

## Case Study Workshop and Panel 2008 ISPA Conference

### Overview

We will repeat the participative training session in cost estimating by presenting a Case Study (also called “Renew your Training” in previous conferences) in order to provide the opportunity for practitioners to team up with colleagues and present their art in estimating to a large audience.



This exercise is intended to complement the various presentations with a close to reality cost estimating workshop deemed to trigger useful debates about the cost estimating practice. This program will be instructive, entertaining, and suitable for a wide interest audience (estimators as well as managers).

During 5 (maximum) sequential afternoon workshop sessions, expert **Estimating Teams** will each present the results of their work which for the 2008 Conference will be an exercise that demonstrates an understanding of the technology and its relationship to and impact on cost. The workshop will be formatted as a **Trade Study Problem** to compare costs and risk between a traditional design and one that has newer technology systems.

A **Senior Review Panel** composed of recognized authorities in the domain of Parametric Estimating will be assessing and commenting on the presentations made by the teams after. The results of the Panel will be presented in a general session to the Conference audience at large. The critique will focus on trade study cost estimating, cost-risk processes and presentation style; and not on the actual cost estimates

The presentations will be conducted in a competitive atmosphere (but in a conference environment) as each team seeks ways to demonstrate its innovation, experience, and presentation skills. Out of fairness to all, we request that teams not present material specifically developed in-house for other purposes, nor to present any classified or proprietary information.

### Problem

You are the Chief Cost Estimator at a giant defense company and have been requested to participate in a trade-off study for either the next generation Stealth Ship or a new Deep Space Observatory Satellite.

Taking into consideration the current technology portfolio and the ongoing technologies development plan of your company (feel free to define it), the objective is to prepare a comparison cost trade study for alternative technologies. The cases to compare are a design for a ship or satellite based on currently available technology and equipment and a design for a ship or satellite based on new technologies currently in various stages of development.

It is likely that the development of the future technology will require more time and will be more expensive. However, recurrent versions may cost less to produce due to benefits in mass and complexity as a result of the use of advanced technologies, while still meeting the same mission objectives, see Figure 1, Programmatic Approach. The cost of implementing new technologies may thus only be compensated for after the production of a certain number of recurring (or at least similar) ships or satellites. It may also be the case that some of the technologies will not allow you to meet the need date.

The presentations should cover:

- Development and production cost estimates detail down to subsystem level;
- Cost risk analyses with emphasis on technology development.
- Discussion on how the TRL (or its proxy) has been taken into account;
- Considering the need date, selection of retained technologies including schedule and cost risk assessment.
- The effects of the new technology on operations and maintenance (O&M) costs will **NOT** be addressed to limit the preparation effort of the Case Study.

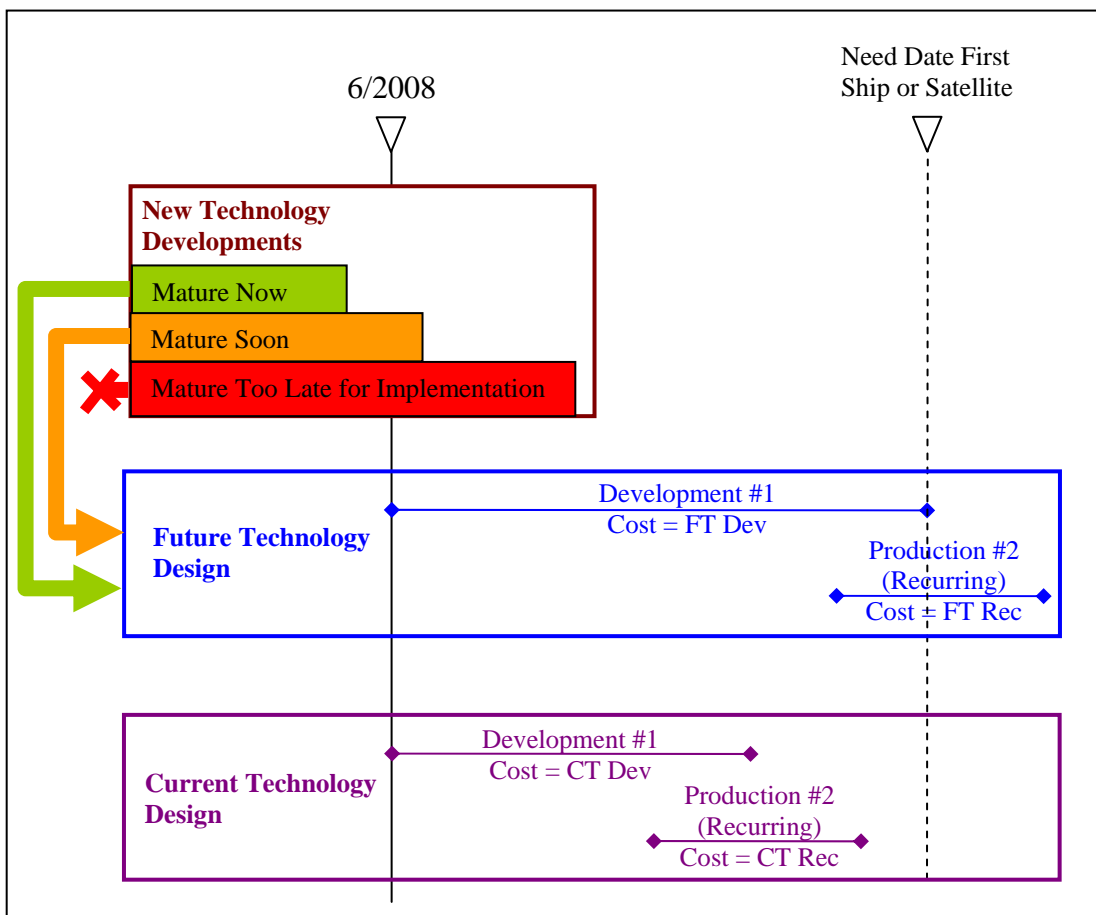
The objective is not so much to prepare accurate and realistic satellite designs and cost estimates, but to describe how the impacts of the different technologies and their current TRL levels have been taken into account in the cost estimates and the cost risk analyses. It is reminded that the Team members should not disclose proprietary

