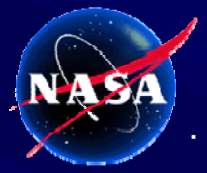

Applied Lessons Learned on ARM Implementation for CEV

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RMC VI
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Outline

- CEV Project Overview
- Near Term CEV Risk Mgmt Actions
- Risk Process Overview
- ARM Implementation Overview
- Future Risk Mgmt Actions

CEV Overview

- The Exploration Systems Architecture Study ("60-Day Study) Team was commissioned by Dr. Griffin to develop the following:
  - Overall Lunar Architecture
  - Design Reference Missions
  - CEV Conceptual Design
  - Preliminary technical requirements for Exploration Architecture and CEV.

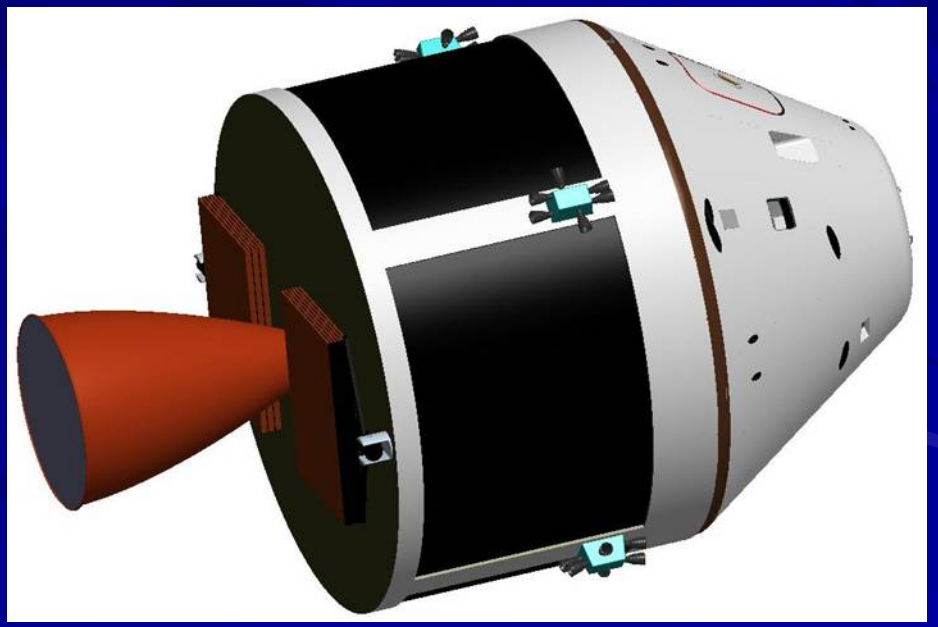
CEV Missions

Multi-role usage of CEV:

- ISS crew ferry (Block 1A)
- ISS pressurized cargo (Block 1B)
- ISS unpressurized cargo delivery vehicle
- Crewed lunar vehicle (Block 2)
- Crewed Mars vehicle (Block 3)

