the SEI and others, yourselves hopefully, in the area of process definition.

In order to demonstrate the potential of this technology, we are going to use it on real DoD projects. Each of the primes will support a projects and we will use this technology to adapt and tailor processes to support those projects.

What I plan to do in the next three slides is to give you three different views of these activities. One from the point of view of who's responsible, who's doing what. Secondly, I'll give you an activity flow and then finally I'll wrap it up with a time line picture of what's happening.

It is important to remember that this program involves more than the STARS prime contractors; IBM, Boeing and UNISYS. SEI, as you can see from this meeting, is heavily involved. The evaluation efforts themselves are really going to be handled by the three services and primarily by the projects that are selected to be evaluated. There's funding to support the evaluation projects in order to help them bring up these environments and use this technology. We are also looking to you, the user community, for support. We have begun the discussion of the concept of the affiliates program which will provide a mechanism to support cooperative efforts.

	STARS Primes	SEI	Evaluation Efforts	Users/ Affiliates
Process management support capabilities				
• Process definition language/notation	Select			Review
• Process definition support tooling	Select			Review
• Process mechanism	Select			Review
Process definition				
• Fundamental process building block assets	Support	Source	Review	Contribute
• Reuse process building block assets	Responsible	Support		Contribute
• Map building blocks to process definition language	Responsible	Review		
• Process metric definition	Support	Source	Review	Review
Process adaptation and tailoring				
• Define process intended for use on evaluation project	Support		Responsible	Review
• Identify metrics to be gathered	Support		Responsible	
• Map evaluation project process to process definition language	Responsible			
• Support use, evaluation and tuning	Support	Support	Support	

Process Management Support Capabilities: Initially each of the three prime contractors is planning to select an approach and prototype. This includes actually selecting a language or notation for process definition (not inventing from scratch) and evaluation of process definition tools. This could include anything from smart editors, graphic editors, all the way through process modeling capabilities. Finally, process mechanisms themselves will be evaluated, integrated into the environments and used in the evaluations. Each prime will initially select an approach to prototype. We will be looking for review and maybe even an evaluation of these prototypes by the users through the affiliates program.

Process Definition: We will first be looking at fundamental process building blocks; the common reusable components of process. We are looking at SEI to take the lead in this effort. The prime contractors will be supporting this activity. It may seem strange talking about reusing processes since we have not figured out how to reuse software, but I contend that if you look at what is done on real projects by experienced organizations, process is the one thing we are already familiar with reusing. I don't think the concept of reusing process is going to be nearly as foreign to most people as trying to reuse software assets.

Reuse process building blocks will be collected by the three primes as part of our heavy focus on reuse. This will include process building blocks to support reuse all the way from domain analysis through the capture, filtering and reuse of assets.

The primes will be responsible for mapping the building blocks into the process definition language. We will be looking at SEI to lead the process metrics definition activity with support from the primes.
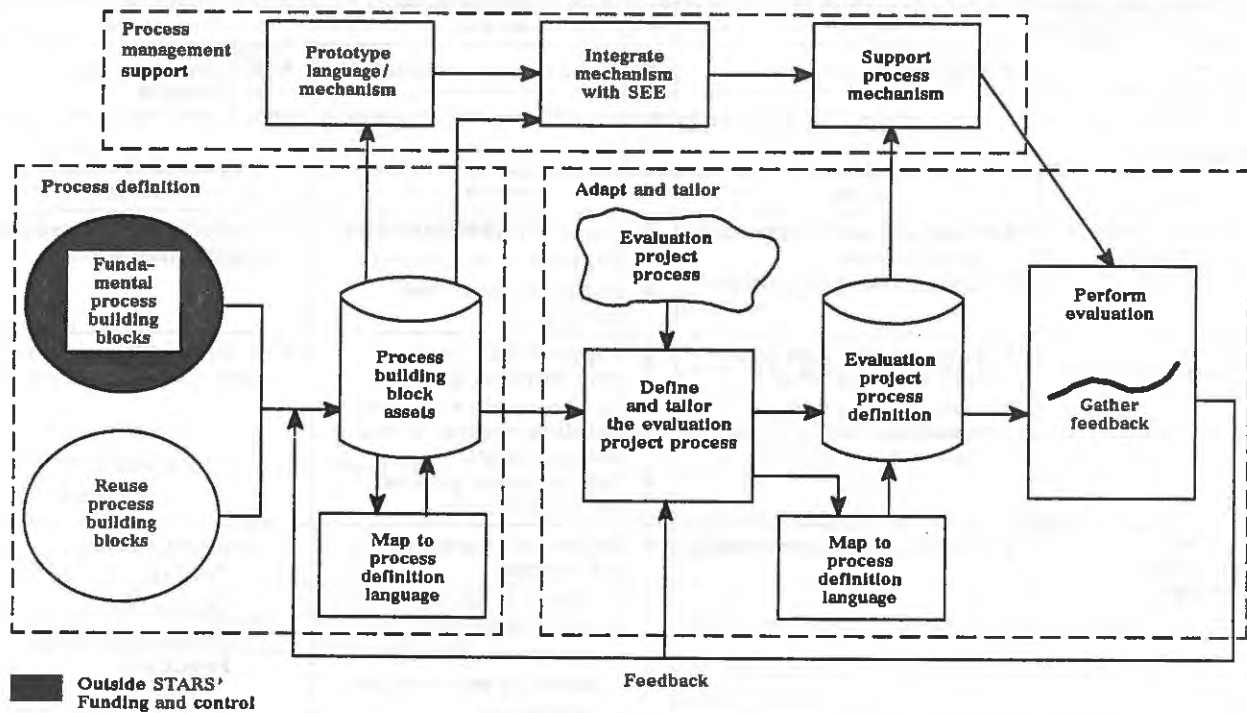
The activity flow starts with the process building blocks being accumulated (creating a set of process asset). The primes will be mapping these to the process definition language which will provide a way of checking the robustness of these languages. We will be using these initial asset definitions for the prototyping of the language, and mechanisms, and to support the integration of the mechanism into the SEE. As we move into adaptation and tailoring, we see that the main activity is to define the process for the evaluation project. This will be done using the building blocks available and the projects understanding of how the process will operate. The process will be mapped into the process definition language. This process is specific to the application being developed by the evaluation project. Remember, at this point all three primes will be supporting different applications and therefore different processes.

The process defined for the specific application will be used to drive the process mechanism within the SEE for that project. The feedback from the actual use of this process will flow back to help tune and tailor the process used, as well as refine and add to the original set of process building blocks.

Process Adaptation and Tailoring: The primary responsibility for this area will rest with the services and the evaluation projects. The primes will support this activity, but only the evaluation project can define its process. We will be identifying metrics to be gathered, but again the project will be responsible with support from the primes. The primes will do the mapping to the process definition language and will be supporting the evaluation.

From overall program timeline

	90–91	92–93	94–96
Process management	• Prototype process mechanism	• Process mechanisms	• Support use and evaluation

Breakdown

SEEs	90–91	92–93	94–96
Process management support capability	• Evaluate languages and mechanisms • Select (one per prime)	• Select STARS approach • Support pilot projects • Refine to beta test quality	• Support use of process mechanisms
Process definition	• Support SEI and process working group • Identify and assess fundamental process building blocks	• Support SEI and process working group • Assess applicability of building blocks to evaluation project • Refine reuse process building blocks	• Support SEI and process working group

Process adaptation/ tailoring	• Adaptation experiments	• Define evaluation project process:
		  – Adapt building blocks
		  – Map to process description language
		  – Identify metrics for collection
			• Support Process
			  – Tuning
			  – Tailoring
			  – Metrics collection
			  – Feedback

From the timeline perspective, we begin with prototyping, with each prime selecting alternative approaches in the early phases (1990–1991) and working with the SEI on the collection of process building blocks.

In the 1992–1993 timeframe, we will have to make a decision. We are looking for feedback from the working groups here. Should we proceed with three different approaches (one per prime) or is it feasible to cut down to one? The decision will be postponed to this timeframe.

The mechanisms and process definitions will be refined to a level sufficient to support the evaluation projects, so that in 1994 and 1995 they can be used. We will also be assessing the applicability of the building blocks we've collected to support that evaluation project. In effect, the major activity during 1992, and primarily 1993, will be the definition of the application projects process.

Finally, during the out years (1994 and 1995) we will be tuning and tailoring the process as well as collecting metrics and gathering feedback.

STARS PROCESS MANAGEMENT
RISK MANAGEMENT

Risk Issue	Mitigation
• Maturity of process management technology	• Early prototyping
• Lack of process definitions to adapt for evaluation project	• Early involvement with SEI efforts • Looking for other groups working this problem • Carefully control granularity of process definition
• Integration of process mechanism into SEE framework	• Early prototyping • Limited integration will provide significant benefit
• Lack of evaluation project acceptance for more formal process management	• Begin working with evaluation project early • Provide support for both technical and management people

Clearly, one of the major risks is that this technology is fairly new and we don't have a lot of experience with it. The maturity of the technology is a concern and that is why we plan a lot of prototyping up front.

We are also concerned about the lack of process definitions to adapt. We really don't have a good base and very little work has gone into formally defining process. We are planning early involvement with the SEI efforts that are going on right now. We are looking for other groups, yourselves included, that are beginning to work in this area and would like to share in this process definition. Finally, we are going to be very carefully controlling the granularity of the process definition. Clearly you need more than something at a very high level, but then again there is a point where your granularity gets far too detailed and process management is getting in the way of doing the job.

We are concerned about integration of the the process mechanism into the SEE. Obviously a process mechanism has impact on all the areas of the software engineering environment. The environment is there to support the process. There is a critical balance to maintain. How should the process mechanism relate to the environment? Should it be very obtrusive, in other words, prevent the user from doing things if they are not allowed by the process or should the mechanisms provide only a warning? This balance will determine the degree of integration required. We will use early prototyping to help determine the proper balance. Even if we only have limited integration, however, we think the significant benefits from the focus on process and having clearer definition of the process prior to starting the project will provide a great deal of benefit.

And finally, the lack of acceptance is a big concern. Any new technology is going to cause people to be worried about negative impact to the project. In the case of process we have a particular concern because we are really getting close to how people do their job. We hope to mitigate this risk by working closely with the evaluation project. We will need the projects buy-in to this technology. They have to understand the technology and believe it can help them. We will look at providing support for both the technical and the management people.

- Will process management technology mature enough to support STARS objectives?

- At what level of detail should software process be defined?

- How would you like to interact with a process mechanism?

- Will projects be able to define their process in sufficient detail to support automated process management?

- How would you distinguish support from enforcement?

Okay, I will leave you with a few questions. Will the technology mature? What is your experience? What is your feeling about where we are in this area? At what level detail should process be defined? The whole granularity issue, there is clearly a point where you have too much detail. How would you like to interact with a process mechanism? Is it the sort of thing that should tell the programmers what to do as they walk in the morning and before they go home, or is it the sort of thing that ought to be controlled more by a process control group that is watching and monitoring the process and trying to keep people on track? How well will projects be able to define the process and will they be able to define the process in sufficient detail for automation? How do you distinguish support from enforcement?

STARS/USERS WORKSHOP OVERVIEW
AGENDA: Monday, 10 Sept 1990

12:30 pm	–	2:00 pm		LUNCH [on your own]
9:00 am	–	9:20 am		DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)
9:20 am	–	9:50 am		STARS Program Overview (Jack Kramer, DARPA/ISTO)
9:50 am	–	10:15 am		Reuse (Teri Payton, Unisys)
10:15 am	–	10:45 am		BREAK [SEI 2nd floor lobby area]
10:45 am	–	11:10 am		Process Management (Dick Drake, IBM)
11:10 am	–	11:35 am	▶	Software Engineering Environment (Bill Hodges, Boeing)
11:35 am	–	12:05 pm		STARS Evaluation (John Foreman, SEI)
12:05 pm	–	12:30 pm		Questions and Answers

The next presenter will be Bill Hodges, the Boeing System Architect who will be covering the STARS activities related to the Software Engineering Environment.

SOFTWARE ENGINEERING ENVIRONMENT

Bill Hodges
Boeing Aerospace and Electronics
10 September 1990
(206) 657-9822
hodges @ stars.boeing.com

I would like to talk to you about the Software Engineering Environment.

SOFTWARE ENGINEERING ENVIRONMENT
REUSE/PROCESS/ENVIRONMENT

Domain-specific Developments   Application Development

Domain Assets   Application Tailoring   Application Adapted Software Engineering Environment

Process Definition

Mission/Reuse Objectives

Domain Architecture & Components

Tools

Life-cycle Process Support

Asset Library

= Influences
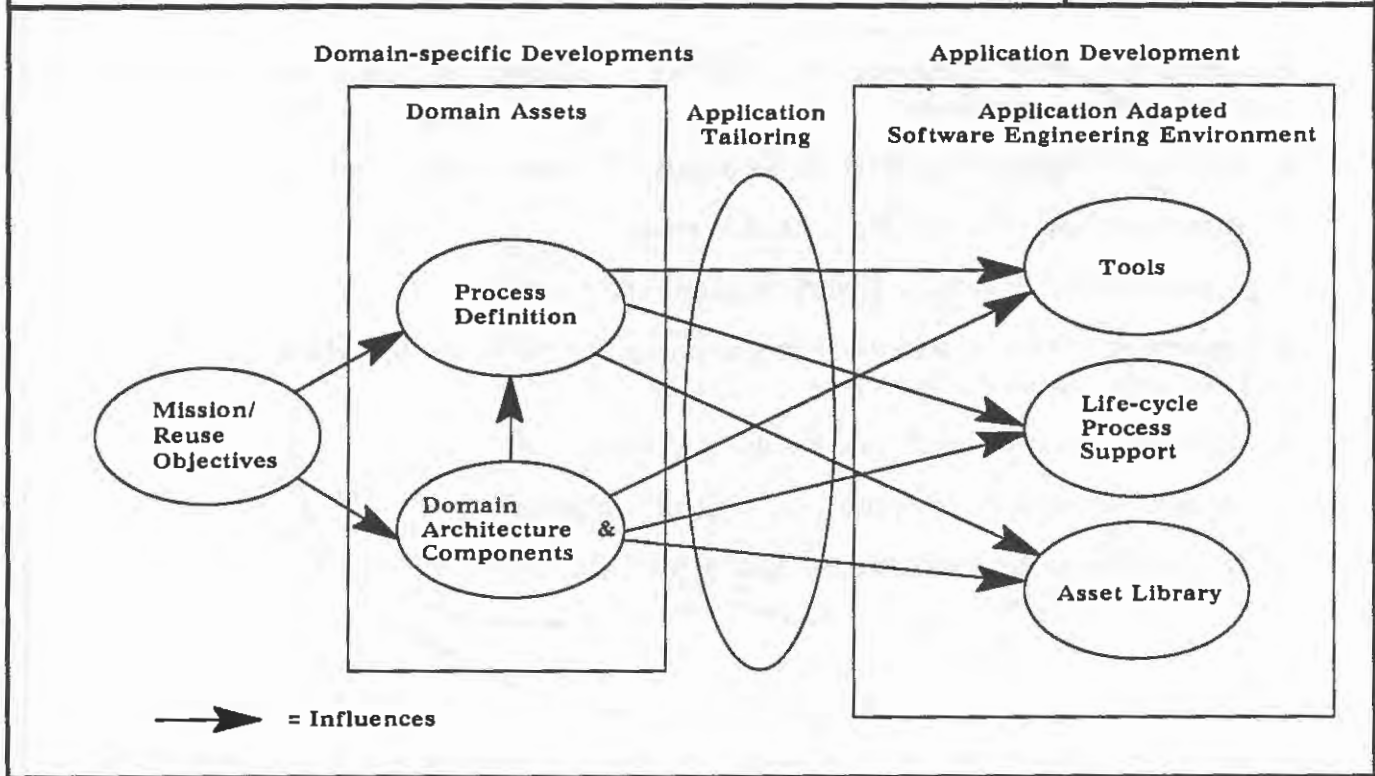
You've seen this chart three times thus far. We have described how the reuse objectives are going to be fulfilled in providing some domain particular assets that would be available to support a project. We have told you how process capabilities will be integrated on the program using the things that are developed outside the program to support the environment. Now I get to tell you about how we have a basic SEE that has a core functional capability in a framework that can receive the work that is done earlier through the process of tailoring to provide the capabilities that you need in a software development project.

The framework will have access to a set of reusable components that can be customized for this particular project. It will have a set of rules that represent the process for this particular customer, this particular application, this particular company. It will have tools that make up the basic core set of tools that can be extended with tools that are specific to this particular domain.

SOFTWARE ENGINEERING ENVIRONMENT
OBJECTIVES

Establish adaptable, commercially viable SEE solutions, available on multiple vendor's platforms

- Life cycle support for DoD high-integrity, mission-critical software

- Interoperating with STARS asset libraries

- Supportive of modern software engineering processes

- Operating within open interface standards for tools, project data, platforms, networks, and user interfaces

- Available on more than two vendor platforms

- Integrated support presentation, control and data

- Ready for use by evaluation projects by 1 October 1993

The objectives for the Software Engineering Environment are to provide adaptable commercially viable SEE solutions that run across multiple platforms. Furthermore, we want to instantiate the capability to provide full life cycle support for the types of things that we do to support the customer base that we have. We want to provide access to repositories. For example, you can bring needed life cycle artifacts from a repository to provide building blocks that are of sufficient magnitude to make a difference in the effort required to build systems. We want to support modern software engineering processes, and by that we mean processes that provide concurrency in development activity, provide reuse capabilities, and have rules that are modifiable for the particular application. We want these processes operating within a set of open interface standards for the tools, data, platforms, and other framework components. This will enable tools to be built to specifications that allow them to run on multiple environments and be machine independent. We feel that the key to this is integrated support for presentation, control, and data. We will talk more later about how this integration will provide an environment that makes a difference. All of this will be available in 1 October '93, the key date for starting the evaluation. At that time, because of the starting points that we have that I will talk about later, we will have an environment in place that will make a difference.

SOFTWARE ENGINEERING ENVIRONMENT
THE WHOLE IS GREATER THAN THAN THE
SUM OF THE PARTS

REUSE

Reuse assets
Legal issues
Acquisition issues

PROCESS

Process definitions
Process languages
Metrics

Significant
Productivity
Improvements

Reuse library mechanisms
Reuse tools
Process mechanisms
Adaptable SEE architectures
SEE integration

Domain specific SEE's
Domain specific architectures

Domain specific
process definitions

Commercial
tools

Standards

SEE

Areas funded by
STARS

Referring back to Jack's chart, he told you about things going on outside of STARS. In particular, with respect to the SEE, commercial tools are being produced today and standards are in the process of evolution. We intend to select from those standards and those tools the things that we need in the STARS SEE to make a difference. We will participate in activities defining Domain Specific SEE's and architectures. We will also participate in domain specific process definitions, and we will fund the activities associated with producing an adaptable, integrated SEE.
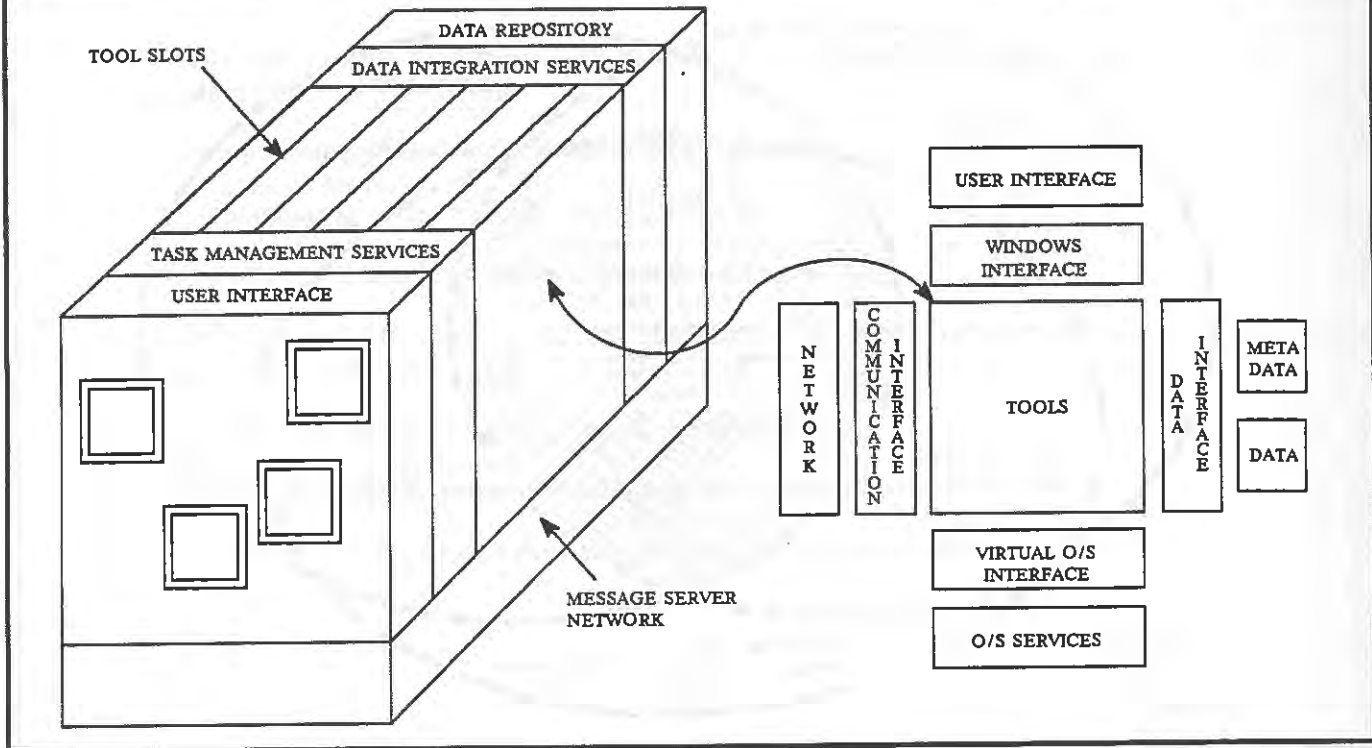
If you look at environments, there are a number of ways to model them. As engineers, we like models; we can talk about things in abstract ways. This chart depicts one model that has been espoused by Hewlitt-Packard. It's predicated upon the concept of services in the environment. One of them is task management services; one is user interface services, one is data access services, and another is message services. These services imply that tools run in the middle and avail themselves of those services. For the purposes of our discussion today, we have moved the stuff from the middle over here and taken a tool centric view. We have said that if tools are built to run in the environment, they have a set of interfaces which need to be built to be portable. We characterize these interfaces as standard virtual interfaces. They provide access to the services of the operating system, access to the network, access to other tools so that you can have tool-to-tool integration. These tools have a standard windowing interface so that your user interface is consistent and is highly functional allowing you to cut and paste data from one application to another rather than rekeying it. In order to share data, tools also require a standard data interface that provides access to both the data, wherever it may reside, and the metadata that describes the characteristics of that data. Keep this in mind as we talk about the approach that we are taking to develop the environment.

STATE OF COTS	• Language-based environments • Emerging repository-based environments for project data
STATE OF DoD PRACTICE	• Loosely coupled tools • X-windows presentation integration • Proprietary environments
STATE OF TECHNOLOGY	• Extended entity relationship approaches • Object-based approaches • Specification to executable programs • Standards development activities
STATE OF RESEARCH	• Knowledge-based environments • Prototyping-based environments (i.e., Arcadia, KBSA, CPL/CPS, Eureka, ...)

We have a technology base to build upon at this time, and it is rich in some areas and in other areas not quite so rich. In the area of the state of COTS (the commercial tools available today) there is quite a bit of capability available, but it is not tied together and we believe that the requirements for an integrated SEE require it to be tied together. Now in some places there is some integration such as the Rational environment. Some of the Common Lisp environments are tied together and some things are emerging here with the IBM and DEC announcements of late.

With respect to what's going on in the DoD, we are still missing some tools. However, there is some presentation integration today, and there are some highly functional proprietary environments which maintain persistent data related to the union of all tools. Many of these things are run on VMS and UNIX while others run on MS–DOS. The technology that we have to build on today is really exploding including work you see in PCTE, CASE–A, and the ATIS or Atherton interface. There's a tremendous amount of work here that's on the verge of providing great breakthroughs for us. There is research going on that is going to come to fruition in the next four or five years, primarily from Arcadia and CPL/CPS. In other areas, KBSA is providing some good insights with respect to configuration management.

SEE Development

Develop open architecture specification

Incrementally grow generic SEE capability

Instantiate SEE for evaluation project
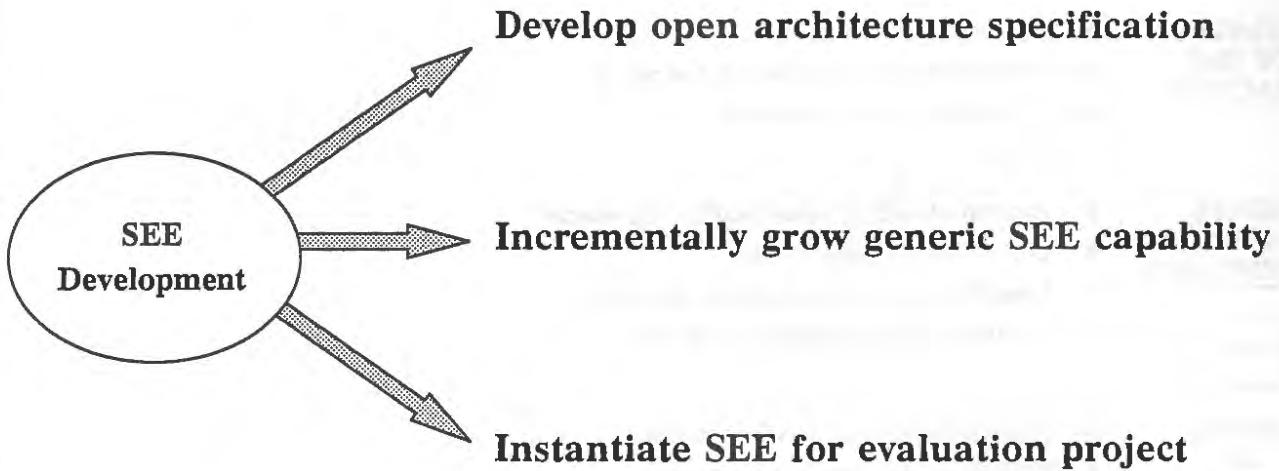
We have identified 3 major activities required to build an environment. In the years '90–'91 we are going to develop the open architecture specification, that will identify the open architecture standards that we will use. I have heard the story that standards are great and everybody ought to have one, but that is not the push we are trying to take. We are trying to identify the minimal number. We have, at this time, a preliminary specification that is in peer review across the three primes. It will continue to mature. It will be given out as a preliminary document that will be evolving over the years throughout the entire development process.

The next period of time is 1992–93. We choose to characterize the focus of our activities during this period as growing the SEE capability. Since we are primarily COTS-based, we will be picking tools that adhere to the preliminary set of open architecture standards established, bringing those into the environment, integrating them, defining the interrelated data between them, and integrating those tools to get them ready to go out into the application.

The period of '94–'96 is devoted to the task of instantiating the SEEs, sending it out to evaluation sites, getting feedback from the usage of the SEEs, and maturing the SEEs, so that they can be turned over for commercial support after that.

SEE Development

Develop open architecture specification

- Identify candidate industry standards
- Support open architecture working group
- Involve user and vendor communities
- Evolve specification
- Conduct risk reduction prototyping activities
- Develop top level information model

The first three areas of the open architecture specification, deal with the activities required to identify the standards and support the standards. These standards would facilitate a mass market for COTS tools targeted for STARS environments. The next set of activities has to do with coordinating activities with the primes, in particular evolving the specification, dealing with the risk reduction issues, and dealing with the top level information model.

SEE Development ⟹

Incrementally grow generic SEE capability

- **Experiment early with prototypical framework**

- **Integrate and test COTS tools**

- **Prototype reuse, process, and DoD unique tools**

- **Customize framework for DoD use**

- **Tune SEE for performance**

- **Refine information model**

- **Support evolution of selected industry standards**

In '92–'93 we will be growing the capabilities of the SEE; again, the concepts here are to expand it early with prototypical frameworks and I'll talk more about what we have chosen to begin with there. We will pick COTS tools, test COTS tools, and look at how those COTS tools will support an automated process. We will identify the leverage from using those COTS tools with respect to how they can help us achieve the STARS' objectives of reducing the cost and time to build systems while improving the quality. We will bring in prototypical reuse and process capabilities at this time and start dealing with the issues of customizing them in order to build for the future. We'll also start identifying DoD unique tools that might be required for our application projects. At this time we will have identified our application projects and, for those unique tools for which we can't convince industry there is a business case, we will prototype approaches and make them available for industry to pick up and commercially support. Then we will customize the framework for the particular applications. As we get down here, we're going to start dealing with the issue of tuning the environment for performance. We'll have a hardware baseline at that time that will include the highest performance workstations that we have at that time. We believe, by that time, that there will be 10 or 15 mips on most desktops, and wide band communications will make many of the barriers you see today go away.

The key to integration of data and control is the information model and issues related to the information model. This includes eliminating areas associated with rekeying and regenerating data. We think that is important. I have some pictures, and I will talk more about that in a minute. We also will support the evolution of selected industry standards. I am sure that as we pick standards we will find things that they do very well, and we'll find some things that they don't do quite so well. As we identify those things, we intend to go back to the standards bodies and try to influence them to make the necessary changes.

SEE Development
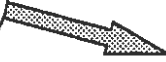
Instantiate SEEs for evaluation project

- Customize SEE for evaluation project
    - Interface to asset libraries
    - Customize for unique process issues
    - Add tools as required
- Develop system administrator concepts/guide
- Validate evaluation test configuration
- Develop SEE user training
- Train environment support personnel
- Train system administrator and SEE users

In the final stage, '94-'96, we will be instantiating the SEEs. This will include customization of the SEE to achieve seamless access to the asset libraries. We want to customize the SEE for the particular processes that the organization uses. We will add domain specific tools that are required to solve the problems a particular project will have. These things force us to identify the application projects early and to start dealing with all of the logistics issues associated with how a prime works with each of these applications. We have to consider user training, environment support personnel, system administrators. Also SEE users need to be trained to use the environment and need to be supported thoroughly for that activity.

SOFTWARE ENGINEERING ENVIRONMENT
EXPLOITING DATA INTEGRATION
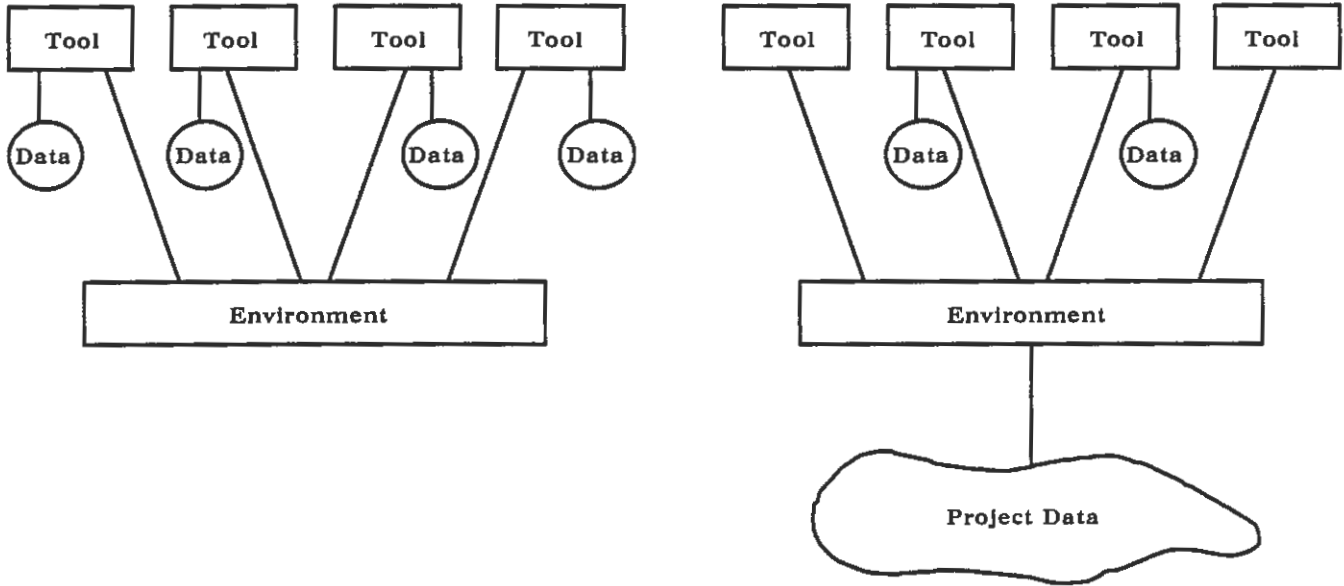
This is a view of data integration. Today we have environments that look kind of like this where each tool owns its own data and the environment is the thing that individuals use to perform the integration function of data. That has some serious shortcomings, and we hope to produce in the STARS an environment that looks more like this—tools can be built to know about the services of the environment, know about the project data, can interchange data, and need to record data in database only once. We know that in the STARS project timeframe we are not going to get all tools converted to run that way. In fact, we will probably get very few. For the tools that have their own data and still control it, we will develop ways within the environment to extract that data and put it into the project database where it can be shared. We also will force these data to be consistant with their metadata.

STARS environments based on commercial solutions

- **Boeing**
  - Building on the Digital Equipment Corporation COHESION framework using DEC and third party commercial tools (VMS & UNIX)

- **IBM**
  - Building on IBM AIX CASE solution using IBM and third party commercial tools

- **Unisys**
  - Building on Unisys Software Productivity Workbench (SPW) framework—a multilevel open systems framework that allows the merger of diverse Unisys hardware/software investment using Unisys and third party tools

This chart depicts the starting point, the strategic point of departure, for STARS. Each of the three primes has put a strategy in place that will provide an environment that has commercial support at the end of the STARS window. Boeing has chosen to put an alliance in place with DEC where the resulting SEE utilizes the DEC Cohesion environment which is a framework built upon an interface specification called ATIS, an extension of the Atherton interface. This SEE is being populated with third party tools. The host framework for the third party tools will be VMS and UNIX.

IBM is building upon the AIX UNIX solution. They are currently evaluating the ATIS specification for suitability. Unisys is building upon an internally developed workbench. It is a open systems framework that will be populated with both Unisys and third party tools.

Portability

Interoperability

Integrity

Integration

Vendor/Market Acceptance

Needless to say this highlights the fact that we have a lot of issues to deal with. For instance, how do we achieve portability, interoperability, integrity, integration? How do we get acceptance from COTS vendors and SEE users within Industry? Some of the things we have to choose from are the virtual operating system interfaces. There are other interfaces that we need to worry about that have to do with data. We need your help in making the right decisions in this area. If you have strong commitments we need to know about them, and we need to guide our activities according to those commitments.

The overall program timeline is a recap of the things that I have talked about. We have chosen to talk about our activities in terms of those associated with developing the architecture, developing the specifications, and doing the integration activity (we have chosen to call the building of the SEE an integration activity, but in reality what that means is your building blocks are just bigger than they would be if you were just building from primitives).

