# *14 sm SCEs around the world in 40 days*

Case Studies

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# *Agenda*

- Who are the players ?
- Car Builder Awakening
- Obtaining CMM Specialists
- SCE Results
- After the SCEs -Milestones 2-4
- Lessons Learned

# *Acronyms*

- CMM: Capability Maturity Model
- KP: Key Practice
- KPA: Key Process Area
- LIRR: Long Island Rail Road
- ML: Maturity Level
- MTA: Metropolitan Transit Authority
- NTP: Notice to Proceed
- PAIS: Process Assessment Information System
- SCE: Software Capability Evaluation
- SQA: Software Quality Assurance

# *Who are the players ?*

- Customer: LIRR New York City, USA
  - NYC MTA's largest commuter railroad in the USA operating 735 trains
  - Replacing/refurbishing entire system $4.6 billion
- Car Builder: Bombardier Transport Montreal, Canada
  - LIRR awarded $655 million CAN ($445million US) contract for design, manufacture and delivery of commuter rail cars; with options, contract worth $2.7 billion CAN ($1.85 billion US)
- Suppliers to Car Builder: Typically small @ 200 employees
  - Propulsion systems - Display systems - Cab Simulators
  - Braking systems - Communication Systems - Event Recorder
  - Signalling systems - Electric power systems - Door Systems
  - Control systems -Air-conditioning systems - Toilet Systems

# *Why CMM and SCE ?*

- Motivation to choose CMM
  - Software was pervasive in all aspects of the LIRR refurbishment plans (trains, stations, controls, interfaces)
  - Convinced adopting CMM would provide better quality products
- Motivation to chose SCE Method
  - Customer desired objective evaluation of the Integrator (Car Builder) and its' suppliers relative to the CMM

# *Customer Requirements*

- SCE to be performed within first 3 months of contract (Milestone I)
- If not ML 2
  - Action Plan to mitigate the risks on the project
  - Action Plan to reach ML 2 in 24 months
  - Actions Plans need to be delivered in the first 6 months
  - Monthly Progress Report
- Follow-Up SCE to confirm achievement to ML 2 within 24 months of contract award (May 1999)

