N-SET - A NASA Research project

NASA Cost Symposium

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Pasadena CA

Presentation Topics

☐ Background
☐ Goals/Objectives
☐ Approach
☐ Usages and Applications
☐ N-SET Design Details
☐ Schedule
☐ Challenges
☐ Summary
Background

Research Task initially awarded in FY05

Problem – NASA is unable to estimate software size/cost early in a project because the software requirements/architecture are not complete and cost model inputs, primarily size, are not available

Purpose - To develop a high level software estimation capability that does not use Lines of Code as an input value

Goals/Objectives

- To use NASA historical experience for creating software estimates
- To provide a user friendly, high level software estimating tool
- To improve the software estimating within NASA
Approach

- Determine integrated mission parameter set
- Proof of Concept
  - GSFC
  - GRC
  - JSC
  - MSFC
- Data Analysis
  - Normalize
  - Stratify
  - Evaluate
  - Validate
- Validation Data
- Develop Tool
  - User Friendly
  - Documented
- Collect Data
- Modify collection forms
- = current activities
- = complete activities
- Documentation

Usages and Applications

- Rough Order Magnitude (ROM) estimates
  - Early "should cost" to establish budget
  - Starting point when no data is available
- Compare to contractor estimates
- Can supplement other methodologies
- Not intended to compete with fidelity of commercial models
Strengths

- Contains NASA data
  - Unique in how we do business
  - Different than DoD
- Uses statistical techniques
- Is self-calibrating
- Easy to use
- Does not require lines of code as an input parameter
- Available at no cost

Beneficiaries and Benefits

<table>
<thead>
<tr>
<th>Beneficiary</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPAO</td>
<td>Data and metrics for use in Independent Cost Estimates (ICEs) and Source Selection evaluations. Tool consistent with CADRe data.</td>
</tr>
<tr>
<td>NASA HQ</td>
<td>Can be used to develop &quot;Should Cost&quot; estimates.</td>
</tr>
<tr>
<td>NASA Centers</td>
<td>Will help with analogy for proposals and other types of estimate preparation.</td>
</tr>
<tr>
<td>NASA Support Contractors</td>
<td>Will provide general information about historical programs so that they can do a better job of preparing their products and estimates for NASA.</td>
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</tbody>
</table>
N-SET Design Details

- No SLOC data required, but part of the internal database
- Based on basic COCOMO algorithms
  - Quantitative responses
  - "Nearest Neighbors" concept
- Iterative process – "training" and "testing" for sensitivity

N-SET Design Details – Artificial Intelligence Agents

- Takes a "partial description" of a project
  - E.g. analyst capability (in COCOMO 81 "acap=1")
- Goes to database of projects
  - E.g. NASA93 COCOMO 81 database
- Find projects "near" the partial description(s)
  - E.g. find the 20 "nearest neighbors" in database
- Build cost models from the 20 "nearest neighbors"
- Compare cost models to other "partial descriptions"
## N-SET Details – Input Selections

### Programming Languages

<table>
<thead>
<tr>
<th>Language</th>
<th>Software Class</th>
<th>Default Flight WBS</th>
<th>Default Ground WBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIX</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Assembly</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Basic</td>
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<tr>
<td>C90</td>
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<tr>
<td>C++</td>
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<tr>
<td>C#</td>
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<tr>
<td>FORTRAN</td>
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<tr>
<td>JAVA</td>
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<tr>
<td>JOVIAL</td>
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<tr>
<td>Katla</td>
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<tr>
<td>PL/1</td>
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<tr>
<td>PASCAL</td>
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<tr>
<td>Shell languages (Csh, bash, etc.)</td>
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<td></td>
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<tr>
<td>Scipting languages (Perl, awk, etc.)</td>
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<tr>
<td>Unknown (AI)</td>
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</tbody>
</table>

### Operating Environment

<table>
<thead>
<tr>
<th>Model</th>
<th>Application</th>
<th>Focus</th>
<th>Development Environment</th>
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</thead>
<tbody>
<tr>
<td>Agile</td>
<td></td>
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<td>Scrum &amp; Agile Practices</td>
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<td>Kanban</td>
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### Tools

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<th>Description</th>
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<tr>
<td>Jira</td>
<td>Issue Tracking System</td>
</tr>
<tr>
<td>Github</td>
<td>Source Code Repository</td>
</tr>
<tr>
<td>VsCode</td>
<td>Code Editor</td>
</tr>
<tr>
<td>Postman</td>
<td>API Testing</td>
</tr>
<tr>
<td>Junit</td>
<td>Test Framework</td>
</tr>
<tr>
<td>Selenium</td>
<td>Automation Framework</td>
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### Test Management

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### Other

- **Artificial Intelligence**
- **Data Analytics**
- **Database Management**
- **Data Visualization**
- **Developer Tools**
- **Software Engineering**
- **Project Management**
- **User Interface Design**
- **User Experience Design**

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**Note:** The above table and text are placeholders and need to be replaced with actual content from the document.
N-SET Details – Output Screen

N-SET Details – Results Screen
Schedule

- Data Collection – on-going
  - Effort to collect Manned System data
- Complete re-programming activity – Sept 07
  - Validate to UNIX version
- Beta release – Sept 07
- Conduct Focus Group – Oct/Nov 07

Data Collection Details

- CADRe data, on a limited basis
- JSC
  - Database
- GRC
- MSFC
  - Chandra
- GSFC - TBD
Challenges

- Re-programming AI scripts into Visual Basic
  - AI Agents operate in UNIX
  - Requires additional operating software
  - Not user friendly
- Need more data

Deployment Decisions

- Currently programming for stand alone capability
- Integrate into other products
  - NAFCOM
  - ACEIT
  - NICM
- Stand alone interfaced to other products
Summary

- Need more (good quality) data
- User input is very important to us
- Seeking additional participants for Focus Group
  - Will incorporate as many improvements as funding allows
- Anticipate Beta release version by the end of the fiscal year