



SURVIVAL in a System of Systems World

SuZ Garcia
smg@sei.cmu.edu

Lisa Brownsword
llb@sei.cmu.edu



Agenda

The System of Systems World

US Army SURVIVAL Manual

Interpreting SURVIVAL for SoS

Summary



Systems of Systems—Health IT Example



Dynamic orchestrations and compositions of autonomously managed, operated, and evolving entities (both technical and organizational)

-That together create sets of desired effects for multiple users.

The effects are themselves dynamic and may or may not be part of the designed repertoire of behaviors of the individual entities



Implications of Systems of Systems

Dynamism of the participating entities and the effects they are trying to achieve and the environment they are working in

- The participating organizations need agility along multiple dimensions
- The demand environment – where you're trying to have an effect – is at least as dynamic as the supplier environment

Autonomy of both the technical and organizational entities

- The organizations participating are not likely to be operating by the same rules—they have different, often incompatible, *governance frameworks*

Effects that cannot be generated from the designed repertoire of individual entities and are *only seen in the system of systems as a whole*

- Unanticipated behaviors could be positive or negative
- Impossible to trace the behavior back to a single entity



Common Themes in Dealing with SoS

No Global View

Unanticipated System Behaviors

Capabilities can't keep up with needs

Unknown Participants

Synchronization Challenges

Latent Incompatibilities

"Common" Terms are understood differently



Why Draw from the US Army Survival Manual?

What does survival behind enemy lines have to do with Systems of Systems?

- The context is different, but the principles for action are surprisingly similar.
- For many of us, working in the SoS environment feels like being dropped into a foreign situation where survival is questionable!
- Staying alive depends on SURVIVAL.



SURVIVAL...the US Army Way!

Size up the situation



Undue haste makes waste

Remember where you are

Vanquish fear and panic

Improvise

Value living

Act like the natives

Live by your wits, learn basic skills



Size up the Situation The Manual Says...

“Size up your environment, physical condition, and equipment

- Environment—learn the rhythms of the area you are in
- Personal condition—take stock of any injuries from battle
- Equipment—take stock of the condition of your weapons”



Size Up the Situation

SoS Application

Expand notion of *environment*:

- The environment you need to analyze is political and social, not just hardware and software components
- The environment for a SoS typically goes beyond enterprise boundaries, and must include the customer/user view
- What's the governance framework you're working in? Is it compatible with other participants'?
 - Are you in a more directed or more collaborative SoS situation?

Expand notion of *personal condition*:

- Think not just of your condition as an individual, but your group's/organization's condition as well
- Don't just think about your system, but the system of system of a whole

Expand notion of *equipment*:

- your equipment—your tools and weapons—in this case include your skills, network of participants you're involved with, sponsorship
 - Some of the skills you'll need are different than ones you've used in the past



Undue Haste Makes Waste The Manual Says...

“You may make a wrong move when you react quickly without thinking or planning, and that move may result in your capture or death. Don’t move just for the sake of taking action. Consider all aspects of your situation (size up your situation) before you make a decision and a move. If you act in haste, you may forget or lose some of your equipment, and you may become disoriented so that you don’t know which way to go. Plan your moves so that you are prepared to move out quickly without endangering yourself if the enemy is near you.”



Undue Haste Makes Waste

SoS Application

“You may make a wrong move when you react quickly without thinking or planning,

- understanding the relevant scope of the purpose and participants in a SoS takes time
- Your actions affect many more constituents in a SoS than you’re accustomed to – acting too quickly (e.g. baselining your requirements too quickly) can create more constraints on the system of systems than is useful

Don’t move just for the sake of taking action.

- Just because a new standard has been released doesn’t mean that it will be broadly adopted – being “first” is often not the right approach in the SoS world

Consider all aspects of your situation

- Sorry, in a SoS world you can only hope to understand enough aspects of the situation to feel safe to move forward, never “all”
- BUT, the typical aspect we miss in SoS is the dynamism of the context of use and the demand environments for our system, which are keys to understanding the SoS



Remember Where You Are The Manual Says...

“Pay close attention to where you are and to where you are going. Do not rely on others present to keep track of the route. Constantly orient yourself. You should always try to determine, as a minimum, how your location relates to:

- The location of enemy units and controlled areas.
- The location of friendly units and controlled areas.
- The location of local water sources (this is especially important in the desert).
- Areas that will provide good cover and concealment.”



Remember Where You Are

SoS Application

“Pay close attention to where you are and to where you are going.”

- Strive for a shared sense of purpose among known participants

“Do not rely on others present to keep track of the route.”

- Constant communication is needed to ensure that your understanding of the demand context is current

“Constantly orient yourself.

- Influence maps may be one way to understand which participants are most important to pay attention to

Try to determine how your location relates to...

- Other participants in the SoS, your users, the customers you know about, your anticipated context of use



Vanquish Fear & Panic

The Manual Says...

“The greatest enemies in a combat survival/evasion situation are fear and panic. If uncontrolled, they can destroy your ability to make an intelligent decision. They may cause you to react to your feelings and imagination rather than to your situation. They can drain your energy and thereby cause other negative emotions. Previous survival/evasion training and self-confidence will enable you to vanquish fear and panic.”



Vanquish Fear and Panic

SoS Application

Fear and panic... “may cause you to react to your feelings and imagination rather than to your situation. They can drain your energy and thereby cause other negative emotions.”

