



The Art of Planning and Managing Reserves

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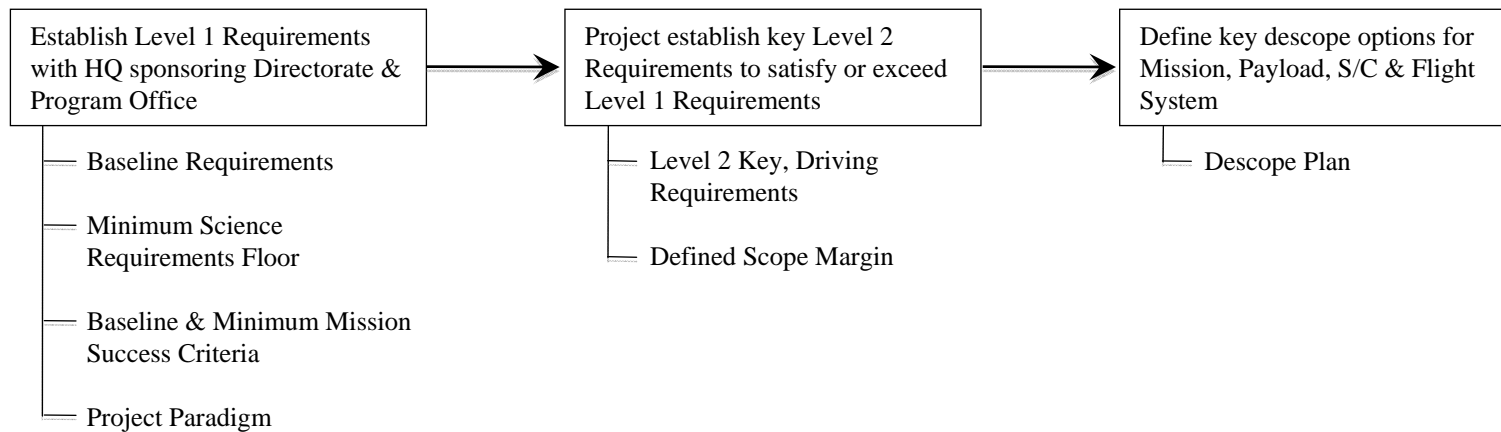


Terminology and Relationships

- Risk Posture → Primary input to determine amount of reserve \$ to be held.
 - Expenditure of reserves reduces or mitigates risk (s), thereby impacting overall risk posture
- Scope Margin → Used to reduce work scope if \$ reserve, schedule margin or technical margins are not sufficient (or predicted not to be)
- De-scope Plan → Produced early in a project's lifecycle to generate various scope reduction options in order to recover \$ reserve, schedule, or technical resources (or some combination thereof)



