AF Leading Indicators of Program Management

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Almost all acquisition programs get into cost and schedule trouble at some time during the program.

A few months before a program breach, all the indicators are **Green**.

One month later, we receive notice that the program is late -- **Red** -- and will have to re-baseline.

What indicators can we use that warn us of the upcoming problems?

Is there time for us to take action to improve our likelihood of success?

Mr. Durante (SAF/SAQ) asked us to investigate the possibilities.

ading Indicators

Presenting information about program problems & risks that can be provided in time to take some corrective action.

Existing examples:

- Earned value can be used to estimate completion time and cost
- Testing and peer review results predict product quality
- Process performance predicts team results

Conversely, status reports, and most progress indicators reflect past performance unless the representation of the data helps us to predict project outcomes.

Our work on program leading indicators has been grounded in:

- Patterns of program success (published literature)
- Patterns of program failure (Aerospace Corp and SEI work)
- Analysis of measurement use within successful programs
- Lean Aerospace Initiative: joint work of MIT, INCOSE and others

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Program failure usually cannot be tracked to single risk, event or single cause; however, we can identify some distinct patterns that allow problems to fester.

Many problems seem to be rooted in ordinary sources of uncertainty that are natural to the various stages of product development.

Failure to deal with the uncertainty in a constructive manner causes a number of the problems.

Sources of Uncertainty and Potential for Action

Representation

Method

We must learn some new capabilities and develop new capacities in order to develop a new product.

If there was nothing to learn, we would not call it a development program.

No risk = No reward

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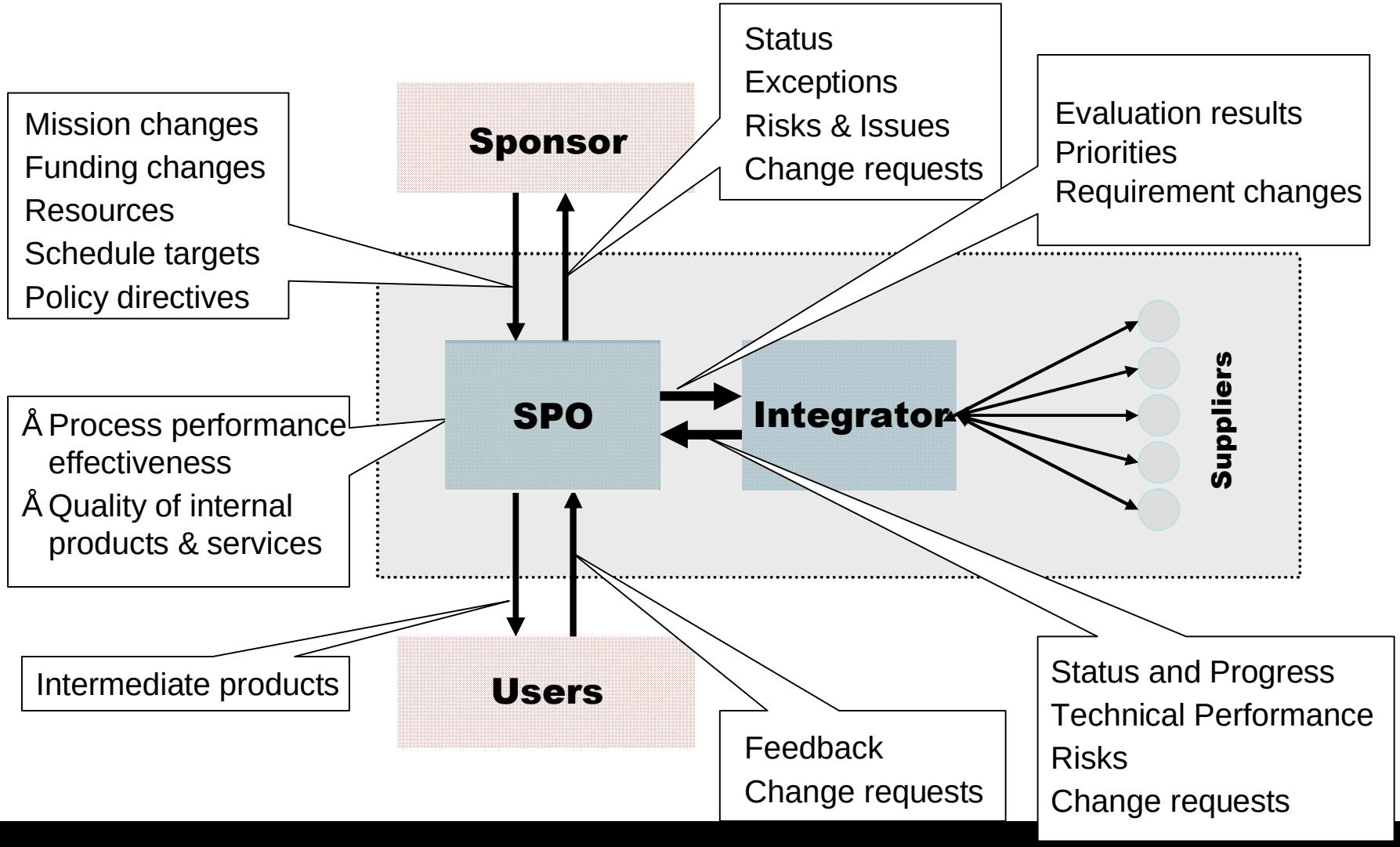
What is it that we do not know when we start?