- Often we react to imagined viewpoints on the SoS rather than gathering the data to understand the real context of use.

You can get trapped in the fear and panic related to the enormity of the changes you're dealing with

- You've probably dealt with ambiguous situations in the past and you've survived, even thrived!
 - Just because our assumptions and practices have to change doesn't mean we aren't competent to learn new ways
- Don't imagine failure when all you're facing is uncertainty, not doom!



Improvise The Manual Says...

“This easy-to-come easy-to-replace culture of ours makes it unnecessary for us to improvise. This inexperience in improvisation can be one of the greatest enemies in a survival situation. Learn to improvise. Take a tool designed for a specific purpose and see how many other uses you can make of it.

“Learn to use natural things around you for different needs. An example is using a rock for a hammer. No matter how complete a survival kit you have with you, it will run out or wear out after awhile. But your imagination will not. Use it.”



Improvise

SoS Application

“Take a tool designed for a specific purpose and see how many other uses you can make of it.”

- Much of the challenge in SoS is in finding new uses for the tools we have, even though how to use them effectively isn't obvious
- The tools for SoS you may wish to improvise with include making greater use of scenarios....

“Learn to use natural things around you for different needs.”

- The “natural” things in an organization are the existing structures, procedures, etc that are already in place. Use them where possible, adapt them to the needs of your anticipated demand context when they can't be used as is

No matter how complete a survival kit you have with you, it will run out or wear out after awhile. But your imagination will not. Use it.”

- Adapting new tools from our existing knowledge is one of the things that we believe will improve our ability to construct SoS of the future – don't be afraid to experiment!



Value Living

The Manual Says...

"All of us were born kicking and fighting to live. But we have become used to the soft life. We have become creatures of comfort. We dislike inconveniences and discomforts. So, what happens when we are faced with a survival situation with its stresses, inconveniences, and discomforts? This is when the will to live—placing a high value on living—is vital. The experience and knowledge you have gained through life and through your Army training have bearing on your will to live. Stubbornness, a refusal to give in to problems and obstacles that face you, will give you the mental and physical strength to endure."



Value Living

SoS Application

“But we have become used to the soft life. We have become creatures of comfort. We dislike inconveniences and discomforts.

- Get over it! Our work lives will never be “comfortable” again

The experience and knowledge you have gained through life and through your <Army> training have bearing on your will to live.

- Many of the things you know can be applied in different ways, if you’re willing to be stubborn about finding new ways to use them

“Stubbornness, a refusal to give in to problems and obstacles that face you, will give you the mental and physical strength to endure.”

- You may not need much physical strength to endure the SoS environment, but most people involved with SoS would agree you need significant mental AND emotional strength to endure!
- Keeping a shared sense of mission going is one of the ways to help with your mental strength, especially if you understand the consequences of NOT succeeding!



Act Like the Natives

The Manual Says...

“The natives and animals of a region have adapted to their environment. To get a feel of the area, watch how the people go about their daily routine. When and what do they eat? When where, and how do they get their food? When and where do they go for water? What time do they usually go to bed and get up? These things are important to you as an evader.”



Act Like the Natives

SoS Application

“The natives and animals of a region have adapted to their environment.”

- We all adapt to the cultural environment of our organization to some extent.
- In SoS, we have multiple, often conflicting cultural environments to adapt to
- Understanding the patterns of adaptation that are needed can help you to find leverage points for enabling change

“To get a feel of the area, watch how the people go about their daily routine.”

- Analyze the “as is” demand for relevant participants and how work is done in the current environment.



Live by Your Wits, Learn Basic Skills The Manual Says

“Without training in basic skills for surviving and evading on the battlefield, your chances of living through a combat survival/evasion situation are slight.

“The time to learn these basic skills is NOW—not when you are headed for or are in the battle. How you decide to equip yourself prior to deployment will impact on whether or not you survive. You need to know about the environment to which you are going, and you must practice basic skills geared to that environment. For instance, if you are going to a desert, you need to know how to get water in the desert.”



Live by Your Wits, Learn Basic Skills Application

“The time to learn these basic skills is NOW—not when you are headed for or are in the battle.”

- It takes time to adapt your behaviors to a SoS environment... Thinking about and practicing now will make the transition easier

“How you decide to equip yourself prior to deployment will impact on whether or not you survive.”

- Understand the tools you know you need to be successful and get comfortable using them
 - “if you do what you’ve always done, you’ll get what you’ve always gotten” and that’s typically not good enough in a SoS world!

You need to know about the environment to which you are going, and you must practice basic skills geared to that environment.

- All SoS settings are different – understand how they differ!
 - And the skills you need will be different – been to a negotiation class lately?



Summary

Asymmetric demand environment, dynamic composition, compatibility of governance frameworks, latent incompatibilities, dynamic contexts of use.....(we didn't introduce you to *all* of these today, but you'll be seeing them in your reading!)

- Some new terms, some new concepts, some new ways of looking at “old” ideas
- A profound and fundamental shift from *asserting control* to *managing influence*

Using metaphoric exercises like figuring out how SURVIVAL plays in this world can help you ground the new concepts

ISIS (Integrating Software Intensive Systems) Initiative of the SEI is actively working on finding ways to navigate this new systems space—stay tuned!