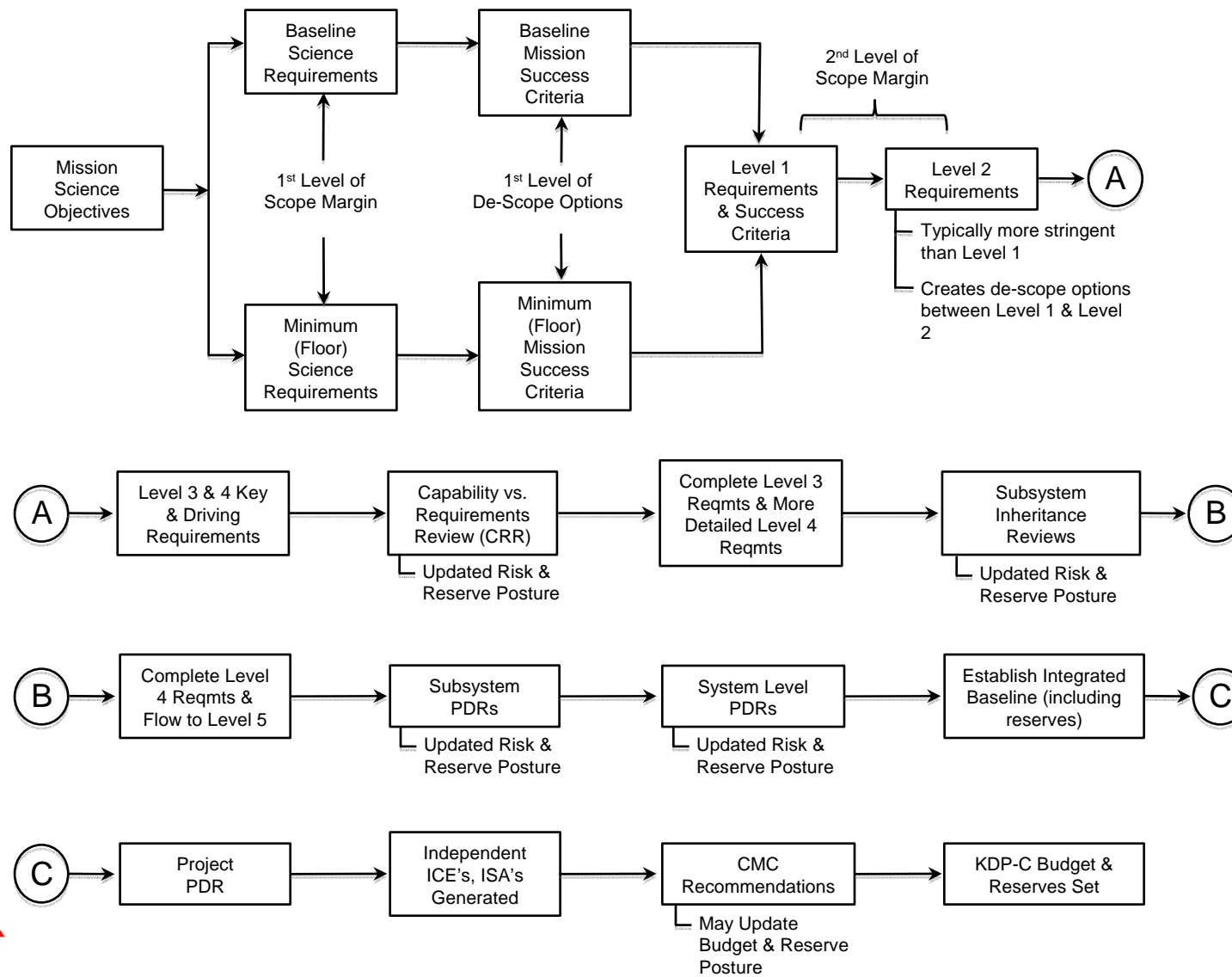
High Level Flow to Establish Scope Margin



Generic Flow & Products for Definition of Project Scope Margin



Progression to KDP-C (for Scope Margin, Budget & Reserves)





Budget & Reserve Estimate Progression

Pre-Phase A & Phase A Budget/Reserves	Phase B Budget/Reserves	KDP-C Budget/Reserves
<ol style="list-style-type: none"> 1) Model-Based Cost Estimates or combination of Model-Based and Grass Roots Estimates 2) Rule-Based Reserve Calculation 3) High Level Risk-Based Reserve Calculation 4) High Level De-Scope Plan 	<ol style="list-style-type: none"> 1) Grass Roots-Based Budget Estimates 2) May Have Updated Model-Based Budget Estimate 3) Rule-Based Reserve Calculation 4) Detailed Risk-Based Reserve Calculation 5) Bottoms-Up Reserve Calculation 6) Detailed De-Scope Plan 	<ol style="list-style-type: none"> 1) Grass Roots-Based Budget Estimate 2) All 3 Types of Reserve Estimates 3) ICE & ISA-Based Budget & Reserves Estimates 4) Detailed De-Scope Plan



Types of Reserve Calculation & Characteristics

Rule-Based Reserve Calculations

- 1) Fixed % Based on Cost

Example:

A. 30% of Phase B/C/D cost & 15% of Phase E cost
B. 25% of remaining Phase B-D budget at PDR; 20% at CDR; 20% at start of System Integration; 10% at ship to launch site
- 2) Start with fixed % and add additional % based on mission characteristics

Example:

30% + 1% for nuclear powered mission, + 2% for lander, etc.
- 3) Reserve calculation algorithm within a cost model