information. They may use and display public domain models or even invent some models for the purpose of the exercise. If so, the Team will indicate it in order to avoid the audience to be misled.

**General Estimating Assumptions:**

1. The team should pick one of the two choices representing future technologies that may be incorporated into two different environments; a naval ship and a space satellite.
2. All costs should be in base year 2008 dollars at the price level (with G&A, fee etc. included)
3. Development and production costs and a risk distribution should be shown
4. The problem offers several technology alternatives for each design architecture
5. The teams will not be limited to technologies on the list and may supply their own insight into future technologies and their costs projections.
6. The output of the trade study should be a comparison of the traditional and more advanced technological solutions. Results will cover the trade space focusing on cost, schedule and risk. The Team may follow the standard programmatic approach indicated in Figure 1
7. Definitions of Technology Readiness Levels may be found at:
  - i. [http://en.wikipedia.org/wiki/Technology\\_Readiness\\_Level](http://en.wikipedia.org/wiki/Technology_Readiness_Level)
  - ii. <http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=37710>

Figure 1 – Programmatic Approach



## Technology #1 - Ship Stealth Technologies



Prepare a comparison cost trade study for conventional and stealth designs for a Destroyer Class ship with systems as given in Table 1a and general specifications given in Table 1b.

- Estimate the design and production cost for 20 systems plus two prototypes
- Assume that the two prototypes are outfitted as determined by team
- The ship will operated in blue water and in littoral scenarios during peace time and war time
- Define the level of TRL for each current and stealth subsystem
- Team can discuss non-cost issues such as ripple effects of new technologies

Table 1a – Ship Technologies

Subsystem	Traditional	Stealth
Hull	Steel	Carbon Fiber
	Traditional Shape	Flat Angular Surfaces
Propulsion	Diesel Engines	Electric Engines
	Propeller	Water Jet
	Traditional Venting	Cooled Exhaust
Weapons	Deck Mount	Stowed Armaments
	Deck Mount	Stowed Communications

Table 1b – Ship Requirements

Requirements for the next generation of Stealth Ship	
1st Prototype Delivery	No later than January 2015
Initial Operating Capability	2021
Specifications	Speed 35 kts
	Displacement 10,000 tons
	Crew 100
	Propulsion 20,000 SHP
Operational Scenario	Blue water and littoral operations

## Technology #2 - Future Satellite Technologies



Prepare a comparison cost trade study for alternative satellite technologies as shown in Table 2a. To ensure that different teams will work on somewhat comparable cases, a high-level description of the Current Technology Satellite is provided in Table 2b.

Cost estimates for the development and production of 2 satellites (i.e. one newly developed and one recurring satellite) for two cases:

- A: 2 satellites based on Current Technology (TRL 7 in 2008)
- B: 2 satellites based Future Technologies currently at various TRL levels determined by the team

- Cost estimates detail down to subsystem level;
- Cost/schedule risk analyses with emphasis on technology development.

Table 2a – Current and future Satellite Technologies

Subsystem	Current	Future
AOCS Sensors	Conventional sensors	MEMS sensors
AOCS Actuators	Reaction Wheels	Flywheels IPAC (Integrated Power and Attitude Control System)
RCS	Chemical thrusters	FEEP (Field Emission Electric Propulsion)
Power Generation	GaAs Solar Cells	Thin Film Arrays
Power Storage	Li-ion batteries	Flywheels IPAC (Integrated Power and Attitude Control System)
Harness	Cables	Wireless Connections
TT&C	S&X-band, Dish Antenna	Ka-band, Conformal Phased Arrays
Data Handling	ASICs	System-on-Chip (multi-function ASIC)
Structure	Alu-honeycomb panels	Composite structures
Mechanisms	Pyrotechnic separation and deployment mechanisms	Shape Memory materials
Thermal Control	Conventional	Variable Emissivity Coating (for instance MEMS louver arrays)
Software	Conventional	?

Table 2b – Generic Satellite Service Module Requirements

Requirements for the next generation of generic Science Bus	
Launch date of the first satellite	No later than January 2015
Orbit	Mainly LEO and L2 types of orbit
Lifetime	5 years nominal, 2 years extension
Mass	Total mass 1200 kg <ul style="list-style-type: none"> <li>• Propellant 150 kg</li> <li>• Service Module 1050 kg</li> <li>• Capability to accommodate Payloads/Payload Module up to 2000 Kg</li> </ul>
Power	Ability to provide 3 kW EOL
Data Handling	Data Rate 5 Mbps, Data Storage 500 Gb, Processing, 200 MIPS
Pointing accuracy	1 arcsec pointing accuracy