SOFTWARE ENGINEERING ENVIRONMENT TIMELINE

From overall program timeline

	90–91	92–93	94–96
SEEs	Architecture risk reduction	Instantiate SEEs	Support use and evaluation

SEEs	90–91	92–93	94–96
Architecture	Select open architecture standards	Refine architecture	Feedback to standards organizations
Specification	Evolve SEE specification	Evolve SEE specification	Evolve SEE specification
Integration	Integrate prototypical SEEs Identify unique DoD requirements Establish preliminary data model	Populate SEE with domain specific tools Adapt to evaluation projects Instantiate evaluation project SEEs Extend data model to domain specific capability	Refine/tune SEEs
Assessment	Assess CASE vendor impact Conduct market analysis for STARS SEE	Assess SEE performance	Support evaluation Publish lessons learned

Assessment activities will be conducted throughout the project. In '90–'91 they will help to refine the architecture, in '92–'93 they will assess performance and then finally publish lessons learned and provide feedback to the standards organizations.

The specification, as I said, is a evolving document. We have a preliminary one today to review. We are going to evolve it incrementally at each step of the program to produce a spec that describes the environment as we understand it.

From the perspective of integration we're going to each pick a particular SEE framework , identify DoD and other requirements that need to be worked into the environment, including version control and configuration management, and establish a preliminary data model that allows us to deal with the data integration and control integration. Following that, in the instantiation phase, we're going to populate the SEE with domain specific tools, adapt it to the evaluation projects, instantiate evaluation projects SEEs and extend the data model to domain specific requirements.

In '94–'95 we're going to support the use of the SEEs, in the process, gain feedback into required refinements. This feedback will go into the commercial vendors' hoppers to improve their products in order to support STARS' domains. As part of the assessment activities, we are going to assess CASE vendor impact up front and conduct market analysis for the STARS SEEs in order to understand some of the financial issues associated with the developing environment.

In '92–'93 we're going to do a preliminary assessment of SEE performance. This will be done in terms of user satisfaction and in terms of achieving STARS goals for reducing the costs and time of building systems. In the '94–'96 time frame we are going to continue to support the evaluation and we will, in the end game, publish our lessons learned.

Risk Issue	Mitigation
• Consensus on standard interfaces	• Top priority • Schedule early decision
• Acceptance by CASE community, system developers and services	• Early involvement
• Maturity of data model	• Identify and support data modeling activities
• Users perceived performance of integrated environment	• Leverage on hardware manufacturers tuning • Leverage on COTS networking advances
• Cost justification	• Construct cost models • Assess productivity and quality improvement • Ongoing cost benefit analysis

Some of the risks that we have to manage are identified in this chart. The first one has to do with the consensus on the minimum number of standard interfaces. Minimum number because anytime there is more than one standard addressing a certain area we have to worry about the cost of transformations from one form to another. We intend to mitigate this by making it a top priority issue and scheduling early decision points. We are concerned about acceptance by the CASE community, system developers, and the military services. They each have different perspectives. The services will be more interested in how it supports developers as well as post deployment support of existing systems. The CASE community is concerned about how it impacts the number of versions of the product required to be maintained. System developers are going to ask, "does it make a difference?", does it really allow them to produce systems for substantially less cost and time? We intend to mitigate this risk with early involvement with all these people, meetings like this and meetings like the one we have scheduled next Spring.

Maturity of the data model is paradoxical because we want the data model at a level where we can realize the benefits of data and control integration, but not to fine a level of detail. We are concerned about keeping it at a level where it makes a difference and yet allows tools and the environment to perform well. The way we intend to work that is to identify and support data modeling activities similar to PDES, IEEE P1175, CDIF and the CALS initiative.

There is a risk issue associated with users' perception of performance. Users have to feel that the environment is interacting with them, and that they are not a slave waiting there to do something. The primary mitigation here will have to do with leverage gained from hardware manufacturers' advanced environments, the residence of data in the particular workstations, and networking as we look at high performance heterogeneous workstations.

Cost of the environment relates to acceptance by systems developers. We will use cost models to assess productivity and quality issues and provide an ongoing cost benefit analysis.

- What engineering disciplines should SEE support?

- What are the high payoff areas for automation in the SEE?

- What advantages and disadvantages do you expect from a commercially supported, adaptable, machine independent SEE?

- What areas of functionality of the SEE are common and unique to MIS, C3, and hard real time?

- What technology do you see emerging in the 1995 time frame that will change the way we do business?

- How many SEE's make sense? What do we lose if we build two?

With respect to the things that we want to talk about in the next day and a half, I'd like to leave you with some higher level questions than those that are in the handout. They have to do with, the question, is the SEE going to make a difference?

The first aspect of that is what engineering discipline should it support and in what manner should it support it? The next one is to identify where are the high payoff areas? Are they primarily automating clerical activities or really synthesizing? Can we do synthesis within the STARS timeframe? What advantages and disadvantages do you expect from a commercially supported adaptable machine independent SEE? These are some issues that we have to deal with. We will ask you to identify the advantages and disadvantages of our approach. We see some and we would like to know what the user community sees.

With respect to application domain dependencies, what are the common and unique aspects to support the various domains? Will one environment support hard realtime and MIS aplications? What tools are common to these domains? We need to have a strategy of how we are going to deal with those issues.

What do you see coming down the pike? Have we painted ourselves into a corner? Is there something that you anticipate being available in 1995 that will make a difference? We want to know about it.

How many SEEs make sense? We currently have baselines developed on three environments. Is that enough? Would two be enough?

As we look at all these issues we need to have your feelings to help us in our design-to-cost specification over the next few months.

9:00 am	–	9:20 am	DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)
9:20 am	–	9:50 am	STARS Program Overview (Jack Kramer, DARPA/ISTO)
9:50 am	–	10:15 am	Reuse (Teri Payton, Unisys)
10:15 am	–	10:45 am	BREAK [SEI 2nd floor lobby area]
10:45 am	–	11:10 am	Process Management (Dick Drake, IBM)
11:10 am	–	11:35 am	Software Engineering Environment (Bill Hodges, Boeing)
11:35 am	–	12:05 pm	▶ STARS Evaluation (John Foreman, SEI)
12:05 pm	–	12:30 pm	Questions and Answers

This concludes my presentation and at this time I would like to get John Foreman back to talk about the STARS evaluation.

STARS EVALUATION

John Foreman
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10 September 1990
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- **Evaluation—Why, When, How**
- **Constraints, Issues, and Scenarios**
- **Risk management**

I am going to tell you about STARS evaluation. Specifically I will be talking to three different topics:

The why, the when, and the how of evaluation. The constraints, the issues, and the scenarios that we have thought of to date and lastly about risk management.

Before I get into talking about whys, whens and hows of evaluation let me tell you that this presentation is somewhat different in its flavor than the other presentations you have seen. Part of that is because our thinking about what evaluation means in the STARS context is more recent and less detailed than some of the thinking that has gone on about reuse and process and the SEE. So I guess what I am saying here is that the purpose of this particular talk is to show you what our goals are and what our thinking has been as regarding the risks we have to face and the issues that have to be worked and challenges that exist in putting together an evaluation program.

Type	Why	Mechanisms
Interim Snapshots	• Progress evaluation • Decision points • Contract actions • Feedback • Additional tasking • Relevance of efforts	• PMRs • Interim product release • Normal program office "stuff" • Phase (increment) evaluation • Working groups • Workshops • Affiliates
Overall Program Impact	• Validate that STARS will make a difference • Providing cost benefit data • Existence proof to motivate rapid tech transfer • Demo feasibility of building systems with COTS SEEs • Identify areas for future improvement/investment	• Distinguished reviewers/JAC • STARS product adoption • Application development

When we first started thinking about evaluation, as a starting point we came up with the notion that there are two types or classes of evaluations that we wanted to think in terms of. First is the notion of interim snapshots and the second is evaluations that emphasize overall program impact. Interim snapshots are sort of self-defining. Their purpose is to take a picture of the program at particular points in time. We do these activities in order to evaluate progress, to make decisions, take various contractual actions, gain some limited forms of feedback, to perhaps assign additional tasking, and assess the relevance of efforts to date. There is a long list of mechanisms that this program uses and others programs use to accomplish interim review including PMRs, interim product releases, normal program office stuff, phased incremental evaluations, as well as working groups, workshops and the affiliates programs. Admittedly, these last three tend to become the bridge, if you will, into overall program impact.

When we think about overall impact, there all a number of areas to try and assess, such as validating that STARS will make a difference, to start providing cost benefit data, return on investment type of figures, that type of stuff. Essentially we want to provide existence proofs that are going to motivate rapid tech transfer. We want to demonstrate the feasibility of building systems with commercial off-the-shelf, Software Engineering Environments, and also identify areas for future improvement and investment. There are a number of ways those actions or reasons can be accomplished. First is through the distinguished reviewers program that Barry talked about in his presentation. Another is to look at where STARS products, both existing products and incremental releases, are being adopted, but the real key to this presentation is to discuss how STARS intends to really validate its results, by using real world applications developments.

Meet charter goals of lower costs, less time, increased quality.

Demonstrate that STARS integrated reuse, process, and SEE solutions meet charter goals in actual practice.

- Show viability of SEEs on DoD application programs

- Demonstrate productivity leverage points of reuse and process management

- Demonstrate that STARS technology shortens acquisition cycle time

- Demonstrate support for DoD tailorability and reliability needs

- Assess costs and benefits of SEEs (ROI)

- Evaluate user acceptance ("Do users like it?")

This is one slide where the briefing does look like the earlier talks. As Jack Kramer mentioned earlier, there are two global objectives for the evaluation activities. I am going to concentrate on this second one —demonstrating that STARS integrated reuse process, and SEE solutions meet the charter goals of lower cost, less time, and increased quality in actual practice. Now a few important sub-bullets are that we want to demonstrate the productivity leverage points of reuse and process management. We want to demonstrate that STARS technology does indeed shorten acquisition cycle time. We want to assess the costs and benefits of the environments, in other words return on investment. Of course the bottom line is 'Do the users like it? Do they want to use it?'

Establish criteria

- For evaluating STARS success
- For selecting application programs

Prepare application programs

- Select programs
- Prepare SPO and contractor

Perform evaluation

- Monitor application development

Assess lessons learned

- Gather feedback
- Further productization
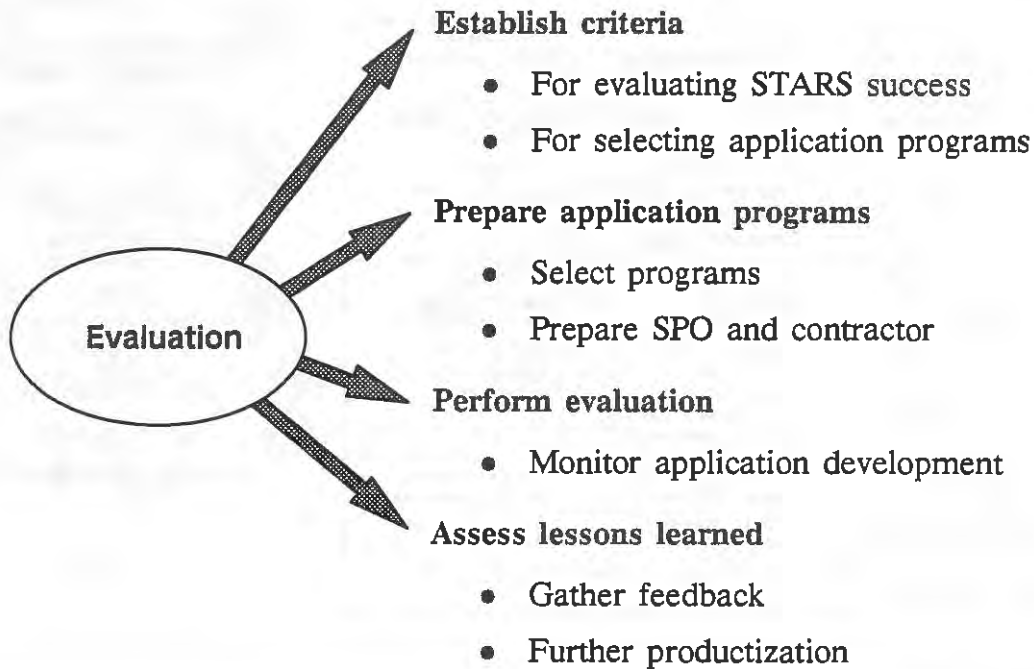
Evaluation

The next three slides are my activity charts, and these will provide different perspectives on the evaluation activity. There are four major activities that must occur. First, we have to establish criteria for the evaluations. There are two parts to this—Criteria for evaluating STARS success and criteria for picking the individual application programs. Now if I haven't made this clear by now, let me restate the fact that these application programs are intended to be real DoD applications. Funded by those particular program offices, and they will be adopting STARS technology for use on those programs.

The 2nd activity is to select and prepare the program offices (SPO's) and the contractors regarding what technology are they going to get, how the process assets get tailored, how the reuse assets get tailored, and things like that.

The 3rd activity, performing evaluation, means that some contractors are going to be building the aforementioned real systems. Finally, the STARS role is to monitor what is going on, assess the results, gather feedback, and based on the results develop lessons learned so that further productization decisions can be made about the STARS technologies.

DARPA

Phase / Activity	90-91	92-93	94-96
	Architecture definition and risk reduction	SEE instantiation	Evaluation/ maturation
SEE, reuse, process technology integration	Prototyping Early integration	Integration Tailoring for evaluation (process, reuse) Evaluation phase support plan	Improvement/ feedback Support to application development
Evaluation and assessment	Criteria for evaluating STARS success Criteria for selecting application development	Continue success criteria development Select and prepare application program (SPO and contractor)	Monitor application development Obtain and assess lessons learned
External activities	Initiate reusable asset and architecture development Software process definition	Continue asset development Initial asset evaluation Software process definition	Application development

DARPA activities after STARS

- Continued feedback and improvement
- Transition
- Lessons learned
- Adaption to new technology from DARPA/ISTO

From the timeline perspective, there are 3 major activity areas. The first line is a synopsis of the reuse, process, and SEE technology development and integration line. In '90 and '91 prototyping and early integration will occur. From '92 to '93 integration work and tailoring for the evaluation and the '94 to '96 timeframe is known as the evaluation and maturation activity in the program. Let me elaborate. Improvement, feedback and support to the application developments occurs during those years.

The second line is evaluation and assessment. During 90 and 91, we have to be building the criteria for evaluating STARS success and for selecting applications. In '92 to '93, the application programs are selected and preparations begin. In the last three years, the activities are monitoring the application developments and obtaining and assessing the lessons learned.

The third major activity is referred to as "externals"—external activities—generally outside STARS funding and control. The external activities are initiating the reusable asset and architecture development, continuing software process definition activities, evaluating the initial assets that have been developed in this phase and when we get into the '94 timeframe, the actual application projects.

When everything gets wrapped up in the '96 timeframe, we envision there will be a set of DARPA activities after STARS which will accomplish continued feedback, improvement and transition of the environments, lessons learned, and provide a basis that other DARPA programs can leverage off.
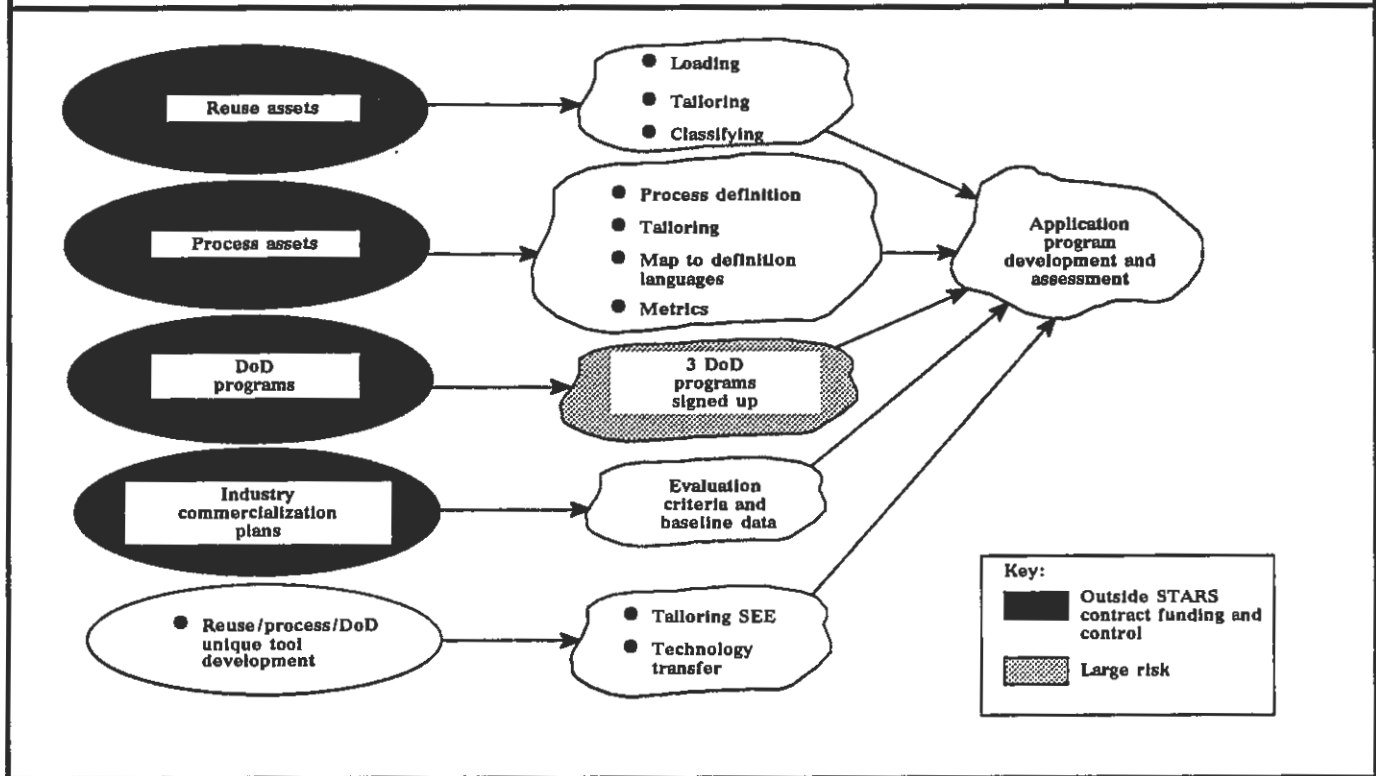
This is a third perspective to the evaluation activity, and that is an aggregate risk/precondition chart. My intent here is to present this as an ETVX chart which as was explained earlier is an entry, task, validate, exit type of presentation. This chart is read from right to left; it shows you where our risks and work areas are and the pre-conditions before we can begin the application developments. Before application development can begin, the activities in this middle column must be completed. For example, from the reuse perspective we must be able to load and tailor and classify via whatever technology I am using, various reuse assets. But of course, I need to acquire the assets. And as you saw from Teri's presentation earlier, the black background indicates items that are outside of STARS contract funding and control. So again, these are the areas where we will be working over the next couple of months to do some risk mitigation/resolution.

In the process world, we need to develop process definitions and assets, and tailor those processes for the particular application developments. We need to map to process definition languages. Various metric activities are also required so that we can evaluate process capabilities, and accomplish further tailoring.

STARS plans three actual.applications development efforts. The risk, as the shading indicates, is because we have to find DoD programs that match our criteria and time-frame, that are willing to work with the STARS program, etc.

Another program issue is the fact that we are working with commercialization plans from industry. That also is somewhat outside of STARS direct funding and control.

We also need to be tailoring the SEEs and doing tech transfer to the contractors that will be doing application development. So all of those issues have got to be comprehended and resolved before the actual application developments can start.

- Evaluation—Why, When, How
- Constraints, Issues, and Scenarios
- Risk management

For the last four or five minutes, I have discussed some of the programmatics and preconditions we have been thinking about, about how activities must flow, activities that have to happen in order to make the evaluation go.

I am going to switch gears a bit now and tell you how we might select an individual application program to use as a STARS evaluation. As I mentioned earlier, this is preliminary thinking; we hope that the people assigned to the evaluation discussion groups, and anybody else that has some good ideas will let us know what you think because we certainly don't have the market on smarts here.

- Software—intensive Ada program

- Sufficiently large to show programming-in-the-large/many

- Must have domain & process assets available in evaluation time frame

- Commercial solutions available for target support (Ada, test tools, etc.)

- Application development must be done by non-primes

- Not a "Black" program

- Cooperative SPO agrees to accept STARS technology

When we discuss evaluation constraints, we are really talking about show stoppers. When looking at candidate application programs, if they don't meet these criteria, they would most likely not make it thru the initial filtering process. So let me explain to you what these criteria mean. Please note that they are not in any kind of priority order.

We certainly want a program that is software intensive and we want it to be an Ada program also. While the environment will certainly support languages other than Ada, from an evaluation perspective this is where we really wanted to concentrate our attention. We would like to minimize the concurrent hardware development in the program so that we can see the productivity improvements that come from the environments.

Another key point is that the selected projects must be able to show programming in the large and programming in the many; we are not interested in projects which could be considered "toys". Our initial thinking is that the candidate programs need to be at least 100K lines of code, and more is better. From a people perspective, we are thinking about a minimum of 10–20 people. Of course, this is initial thinking and subject to change. From the earlier presentations, you know that we need to have domain and process assets ready for the evaluation, which is scheduled to start about Oct 93.

Depending upon the target processors being used, we want commercial solutions for those target processors. We certainly don't want to be in a situation where we are doing the concurrent development of additional compilers or code-generators at the same time we are trying out the other STARS technology. Many of you have been in similar situations before and know the difficulties of that situation.

Another constraint is that the application development must be done by non-STARS primes. Additionally, "black" programs are not appropriate because of the clearances needed and also because of the difficulty of disseminating results. We also need a cooperative SPO which agrees to accept and use the STARS technology.

- **Program schedule must be compatible with STARS schedule**
  - Evaluation phase lasts 18–24 months, starts Oct '93—assessment phase additional 12 months
  - Must go far enough into life cycle to show merit of STARS
  - Final product must include code and some level of test, integration, and documentation

The final constraint is that the selected program's schedule must be compatible with STARS schedule. The particulars here are the evaluation phase lasts 18 to 24 months, and starts about October '93. Assessment, consisting of lessons learned, feedback and the like, would go on for another 12 months, so there is a period of about 30 to 36 months allocated to evaluation.

Any program that is chosen has to provide the opportunity to go far enough into the life cycle to show the relative merits of STARS. We are also vitally concerned that the final product of these application developments must include code and some level of test, integration, and documentation. Code is required because that is the only thing that people really believe. We want test, integration, and documentation as well because they are part of developing real world DoD programs. "Some level of" means that if you are working on an incrementally phased type of program you may not be able to get through final test, integration, and documentation but you may be able to accomplish that for the particular phase that you are in.

- **3 Different projects in 3 application domains**
- **Contractual and business relationships must be established**

To make the situation/requirements even more interesting, we need, as I mentioned earlier, three different projects in three different application domains. And there are some very interesting contractual and business relationships that have to be established to do these evaluations. Let me give you an idea of them.
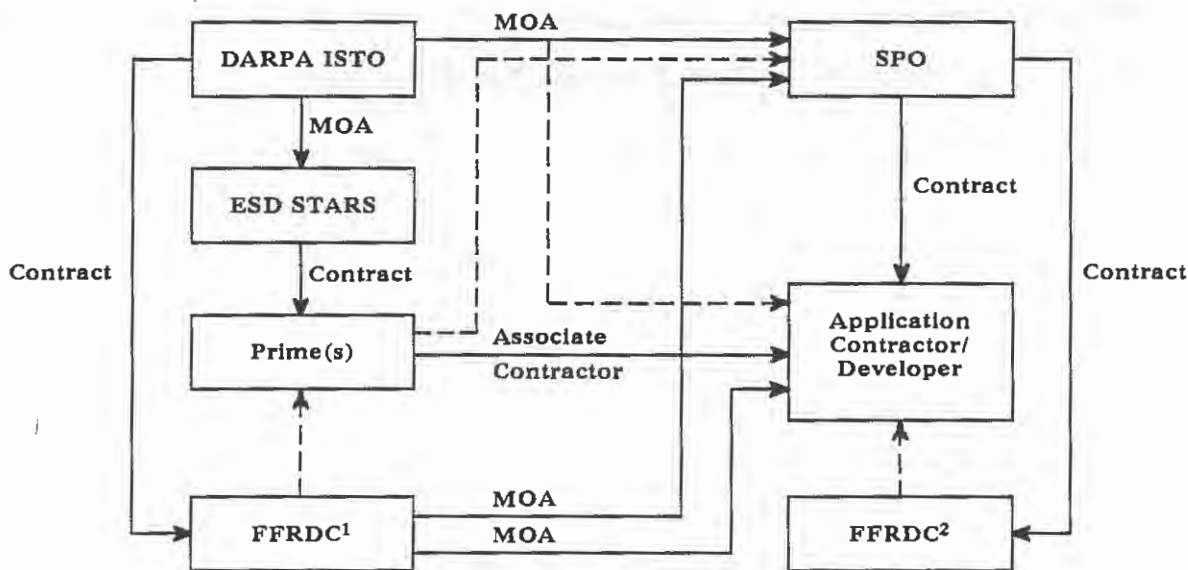
This is one cut at one type of contracting or business relationship that might exist. On the left side is the STARS contracting relationships from DARPA/ISTO to Electronic Systems Division to the primes and the FFRDCs that are involved. On the right is the application development side, complete with program office, whatever contractor does the application and whatever FFRDC might be assigned there, for example, like MITRE, Aerospace, or any others. As you can see, there are a number of MOAs (Memorandums of Agreement) that are required, as well as some associate contractor agreements. All those business relationships would have to be worked out, as part of getting these evaluations efforts underway.

Earlier, I discussed a series of expected constraints with you. The next slide presents a slightly different view of the problem. What we tried to do was think in terms of different classes of applications that might work as STARS evaluation projects and organize them from the perspective of complying with the constraints (those at the top) and then constraints are reduced as we progress thru the spectrum. Let me explain this further. One of the reasons I am also talking through this list of possible ideas is to stimulate thinking on your part. Maybe you know of some candidate programs.

Reduced Constraints

- **New development**
  - System
  - Subsystem
- **Ongoing development**
  - Incremental
  - Block upgrade
- **PDSS (logistics)**
- **"Below-the-Line" program**
- **Shadow**
- **Experimental**
- **Asset creation**

One scenario is a new development effort—find a program that is expected to go into development in the next couple of years, capture that program, and work with them. Now there are two ways that can work. We can attempt to do the whole system, if it is small enough, or apply STARS technology against large subsystems if the program is much larger than 100,000 lines. Incremental development techniques would be included.

Another idea is to find a program that is already in progress. There are 2 approaches here: some kind of incremental approach again or a program which has some very structured block upgrades that are coming down the pike. The idea of a block upgrade is coupled to the notion of "maybe we can find some program that is a good candidate in the PDSS" (Post Deployment Software Support) logistics arena. One of the challenges or complications in the PDSS arena would be programs that might not have been originally developed in Ada—we might end up having to do some reengineering work to make that happen.

What is a below the line program? Here is an analogy. In many of your companies part of the IR&D process is that the proposals get ranked and a line is eventually drawn based on available funding. A similar process happens in the services. There are certain programs, that while worthwhile, won't get funded. Maybe STARS can find some program that is below the service funding line and through some interesting/innovative funding work STARS might be able to fund it ourselves. That way the service would get an application that they didn't expect and STARS might be freed of some of the contracting issues that we saw on the Wiring Diagram a few slides ago.

- Some form of SRS available end '93

- Design not done

- Ada

- Precedented system—C^3I, MIS, . . .

- Environment decision *not* made

- PEO interest in reusable assets

- Good technology transition receptor organization

Let me talk a bit more about the new development scenario, particularly system development. In this scenario, we would expect some form of a systems requirements spec to be available by the end of '93. The design can't be done. It has to be an Ada program. We are looking for precedented systems, most likely in the C3 or MIS world. An unprecedented system is not desired, as that would seriously increase the risk of showing the affect of STARS technology. Obviously, the environment decision should not have been made. We are looking for program executive officers, program managers that have long term interest in reusable assets in their particular application domain or product line. We are certainly looking for contractors that have good technology transition receptor organizations, who are interested in bringing in new technology and working with it.

What is a shadow? In the past STARS has done shadow projects that worked out rather well. Those original Shadows focused on doing an Ada development in parallel with an existing development in another language. Shadows at this level would probably involve doing the same application system, using STARS reuse, process and SEE solutions, in parallel with another software development environment.

Experimental means perhaps the STARS program can couple up with a particular application domain for some cooperative, mutually beneficial efforts. For example, build some reuse assets together and then try those assets out on some experimental programs in that particular application domains. If you let your imagination run a little bit you also can think where that could scale up very nicely into a full-blown development effort.

Asset creation is the low order notion on our spectrum. This idea refers to using STARS technology to create reusable assets only. There is no application development, and that's why it is at the end of the spectrum.

- **Evaluation—Why, When, How**
- **Constraints, Issues, and Scenarios**
- **Risk management**

Last but not least, I will talk about risk management. By this time, many of you in the audience could probably create these slides for me!

Risk Issue	Mitigation
• Identify three *real* programs that satisfy constraints	• Stimulate system builders to promote candidates • Stimulate government to identify candidates • Work the problem early
• Existence of and sufficiency of reuse and process assets	• Examine current domain specific assets for applicability • Seek other sources of assets • Initiate development: identify funding and contractor immediately
• Contractual relationships (per diagram)	• Consider innovative approaches • Early role definition and commitment

A major Risk issue is to identify three real programs that satisfy the constraints that we have listed earlier. How are we going to go about finding those? We want to stimulate system builders to promote candidates. That is one of the reasons we are having this workshop. Hopefully we can unearth some candidates because of that. Same thing goes for the Government side. Those of you who are in program offices, we certainly want you to think along those lines, too. Obviously, we are trying to work the problem early so that things can be done on time.

A 2nd risk is the existence of and the sufficiency of reuse and process assets. We will attack this by examining existing/current domain specific assets for applicability. We may well find it necessary to seek other sources of assets or enter into cooperative development agreements with various programs or application domains.

Perhaps not a large risk are the contractual relationships I showed you on the Wiring Diagram earlier. We want to consider some innovative approaches but if we do end up in that kind of a Wiring Diagram scenario, one of the ways we will handle that is through early role definition and commitment by both the application developers and STARS.

Risk Issue	Mitigation
• SEE delivery (COTS tools, processes, etc) on time and with sufficient quality, tailoring and functionality	• Early involvement of application developers • Early use of STARS products • Careful review of entire program plan, schedule and budget allocation • Balance evaluation plan vs available funding vs technical development and integration
• Lack of quantifiable measurements for productivity evaluation • Lack of baseline data for these measures	• Early identification of precedented programs • Industry consensus on suitable metrics • Help sought

Two more risks. We are concerned that the Software Engineering Environments will be delivered on time and with sufficient quality, tailoring and functionality to be really useful for the application development activities. We will attack this risk thru early involvement by the application developers once they are identified. Additionally, we plan early use of STARS products so that there is feedback and improvement. Also, we intend careful review of the entire program plan to balance evaluation goals, available funding, and the technical development and integration activities that the program has planned.

On the last risk, we could certainly use your help. Any time an evaluation is done we are attempting to determine how much better the new "stuff" is. But before you can determine how much better, you need to know where you were before attempting to try out the new "stuff". We have faced this problem most recently, and perhaps not very succesfully, with Ada, we have been faced with these questions with other supposed improvements. A common problem is the lack of quantifiable measurements for productivity evaluation and the lack of baseline data against which to calibrate and compare. Again, this is certainly one area where we are looking for help and we are looking for industry consensus on meaningful, suitable metrics and indicators.

- How many evaluations make sense?

- Who should do them? Projects within STARS Primes? Others?

- What evaluation scenarios make sense to you? Do other plausible scenarios exist? What are the good and bad points of the scenarios?

- Are the constraints correct?
  Should any be relaxed?
  Are any constraints missing?

- Under what circumstances would you be willing to promote your program to be one of the application development projects?

If I haven't given you enough to think about, let me suggest a few more. How many evaluations make sense? Our current plan is three. Is two better? Is one better? What is the down side, what is the up side of those alternatives?

Who should do these application development projects? Should they be done by the STARS primes or projects within IBM or UNISYS or Boeing that are not associated with the STARS efforts? Should they be done by outsiders? Should they be done by some combination thereof?

I discussed evaluations scenarios at length. Which of those makes sense? What are the good and bad points of those particular scenarios? Are there others that we haven't thought about?

I also discussed some of the constraints that we have thought about. Are those the right ones? Should any of them be relaxed? Have we over constrained the problem? Are any constraints missing, are there constraints to be added?

Perhaps our most critical question is this: Under what circumstances would you, either contractor or Government, be willing to promote one of your programs as a STARS application development effort?

Thank you, The next block of time (25 minutes) will be devoted to questions and answers.

STARS EVALUATION
AGENDA: Monday, 10 Sept 1990

9:00 am – 9:20 am		DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)
9:20 am – 9:50 am		STARS Program Overview (Jack Kramer, DARPA/ISTO)
9:50 am – 10:15 am		Reuse (Teri Payton, Unisys)
10:15 am – 10:45 am		BREAK [SEI 2nd floor lobby area]
10:45 am – 11:10 am		Process Management (Dick Drake, IBM)
11:10 am – 11:35 am		Software Engineering Environment (Bill Hodges, Boeing)
11:35 am – 12:05 pm		STARS Evaluation (John Foreman, SEI)
12:05 pm – 12:30 pm	▶	Questions and Answers

III. Issues for Discussion Groups

This part of the STARS/Users Workshop final report contains:

- The charge given to all workshop attendees and discussion group leaders (Pages 14 - 16);

- The questions put to each discussion group for their consideration Monday afternoon and Tuesday morning (in **bold** font in each of Chapters 1 through 11);

- A transcription of the transparencies presented by each discussion group to the STARS Program and workshop attendees Tuesday morning (in this font, in each of Chapters 1 through 11, in sections titled "Discussion Group Slides");

- A brief write up from each discussion group, providing more of the background and rationale than could appear on transparencies (in a variety of fonts, in each of Chapters 1 through 11, in sections titled "Discussion Group Write Up");

- A point-by-point response by the STARS Program to each of the issues and recommendations identified by each discussion group (the responses are interspersed with the discussion group slide text; the short response is underlined; the explanation of that response is in *italic* font, in each of Chapters 1 through 11, in sections titled "STARS Program Responses").

Introduction

This document provides the framework for the discussion groups to be held Monday afternoon and Tuesday morning. It is primarily a collection of issues to be discussed. As each discussion group reports back, that information will be collected and appended to the appropriate section. The STARS Program overall responses will be provided at the end.

Notes to Discussion Group Leaders

The goal of the discussion groups is to provide concrete recommendations and critiques to the STARS Program. As such, please don't just discuss issues. Validate those concerns against what STARS is/should be doing; ask those questions; provide concrete examples/alternatives as much as possible. Also discuss realistic cost and schedule impacts, and inherent risks. Identify risk mitigation strategies wherever possible.

One of the discussion groups will be using a more structured brain-storming technique called "Nominal Group Technique" (NGT). A facilitator knowledgeable about NGT will be working with that group to assist with its effectiveness.

For all other discussion groups, there are a number of "common sense group management" strategies to remember:

- Each discussion group has a group leader for the duration of the Workshop. It is the responsibility of that group leader to:

  - Maintain focus on the issues assigned to the group. Each discussion group is provided with several questions/issues for discussion. It is not a requirement to address all of them. If the discussion group prefers (or if the experience of the group leads) to discuss just a few of the issues in depth versus broadly discussing all the issues, that is acceptable. To begin with, get a group consensus on which issues will be addressed.

  - Ensure that those issues get discussed. This does not mean that, as work progresses, additional discussion items may not be addressed, or, if the original group plans prove too ambitious, that some items may be omitted from discussion. Try to ensure that you have enough time to clearly articulate responses to each of the items that are discussed.