Risk-Based Reserve Calculations

- 1) Project Team assigns possible % cost increase (by FY) to each Level 4 WBS element based upon Risk List, CRR, Subsystem PDRs, etc.
 - Convert % increase to \$ and add to get totals by FY
 - Add lien list items to each FY total
 - Add additional % to each FY for "unknowns"
 - Compare to rule-based & bottoms-up estimates
- 2) Start with a rule-based percentage (e.g. 30%), and add additional percentages based upon unique mission risks.
Example:

30% + 2% for new technology + 1% for each mission item that has never been done before + .5% for hardware or software elements with significant new design activity, etc.

Bottoms-Up Based Reserve Calculations

Each Level 4 WBS element manager estimates a reserve percentage for that element based upon risk factors, inheritance assumptions, work scope, etc.

Project office totals all recommended reserve \$ from the Level 4 WBS managers

Project applies additional fixed percentage on top of total for "unknowns" and compares to rule-based and risk-based calculations



Capabilities and Requirements Review (CRR)

- This is a Project level peer review as an intermediate milestone to SRR/MDR
- There will be a review board, chaired by the PM, with some external members
- Objectives:
 - Assess Project understanding of science requirements and how they flow down to Project, system and subsystem driving requirements
 - Assess capability of each system and subsystem to meet their driving requirements based upon **existing designs**
 - Identify **new designs**, or existing designs that must be **modified**, in order to meet driving requirements
 - Identify which driving requirements are forcing new or modified design work and whether “**push back**” to **current capability** is possible



Capabilities and Requirements Review (CRR) - 2

- Objectives (continued):
 - Assess **plans/approach** for new or modified designs
 - Assess **cost, schedule and technical risk** associated with new or modified designs
 - Note: Project re-evaluates risk and reserve posture based upon this
 - Assess **Reserves** and **Margins** against new or modified design items as well as top issues list, risk list, liens and threats list, etc.
- Possible algorithms for risk and reserve \$
 - Existing capability = Low risk → 5% - 10% reserves
 - Modified capability = Medium risk → 10% - 25% reserves
 - New capability = High risk → 25% - 50% reserves
- Caution: Inheritance still assumed without considering all mission specific applications

