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

**PO**  
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)

**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

**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**

**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

**SEL DATA BASE**
- FORMS LIBRARY
- REPORTS LIBRARY
- 160 MB
- 220,000
  - SEL reports
  - Project documents
  - Reference papers

**STAFF 3-6 support staff**

**FUNCTION**
- Process forms/data
- QA all data
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**NASA + CSC**

**PO PROCESS ANALYSTS**

**EF**

Using Baselines to Show Improvement  
1987 vs. 1991

- **Error Rates (development)**
  - High 8.9
  - Average 4.5
  - Low 1.7
  - Decreased 75%

- **Cost (staff months)**
  - High 755
  - Average 490
  - Low 357
  - Reduced 55%

- **Reuse**
  - High 90
  - Average 79%
  - Increased 300%

**Early Baseline** = 1985-1989
**Current** = 1990-1993
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

Fraunhofer Center
for Experimental Software Engineering
was created in Maryland in 1998