  - Ensure that ideas are captured (use one or more recorders for the group). This will become the basis for the preliminary feedback to the STARS Program Monday night (working dinner) and for the Discussion Group Reports on Tuesday.

  - Ensure that schedules are respected (use one or more time keepers for the group). Be sure to provide sufficient time to prepare the slides for presentation at the Discussion Group Reports session. Emphasize by your example the importance of timely arrivals and resumptions after breaks.

  - Participate in the working dinner Monday evening. Discussion group leaders will be providing initial feedback to the STARS Program, and may take additional information back into their discussion groups for the Tuesday session.

  - Prepare, with the group, a 7-10 minute summary presentation for the Tuesday morning Discussion Group Reports session. This summary should use about 5 slides for the presentation and will, of course, be geared to the area on which the discussion group focussed. The following enumerates the general format preferred for that presentation:

Slide 1:   *Title:* STARS Plans - Positive Points

What did the discussion group like best about the STARS plans in the area the group addressed?

Slide 2:   *Title:* Recommendations

1. Are the right activities being addressed by the STARS Program?

2. Is STARS taking the right approach in how it addresses those activities?

3. Should there be more/less emphasis in certain areas?

4. What critical activities are missing from STARS? Are they being addressed elsewhere?

Slide 3:   *Title:* WIN/WIN

1. What aspects of the STARS plan represents a WIN condition for you?

2. How could the STARS plan be more effective in providing a WIN condition for you?

Slides 4, 5:   *Title:* Responses < discussion-group-title >

Discussion Group responses to specific questions/issues discussed by the group.

- Make that 7-10 minute summary presentation Tuesday morning.

- Provide a copy of that presentation and supporting (short; 3-6 pages; stressing rationale behind the conclusions presented via the slides above) writeup to Judy Bamberger by Friday, 21 September 1990. This information will be included in the "final report" that comes out of this Workshop.

- Consider beginning with the old-fashioned "ice-breaker"; go around the room with a 3 minute "Who am I?" so people can begin to understand the perspective of each person. Have people write their names on the table tents provided (as badges are not visible across tables).

- Ensure as many people get involved in the discussion group as possible; when people feel some degree of "ownership" of the process, they are more willing to participate. Involvement is not only via talking; there is the need for one or more recorders, time keepers, slide producers, etc. These roles can pass from one to another throughout the two days.

- Keep the discussion at the appropriate level and focused on the topic at hand with the overall goals in mind. It is fine to explore a tangent briefly, as that may provide deeper insights into the current issue. However, do not hesitate to bring the discussion back into line should the tangent begin to become all-consuming.

- If there is a relatively quiet person in the group, pause for a moment, and direct a question to that specific individual. Draw that person into the discussion in an accepting manner, allowing that person to contribute.

- If things begin getting "out of hand," it is OK to revert to the classroom method of asking people to raise their hands, so that everyone can be heard. Enforce it for a while, until control/sanity are reestablished, then feel free to relax the rule, for as long as control remains.

- While breaks are at scheduled time (i.e., that is when the refreshments arrive), feel free to allow for breaks at other critical times, should they arise.

- Encourage all questions of clarification; nothing derogatory should be allowed; do *not* criticize people; do *not* allow criticism of people by other people!

1. STARS Program Concerns

Charter: Examine issues related to the overall STARS plan and how it relates to the DoD software community.

Discussion Group Location:

Training Room B Monday
Training Room B Tuesday

Discussion Group Leader:

Ed Evers, *General Dynamics*
Bob Park, *SEI* [discussion group facilitator]

Discussion Group Members:

David Carney, *IDA*
Peter Feiler, *SEI* [Monday only]
Alec Grindlay, *USN/SPAWAR* [Tuesday only]
Rick Gross, *USAF/HQ USAF*
Andrew Hodyke, *USAF/ESD*
Dick Hotz, *Grumman*
Jim Perry, *GTE*
Erhard Ploedereder, *Tartan*
Win Royce, *TRW*
Paul Stevens, *Hughes*
Karen Thelen, *Honeywell*

1.1. Validation of Top-Level STARS Plan

One strong point I see in the new STARS plan is ...

What causes me concern about the new STARS plan is ...

(eventually providing "why," of course!)

(include not just "what" is being addressed, but the time frame - realistic or not - key risk items - and presence/lack of mitigation strategies)

1.2. Activities / Technology Addressed by STARS

One high-leverage activity that is/should be addressed by STARS is ...

One low-leverage activity that is not/should not be addressed by STARS is ...

One up-coming technology that should be examined by STARS is ...

One up-coming technology that should not be examined by STARS is ...

One existing technology that should not be a part of STARS but is is ...

One existing technology that has been overlooked by STARS and should be included is ...

(eventually providing "why," of course!)

1.3. Recommendations

Is STARS examining the highest leverage activities involved in software development/maintenance?

Where should STARS put more of its effort? less?

What additional resources must/could/should be brought to bear on these issues in order to make any progress on them?

Economics - what business environment can be assumed "after STARS"?

1.4. Integration of New Technology

What areas of STARS appear to shut out, or put up arbitrary barriers, to ready adaptation/adoption of new products and technologies in software development (e.g., advanced CASE tools, domain-specific software architectures)? In which areas does STARS risk becoming obsolete by the time STARS is developed due to these artificial constraints?

1.5. STARS Scope

What should the scope be for STARS? Should reengineering be an important part of STARS? Should STARS be viable for "new starts" only? Should STARS address the maintenance/PDSS area? What issues must STARS address to remain/become viable in these domains?

1.6. Timeliness of STARS

Can STARS accomplish what the plan includes?

Will STARS be obsolete by the time STARS is operational?

1.7. Discussion Group Slides

DG1.1 - STARS Program Concerns

- 11 people representing
    - Services
    - Industry - large & small
    - STARS

DG1.2 - STARS Program Concerns

- Structured Brainstorming Process Used
    - Brainstorm
    - Discuss/Combine
    - Lobby
    - NGT
- Concerns were raised - Original 34 reduced to 33
    - Budget/schedule
    - Focus/Breadth
    - Reuse as panacea
    - Evaluation Process
    - Credibility
    - Scalability
    - Non-Technical Issues
- Two-stage NGT reduced to 17; then blocks of 3 and 5 concerns
- Strong points identified - original 16 reduced to 12
    - Process
    - Commercial sources
    - Standards
    - Cooperation
    - Involvement
    - "New" program
- NGT reduced to 3 levels of two strong points apiece
- 26 recommendations mapped to top four concerns

DG1.3 - Initial Strong Points

- First set of strong points
    - Focus on commercial sources for tools/solutions (9/39)
    - Coordinate and leverage off other software standardization efforts (10/31)
- Second set
    - Recognition and emphasis on process (8/24)
    - Expressed desire to solicit and retain end-user consensus (7/19)
- Third set
    - Evidence of improving the program: "new" STARS (6/13)
    - STARS is one of few "national" initiatives toward national cooperative efforts (4/14)

DG1.4 - Initial Concerns

- First set of concerns

    1. Too many concerned parties, involvements; not focused; fear of redirection (6/20)

    2. Slaying 3 dragons in parallel; really interrelated (Reuse/Process/Tools) (5/18)

    3. Reuse is painted as panacea - will work better in some domains than others (5/16)

- Second tier of concerns

    4. Failure to address non-technical issues (6/13)

    5. Not enough budget for all the ideas (5/13)

    6. DARPA software technology largely ignored - too little in new program to change this (4/13)

    7. Reliance on assets - origin unknown (4/12)

    8. Belief that under DoD contracts, a viable SEE can be built (3/12)

DG1.5 - Recommendations

1. Too many concerned parties, involvements; not focused; fear of redirection

    - Identify key standardization efforts and work with them

    - Strengthen end-user involvement (early requirements)

    - Roadmap and plan for interaction

    - Insure continuing cooperative primes ·

    - Single specification

2. Slaying 3 dragons in parallel; really interrelated

    - Roadmap and plan for interaction

    - Insure continuing cooperative primes

    - Integral concept needs to be formulated to unify "3 dragons" on which a process to facilitate reuse can be based and supported by tools

3. Reuse is painted as panacea - will work better in some domains than others

    - Identify contractual mechanisms to incentivize contractors to use reusable components

    - Specific definitions for reuse at its various levels and intricacies

    - Reuse strategy has to be formulated and only specific types of reuse should be addressed

    - Research and identify software technology attributes required for reuse

    - Integral concept needs to be formulated to unify "3 dragons" on which a process to facilitate reuse can be based and supported by tools

    - Start initiative to collect existing assets

4. Failure to address non-technical issues

   - DARPA/STARS answer criticism - "technical answer to non-technical problem"

   - Identify contractual mechanisms to incentivize contractors to use reusable components

   - Do a study on liability and data rights issues

   - DARPA work with DoD acquisition commands to embed DARPA recommendations into acquisition

   - Certification of reuse assets

   - Must address software acquisition policy

DG1.6 - Conclusion

   - Significant positive changes have been made to STARS

      - commercialization

      - standards

      - user involvement

   - Concerns have been identified and recommendations have been provided

1.8. Discussion Group Write Up

(begins on following page)

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DISCUSSION GROUP 1 REPORT:
STARS PROGRAM CONCERNS

The discussion group met in two sessions. The group elected to concentrate on following the suggested approach outlined by our facilitator - Robert Park.

Step 1: Identify <u>strong points</u> and <u>concerns</u> about the STARS program.

The group consisting of eleven participants identified 16 strong points and 34 concerns. Generally during this round the individual strong points and concerns were voiced without lobbying. These 50 items are included in Exhibit A in the order they were presented and using the exact wording, punctuation, and misspellings as they were enscribed onto the walls. It took about seven rounds before eleven consecutive passes were obtained.

Step 2: Consolidate similar points.

On the "concerns" side, item 12 was consolidated with item 28. Thus concerns were reduced by one from 34 to 33.

On the "strong points" side, items 2 and 5 were combined with 14, item 4 with 3, and item 6 with 8. Strong points thus were reduced from 16 to 12.

Step 3: Lobby on behalf of or against concerns.

Two to three rounds were needed to exhaust the lobbying for concerns.

Step 4: Reduce the candidate concerns by one half.

Each of the eleven participants was permitted 17 votes to be cast one at a time against 33 concerns. The resultant voting tally in shown is the last chart of Exhibit A. It was decided that 6 votes or better were needed to qualify for the next round. This left 16 qualified concerns.

Step 5: Rank the candidates on a 5-4-3-2-1 basis.

Each of the eleven participants picked their top five, awarding scores of 5 through 1; 14 of the 16 concerns received at least one vote. These voting results are included in Exhibit A.

Three concerns stood out with accumulated scores of 16 (5, 4, 3, 3, 1), 18 (5, 5, 4, 3, 1), and 20 (5, 5, 4, 3, 2, 1). Five others were approximately tied with accumulated scores of 12 or 13 and were included in the second rank. Rejected concerns in this second voting round had accumulated scores of 10, 10, 9, 8, 7, and 4.

The selected top eight concerns are included in Exhibit B. This same information was presented in the evening session to the STARS program working group. The STARS working group asked for explicit recommendations for three of the eight concerns (the 1st, 2nd and 4th ranked).

This completed the first day's work. There was a general feeling by the participants that the voting for concerns was unexpectedly diffuse.

Beginning the second day there was a slight reworking of the plan to invest more time into recommendations.

Step 6: Lobby for or against strong points.

This took place quickly in one round.

Step 7: Vote for strong points based on a 5-4-3-2-1 ranking.

The results of this vote are included in Exhibit A.

Six of the twelve strong points were deemed to be most significant and are included in a figure of Exhibit A.

The six highest ranking strong points had accumulated scores of 39, 31, 24, 19, 14, and 13. The six rejected strong points had scores of 8, 6, 5, 3, 1, and 1.

Step 8: Identify recommendations to address the concerns with emphasis on the three concerns specifically identified by the STARS working group (numbers 6, 14, and 29 of Exhibit A).

Three to four rounds were needed to identify 26 recommendations. The results are included in Exhibit C.

Step 9: Consolidate similar recommendations.

One consolidation was achieved - item 26 was lumped with 16.

Step 10: Lobby for or against the recommendations.

Time was growing short so only one round of lobbying limited to a 15-second speech was permitted.

Step 11: By a show of thumbs up, sideways, or down indicate concurrence, indifference or opposition to the recommendations. Explain opposition in 15 seconds or less.

With two exceptions there was little opposition to the recommendations. The negative numbers included with each recommendation represent the original thumbs-down count. In all but two cases after minor rewording the objections were removed.

In two instances the group of eleven participants could not achieve a consensus and were in fact roughly separated into three equal but opposing constituencies.

Recommendation 18 argues that reuse must be worked first before process and tools. Recommendation 19 argues that process comes first, next tools, and finally reuse. Two diametrically opposed recommendations were deliberately nominated. One group was strongly for 18 and against 19, a second group of about equal size was polarized oppositely, and a third group had various other ideas. Clearly no consensus was possible and recommendations 18 and 19 were officially dropped.

Finally of the remaining 23 recommendations it was decided not to rank them. It was argued that the ranking of concerns constituted an inherent ranking of recommendations. Step 12 was added then to trace recommendations back to concerns.

Step 12: Complete a traceability of recommendations back to the eight top-ranked concerns.

A traceability was done. Generally each recommendation fits two or more concerns except for two instances where the recommendation was judged to be not applicable (N/A) to any concern. The following table summarizes the traceability of recommendations to concerns.

Concern #	Recommendation #'s
1	7, 13, 16, 20, 21
2	16, 21
3	3, 6, 8, 9, 25
4	2, 3, 8, 14, 15, 24
5	11, 12, 16, 17
6	4, 13, 14
7	15, 25
8	1, 4, 11
N/A	5, 17

Concerns 1, 2, and 4 were the concerns for which the DARPA working group asked specifically for recommendations. The STARS program concerns discussion group listed eleven recommendations aimed at these three top concerns.

Step 13: Report out the strong points, concerns and recommendations.

Our discussion group leader, Ed Evers, reported on our deliberations at the afternoon session of the second day.

STRONG POINTS AND CONCERNS

FORMAT:

(22.) REUSE IS PAINTED AS A PANACEA

5 4 3 3 1   5 / 16

circle indicates
selected for
consideration in   ranked scoring   number of   accumulated
the 2nd round   (steps 5 & 7)   participants   score
(step 4)   voting for
                                            item in
                                            last round

cross-outs and stray   ◯ = 1st rank
numbers below text   ▢ = 2nd rank
indicate how items   ✦ = 3rd rank
were combined
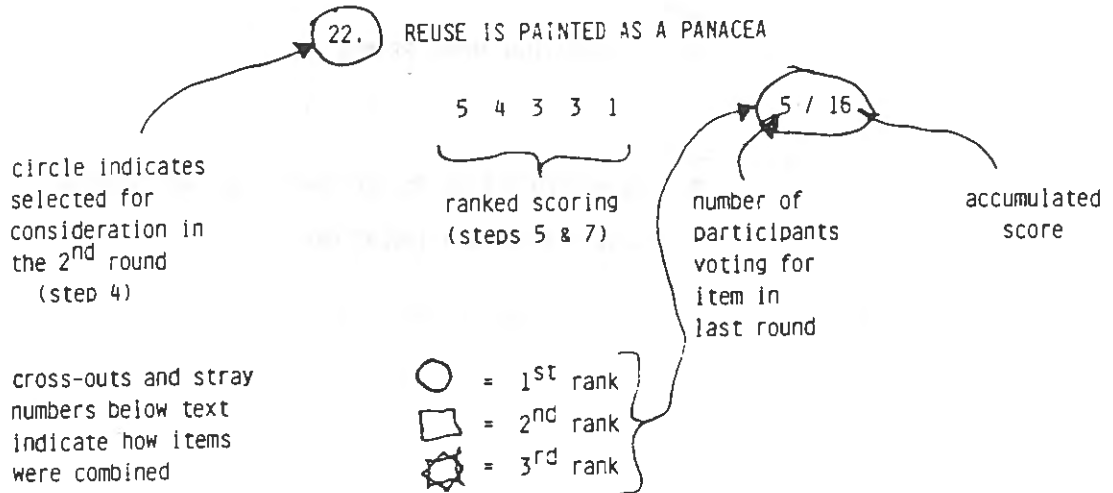
ONE STRONG POINT I SEE IN THE NEW STARS PLAN IS . . .

1. FOCUS ON COMMERCIAL SOURCES FOR TOOLS/SOLUTIONS

    5 5 5 5 5 4 4 4 2   (9 / 39)

(2.)
14. HEALTHY DEPARTURE FROM PREVIOUS STARS INSULARITY

3. RECOGNITION AND EMPHASIS ON PROCESS

    5 4 4 3 2. 2 1   8 / 24

    -4

(4.)
3.   FORMAL METHOD TO DESCRIBE PROCESS

(5.)
14.   COOPERATION AMONG PRIMES

(6.)
8.   EXPRESSED DESIRE TO USE COMMERCIAL AND EXISTING

     STDS RATHER THAN INVENT OWN

7.   STARS IS <u>ONE</u> OF <u>FEW</u> "NATIONAL" INITIATIVES TOWARD NATIONAL,
      COOPERATIVE S/W ENDEAVOR

          --   DOD

          --   NASA

          5 5 3 1   4 / 14

8.   COORDINATE AND LEVERAGE OFF OTHER S/W STANDARDIZATION
      EFFORTS (E.G., NIST, ECMA)

              6

          5 5 4 4 3 3 3 2 1 1   10 / 31

9. SPECIFY EVALUATION METRICS TO MANAGE S/W PRODUCTIVITY

    4 3 1   3 / 8

10. SOME RECOGNITION OF DATA RIGHTS ISSUE   .

    3 2   2 / 5

11. HIGH-LEVEL MODEL OF OWN PROCESS (ACTIVITIES, EFFORTS) TO
    PUSH TECHNOLOGY

    2 1   2 / 3

12. TIE OF SEI AND STARS (ESPECIALLY IN PROCESS AREA)

    4 1 1   3 / 6

13. EXPRESSED DESIRE TO SOLICIT AND RETAIN END-USER CONSENSUS

    5 4 3 3 2 2   6 / 19

14. EVIDENCE OF IMPROVING THE PROGRAM: "NEW" STARS

    -- LEARN FROM 'OLD'; REBIRTH

    4 3 2 2 1 1   6 / 13
    2
    5

15. MULTI-TIER AFFILIATE PROGRAM FOR "OUTSIDE" WORLD TO
    UNDERSTAND THE PROGRAM

    I   1 / 1

16. ADDRESSING OF DOMAIN SPECIFICITY

    I   1 / 1

TOP SCORING STRONG POINTS

FOCUS ON COMM	9 / 39
STDS	10 / 31
PROCESS	8 / 24
USER CONSENSUS	6 / 19
IMPROVING	6 / 13
"NATL" INITIATIVE	4 / 14

WHAT CAUSES ME <u>CONCERN</u> ABOUT THE NEW STARS PLAN IS . . .

1. NOT ENOUGH BUDGET FOR ALL THE IDEAS

    5 2 2 2 2   5 / 13

2. LACK OF SPECIFICATIONS

    -- SEEMS LIKE 3 FOR EACH AREA (MULTIPLE IMPLEMENTATIONS)
    -- NO UNITY!!!

3. RELIANCE ON ASSETS

    -- ORIGIN UNKNOWN

    5 4 2 1   4 / 12

4. TECHNOLOGY FOR PROPOSED EVALUATION IS MISSING

    4 4 1 1   4 / 10

5. TIGHTNESS OF SCHEDULE (ESPECIALLY 1993)

    3 2 2   3 / 7

6. SLAYING 3 DRAGONS IN PARALLEL; REALLY INTERRELATED
    (REUSE, PROCESS, TOOL)

    5 5 4 3 1   5 / 18

7. DARPA S/W TECHNOLOGY IS LARGELY IGNORED BY AEROSPACE
   PRODUCTION INDUSTRY; TOO LITTLE IN NEW PROGRAM TO CHANGE THIS

   5 4 2 2   4 / 13

8. UNCLEAR PROCESS TO INFLUENCE STANDARDS

   4   1 / 4

9. VERY OPTIMISTIC PLAN IN EVALUATION ABOUT GETTING
   PROGRAM MANAGERS TO USE STARS PRODUCTS

10. NO ACKNOWLEDGEMENT AT INTERFACES OF SHADED AREAS ON CHART #19

    5 3 1 1   4 / 10

11. NO MEDIUM TERM S/W DEVELOPMENT TECHNOLOGY MONEY --
    WHO REPLACES "OLD" STARS IN THIS REGARD?

28. NO CLEAR SHORT TERM PRODUCTS

(13.) REUSE PROJECT TOO BROAD; NOT FOCUSED

3 3 3   3 / 9

(14.) TOO MANY CONCERNS, INVOLVEMENTS, NOT FOCUSED --
SCATTERED; FEAR OF TOO MUCH REDIRECTION

-- QUESTION OF FOCUS; VISION OF UNITY
-- ABILITY TO ACHIEVE FOCUSED PLAN
(NOT ENOUGH TIME TO RESPOND TO POLLS)

5 5 4 3 2 1   6 / 20

15. LONG TERM FUNDING

16. NOT ADDRESSING SYSTEM ENGINEERING PROBLEM

17. ACTUAL PRESENTATION OF PROGRAM TOO COMPLEX/HEAVY
TO OUTSIDE WORLD

18. NO CLEAR CUT USE OF VARIOUS TECHNOLOGIES (OLD; NEW;
PROMISING) -- EFFORTS IN EACH AREA -- WHY

NO CLEAR VISION OF WHERE TECHNOLOGY IS AND WHERE THINGS ARE GOING

19. NO PRODUCT QUALITY INTEGRATION OF COTS TOOLS

20. SCALABILITY OF PRODUCTS BEING DEVELOPED

    -- FEASIBILITY OF SCALING UP NEW TECHNOLOGY

21. NOT ENOUGH TIME FOR MEANINGFUL TECH TRANSFER OF
     SOME OF THE TECHNOLOGY

22. REUSE IS PAINTED AS A PANACEA
     -- WILL WORK BETTER IN SOME DOMAINS THAN OTHERS

     5 4 3 3 1   5 / 16

23. NEED CLEARER DEMONSTRATION OF ROLE OF OTHERS (NON PRIME'S
     AND SUBCONTRACTORS) IN PROGRAM AND BENEFIT TO OTHERS

24. "ALL NEW DEVELOPMENTS IN PUBLIC DOMAIN" -- DATA RIGHTS ISSUE

                              0 / 0

25. VALUE ADDED OF <u>PROCESS MANAGEMENT</u> FROM STARS

26. EVALUATION PROCESS IS FAULTY   (I.E., IN SELECTING
    PROGRAMS TO JUDGE SUCCESS)

27. NOT ENOUGH CONSIDERATION OF RAPID PROTOTYPING

28. POTENTIAL CREDIBILITY GAP (E.G., YET <u>ANOTHER</u> 5-YR PLAN)
    -- 12
    5 3   2 / 8

29. FAILURE TO ADDRESS NON-TECHNICAL ISSUES (CF DSB); LEGAL, ETC.
    5 3 2 1 1 1   6 / 13

30. NOT A STRONG ENOUGH CENTRAL ENTITY TO KEEP VARIOUS PLAYERS
    COORDINATED (LACK OF COORDINATION)

31. BELIEF THAT UNDER DOD CONTRACTS, A VIABLE SEE CAN BE BUILT

4   4   4   3 / 12

32. COST OF MAINTAINING NETWORK TO LEVERAGE OFF OTHERS

33. HOW MUCH IS STARS GOING TO COST "MY" COMPANY??

    -- (INTERNAL INVESTMENT)

34. WHAT IS STARS??

    I UNDERSTAND GOALS.

    WHERE DOES STARS START? (IN LIFE CYCLE)

        -- TOO GRANDIOSE FOR 6-YR EFFORT (INCLUDING TOOLS, PROCESS)

1. ⦿ ~~THL~~ IIII   13. ~~THL~~ II   25. I

2. ~~THL~~   14. ~~THL~~ IIII   26. ~~THL~~

3. ~~THL~~ III   15. ~~THL~~   27. III

4. ~~THL~~ IIII   16. ~~THL~~   28. ~~THL~~ III

5. ~~THL~~ IIII   17. ~~THL~~   29. ~~THL~~ IIII

6. ~~THL~~ II   18. III   30. II

7. ~~THL~~ I   19. ~~THL~~   31. ~~THL~~ III

8. ~~THL~~ II   20. ~~THL~~   32. ~~THL~~

9. ~~THL~~   21. ~~THL~~ I   33. III

10. ~~THL~~ I   22. ~~THL~~ II   34. ~~THL~~

11. ~~THL~~   23. III

~~12.~~   24. ~~THL~~ I

Exhibit B

Summary Viewgraphs Presented at

Evening Working Session

Initial Concerns

First set of concerns:

1. Too many concerned parties, involvements; not focused; fear of redirection (6/20).
2. Slaying 3 dragons in parallel; really interelated (Reuse/Process/Tools) (5/18).
3. Reuse is painted as panacea; will work better in some domains than others (5/16).

Second tier of concerns:

4. Failure to address non-technical issues (6/13).
5. Not enough budget for all the ideas (5/13).
6. DARPA software technology largely ignored; too little in new program to change this (4/13).
7. Reliance on assets; origin unknown (4/12).
8. Belief that under DoD contracts, a viable SEE can be built (3/12).

EXHIBIT C

RECOMMENDATIONS

FORMAT:

13.   STRENGTHEN END-USER INVOLVEMENT

                6, 1   (-1)

                ‿ᴖ‿

        traceability to numbered   initial thumbs-down
        concerns using numbering   count of step 11
        system of Exhibit B

RECOMMENDATIONS

1.   DARPA TO EXPLAIN WHY THEY ARE SUPPORTING 3 ENVIR.
     AND ARE DISSATISFIED WITH COMMERCIAL ENVIR.

                    8

2.   DARPA/STARS ANSWER CRITICISM -- TECHNICAL ANSWER TO
     NON-TECHNICAL PROBLEM

                    4

3.   IDENTIFY CONTRACTUAL MECHANISMS TO INCENTIVIZE
     CONTRACTORS TO BUILD AND USE REUSABLE COMPONENTS

                    3, 4

4. RESPONSIBILITY FOR TECH TRANSFER NEEDS TO BE EXPLICIT

  6, 8

5. POST WORKSHOP FEEDBACK MECHANISMS

  N/A

6. SPECIFIC DEFS. FOR REUSE AT ITS VARIOUS LEVELS AND INTRICACIES

  3

7. IDENTIFY KEY STDS EFFORTS AND WORK THEM

  1

8. STUDY OF LIABILITY DATA RIGHTS ISSUES WITH REGARD TO REUSE

  4, 3

9. A REUSE STRATEGY HAS TO BE FORMULATED AND ONLY SPECIFIC
  TYPES OF REUSE SHOULD BE ADDRESSED

  3

10. RESEARCH AND IDENTIFY SW TECH ATTRIBS REQUIREMENTS FOR REUSE

  3

11. DARPA SHOULD REMEMBER TO GET WHAT THEY PAY FOR

  5, 8

12. IDENTIFY SHORT-TERM DELIVERABLES AS STRATEGY (SALE)
  OF GETTING MORE $$$

  5

13. STRENGTHEN END-USER INVOLVEMENT (GET INVOLVED EARLIER
  IN REQUIREMENTS PHASE)

  6, 1   (-1)

14. DARPA TO WORK WITH DOD ACQ. COMMANDS TO EMBED DARPA
    RECOMMENDATIONS INTO ACQ.

    6, 4

15. CERTIFICATION OF REUSE ASSETS

    4, 7

16. ROADMAP AND PLAN -- HOW PARTICIPANTS INTERACT
    (PRIMES, SERVICES, SUBCONTRACTORS)

    INCREMENTAL PRODUCT DELIVERIES RELATE TO 3 PROJECTS
    AND NEEDS IN TIME

    1, 2, 5

17. PROVIDE VISIBLE ROI (PARTICIPANTS) TO EVALUATION
    PARTICIPANTS

    5, N/A

18. BEFORE PROCESS AND TOOLS GET ARMS AROUND REUSE

    2, 3   (-5)

19. FOCUS ON PROCESS THEN TOOLS THEN REUSE

    2, 3   (-2)

20. THERE SHOULD BE ONLY A SINGLE SPECIFICATION

    1   (-1)

21. INSURE CONTINUING <u>COOPERATIVE</u> PRIMES

    1, 2

22. INTEGRAL CONCEPT NEEDS TO BE FORMULATED WHICH WILL
    UNIFY THE THREE DRAGONS (PROCESS TOOLS REUSE) UPON
    WHICH A PROCESS CAN BE BASED ON WHICH TOOLS AND
    REUSE CAN BE BASED

    2, 3

23. IDENTIFY POST '96 STARS SUPPORT MECHANISM

    N/A   (-3)

24. MUST ADDRESS SW ACQUISITION POLICY

    4

25. START AN INITIATIVE TO COLLECT EXISTING ASSETS

    7, 3   (-3)

(tot.)

16. NEED AN "INTEGRATION"/COORDINATION PLAN WHICH
IS THE RESPONSIBILITY OF SINGLE "SYSTEM ORG."

1, 2, 7   (-3)

1.9. STARS Program Response

DG1.5 - Recommendations

1. Too many concerned parties, involvements; not focused; fear of redirection

   STARS Response: Agree. Because we want to have an open program, there are going to be a lot of opportunities for people to try and influence the program. As you pointed out, it is not possible to follow everyone. We recognize the risk and will attempt to manage that risk. We will identify the key interactions and try to focus our efforts on those.

   - Identify key standardization efforts and work with them

     STARS Response: Agree. As part of the open architecture, we will identify and prioritize those standardization efforts most important to STARS. We will then work with those standardization efforts to evolve the standards or gain their adoption as necessary. This is an area where we are looking for industry consensus that the standards adopted by STARS are the correct ones.

   - Strengthen end-user involvement (early requirements)

     STARS Response: Agree. We intend to continue use of the newsletter, workshops and an affiliates program to strengthen the involvement of the end-user. The evaluation section of the STARS plan will include activities addressing this issue. The three Service deputies will assist in establishing such interactions in the services, and we hope the affiliates will permit the same interaction in the contractor community. We are going to develop a technology transition plan, and this issue will be considered as a requirement on that plan.

   - Roadmap and plan for interaction

     STARS Response: Agree. The STARS plan will clearly lay out the roadmap for how we interact with the outside world in the three technical areas and during the STARS evaluations. We will specify how the three primes, their subcontractors, the services, the FFRDCs, and the general public will interact. Part of the plan will be a periodic assessment of the cost and benefit of the various interactions and how they are contributing to achieving the STARS goals. The STARS Distinguished Reviewers will be asked to review periodically the roadmap for interaction with the standards community to make sure we are focusing on the right areas and have the correct priorities established.

   - Insure continuing cooperative primes

     STARS Response: Agree. The cooperation of the primes in developing the consolidated STARS plan will continue and be strengthened. We recognize the benefits to STARS of cooperation across primes in leveraging their efforts in working with the standards community. STARS cannot afford the cost of independent, non-cooperative efforts in the standards area. Cooperation is necessary to establish open architectures and common approaches to reuse and process and to convince the general community that STARS is pursuing a common path.

   - Single specification

     STARS Response: Agree. We intend to pursue a common approach to open architecture, and, where appropriate, common approaches to other aspects of reuse, process, and SEE. The three instances assembled by the primes will then be instantiated to those agreed-to architectures, and tailored to the specific evaluation applications. We believe a single common open architecture specification is critical to the success of STARS. We also believe that the architecture must be based on industry standards and accepted by the "users."

2. Slaying 3 dragons in parallel; really interrelated

STARS Response: Agree. The areas of reuse, process, and SEE are strongly interrelated. On the other hand, there are significant productivity improvements to be achieved if our solutions leverage the intersection of the three areas. In order to achieve the extra benefit, we will work the three areas in a complementary way. Our plan will do a better job of showing the interrelations of the three activities and how they will be evaluated.

- Roadmap and plan for interaction

STARS Response: Agree. With respect to "Slaying 3 dragons in parallel," the STARS plan will lay out clearly the roadmap for success in the three technical areas. We will specify how the three primes, their subcontractors, the services, the FFRDCs, and the general public will interact across the three areas. Part of the plan will be a specification of incremental deliveries in each of the three areas so we can see how the primes are interacting and how they are progressing towards achieving the STARS goals. A periodic assessment of the plan and the priorities of the various activities will be conducted to make sure we are investing in the right things at that time. The STARS Distinguished Reviewers will be asked periodically to review the roadmap for interaction across the "3 dragons," to make sure we are focusing on the right areas and have the correct priorities established. Also see "Roadmap" response under the standards recommendation above.

- Insure continuing cooperative primes

STARS Response: Agree. The cooperation of the primes in developing the consolidated STARS plan will continue and be strengthened. We recognize that the benefits to STARS of cooperation across primes in "slaying 3 dragons" is necessary, particularly in establishing open architectures and common approaches to reuse and process. Also see the "Ensure continuing cooperative primes" response under the standards recommendation above.

- Integral concept needs to be formulated to unify "3 dragons" on which a process to facilitate reuse can be based and supported by tools

STARS Response: Agree. One of the four thrusts in the planning for the reuse area is understanding the reuse process and how it needs to be supported by tools. An important part of our continuous planning and reassessment will revolve around this issue. Because solving the three areas at once is a difficult problem, we are treating this as a risk item and developing fall back options of less-than-complete functionality in all three areas. There is benefit to be gained in each of the areas, independently. We win if we have a very good SEE, we win if we make good progress in reuse, and we win if we make good progress in the process area independently, but the biggest win comes from improving the intersection of the three. The reuse, process, and SEE areas will interact closely to make sure we can make the most progress possible in leveraging the intersection of the three technologies and that we have the correct priorities established among them.

3. Reuse is painted as panacea - will work better in some domains than others

STARS Response: Disagree. We do not consider reuse as the panacea for all of the DoD's software problems, but we have seen it succeed in some areas. We want to characterize and replicate those success conditions where possible. As stated above, we believe that the technical solution to the DoD's software problems involve solutions in reuse, process, and SEE. We agree that there are a lot of non-technical issues that could hinder widespread application of reuse, and, as a result, are coordinating with a number of DoD activities working in this area. These interactions will be managed along with the others discussed in DG1 response above. (See also DG5.3.)

- Identify contractual mechanisms to incentivize contractors to use reusable components

STARS Response: Partially agree. We agree that it must be done, but disagree that STARS is the correct place to do it. We are working within the Software Master Plan to identify the proper organizations that have the charter to work on this problem. We are also working with programs that are doing early contractual work in using reuse to understand the issues. We will work to stimulate these activities and to make sure that the technical solutions adopted by STARS are supportive of the solutions to the non-technical issues developed under these other activities. (See also the discussion in DG5.3.)

- Specific definitions for reuse at its various levels and intricacies

STARS Response: Agree. As part of STARS work in understanding and developing building blocks for the reuse process, we will make sure that we establish definitions for reuse at the various technical levels such as code, design, requirements, and we will provide a concept of operation for using the different levels. The STARS reuse process work will address also the various ways that reuse can be used on a DoD project, such as within a company, across companies, from a general project library, etc.

- Reuse strategy has to be formulated and only specific types of reuse should be addressed

STARS Response: Agree. We agree that we must prioritize the areas of reuse that are most important to STARS. The current evolution of the STARS plan, based on inputs from the workshop, is beginning to detail those choices. We will provide more program plan detail in the reuse area for the next STARS/Users workshop, so it will be possible to see the strategy and which of the types of reuse are being pursued.