How can we observe that we are learning these things?

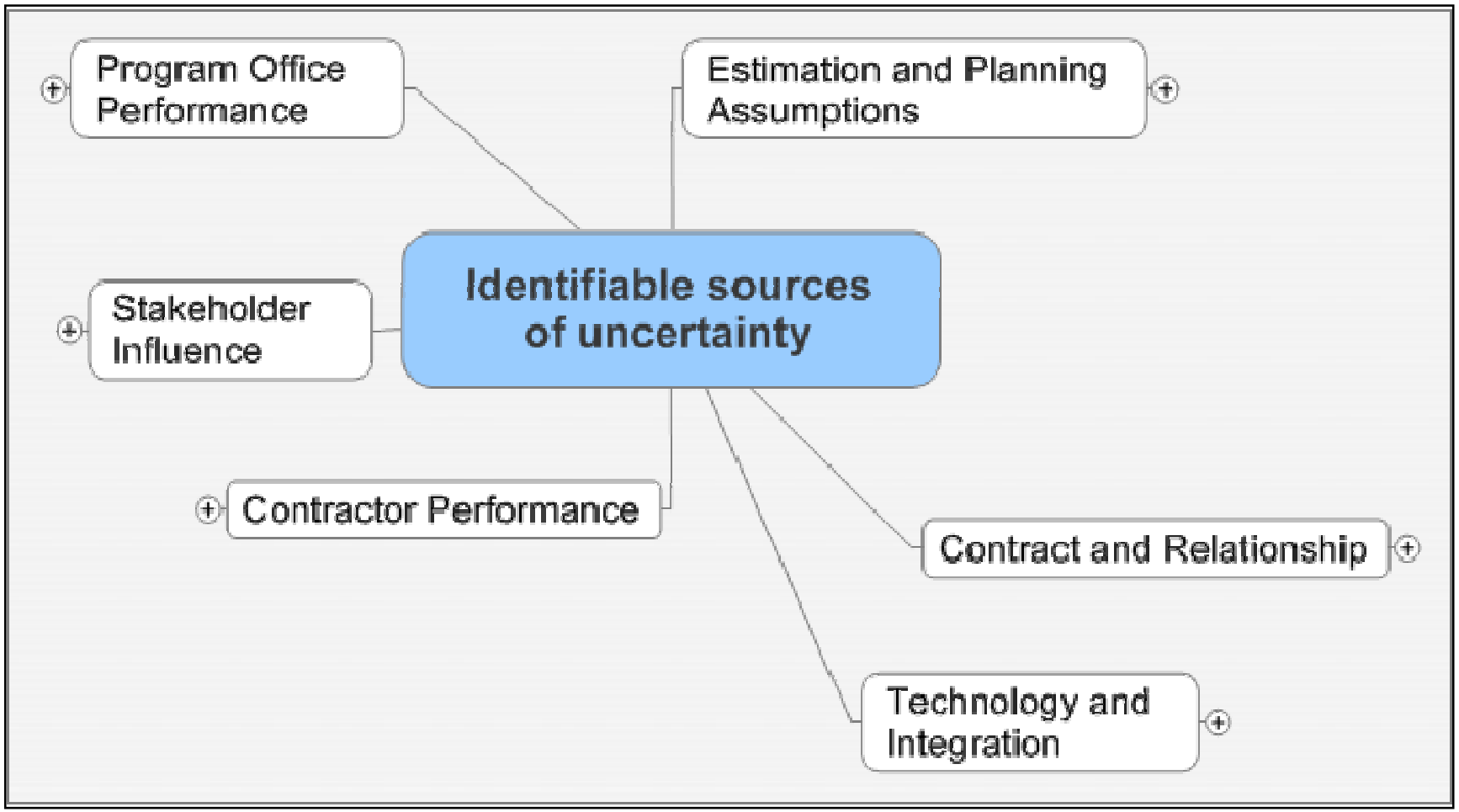
How can we observe that we are developing the needed capability and capacity for the work?