Crew Lunar Layout

Apollo Derivative CM
5.5 meter diameter

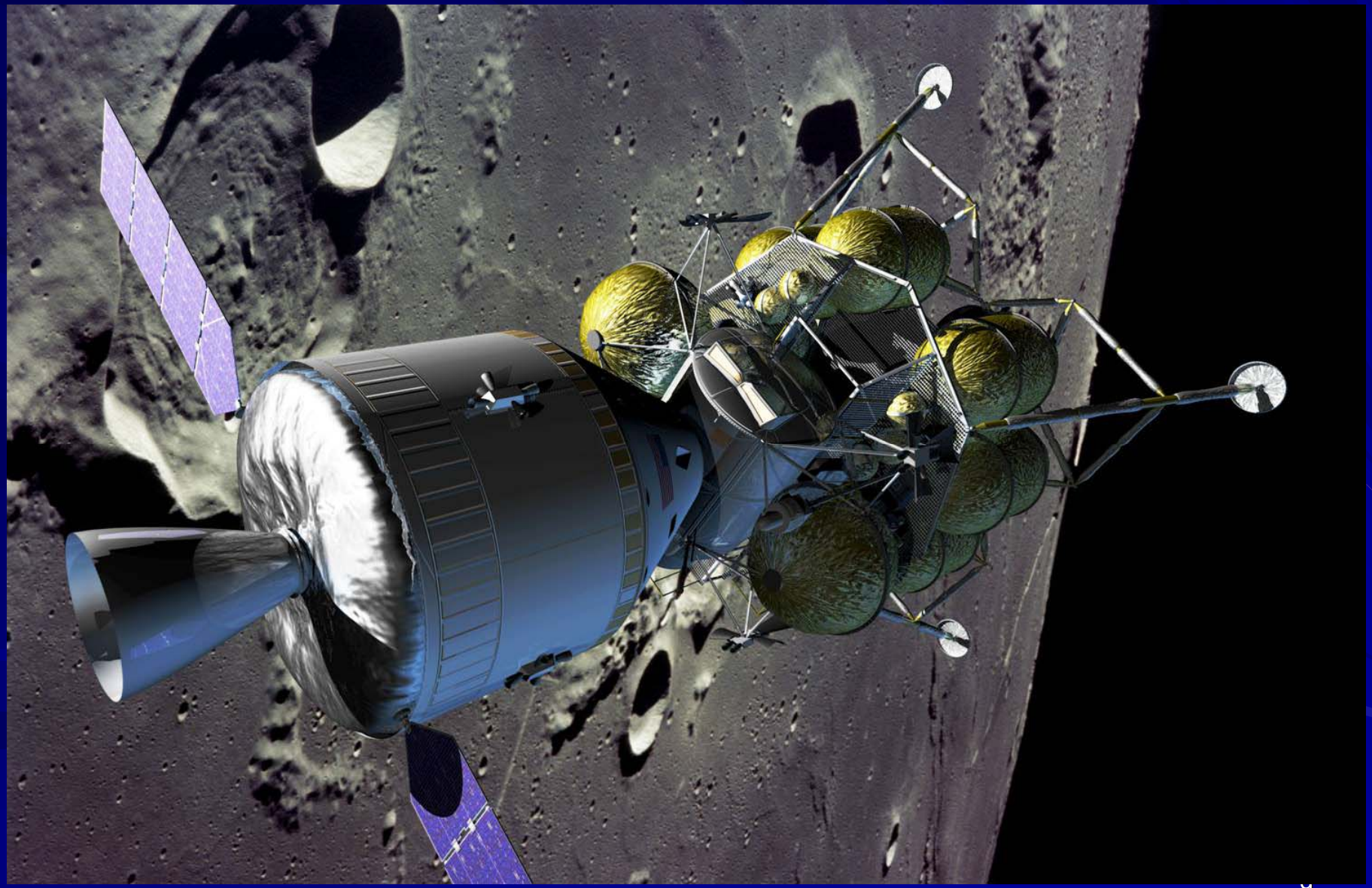


CEV Launch on SRB Derived Launch Vehicle

CEV Approaching ISS

CEV, LSAM, & EDS in LEO

CEV & LSAM in Lunar Orbit



Current Status

- ESAS Requirements Transition Team
  - Multi-center team tasked to assure proper definition and flow-down of ESAS requirements.
  - Taking on Exploration Architecture and CEV requirements.
  - JSC S&MA participation.
- CEV Project Office stood-up at JSC (Code TA)
- Constellation Program Office in formulation.
- RFP (“Call for Improvement”) for CEV Phase 2 is in work.
  - Draft RFP release anticipated in October 05; Final RFP release anticipated in November 05
  - Takes single contractor out through first crewed flight.

Near Term Risk Management Actions

- Develop top level risk management process flow and interfaces (within CEV PO and others like ESMD, CLV, etc) and quantitative risk assessment elements and support
  - Determine risk management roles/responsibilities including implementation of risk management within each office's control boards and decision forums (frequency and breadth and depth tiered-review – process for formulation and management of top ten list at each level of the organization)
    - CEV Mgrs (Spacecraft, Ops, Flight Test), SEI Office, GEM Projects Office
    - Name Risk POCs from each CEV office to help facilitate risk implementation and operation
  - Develop structure and frequency of CEV PO Risk Management Board (integrated management and risk review chaired by Project Manager)
  - Establish quantitative risk methods (e.g. PRA) to assist project management in strategic and operational decision making
- Develop proposed changes/updates to ARM to meet our specific needs
  - Establish schedule and mechanisms for ARM implementation within CEV PO
  - Provide ARM training to CEV PO
  - Prioritized list of ARM changes/improvements
  - Work with ESMD ARM team
- Develop charter for CEV RM Working Group (group to help facilitate implementation within CEV)
- Provide CEV dashboard risk Inputs (what and how risk metrics will feed into, and how and how they are integrated with other CEV metrics)
  - Establish risk management metrics to assist in process improvement