- Research and identify software technology attributes required for reuse

STARS Response: Agree. STARS is working with several other organizations trying to do reuse, and is encouraging new activities in this area. We believe that understanding the technology attributes required for reuse is in an experimentation phase. By working with people trying to do reuse-oriented development, we hope to understand which attributes are most important. STARS does not intend to fund directly such experiments itself, but rather intends to capture the results of others. STARS is also able to leverage several other DARPA programs looking at reuse-related issues, such as the new DARPA Domain Specific Software Architecture (DSSA) and prototyping technology programs.

- Integral concept needs to be formulated to unify "3 dragons" on which a process to facilitate reuse can be based and supported by tools

  STARS Response: Agree. See the discussion above.

- Start initiative to collect existing assets

  STARS Response: Agree. See DG4.3(7).

4. Failure to address non-technical issues

   STARS Response: Agree in principal. It is not that we have ignored the non-technical issues. Both Dr. Kramer and Dr. Boehm have long experience with these issues and understand their importance to the success of STARS. STARS must make sure that the non-technical issues are understood, but STARS in DARPA is not the proper place to solve them. (See also DG1.5 (3a) above.)

   - DARPA/STARS answer criticism - "technical answer to non-technical problem"

     STARS Response: Partially agree. The problem is both technical and non-technical. Any movement towards addressing the DoD software problem needs both technical and non-technical problems solved. There are a lot of hard technical problems that need to be solved in the areas of reuse, process, and SEE. Discussion Group 1 recognized just that, when they raised the concern about "slaying 3 dragons." In order for reuse and process to become a natural part of doing business, they must become transparent to those using them. If the cost of doing reuse or of defining and monitoring the software process are noticeable, most people will not do them, even if we could solve all of the non-technical issues. Much of the technology of STARS will have value, even without solutions to the non-technical issues. But, since those benefits would be much less than we believe are possible if the non-technical issues are solved, we have been working very hard through the DoD Software Master Plan process to get the correct non-technical issues and processes identified to address them. We are continuing to work with that process and with other organizations trying to address the non-technical issues to make sure that these issues are not forgotten.

   - Identify contractual mechanisms to incentivize contractors to use reusable components

     STARS Response: Disagree. We agree that the issue needs to be solved, but disagree that STARS should solve it. There are a number of organizations working on this problem (e.g., SDIO, JIAWG), and STARS has a small effort trying to understand what solutions others are identifying. We are participating in those deliberations to make sure that STARS technology is compatible with those solutions. See response above.

   - Do a study on liability and data rights issues

     STARS Response: Disagree. See response above.

   - DARPA work with DoD acquisition commands to embed DARPA recommendations into acquisition

     STARS Response: Disagree. See response above.

- Certification of reuse assets

  STARS Response: Agree. *STARS is working on the problem of certification of reuse assets. In addition, we are interacting with a number of other activities interested in the same issue.* *In our joint activities with the Army RAPID organization, we are trying to establish common definitions of classification levels and common processes to certify reuse assets to those classifications. This is a problem that must be solved across activities, or the activities will not be able to share assets. We are also investigating tools that can help in the certification process.*

- Must address software acquisition policy

  STARS Response: Disagree. *See response above.*

2. Business Practices

Charter: Examine issues related to the present and future business practices of DoD and the software industry supporting it, and assess the STARS plan as it might affect those business practices and be affected by them.

Discussion Group Location:

4000 Monday
4000 Tuesday

Discussion Group Leader:

Thomas Grobicki, *SYSCON*

Discussion Group Members:

Christopher Byrnes, *MITRE*
Bill Farrell, *DSD*
Tom Frazier, *IDA*
Lewis Gray, *AdaPROS*
Alec Grindlay, *USN/SPAWAR* [Monday only]
Ranwa Haddad, *Aerospace* [Monday only]
Paul Kirby, *IBM*
Bob Mellott, *Unisys*
Boris Mutafelija, *Grumman Data Systems*
Walt Penney, *Verdix* [Monday only]

2.1. Business Practices

What business environment can be assumed "after STARS"? To what degree should use of STARS products and technologies be mandated? Should STARS products and technologies be used as a "baseline" against which all other efforts are to be measured during the procurement process? Would it be a valid baseline across domains, project sizes and durations, etc? To what degree should waivers be required to use non-STARS products and technologies?

2.2. Processes and Tool Insertion

What can STARS do to cause insertion of new processes and tools into organizations that already have proven, robust software development processes supported by appropriately populated toolsets (software and hardware)? To what degree should the aforementioned existing processes and toolsets be invalidated or made obsolete by STARS? What are the issues in the competitiveness of an organization that uses existing (proven, etc) processes and tools versus STARS processes and tools?

2.3. Economics

How will industry determine if a sufficient return on investment exists to warrant investing in STARS technologies? How can STARS best function as a community catalyst and facilitator in order to multiply the impact of its (and everyone's) limited resources? What can STARS do to increase the incentive for industry to use STARS technology?

2.4. STARS Program Impact

How does STARS get more vendors to "buy in"? What near-term goals, strategies, objectives, prototypes, presentations must vendors see to get their "warm fuzzies" about the direction, impact, etc of STARS? Are there show stopper "win" or "loose" conditions for vendors and users which STARS has not sufficiently considered?

2.5. Measurements to Encourage STARS Technology Adoption

What data gathering and metric collection should be done in order to convince industry that it is worth evolving older ways of doing business and adopting STARS technologies? What types of arguments will convince you? What base line can STARS use to show its technology makes a difference? How long must the data be collected in order to convince you? When does the STARS program need to begin collecting the data?

What data gathering and metric collection should be done in order to convince vendors? How will vendors determine if the return on investment is really there? Will vendors want to participate in STARS?

2.6. Commercialization

A key principle for STARS is commercialization; that tools and methods used for DoD software should be available and supported via the commercial marketplace, thereby lessening maintenance costs. In what software areas and applications might this approach not be feasible? Are there any "down sides" to commercialization that STARS has not considered? How important is commercial availability to software developers and maintainers? How can STARS incentivize vendors and industry to invest in commercializing software technology?

2.7. Discussion Group Slides

DG2.1 - STARS Plans - Positive Points

- STARS has addressed the three general topics of most importance
- STARS is not creating new standards
- STARS is creating a framework for COTS vendors to adapt
- Associates [should read: Affiliates] program is good

DG2.2 - STARS Plans - Negative Points

- Explanation and data was lacking
- What products and technologies are being proposed
- There is not sufficient information to make a business commitment to STARS

DG2.3 - Recommendations

- Right Activities. - Yes but ? if all things can be completed with $ proposed. Demonstrations in particular.
- Right Approach - Yes but STARS should do a better job of articulating fine details. Ensure they sell both to Industry/Government.
- More emphasis on educational guidance. Two ways - Procurement and use.
- Critical Activities - Did not connect on standards

DG2.4 - WIN/WIN

- If STARS meet their objectives - we all WIN!

DG2.5 - Responses: Business Practices

- STARS products and Technologies should not be mandated
- Make process/SEE usable in subsets
- Show community that primes are using STARS in their commercial work
- "Try before buy"
- STARS can get more vendors to "buy in" by showing them which commercial standards it will adopt -- STARS should also show what validation procedures they will adopt for non-commercial standards.
- Users want to see size and quality indicators like function point, complexity metrics, error density, before release. Vendors want to see a percentage of market set aside for STARS-related.
- One downside of commercialization of framework, possible finger pointing between framework/tools vendors when user discovers SEE problem.

2.8. Discussion Group Write Up

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============== BUSINESS PRACTICES ==================

     NAME              ATTEND    COMPANY          COMMENTS
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  Thomas A. Grobicki   - M&T    - SYSCON         - DGL and Editor
  Chris Byrnes         - M&T    - MITRE          - Scribe and Writeup
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Boris Mutafelija        - M&T    - GRUMMAN
Paul Kirby              - M&T    - IBM
Bill Farrell            - M&T    - DSD Laboratory
Tom Frazier             - M&T    - IDA          - Slides
Alec Grindlay           - M      - Navy SPAWAR
Lewis Gray              - M&T    - AdaPROS       - Slides
Walt Penney             - M      - Verdix
Ranwa Haddad            - M      - Aerospace
Robert Mellott          - M&T    - UNISYS
Jack Kramer             - M      - STARS         - Briefly sat in
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The STARS/Users Workshop was broken into eleven discussion groups;
each covering a specific aspect of the STARS program as it was
presented to us. Thomas Grobicki (Syscon) served as the group leader
for the Business Practices group. I was assigned to this group and
ended up as the official scribe for our discussions; below are my
notes from our meetings. Eventually a version of these notes and our
final slides (along with those from the other groups) will be included
in the final workshop report.

1 GENERAL DISCUSSIONS

As with the other working groups, the workshops organizers had prepared
a series of issues for us to discuss and prepare responses
to. Our issues generally related to what impact(s) would the STARS
program have on (our) business practices. What would have to be done
in the STARS program and the products it creates to get STARS accepted
within our and other organizations? This section of the session
summary will capture the generally free-form discussions we had on
this general area and the specific questions raised by the workshop
organizers. Later we would try to organize these discussion comments
into the issues originally presented to us.

One question raised was whether the STARS programs products should be
mandated for use in other government programs. If so, would this
mandate apply to all STARS products? Would a STARS mandate apply to
an entire unitary STARS product (for example, an entire SEE) or to
just certain tools within it? Would this STARS mandate take effect
before the overall 1993 completion date for the major STARS
development effort (for example, on early products delivered before
then)?

Another question was the relationship of STARS to other standards
(mandated or not). For example, some in the group claimed that the
major obstacle to cost-effective government software development was
not inadequate SEEs but the poor application of CSCI and unit mappings
within the DOD-STD-2167A standard. If the application communitys use
of the (mandated) DOD-STD-2167A standard is broken and any STARS
products also have to exist with DOD-STD-2167A, is it STARS's or
someone else's job to fix the problem of SPOs and project managers
mis-application of DOD-STD-2167As rules? Others in the group argues
that this in a non-technical training and experience problem; one
that's better addressed by other DOD initiatives.

Many of the current standards are evolving rapidly, how does the STARS
program (and the products it will be producing over the next few
years) plan to keep up with these changes. Standards such as
DOD-STD-2167A (and its related DOD-STD-2168, MIL-STD-1521B, and

DOD-STD-499), Ada (MIL-STD-1815A), CALS, POSIX, and GOSIP are all going to be upgraded with new releases in the next few years. Will STARS products become victims of standard version skew? Will some of current state-of-the-practice software development standards and assumptions (that STARS is developing to) be obsolete or overtaken by events by the mid-1990's (when STARS products start getting wide distribution)? Can the STARS program become a framework for government software development unless they show the interface to these other standards?

Will STARS products be required to be used before the government awards you a contract (much as Ada is finally being required)? If STARS usage is to be mandated, what would be the justification for it? Would this be done for delivered software quality, development tool portability, SEE interoperability? If STARS product usage is mandated, what would be the validation suite that defines conformance to the STARS standards? To what extent would these STARS standardization efforts duplicate other existing formal and de facto efforts by the commercial community?

Should STARS mandate the usage of a SEE (either its own or others) on government software developers? Ada was mandated; how long would it have taken to build up Ada's use without a mandate? Helped by this mandate, Ada now has >100 validated compilers available for software developers to choose from. If (STARS) SEE usage is mandated, how many conforming or validated SEEs will be available for developers to choose from?

Some members pointed out that Ada defines primarily a product while the STARS program defines a process and product combination; should the government get into the business of mandating process? These STARS standards will be a combination of hard interface standards and soft process and documentation standards. Can all these different styles of standards combine to produce tools and environments that are in conformance with all the other government standards?

The three cooperating STARS primes say they are looking at COTS tools that produce the required documentation and products, at various levels of quality. The hope is that the primes will provide frameworks (and guidance) that every CASE tool vendor can provide (conforming) tools to. There was some discussion whether this guidance should be to the level of how to do CDRL tailoring. Some felt this issue was out of scope with STARS's main focus as a research effort in SEEs, processes, and repositories. Should STARS be in the business of creating more mandates, standards, and regulations?

Why will organizations upgrade their SEEs over the next few years? Will the source selection process recognize high quality software development environments as such a discriminating factor that contractors will start winning contracts because of it? Or will conformance to STARS products be used as a means of eliminating bidders who use poor software development practices? Will the STARS program view these two questions as being equivalent?

If STARS is defining a framework for CASE tools to fit into, then how is STARS related to other existing framework efforts such as CAIS, PCTE, and ATIS? The STARS program hopes their work is complementary. STARS is hoping to reuse existing standards to create a framework (similar to what ATIS is doing) rather than trying to create an

all-new SEE (as was done with CAIS).

Several people noted that the software development industry in general seems toe stuck at Levels 1 and 2 of the SEIs Contractor Assessment Process. What can STARS do to get such Level 1-2 companies to effectively use the advanced products and processes the STARS effort will create? Can such contractors be encouraged to invest in STARS-like SEEs and processes as one part of an overall effort of achieving Levels 3 and higher; or must those contractors be compelled to improve? As contractors upgrade their SEEs, how will they reuse their huge investments in current tools and environments as they cut over to STARS?

If STARS intends to build on a COTS base, then how many COTS tool and SEE vendors will be able to fit into a STARS framework? If STARS has standards that are so loose that hundreds of CASE vendors can instantly claim conformance to STARS, when just what level of tool interoperability has really been achieved? Consider the example of Ada, where a fairly rigorous definition and validation suite hasn't prevented the development of non-portable and unmaintainable code.

In the earlier Workshop Overview we saw how STARS was trying to focus on those aspects of SEEs that overlap the area of software development, reuse, and process. What happens when contractors wish to use tools and products (such as domain-specific tools) that lie outside this area of STARS expertise? That could introduce new standards and interoperability issues for the developers management to worry about.

STARS now stresses the importance of reuse and repositories. Will the code modules that are placed in the STARS SEE repositories be usable in the repositories being created by others? For example, the RAPID program is creating their own approach to repositories and their organization. Can a STARS SEE work with them?

Several people pointed out that the greatest obstacle to modern SEE usage where not technical but were instead the bottom-line, and Return On Investment (ROI) justifications that companys MBAs and bean counters required. The STARS program announced plans during this workshop to conduct three demonstrations and evaluations of the eventual STARS products. Will these three evaluations show the necessary productivity and ROI numbers required of our favorite MBAs? If STARS could ever show such improvements, would they be sufficient to justify to management the use of modern (STARS) SEEs in the era of declining budgets and Firm Fixed Price (FFP) contracts?

How detailed must this STARS SEE usage productivity information gathering be? The MIS community has jumped on CASE tool usage without requiring Ada-like mandates or exhaustive usage metrics. If quantifiable ROI numbers aren't available, will qualifiable numbers (such as engineer satisfaction, reduced numbers of errors and contract awards) be good enough? If STARS is to encourage requirements, design, and test (plan and result) reuse, then how would that be measured in these three evaluations?

If large software development organizations are to achieve higher productivity through large-scale reuse, what standards and SEE features have to be available to encourage this? Which of these incentive have to be financial? Many contractors currently practice

reuse, except that it's done behind the government's back or done mainly within someone's head. If reuse is to be made industry-wide, what set of development and contractual paradigms are needed? Will contractors spend money to use STARS tools and processes when they're available to anyone from a public repository? If STARS leads to the application (or repackaging) of CASE tools, SEEs, and processes that the entire industry uses (to save the government money), what will contractors use as justifications to the government for having a competitive edge over other contractors?

What will formally define success when STARS products are used? If high levels of reusability are a measure of success, then presumably some reuse repository metric tool would be needed to measure this reuse. But what would prevent the abuse or misuse of such metrics, as was done with the Adamat Ada metrics tools and its bizarre definitions of acceptability in an Ada program? And wouldn't different (but equally valid) programming paradigms such as OOD and SA/SD result in much different measures of how components are defined, identified, and reused?

Some of this groups attendees pointed out that several studies have shown that the major discriminant between success and failure in a project is not the SEE or programming language, but the skill levels of the people creating the software. Where will all the skilled software engineers that are going to be using these STARS SEEs and processes going to come from as these products are released in a few years? Poor levels of training and experience could overwhelm any evaluations that are supposed to be establishing ROI.

One proposed evaluation approach for the completed STARS SEE is to apply it to an acquisition in need of some help. But even if STARS could immediately jump in with great new environments and tools, would that be enough to help a troubled program? Wouldn't any productivity improvements available through the STARS SEE be outweighed by the skill levels of the developers (who got the program into a mess in the first place), the sudden need to (re)train in the middle of development, and Brooks Law?

Commercial CASE tool vendors (as in the MIS domain) will upgrade the performance and functionality of their tools in response to demands from their customers. Who will be the ultimate source of demand for proper performance of STARS products? What numbers/metrics will be (automatically) collected to show the success of STARS to the satisfaction of the users and their managers? Are technical numbers such as productivity improvements and transportability of project information between SEEs good enough, or will number like better business prospects also be required?

If STARS is to addressed the SEE interoperability problem by demonstrating CASE tool integration, then what does that really mean? Can the project data be moved or saved as tools are exchanged? Some thought these issues are also be addressed by the SEE community looking into environment reference models. STARS currently has no validation suite concept or a way to integrate existing or COTS standard validation suites. This could make SEE integration within the STARS framework hard to demonstrate.

If a STARS SEE is to be used throughout a systems development, then who does the government send money to for maintenance after the STARS

program comes to its conclusion? If a STARS SEE incorporates COTS products, are the original tool developers or the STARS primes responsible for maintenance? Who and how much can be charged for improvements to STARS products? Several people pointed out that interoperability problems among third party vendor usually leads to finger pointing.

If STARS is to reuse existing standards in its frameworks, will the proper level of support for those standards be available? Consider a de facto standard like the X Window System. There are many levels in the X hierarchy or conceptual model, with the trend among application developers going towards working at the very highest layers. Will STARS standards conformance mean developers will have the levels of support they expect?

There's also concern whether STARS standardization would help or hurt technical innovation. Some claimed that just the announcement that STARS was funding an Ada/X binding scared off some potential developers from creating their own Ada/X implementations or bindings. Are these forthcoming STARS standards going to have a similar effect on the commercial SEE industry? Others stated that STARS was trying to move the battle between general interoperability and commercial technical advantage more in favor of the government. For example, the initial two attempts at STARS-funded Ada/X binding led to interfaces that were incompatible at the Ada applications program level. STARS eventually had to move and insist that common interface specifications be developed so applications programmers wouldn't need different versions. This would be an example where commercial companies would eventually compete on the basis of efficiently implementing a common standard.

Will STARS define the (ROI) tradeoffs between the improved development productivity the use of these (de facto) standards provide against their associated costs (such as training and X's urgent need for more powerful [and expensive] workstations to support all those new features). Given the importance of these (existing) standards to STARS, should the STARS program have training classes and/or materials prepared in these standards before the three evaluation projects take place (so there are no learning curves to skew the metrics that would come out).

The issue of how much STARS should become involved with training caused some controversy. Some felt that since the use of these SEEs and processes required upgrades to existing skill levels, STARS was wasting time and money if they didn't make sure the training courses and materials weren't available well before the products were. They argued that the commercial CASE/SEE world must provide training so their products have at least a chance of being used properly; will STARS provide equal levels? Others argued that there are enough people working on software engineering skill upgrades and education (including many at SEI); theres no need to dilute STARS's already limited budget and schedule with duplicative work.

At one point during our discussions Dr. Jack Kramer wandered in and answered some of the questions we were raising; particularly those related to the products and technologies STARS is building that might become mandated. Kramer reports that STARS intends to develop one to three instances (one from each of the primes) of the STARS environment and its associated tool set. A particular SEE backplane or framework

will be chosen as the integration mechanism. The STARS environment
will include a populated reuse library, along with the construction
components used to build/extend that library. But Kramer notes that
theres no explicit list of products yet that formally define whats in
the STARS environment.

Kramer believes that the products developed, integrated, and
demonstrated by STARS could become STARS standards and eventually end
up being mandated by the government. As with the Ada mandate, the
terms of any mandate could vary from service to service.

Kramer looks to the OTS world to provide the lead of what standards to
follow in STARS. He realizes that theres a tradeoff between closely
coupled tools and openness in SEEs. STARS won't mandate a unitary
SEE, but instead the pieces you can pick up. The STARS architects
will have to work to solve the standards consistency problem as well
as the standards version skew problem.

After 1993 (when STARS development wraps up), ISTO will move on to
other software technology programs that will be based on the results
of STARS. The commercial CASE and SEE world will then be responsible
for picking up on and maintaining any STARS products and standards.

2 ANSWERS TO QUESTIONS

After these general discussions, we sat down and worked out some
answers to the original questions raised as issues to this discussion
group by the workshops organizers. Given the limited amount of time
available, we didn't answer every single issue presented to us. The
answers below are based on a generally broad consensus of the groups
members.

2.1 BUSINESS PRACTICES

We concluded that STARS products should not be mandated on any
acquisition or program. We also believe that STARS products should
not be baselined as that would inhibit those firms that do have good
existing software development practices and environments.

2.2 PROCESS AND TOOL INSERTION

STARS products and processes usable during source selection requires
training of SPOs, procurement officers, and others. STARS should be
providing the training materials for this. This training would cover
all of STARS, including the newly-expanded focus on processes and
reuse (to go along with SEEs). There are still some issues to be
worked out, such as whether STARS SEEs and tools are self-training (in
the Macintosh sense) and whether training is for SEE usage or
procurement (within the context of a SDP evaluation). STARS could
assure such training is available through influence on the DODs
forthcoming Software Roadmap, which contains aspects of training in it
(as does the SEI).

The STARS SEE and toolset should be partitionable, so potential users
don't have to get one huge monolithic environment. STARS products
usable in subsets avoids the Big Bang phenomena where everyone waits
for 1993 for all their software programs to be instantly solved.

The competitiveness issue is addressed by letting the best man win,

where hopefully the best developers will be drawn towards employing STARS products and processes through their technical superiority. The STARS program has to develop ways of reducing the risk taken by contractors as they spend money to switch over from current technique to these modern SEEs. The STARS prime contractors should demonstrate faith in their environments by employing them in some of their commercial work. As the STARS environments are used on real software developments (such as those three evaluation projects), independent monitors or controllers should be used to assure the validity of any claims of success.

2.3 ECONOMICS

STARS should work within existing standards groups; theres no need for STARS-specific standards. The STARS management should publish the industrial (including those still existing as drafts) standards the STARS program is getting involved in. Any STARS-specific standards must have extensive validation suites, just like an industrial standard.

Acceptance of STARS products requires that STARS identify a clear need they're trying to meet and then show how they've meet that need. Public demonstrations of STARS tools and products would help show the value added by them. A variety of access options such as dial-up lines and on-line access would allow potential users to try before you buy. This would enable a "TRY-BEFORE-BUY" approach.

2.4 STARS PROGRAM IMPACT

STARS should better define all the tool aspects (as with reuse) they will be placing in their SEE. STARS has to show how all these novel software engineering aspects (as with an extensive reuse-based approach) will really work in practice. STARS also has to show how to inject these key new technologies into the general CASE vendor community. STARS should show what metrics have been defined and will be collected that show the improvements possible through the use of these novel aspects.

STARS has to show the level of maturity the STARS tools will be at when they are made available to the world. Potential users need to know if these tools will be at the commercial CASE tool level of maturity or available as source code only (as is currently done with software systems such as the X Window System, GNU Emacs, and various personal computer shareware programs). The STARS SEE also has to demonstrate its maturity in integrating or developing project-specific tools (such as test drivers). STARS should show how their tools and processes will always be available on common commercial hardware platforms.

2.5 MEASUREMENTS TO ENCOURAGE STARS TECHNOLOGY ADOPTION

The STARS program should recognize that they must provide data that proves the claims for increased productivity; and that different communities (such as CASE vendors and contractors) will want to see different numbers/metrics. Given the costs associated with upgrading programming practices to employ a (STARS) SEE, the STARS program should investigate ways to incentivize the usage of these SEEs in certain acquisitions. STARS should also look into whether certain classes of applications (such as MCCR) should have funds set aside to

help meet any STARS mandates placed on them. A STARS set-aside could potentially provide this.

STARS should certainly publish size, quality, function point, complexity metrics, and error density information regarding the use of SEE.

2.6 COMMERCIALIZATION

The STARS program should define how interoperability finger pointing problems will be addressed as multiple tools and vendors become involved. The role of the system integrator for a particular organization or project (that might involve STARS products) needs to be defined. The STARS prime contractors and the evaluation projects should provide an example of how integration is done. The STARS program should also address how STARS products and processes would be (commercially) supported on black programs where access by a CASE vendors maintainers is limited.

3 FINAL SESSION COMMENTS

Our discussion group was also asked to make some general comments on the overall STARS program we heard about at this meeting. We thought the STARS plan had some positive features:

> the plan attempts to provide an answer to a real need,
> the evaluations create a real test of whether these ideas really work,
> the plan stresses commercialization and commercially available tools (e.g., CASE tools, X),
> the plan reuses existing standards instead of creating old ones, and
> the plan calls for the creation of a framework that many different vendors can plug into.

One the other hand, we identified these negative aspects of the STARS plan:

> the plans are at a very high level; the explanations, data, and details were lacking,
> you have to be part of the new affiliates program to find out these details,
> the definition of products and technologies to be used in STARS is still vague, and
> there's not enough detailed information available to make a business decision on.

We made the following high-level recommendations to the STARS program management:

> make sure there's enough money to do all this (especially convincing demonstrations),
> involve the government (the bean counters and SPOs) to get them up to speed,
> make sure the services get their end user communities to provide inputs to STARS,
> make more of an effort to describe (publicize) whats going on in STARS,
> provide more educational guidance on what people need to know (as about SEEs) including procurement and how to use, and

better connect the STARS effort to existing standards efforts
(such as DOD-STD-2167A).

2.9. STARS Program Response

DG2.3 - Recommendations

- Right Activities. - Yes but ? if all things can be completed with $ proposed. Demonstrations in particular.

STARS Response: Agree. The STARS program is ambitious, and there is a lot more we could do if there were a larger budget, but there is not. Although, we are trying to get additional budget as part of the Software Master Plan process, we believe the STARS program is viable within the current budget. What you see is only the DARPA funding. There is a lot of corporate commitment beneath the surface, by the primes and their team members, that we are leveraging. We would be wrong to plan on a program requiring a budget larger than we currently have available. We are also trying to leverage other efforts, particularly those investing in reuse technology and assets, and software process activity. One example of this is the Navy Next Generation Computer Resources (NGCR) Program Support Environment Working Group (PSEWG), which will be establishing PSE open architecture standards for the Navy. The current strategy of using commercial products and industry standards based on an agreed-to open architecture permits us to leverage the investments of industry. An important part of the STARS program are the evaluation demonstrations. We are planning for those just as we are planning the other STARS activities. The costs of doing them are treated as all of the other costs. We consider the overall STARS budget a high priority risk item that must be managed properly in order to achieve what STARS has set out to do. We are continuously doing a design-to-cost analysis of our plans, including the evaluation demonstrations, and adjusting our plan to stay within budget.

- Right Approach - Yes but STARS should do a better job of articulating fine details. Ensure they sell both to Industry/Government.

STARS Response: Agree. The workshop was intended to be the first public review of the STARS plan. The goal was to give enough detail so the participants could comment on the more strategic questions. We have included the workshop results as an additional input into the next level detail of the plan. We received the kind of input we wanted, and the detailed planning is almost done. The results of that planning will be documented in a STARS consolidated plan, which will be discussed at the next STARS/Users Workshop. We also agree that we need to sell the program to both industry and the Government. As a result of the strong recommendation from the workshop, we are developing a technology transfer plan, and will explicitly include this selling activity as part of the technology transfer plan.

- More emphasis on educational guidance. Two ways - Procurement and use.

STARS Response: Partially agree. It is important that proper education be provided on the procurement and use of STARS technology. When there are STARS-unique requirements, we will include such activities as part of the technology transfer plan. When the requirements are DoD-generic, we will work with other organizations in the DoD to plan such activities. Also, as with any commercial product, the commercial vendors will provide educational services for their products. (See also DG1.5.4 and DG1.5.4b above.)

- Critical Activities - Did not connect on standards

STARS Response: Agree. We agree that standards are critical and intend to focus on those during the open architecture definition. (See also DG 1.5.1a.)

3. Technology Transfer

Charter: Examine issues relating to the interactions of STARS with the DoD software Community and the transition of STARS products into that community.

Discussion Group Location:

> Training Room C Monday
> Training Room C Tuesday

Discussion Group Leader:

> Sam Redwine, *SPC*

Discussion Group Members:

> Norman Howes, *IDA*
> Al Kopp, *TeleSoft*
> Randy Lichota, *Hughes*
> Hans Polzer, *Unisys*
> Thomas Reid, *Contel*

3.1. Synergizing the Community / Credibility of STARS

How does STARS get more of industry to "buy in"? What near-term goals, strategies, objectives, prototypes, presentations must industry see to get their "warm fuzzies" about the direction, impact, etc of STARS?

What must STARS do, and in what time frame, to ensure that industry and vendors know and believe that STARS is relevant to them and that STARS is keenly interested in their requirements and inputs?

What role do you see industry playing during the next "formative" year of STARS? What role do you see after that year? What role for vendors?

How can STARS better interact with applied research and development organizations beyond the Primes to assure that STARS incorporates the best available technology?

How can STARS best function as a community catalyst and facilitator in order to multiply the impact of its (and everyone's) limited resources, especially as regards internal R&D activities?

3.2. Transition via Guidance from STARS

What guidance should STARS provide, and plan to provide, to federal agencies, industry, and the private sector with respect to the evaluation and acquisition of software engineering environments? What existing work is already going on in this area outside STARS? How can STARS coordinate with/influence that effort?

3.3. Receptor Groups

What should STARS be doing to interact with potential consumers of STARS products and technology? How can STARS assure that the consumers are receptive to STARS products and technologies? What existing activities should be continued? New ones begun? On-going ones ceased?

How can universities become part of this process (e.g., transition a la the Unix model)?

3.4. Evaluation of STARS Products and Technologies

- What products and technologies should be available from STARS when the program is complete? What should the form of those products (e.g., reports, formal specifications, language-X binding, canonical models) be?
- How much "validation" should be done for each product?
- What kind of training, customer support, cost plans should exist for STARS products and technologies?

3.5. Existing Support Environments

What are the issues in inserting new STARS technology and products into existing development environments and cultures? Will phased/partial adoptions be possible/feasible? How should STARS prepare for this?

What are the needed warranty and data rights for industry/vendors to welcome STARS products and technologies into their own processes and tools? Are there different classes of warranty and data rights we need to identify?

3.6. STARS Affiliates Program

Does the draft STARS Affiliates program provide the right infrastructure so that industry and government users can get involved with the STARS Program? What key ideas have been overlooked in the draft affiliates plan? Would your company and/or government agency be willing to become a STARS affiliate?

3.7. STARS Distinguished Reviewers

What type of talent mix should be required for the distinguished reviewers group? How often should such a group meet? What should be its role?

3.8. DARPA/ISTO

What should STARS be doing to prepare itself as a vehicle to integrate and transition other DARPA/ISTO products as they mature? What should DARPA/ISTO be doing on its end? What resources and time lines would be reasonable? What organizational infrastructure would be required? What criteria should DARPA/ISTO and STARS use to identify:

- DARPA/ISTO technologies that are appropriate to be transitioned via STARS?

- Those technologies that the client community feel would be most beneficial to them (versus being told by technologists "what is good for them")?

3.9. Discussion Group Slides

DG3.1 - Technology Transfer

- Sam Redwine
- Hans Polzer
- Tom Reid
- Norm Howes
- Al Kopp
- Randy Lichota

DG3.2 - Positive Points

- Emphasis on Broad Involvement

- Development of an Open Architecture

- Increased Emphasis on Commercialization

- Provision for Affiliates, Distinguished Reviewers

- Notion of Process Tailoring

- Focus on Portability, Multiple Platforms, Ability to Select/Choose Required Tools

DG3.3 - Goal

- Marketplace based on standard open interfaces with commercially available implementations meeting DoD needs

  - Open standards sxistence and acceptance

  - Commercialization of

    - Infrastructure

    - Conforming Tools

DG3.4 - WIN/WIN

- Most important WIN conditions

  - Win for vendors (of all stripes)

    1. Establishment of framework reference model

    2. Framework standard interfaces

    3. Broad tool market place

  - Win for DoD contractors

    1. Wide variety of available tools

    2. Widely accepted tool interchange standards and practices

    3. Support for DoD needs in commercial tools

  - Win for STARS

    1. Acceptance of framework standards by CASE vendors

    2. Increased use of frameworks and advanced tools by DoD contractors for:

      - More cost effective software development

      - Wider, more competitive technology market

DG3.5 - Recommendations

- Tech transfer should begin now and be intuitive and incremental
- Tech transfer should involve vendors for buy-in
- STARS should drive for official standardization
- STARS should give tech transfer and commercialization priority over evaluation
- STARS should proactively support an affiliates program
  - Use for early tech transfer (awareness and understanding)
  - Use for strategic alliances for commercialization
  - STARS must provide sufficient resources to drive tech transfer
  - Should involve full spectrum of vendors and users
- Distinguished Reviewers good - should include standards organizations
- Appoint tech transfer czar
- STARS must pay special attention to marketing and advocacy

DG3.6 - Other Issues

- Buying power
- Quality/price
- International involvement

DG3.7 - Summary

- Success for STARS is tech transfer
- Commercialization more important than evaluation/demonstration
- Tech transfer best incremental and interactive and should start now

3.10. Discussion Group Write Up

STARS TECHNOLOGY TRANSFER

Introduction

The Technology Transfer Working Group had a significant level of concern about the STARS plan but felt this concern could be addressed as STARS planning progresses. Members readily agreed both on the technology-transfer-related problems with the STARS plan as presented and on a set of recommendations to address them.

The many problems identified -- including a general underemphasis of technology transfer and plans for evaluation that did not primarily aim at aiding technology adoption decisions -- were believed to be important. But more basically the plan lacked explicit recognition that the criteria for STARS Program success is success in technology transfer and, therefore, that (1) vendors are critical to success and (2) all facets of the program should have technology transfer concerns integrated in them. In addition to these recognitions, the Working Group made a number of concrete recommendations.

This note briefly describes the problems and rationale that led to the Group's recommendations and enumerates the recommendations.

Problems

The STARS plan presented had a number of apparent problems related to technology transfer.

- Plan underemphasizes technology transfer

    - No assignment of responsibility/ownership of technology transfer within program

    - User requirements need to be researched and evolved recognizing the changing context/market

    - Little incrementalism apparent in deliveries

    - Inadequate recognition of importance of early awareness and experience to impact successful evolution of products and technologies

    - Inadequate recognition of the support that will be needed by early users

    - Limited provisions and aids for adaptation

- Misdirected program evaluation not aimed at facilitating technology transfer

- Inadequate planning for getting industry on-board.

No coherent strategy existed for technology transfer, and technology transfer concerns were seldom mentioned in plan.

STARS Goal

STARS is not just a technology R&D program aimed at improving the state of the art, but a program aimed at changing the state of practice. Successful technology transfer is the goal that should drive STARS and by which it ultimately should be judged.

STARS Marketplace Strategy

Furthermore, STARS aims to achieve this goal by creating a marketplace based on standard, open interfaces having commercially available implementations meeting Department of Defense needs. This, first, requires that standards exist for a number of interfaces -- either by identifying existing standards or creating new ones. Second, these standards need to be accepted by users and suppliers. Third, conforming commercial implementations must exist of both the infrastructure and tools.