Who can we influence if the right things are not happening?

ogram Office Work



urces of uncertainty



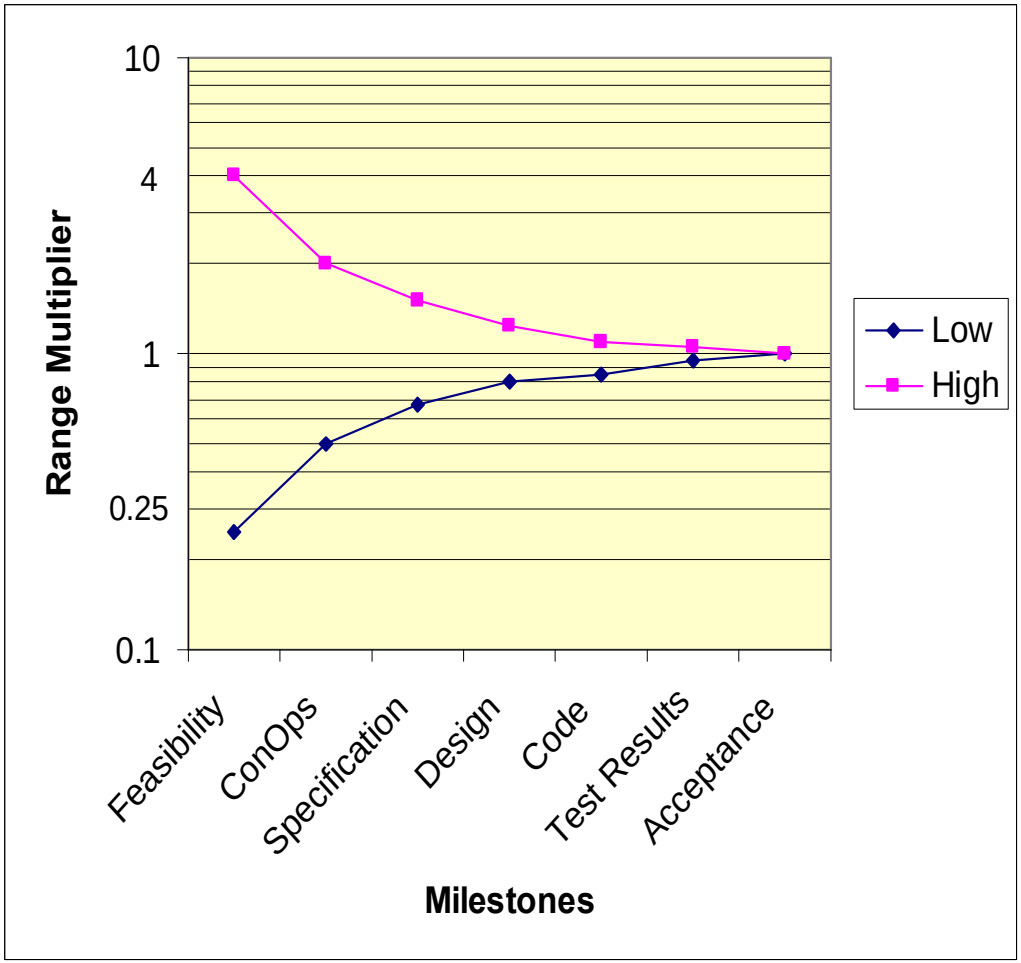
nning Uncertainty

Feasibility
- Types of users
- External interfaces
- Constraints

ConOps
- Feasible performance bounds
- Understanding of user need

Specifications
- Secondary functions
- Storage needs
- Optimal architecture
- Developer skills

Code
- Reliability
- Achievable performance
- Tester understanding of scenarios



Basili work at NASA-Goddard SEL

elationship

Required Learning: Contractor and acquirer must respect each others values and work toward common goals.