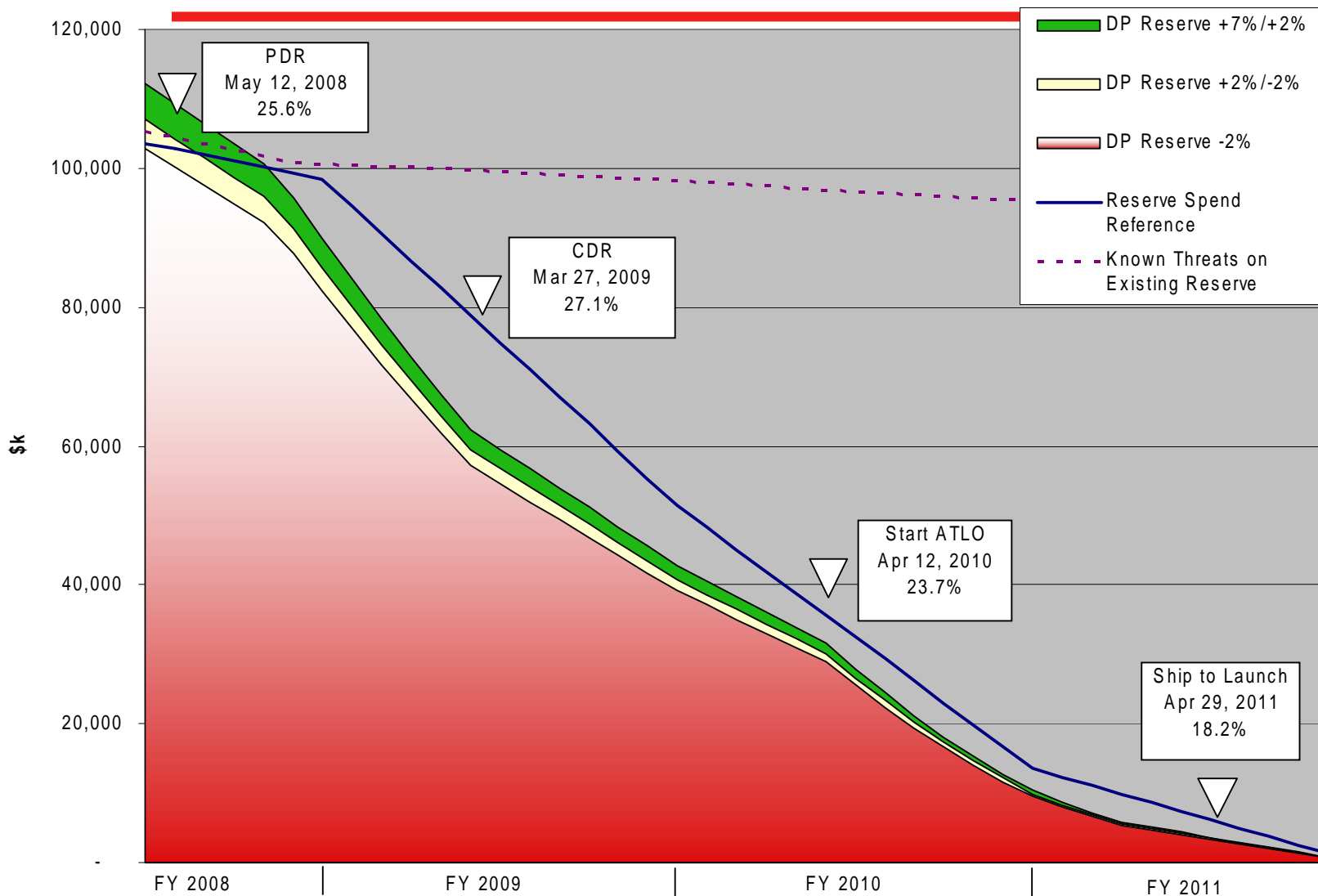


Inheritance Reviews

- The inheritance review evaluates system compatibility of the inherited or commercial off-the-shelf (COTS) functionality (design or product or process) with project level 3 and 4 requirements.
 - It assesses potential risk associated with use of the inherited product or process. It also assesses the need for modification or additional testing.
 - The review may be formal (with a review board) or informal (peer review, etc.) The following elements describe the scope of the assessment
 - Description and prior history
 - Application in project.
 - Compatibility with project requirements.
 - Cost



Example: Reserve Expenditure Plan and Tracking



JPL Reserve spend plan shows annual reserve evenly spent as allocated by fiscal year