Vendors are clearly prerequisite players in achieving this. While some analogous efforts such as MAP/TOP have arisen from user impetus, vendors have to be on-board for success. OSF and PCTE are efforts showing, in part, the value of early vendor involvement and commitment. STARS success would be aided by the involvement of a number of different classes of vendors large and small as they are likely to supply different types of needed products in the future marketplace.

Many of the Working Group's recommendations derived directly from this essential importance of vendors and commercial marketplace creation.

- STARS technology transfer should involve vendors for buy-in
- STARS should drive for official standardization
- STARS should proactively support an affiliates program
    - Use for strategic alliances for commercialization
    - Involve full spectrum of vendors
- Distinguished reviewers should include individuals involved in standards.

Two marketplace-related issues were not resolved by the Group. DoD buying power is probably of some influence, but the Group reached no conclusions on its use. Likewise, while international involvement has some potential to enlarge the market, the Group gave no recommendation.

Technology Transfer to Users

The final technology transfer requires the other side of the market -- the users. User involvement early and often is one tried and true technology transfer practice. Indeed, if STARS did not plan it, then vendors might force it. This involvement increases both the chance of a useful product emerging and the likelihood of involved users accepting it -- two other aspect of a successful technology transfer.

Many of the recommendations were based on this need for user involvement.
- Technology transfer should begin now and be iterative and incremental
- STARS should proactively support an affiliates program
    - Use for early technology transfer (awareness and understanding)
    - Involve a full spectrum of users.

STARS Program Management

Lastly, several of the recommendations from the Working Group related to internal STARS programmatic actions that would increase the emphasis on technology transfer.
- STARS must provide sufficient resources to drive technology transfer
- STARS should appoint a technology transfer "czar"
- STARS must pay special attention to marketing and advocacy
- STARS should give technology transfer and commercialization priority over "Evaluation".

This combination of (1) enlisting vendors and creating a marketplace, (2) involving users early and often, and (3) giving technology transfer programmatic power and prominence directly addresses the Working Group's concerns about STARS technology transfer.

3.11. STARS Program Response

DG3.5 - Recommendations

- Tech transfer should begin now and be intuitive and incremental

  STARS Response: Agree. It is important that we explicitly address technology transfer as a managed part of the STARS program. As a result of the workshop, we are tasking the SEI to develop a comprehensive technology transfer plan to become part of the overall STARS program. Some technology transfer has already begun; the STARS newsletter is part of this communication, as is STARS involvement in a number of government and industry workshops and other public forums. The technology transfer plan will explicitly address the need for such activities to be intuitive and incremental, and that such activities must be initiated now, not just at the end, and must involve all the players.

- Tech transfer should involve vendors for buy-in

  STARS Response: Agree. The technology transfer plan will address the issue of obtaining vendor buy-in. Because of the emphasis in STARS on commercially available products, it is extremely important that we obtain their buy-in. As STARS takes the lead in establishing an open architecture and instantiates it on the three environments, the market will become more viable for the vendors. As part of this activity, we need to identify the total market and significant segments of the market so we can address each. We intend to hold a CASE-oriented workshop in Spring 1991 and will use this as an important part of obtaining vendor buy-in.

- STARS should drive for official standardization

  STARS Response: Partially agree. The DARPA approach, as with Berkeley Unix, X, Mach, and TCP/IP, is to develop viable "standardize-able" technology, and encourage industry to standardize it. We intend to work very closely with the Navy NGCR PSEWG in this area to leverage their work with the standards community.

- STARS should give tech transfer and commercialization priority over evaluation

  STARS Response: Partially agree. Commercialization is our top priority, but putting technology transition and evaluation in opposition is dysfunctional. We believe that the credibility and transition of STARS technology depends a large part on the success of its demonstration during the evaluations. We understand concerns about not over-emphasizing the evaluations to the detriment of technology transfer and getting users to want to use the technology. The evaluation of the success of the STARS program itself will involve other metrics than just the results of the evaluation applications. We will stress technology transfer and commercialization as two of those additional metrics. We have included these concerns in our next level of detailed planning and will discuss this at the next STARS/Users Workshop to see if we understood what you were telling us.

- STARS should proactively support an affiliates program

  - Use for early tech transfer (awareness and understanding)

  - Use for strategic alliances for commercialization

  - STARS must provide sufficient resources to drive tech transfer

  - Should involve full spectrum of vendors and users

STARS Response: Agree. We accept your emphasis that the affiliates program is a very important part of the STARS program, and we will include it as part of the technology transfer plan. We also accept that such a program must be supported with both management attention and funds. We will plan out the activities and required support as a part of our technology transfer planning, and, as a result of that planning, budget for support of the affiliates program. We will include oversight of the affiliates program as one of the activities of the technology transfer function. The affiliates program planning and activities will include emphasis on all of the bullets above. We intend to conduct follow-on workshops for the affiliates, and will make sure such topics are included.

- Distinguished Reviewers good - should include standards organizations

STARS Response: Agree. As stated above, we agree with the premise that STARS open architecture standards must be accepted generally. In order to help STARS prioritize its activities in this important area and to understand how to proceed, we will encourage participation in the STARS Distinguished Reviewers program by representatives of the standards organizations that are most important to the STARS program.

- Appoint tech transfer czar

STARS Response: Partially agree. Technology transfer is very important. We have asked the SEI to develop a technology transfer plan, and part of that plan will be the coordination of government and industry technology transfer efforts. This activity will be managed along with all of the other aspects of the program. A STARS technology transfer czar is not necessary.

- STARS must pay special attention to marketing and advocacy

STARS Response: Agree. We agree that STARS is not just a technology R&D program aimed at improving the state-of-the-art, but a program aimed at changing the state-of-the-practice. As indicated, STARS needs the standards and technology to be accepted both commercially and by the users, and that commercial implementations must exist for both the infrastructure and tools. We will pay special attention to marketing and advocacy to make sure that both the provider and the user side of the market is developed, so that we have useful products emerging and that the users will accept them. We are developing cost-benefit models for STARS technology in order to try and put some quantitative substance behind our marketing and advocacy efforts.

4. Technical Barriers to Reuse

Charter: The Technical Barriers to Reuse Discussion Group should address issues related to:

- The current STARS reuse plan, and
- The technical issues from the STARS plan that would facilitate transitioning reuse into practise within your organization.

Discussion Group Location:

> 4300 Monday
> 4300 Tuesday

Discussion Group Leader:

> Ronald Green, *USArmy/SDIO*

Discussion Group Members:

> Sholom Cohen, *SEI* [Monday only]
> Maggie Davis, *Boeing*
> Joe Greene, *Real-Time Solutions*
> Marlene Hazle, *MITRE*
> Robert Holibaugh, *SEI* [Monday only]
> Anita Hudson, *Harris*
> Nick Kamenoff, *SEI* [Monday only]
> Beverly Kitaoka, *SAIC*
> Guillermo Rodriguez, *JPL*
> Robert Saisi, *DSD* [Monday only]
> Steven Sherman, *Lockheed* [Monday only]

4.1. STARS Reuse Plan

Do you agree with the general direction of the STARS reuse plan? What additional risks do you see? What additional risk mitigations are needed? What on-going efforts are you aware of that could help to mitigate risks?

Can you suggest specific improvements to the plan?

4.2. Reuse of All Artifacts

What should be provided to support reuse of all levels of artifacts (architectures, requirements, design records, automated support for reasonable documentation...)?

4.3. Multiple Libraries

Do you agree with STARS assumption that multiple, physical libraries will be used in the future?

Do you agree with a STARS focus on initial support for "seamless" operations across libraries? What does "seamless" mean to you in this context?

4.4. Developing Corporate Software Assets

Does your company use an asset library? If so, is there a mechanism to support it and what is it like?

What would encourage your company to make use of an asset library? What do you require in terms of access mechanisms (e.g., kinds of user interfaces, remote access)? What kinds of information do you want to store in addition to software design, implementation, test records (e.g., usage reports, performance information, bug reports, new feature requests)?

4.5. Using Corporate Software Assets

If the asset is code, should the library record how many compilers with which it has been successfully compiled and how/why it fails with others? With how many compilers do you think a well-tested asset should work? Who should put this information in the library: the asset developer? The library administrator? The reuser who tries an asset with another compiler?

4.6. Certification of Assets

Should there be "levels of certification" of assets? Should raw data be supplied or just a level indicator (eg. untested, tested and tests are part of asset library, reuse metrics...) Should there be a standard procedure for certification of assets? What process should be used to involve the community in such an effort?

4.7. Use of Assets

Should contact information be provided on users who have also extracted that component? Would YOU mind if other potential users contacted you about experiences with a particular component?

4.8. Support for Embedded Systems

Is there specific information that should be supportable for embedded systems?

Currently code descriptions are functional (what a component does and how it does it [e.g., stack: sequential, bounded, parallel]); without detailed resource consumption information. For embedded (resource-constrained) systems, reuse may be unaffordable (i.e., cheaper to build from scratch than test, divine resource consumption). What kinds of resource usage information should be provided? And in what format and notation should that information be recorded and gathered? How "portable" is that information?

4.9. Barriers to Development of Reusable Components

Do the current methods and tools used to develop software impose unnecessary barriers to the development of reusable components? To the use of reusable components? If so, what kinds of issues must be addressed and what sorts of methods, techniques, tools are needed?

4.10. Consistent Views

Is it important for the library to always contain the same related information for an asset? What sort of consistent view could/should be maintained for assets associated with a code asset -- for analysis, design, code that may have been developed under different paradigms? In different languages?

4.11. Discussion Group Slides

DG4.1 - STARS Plans - Positive Points

1. Tailorability of asset management approach

2. Open architecture of SEE/library

3. Reuse process adaptability.

4. Asset interchange activities

5. Establishment of certification criteria and procedures

6. Broad definition of asset

7. Reuse is addressed in context of process, SEE

DG4.2 - Recommendations

1. Identify interim reuse and library products

2. Balance emphasis on library with other reuse life cycle activities

3. Clarify role of formalism

4. Exercise, validate, recommend reuse asset development/use standards and processes

5. Define and support reuse cost (and quality) benefit tradeoff analysis

6. Ensure early involvement of "evaluators" with use and testing of interim reuse products

7. Identify source of assets ASAP for evaluations

   - Identify organizations with reuse initiatives

8. Use SEE development based on reuse as one evaluation to demonstrate benefits of reuse

   - Primes should identify SEE assets to be shared among the environments

DG4.3 - WIN/WIN

1. Reuse cost/benefit demonstration

2. Actualization of standards, guidelines, procedures, and tools to affect reuse based development

3. Transfer of the reuse process and culture

4. STARS reuse plan needs to be synchronized with other plans such as JIAWG, SDIO, DoD Master Plan, DARPA software strategy to demonstrate synergy

1. Domains are complex, ill-defined and poorly understood

   - Recognize domain expertise is essential

   - Technology must support understanding and transfer of domain and technical knowledge

2. Traceability

   - specification standards

   - variability information

   - mutants and clones

   - design issues and rationale

3. Certification

   - establish criteria

   - process for creation and use

4. Asset type definition

   - what is an asset

5. Reuse process (and procurement practice) must be flexible enough at requirements and specification level to take advantage of existing assets

6. Need for inter-communication among

   - asset developers

   - library tailorers

   - reusers

4.12. Discussion Group Write Up

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Minutes from STARS User's Workshop Discussion Group 4
        TECHNICAL BARRIERS TO REUSE

This discussion group was chartered to address the current STARS reuse
plan and the technical issues that would facilitate transitioning
reuse into practice.   The group leader was Ronald Green, US Army/SDIO.
Other members of the group included:
        Sholom Cohen, SEI
        Maggie Davis, Boeing - STARS (Minutes recorder)
        Joseph Greene, Real-Time Solutions
        Marlene Hazle, Mitre (Chartist 2nd session)
        Bob Holibaugh, SEI
        Anita Hudson, Harris Corporation
        Nick Kamenoff, SEI
        Bev Kitaoka, SAIC- STARS (View foil maker)
        Steve Sherman, Lockhead
        Bob Saisi, DSD (Chartist 1st session).

FIRST SESSION - BARRIERS TO REUSE:

Ron Green led off the discussion by asking if the group perceived that
there were technical barriers to reuse and if so, what were they.
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Steve Sherman responded by pointing out what made certain reuse libraries successful -- well defined and reasonably understood domains with little interaction or combination of components. These statements sparked a discussion about the difficulty in reusing other products than software code. The group then went on to discuss what might be useful assets to reuse. Types mentioned included reuse of subsystems, specifications, and designs.

Bob Saisi then asserted that the reuse process should be matched to whatever type of asset is to be reused. This lead to a digression discussing whether designs are ever reused. The conclusion was that reuse of complex assets such as designs is accomplished because reusers understand to a detailed level what they are reusing. This lead Marlene Hazle to ask if the STARS reuse approach should make provisions for training people in existing systems that are candidates for reuse.

Bev Kitaoka made another point about why people are successful at reusing code: code has a formal description and has syntactic and some degree of semantic consistency.

Marlene Hazle described a Mitre project that had supported the reuse of A specs. The reuse was fostered by requiring the specs to be written in a standard format. However, Marlene pointed out that the project expended considerable effort in then translating from the standard format into a reusable form that the computer system managed.

Anita Hudson followed up on this discussion by asserting that STARS should provide a formal definition of the syntax for supplying different types of assets. She also expressed a concern that the three thrusts of STARS (reuse, process, SEE) will integrate. She asked if the SEE will be able to assist you in figuring out what is a valid next development step from its knowledge of the process and of currently available assets. She expressed a desire that the SEE provide this assistance but did not feel the morning's presentations had enough detail to conclude that.

Joe Greene brought the group back to the idea that the reuser needs to understand the domain by expressing skepticism of the expectation that reuse can be accomplished by someone who does not understand the domain in which the development is occurring. He gave an example of a very complex problem that required a high degree of education in Physics.

Steve Sherman followed up by Greene's statement by asserting that the type of expertise needed varies as system development progresses. In the early stages, application domain expertise is required with a transition to expertise in general computer science as development proceeds. He also stated his belief that the higher of abstraction of an asset, the easier it is to reuse.

Joe Greene then brought up the issue of confidence in what is being reused. He pointed out that when code is executable, one can have some confidence that it expresses a set of requirements. He stated that there should be some way to demonstrate that the code is consistent with requirements. Marlene Hazle then asked if that meant that tools that back up from code to requirements (design recovery) were useful and needed.

The group then spent some time discussing various issues surrounding traceability and design recovery. Steve Sherman questioned the validity of assuming that requirements traceability would guarantee consistency of executing code with requirements. Greene pointed out that comparing the performance characteristics of different executing systems can be a powerful decision aid in deciding what was a useful system to select for reuse.

Bob Holibaugh then brought up another issue affecting reuse. How do the design and requirements approach used to develop assets affect their reuse? He asserted that the real goal of documentation is to communicate and that a standard form of specification is needed along with a capability to describe the range of variability of a code part. Sholom Cohen stated that there is a need to understand variability when using/creating application generators.

Steve Sherman stated that if reuse begins at the subsystem level, there is a need for tools that support substitutions and/or supply of new subsystem parts. He pointed out the lack of a language or representation to capture the description of parts and parts interactions in a system, pointing out that interface specifications are often not sufficient. Steve went on to say that if it would be useful if there was a way to determine that a small change in the requirements or design approach being used would provide a major opportunity to reuse existing code.

Bob Holibaugh raised the issue that more and better ability to reuse will benefit system deployment and maintenance. Ron Green followed up this statement that one should not count on maintenance to cost justify the development of reusable components.

Bob Saisi asked how could reuse be fostered across domains? Steve Sherman reiterated his point that reuse has been successful only within very limited domains. This lead Bev Kitaoka to ask if a barrier to reuse was that there no requirements and design techniques that allowed planning for reuse -- either to develop reusable components or to use them.

Sholom Cohen then questioned whether there was sufficient time compatibility between the STARS program and the current developments of reverse engineering and design recovery tools. He also asked how STARS was planning to merge independently developed domain analyses and components for the 1993 evaluation projects. Bob Saisi suggested that the criteria for selecting the contractor and evaluation projects would provide inherent reuse of domain knowledge and components.

The group then listed some successful applications of a reuse-oriented process (J. Greene - Foxboro Corp; S. Sherman - Toshiba; A. Hudson - an architectural firm). The discussion that followed emphasized that even in these successful reuse illustrations, the retention of domain experts (either in application or solution) domain was critical.

Sholom Cohen brought up the issue that the STARS flexible approach to a reuse design process does not guarantee compatibility with the tools provided by the SEE or domain assets available. The following discussion revealed that, in spite of the morning presentations, there were considerable mistaken impressions that there would be a STARS approved reuse methodology and standards.

Next, the discussion turned on the point of what standards and criteria might be appropriate for STARS in the area of reuse and reuse process. Anita Hudson queried whether the plan included the development of levels of criteria or certification. She emphasized that asset certification is a technical obstacle and that criteria needed to be customized to the type of asset evaluated.

Ron Green asserted that the STARS approach to 1993 evaluations vis-a-vis reuse was still unstructured. More discussion followed that touched on the need for asset criteria as critical to the evaluations in 1993. There is risk that domain assets will not meet the 1993 criteria; risk that criteria should be domain and methodology dependent as well as asset type dependent; risk that the classification and supply process will require more human effort than will be available.

Sholom Cohen was concerned because the STARS plan did not determine one process for creating reuse assets. Anita Hudson countered that by the time STARS delivers its final products, potential using organizations will already have their own reuse process. She used this to support the notion that STARS should not converge on one reuse process.

Steve Sherman asked if the intent was that each library mechanism would work on each other platforms. Marlene Hazle, Bev Kitaoka, and Maggie Davis then explained about the repository working groups and the plan to have a programmatic interface for all the repositories. This lead to these three giving more details on the repository working groups and what approaches they are pursuing.

The session concluded with some attendees stating that they would be attending the SEI affiliates tutorials the next day and not attending the second discussion group.

SECOND SESSION -- REPORT OUT DEVELOPMENT:

This session was devoted to developing material for the slides for the discussion group report out.

For slide #1, the positive points about the program, the group listed:
1. Tailorability of asset management approach
2. Open approach to SEE/Library mechanisms
3. Adaptability of reuse process
4. Addressing asset interchange
5. Establishment of certification criteria and procedures
6. Broad definition of asset
7. Reuse is being addressed in the context of process and SEE

For slide #2, recommendations, the group listed:

1. Identify interim reuse and library products
2. Balance emphasis on library mechanisms with attention to reuse life cycle activities
3. Clarify role of formalism
4. Exercise, validate, and recommend asset development and (re)use standards and processes
5. Define and support reuse cost (& quality) tradeoff analyses
6. Ensure early involvement of "evaluators" with asset development

and reuse and library mechanisms

7. Identify source of assets for 1993 evaluations ASAP
8. Use SEE development as one evaluation to show benefits of reuse

For slide #3, win-win conditions, the group listed:

1. Reuse cost/benefit demonstration
2. Actualization of reuse standards, guidelines, procedures, and tools to effect reuse based development
3. Transfer of the reuse culture and a reuse approach to the development process

4.13. STARS Program Response

DG4.2 - Recommendations

1. Identify interim reuse and library products

   STARS Response: Agree. A top-level consolidated plan was presented at this meeting to gain initial feedback from industry. The feedback gathered has been fed into next level planning sessions and interim products will be one of the items identified in these sessions. STARS will provide the next level planning materials to industry participants prior to the next STARS Users Workshop.

2. Balance emphasis on library with other reuse life cycle activities

   STARS Response: Agree. This request will be filtered into the next level planning process. STARS agrees that the emphasis on the library mechanisms needs to be balanced with initial definition of reuse processes and integration/development of reuse support tools to actively support those processes. The library mechanisms are one of five major activities in the STARS reuse plan: reuse processes, reuse support tools, asset acquisition, support for seamless operations and library mechanisms.

3. Clarify role of formalism

   STARS response: STARS has had difficulty interpreting this issue. Clarification from working group participants indicate that the discussion focused on the notion that code is more reusable than non-code assets since code has an understandable formalism. The issue was reconstituted as "examine the importance of formal representation of assets/components through the use of formal requirements specification, formal design languages etc". STARS has no plans to require use of specific formal techniques for early life-cycle artifacts in order to make use of the STARS library mechanisms. STARS does encourage that early life-cycle artifacts be part of what is stored in the reuse libraries. But, it is beyond the scope of STARS to gain community consensus and institute a single formal design record. Longer range DARPA ISTO research on the software design record is geared to address this need.

4. Exercise, validate, recommend reuse asset development/use standards and processes

   STARS Response: Agree. STARS agrees that the reuse processes, support tools and library mechanisms need to be exercised prior to the October 1, 1993 start of the evaluation project. STARS is developing these capabilities incrementally with the intent that early trial usage both by the Prime contractors and by industry affiliates will provide early validation and feedback. STARS believes it to be an acceptable risk that we can encourage sufficient trial usage on domain asset development without directly funding the asset development under STARS. DARPA plans for the domain assets created under the Domain Specific Software Architectures (DSSA) program to be stored in STARS library thus providing a means of validating the mechanisms.

5. Define and support reuse cost (and quality) benefit tradeoff analysis

STARS Response: Disagree. Many studies have been conducted to date on the cost/benefit of reuse. STARS does not believe that there would be sufficient benefit for the community if STARS were to do another cost benefit model. The SEI, SPC and others have modeled the economic benefits of reuse. Instead, STARS plans through empirical means -- the evaluation project -- to actively demonstrate the benefits of reuse on real DoD programs and collect the empirical data from the real project experience.

6. Ensure early involvement of "evaluators" with use and testing of interim reuse products

STARS Response: Agree. Once the application domains for the evaluation projects have been selected and the domain asset developers identified, STARS staff plan to be working closely with them and with the application developers to successfully transition STARS technology into use. STARS hopes that at least some of the domain assets used in the evaluation projects will be developed early using interim STARS reuse processes and tools.

7. Identify source of assets ASAP for evaluations

STARS Response: Agree. STARS agrees that it is important to select the application domains for the evaluation projects early and identify the source of assets. Since the September workshop, STARS has convened an Evaluation team that is investigating asset sources with both government and industry. This team is beginning to identify real service interest and potential for asset sources. STARS is not looking in places like the SIMTEL20 system for piece-meal components but is investigating sources for application architectures and architecture based assets. If you are personally aware of potentially applicable domain architecture development, please contact the STARS Technology Center.

- Identify organizations with reuse initiatives

STARS Response: Agree. STARS has begun to identify and establish relationships with several of the organizations with reuse initiatives. One of the on-going STARS tasks has interviewed key personnel from government and industry on reuse and potential impact on acquisition guidelines. The tier II reuse plans are identifying related organizations and assigning responsibility for interaction to the Primes and the FFRDCs.

8. Use SEE development based on reuse as one evaluation to demonstrate benefits of reuse

STARS Response: Disagree. While STARS does intend to reuse software in instantiating the SEE, one major change in program direction over the past year has been to emphasize evaluation through usage on real DoD programs rather than evaluation through usage on STARS itself.

- Primes should identify SEE assets to be shared among the environments

STARS Response: Agree. The next level of STARS planning for the SEE emphasizes a common open architecture and cooperation among the Primes. The consolidated plan is intended to minimize duplicative activities unless multiple approaches are warranted and foster a sharing of assets among the environments.

5. Non-Technical Barriers to Reuse

Charter: The Non-Technical Barriers to Reuse Discussion Group should address issues related to:

- Addressing the cultural, management and business issues involved in making reuse practical for DoD MCCR systems.

- Providing a list of what is being done elsewhere off which STARS can leverage.

- Identification of specific actions that STARS or others could take to facilitate removal of the non-technical barriers to reuse.

Discussion Group Location:

> 4320 Monday
> 4320 Tuesday

Discussion Group Leader:

> Dennis Struble, *Intermetrics*

Discussion Group Members:

> James Baldo, *IDA*
> Robert Bowes, *DSD*
> Gerald Brown, *USArmy/CECOM* [Monday only]
> Rich D'Ippolito, *SEI*
> Ed Liebhardt, *OSD/AJPO*
> Jim Moore, *IBM*
> William E Novak, *GE Aerospace* [Monday only]
> Gerald White, *Foxboro*
> Bill Wood, *SEI*

5.1. Origin of Assets

Does your company have an asset library today? If so, from where did the assets come from? IR&D? From a specific application development? From outside sources? How often is the asset library used? Has it been worth the investment?

5.2. Corporate Investment

Is your company investing in domain-specific software architectures or assets in their major product lines or domains?

If not, what would encourage this investment?

5.3. Licensing Corporate Assets

Would your company be interested in making reusable assets licensable?

What would encourage this?

5.4. Domain-Specific Architectures

Would your company cooperate towards community consensus in domain specific architectures for DoD MCCR application domains?

What would encourage this?

5.5. Feedback into Asset Libraries

How can reusers be encouraged to provide information back to the asset library (success, failures, new feature requests etc)?

Should modified assets be put back into the asset library? What would motivate you to do this?

5.6. Support for Reuse Libraries

Should reuse libraries become self supporting organizations? Would you pay for assets? Would you pay a library connection service fee? What sort of services would you then expect?

What sort of organization should run a domain specific reuse library? Government? A Service? At the DoD level? DoD contractors? Private commercial industry? What are the risks/mitigations associated with each mode of operation?

Should there be multiple domain specific libraries in the future? Should there be a single National Asset Library? What would you desire as the concept of operations?

5.7. Existing Reuse Efforts

What existing (and available) reuse efforts are underway - Ada and non-Ada, defense and public sector? What kinds of issues, applications, levels of granularity (subprogram, subsystem), object (code only, documentation) are being addressed? To which of these efforts should STARS be paying attention? Why? What are the entrees into these efforts?

5.8. Reuse after STARS

After STARS, to what degree should there be DoD-mandated domains for reuse? Should there be libraries or repositories for required searching, contributing? (Who pays? Who gets "rewards"?) Should DoD require a waiver not to use a particular software component? How would contractors and customers determine whether or not this would be cost effective? What about suppliers of reusable components? Maintainers of libraries?

5.9. Reengineering

Are reengineering needs being addressed adequately by STARS, or does STARS appear to be viable for "new starts" only? What about maintenance/PDSS - are there barriers for STARS use in that area? Should STARS be addressing these areas? What issues must STARS address to remain/become viable in these areas?

5.10. Reuse and Acquisition Issues

It is said that acquisition issues get in the way of achieving reuse (licensing among them). What are the real barriers? What are just "excuses" to allow contractors and customers to continue doing business as usual? What new procedures/policies are really needed in order to really implement reuse? What new procedures/policies is DoD planning?

5.11. Silver Bullet

To what degree is the software industry (producer, contractor, customer) looking at reuse as a silver bullet? What can reasonably be expected from reuse, as far as productivity and reliability go?

5.12. Discussion Group Slides

DG5.1 - Roles in Reuse

1. Supplier / producers

2. User / consumer

3. Value-added services

- Domain-specific expertise

- Process / library expertise

4. Research community

5. DoD evaluators

DG5.2 - Asset Library Survey

	Yes	No
Asset Libraries	3	2
Reuse formal	1	
informal	3	
none	1	

Who:

- Foxboro

- GE Aerospace

- IBM

- Intermetrics

- Unisys

DG5.3 - First Level Issues

- The plan lacked enough detail for analysis by the group

- STARS must address non-technical issues as a task

  - active participation, or

  - passive coordination

  - non-technical issues must feedback into design

- Acquisition process does not foster reuse

  - lack of clarity in licensing, warranties, regulations

DG5.4 - Second Level Issues

- STARS/User Workshop should have more attendees that represent legal and business communities (i.e., from primes and other organizations such as NSIA, AFCEA, AIAA, etc.)

- STARS should consider both new and reengineering assets in designing their asset library (evaluation projects should also consider reengineering project as candidates)

- Funding, schedule, and contractual relationships are high risk issues (wrt business relationships) for STARS demonstrations

DG5.5 - Third Level Issues

1. A successful inter-company asset library will be far more difficult to achieve than an intra-company library. STARS plan didn't convey a recognition of this difference.

2. The STARS plan is not believable in terms of populating the library with C3I, MIS, MCCR domain assets in time for the evaluation.

3. STARS should early on define the procedures/filters that will eventually be used to assure the library is populated with only high-quality, reusable components.

DG5.6 - Win/Win

- Decreased gap between need for systems and capacity to produce them
  - industrial base
  - defense budget

- Business practices which reward contractor for successful, innovation
  - (not in current program)

- Increased predictability of system development efforts

- Rejected as not necessarily beneficial to contractors under current acquisition practices:
  - Decreased cost to produce systems
  - Decreased time to produce systems

5.13. Discussion Group Write Up

(begins on following page)

Non-Technical Barriers

to Software Reuse

Report from the STARS/Users Workshop

September, 1990

1.0 Introduction

Discussion Group 5, Non-Technical Barriers to Reuse, was asked to evaluate the STARS program from the perspective of whether business and legal factors would prevent widespread software reuse. The members of the group were:

James Baldo, Jr. / Institute for Defense Analysis
Robert Bowes / DSD Laboratories (consultant)
Gerald Brown / U.S. Army CECOM
Richard D'Ippolito / Software Engineering Institute
Ed Liebhardt / Ada Joint Program Office
James Moore / IBM
William Novak / GE Aerospace
Dennis Struble / Intermetrics
Gerald White / Foxboro
William Wood / Software Engineering Institute

Misters Baldo, Bowes, Moore, and Struble wrote this report. Mr. Struble acted as discussion group leader and report editor.

The group identified and prioritized a number of issues that the STARS program must address to achieve the STARS program's goals for DoD software reuse. During our discussions, several non-technical problem areas arose again and again. The STARS community is well aware of these problem areas, but for completeness and to set the framework for this report, we first provide a sampling of these problems areas:

Who owns assets in an asset library and how are copyright problems to be addressed?

Will the asset librarian be responsible for licensing assets to users? Will there be a standard license to be used for all components in an asset library or will a new license agreement be negotiated each time assets are used?

Will the asset library provide accounting of who is using which assets? Will the library provide financial services, such as quarterly royalty billings?

Will the Federal Acquisition Regulations (FAR) be modified so that companies will be able to productively utilize the STARS reuse technology?

How will the asset libraries enforce DoD security requirements and yet provide nation-wide access to the assets?

Who bears the liability for malfunctions in reused in assets?

Will the asset library allow on-going maintenance

of assets? Presumably, many assets in an asset
library will be enhanced periodically. Will
the asset library provide facilities to
coordinate users' upgrade to new versions of
enhanced assets?

Our findings are discussed below in three sections.
First, in Section 2, we enumerate the different asset library
user categories we foresee. Section 3 is the heart of our
report; its contains the issues we believe the STARS program
must address. Finally, Section 4 comments on "Win/Win"
conditions; that is how the STARS Program, the DoD, and
contractors can all be winners. An appendix contains the
results of a survey of reuse by companies represented in our
discussion group.

2.0   Roles In Reuse

In designing their asset libraries, the STARS primes
must be aware of the differing user categories. The
libraries must provide mechanisms and procedures which
support the needs of each user category. We identified five
user categories. Two categories are obvious: asset
suppliers and asset users. We see three additional
categories which the STARS primes may not have considered:

Value-added servicers

Presuming the eventual existence of a thriving
reuse industry, there will be companies who
provide reuse services. Examples of such services
are the provision of domain-specific expertise or
the provision of assistance in using a specific
asset library technology.

Research community

The research community will wish to measure and
evaluate the dynamics of reuse. Specialized
instrumentation of asset libraries, as well as
entire STARS Software Engineering Environments
(SEE), would aid such research.

DoD evaluators

During the STARS lifetime, DoD agencies, such as
DARPA, will want to demonstrate the success of
reuse, STARS, and Ada. Properly instrumented
asset libraries could be a key aid in such
demonstration.

3.0 Non-Technical Issues

Our group partitioned into three levels the issues we
suggest the STARS program consider. The issues are
described below, with the highest priority issues first.

3.1 First Level Issues

3.1.1 STARS Must Provide More Program Plan Detail

The group consensus was the STARS briefing had not provided sufficient detail to permit us to provide the level of analysis we believe was expected. Nontheless, we worked with what we had, supplemented by our collective experience and understanding of STARS.

3.1.2 STARS Must Address Non-Technical Issues

The group was unanimous in its believe that reuse cannot be successful without timely consideration of the non-technical business, contractual, legal, and programmatic issues. We strongly urge specific STARS effort (beyond the current minimal tasking) to address these non-technical issues. Without it, reuse will not be successful.

The group was concerned because the STARS briefing did not indicate awareness of the necessary connection between non-technical reuse issues and the technical design of the asset libraries. The briefing implied that STARS would focus on the technical design of asset libraries, presuming that other DoD initiatives would resolve the non-technical problems and that the resolution of the problems would have no bearing on the technical design of the libraries. Such a technocentric approach could well lead to failure in fostering reuse, particularly reuse across company boundaries.

STARS can participate in resolving the non-technical issues either actively or passively. As an active participant, STARS could identify impediments and areas requiring change. Even if such activity is outside DARPA's primary charter, there is much to be gained in pursuing an intelligent advocate role by recommending new concepts and by suggesting actual changes in procedures, regulations, and training. These changes would be provided to the organizations with primary responsibility. We stand by the belief a good idea will win acceptance regardless of its origins.

Passive coordination, although less preferred is another alternative. By participating in, and encouraging, associations such as NSIA, AFCEA, AIAA, IEEE, and EIA to focus on non-technical issues, STARS could potentially marshall these association resources in an alliance.

3.1.3 STARS Should Push for Updating the Acquisition Process

We recognize organizations such as the JAIWG, IDA (and even STARS to a minor extent) are looking at the acquisition process. It is critical to the success of reuse that regulations, training, and education media all explicitly and thoroughly address the non-technical issues. It is

clear to the group and to many others that there is a lack
of clarity in regulatory and procedural material regarding
the more esoteric topics of software licensing, copyright,
warranties, and the intricacies of software acquisition.
Today's federal acquisition personnel (program managers,
contracting officers, legal, and financial people) do not
adequately understand software acquisition, and particularly
software reuse, nor are they being provided the tools to
improve their understanding.

3.2 Second Level Issues

3.2.1 Workshops Should Include Business/Legal Personnel

Future STARS/User Workshops should have more attendees
that represent legal and business communities (i.e., from
prime contractors and other organizations such as NSIA,
AFCEA, and AIAA)

Legal and contractual issues could seriously inhibit
the application of software reuse on DOD systems, even if
major technical issues for software reuse are solved (i.e.,
from STARS program). Providing software developers with the
capabilities to access and use reusable software components,
requires a legal and contractual framework that enables the
appropriate technologies to be used and provides incentives
for industry to utilize reuse technology as it matures and
becomes available.

In order to assure that both software reuse technology
and necessary acquisition mechanisms are inserted into the
DoD software life-cycle, both contractor and DoD
participation will be necessary. This activity will help
determine if industry will agree to the business impact that
large scale reuse will have and changes that may be needed
to the DoD acquisition process to support large scale reuse
technology developed under STARS.

3.2.2 STARS Should Support Reengineering Projects

In the future, the majority of the DoD's software
budget will be spent on maintaining and enhancing existing
systems rather than on developing new systems. (DoD members
of our group indicated that systems reengineering could
consume as much as 80% of the software budget.)
Consequently, STARS should treat the needs of reengineering
projects with at least as much priority as new-start
projects, particularly in the design of asset libraries.

Reengineering projects should also be considered as
candidate evaluation projects. Since the needs of
reengineering projects are different from new starts, a
STARS evaluation based only on new starts would be
incomplete.

A third issue regarding reengineering projects is that

such projects could well prove to be the primary source for populating the STARS asset libraries. The development of a reusable component necessarily increases the cost and schedule of the design, implementation, and testing phases. In order for STARS to reduce the time and cost of populating its asset libraries, consideration should be given to reengineering existing software.