Risk Management System Implementation Strategy

- Covers all phases of the life cycle
- Provide a risk management communication infrastructure to store, analyze and deal with problems proactively – overlay on existing management infrastructure
  - Deploy the risk process, tools and systems within the whole enterprise and integrate with other management systems
- Require risk identification and management to occur in a tiered, integrated, structured manner
  - Remove roadblocks preventing entry into risk management system (ensure risk management accessible to all levels of the organization)
  - Track and individually manage the risk consequence categories (e.g., Safety, Cost, Schedule, & Technical) for comprehensive understanding of risk impacts
  - Manage risks by developing appropriate risk handling strategies & then monitor/control
  - Assign risk ownership to the individual best suited to effectuate effective closure (usually technical expert). Risk owner will then shepard risk through closure.
- Prioritize and elevate risks appropriately, only elevate issues that need resolution from above
  - Information is flowed up, resources and prioritizations are flowed down, while coordination is made with all responsible stakeholders
  - Manage risks at the lowest level possible where the subject matter experts are and where it is the easiest to implement risk mitigation strategies and monitor its affectivity
  - Ensure that risks receive the appropriate level of management review and resources to effectively mitigate significant threats as early as possible (as cheaply as possible)
  - Criteria for Risk escalation (to the next level): those that (1) require integration (or have potential impacts) from other levels of the organization, (2) those that require resources outside current org reserves or could have impacts on major milestones, (3) those that require visibility or decisions made from management above.

CEV Risk Management Process

Control:

Control risks to ensure all risks are

- Determine whether current mitigation efforts are progressing according to plans and initiate fallback plans as necessary
- Make adjustments in planning and execution as necessary
- Allocate risk resources as necessary
- Alter mitigation approach as necessary (accept, watch, mitigate, close)

Identify:

New risks are entered into risk system as a "concern". Basic risk attributes are documented into system.

Analyze:

Review and vet new "concerns IPT/Org Control boards review risk:

- Assigns new risk owner – individual and org that is best suited to effectuate risk closure (may be different from risk identifier)
- If risk description is vague/unclear, assign for further research and analysis to better understand risk.
- If IPT/Org control board concurs with "concern", it is converted into a risk within system. If disapproved, "concern" is closed within system and rationale is documented.
- Analyze risk including determining probability, impact/ consequence (cost, schedule, safety, technical impacts), timeframe, priority and identify other potential stakeholders

Track:

Individual risk owner and IPT/Org control boards will track progress of all relevant risks

- Track risk mitigation progress (including metrics) to ensure successful mitigation.
- Track control/trigger points to decide when fallback plans will be initiated

Plan:

Individual risk owner (with input of stakeholders) plan detail course of action (research, watch, accept, mitigate) with approval by IPT/Org control boards:

- Develop mitigation plans with detail schedule and individual task responsibilities
- Develop Acceptance/Closure rational
- Define tracking requirements and metrics to ensure successful mitigation

