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JPL REUSE PROGRAM

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The goal of the JPL reuse activity is to develop a quantitative understanding of the factors which encourage or inhibit software reuse, and of productivity improvements achievable through reuse. The primary activity is the measurement of parameters relevant to reuse in the environment of actual projects. The program has three objectives: (1) to develop a model to allow assessment of competing reuse techniques, (2) to extend reuse from the unit to the sub-system level, and (3) to expand from specific applications to a broader application domain. Application domains, which apply to all interplanetary projects, include Mission Operations, Science Information Systems, Flight Software, and Simulations. The program is targeting all phases and activities of the life cycle and a full range of software products. The approach will be both experimental (observe, hypothesize and evaluate) and constructive (introduce new tools and techniques). The primary target projects are Deep Space Network activities - the Ground Facilities facility upgrade, the Network Operations Control Center upgrade, and the Signal Processing Center. This is the first group of closely related projects being done in Ada at JPL. A "reuse base" will be developed initially by classifying potentially reusable components from one project; it will be used and expanded with additional projects.

GOAL

GOAL: Improve the software development process by application of advanced reuse technology

- OBJECTIVES:**
- Develop a model to allow assessment of competing techniques for reuse
 - Improve leverage by extending reuse from the unit to the subsystem level
 - Expand from specific applications to broader application domain

SCOPE - APPLICATION DOMAINS

- **Mission Operations** (planning, commanding, navigation, tracking and data acquisition for unmanned spacecraft)
- **Science Information Systems** (data management, level conversion, visualization, analysis and modeling)
- **Flight Software** (autonomous spacecraft operation, instrument software)
- **Simulations** (spacecraft operations, physical processes, command/control problems)

SCOPE - FULL LIFE CYCLE - ALL PHASES AND ACTIVITIES

Investigate impact of reuse on:

- **Requirements Analysis**
- **Design**
- **Implementation**
- **Integration**
- **Test**
- **Maintenance**
- **Inter-project relationships**

SCOPE - FULL RANGE OF SOFTWARE PRODUCTS

- **Plans and Procedures (e.g. software management plans, configuration management plans, integration and test plans)**
- **Requirements and Constraints**
- **Designs**
- **Code (e.g. 3GL, 4GL, execution procedures, data tables)**
- **Test cases and test data**
- **Development tools and environments**
- **Run-time data (e.g. file labels, digital maps)**

APPROACH

CHARACTERISTICS

- **Experimental** [observe (exploratory, descriptive), hypothesize, evaluate]
- **Constructive** (introduce new tools and techniques rather than survey natural selection)

STEPS

- **Identify currently available reuse technologies**
- **Select a model that seems likely to improve software development**
- **Construct a "reuse base" based on the model**
- **Observe (measure) utilization patterns by actual development projects**
- **Revise and refine model based on observations**
- **Recommend tools and techniques for effective reuse**

TARGET PROJECTS

Deep Space Network

- **Ground Communications Facility Upgrade (GCF)**
- **Network Operations Control Center Upgrade (NOCC)**
- **Signal Processing Center (SPC)**

Others (TBD)

BACKGROUND

Products available from previous work:

- **Theoretical model**
- **Technology assessment**
- **Metrics evaluation**
- **Behavioral design for reuse base**

SCHEDULE

Phase 1 (FY89)

- **Determine user needs (GCF); acquire and analyze components**
- **Design reuse base**
- **Implement reuse base**
- **Analyze reuse and report**

Phase 2 (FY90-91)

- **Determine user needs (NOCC, SPC)**
- **Identify new suppliers**
- **Modify reuse base design**
- **Implement modifications**
- **Monitor reuse; add users; add suppliers; adapt reuse base**

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