A number of well understood domains exist (e.g., communications software, avionics, and database applications), which have large amounts of software components that may be reengineered for submission into the STARS asset library. For domains that map closely to DoD applications, the cost savings of reengineering may be considerable. The reengineering process may also assist STARS reuse designers and implementors in understanding practical software engineering practices that are being used.

3.2.3 STARS Should Reassess Evaluation Approach

We recall the original context for the STARS evaluation was to "shadow" one or more DoD programs, using STARS developed technology to demonstrate its technical, schedule and cost effectiveness over traditional software development. The current STARS evaluation is more ambitious, appearing to have as its objective that three DoD programs adopt, and perhaps partially fund, the STARS technology as the primary approach to software development. The potential impacts on the programs are significant:

Risk is increased dramatically:

> The STARS process is an unknown in the development cycle.

> A prime contractor may have to be directed to use it, creating serious questions regarding both design and performance liabilities. Further, such direction would require lengthly, difficult negotiations.

The government program manager (PM) looses a measure of control of the program, its destiny, and the PM's success:

> More players are introduced with objectives not always in concert with those of the PM.

> Should the STARS players not have a keen appreciation of the intricacies of the program's acquisition process, their learning could increase risk and program management coordination activity.

The STARS briefing identified multiple relationships among the STARS players and the evaluation project players. STARS should not underestimate the complexity of managing

these relationships:

> MOA's and contract language will required involvement of reasonably sophisticated personnel from all organizations.

> We believe a MOA will be necessary between the two FFRDCs to clearly define roles and responsibilities.

Perhaps the STARS organization should conduct a risk assessment of alternative evaluation techniques (prime, shadow, or other) to identify the most viable and effective technique.

3.3 Third Level Issues

3.3.1 STARS Must Focus on Intra-Company Reuse

An asset library that supports reuse across company boundaries will be far more difficult to produce than a strictly intra-company library. As soon as software assets are reused across different companies, all the issues identified above in Section 1 will come into play. The STARS plan did not convey that STARS has plans for addressing the inter-company issues, nor even that the STARS program recognizes the substantial additional effort required to jump to inter-company reuse.

The group discussed the possibility that perhaps the 90/10 rule applies in this case. That is, 90% of the anticipated gain from STARS could be achieved by providing a productive intra-company reuse SEE. Further, this 90% gain could be achieved at a much lower risk and program cost than that required to provide a successful inter-company reuse SEE. It was interesting to note that the discussion group members who were contractors advocated this position, whereas the DoD representatives did not.

The DoD representatives stated that individual contractors might not pass on to the DoD the cost-savings arising from intra-company reuse and that, anyway, the big gain would come from inter-company reuse. Jack Kramer, the STARS Program Manager, in reviewing our discussion group's issues echoed the DoD representatives' position, stating that the STARS Program is strongly committed to providing SEEs which support inter-company reuse.

3.3.2 STARS Must Find Reuse Assets for the Evaluations

To successfully demonstrate reuse, the STARS evaluation projects will need access to libraries already populated with assets useful to each project's domain. Presumably the desired project domains are C3I, embedded systems, and MIS. The group is skeptical that by the start of the evaluation in October 1993, the STARS asset libraries will be populated

with enough assets to allow the evaluation projects to meaningfully demonstrate reuse.

This skepticism arises from first observing that today's STARS repository is populated primarily with components which support the software tool domain rather than with substantial subsystems from the C3I, embedded systems, or MIS domains. Secondly, it appears that the SEE frameworks will just have been completed in October 1993 and will be transitioning to the beta test phase. If this is case, it is hard to see how these newly completed libraries could be populated prior to commencing the evaluation projects.

The group recommended that the STARS program include one or two reengineering projects as its evaluation projects. In a reengineering project the development scenario could be: first, use the STARS SEE to identify reusable components in the existing system, install these components into the STARS asset library, and finally construct an enhanced system from these components combined with new code. Such a scenario has the advantage of the project itself populating the library. This contrasts with a new-start project, where the emphasis would be on extracting pre-existing components from the library to build a new system.

3.3.3. STARS Must Define Reuse Asset Quality Procedures

The quality of components in the existing nation-wide asset libraries is, at best, variable. Users of these components have found some components to be buggy, poorly documented, platform-dependent and/or compiler-dependent.

The STARS program should include a task to specify the characteristics which assets must have to be considered for inclusion in the asset library. Having specified these characteristics, the STARS program would then need to delineate the procedures to be used to assure compliance with the characteristics. Finally, the STARS program should suggest the agents who would perform this quality assurance.

4. STARS "Win/Win" Conditions

The discussion group was asked to suggest "Win Conditions" which would represent possible outcomes of the STARS program which would be mutually beneficial to all parties in the program, notably government and contractors.

4.1 Decreased Gap Between Systems-Need and Systems-Capacity

It is widely perceived that a large and growing gap exists between the requirements of the Department of Defense for the production of mission-critical systems and the capability of the country to support their development. Perceptions suggest that the defense budget will be

inadequate to fund the development of needed systems and, furthermore, even if the systems could be funded, the industrial base, e.g. supply of programmers, would be insufficient to actually develop them. The discussion group felt that it would be beneficial to all parties if the results of the STARS program made it possible to close this gap.

4.2 Business Practices Which Reward Contractor Innovation

The discussion group felt that there is little incentive today for contractors to pursue innovation in the area of reusable software. Typical government contracting practices provide no mechanism for contractors to be rewarded for successful innovation in reuse technology or the development of reusable software components themselves. If practices were changed to provide an incentive, the contractors could be rewarded financially and the government would benefit from decreased costs and schedules in the development of systems.

4.3 Increased Predictability of System Development Efforts

Both government and contractors suffer from overruns in development efforts. Even in the case of fixed price efforts, the government suffers because the needed capability is delayed. Even in the case of cost-plus efforts, the contractor suffers because the profit margin erodes and may, in fact, eventually be exceeded by the percentage of unallowable costs which burden contractors. So both contractors and government would benefit from improved accuracy in the estimation of costs and schedules.

4.4 Rejected Win Conditions

The group did not include two commonly presumed "Win Conditions" because, upon closer examination, they are not necessarily beneficial to contractors under current acquisition practices.

o   Decreased cost to produce systems

This, per se, is not necessarily attractive to contractors in a non-competitive environment. If the cost reduction is identified prior to contract award, it serves to shrink both the fee base and potential revenue. In the case where the contractor identifies and applies a substantial cost reduction subsequent to negotiation of a fixed-price award, there is a chance that the government will move to take back the "excess profits". So, absent other incentives, decreased cost is not necessarily attractive.

o   Decreased time to produce systems

In an era of declining defense budgets, decreased

development time serves to hasten the time when a contractor
might have to reduce employment.

Reuse Survey

We surveyed the companies represented in the discussion
group to determine:

If the companies had asset libraries in place, and

If the companies had successfully accomplished
component reuse, either "formally" (i.e., via an
institutionalized asset library) or "informally" (i.e., via
word-of-mouth identification of reusable assets.)

	Yes	No
Existing Asset Libraries	3	2

Reuse:

Formal 1

Informal 3

None 1

Companies:

Foxboro, GE Aerospace, IBM, Intermetrics, Unisys

5.14. STARS Program Response

DG5.3 - First Level Issues

- The plan lacked enough detail for analysis by the group

  STARS Response: Agree. STARS will provide more program plan detail before the next Users Workshop. A top-level consolidated plan was presented at this meeting to gain initial feedback from industry. The feedback gathered has been fed into next level planning sessions.

- STARS must address non-technical issues as a task

  - active participation, or

  - passive coordination

    STARS Response: Agree. STARS agrees that non-technical issues in reuse are critical. STARS is working through the DoD Software Master Plan where non-technical issues are treated as critical. STARS agrees to coordinate and help catalyze industry attention on non-technical issues where STARS has high leverage. STARS has a small on-going task, co-funded by the Air Force, to assimilate the work of many reuse activities and make initial recommendations to foster reuse in the acquisition process. There are other organizations (eg. Army RAPID, SDIO) that are actively pursuing the non-technical issues in reuse. STARS plans to leverage their work to address the non-technical issues that are needed to support the STARS program and its evaluation projects.

  - non-technical issues must feedback into design

  STARS Response: Agree. STARS will work with other organizations that are actively addressing the non-technical reuse issues to solicit requirements that will impact the design of STARS library mechanisms, reuse processes and reuse support tools. STARS will also request review of the designs/prototypes by those who are addressing the non-technical issues to ensure the requirements are adequately handled. STARS envisions that the library mechanisms must be able to support situations where a specification is public but the implementation is proprietary and must be licensed. This has already been addressed in STARS libraries for the Booch components. STARS also envisions that the library mechanisms might need to address accounting type functionality to address the non-technical issues.

- Acquisition process does not foster reuse

  - lack of clarity in licensing, warranties, regulations

  - inadequate training and education of acquisition personnel

  STARS Response: Agree. STARS has a small task that is directly looking at acquisition regulations. STARS agrees that it is important that the acquisition process be addressed. However, changing the acquisition process is outside the scope of a DARPA program. STARS will work through the DoD Software Master Plan as well as with other organizations to facilitate changes to the acquisition process. STARS has no plans for a major thrust to develop a new acquisition process.

- STARS/User Workshop should have more attendees that represent legal and business communities (i.e., from primes and other organizations such as NSIA, AFCEA, AIAA, etc.)

STARS Response: Agree. STARS will invite such attendees to future meetings.

- STARS should consider both new and reengineering assets in designing their asset library (evaluation projects should also consider reengineering project as candidates)

STARS Response: Agree. COTS reengineering tools will be included in reuse tool activities. Reengineering support will be considered in library mechanism design. Reengineering will be one of the reuse process building blocks. However, STARS will not spend significant dollars in developing new approaches to reengineering. DARPA recognizes the importance of reengineering to the DoD community and has a proposed FY92 research new start to develop and transition the next generation reengineering technology. The STARS evaluation effort will not be excluding developments that involve reengineering as candidate evaluation projects.

- Funding, schedule, and contractual relationships are high risk issues (wrt business relationships) for STARS demonstrations

STARS Response: Agree. It is essential for STARS to start immediately to identify potential evaluation projects so that appropriate business relationships may be established.

DG5.5 - Third Level Issues

1. A successful inter-company asset library will be far more difficult to achieve than an intra-company library. STARS plan didn't convey a recognition of this difference.

   STARS Response: STARS goal is to support inter-company asset libraries. Within large companies with multiple divisions, many of the issues to achieve successful inter-company reuse may apply to an intra-company library. The reuse thrust in support for seamless operations provides some of the technical basis to support use of multiple asset libraries among different organizations (both government and private). The emphasis on architecture based reuse, both in the mechanisms within STARS and in the domain assets within the DARPA DSSA program, establish a common grounds (application architectures, common interfaces, protocols) to facilitate reuse across companies.

2. The STARS plan is not believable in terms of populating the library with C3I, MIS, MCCR domain assets in time for the evaluation.

   STARS Response: Disagree. The domain assets are not developed within STARS. Initial contacts with the services have been positive. The DARPA DSSA program is another potential source of assets. The specific application domains and evaluation projects have not yet been selected. The selection criteria can include the timely development of domain assets. Identifying the assets is a risk to the STARS program but a risk that STARS believes is manageable. The tier II evaluation plan that is under development will identify steps to reduce this risk.

3. STARS should early on define the procedures/filters that will eventually be used to assure the library is populated with only high-quality, reusable components.

   STARS Response: Agree. Yes, STARS will develop initial metrics/processes for evaluating assets and this has been part of our plan. Initial sets of reuse guidelines and metrics have already been established. Significant effort is being expended to define asset quality criteria, the process for assuring compliance, and to provide tool support to the assurance process. STARS agrees that support for quality assessment is critical and plans to work that early. STARS disagrees with the notion that only assets that pass certain tests will be allowed to reside in the library. Asset quality should be part of the information that is available for an asset. However, there may be multiple tiers supported. A project might establish its own criteria for the degree of quality/integrity required. In some projects, use of prototypes that might not be rated highly according to the criteria may be warranted. Programs should not be prohibited from having such components in the library.

6. Process Management Support

Charter: The Process Management Support Discussion Group should address issues related to:

- Automated support for process management (process mechanism),
- Language or notation required to drive the automated support,
- Support capabilities and tools necessary to aid in the description of processes,
- Definition of terminology in this area,
- Degree of integration of the process mechanism with the software engineering environment

Discussion Group Location:

> 3300 Monday
> 4200 Tuesday

Discussion Group Leader:

> Nancy Giddings, *Honeywell*

Discussion Group Members:

> Nancy Botten, *IBM*
> James Greenwood, *ADS*
> Hal Hart, *TRW*
> Jim Henslee, *USAF/ESD*
> Lawrence Isaac, *Navajo Technologies*
> Robert Roy, *GE Aerospace* [Monday only]

6.1. Process Management Technology Maturity

Will process management technology mature enough during the STARS program for STARS to be successful?

6.2. Process Definitions

What techniques are best for defining process?

What languages and notations should be considered for use in automated process management?

6.3. Interaction

What level of interaction should there be between the process mechanism and the management and technical people doing the development?

6.4. Support versus Enforcement

How would you distinguish support from enforcement?

6.5. Measurement

How should STARS measure process improvement?

6.6. Related Work

What other work do you know of in this area which should be examined by STARS?

6.7. STARS Effects on Development Process

Use of STARS products and technologies will invariably affect the way systems are developed. Does the strategy taken by the STARS environment and process work imply a single software development process? Implementation language? Domain? Size of project? Should it? Will STARS products and technologies be usable in multi-lingual systems? Multi-paradigm systems? Heterogeneous environments? Databases? Embedded, real-time, distributed systems? Should they?[1].

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[1]See also 8.3

6.8. Discussion Group Slides

DG6.1 - Positive Plan Aspects

- Taking time to organize the program and present for feedback

- Information sharing

- Dealing with process explicitly is important

- Risks identified in presentation are generally on-target

DG6.2 - Recommendations

- Plan needs to use a spiral-type approach to gain incremental insights into risks, etc. This could be especially useful for the process management area, which is largely new technology. This should drive 2nd tier planning for FY91.

  STARS needs a lot more money to really make a significant difference across the topical areas; $100million per year is not out of proportion compared to funding for other initiatives. For example, system builds could be taxed 1 - 5% per year to support STARS.

  STARS leadership role in process (and other topics) needs to be more clearly defined.

- STARS could exploit greater leverage with other process and product modeling activities (like PDES) which would contribute momentum to the STARS activities.

  The program needs a longer timeline than October 1993 given the budget (particularly for process).

- Is the reliance on SEI for "process building block assets" an acceptable risk?

  The problem is bigger than SEI and STARS - how can we mobilize broader resources to address this area? Also, SEI and STARS need to be more integrated, (maybe a single organization?) Clarify where SEI and STARS are on 6.1-6.2-6.3-6.4 spectrum.

- STARS needs to become much more central and influential in the community. Needs more continuity.

  There is a great opportunity for a STARS leadership role in standards/pre-standards efforts in process. STARS needs to mobilize its standards/pre-standards activities according to opportunity/cost/payoff; in order to do this STARS needs to sort out and focus on standards topics:

Standards STARS can drive	Standards STARS needs to live with and affect	STARS doesn't care what these standards are - any result can be tolerated	STARS likes the way the standards are going - no STARS catalyst needed

- Process architectures must be defined for 6.1-6.2-6.3 which supports migration.

- Follow-up on recommendations at subsequent workshops; don't start the next workshop with a blank slate

6.9. Discussion Group Write Up

(begins on following page)

The following is the report from the "Process Management Support" group at the STARS workshop in Pittsburgh on Sept 10-11.

The Process Management Support Group was intended to address issues related to:

- Automated support for process management (process mechanism).

- Language or notation required to drive the automated support.

- Support capabilities and tools necessary to aid in the description of processes.

- Definition of terminology in this area.

- Degree of integration of the process mechanism with the software engineering environment.

The discussion groups members addressing these issues were: Nancy Botten (IBM), Dick Drake (IBM), Nancy Giddings (Honeywell-Group Facilitator), James Greenwood (ADS), Hal Hart (TRW), Jim Henslee (USAF-ESD), Lawrence Isaac (Navajo Technologies), and Robert Roy (GE Aerospace).

GROUP CONCLUSIONS

The group presented two sets of conclusions to the workshop attendees on Tuesday: Positive Plan Aspects and Recommendations. Neither set of conclusions were limited to the topical area, process management; comments referring to the overall STARS approach were included as well.

The Positive Plan Aspects enumerated were:

1. The group commended the STARS team for taking the time to organize the program and obtain community feedback on the intended direction before fully undertaking the new program plan.

2. The group indicated that the commitment to information sharing and feedback was a strong positive direction.

3. Regarding process specifically, the group liked the fact that process was called out as a major emphasis and was dealt with explicitly.

4. We felt the risks identified in the overview presentations were generally on-target.

The following are the major Recommendations which derived from the group's discussion. The items are labeled as being General in nature (referring to the overall STARS approach), Specific (referring to the process subject), and Both (having both general and specific connotations).

- The group felt that the approach being used in the STARS program design needs to use the spiral model to gain incremental insights into risks, etc. This could be especially useful for the process management area, which is largely new technology. This should drive the second tier planning for FY91. (Both)

- STARS needs a considerable amount of money to make a significant difference across the topical areas which it has identified as emphases (process, reuse, and environment). $100M per year is not out of proportion compared to funding for other initiatives. One idea for obtaining this funding would be to tax systems builds 1-5% to support STARS. These system builds are the beneficiary of the STARS software improvements. (General)

- STARS leadership role in process (and other topics) needs to be more clearly defined. That is, does the STARS program intend to produce a process model, orchestrate the standards process, etc., or does STARS intend to leverage off other efforts? Which efforts? This vision of STARS in the larger technical community needs to be articulated so as to clearly identify where STARS will be leading. (Both)

- STARS could exploit greater leverage with other process and product modeling activities (like PDES) which would contribute momentum to the STARS activities. These other product modeling activities have committees in place which could, for example, be used as a vehicle to support STARS community interaction. Also, these activities have some technology base in modeling which may be applicable, and which would offer collaboration opportunities for the STARS program. (Specific)

- The program needs a longer time line than October '93 given the budget (particularly for process). There was concern that development is done before October, 1993, followed by an evaluation phase. We questioned whether process could be successfully addressed in that time frame given the level of staffing devoted to it. (Both)

- Is the reliance of SEI for "process building block assets" an acceptable risk? There was a question whether the SEI had sufficient resources to devote to this to improve the risk directly above. (Specific)

- The problems STARS is addressing are larger than SEI and STARS – how can we leverage broader resources to address this area? Also, could SEI and STARS be integrated? There was an original description of the relationship of SEI and STARS published in

the mid-80s which has largely fallen by the wayside due to the procurement delays in STARS and the forging ahead of SEI. Is the relationship being reconfigured, and what is the new one? (General)

- STARS needs to be more central and influential in the community. The program needs more continuity – every workshop is a new start. There is a great opportunity for STARS to have a leadership role in standards and pre-standards groups, but the program needs to focus its energies in an organized way. We suggest identifying standards and pre-standards groups according to the projected STARS relationship to that group: standards STARS can drive, standards STARS needs to live with and therefore should affect to whatever extent necessary, standards which STARS can tolerate any outcome, but needs to integrate the results, and standards which STARS likes the way the groups are going–where STARS doesn't need to modify direction. (General)

- The process architectures must not only support the different processes for 6.1-6.2-6.3-6.4 but also support the migration of a system through these life cycle phases. (Specific)

- The STARS program needs to follow-up on the recommendations from this workshop; don't start the next workshop with a blank slate. Start with the actions taken from this workshop's recommendations and show how the program has evolved.

DISCUSSION MATERIAL

This section of the report contains a summary of the discussions which occurred in the Process Management Support group which resulted in the Conclusions noted above.

In order to organize a discussion attack on the subject area, we began with the following agenda of topics:

- Why do we care about process?

- Process/process management. Definitions and scope.

- Relationship to framework/SEE execution and/or data models.

- Mechanism – events, triggers, control points, etc.

- Relationship of process language to framework extension language.

- Process/product modeling underway in other setting.

- Attributes of process management. Granularity and performance.

An initial discussion on value of process and process management resulted in many recommendations and requirements on the process management facility. The desire to obtain predictability and replicability in software development was identified as one of the primary drivers behind the current interest in process management. In addition, without formalization of process descriptions and process management windows, there is little opportunity to measure, and therefore, improve process.

We also recognized the value of process formalization to support industrial information and product exchange. That is, unless some terminology and process concepts become widely accepted and used, the potential for leveraging between industrial, academic, and government concerns is very limited. How do you decide what to reuse if the whole concept of the development process is incompatible?

The current efforts in process, particularly 2167, were criticized as being bureaucratic attempts to achieve uniformity of process.

The particular needs of DoD software development and the requirements these place on whatever process concepts are developed by STARS was discussed. First, the process approach must support the uncertainty aspect of most DoD procurements. (Requirements change during the development process. The software process support must be capable of reflecting the needed flexibility.)

Second, the migration of systems through the 6.1–6.2–6.3–6.4 cycle was discussed, and the implications that this would have on the process model and the support automation were examined. A shortcoming of current process efforts was identified as being the lack of recognition and support for this migration process. Is there a core process which is shared between these development phases, or is the migration itself part of the model?

It was agreed that the process language and mechanisms must support this range of processes.

We discussed at some length the relationship of the STARS process activities to other activities underway in other engineering disciplines, such as the PDES activities in mechanical and electrical engineering and the CFI activities in electrical modeling. PDES has also started a subcommittee on software modeling. How does this relate to the STARS effort?

PDES and other communities have also done considerable work on process/product modeling notations and languages and have a history of over 10 years in the consensus building activity which is necessary to get widespread use of the models. CFI recently completed an evaluation and analysis of modeling notations and languages to support their electrical modeling activities which might be useful to STARS. The contact names for these programs are: Software Subcommittee of PDES, Tom Baker (Boeing - 206-234-6234), CFI General Contact, Andy Graham (CFI President - 303-530-4562), and Author of CFI Report on Modelling Notations and Methodologies, Glen Fullmer (Motorola - (602-897-5115).

We proceeded to discuss process management support and came up with the following ob-

servations:

- What are the differentiators among processes? How do you measure them? Examples are product "ilities." total cost, process quality and flexibility, product improvement, process supports constraints (domain, cost), and consistency/repeatability.

- Process support must be tailorable.

- Process should allow initiative on the part of developers, compared to bureaucratizing software development, thereby achieving least common denominator performance.

The process management capability must allow classification of activities, including description of activities, flow among activities, and dependencies. Process models are related to product models. We returned to the discussion of PDES and other activities and wondered why software engineering talks almost exclusively among process models, while other engineering disciplines view a process model as only an intermediate step to obtain a product model, which receives more extensive automation.

Process models should have the reward structure associated with it. The model must accommodate descriptions of resources and people in addition to software objects.

Regarding automation of process management, we emphasized that the important part was to have a well-defined process which is used. We wrestled with the idea of what this means in terms of automation, and agreed that having a machine processable process offered the opportunity for automation of process management, but that automation should be used judiciously in positive, empowering ways, and not as enforcement.

Examples of process automation are decomposition of the process into sets of tasks (planners), managing the decomposition process, notifications among team members, providing management insight into progress, and measurement, analysis and feedback to improve process performance. We wondered whether the size and complexity of the development activity affected how much automation is needed and/or can be afforded.

On the subject of process language, we asserted that we are not necessarily talking about a language. There was concern that a textual language would be too low level and not offer the dimensionality needed. We did agree that STARS should make some choices and move forward, rather than hesitating on this issue. Does STARS need to fund new modeling notation and methodology work?

The process description must be dynamic to reflect changes as the project is executed. The process must reflect the notion of roles of people involved in execution. The process should also reflect planning resources as relates to the process.

We digressed to discuss STARS' role in the community vis-a-vis standards and pre-standards groups, and recommended that STARS needed to focus its influence in order to achieve any

results. (See recommendation section for the outcome of this discussion topics – identification of standards and pre-standards groups and how STARS should affect, follow, or lead them.) There are various opportunities for STARS depending on the committee, as well as various costs and potential payoff for the program.

We only touched on process mechanisms. We emphasized that the plan must be in the repository, and be updated automatically by whatever mechanisms were available. We made no conclusions regarding granularity, although it seems obvious that granularity, mechanism, and performance are interrelated. Existing framework prototypes and products demonstrate that mechanisms and execution/data models are interrelated, but we did not discuss this at any length.

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6.10. STARS Program Response

DG6.2 - Recommendations

- Plan needs to use a spiral-type approach to gain incremental insights into risks, etc. This could be especially useful for the process management area, which is largely new technology. This should drive 2nd tier planning for FY91.

STARS Response: Suggestion accepted. We have accepted your suggestion and have incorporated it into our Tier 2 plan for process management. The plan contains spirals addressing the technological risks in this area. Some of the risks are already being evaluated. Unisys task US40 is addressing the feasibility of tailoring process building blocks to specific application domains.

STARS needs a lot more money to really make a significant difference across the topical areas; $100million per year is not out of proportion compared to funding for other initiatives. For example, system builds could be taxed 1 - 5% per year to support STARS.

STARS Response: Disagree. We feel that STARS does have sufficient funding to make a difference. We will leverage off other work to aid in the transition of technologies into practice within DoD. We disagree with the suggestion of a 1 - 5% tax on systems development to support STARS. This would produce a very negative reaction from the people who must cooperate with us if STARS is to succeed in transitioning new technologies into these same programs.

STARS leadership role in process (and other topics) needs to be more clearly defined.

STARS Response: Agree. We feel that the close association of STARS with the on-going process work at the SEI will place us in a good position to coordinate with other process activities and take a leadership role in this area.

- STARS could exploit greater leverage with other process and product modeling activities (like PDES) which would contribute momentum to the STARS activities.

STARS Response: Agree. The applicability of the work being done in connection with PDES will be evaluated, and we will seek out and form relationships with other groups doing related work.

The program needs a longer timeline than October 1993 given the budget (particularly for process).

STARS Response: Disagree. It is true that the technology is new in the area of process and will need time to mature. However, it is necessary to begin to introduce a more formal approach to process into DoD programs now. STARS will by no means solve all the problems related to managing the software process on DoD programs. But in order to begin to better understand the technology, it will be necessary to gain real experience. The STARS timeline will force us to gather the best available technology, mature it, and put it to use. We feel that STARS will demonstrate the potential of process management and guide further technology development.

- Is the reliance on SEI for "process building block assets" an acceptable risk?

STARS Response: Agree. The Tier 2 plan will carefully define the roles of STARS and SEI with respect to the development of process building blocks. We feel that the experience of the SEI along with the STARS prime and subcontractors will be extremely valuable in this area. SEI's unique role in the community also provides them with insight into other activities that can help in the development of process building blocks.

The problem is bigger than SEI and STARS - how can we mobilize broader resources to address this area?

STARS Response: Agree. We intend to develop and exploit relationships with other DARPA ISTO activities, service sponsored activities, and other industry and academic activities using the STARS affiliates program. The STARS program will provide a focus on near term exploration of process management technology. The plan for the STARS evaluations will generate a great deal of interest because it will provide an opportunity to evaluate the technology on real programs. We will encourage other groups to work with us and benefit from this feedback. We will also continue to sponsor workshops and encourage more participation with the program by the DoD community.

Also, SEI and STARS need to be more integrated, (maybe a single organization?)

STARS Response: Integration/cooperation - agree; single organization - disagree. The Tier 2 plan will define a closely integrated approach to process management involving the SEI and all three primes. A close relationship between STARS and SEI has already been developed. Both programs report into DARPA through Dr. Kramer, and SEI personnel are involved in all of the STARS major technology activities. The DARPA model is to develop technology, transition the technology and then start a new program. STARS is an example of this; SEI is an exception. SEI performs a role of transitioning technology from all DARPA programs. We therefore feel the present close working relationship is the correct approach and no further organizational merging would be useful.

Clarify where SEI and STARS are on 6.1-6.2-6.3-6.4 spectrum.

STARS Response: Clarification provided. All programs have some mixture of 6.1, 6.2, 6.3, and 6.4 aspects. SEI's role is principally technology transition. To be effective, however, SEI participates in 6.1 and 6.2 to prepare products for transition. STARS will also follow this model.

• STARS needs to become much more central and influential in the community. Needs more continuity.

STARS Response: Agree. Your suggestion implies that STARS needs to do a better job of marketing itself. The motivation behind the first STARS/User Workshop was to begin to sell the program and gain the support of the DoD community. We will follow this with more workshops and an affiliates program to encourage others to participate in the STARS program. We agree that STARS needs to demonstrate more continuity. The STARS consolidated plan to be released early next year will define the approach to be follow over the next five years.

There is a great opportunity for a STARS leadership role in standards/pre-standards efforts in process. STARS needs to mobilize its standards/pre-standards activities according to opportunity/cost/payoff; in order to do this STARS needs to sort out and focus on standards topics:

Standards STARS can drive	Standards STARS needs to live with and affect	STARS doesn't care what these standards are - any result can be tolerated	STARS likes the way the standards are going - no STARS catalyst needed

STARS Response: Agree. STARS has been actively tracking the relevant standards activities over the last two years. STARS is represented on a number of standards committees. We are coordinating our activities with NIST and the Navy NGCR activities. CDRL item 500 from task UQ14 presents an overview of the relevant standards. A joint activity is planned to begin in November 1990 involving all three primes, the SEI, and the Navy, to select the set of open architecture industry standards with which the STARS environments will comply.

• Process architectures must be defined for 6.1-6.2-6.3 which supports migration.

STARS Response: Agree. We will be working with the SEI to define some generic architectures that could be used as models for DoD programs. The major activity here, however, will be associated with the developing of the process and a process architecture for the evaluation projects. This experience will help us to refine our generic models.

• Follow-up on recommendations at subsequent workshops; don't start the next workshop with a blank slate

STARS Response: Agree. We are working on the Tier 2 plan in each of the technical areas (Reuse, Process, SEE, and evaluation). These plans will be combined into a consolidated STARS plan available during the first quarter of 1991; prior to the next STARS/Users Workshop.

7. Process Definition

Charter: The Process Definition Discussion Group should address issues related to:

- The complexities of defining processes,
- The need for more rigorous definition of process,
- Techniques for defining process,
- The cost of defining processes,
- Definition of terminology in this area,
- The applicability of process building blocks, and
- Process metrics.

Discussion Group Location:

> 5300 Monday
> 5504 Tuesday

Discussion Group Leader:

> Art Pyster, *SPC*

Discussion Group Members:

> Benjamin Barlin, *USN/NOSC* [Monday only]
> Gentry Gardner, *Rockwell*
> Jim King, *Boeing*
> Dick Martin, *SEI*
> Bob Munck, *Unisys*
> Jim Over, *SEI*
> Susan Roberts, *USArmy/ADCCS*
> Carol Ulrich, *Hughes* [Monday only]

7.1. Understanding of Process Definition

Will process definition techniques be well enough understood during the STARS program to allow the STARS evaluation projects to define their processes?

7.2. Level of Detail

At what level of detail (refinement) should software processes be defined in order to maximize continuous process improvement?

7.3. Process Definitions

Are there examples of process definition available for such things as reuse, prototyping, concurrent engineering, and evolutionary development?

Are there additional process building blocks STARS should develop?

7.4. Process Metrics and Measurement

What are the correct set of process metrics which should be captured?

How should STARS measure process improvement?

What other work do you know of in this area which should be examined by STARS?

7.5. Discussion Group Slides

DG7.1 - Process Definition - Good Stuff (9 people)

1. Process is important - good that it is addressed in a central role

2. Use of evaluations to validate process definition approach, notations, acceptance, ...

3. Recognition that process definition must be tailorable to each project, organization, ...

4. Building block idea is good - potential mechanism for tailoring, reuse within process definition

5. If STARS meets its goals, everyone wins

DG7.2 - Bad Stuff / Non-Technical

1. Successful process definition (rigorous) may lead to organizations patenting processes and building blocks (or otherwise protecting)

2. Will users accept STARS recommended style, notations for documenting process?

   - early user involvement
   - multiple views for multiple users

3. Will users accept paradigm shift to define process?

   - early user involvement
   - pick projects that already have "defined" process to minimize paradigm shift

4. Not clear process repository will have the right pieces/building blocks to support evaluation projects. Users may have NIH [not invented here] problems with using STARS process repository.

  - incremental validation and use

  - will SEI role succeed?

5. Early user involvement is problematic

  - need to work with projects now to assure process definition approach will be acceptable and useful

  - not clear how projects can be selected early

  - is there adequate funding for early involvement?

6. Where will process architecture for building blocks come from? Can we assure architecture works for all 3 primes and SEI? If reuse of code is hard, how hard is reuse of process? certification ...

7. Process metrics definition task needs elaboration

  - SEI publish plan

Not on page 80 (activity flow) - is it funded explicitly?

  - provide direction/funding to SEI to support task

8. Magnitude of process definitions

  - example of "complete" definitions: 1,000 pages and 5,000 pages

  - what is minimum definition to be useful and still cost effective?

9. Are existing notations for process definition adequate to "select" without additional research?

  - STARS office provide criteria for "adequacy"

  - primes justify choices

  - transitioning research into practice?

7.6. Discussion Group Write Up

Write up not received in time for publication

7.7. STARS Program Response

DG7.2 - Bad Stuff / Non-Technical

1. Successful process definition (rigorous) may lead to organizations patenting processes and building blocks (or otherwise protecting)

   STARS Response: Will investigate. This is an interesting issue. We will add an activity to our plans to investigate this potential and to develop guidelines that protect the government and developers of process definitions.

2. Will users accept STARS recommended style, notations for documenting process?

   - early user involvement

   - multiple views for multiple users

   STARS Response: We think they will. Most projects today use only English to define their process. STARS will provide multiple notations that will accommodate different needs and people on a project. This will include structured English, as well as more formal notations. We feel that by providing training and working with the projects early, these notations will be accepted. We are not replacing a notation already in use, but providing a more formal, structured approach.

3. Will users accept paradigm shift to define process?

   - early user involvement

   - pick projects that already have "defined" process to minimize paradigm shift

   STARS Response: Will evolve. Unlike introducing some new development paradigm, we see the shift to well defined, automated process management to be gradual. All projects have a process. What we are trying to do is make the process better understood, defined, controlled, and measured. This does not have to be a revolutionary paradigm shift.

4. Not clear process repository will have the right pieces/building blocks to support evaluation projects. Users may have NIH [not invented here] problems with using STARS process repository.

  - incremental validation and use

  - will SEI role succeed?

STARS Response: STARS won't provide it all. We don't anticipate being able to collect all the necessary pieces of process that a project would require. Our goal is to begin capturing a basic library of process definitions that is likely to have wide applicability across many types of projects. A great deal of the process for the evaluation project will be defined uniquely for the project and by project personnel with the help of STARS.

5. Early user involvement is problematic

  - need to work with projects now to assure process definition approach will be acceptable and useful

  - not clear how projects can be selected early

  - is there adequate funding for early involvement?

STARS Response: Agree. This is a major risk. Our strategy is to provide support for both technical and management activity and demonstrate the value in pilot projects. We feel that there is adequate funding for early involvement by the evaluation project. The initial process definition for the evaluation project will not require a large number of the people from the project. Much of the refinement of the process will take place after the project begins the development activity.

6. Where will process architecture for building blocks come from? Can we assure architecture works for all 3 primes and SEI? If reuse of code is hard, how hard is reuse of process? certification ...

STARS Response: See response to related Discussion Group 6 issue (page 113).