Example: Liens and Tracking

UNINCORPORATED UNAPPROVED LIENS/ THREATS (UNINCORPORA

Task #	Task Name	Description	FY'06	FY'07
THREATS REQUIRING DISCUSSION AT LIENS/THREATS MEETING				
WBS 6.0	Flight System	Reliability Analysis Updates (Task 23)		
WBS 6.0	Flight System	3 month Staffing Ramp		
WBS 6.0	Flight System	MA, Power and Telcom Workforce (Mod complete. Need Lien form)		
WBS 6.0	Flight System	Random Vibration Aft Deck Frames		
WBS 6.0	Flight System	Third Seat Safety Inhibit (Option 1)		
WBS 6.0	Flight System	MWR Mock-up		
WBS 6.0	Flight System	UVS Burst High Rate Fix		
WBS 6.0	Flight System	KaT 1553 Interface Change		
WBS 6.0	Flight System	Split DSM (covered elsewhere?)		
WBS 6.0	Flight System	Diode Boxes		
WBS 6.0	Flight System	Missing EMC Tests for PDDU, PIU, and C&DH		
WBS 6.0	Flight System	SRU Contract Cost Growth		
WBS 6.0	Flight System	Ka Diplexer Deletion (Telecon offset?)		
WBS 6.0	Flight System	SRU Credit to Phase C		
WBS 3.0	Mission Assurance	Radiation Tests for Payload		
WBS 3.0	Mission Assurance	Radiation Tests for FS		
WBS 03	Mission Assurance	Radiation Shield Mass Optimization by Subsystem		
WBS 03	Mission Assurance	High Voltage Cable Testing		
WBS 7.0	Mission System	77 Day Capture Orbit JPL (Rick said to prepare a lien. Scott/Steve action)		
WBS 7.0	Mission System	MSSS JunoCam Support		
WBS 7.0	Mission System	MSSS JunoCam Support transfer from SWRI EPO to MSSS		
WBS 7.0	Mission System	MSA HW Engr (truncated in C/D Grassroots estimate)		
WBS 05.05.01	SHM	Polatomic move budget from Phase C to B		
WBS 05.05.01	SHM	SHM Vibration Launch Levels - Phase B FY 08		
05.10	JunoCam	JunoCam Narrowband Filter Addition (from Reserve)		
05.10	JunoCam	JunoCam Narrowband Filter Addition (from SwRI to Reserve)		
WBS 05.08	MWR	MWR Die Attach Equipment (Possibly paid for by TIFM)		
WBS 05	SWRI Instruments	Impact of adding JPL burden to SWRI Instrument Contract		
WBS 05	SWRI Instruments	Add SWRI Instrument CTM		
WBS 02.04	IM/CM	IM/CM Labor Growth (form complete. Need signatures and FFE)		
WBS 02.07.01	Materials and Processes	Increased M&P Support		
WBS 01.01	Project Office	FY 08 Project Planning balance with EPO estimate "1.2M" and fund one FTE for Andy		
WBS 07.03	Mission System	NASA Integrated Services Network (Bypass from JPL to MSFC)		
WBS 07.03	Mission System	NASA Integrated Services Network (Bypass to MSFC from JPL)		
WBS 5.5.2	Fluxgate Magnetometer	Optical Bench *		
WBS 5.5.2	Fluxgate Magnetometer	ATLO Support & Mag Contamination *		
WBS 5.5.2	Fluxgate Magnetometer	Calibration, Integration & Test *		
WBS 7.0	Mission System	Phase E Cost Estimate Reduction Goal		
WBS 5.5.1	SHM	ETL Rate Changes		
WBS 5.8	MWR	Non-consolidated mech engr supt for antennas - MWR *		
03.01.01	Mission Assurance Mgt	Data Management and Payload MAM *		
03.02.01	Systems Safety	Safety Support to Instruments, MSPSP Prep *		



EV Data and Reserves

- Using Cost Variance (CV) and Schedule Variance (SV) from your earned value system is another set of tools to understand possible threats on your reserve
 - $CV = BCWP - ACWP$
 - $SV = BCWP - BCWS$
- $BCWP =$ Budgeted Cost of Work Performed
- $ACWP =$ Actual Cost of Work Performed
- $BCWS =$ Budgeted Cost of Work Scheduled
- Cost Performance Index (CPI):
 - $CPI = BCWP/ACWP$
 - Example: $1520/1580 = 0.96 \rightarrow$ Performed .96 units for every 1.0 unit of cost incurred
- Schedule Performance Index (SPI):
 - $SPI = BCWP/BCWS$
 - Example: $1520/1490 = 1.02 \rightarrow$ Approximately 2% ahead of schedule (ahead of schedule and under cost)
- Estimate at complete (EAC):
 - $EAC = BAC/CPI$, where BAC is Budget at Completion
 - Example: $BAC = \$1M$ and $CPI = .8$, then $EAC = \$1M/.8 = \$1,250,000 \rightarrow$ predicts you will be \$250K overrun at completion



Summary

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- In order to effectively plan and establish reserves:
 - Establish project scope margin
 - Generate a realistic de-scope plan
 - Understand your risk posture and update it as you progress through the formulation phase (via the various reviews discussed)
 - Generate and refine budget estimates as the design matures, using both model-based and grass roots methods
 - As the risk posture and/or budget estimates are updated, calculate reserve requirements via multiple methods and select “best fit”
 - In order to effectively manage reserves:
 - Use all the “tools” in your tool box (risk list, liens list, reserve spending plan & tracking, earned value metrics, etc.)
 - Update your reserve spending forecast and “what if” scenarios on at least a quarterly basis