

*14sm 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 1)
- 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)

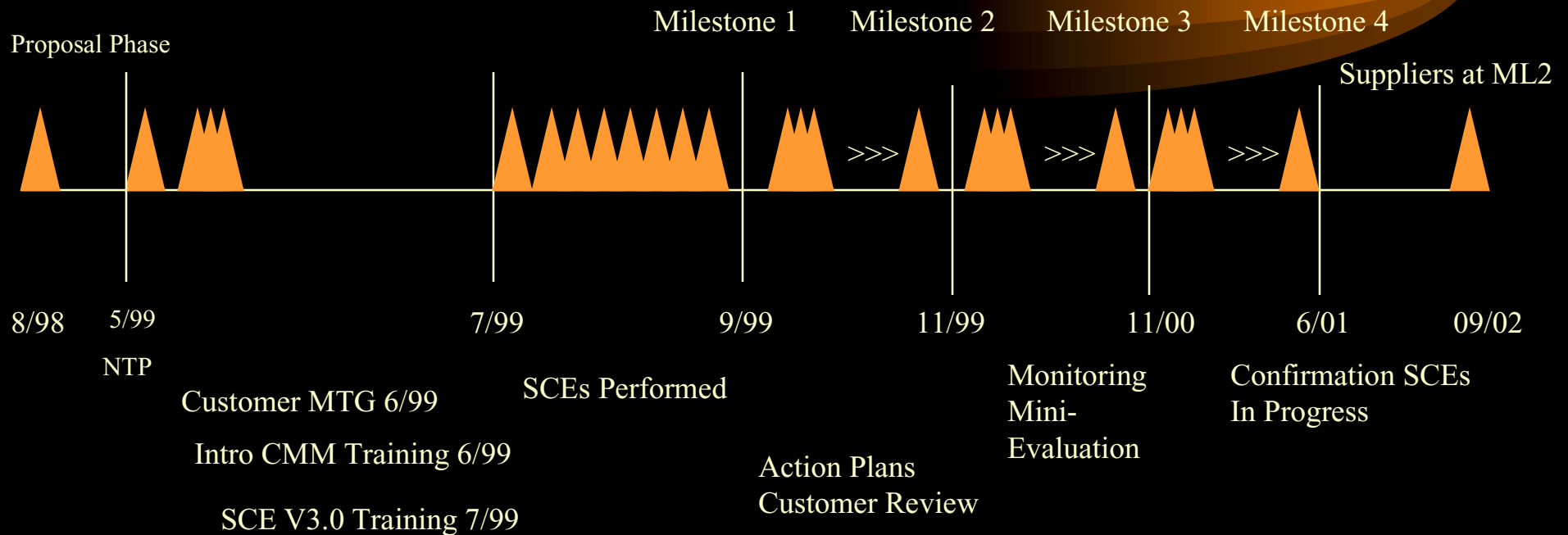
Car Builder Awakening

- 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

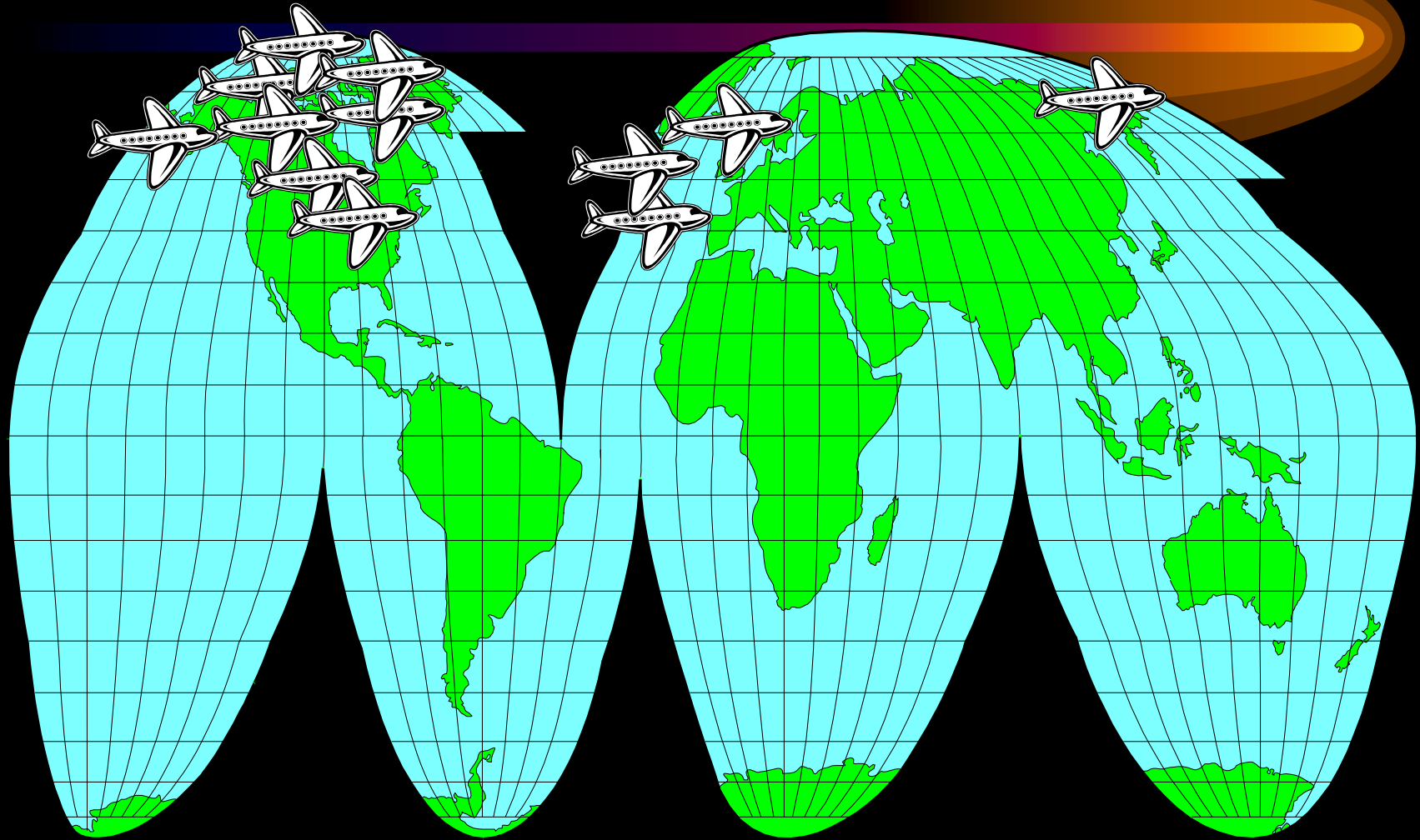
Training the Team Members

- 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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