Risk Management Process w/ARM

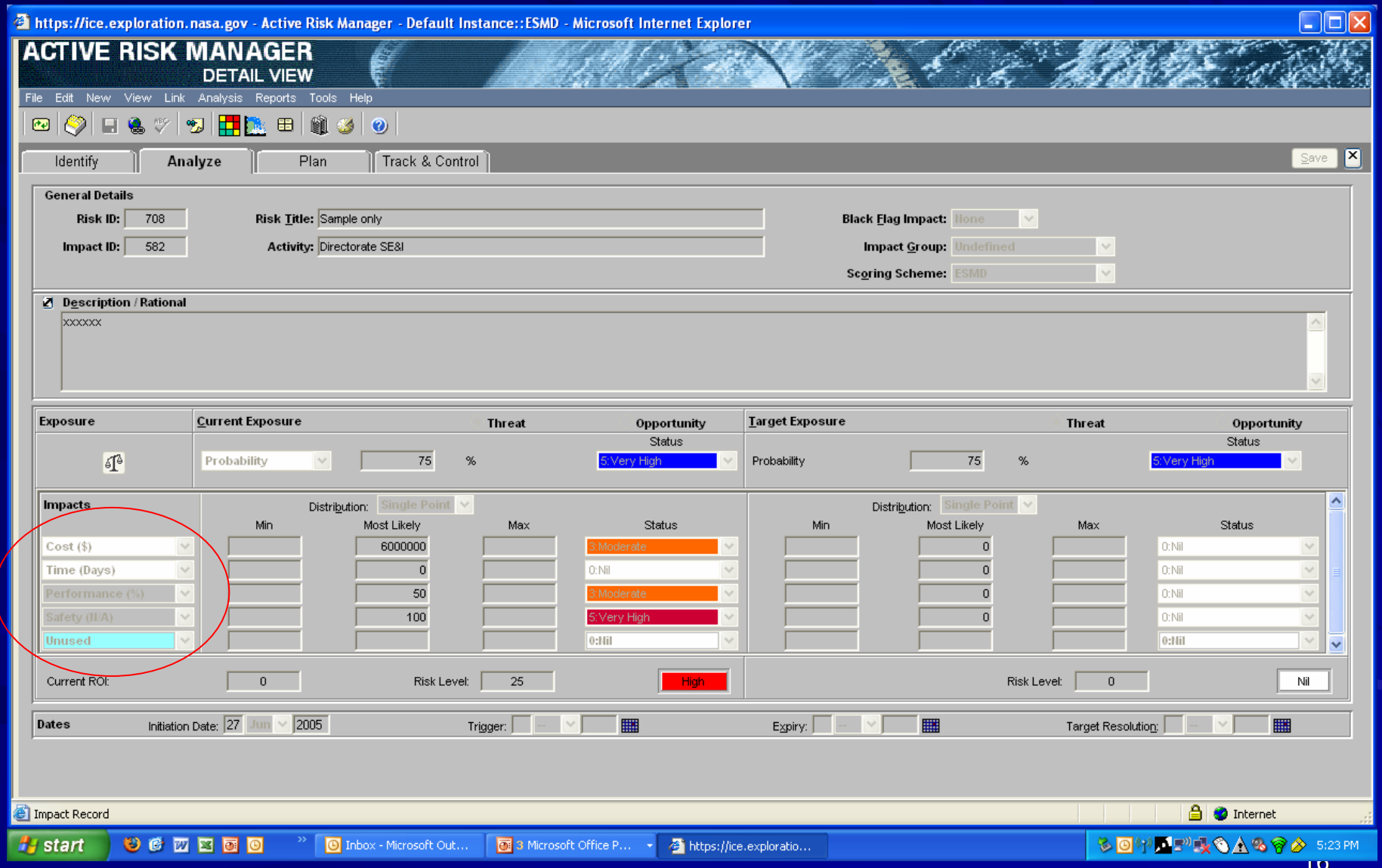
TOOL: ARM

PROCESS: Risk ID facilitation

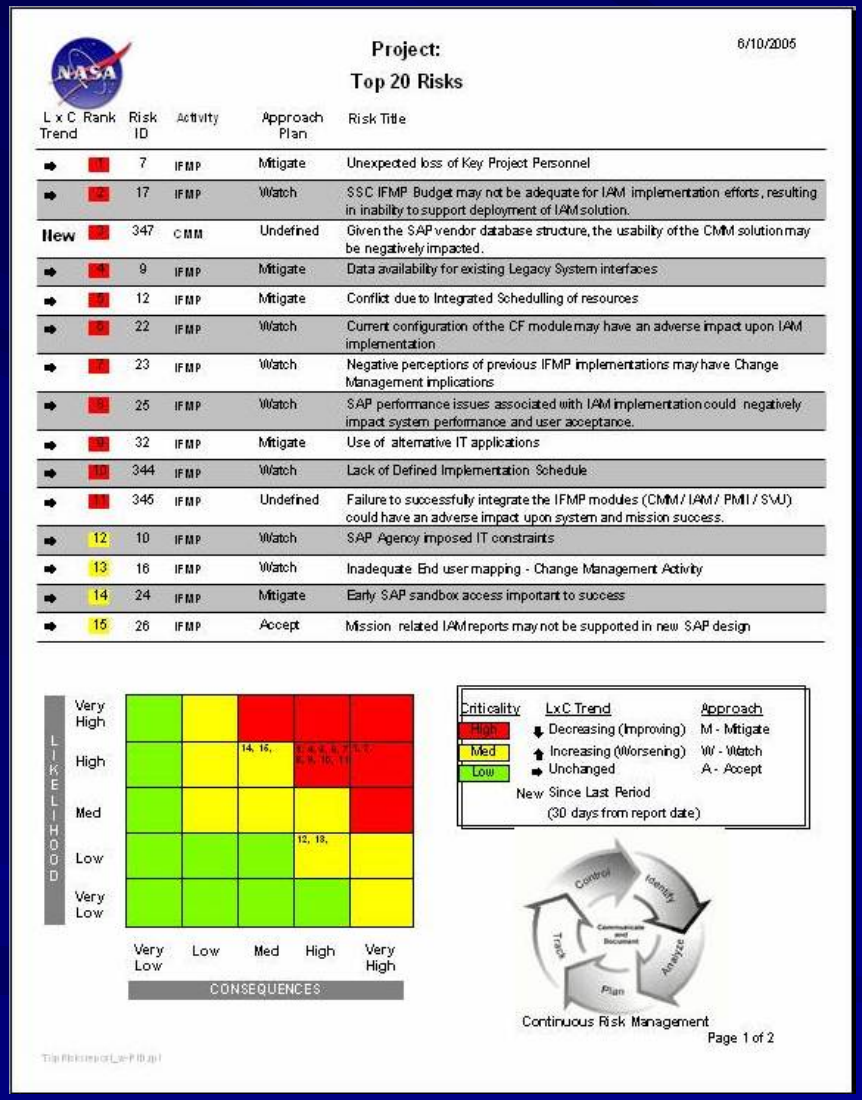
ARM Does ***Not*** Replace the CRM Process for the Decision Maker
Yet Supports Complex System Implementation while Minimizing Resource Requirements