Disconnects between program office and contractor

- Increasing numbers of action items and issues.
- Lack of transparency and trust (calls for occasional review of relationship)

Possible drivers

- Too few or too many communications links.
  - Too few means that communications take too long.
  - Too many means that decisions can become invisible.
- Personnel turnover or role changes on either side.
- Change request queue is not managed promptly.

Required Learning: Introduction of new technology requires the contractor to develop many new capabilities. Progress must be made on other fronts as well.

- Technology Readiness Level (TRL) is evidence of the maturity of the technology (but not the process and other elements)
- Design rules for using the technology including interfaces, timing, and other aspects of system architecture
- How to verify and validate (test) components with the new technology
- How to write documentation for users and support
- Tooling and manufacturing

ation

Required Learning: Teams must talk about interfaces and integration

Product integration results provide the best evidence of progress.

- Project management requires multiple integration points
- Systems engineering and architecture identify integration points
- Verification activities demonstrate low level functionality
- Validation activities demonstrate ñfitness for useò for other development staff.

Failure to integrate often allows for some drift phenomena that are difficult to manage.

- Requirements change by 2% per month
- Affects design and test at 3x-5x rate.
- We need to minimize the rework that results from these changes; therefore we must discover the effects sooner.

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Required Learning: Are any teams underperforming (vs. plan)?

Resources

- Availability, capability and utilization compared to plan

Process

- Process assurance and rework measures
- Process performance by team (ñsay-doòratio)

Earned Value Management System (EVMS)

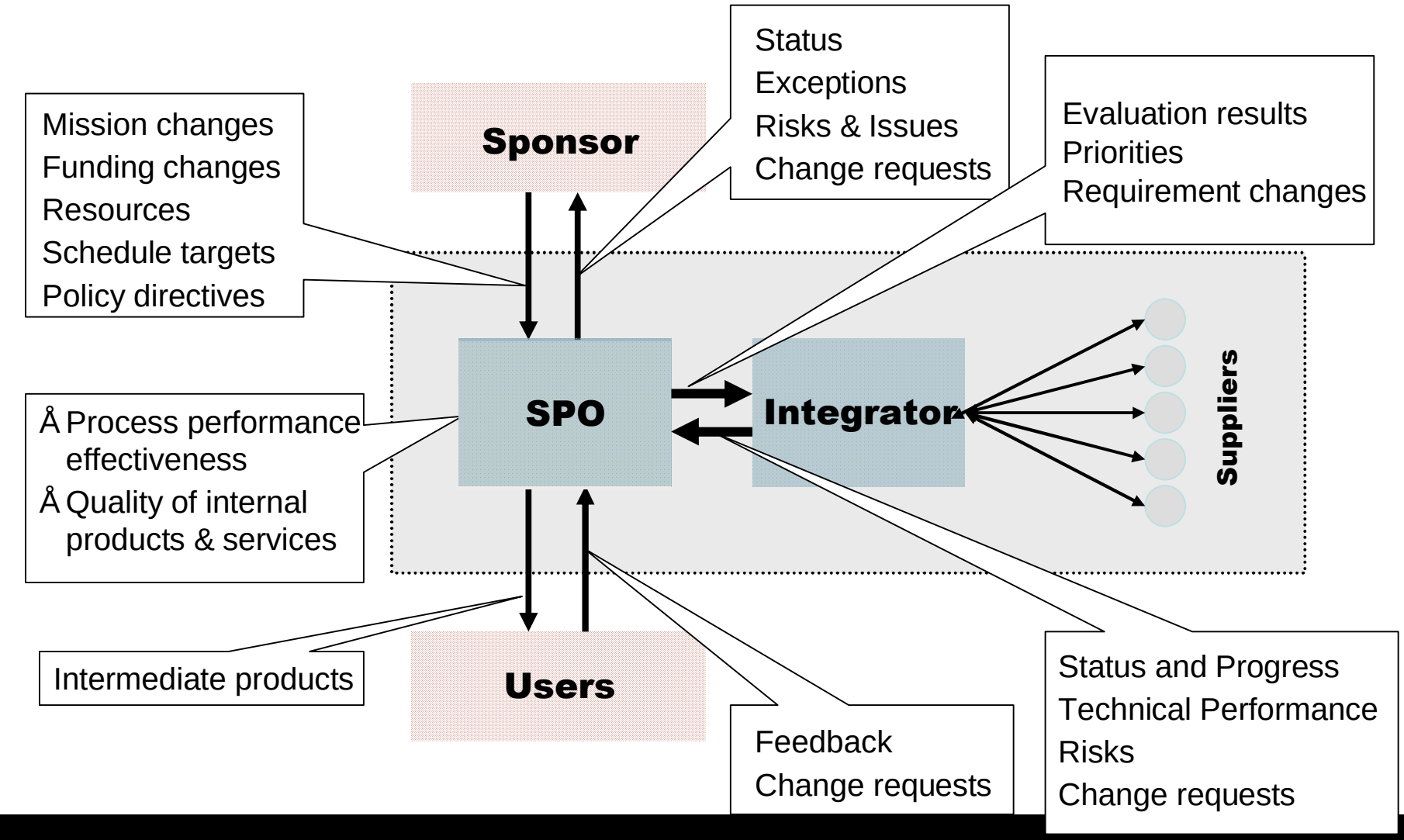
- Compares cost and task completion to plan