7. Process metrics definition task needs elaboration

  - SEI publish plan

Not on page 80 (activity flow) - is it funded explicitly?

  - provide direction/funding to SEI to support task

STARS Response: Agree. There will be a coordinated plan between STARS and SEI for metrics definition that will be covered in the STARS consolidated plan available early in 1991. The SEI has funding for this activity, and STARS funds will support the SEI to help the coordination with the STARS activities.

8. Magnitude of process definitions

- example of "complete" definitions: 1,000 pages and 5,000 pages

- what is minimum definition to be useful and still cost effective?

STARS Response: Clarification provided. Our intention is to provide clear, explicit process definitions (process definition language) for those aspects of process that are critical to controlling, monitoring, and measuring the process. Much of what is included today in large volumes of process documentation are guidelines, standards, procedures, and forms. Much of this will remain as supporting material. However, the essentials of the process necessary to be captured in a more formal manner will be a small subset of what is documented today.

9. Are existing notations for process definition adequate to "select" without additional research?

- STARS office provide criteria for "adequacy"

- primes justify choices

- transitioning research into practice?

STARS Response: No single notation will be sufficient for process definition. Our strategy is to use the available notations for our prototyping, pilot projects, and the evaluation projects to better understand which notations are best and where to use them.

8. Software Engineering Environment Coverage and Effectiveness

Charter: The Software Engineering Environment Coverage and Effectiveness Discussion Group should address issues related to:

- Identification of design thread/record (artifacts) across concept development, Dem/Val, FSED, and PDSS, and

- Identification of high-leverage areas for automation:

    - Rank by likelihood to reduce labor, minimize development time, and improve quality.

Discussion Group Location:

    5000 (Board Room) Monday
    Training Room A Tuesday

Discussion Group Leader:

    Charles Koch, *USN/NADC*

Discussion Group Members:

    Kirk Beitz, *Intermetrics*
    Marty Detwiler, *GHG Corp*
    Bob Ekman, *IBM*
    Barry Kaplan, *Rockwell Collins*
    Jim Milligen, *USAF/RADC* [Tuesday only]
    Thomas Ryan, *Navajo Technologies*
    Barry Siegel, *USN/NOSC*
    Joel Sturman, *GE*
    Kurt Wallnau, *SEI*

8.1. Environment Support for Embedded Systems

What environment support is required specifically for the development and maintenance of embedded systems? For distributed targets? Which of those issues should STARS be pursuing? Even if STARS currently does not pursue embedded system support directly, what must be done for the embedded systems community to leverage off the work that is done? Is STARS doing anything that innately precludes use on embedded system? Is this a "necessary evil" or should this be overcome by STARS?

8.2. Automation

Where should the environment support (automation) end and the user manipulation (brute force) begin? For the purposes of automation and standardization, is STARS examining the highest leverage activities involved in software development and maintenance? Is it possible to achieve full life-cycle integration or will there always be a bit of "brute force" required?

8.3. STARS Effects on Development Process

Use of STARS products and technologies will invariably affect the way systems are developed. Does the strategy taken by the STARS environment and process work imply a single software development process? Implementation language? Domain? Size of project? Should it? Will STARS products and technologies be usable in multi-lingual systems? Multi-paradigm systems? Heterogeneous environments? Databases? Embedded, real-time, distributed systems? Should they?[2].

8.4. Number of Software Engineering Environments

How many software engineering environments make sense in the context of the STARS program? What is lost if only two are developed instead of three?

8.5. Taking Measurements

How should measurements be taken to determine the effectiveness of STARS tools, environments, technologies, process? What should be the measures of goodness? Who should decide?

---

[2]See also 6.7

8.6. Discussion Group Slides

DG8.1 - SEE Coverage and Effectiveness

Kirk Beitz	Intermetrics
Marty Detwiler	GHG
Bob Ekman	IBM
Barry Kaplan	Rockwell
Chuck Koch*	NADC
Tom Ryan	Navajo
Barry Siegal	NOSC
Joel Sturman	GE
Kurt Wallnau	SEI

* Chairperson

DG8.2 - Most Critical SEE Issue

- SEE Interfaces

    - Who, when, and how to pick the interfaces upon which the SEE will be built.

    - How to entice the vendors to build tools that conform

        - business decision

        - user satisfaction

    - If this doesn't happen - STARS SEE will not succeed.

DG8.3 - STARS Plan - Positive Points

1. SEE provides integral support for process/reuse

2. STARS is now involving users and vendors

3. Based on open systems/commercial standards

4. Incremental development using prototyping

5. Tool-centric SEE model - minimal set of interfaces selected soon

6. Use of COTS tools, standards, technology - supplement and complement commercial development

7. Multi-lingual

DG8.4 - Concerns / Recommendations

1. Need more user involvement - get them on board to drive market

2. Decide on a single, minimal set of interfaces

3. Encourage more vendor involvement, must influence vendor market.

4. Get a concrete schedule with early, interim, SEE products for release to users

5. Explore portability issues

6. Strengthen technology transfer plan.

DG8.5 - Recommendations

- Build only those parts of a SEE that COTS vendors will not

- Involve project people and users in the process (this workshop is primarily SEE researchers and tool builders)

- Look hard at other SEE efforts that have failed. Also look at CAE/CAD/CAM efforts that are successful.

- Spend some significant effort to find ways to prove/convince/show that STARS products are effective (money/time/quality).

DG8.6 - WIN/WIN

- Seamless tool integration (plug and play)

- Evolutionary SEE

- SEE must work and be affordable

- Quicker transition of tools from R&D to use

- Reduce cost of software to government

- SEE tools have a convincing place in market.

- SEE is accepted by contractors (interoperable, portable)

- SEE supports a process definition language.

DG8.7 - Responses: SEE Coverage and Effectiveness

- Support for embedded systems:
  - Hard real time tools
    - design
    - compiler
    - target debugger
  - Data model that includes appropriate structures.
  - Need more detail from STARS primes.
- Automation
  - Whole life cycle.
  - Emphasis needed on front-end
- Number of SEE's
  - One set of standards
    - Many implementations
- Taking measurements
  - Difficult area.
  - Effort should be attempted.
  - One measure of "goodness" is how accepted is it

DG8.8 - SEE Coverage

- Bottom line

  - STARS is generally working on right things

  - They are hard!

  - Not enough time in workshop.

  - Involve users

8.7. Discussion Group Write Up

STARS Workshop - Panel 8 Report   C. F. Koch

Discussion of Issues Critical to SEE

Whenever any group of software people get together to talk about software support environments the discussion quickly becomes animated and lively. Panel 8 was charged with discussing the Software Engineering Environment (SEE) Coverage and Effectiveness in relation to the STARS program. It quickly became clear that the room was filled with people who held some common beliefs about SEEs, but also had many differing opinions including, at the very base, the definition of a SEE. In fact, definitional problems were significant and would have required much time to sort out and come to agreement. Given our limited allotted time, we hoped for the best.

A SEE's primary usefulness is to provide automation for an organization's software process. Ideally, the SEE will automate functions across the entire software life cycle. Today there will be gaps in coverage where manual tasks must be accomplished. As tools and tool functionality mature, seamless support for the process will evolve. The driving factor, though, is the software process. It defines what, when, and how tasks must be accomplished over the software life cycle. The SEE supports that process. The SEE also supports re-use over the software process. This includes not only reuse of the code, but also the requirements, the designs, the tests, and documentation.

Foremost in everyone's mind was the issue of tool integration and interface standardization. We agreed that a SEE is a collection of methods, procedures, and software tools, integrated around a framework of some sort, possibly a framework of interface standards. We discussed, without much convergence, aspects of various interface standards like the Common APSE Interface Set (CAIS) and the Portable Common Tool Environment (PCTE+), and the disadvantages of the Government producing and marketing its own interface standards. At one point, the Government's share of the computer market was large. Today it is a drop in the bucket, and it is unlikely that STARS can make a major impact in the academic, standards, and research communities. We concluded that, given the Government's declining influence in the software and computer market, that the Government could best adopt emerging standards. The best that STARS could achieve is the benefit of having influenced the standard's contents by working with the standards organizations during the "open" process of standard development.

Perhaps the greatest concern is that of enticing, convincing, or persuading tool vendors to produce tools that will work in the STARS SEE. This will occur only if the vendors believe that there is a market--it will always be a business decision. A market will exist if the set of interfaces is widely adopted, and if the tools under consideration are deemed likely to attain a high degree of user satisfaction. If this marketplace does not materialize, the STARS SEE

cannot be successful.

Positive Points about the STARS Plan

The panel felt that there were many good things about the STARS plan for a
SEE. The STARS plan generally subscribes to the definitions of the purpose and
goals of a SEE as discussed above. The recent opening up of the STARS program
to validation by users, vendors, the government, and other SEE and tool
builders will broaden the applicability of the SEE and add confidence that STARS
is pursuing the right goal. STARS plans correctly base the SEE on commercial
standards and open systems. This will help assure that the government will not
be faced with maintenance of unique, obsolescent, and non-evolvable SEEs .
While development by the government of its own tools may have been the correct
solution in the past, today's Commercial Off-the-Shelf Tools (COTS) are the
only practicable solution when costly life-cycle support is considered. The
STARS plan also correctly specifies modern life cycles that include incremental
development and prototyping as an integral part of the development process. The
plans have indicated the desirability of standardizing on a minimal set of
interfaces (between tools, OS, data repository, etc.) and making that
selection early. Where appropriate commercial standards are not yet in
existence, STARS must contribute persons to the standardization effort, in the
way that the NAVY's Next Generation Computer Resources (NGCR) program is doing.
Finally, the decision of STARS to include in its arena support for a
multiplicity of languages, and not be singularly focussed on Ada, was seen as
positive by most panel members (though not unanimous).

Concerns about the STARS Plan

Despite the fact that the panel generally agrees with the STARS approach and
direction, the panel had some concerns with the STARS plan. Even though STARS
has opened its doors to the research and vendor communities, it must also make
strong efforts to involve and listen to the actual SEE end user, the program
and/or project managers that will need the SEE to build software. Only by
getting their support can STARS hope to influence vendors to supply the tools
needed to assemble a successful SEE. There are also concerns that a set of
interfaces should be decided upon NOW, but, regrettably, that the required
interfaces are not really ready yet. This is a dilemma that STARS faces. The
panel had major concern over the high risk that STARS faces in successfully
influencing the vendor market. Other efforts that have tried and failed were
doomed. A concern was voiced that in the quest for tool interoperability the
need for portability has been forgotten. The consensus was that in Ada it is
difficult to port software for many reasons. This should improve as experience
with Ada grows. Today, however, in many ways Ada is less portable than "C".

Recommendations of the Panel

In an attempt to succeed in building vendor and user confidence, STARS should
plan to have early, interim SEE products for release to the community. The
schedule for these should appear soon, and be set in concrete. A
strengthening of the plan for transferring this technology should occur. It
should be thought of as a process that starts now, not waiting until products
emerge.

STARS should examine closely other recent SEE efforts that have been less than
fully successful or have failed. Many examples are evident including NASA's
SSE, AJPO's CAIS, the NAVY's ALS/N, and the partially successful Air Force's
SLCSE. Today it seems as if SEE builders everywhere are backing off from the

goal of building the ultimate super-capable, super-adaptable, all-things-for-all-people SEE, and scaling back to more realistic pursuits. An analysis of the probable causes would be invaluable. Also useful would be investigation into the realm of Computer Aided Design/Manufacture/Engineering (CAD/CAM/CAE) to see if any of the elements of its success could be used in the software engineering field. In many ways it is easier to automate the hardware design process than the software design process, but there are similarities and they should be exploited.

Finally, the STARS program should initiate an effort to determine how to prove that building and using a SEE will indeed save a program money, shorten the software development schedule, and produce higher quality software. Until program managers are convinced that the SEE will provide those benefits they will not be interested in making the required investment.

How STARS Will Help Organizations

Most organizations represented by this panel felt that if STARS resulted in a SEE with the qualities discussed here a WIN/WIN situation would exist. That SEE would have the following characteristics:

> It would work and be affordable
> It would be evolutionary
> It would provide seamless tool integration
> It would speed transition of tools from R&D to use
> It would provide a convincing market for tools
> It would be accepted by contractors
> It would be interoperable and portable
> It would support a process definition language

Bottom line: It would convincingly reduce the cost of software to the government.

Issues of SEE Coverage

For a SEE to be useful to the government it must well support development of embedded systems and hard real-time software. This implies a number of considerations. It requires that the SEE have tools for designing, coding, and debugging mission-critical software with stringent real-time requirements. This includes command and control, target tracking, fire control, etc. These applications present complex requirements that typical commercial applications do not have. Commercial applications usually must respond in seconds (like cash machine transactions), while military mission-critical applications must respond in microseconds dealing with critical life-death situations. The basic data model of the SEE must include the appropriate structures and capabilities to handle these requirements. This panel lacked two important items to pursue this issue: further details from the plans of the STARS primes, and deep experience in the real-time arena.

It was generally agreed that the SEE should support an organization's software process by providing automation for its tasks. Ideally, the SEE would support tasks across the entire life cycle. STARS should strive toward this goal. Because the coding phase of the life cycle has long enjoyed limited automation (compilers, editors, loaders), and because the tools required by that phase are project- or platform- unique, the panel agreed that the STARS SEE should instead emphasize coverage of the front-end of the life cycle. Immaturity of the available tools will make this difficult.

To the issue of how many SEEs should STARS produce, the panel felt strongly that STARS should standardize on a single set of SEE standards. It should

select that set of standards early in the process, and, it should build
multiple implementations of SEEs conforming to that set of standards. By doing
that, STARS would build confidence in the selected standards and also limit the
domain in which it must operate. For STARS to build SEE implementations based
on sets of different standards would greatly increase the difficulty and the
risk, and would make a comparison of results harder and more subjective.

Measuring Effectiveness of the SEE

There was consensus that a measure of effectiveness of the SEE is crucial to
its acceptance. But, after sustained discussion, it became evident that no
one had any idea how to accomplish the required measures, or even what to
measure. To do a controlled measurement of cost, schedule, and quality on any
real software project is next to impossible. The only measure that the panel
could agree on is that of user acceptance. If a product is being used and is
generally liked, then it is probably a good product. This increases the
importance of getting early versions of the SEE out to users to begin to build
the acceptance and experience required to show its value.

Despite its difficulty, work in this area should be pursued and given
emphasis.

8.8. STARS Program Response

DG8.4 - Concerns / Recommendations

1. Need more user involvement - get them on board to drive market

   STARS response: Agree. We intend to continue the dialogue started with this meeting. We will schedule another late next spring.

2. Decide on a single, minimal set of interfaces

   STARS response: Agree. We will schedule these decisions to be made by early next year. We feel it is the highest priority task to be accomplished in the near term to identify the existing standards that are needed to allow the attainment of STARS goals.

3. Encourage more vendor involvement, must influence vendor market.

   STARS Response: Agree. We feel that we must first align our alternatives with those being considered by major players in the CASE community. We will have a CASE COTS vendor exposition next spring in which we will establish dialogue that will guarantee that their paths will converge with STARS.

4. Get a concrete schedule with early, interim, SEE products for release to users

   STARS Response: Agree. We will continue the consolidated planning activities that are being reviewed at this meeting. Two key elements of this thrust are the concept of incremental development products and the affiliate program to allow interested organization to evaluate these early products.

5. Explore portability issues

   STARS Response: Agree. The approach to this is closely associated with the activity to select a minimal set of open standards. Our objective is to select the standards that will facilitate the portability of the frameworks and third party tools across multiple platforms as market forces dictate.

6. Strengthen technology transfer plan.

   STARS Response: Agree. One facet of the intent to strengthen the technology transfer is the affiliates program mentioned above. Another is the process that is underway to identify reports and software that can be released through DTIC.

- Build only those parts of a SEE that COTS vendors will not

  STARS Response: Agree. We characterize the role of the STARS prime contractors as "System Engineering and Integration". However, in areas where DoD specific needs are not being fulfilled by COTS endeavors we will fabricate prototypical tools and then try to find COTS vendors to commercialize them.

- Involve project people and users in the process (this workshop is primarily SEE researchers and tool builders)

  STARS Response: Agree. The intent of this meeting was to involve "real users". We think this is one that we need to work in cooperation with industry. We need your help in identifying the appropriate candidates and we need your influence to see that they are freed up from their demanding duties to be a part of the next meeting. We will design a mailing early next year to ask you and users that should participate in the next workshop.

- Look hard at other SEE efforts that have failed. Also look at CAE/CAD/CAM efforts that are successful.

  STARS Response: Agree. We believe this is the only way to prevent the same failures. We have looked at National Software Works, ALS, Genos, WIS ISTAR, and several proprietary aerospace company environments. We think this forum is a good opportunity to solicit other relevant input.

- Spend some significant effort to find ways to prove/convince/show that STARS products are effective (money/time/quality).

  STARS Response: Agree. This is the intent of the evaluation phase of STARS, we will spend well over 50% of the STARS funding to support these evaluations. We expect the evaluations to provide insight into the effectiveness of STARS products to provide improvements in productivity and quality.

9. Architecture / Environments

Charter: The Architecture / Environments Discussion Group should address issues related to:

- Identification of the role of standards,
- Aggregation of pieces in bigger pieces,
- Identification of common services to frameworks:
    - Version control?
    - Configuration management?
- Identification of "tools" required in 1995,
- Interaction with the commercial world and CASE community.

Discussion Group Location:

    3505 Monday
    3505 Tuesday

Discussion Group Leader:

    Andres Rudmik, *SPS*

Discussion Group Members:

    Don Hartman, *ISSI*
    Jon Hill, *Unisys*
    Phil Mullen, *GTE*
    Carl Schmiedekamp, *USN/NADC*
    Lui Sha, *SEI*
    Dennis Smith, *SEI*
    Ramiro Valderrama, *ATAC*
    Susan Voigt, *NASA*
    William Wong, *NIST* [Tuesday only]

9.1. Integration of New Technology

What areas of STARS appear to shut out, or put up arbitrary barriers, to ready adaptation/adoption of new products and technologies in software development (e.g., advanced CASE tools, domain-specific software architectures)? In which areas does STARS risk becoming obsolete by the time STARS is developed due to these artificial constraints?

9.2. Standard Interfaces and Standard Identification

What set of software engineering environment interface standards are really needed to facilitate the integration of tools supporting software development? What activities is STARS monitoring/joining to define such standards?

What criteria exist for STARS to evaluate an existing or emerging standard for monitoring, influencing, integrating? What criteria should exist?

9.3. Reuse of COTS

Is STARS paying sufficient heed to available commercial, off-the-shelf software (COTS) capabilities and not re-inventing existing tools? What more/less should STARS be doing?

9.4. On-Going Key Standards Work

Which technologies and standards is STARS currently monitoring, influencing, integrating? Which of these are the right ones? The wrong ones? Are these current activities being monitored, influenced, integrated effectively? What should STARS do to position itself such that it can/does have influence on such standards?

9.5. New Standards Work

What other technologies and standards should STARS be monitoring, influencing, integrating? How should STARS position itself for them? Will STARS be defining any new standards, binding efforts? Should STARS?

9.6. Right Building Blocks

How does STARS converge on the "right" building blocks for environments, for example:

- Standard interfaces (POSIX, X11, SQL, MOTIF, CAIS, PCTE, ATIS, etc)

- Program language bindings (Ada, C++, etc)

What mechanisms should there be for interfacing between tools/languages coming from different basic paradigms (e.g., an Ada binding for X Windows)? Should there be any new secondary standards for Ada?

9.7. Two CASE Communities

Are there two distinct (and conflicting) CASE cultures emerging - the "front-end CASE" versus the "back-end CASE"? Is there a gap between the two? Where are other gaps? Which gap deserves the highest priority (i.e., should be addressed first)? What really is a "gap" (e.g., what does it mean to "integrate" tools)? What mechanism exists to confirm that a gap has been filled effectively?

9.8. Cooperation / Competition

How does it appear that STARS products and technologies will compete, cooperate, co-exist with existing CASE vendors? How should they? What strategies and activities (both for the STARS Program and for CASE vendors) are needed to get from the current state to the more ideal state?

What motivation is needed to encourage tool (compilers .. CASE) vendors to provide sufficiently detailed descriptions of their interfaces, underlying data models, etc, so that tool users could extend the tool, integrate the tool with other tools, etc?

9.9. New Technology

What technology do you see emerging in the 1995 time frame that will change the way we do business?

9.10. Discussion Group Slides

DG9.1 - STARS PLANS - Positive Points

- Increased emphasis on commercial
    - COTS SEE components
    - Standards
    - Commercialization of STARS results
- Improved focus within the program
- Increased emphasis on leveraging
    - Industry
    - SEI
    - Other research
- More cooperation among primes
- Recognized need for 3 services involvement

DG9.2 - Recommendations

- STARS needs to focus on the value added and DoD specific needs: real-time, security, fault-tolerance, Ada

- Don't limit tool integration to database integration. Explore other tool integration mechanisms: Control, Communications, Link databases ...

- Review existing standards and identify requirements for STARS standards.

- Take a proactive role in standards to address interoperability. Work within the standards community.

- Provide guidelines to improve tool integration and interoperability.

- STARS effort is very ambitions - most real-world experience indicates that effective COTS integration is hard to achieve. Provide early prototypes, user experience, solicit feedback.

- Provide a prioritized list of products.

DG9.3 - Win/Win

- Aspects representing a win

  - Use of industry standards

  - Use of COTS

  - Open architecture

  - Increased service participation

  - Increased realism in the program and expectations

- How can STARS be more effective

  - Provide tool vendors with guidelines defining interfaces and information model

  - Provide list of standards STARS is planning to adopt

  - Better dissemination of information

DG9.4 - Responses

- 9.2. Standard Interfaces and Identification

  - Establish a STARS process for standards.

- 9.3. STARS COTS Approach

  - COTS cost to end users needs to be reasonable.

- 9.4. On-going Key Standards Work

  - Continue participation in NIST/ISEE working group

  - Participate in PCIS, CALS, CIS

- 9.5. New Standards Work

  - Provide Ada bindings to support standards

  - Need inter process communication standards

- 9.6. Right Building Blocks

    - Examine the SEE framework modeling capabilities. Are they expressive enough to support process modeling and execution.

    - Examine building blocks for their support of distribution.

- 9.7. Two CASE Communities

    - Need to take a (domain specific) wholist approach. Lifecycle, disciplines

    - Many communities - today

- 9.8. New Technology

    - Visual programming

    - Formal techniques

    - Object-oriented paradigm, databases, user interface

9.11. Discussion Group Write Up

(begins on following page)

Architecture / Environments

Discussion Group Summary

Group Leader: Andy Rudmik, SPS

Group Members:
- Don Hartman, ISSI
- Jon Hill, Unisys
- Bill Hodges, Boeing
- Phil Mullen, GTE
- Carl Schmiedekamp, USN/NADC
- Lui Sha, SEI
- Dennis Smith, SEI
- Ramiro Valderrama, ATAC
- Susan Voigt, NASA
- William Wong, NIST

The goal of the Architecture / Environment working group was to examine and evaluate the technical approach to developing the STARS environment.

Overall we were encouraged by the emphasis on the use of or development of commercial software. Commercialization of the STARS technology is the only means by which the technology can be transfered and put into use successfully. We felt that the problem being addressed was much larger than the effort funded by STARS, and that mandating the commercialization of the software would result in cost sharing and technology and resource leveraging that would not occur otherwise.

The following is a summary of our findings.

Recommendations:

1. The STARS environment needs to focus on the value added and DoD specific needs such as hard real-time, security, fault-tolerance and Ada.

2. There has been a tradition within Government funded environment efforts to focus on achieving tool and process integration through the use of a logically centralized environment database. We acknowledge that there are many merits to this approach. There are existing commercial environment integration frameworks that exploit this concept. On the other hand, there are many other integration mechanisms that also need further exploration and evaluation. We recommend that STARS take a broader view of how one can achieve

effective integration using mechanisms such as control integration, communications, link databases and data interchange standards. It is the opinion of this working group, that the heterogeneous nature of an organization's computing environments and the diversity of tools in use today warrants the exploration of integration mechanisms.

3. We believe the role of standards is most critical for integration and that the STARS program needs focus considerable effort to identify and support commercial standards that promote. The use of proprietary or Government only standards within the environment will limit the acceptance of the STARS environment.

    The STARS program needs to take a proactive role in standards that address tool interoperability, data interchange, operating systems, and communications as they pertain to the environment.

4. Guidelines are needed for tool vendors to improve tool integration and interoperability. The guidelines need to identify and prioritize relevant standards. The guidelines should also identify the separation of concerns between the environment and tools. For example, if configuration management is the responsibility of the environment, then what is the responsibility of tools to support and correctly interface to the configuration management services of the environment.

5. The STARS program is still very ambitious. Much of our real world experience indicates that effective integration of commercial-off-the-self tools is difficult and rarely realized. The STARS program needs to provide early prototypes to provide user experience and feedback.

6. The STARS program needs to provide a prioritized list and schedule of environment work products. In addition, STARS needs to continue to schedule industry conferences and workshops where the participants can review and provide input on these work products.

Win/Win Strategy

The STARS program represents a WIN / WIN condition if it accomplishes the following:

1. The STARS program demonstrates that increased tool integration and process support by the environment will significantly reduce life cycle costs. A demonstration that uses commercial environment framework components and tools that can be reproduced at contractor and government sites will allow these experiments to be conducted on other programs.

2. Establish qualification guidelines and procedures whereby tools can be qualified as being STARS environment compliant. An environment that provides the end user with a rich set of tool choices is more likely to be accepted. Tool vendors not selected by the STARS Primes need a vehicle for having their tools qualified and available to users of the STARS environment.

Responses to Questions

The following is a summary of our discussions on the questions posed by the STARS primes.

Q9.2, Q9.4, Q9.5 Although we did not develop an itemized list of standards for the STARS environment, we did identify the need to establish a STARS process for standards activities. We recommend that the STARS environments use a common set of standards. In addition, the STARS program needs to participate and influence standards bodies that are developing environment related standards.

The STARS program should provide Ada binding to standards where those bindings do not exist. The Ada interface specifications should be placed in the public domain, the software supporting these interfaces should be of commercial quality with good documentation and support. Identifying a vendor who will perform the commercialization and marketing of this software is necessary to insure their quality and maintenance. Public repositories have not gained the reputation as sources of quality software.

Q9.3 We felt that the use of COTS software is both desirable and fraught with risks. Most of our experience points to more problems than solutions when attempting to integrate COTS tools. Furthermore, a COTS environment can be very costly. The STARS environment approach needs to allow subsetting and incremental acquisition and evolution of the environment. If the average company is spending in the order of $10 - 15 k per engineer to provide computing and software resources then the cost of the STARS environment must be in line with these figures.

Q9.6 The question of whether-or-not the STARS program is using the right building blocks raised some concern about the environment being sufficiently expressive to support process modeling and enforcement. We felt that it was too early to evaluate this since information on the environment building blocks was unavailable. We recommend that STARS consider a risk reduction effort in this area were each Prime examines their environment relative to the ways it can provide support for process modeling and enforcement.

Q9.7 Our recommendation is that the STARS program must take a wholistic (but domain specific) approach to its support of the life cycle. Even though it is well known and accepted that improvements in the front-end of the life cycle has the greatest pay back, we recommended that the STARS environment be complete. One reason is that many of the environment integration problems

surface as one tries to integrate tools and processes across the life cycle and different project disciplines.

Q9.8   Although we did not spend a lot of time examining new technologies we identified several that need to be considered by the STARS program:

- Visual programming
- Formal techniques
- Object-oriented development
- Object-oriented databases & user interfaces

9.12. STARS Program Response

DG9.2 - Recommendations

- STARS needs to focus on the value added and DoD specific needs: real-time, security, fault-tolerance, Ada

  STARS Response: Agree. We will exploit the commercial products to fulfill as much functionality as possible. We will target government funded development at high leverage prototypes. It is unlikely that some of the more challenging areas such as security or fault-tolerance will be impacted with the amount of funding that STARS can bring to bear.

- Don't limit tool integration to database integration. Explore other tool integration mechanisms: Control, Communications, Link databases ...

  STARS Response: Agree. We will pursue presentation integration, and control integration as well as data integration.

- Review existing standards and identify requirements for STARS standards.

  STARS Response: Agree. See response DG8.2.

- Take a proactive role in standards to address interoperability. Work within the standards community.

  STARS Response: Agree. We will take active roles in NIST, IEEE, and Industry Standards Groups to bring the required standards to maturity.

- Provide guidelines to improve tool integration and interoperability.

  STARS Response: Agree. The next twelve months are devoted to investigating architectural issues. It is expected that during this activity lessons will be learned that can be documented in terms of guidelines that will increase the level of integration and portability of tools developed to the open standards selected by STARS.

- STARS effort is very ambitions - most real-world experience indicates that effective COTS integration is hard to achieve. Provide early prototypes, user experience, solicit feedback.

  STARS Response: Agree. Stand alone prototypical tools are available today. The offerings of the prime contractors commercial counter parts will make prototypical, partially populated/integrated environments possible in mid 1991. The affiliate program mentioned above will provide a mechanism to make these capabilities available for early evaluation and feedback.

- Provide a prioritized list of products.

  STARS Response: Not just yet. We feel that we cannot provide a prioritized list of products at this time. We believe that as the specification becomes more complete we will be able to provide a prioritized list of functional capabilities.

10. Evaluation - 1

Charter: To review the plan for evaluating results of the STARS program, offer suggestions that will improve chances of success, and to brainstorm other feasible evaluation approaches.[3]

Discussion Group Location:

2320 Monday
2200 Tuesday

Discussion Group Leader:

Frank Belz, *TRW*

Discussion Group Members:

Dave Ceely, *IBM*
Larry Frank, *Boeing*
Tom Hendrick, *USArmy*
David Hislop, *USArmy*
Hui Huang, *NIST*
James Robinette, *DCA* [Monday only]
Sharilyn Thoreson, *McDonnell Douglas*
David Weisman, *Unisys* [Monday only]

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[3]note that Evaluation - 1 (Chapter 10) and Evaluation - 2 (Chapter 11) have the same charter and discuss the same issues.

10.1. Taking Measurements/Data Gathering

What types, kinds, durations of data gathering and metric collection should be done, beginning when, in order to convince industry that it is worth shedding older ways of doing business and adopting those promulgated by STARS?

Often comparison data is not available against which to compare the value/improvement provided by new technology. Additionally, data also varies between application domains. How should measurements be taken to determine the effectiveness of STARS tools, environments, technologies, process? What should be the measures of goodness? Who should decide? How should the experiments be "controlled" to obtain reliable results?

10.2. Other Long Term Evaluation Techniques

What additional long term evaluations might STARS consider in addition to distinguished reviewers, product adoptions and application development? What advantages do these additional techniques offer?

10.3. STARS Distinguished Reviewers

What type of talent mix should be required for the distinguished reviewers group? How often should such a group meet? What should be its role?

10.4. Number and Type of Application Developments

How many applications make sense? Who should do them? What is the down side to having some/all of the projects accomplished within STARS Primes? Does having the application developments done by projects within the primes make any data gathered less believable? What evaluation scenarios make sense to you? Do other plausible scenarios exist? What are the good and bad points of the scenarios? Which have the greatest chance of success?

10.5. Evaluation Constraints

The briefing listed several initial constraints. Are the constraints correct? Are they unnecessarily restrictive? Should any be relaxed? Which ones and why? Should any constraints be added?

10.6. Asset Development

In order to show the productivity impact of reuse, asset bases are required. These currently are outside the control of the STARS program, although STARS will be working this issue. What meaningful application specific asset development efforts are you aware of, in both government and industry, with which STARS might be able to attain synergy?

10.7. Timing and Emphasis on Evaluation

Is the program placing too much emphasis on evaluation? Does the current evaluation plan unduly restrict STARS technical development and integration work? If so, how can more balance be achieved and still achieve program objectives?

10.8. Resistance/Difficulty

Under what conditions would you be willing to promote your program to be one of the application development projects? What are the barriers/resistances that can be expected from program managers to STARS using their programs as a vehicle? How can these issues be overcome?

10.9. Risk Identification

What additional risks exist to the evaluation portion of the program? What additional risk mitigation strategies should be applied?

10.10. Discussion Group Slides

DG10.1 - STARS Plan - Positive Points

- Emphasis on Evaluation

    - Non-primes involved in evaluation

- Integration of STARS with DARPA/ISTO program

- WIN/WIN approach - sensitivity to fact:

    - success will depend upon multiple needs and interest

- Controversial - commercialization

DG10.2 - STARS Program Recommendations

- Guarantee STARS SEEs can be useful even where new reuse-based paradigm preconditions not satisfiable

- Remember STARS [A => adaptable; R => reliable]

    - reuse not always => adaptability

    - prototyping support important

    - maintenance focus important

    - reverse engineering

- Begin preparing the community (marketplace) for paradigm shift

    - rebuild STARS program credibility

DG10.3 - WIN/WIN

- Provide a window into technical process

    - *build a community of champions on the user side*

    - Distinguished Reviewers - university, government, user community

    - Affiliates - marketing strategy essential

- Demonstrate active interaction with agencies/process to address non-technical issues

    - acquisition

DG10.4 - Evaluation Issues

- Timing and Emphasis

    - Emphasis on evaluation appropriately high

    - Use evaluation process to enhance technical development and integration

        - evaluation in first 3 years critical

            - Affiliates

            - Distinguished Reviewers

            - Contract R&D programs

            - Application Developers

        - synergize with other ISTO projects

            - DSSA

        - synergize with other research projects

            - service research programs

        - examine existing reuse success/failures

DG10.5 - Evaluation Issues (2)

- Number and Type of Application Developments

    - More important to have one substantial example that works

        - concert of goals

        - but be honest in sales pitches

    - Be willing to use experimental programs

        - use DSSA as a resource for Asset base

        - synergize on common concerns in DSSA program

        - use other PO (Program Office) programs that permit risk

        - use contract R&D

10.11. Discussion Group Write Up

> Write up not received in time for publication

10.12. STARS Program Response

DG10.2 - STARS Program Recommendations

- Guarantee STARS SEEs can be useful even where new reuse-based paradigm preconditions not satisfiable

    STARS Response: Generally agree. While a fundamental premise of the STARS program is that much productivity and quality improvement will come from the synergy between reuse, process, and SEE (the whole is greater than the sum of the parts), the program will endeavor to provide the technologies in a stand-alone mode.

- Remember STARS [A => adaptable; R => reliable]

    - reuse not always => adaptability

    - prototyping support important

    - maintenance focus important

    - reverse engineering

    STARS Response: Agree. For example, STARS will be pursuing actively quality reverse engineering capabilities for inclusion in its environments. STARS realizes that significant quality and cost improvements can be attained in the software maintenance community as well as in new developments, and will apply some segment of its resources there. In addition, STARS intends to include representatives of the PDSS (post-deployment software support) community in the Distinguished Reviewers group.

- Begin preparing the community (marketplace) for paradigm shift

    - rebuild STARS program credibility

    STARS Response: Agree. The program has begun to take steps toward rebuilding credibility. The first was this workshop. Other steps will include additional workshops, presentations and demonstrations at major conferences, a Distinguished Reviewers program (from university, government, user community), a multi-level Affiliates program, as well as other technology transition activities. In addition, technical products developed and or integrated by the prime contractors will be released at interim phase points for community testing and feedback. Lastly, plans for the evaluation projects include allocating significant resources for the purpose of preparing and providing continuous support to the development organizations using STARS technology on the evaluation development efforts.

