The Software Engineering Laboratory (SEL)

Consortium of
- NASA/GSFC
- Computer Sciences Corporation
- University of Maryland

Established in 1976

Goals
- better understand software development
- improve the process and product quality
  at Goddard, formerly in the Flight Dynamics Division, now at the Information Systems Center
using observation, experimentation, learning, and model building
Observation, Feedback, Learning, Packaging

Used the SEL as a laboratory to build models, test hypotheses,
  Observation played a key role
  Feedback loops provided an environment for learning
  Generated lessons learned that were packaged into process, product
  and organizational structure

Used the University to test high risk ideas

Developed technologies, methods and theories when necessary

Learned what worked and didn’t work, applied ideas when applicable

Kept the business going with an aim at improvement, learning
SEL Experience Factory Structure

DEVELOPERS
(SOURCE OF EXPERIENCE)

- STAFF: 275-300 developers
- TYPICAL PROJECT SIZE: 100-300 KSLOC
- ACTIVE PROJECTS: 6-10 (at any given time)
- PROJECT STAFF SIZE: 5-25 people
- TOTAL PROJECTS (1976-1994): 120

PROCESS ANALYSTS
(PACKAGE EXPERIENCE FOR REUSE)

- STAFF: 10-15 Analysts
- FUNCTION:
  - Set goals/questions/metrics
  - Design studies/experiments
  - Analysis/Research
  - Refine software process
  - Produce reports/findings
- PRODUCTS (1976-1994): 300 reports/documents

DATA BASE SUPPORT
(MAINTAIN/QA EXPERIENCE INFORMATION)

- STAFF: 3-6 support staff
- FUNCTION:
  - Process forms/data
  - QA all data
  - Record/archive data
  - Maintain SEL data base
  - Operate SEL library
- SEL DATA BASE: 160 MB
- FORMS LIBRARY: 220,000
- REPORTS LIBRARY:
  - SEL reports
  - Project documents
  - Reference papers

PO

NASA + CSC

EF

NASA + CSC + U of MD
Technology Transition Process
Improving via the Experience Factory

- Public domain process
- Current local process
- Problems

- Tailored process
- Goals
- Measurement & feedback
- Lessons learned & recommended changes
- SEL tailored process

Project Organization
- Project 1
- Projects 2, 3, ...

Experience Factory
- Researcher Analyst
- Experimenter Team
- Model Packager
Using Baselines to Show Improvement
1987 vs. 1991

Error Rates (development)

- Early Baseline: 8 similar systems, High 8.9, Average ~4.5, Low 1.7
- Current: 7 similar systems, High 2.4, Average ~1, Low 0.2

Cost (staff months)

- Early Baseline: 8 similar systems supporting 4 projects, High 755, Average ~490, Low 357
- Current: 7 similar systems supporting 4 projects, High 277, Average ~210, Low 98

Reuse

- Early Baseline: 8 similar systems, Average ~20%
- Current: 8 similar systems, 61% FORTRAN (3 systems), 90% Ada (5 systems), Average ~79%

- Increased 300%
Using Baselines to Show Improvement

Continuous Improvement in the SEL

Decreased Development Defect rates by

75% (87 - 91)  37% (91 - 95)

Reduced Cost by

55% (87 - 91)  42% (91 - 95)

Improved Reuse by

300% (87 - 91)  8% (91 - 95)

Increased Functionality five-fold (76 - 92)

CSC

officially assessed as CMM level 5 and ISO certified (1998),
starting with SEL organizational elements and activities