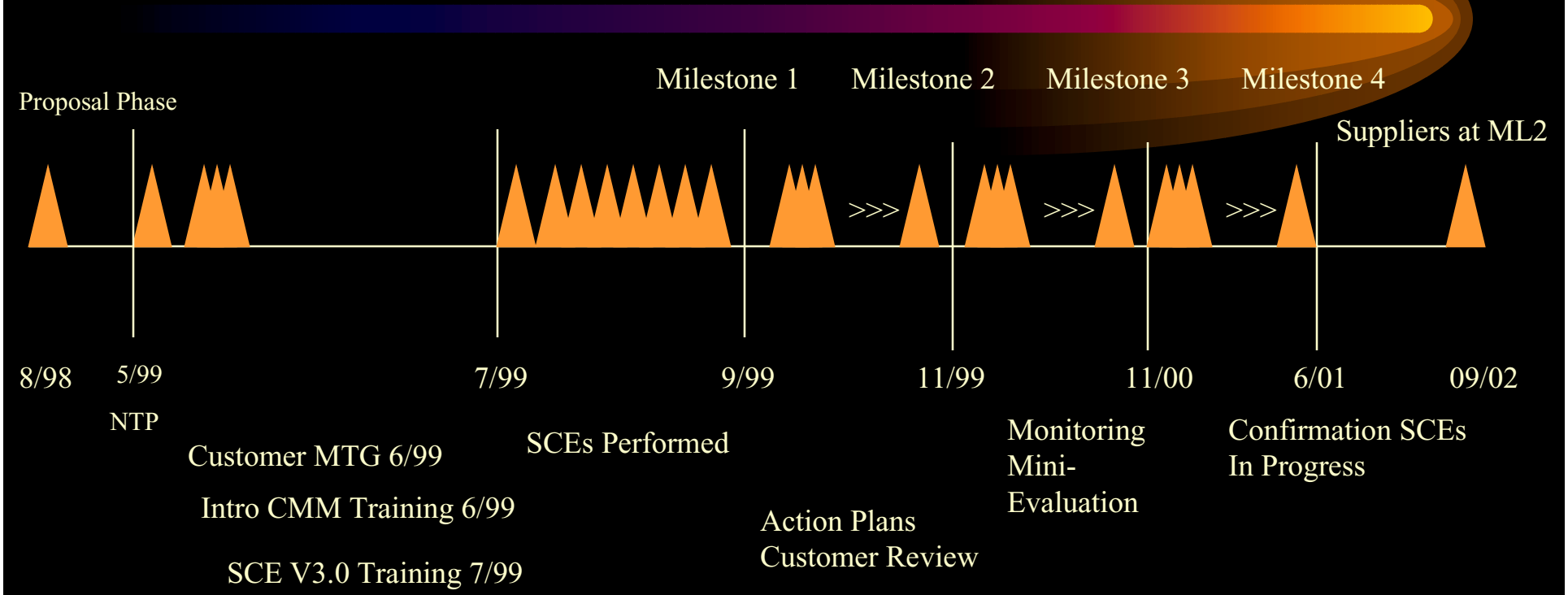
# *Car Builder Awakening*

- Proposal phase- Car Builder had a limited understanding of the implications of CMM Requirements
- CMM and SCE method knowledge virtually zero
  - CMM and SCE Team Training Required
  - Logistics of obtaining training and executing SCEs developed as required
- Suppliers (20) negotiations ongoing at beginning
  - Two aspects of negotiation
    - Negotiating for their portion of overall Car Builder contract
    - Negotiating regarding SCE requirements and schedule
- Who would pay for the SCE ?
  - Car Builder or the Suppliers?

# *Car Builder Schedule: NTP*

- Notice to Proceed: May 23rd, 1999
- Customer Meeting “How Car Builder will execute”: June 24th, 2001
- Training:
  - Intro to CMM June 14-18th, 1999
  - SCE V3.0 Team Training: July 5-8th, 1999
- First SCE started: July 12th, 1999
- Last SCE ended: August 19th, 1999
- Milestone I: August 23rd, 1999

# *Car Builder Timeline*



# *Obtaining CMM Specialists*

- Contracting an external Canadian consulting firm
- Finding SCE Lead Evaluators
- Contracting independent Lead Evaluators to perform 14 SCEs in 6 weeks
- Meet the Customer
- Establish the Evaluation Plan
- Availability of Lead Evaluators and SCE team members for 6 weeks