- Timing and Emphasis

    - Emphasis on evaluation appropriately high

    - Use evaluation process to enhance technical development and integration

        - evaluation in first 3 years critical

            - Affiliates

            - Distinguished Reviewers

            - Contract R&D programs

            - Application Developers

        STARS Response: Agree. This appears to have been a miscommunication in the presentation. While the briefing intentionally concentrated on the three large-scale evaluation projects to begin in the October 1993 time frame, STARS did not mean to imply that these are the only evaluation activities in the program. The Affiliates program being initiated may provide significant interaction with the primes at some levels of participation. In addition, Distinguished Reviewers are being solicited. STARS is also very interested in adoption and use of interim products such as process definitions, Ada bindings, repository tools, etc. Said usage provides a measure of success, plus invaluable feedback for continued product development and maturation.

        - synergize with other ISTO projects

            - DSSA

        STARS Response: Agree. STARS intends to synergize with other ISTO programs as much as is possible based on each program's technical focus and schedule. In the specific case of DSSA, the two programs will be working closely to determine how STARS tool, environment, and repository developments can support DSSA reusable asset creation, while at the same time determining how the assets might support and be used by STARS evaluation projects.

        - synergize with other research projects

            - service research programs

        - examine existing reuse success/failures

11. Evaluation - 2

Charter: To review the plan for evaluating results of the STARS program, offer suggestions that will improve chances of success, and to brainstorm other feasible evaluation approaches.[4]

Discussion Group Location:

>1200 Monday
>2300 Tuesday

Discussion Group Leader:

>Cathy Peavy, *Martin Marietta*

Discussion Group Members:

>Odean Bowler, *USAF/STSC*
>Paul Brown, *GE*
>Mary Forthofer, *IBM*
>Lon Jackson, *Rockwell*
>William Wong, *NIST* [Monday only]

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[4]note that Evaluation - 1 (Chapter 10) and Evaluation - 2 (Chapter 11) have the same charter and discuss the same issues.

11.1. Taking Measurements/Data Gathering

What types, kinds, durations of data gathering and metric collection should be done, beginning when, in order to convince industry that it is worth shedding older ways of doing business and adopting those promulgated by STARS?

Often comparison data is not available against which to compare the value/improvement provided by new technology. Additionally, data also varies between application domains. How should measurements be taken to determine the effectiveness of STARS tools, environments, technologies, process? What should be the measures of goodness? Who should decide? How should the experiments be "controlled" to obtain reliable results?

11.2. Other Long Term Evaluation Techniques

What additional long term evaluations might STARS consider in addition to distinguished reviewers, product adoptions and application development? What advantages do these additional techniques offer?

11.3. STARS Distinguished Reviewers

What type of talent mix should be required for the distinguished reviewers group? How often should such a group meet? What should be its role?

11.4. Number and Type of Application Developments

How many applications make sense? Who should do them? What is the down side to having some/all of the projects accomplished within STARS Primes? Does having the application developments done by projects within the primes make any data gathered less believable? What evaluation scenarios make sense to you? Do other plausible scenarios exist? What are the good and bad points of the scenarios? Which have the greatest chance of success?

11.5. Evaluation Constraints

The briefing listed several initial constraints. Are the constraints correct? Are they unnecessarily restrictive? Should any be relaxed? Which ones and why? Should any constraints be added?

11.6. Asset Development

In order to show the productivity impact of reuse, asset bases are required. These currently are outside the control of the STARS program, although STARS will be working this issue. What meaningful application specific asset development efforts are you aware of, in both government and industry, with which STARS might be able to attain synergy?

11.7. Timing and Emphasis on Evaluation

Is the program placing too much emphasis on evaluation? Does the current evaluation plan unduly restrict STARS technical development and integration work? If so, how can more balance be achieved and still achieve program objectives?

11.8. Resistance/Difficulty

Under what conditions would you be willing to promote your program to be one of the application development projects? What are the barriers/resistances that can be expected from program managers to STARS using their programs as a vehicle? How can these issues be overcome?

11.9. Risk Identification

What additional risks exist to the evaluation portion of the program? What additional risk mitigation strategies should be applied?

11.10. Discussion Group Slides

DG11.1 - Positive Observations

1. Recognizing evaluation issue

2. De-scoping to more realistic approach

DG11.2 - WIN/WIN

- Must be economically attractive to end users

  AND

- Must be technically attractive to end users

DG11.3 - Evaluation Techniques

1. Near term phased releases (small evaluations)

2. Experienced independent evaluation teams.

   - <u>Not</u> primes or project companies

   - multi-company "super stars"

3. Auditable results

4. Data collection built-in and automated

5. Statistically significant sample

DG11.4 - Project Criteria

- At least 3 application areas
    - Statistically valid sample size
        - 6 - 8 small projects (10K - 40K source lines of code)
        - 1 large project (100K source lines of code)
- Multi Lingual
    - Ada and other HOL and assembly language
- Evaluation should include software requirements development (SRS)
- Project team with average skill levels

DG11.5 - Risks

1. "Big Bang" approach
    - Cost
    - Schedule
    - Credibility
2. Interface "Catch-22"
    - Need COTS tools for testing
    - New STARS standards preclude use of COTS tools
        - Are existing/emerging standards adequate?
        - If not, where are the tools coming from?

DG11.6 - Recommendations

1. Right Activities - The activities are adequate for the approach as presented.
    - There are missing activities.
        - Evaluation of phased releases missing
        - Develop an operational concept
        - Get user community buy in of operational concept
2. Right Approach
    - No - Based on Big Bang
    - Recommend - Phased incremental releases
        - earlier than 1993
    - Early feedback and testing
3. < last line illegible >

11.11. Discussion Group Write Up

> Write up not received in time for publication

11.12. STARS Program Response

DG11.3 - Evaluation Techniques

1. Near term phased releases (small evaluations)

2. Experienced independent evaluation teams

   - <u>Not</u> primes or project companies

   - multi-company "super stars"

   STARS Response: Agree. STARS will have independent evaluation, and will be working to determine the right metrics to collect. As stated in the workshop briefings, we welcome review, comments, and suggestions from the community as to relevant data that must be gathered.

3. Auditable results

4. Data collection built-in and automated

5. Statistically significant sample

DG11.4 - Project Criteria

- At least 3 application areas

  - Statistically valid sample size

    - 6 - 8 small projects (10K - 40K source lines of code)

    - 1 large project (100K source lines of code)

  STARS Response: Generally disagree. While we agree and are planning on three application domains, and a large project in each, an additional 6 - 8 small projects is not possible given current program resources and schedule. However, interim product releases should help address the desire for small projects, by providing for early feedback and testing.

- Multi Lingual

  - Ada and other HOL and assembly language

  STARS Response: Generally agree. STARS intends to provide multi-language support in the environments that will be produced. For the purposes of the evaluation projects, however, Ada is the prime language. Potential evaluation projects can have small portions of non-Ada code, in accordance with DoD policy.

- Evaluation should include software requirements development (SRS)

- Project team with average skill levels

12. Workshop Attendees Not Assigned to Discussion Groups

Discussion Group Members:

Judy Bamberger, *SEI*
Barry Boehm, *DARPA/ISTO*
Dick Drake, *IBM* [shared time between two Process discussion groups]
Larry Druffel, *SEI*
John Foreman, *SEI* [shared time between two Evaluation discussion groups]
Bill Hodges, *Boeing* [shared time between two SEE discussion groups]
Jack Kramer, *DARPA/ISTO* [shared time between general issue discussion groups]
Teri Payton, *Unisys* [shared time between two Reuse discussion groups]

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13. Overall STARS Program Responses

The STARS users workshop was structured so that each discussion group could report findings and recommendations at a general session, just before lunch on the second day. After lunch, the STARS Program Office presented an initial response to the discussion group reports.

The STARS prime system architects, along with representatives from DARPA/ISTO, the STARS Program Office, and SEI, developed these initial responses over the extended lunch period. Jack Kramer (Director of the STARS Program) presented the responses. These immediate responses formed the basis for the more detailed responses provided in the *STARS Program Response* sections in this document. They also became an important input into the Tier 2 planning work. A transcribed copy of Dr. Kramer's slides follow.

13.1. Onsite STARS Program Response

FIN.1 - DARPA-Level Concerns

1. Slaying three dragons in parallel (reuse/process/tools)

    - They are inter-related

    - Too important not to try

    - Fallback options are available

    - Not risk-free program - DARPA program

2. DARPA software technology program largely ignored (DG1); synergy with ISTO programs good (DG10)

    - Agree on importance of emphasizing

    - Being directly addressed as part of ISTO strategy

    - DSSA/SEI - future programs

    - STARS is mechanism to showcase DARPA technology

3. Ignoring non-technical issues

    - DARPA not in position to drive implementation

    - Agree proactive approach is important

    - Expand interaction with Services, NIST, NGCR

4. SEI as source of process building blocks

   - Tech transfer channel for a better description

   - Need lost of help from community here

   - SEI as catalyst for process enhancement and tech transfer

SEI and STARS need to be more integrated

   - DARPA mode is to develop and transition technology, then start new programs

   - STARS is an example

   - SEI is an exception

   - SEI is positioning to help transfer STARS results; also doing the same for other programs - DSSA

Clarify where SEI and STARS are on 6.1 - 6.4

   - All programs are a mix

   - SEI role is principally tech transition - to be effective, SEI participates in 6.1, 6.2 to prepare the products

- **FIN.2 - Follow on planning - Tier 2**

   - Use workshop recommendations as input

   - Provide responses in December [1990], point by point

- Not using a "Big Bang" approach

   - Affiliates program for interim products

   - Based on commercial products

   - 1 October 1993 a program date for start of evaluation

   - Will work harder on this

- "Explanation and data was lacking"

- Not enough budget

   - Commercial strategy invites cost sharing

   - Agree program is ambitions

   - Design-to-cost approach helps

   - Trying to get more budget via Software Technology Plan

   - <u>BUT</u> believe STARS is "viable".

   - Leveraging other efforts

      - NGCR/PSEWG

- Technology Transfer - Tier 2 will include detail
    - Appoint czar - develop plan
    - Invoke Affiliates Program
    - CASE workshop spring 1991 - agree very important
    - Follow on workshop "Affiliates"
    - Primes and CASE via commercial incentives
    - Will present Tier 2 plan
- "Reuse is painted as panacea
    - will work better in some domains than others"
- Make processes/SEE usable in subsets

FIN.3 - DG4 - Technical Barriers to Reuse

- Balance emphasis on library with other reuse life-cycle activities
    - will feed this into tier II planning groups
- Exercise, validate reuse processes/tools
    - internal non-STARS funded efforts by Primes now
    - will encourage exercise in affiliates program
    - will encourage early usage on other programs (e.g., SAIC domain analysis for flight simulation contract)
    - will cooperate with DSSA
    - will exercise with STARS developed components
    - agree it's important that domain assets for evaluation project be developed with STARS processes/tools

FIN.4 - DG5 - Non-technical Barriers to Reuse

- STARS should consider reengineering of assets
    - Agree - STARS SEEs should incorporate tools for reengineering
    - Agree reengineering should be one of the reuse process building blocks
    - DARPA/ISTO has a proposed FY92 new start to develop/transition re-engineering technology.
        - will be worked in concert with STARS
- STARS must address non-technical issues as a task
    - Agree they are critical
    - STARS working through DoD Software Master Plan where they are treated as critical
    - Agree that STARS should address/coordinate issues where STARS has high leverage
        - small current task to coordinate issues addressing acquisition process
        - agree to contact industry organizations (eg NSIA, AFCEA, EIA ...) to catalyze business attention

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FIN.5 - DG6

1. Use spiral-type approach to minimize risks, etc.

- Yes, we agree. Will be considered in our Tier 2 planning.

- With respect to process management, we are looking for groups to participate (affiliates)

   • contribute process definitions, building blocks

   • evaluate/contribute:

     • process description techniques

     • tools to aid process definitions

     • process mechanisms

2. STARS needs more $ to really make a difference. Tax production programs.

- Reality within government and DoD must be considered.

- Building alliances within DARPA and other DoD agencies to synergize technology and development efforts .

- We need your help

FIN.6 - DG6: Process Management Support

- Is STARS reliance on SEI for "process building blocks" an acceptable risk?

   • <u>YES</u>

   • SEI is leading the DoD community relative to process

   • SEI has activities in place

   • SEI is not the only one working this

     • STARS will do reuse process

     • We expect support from others

   • Tier 2 plan will refine the planned interactions

FIN.7 - DG7: Process Definition

- Need early user involvement

   • We will start with Affiliates program

   • Tier 2 plan will identify pilot projects/experiments to evaluate process management technology.

- Need early involvement with evaluation project.

   • Evaluation project identified in 1991

   • Some funding for evaluation available in 1992 more in 1993

   • A more detailed plan is necessary as part of Tier 2.

FIN.8 - SEE Recommendations/Response

- Make early decision on a single, minimal set of commercial interfaces/standards
    - this is considered to be HIGH priority.
    - currently conducting trade studies on controversial standards.
    - will make decisions early next year.
- STARS effort is very ambitions ... effective COTS integration is hard to achieve. Provide early prototypes, ... solicit feedback.
    - commercial offerings will make prototypical, partially populated/integrated environments possible in mid 1991.
    - stand alone tools available now
    - Affiliates program will provide mechanism for interested evaluators
- No definition, prioritized list of SEE products revealed.
    - We are currently peer reviewing Preliminary System Specification
    - We are currently involved in Tier II planning activity
- Look at lessons learned from other SEE efforts
    - We have looked at National Software Works, ALS, Genos, ISTAR, and several aerospace company environments
    - Soliciting other relevant lessons learned.

FIN.9 - Evaluation [DG 10 and 11]

- Big Bang, interim releases, use evaluation to support technical development
    - Miscommunication! Intend interim releases
- Partial "use" of STARS SEE's - agree
- STARS - Adaptability, reliability
    - To be further examined
- Preparing community/credibility
    - Agree
    - Distinguished Reviewers, affiliates are initial efforts
- Independent review teams
    - to be considered
- Multi-lingual - agree
- Integration with DARPA/ISTO - DSSA
    - to be considered for finding/developing assets
- Evaluation purpose

what goes here is general stuff if not appropriate to put in each DG chapter, point-by-point

Appendix A: Summary of Workshop Critique Forms

The following is an un-scientific summary of the responses to the questionnaire provided to all STARS/Users '90 Workshop attendees (about 110). A total of 15 were returned, four of them from discussion group leaders. The questionnaire text is provided in plain font; the responses are provided in **boldface** font. The critique form also afforded attendees the opportunity to ask additional questions or raise additional issues. These questions and issues are included at the end of this Appendix, with the Question paragraph being the question or issue raised by workshop attendees, and the following paragraph is the STARS Response.

STARS/Users Workshop Critique Form

The STARS Program requests your written comments on this workshop, since the Program plans to hold similar workshops in the future.

1. Please provide your perspective on workshop logistics, facilities, accommodations, food.

    - **Excellent; right materials for DGs** *[many]*
    - **Need 2.5 or more days for workshop like this** *[many]*
    - **Need STARS information ahead of time to prepare** *[several]*
    - **Need more telephones!** *[several]*
    - **Shuttle bus good idea**
    - **Provide dinner for all (continue informal interchange), even if some in working meeting**
    - **Switching buildings was distracting, time consuming**
    - **Competition with SEI Affiliates Symposium impacted consistency of attendees**

2. Indicate the most positive part of this workshop.

    - **Allowing feedback; dialogue; STARS listening; visibility; interaction** *[many]* **its existence**
    - **DGs, team assignments**
    - **Information about new STARS**
    - **Interrelationships ("networking")**
    - **Prepared-ness of presenters and DG leaders**
    - **Good access to STARS staff at all levels**
    - **Final workshop report must, however, credibly address specific workshop recommendations to retain user participation/good-will**

3. Indicate the most negative part of this workshop.

- Lack of detail on (general plans, actual SEE as of today, evolving solutions)

- First-day presentation too complex/heavy, simplify, too many "models"

- Too short, especially time in DGs

- Allow people to select DG area

- Only allowed input into one and only one DG

- Mechanisms of feedback from DGs to the workshop and answers to DG questions

- More trained facilitators

- Goals for DGs too broad; too many questions

4. Did the workshop meet your expectations? If no, please indicate why not. What could have been done better to meet your expectations?

- Yes; in general, but needed more real users in attendance *[vast majority]*

- No; expected more detailed information

- Too many non-integrated handouts

- Need more time

5. Will the new opportunities to participate (workshops, affiliates program, newsletter, product availability) make it possible/easy for you and your organization to participate in STARS? If no, please identify the remaining barriers to your participation.

- Yes *[majority]*

- Affiliates program is good idea *[several]*

- Need early releases *[several]*

- Yes, but only if progress in same direction continues and expands

- No - STARS must also forge infrastructure to *decision makers* in services to allow this to happen

- Barrier: employer still does not have enough insight into what STARS is trying to do

- Also newsletters, workshops, ...

- Need expedient communication of planned events (facilitates travel!)

6. Do you have any suggestions for the conduct of future workshops, including topics to address?

- **More focussed; focus on only 3 - 5 topics, not so many!** *[several]*

- **Need information before workshop** *[several]*

- **Send out DG questions in advance** *[few]*

- **Topics:**

    - **More detailed examination of standards: what level of involvement should STARS have? Identify gaps, overlaps, ...**

    - **Ada bindings to X, MIS, and other bindings**

    - **STARS Advisory Group Report**

    - **How is STARS tuning to users needs/wants**

- **Be aware workships are costly for users; don't overuse them; make sure users perceive positive ROI; use prior workshop recommendations as starting point for ensuing is good way to achieve this**

- **Workshops to allow critique of development; visibility will create a following and advocacy**

- **More time for DG presentations**

- **Also have business/legal group with business/legal people (versus technical managers)**

7. Do you think the STARS plan, as presented, is:

            too conservative   about right   too ambitious

Please circle exactly ONE. If you selected "too conservative" or "too ambitious," please provide some brief rationale.

- **Too ambitious (not enough money, hard problem, short schedule, questionable evaluation program, focus on enabling technology versus promise to deliver "commercial" SEEs; will need to find effective means to leverage other technology)** *[vast majority]*

- **Too conservative: STARS should be as candid as possible in presenting futuristic plans with government and industry**

8. Please indicate the ONE issue you feel the STARS Program should place the highest priority on addressing.

4 **Process (automation, tailoring)**

3 **Integration standards**

1 **Obtaining commercial acceptance of framework reference model and standards**

1 **Overall SEE architecture**

1 **Selection of evaluation project**

1 **Consumating STARS interface with DoD applications**

1 **Reuse process**

1 **Use vendor community to produce/support environments**

9. Please use the rest of this critique form, as necessary, to:

   a. Pose questions about STARS that the presentations or discussion groups did not answer, or

   b. To make other comments about the STARS Program.

The STARS Program will endeavor to answer your questions as part of the final workshop report. Thank you for participating in this workshop and for completing this critique form.

10. The following are items that were submitted on the STARS/Users workshop critique forms that were taken as questions or issues that required a response from the STARS program. They have been grouped into related areas.

   • Reuse

      a. Question: If STARS is to work, the acquisition process must be changed (especially with respect to reuse) - STARS must have a strategy for that and have someone working it.

      STARS Response: Partially agree.   There are many improvements that could and possibly should be made to the acquisition process. It is also true that STARS might have more impact if these changes were made. DARPA is working within the framework of the Software Master Plan to make sure that the organizations who can do something about the problem, have action to work the problem. STARS has a small activity working with the various ongoing activities on the non-technical issues of reuse, to make sure the issues continue to receive attention.   (See more detailed responses in the replies to the DG questions).

      b. Question: JIAWG Software Task Group - Reuse Subgroup did a *lot* of work on non-technical issues (Harley Ham - NADC was chairperson).   Also, look at JIAWG SEE Specification.

      STARS Response: Agree. STARS has had interactions with the JIAWG SEE and Reuse activities and is including this information in its planning.

      c. The issues of data rights and copyrights of reused or commercial software were not addressed and may represent a major challenge.

STARS Response: Partially agree. See comment 1 above.

d. Question: Software reuse methods and tools are as immature as process modeling. STARS money would be better spent solving the basic technology problems in these areas rather than trying to integrate. First things first.

STARS Response: Partially agree. STARS agrees that both reuse and process are immature technologies. On the other hand, we believe that there is major benefit to be gained from working them together along with commercial quality software engineering environments. If they are not worked together, there is a very good chance that the technologies developed would be incompatible because of arbitrary engineering choices. We understand that this interaction is a risk item that must be managed, and will do so, but believe the risk is worth it. (See the responses to DG questions for additional information.)

• Process

a. Question: AFSC Software Process action team is looking at acquisition process issues - consider working with them.

STARS Response: Agree. We will coordinate our work with them.

• Software Engineering Environments

a. Question: The STARS/Users workshop never answered the question: "Will there be one environment with three instantiations or three environments?" STARS people give conflicting answers.

STARS Response: STARS will have an agreed-to, common open architecture based on commercial standards. Each software engineering environment will then be instantiated to this architecture and populated with tools appropriate to the evaluation domain and application on which it is to be demonstrated.

• Technology Transfer

a. Question: "Success for STARS is technology transfer."

STARS Response: Partially agree. (See DG3 responses.)

b. Question: Post-FY96 support of STARS technology should be addressed now.

STARS Response: Partially agree. Since STARS technology is to be commercially based, it does not need to have the continued government support that a government-developed and -maintained technology would need to have. On the other hand, we recognize that there will be many lessons learned and that we may be only beginning to get some of the technology accepted by the end of STARS, and therefore there will be additional work required after STARS. We will address this issue in our technology transition plan. (See DG3 responses.)

c. Question: "Affiliates Program" is a gem of a good idea, but implementation/objectives need some fine (perhaps even coarse) tuning.

STARS Response: Agree. We are evolving the concept.

- Global Issues

  a. Question: Intermediate milestones would be beneficial for measuring progress of STARS.

  STARS Response: Agree. The consolidated plan, which will result from our Tier II planning, will identify intermediate milestones.

  b. The STARS program should address the practical needs of software developers to effect a change in the way the US industry/DOD does business. Less emphasis on research programs (that can come from other DARPA and service sources) and more on leveraging the research and showcasing effective application of research results and successful COTS integration.

  STARS Response: Agree. We believe that is what we are doing. That is why the emphasis on commercialization in STARS. On the other hand, we want to transition as much technology into STARS environments as we can within our funding, and we want to make sure that the decisions we make do not prevent insertion of new technology in the last half of this decade.

- Global/Software Engineering Environments

  a. Choice of standards for communication, windowing, etc., needs to be decided early, and a policy needs to be established for what to do about COTS tools that don't conform to these standards. What standards will be chosen? More importantly at first: How will these decisions be made? In which areas are standards most important?

  STARS Response: Agree. Establishing the open architecture to which the three primes will instantiate their software engineering environments is one of the most important activities in FY91. A detailed plan for the process of determining this open architecture will be in the Tier II plan. We will coordinate this with the Navy PSEWG through the Navy/STARS MOA to make sure these two activities are coordinated.

  b. Question: Failing to get the vendors and end-users involved and interested in STARS early on with spell death for STARS, as it has for other large-scale efforts that have attempted to become standard by self-decree.

  STARS Response: Agree. This is a very important aspect of getting STARS technology accepted. We believe that emphasizing an open architecture based on commercially supported standards helps us, but realize we must still be proactive. We do not anticipate that there will be any decree about STARS, so we must work harder to make sure people understand and want what we are doing. One of the reasons for the emphasis on commercially supported technology is that the commercial vendors have an interest in transitioning their technology and will be active in trying to do so. This should help STARS technology transition also. (See the responses to DG questions for additional information.)

- Miscellaneous

    a. <u>Question:</u>   Despite all the concerns .... you are attacking the environments/process problems the right way!

    <u>STARS Response:</u> <u>Agree.</u> No response necessary.

Completed critique forms may be left at the STARS/Users Workshop Help Desk or, should you desire to return the critique form via mail, please send it to:

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Appendix C: STARS / Users Workshop Application

The STARS (Software Technology for Adaptable, Reliable Systems) Program is focused on providing the DoD software community with a software engineering environment, repository technology, and process models. STARS is sponsoring a workshop targeted toward increasing the communication between the STARS Program and the builders of software-dependent systems. This will be the first of many public discussions hosted by the STARS Program. This workshop is being hosted by the SEI.

The primary purposes of this workshop are:

- For organizations building software-dependent systems to review STARS Program goals, objectives, and progress and to provide input into the STARS Program plans.

- For the STARS Program to validate its goals, objectives, and plans.

The goals of the workshop are:

- To begin an on-going dialogue with the intended users of STARS products and technologies toward a shared vision for tools and environments to support large system development effectively.

- To validate STARS assumptions about the needs and requirements of organizations building large software-dependent systems.

The target audience of this workshop is those who specify, buy, and use environments to build and maintain large, operational software-dependent systems.

To this end, the workshop will feature:

- An overview of the current direction of the STARS Program.

- A discussion of key issues affecting the STARS Program, and the technical thrusts of the STARS prime contractor efforts to date.

- Small discussion groups, focusing on current "hot topics" applicable to STARS, such as: reuse, process, interface standards, frameworks, distribution, reverse engineering, responsiveness of the CASE industry, and STARS commercialization strategy.

- A STARS Program response to the issues raised by the workshop attendees during discussion groups.

The output from this workshop will be a written summary of the meeting, including discussion group reports and STARS Program responses, as well as plans for follow-on events; this summary will be mailed to workshop attendees within 45-60 days of the workshop.

STARS / Users Workshop participants are also encouraged to attend SEI's Affiliates Symposium, the annual event that provides a showcase for current SEI and Affiliate activities; it is being held following this workshop. STARS / Users Workshop participants are invited to attend this event, which is normally limited to SEI Affiliates, 12 - 13 September 1990 (tutorials are offered 11 September), and requires separate registration. Contact Helen Joyce at 412-268-6504 for registration information.

Application for STARS / USERS WORKSHOP

Attendance will be limited because of space, so applications <u>must</u> be received by _MONDAY, 6 AUGUST 1990_. Notification of acceptance and conference registration information will be sent out by Monday, 13 August 1990.

Please complete <u>both</u> <u>sides</u> of this form and send to:

> Shirley Brooks
> Software Engineering Institute
> Pittsburgh PA 15213
> FAX: 412-268-5758
> Email: sab@sei.cmu.edu

There may be a small registration fee ($40.00) to cover workshop incidentals.

Applicant Information

Name _____

Title _____

Company _____

Division _____

Address _____

_____

City/State/Zip _____

Business Phone _____

Email _____

To ensure a mix of interests at discussion groups, please check the area below that best represents your work:

_____ STARS Prime or related (e.g., DARPA)

_____ System builder

_____ CASE / tool vendor

_____ Other (specify)

- OVER -

Please provide a one-paragraph discussion of your interest in the STARS Program and its products, and how you are or may be impacted by them.

Please suggest one (or more) issue(s) you would like to see discussed among the workshop participants, STARS Program Office, and STARS primes. (Some candidate issues appear on page 6.)

A similar workshop is intended in Spring 1991 for CASE tool vendors.

MONDAY, 10 September 1990

    8:00am -   8:45am Registration and continental breakfast *[SEI Cafeteria]*

        *** SEI Auditorium ***

    8:45am -   9:00am Welcome and Introductions (John Foreman, SEI)

    9:00am -   9:15am DARPA/ISTO Overview (Barry Boehm, DARPA/ISTO)

    9:15am -   9:40am STARS Program Overview (Jack Kramer, DARPA/ISTO)

    9:40am - 10:00am Workshop Overview (John Foreman, SEI)

 10:00am - 10:30am Issue: Reuse

 10:30am - 11:00am BREAK *[SEI 2nd floor lobby area]*

 11:00am - 11:30am Issue: Process

 11:30am - 12:00pm Issue: Software Engineering Environment

 12:00pm - 12:30pm Issue: STARS Evaluation

 12:30pm -   2:00pm LUNCH *[on your own]*

        *** SEI Conference Rooms ***

    2:00pm -   5:30pm Discussion Groups

    4:00pm -   4:30pm BREAK *[SEI 2nd floor lobby area]*

    6:00pm -   9:00pm Working dinner - initial feedback from DG leaders
                  to STARS Program

TUESDAY, 11 September 1990

        *** SEI Conference Rooms ***

    7:00am -   8:30am STARS Program meeting (continued, if needed)

    8:00am -   8:30am Continental breakfast *[SEI Cafeteria]*

    8:30am - 10:30am Discussion Groups (continued)

 10:30am - 11:00am BREAK *[SEI 2nd floor lobby area]*

 11:00am - 12:30pm Discussion Group Reports

 12:30pm -   2:30pm LUNCH *[Syria Mosque, banquet hall, lower level,*
                  with SEI Affiliates Symposium]

        *** Mellon Institute Auditorium ***

    2:30pm -   4:30pm Wrap-up - STARS initial responses to workshop issues

Candidate Issues for Discussion Groups

The following list identifies candidate issues that may be appropriate for discussion by workshop attendees. When filling out the "issues to be discussed" section of the application form, feel free to select one or more of these issues, or add your own to this candidate list.

1. How do industry and government users get involved with the STARS Program? Set up cooperative efforts? Affect internal R&D activities to take the most advantage of STARS products and technologies?

2. "I already have a significant investment in process and tools, and support for both. How do I capitalize on that, given STARS?"

3. What message can the STARS Program and system houses take to the CASE vendors?

4. Are there two distinct (and conflicting) CASE cultures emerging - the "front-end CASE" versus the "back-end CASE"? Is there a gap between the two? Where are other gaps? Which gap deserves the highest priority (i.e., should be addressed first)? What really is a "gap" (e.g., what does it mean to "integrate" tools)? What mechanism exists to confirm that a gap has been filled effectively?

5. What issues must be addressed when integrating multi-method/paradigm tools and multi-lingual systems? What support must be provided by an environment?

6. Where should the environment support (automation) end and the user manipulation (brute force) begin? For the purposes of automation and standardization, is STARS examining the highest leverage activities involved in software development/maintenance?

7. Economics - what business environment can be assumed "after STARS"?

8. How does STARS converge on the "right" building blocks for environments, for example:

   • Standard interfaces (POSIX, X11, SQL, MOTIF, CAIS, PCTE, ATIS, etc)

   • Program language bindings (Ada, C++, etc)

   What mechanisms should there be for interfacing between tools/languages coming from different basic paradigms (e.g., an Ada binding for X Windows)?

9. What environment support is required specifically for the development and maintenance of embedded systems? For distributed targets? Which of those issues should STARS be pursuing?

10. What should environments have to support reuse of all levels of artifacts (e.g., automated support for reasonable documentation, testing, recording of history, design records, full/formal specifications)?

11. What is STARS doing about system development processes that emphasize interactive models of designing and implementing (e.g., prototyping)?

Appendix D: Acronyms

ADPS	Application Development Process Support
AMS	Asset Management System
ANSI	American National Standards Institute
APSE	Ada Programming Support Environment
ATIS	A Tool Interface Standard
ATVS	Ada Test Validation System
CAIS	Common APSE Interface Set
CALS	Computer-Aided Logistics Support
CASE	Computer-Aided Software Engineering
C3I	Command, Control, Communications, and Intelligence
CDRL	Contract Data Requirements List
COTS	Commercial Off-The-Shelf
CPL/CPS	Common Prototyping Language/Common Prototyping System
DACS	Data and Analysis Center for Software
DARPA	Defense Advanced Research Projects Agency
Dem/Val	Demonstration/Validation
DSSA	Domain-Specific Software Architecture
DTIC	Defense Technical Information Center
ESD	Electronics Systems Division (AF Systems Command)
FFRDC	Federally-Funded Research & Development Center
FSED	Full Scale Engineering Development
GFE	Government-Furnished Equipment
GRACE	Generic Reusable Ada Component Environment
HPC	High Performance Computing
IDA	Institute for Defense Analyses
I/F	Interface
ISTO	Information Science and Technology Office (of DARPA)
JAC	Joint Advisory Committee
KB	Knowledge-Based
KBSA	Knowledge-Based Software Assistance
Mach	DARPA-Sponsored operating system
MCCR	Mission-Critical Computer Resources
MIS	Management Information System
MOA	Memorandum Of Agreement
NGCR	Next Generation Computer Resources
NAFS	National Andrew File System
NIST	National Institute of Standards & Technology
O&M	Operations & Maintenance

O/S	Operating System
OSD	Office of the Secretary of Defense
PCIS	Portable Common Interface Set (proposed merger of CAIS & PCTE)
PCTE	Portable Common Tool Environment
PDSS	Post-Deployment System Support
PEO	Program Executive Officer
PMR	Program Management Review
POSIX	Portable Operating System Interface
PSEWG	Programming Support Environment Working Group (of the NGCR)
RLF	Reusablity Library Framework
ROAMS	Reusable Object Access & Management System
ROI	Return On Investment
SADT	Structured Analysis & Design Technique
SEE	Software Engineering Environment
SFLC	Software-First Life Cycle
SGML	Structured Generalized Markup Language
SQL	Structured Query Language
SPO	System Program Office
SRL	Software Reuse Library
SRS	Software Requirements Specification
UI	User Interface
UIMS	User Interface Management System
WG	Working Group

Appendix E: Preliminary STARS Affiliates Program Description

STARS is considering the establishment of an affiliates program. This program is intended to provide an opportunity for the DoD software community to participate in the technology activities associated with the STARS Program.

The rest of this handout describes the thinking-to-date about the structure and objectives of the affiliates program. Your comments and ideas on how the affiliates program should operate are welcomed.

STARS affiliates would be individual representatives of organizations involved in software development for the government, including government contractors, universities, government agencies, and environment/tool vendors.

Several levels of affiliates are envisioned:

- *Information Dissemination Affiliates:* This level of affiliate would:

    - Have access to information regarding the STARS program such as newsletters,
    - Be included on the STARS mailing list,
    - Have access to the bulletin board, and
    - Be invited to an annual STARS Program briefing.

- *Information Exchange Affiliates:* This level of affiliate would play a more active role in the STARS Program. Information Exchange affiliates would participate in STARS technology exchange working group meetings. These working group meetings would be coordinated by STARS and would meet periodically with network interaction between meetings. Sub-groups might be established to focus on specific technology areas. Exchange associates would become familiar with the STARS Program and consistently participate in the working group meetings. In some cases, information exchange agreements may be required between STARS and the participating organization.

- *Prime Affiliates:* Prime affiliates would work directly with one or more of the STARS prime contractors in technology activities relevant to the STARS Program, such as product evaluation, technology transition, technology integration, and tool development. In addition to participation in the periodic workshops as described above, Prime affiliates might also participate in prime team meetings. Joint activities with any of the prime contractors would be arranged directly with that prime and would be handled on a case-by-case basis.

Labor and travel expenses associated with participation in the affiliates program would be the responsibility of the sponsoring organization. The STARS Program would provide meeting accommodations and network access.

Comments and suggestions regarding the affiliates program may be left at the STARS/Users Workshop Help Desk or sent directly to the STARS Center:

> STARS Center
> 1500 Wilson Blvd.
> Suite 317
> Arlington, VA 22209
> 703-243-8655

or via Email to:

> affiliates@stars.rosslyn.unisys.com

Appendix F: List of STARS Contact People and ESD Contracts People

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Reuse	M.J. (Maggie) Davis	(206) 657-6797	mjdavis@astarsgate.boeing.com
SEE	John Neorr	(206) 657-6790	neorr@astarsgate.boeing.com

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Seattle WA　98124-2499

-- IBM --

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SEE & Reuse	Bob Ekman	(301)240-6431	ekmanb@gbgvm7.iinus1.ibm.com

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Gaithersburg MD　20879

-- Unisys --

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SEE	Robert Munck	703-620-7991	munck@stars.reston.unisys.com
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