SQUARE KILOMETER ARRAY
US CONSORTIUM

FEBRUARY 28 AND 29, 2000
ARECIBO OBSERVATORY/NAIC, CORNELL UNIVERSITY

SKA Computing and Software

Speaker: Tony Beasley, NRAO
SKA Computing & Software

Tony Beasley NRAO

- Software expectations
- Software Process/Engineering
Software expectations

IDEA - TELESCOPE - ANALYSIS
SOFTWARE
HARDWARE

- planning tools
- electronic proposal/review
- science-based scheduling
- Queue/dynamic scheduling
- remote interactive observing
- online calibration
- direct data download
- first-order redux, scripting
- integrated archive/export
- GUI-based, programmable redux
- paper segments
Radio Astronomy

- poor record
- real-time imaging - 1980
- mosaicing - mid/late 80's
- multi-res clean - late 80's
- visualization, user interfaces - ??
- (why?) demographics, funding, science education

- decade reviews
- balkanization (AIPS, aips++, miriad, Gipsy, Karma etc.)
- failure to follow industry
  - architecture independence
  - Windows
  - outsourcing/ASP - can't afford the software people you need
  - software process/engineering
The CMM and the PSP-4

Management

SEPG

The software engineering work

SQA/SCM

Engineers

CMM

PSP down here - engineer discipline
### The CMM and the PSP - 2

<table>
<thead>
<tr>
<th>Level</th>
<th>Focus</th>
<th>Key Process Areas (KPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Optimizing</td>
<td>Continuous process improvement</td>
<td>Defect prevention, Technology change management, Process change management</td>
</tr>
<tr>
<td>4 Managed</td>
<td>Product and process quality</td>
<td>Quantitative process management, Software quality management</td>
</tr>
<tr>
<td>3 Defined</td>
<td>Engineering process</td>
<td>Organization process definition, Training program, Integrated software management, Software product engineering, Intergroup coordination, Peer reviews</td>
</tr>
<tr>
<td>2 Repeatable</td>
<td>Project management</td>
<td>Requirements management, Software project planning, Software project tracking, Software quality assurance, Software configuration management, Software subcontract management</td>
</tr>
</tbody>
</table>

*indicates the CMM Key Process Areas that are fully or partially addressed at the personal level in the PSP*
CMU CMM + Personal Software Process - two week course (also: GSFC SEL)

- process - clearly defined path to producing software; personal and team management

- CMM levels, stages of projects

- Dos
  - create + follow a plan
  - empower project personnel
  - minimize bureaucracy
  - define requirements baseline, manage changes to it
  - track project progress, estimates
  - define/manage phase transitions
  - foster team/community spirit
  - start with small senior staff
Don’ts

- don’t let people open-loop
- don’t set unreasonable goals
- don’t implement changes without analysis & approval
- don’t “gold-plate” - keep it simple
- don’t overstaff, esp. early
- assume constant productivity (won’t make up time later)
- don’t relax standards to address budget/schedule shortfalls
- don’t assume large amounts of documentation ensures success
Lots of theory - practice?

10 assignments

- Using linked lists, calc. mean, sd
- Program to count LOC
- Count Program, object LOC
- Linear regression parameters
- numerical integration
- linear regression, prediction interval
- correlation of two datasets
- sort a linked list
- Chi^2 test for normal distribution
- linked-list program to calculate 3-parameter multiple regression + prediction interval
Conclusions

- SKA will have a lot of software, might be 10% of the instrument cost
- Currently, RA way behind industry in terms of technology and approach -difficult to achieve sizeable fraction of our requirements
- Need to shift our culture towards software engineering practices, outsourcing etc.
- Forget C++ courses: send to process courses, software acquisition
- Mercy of the technoliterate
- The right stuff.....