Risk Management Fundamentals

Impact category selection in ARM



ARM “Crystal Reports” Output



Project:

Top 20 Risks

6/10/2005

L x C Trend	Rank	Risk ID	Activity	Approach Plan	Risk Title
➡	1	7	IFMP	Mitigate	Unexpected loss of Key Project Personnel
➡	2	17	IFMP	Watch	SSC IFMP Budget may not be adequate for IAM implementation efforts, resulting in inability to support deployment of IAM solution.
New	3	347	CMM	Undefined	Given the SAP vendor database structure, the usability of the CMM solution may be negatively impacted.
➡	4	9	IFMP	Mitigate	Data availability for existing Legacy System interfaces
➡	5	12	IFMP	Mitigate	Conflict due to Integrated Scheduling of resources
➡	6	22	IFMP	Watch	Current configuration of the CF module may have an adverse impact upon IAM implementation
➡	7	23	IFMP	Watch	Negative perceptions of previous IFMP implementations may have Change Management implications
➡	8	25	IFMP	Watch	SAP performance issues associated with IAM implementation could negatively impact system performance and user acceptance.
➡	9	32	IFMP	Mitigate	Use of alternative IT applications
➡	10	344	IFMP	Watch	Lack of Defined Implementation Schedule
➡	11	345	IFMP	Undefined	Failure to successfully integrate the IFMP modules (CMM / IAM / PMI / SVU) could have an adverse impact upon system and mission success.
➡	12	10	IFMP	Watch	SAP Agency imposed IT constraints
➡	13	16	IFMP	Watch	Inadequate End user mapping - Change Management Activity
➡	14	24	IFMP	Mitigate	Early SAP sandbox access important to success
➡	15	26	IFMP	Accept	Mission related IAM reports may not be supported in new SAP design

Criticality: High, Med, Low

LxC Trend: ➡ Decreasing (Improving); ➡ Increasing (Worsening); ➡ Unchanged

Approach: M - Mitigate; W - Watch; A - Accept

New Since Last Period (30 days from report date)

Continuous Risk Management

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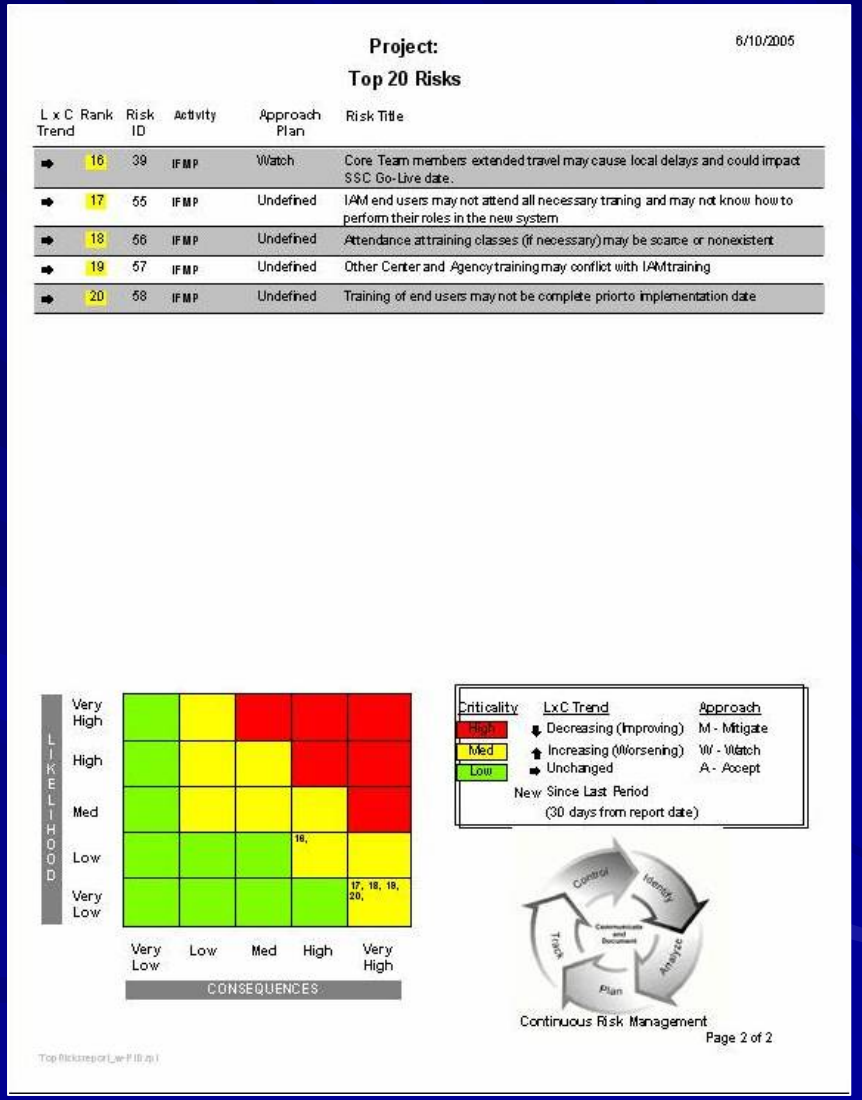