Problem Drivers:

- Extreme schedule pressure
- Internal process problems (Including hiring practice)

"Projects fail one team at a time" Bob Ferguson

rformance of the Program Office?



e Performance

All the usual problems exist.

- Resources
- Process
- Quality Assurance and Rework
- Schedule
- Change Requests and Volatility

There is rarely any measurement data that addresses internal performance.

There is rarely a real project plan in use within the program office.

Only a few processes are documented and trained (source selection is).

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Stakeholder Influence

- Funding
  - Volatility in either direction causes some change impact.
- Specification and Validation
  - Lack of participation by users and sponsors as agreed is a strong warning
  - Both must participate in validation work.
  - Executives must be responsive to change requests (yes/no)
- Sponsorship
  - Advertising
  - Interest and support for the work

User Community Problems

- Timely participation, too much senior officer interference

Action

Technology

- alternative sources
- capability development

Contractor Relationship

- commitment and trust

External Stakeholders

- commitment and trust

Program Management (synchronization)

- team readiness, product readiness
- verification validation results and change management

Sources of Uncertainty and Potential for Action

Representation

Method

Different stakeholders need different representations of the data.

- Stoplights might be ok for executive communications
- They are not sufficient for PM and program office staff.

The representation should communicate the opportunity for action.

- Who needs to know? Who can we influence? How urgent is the action?

Learn to ask the right questions.

- When you select the indicator (charté), think about what you might see if something bad were happening? How would you ask questions to confirm your judgment?
- What does it mean if the graph goes down instead of up? If a threshold is crossed?

ews

Systems Engineer

Contractor Project Management

Program Management

PEO

Acquisition Executive

ñSchoolhouseò

Field Commander

Technology Implementation

Continues to be a problem.

Does capability exist (implemented)?

Examine schedule for integration points.

What verification and validation tests represent ñgood enoughò?

What organizational capability is needed for use at this point?

Confirm/agree with Contractor to these quality criteria.

Create Kiviat diagram showing the various dimensions of this TPM with TPI, MOE, MOP measures represented

Review after each integration.

Progress is evidenced when all dimensions are at the desired level.