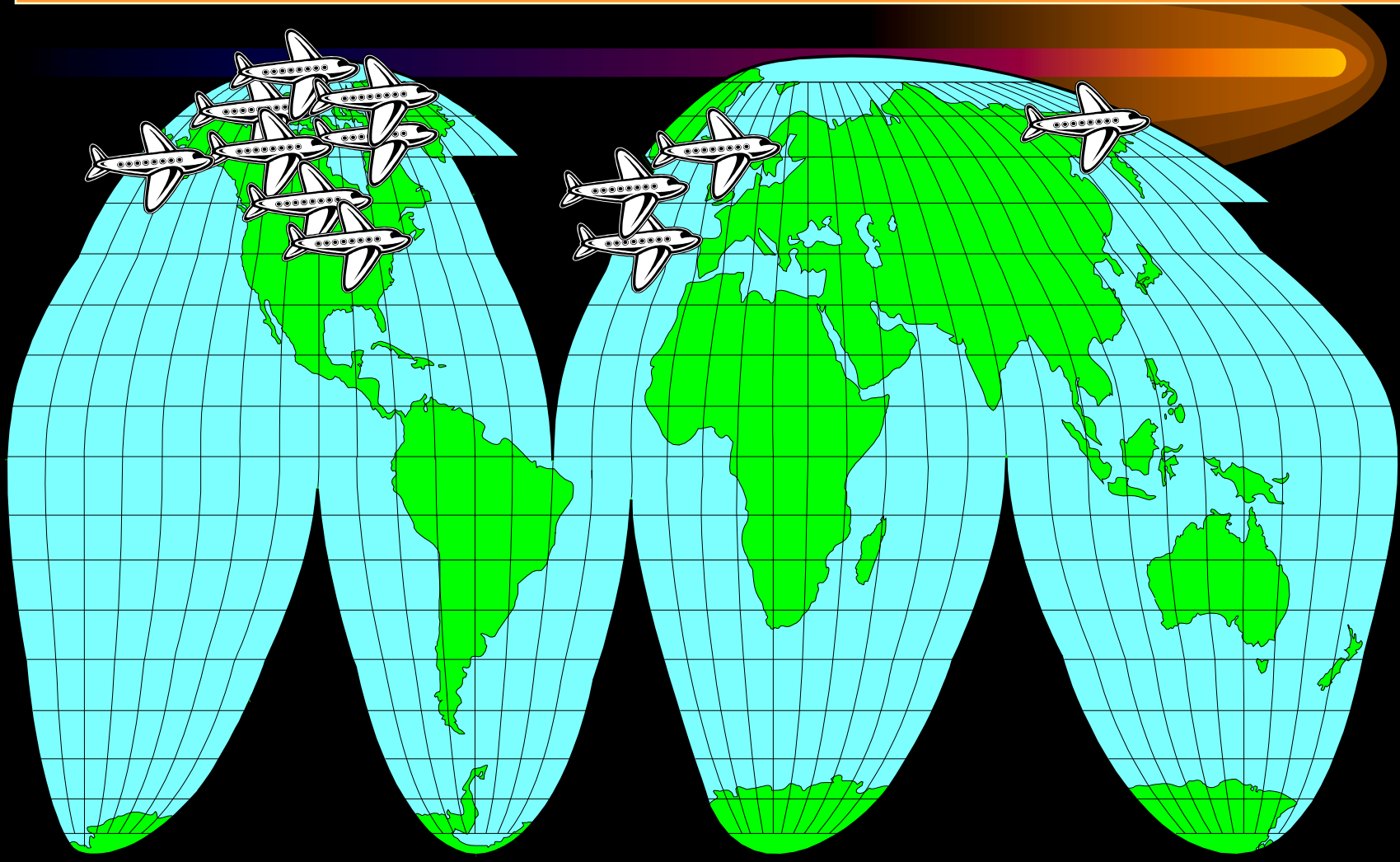
# *Training the Team Members*

- No Lead Evaluator would commit to 14 SCEs in six weeks
- 3 SCE Teams of 5 members
  - Suppliers Team A
  - Suppliers Team B
  - Car Builder Team C
- Team Members from:
  - Customer, Car Builder, External consultants
  - Assess team members experience and credentials, knowledge of CMM

# *Planning for Multiple, Multinational SCE Execution*

- Initial SCE Plan expanded to include changing execution requirements
  - list of suppliers to evaluate not finalized
  - itinerary for each team unknown
- Teams had no common tools or templates
  - Established common templates and tools for the three teams (laptops, projectors, worksheets, scripts and reports)
  - Established a communications protocol for Car Builder's notification
- Car Builder desired Ratings (satisfied/not satisfied) for all KPs and ML

# SCEs Around the World in <40 Days



# *Travel Schedule for Team A*

- July 12-15: Westminster, MD (3 days)
  - SCE team not onsite 14th
- July 19-23: Osaka, Japan (5 days)
- July 27-29: Germany (3 days)
- August 2-4: Chicago, IL (2.5 days)
- August 4-6: London, Canada (2.5days)
- August 9-11: La Pocatière, Canada (3 days)

# *Travel Schedule for Team B*

- July 14-16: Pittsburgh PA (3 days)
- July 25-28: Madrid, Spain (3.5 days)
- July 28-30: Madrid, Spain (2.5 days)
- August 9-11: Montréal QC, Canada (3 days)
- August 17-19: Victoria BC, Canada (3days)

# *Travel Schedule for Team C*

Car Builder: Two distinct Software Groups

- August 9-11: Software Development Group, Montréal QC, Canada (2.5 days)
- August 11-14: Car Builder and Information Technology Group, Montréal QC, Canada (3.5 days)

- Note: Car Builder is not developing Software for Customer only acquiring it

# *SCE Logistics*

- Team Members first language and culture
  - English, French, Spanish, Vietnamese
- One team had Car Builder team members rotating at each SCE site
- Suppliers in multiple countries-concerns
  - Interpreters
  - Facilities, rooms, electrical power, catering
  - holidays
- CMM interpretation learning curve, fairness to all suppliers e.g. institutionalization rules

# *SCE Logistics -2*

- Living Expenses and credit card acceptability unknown (some team members ran out of money)
- Single Point of Contact for the Travel Logistics
  - Airline and rental car reservations
    - Coordinating travel for multinational teams going to multiple countries in a short timeframe was formidable
    - Business Class travel and accommodations was standard
- Security
  - One site precluded late night work by team due to security issues of neighbourhood
- Confidentiality agreements

# *Milestone I: SCE Results*

- 14 SCEs performed by 3 teams
- All ML 1
- Key Practices Rated
  - 6 SCE for 121 Key Practices (ML 2 KPAs)
  - 8 SCE for 99 Key Practices (ML 2 KPAs less SSM)
  - 1 SCE for 4 Goals (Discovered On-Site Only that Software Development is Subcontracted)
- Worst KPAs: SQA and SPTO
- Worst Goals: SPP1, SQA3 and SCM1

# *After the SCEs - Milestones 2-4*

- Customer Requirements
  - Action Plan to Mitigate the risks on the project (Milestone 2)
  - Action Plan to reach ML 2 within 24 months (Milestone 2)
- Car Builder required Actions for each Key Practice(s) found "Not Satisfied"
- After final negotiation:
  - Of the 12 Software Development Organizations, 3 suppliers received a Waiver from CMM implementation (MIS, Simulator, Small Modifications to existing Software)

# *Customer reviews*

- Customer reviewed Action Plans
  - As part of Milestone 2
  - Supplier(s)Goals Satisfied
    - Best organization: 15 on 20 goals satisfied
    - Worst organization: 2 on 20 goals satisfied
    - Organization under 25 % goals Satisfied were required to defend their Action Plans