Project:

Top 20 Risks

6/10/2005

L x C Trend	Rank	Risk ID	Activity	Approach Plan	Risk Title
➡	16	39	IFMP	Watch	Core Team members extended travel may cause local delays and could impact SSC Go-Live date.
➡	17	55	IFMP	Undefined	IAM end users may not attend all necessary traning and may not know how to perform their roles in the new system
➡	18	56	IFMP	Undefined	Attendance at training classes (if necessary) may be scarce or nonexistent
➡	19	57	IFMP	Undefined	Other Center and Agency training may conflict with IAM training
➡	20	58	IFMP	Undefined	Training of end users may not be complete prior to implementation date

Criticality: High, Med, Low

LxC Trend: ➡ Decreasing (Improving); ➡ Increasing (Worsening); ➡ Unchanged

Approach: M - Mitigate; W - Watch; A - Accept

New Since Last Period (30 days from report date)

Continuous Risk Management

Page 2 of 2

Language Localization is Critical to Implementation

Risk Process & ARM Implementation Strategy

ARM - Issues With Initially Training Everyone*

- A lot of time spent on ARM re-training
- Project team mitigation efforts diluted with trying to learn a new tool
- Risk Ownership disagreements
- Risk input individually and not in team environment where communication is possible.
- Time needed to validate risks input by team members
- No clear guidelines or roles

* SSC ARM implementation

Lessons Learned from previous non-CEV project ARM implementations*

- **L-1** , Communicate in the Language of the PM
  - Integrate SME and POC's in RM Process
  - Provide PM with Ability to Make Risk-Based Decisions
  - Establish Risk Owners Working Group with PM participation
  - Do not bury PM in Data
- **L-2**, Focused Training and Deployment
  - PM Access to ARM Facilitation and System Integration Knowledge to Extract Full Value
  - Focus Training on Subject Matter Experts and Points-of-Contacts
- **L-3**, ARM Does ***Not*** Replace the CRM Process
  - Provides Automated Capability to Track, Control, Document and Communicate Risks
- **L-4**, Language Localization is Critical to Implementation
  - Tailored Reports and Scoring Schemes, etc.
- **L-5**, Complex Systems Development Requires Automation to Retain Value Over Lifecycle
- **L-6**, Risk Management is a Unique Skill Set
  - Risk Management is ***Not*** only Change Management
  - Risk Management is an Attribute of System Engineering Function by Definition

* NASA Stennis Space Center ARM implementation

Proposed Strategy

- Focused ARM training
  - Only train fully project risk manager and brief overview to rest of team
- Clarification of Risk Roles
  - ARM Admin
  - Project Risk Management
  - Project Manager
  - Sub-process POC
  - Project Team
- Risk Owners Working Group
  - Risk management is a “team sport”
- Clarification of successful project picture of success
  - Team input and clarification on project risk scoring schemes