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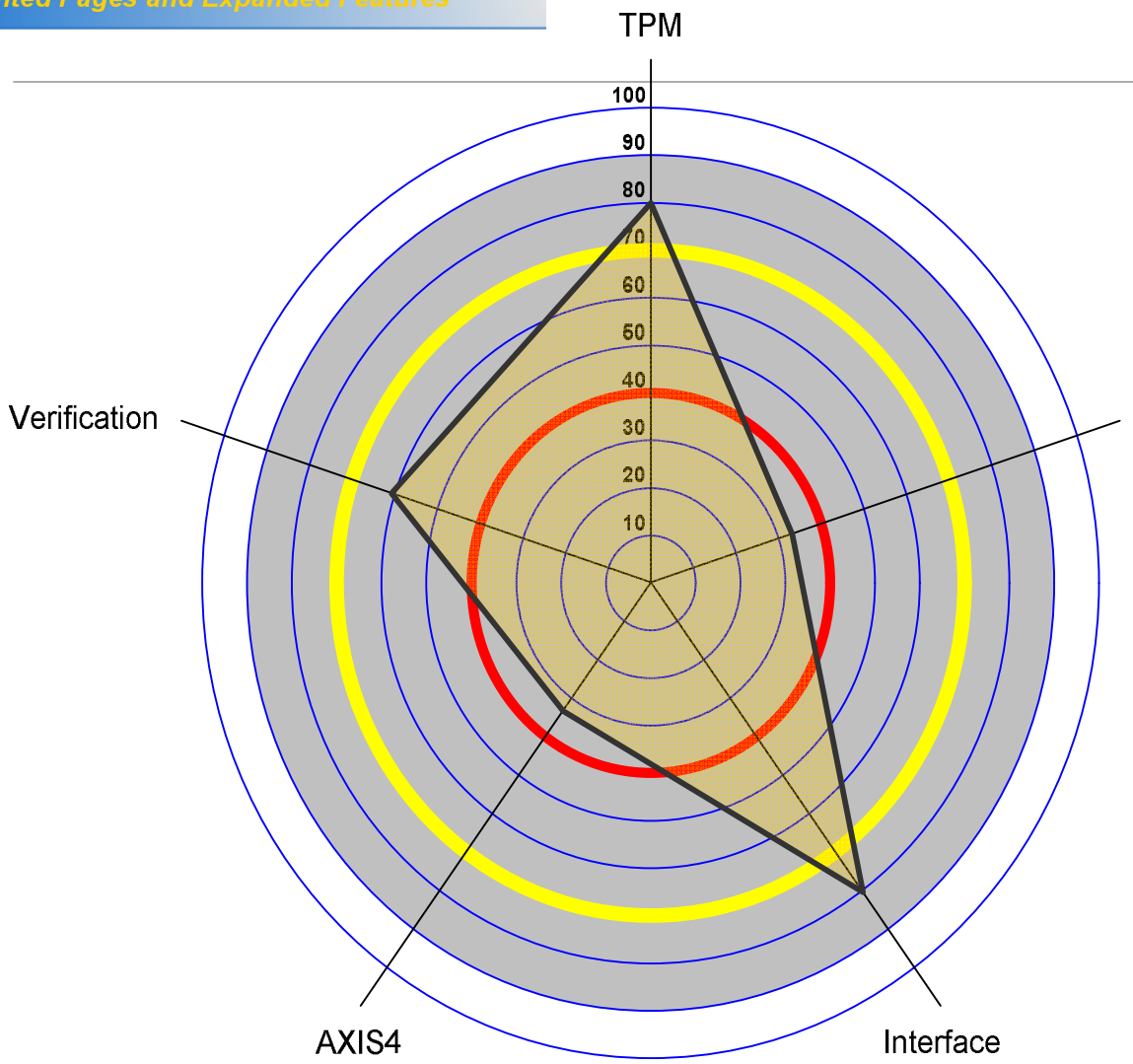
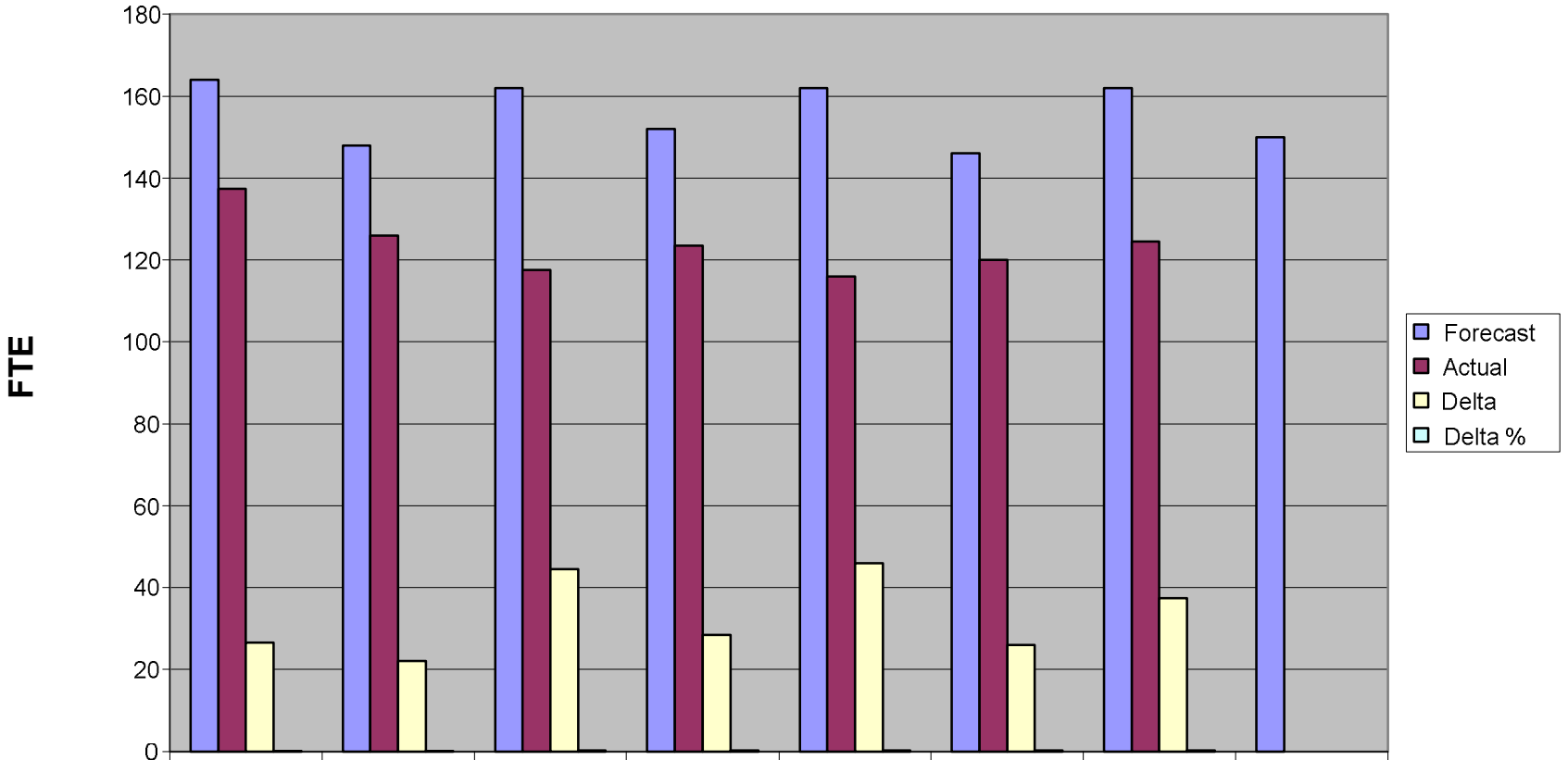