# *Monitoring the Progress*

- Monthly Progress Report
  - 121 Key Practices Implementation Status Worksheet
- Quarterly visits by Car Builder SQA Advisor to validate progress
  - only “Not Satisfied” Key Practices
- Monitoring
  - Progress on the Documentation Activities
  - Progress on the Training Activities
  - Progress on the Implementation Activities

# *Milestone 3: Mini-Evaluation*

- Planned
  - 12 months after Approval of Action Plans
  - Confirm progress
    - Documentation and Implementation
  - Re-Confirm the “Satisfied” rating of Key Practices
- Reality
  - Confirm readiness for Follow-up SCE
  - Only two done at the 12 months milestone

# *Milestone 4: Reaching ML 2*

- Confirming ML 2
  - NTP + 24 months
- Performed by a SCE Team
  - 2 to 5 members
- Paid for by Suppliers
- Customer strongly recommended the use of the same SCE team or at minimum the same Lead Evaluator who performed “baseline” SCE
  - To date both Baseline Lead Evaluators and some of the original SCE Team Members have participated in the ML2 confirmation SCEs

# *Milestone 4: Follow-Up SCE*

- First Supplier ready 16 months after initial SCE
- Worst Supplier (102 KP “Not Satisfied” at the initial SCE) close to ML 3
- Customer Confidence with one Supplier went from the worst to the best, as a result of the ML Progress. Resulted in:
  - Less tracking and reporting activities from Customer and Car Builder
  - Less on-site visits by the Customer and Car Builder
  - Facilitate the approval of the Software Documentation

# *Milestone 4: SCE Results*

- By May 23rd, 2001:
  - 5 SCEs performed confirming achievement of ML2
  - 5 reached ML 2
  - One close to ML 3
  - Firm intention to move towards ML 3 within next 12 months
- What about the others ?
  - Extensions till December 2001, May 2002, August 2002
  - Customer has no intention to relax the ML2 requirement

# *After Milestone 4: First ML3*

- In June 2000
  - Potential Software Supplier reach ML2 in order to be considered in the selection process
- In February 2002
  - One Software Supplier reached ML3
    - Most critical Software Systems is developed by this Software Supplier
    - Only Software Supplier to reach ML3
    - Considered an Internal Software Supplier of the Car Builder
- In August 2002
  - Car Builder reach ML2

# *After Milestone 4: The last ones*

- In August 2002
  - One other Software Supplier reached ML2
  - One Software Supplier, not selected on the project, reached ML2 (stay competitive)
- In September 2002
  - Last Software Supplier to reach ML2

# *After Milestone 4: Final Results*

- 14 SCE in 40 days
- One Supplier reach ML2 in 16 months
- One Supplier reach ML3 in 30 months
- One Supplier not selected reach ML2 in 36 months
- Six Suppliers reach ML2 within the 24 months
- All selected Suppliers reach at least ML2 within 36 months
  - 10 Organizations (Car Builder and Software Suppliers)

# *Lessons Learned*

- Customer:
  - Software continues to become ubiquitous and pervasive in their traditional “brick and mortar and steel industry”
  - Changing demands of their customers--higher quality service
  - SCE should have been performed for ML3 to cover the Software Product Engineering and Peer Reviews
- Car Builder:
  - Ditto customer demands for higher software quality
  - Must “lead, demand” same quality from suppliers
  - Provide Increased Confidence in Supplier’s Capability and Supplier’s Change Requests

# *Lessons Learned -2*

- Car Builder SQA Advisor
  - From an ISO Auditor to a CMM Lead Evaluator
  - Monitoring Approach- constancy of purpose pays off
- Suppliers:
  - CMM software process improvement works!
  - Seek professional SPI help immediately
  - Better working relationships with Car Builder
  - Stronger position for negotiating  with all customers
    - (better estimates, known processes, confident work force)

# *Lessons Learned -3*

- Lead Evaluators:
  - Multinational teams can effectively perform in multiple countries with different cultures and languages
  - Logistics require extensive, dedicated attention to detail
  - Close attention to CMM interpretation issues is vital to consistency
  - A 2nd language would be helpful
  - Team members with 2nd and 3rd language capabilities are invaluable

# *Lessons Learned -4*

- Lead Evaluators:
  - Interpreters, ideally, will be familiar with CMM and have attended Intro to CMM training, or participated in SCE or assessment
  - Documents written in language team does not know requires a CMM knowledgeable interpreter
  - Plan for worse case scenarios e.g. Lead Evaluator does not make plane connection, is not there for kick off, team member takes ill
  - Insist on Suppliers to provide ready access to the documentation for entire SCE On-Site evolution

# *Presenters*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