Proposed ARM Risk Management Implementation Process

CRM training

Selective ARM training

ID Sub-process Risk POC that will work with ARM

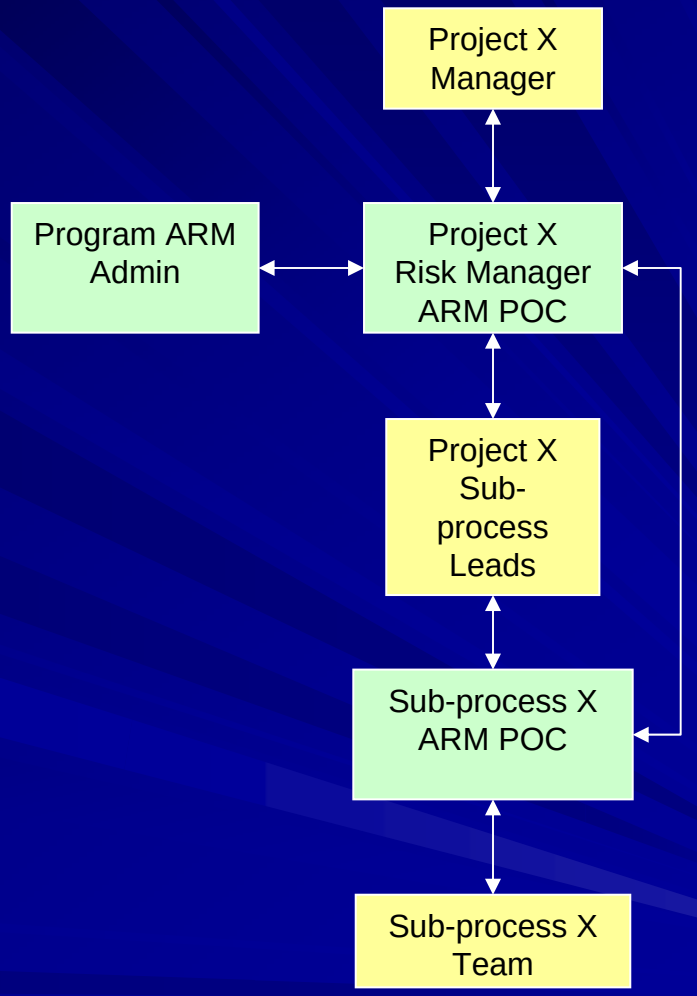
Sub-process Risk ID facilitation

Initial Risk Capture

Communication of Identified Risk, Impacts, Plans, Responses

Risk data maintenance

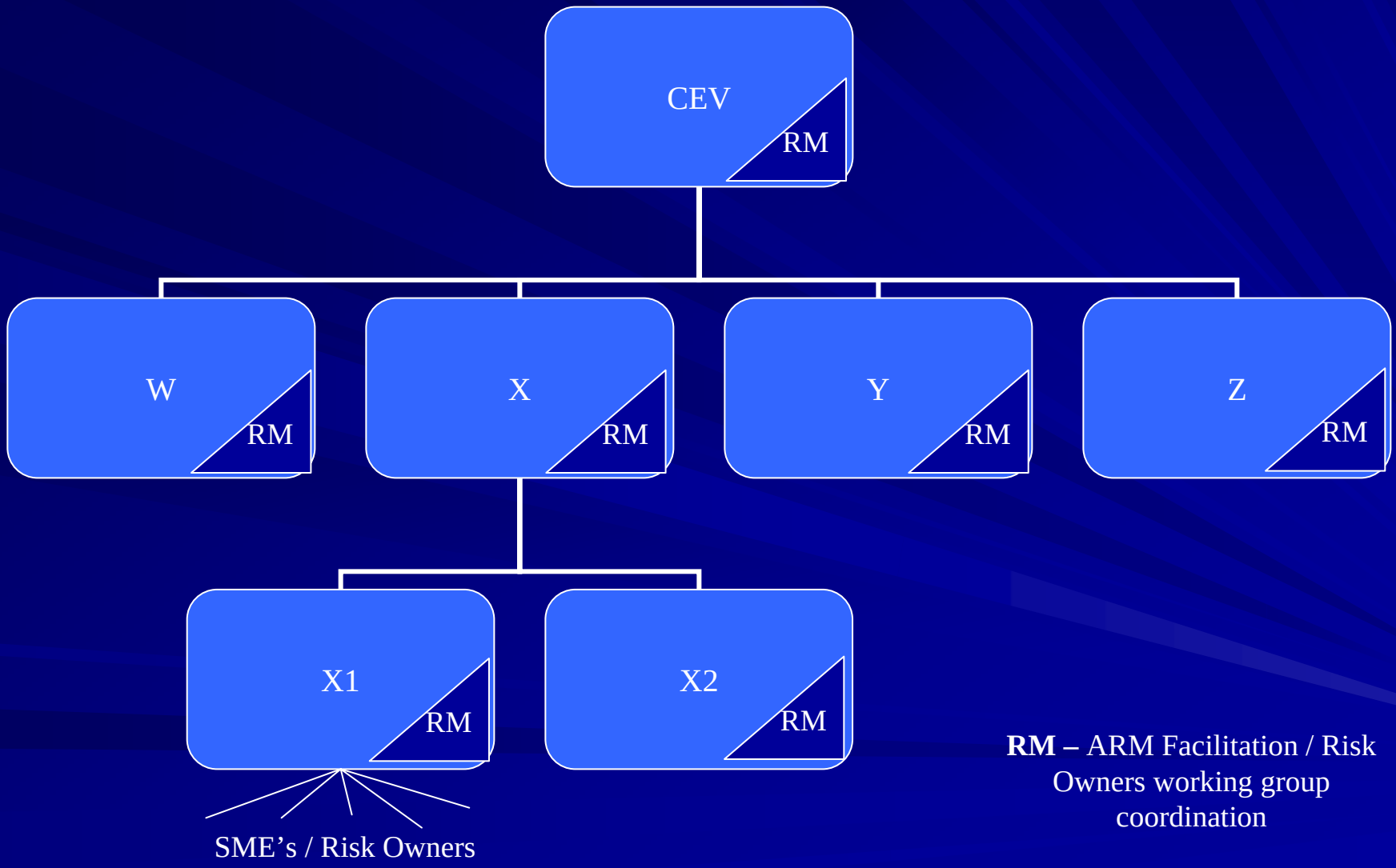
Reports: Standard/Customized



Full ARM Training

Reduced or No ARM Training

Proposed ARM Risk Management Implementation Process



RM – ARM Facilitation / Risk Owners working group coordination

Advantages of Proposed Process

- Capture of relevant, consistent, accurate risk data
- Risk Owners Working Group (ROWG) meetings promote:
  - Constructive discussion and communication
  - Increased ownership of risks and mitigations by team members
  - Increased buy-in
  - Sense of contribution
  - The risk of lack of communication between key members mitigated by participation in meetings

ARM Risk Management Implementation Process Checklist

- CRM training
  - Overview of the NASA risk management policy, why do risk management, the risk management paradigm, explain what a risk is, how to write a proper risk statement, explain the 5x5 matrix
- ID Project/Sub-process Risk POC that will work with ARM
  - Project manager must assign someone responsible within his team to facilitate, coordinate, gather and capture all the risk information into the software
  - Clarify roles and how it ties to the risk management process
- ARM training
  - Go over the major screens of the software and where information is captured.
  - Reports
- Project/Sub-process Risk ID facilitation
- Initial Risk Capture
- Communication of Identified Risk, Impacts, Plans, Responses
- Risk data maintenance
- Reports Standard/Customized

Risk Manager