NOTES:
Inside Red circle is unacceptable risk.
Inside Yellow circle is manageable risk
Outside Yellow circle is "Green"

Multiple axes represent the different things that have to be learned to deploy the technology

Rings can represent whether the level of completion is acceptable.

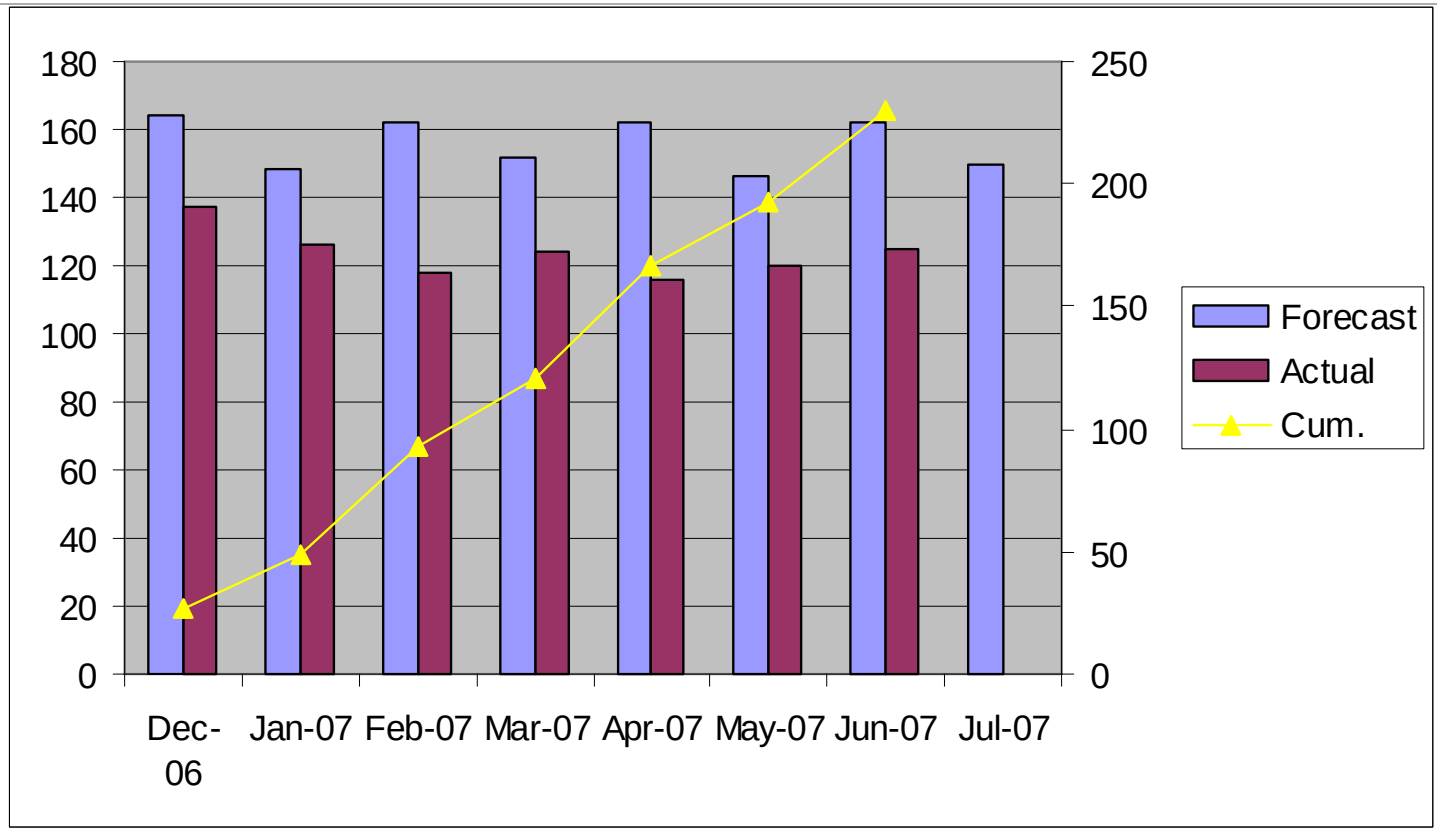
lability/Utilization vs. Plan



	Dec 06	Jan 07	Feb 07	Mar 07	Apr 07	May 07	Jun 07	Jul 07
Forecast	164	148	162	152	162	146	162	150
Actual	137	126	118	124	116	120	125	
Delta	27	22	45	29	46	26	37	
Delta %	16%	15%	27%	19%	28%	18%	23%	

esentation

m: 230 person months behind



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Method

Diagnostic (based on Alberts & Dorofee)

- Identify principle drivers and nature of uncertainty
- Prioritize near term concerns

Goal-driven measurement

- Establish goals for reducing uncertainty
- Ask questions about how to understand it with measurement
- Ask questions about success criteria for management
- Create useful indicators (charts)
- Plan for data collection and implementation
- Assign individual responsibility

Contractor

- Plan the contractor questions
- Identify (with contractor) how questions will be addressed

tial Effort

Diagnostic is an interview.

- Each participant requires about 30 minutes.

Goal-Driven Measurement is a facilitated method

- Can be effectively performed in 2 days or better in a sequence of 5-6 2-hour meetings that can be accomplished in a week.
- PM, deputy and chief engineer should attend the first meeting.
- Method is followed by a briefing to PM.

Working with the contractor requires approximately 2-3 days at contractor site. It includes face to face meetings with program management and IPT leads.

Lean Aerospace Initiative: several interesting publications

http://lean.mit.edu

Aerospace Corp: ñBell-ringing Criteriaòand ñPatterns of Program Failureò

Suellen Estlinger, Richard Ableson, available at SSTC programs

Fred Schenkerôs presentation at this conference

ñProject Management by Functional Capabilityò

Army and Air Force ñProbability of Program Successò

See DAU website and IT-COP

First pilots are just starting ï 1 in the Army in 1 in Air Force

The diagnostic does help us narrow the concerns quickly.