- CRM / ARM training
- CRM – Facilitate initial risk owners working group meetings
- ARM database project set-up
  - Scoring scheme set-up
  - ARM project folder structure
- ARM Continuing support
  - ARM customer support for sub-process POC
  - Manage database users profiles
  - Manage risk access security levels
- Perform risk analysis
- Customized reporting templates
- Integrate risks that affect other sub-processes and coordinate mitigation efforts
- Integrate NASA and Contractor risks

Sub-process Risk Management POC

- Input/update project risk into ARM
- Create reports from ARM database for team and management
- Facilitate risk owners working group meetings
- Perform risk analysis

Project Team Members

- Have risk management mentality in order to identify risk in their area of expertise as well as overall project
- If mitigation plan is assigned then supervise that the underlying responses are completed
- If response is assigned, then carry out the task

Project Manager/Sub-process Leads

- Support and attend meetings
- Have risk management mentality in order to Identify high level risk and voice it in ROWG meetings.
- Receives Project Risk Reports
  - Have a pulse on project
  - Make risk informed decisions
  - Assess strategies or what risk plans to follow
    - Accept
    - Watch
    - Mitigate

Current ARM Risk Activity

- Initial ARM folder structure complete
- CEV scoring scheme complete
- First cycle of risks captured into ARM complete

Future CEV Risk Management Actions

- Begin sub-process risk integration
- Phased training of project team members so they can browse/input/update risk information within ARM and produce reports
- Create customized ARM reports with meaningful risk metrics that measures effectiveness of risk management process.

Questions?

Comments?