Abstract

Source of Acquisition
NASA Marshall Space Flight Center

NASA EVM Overview and Case Study

Presenter

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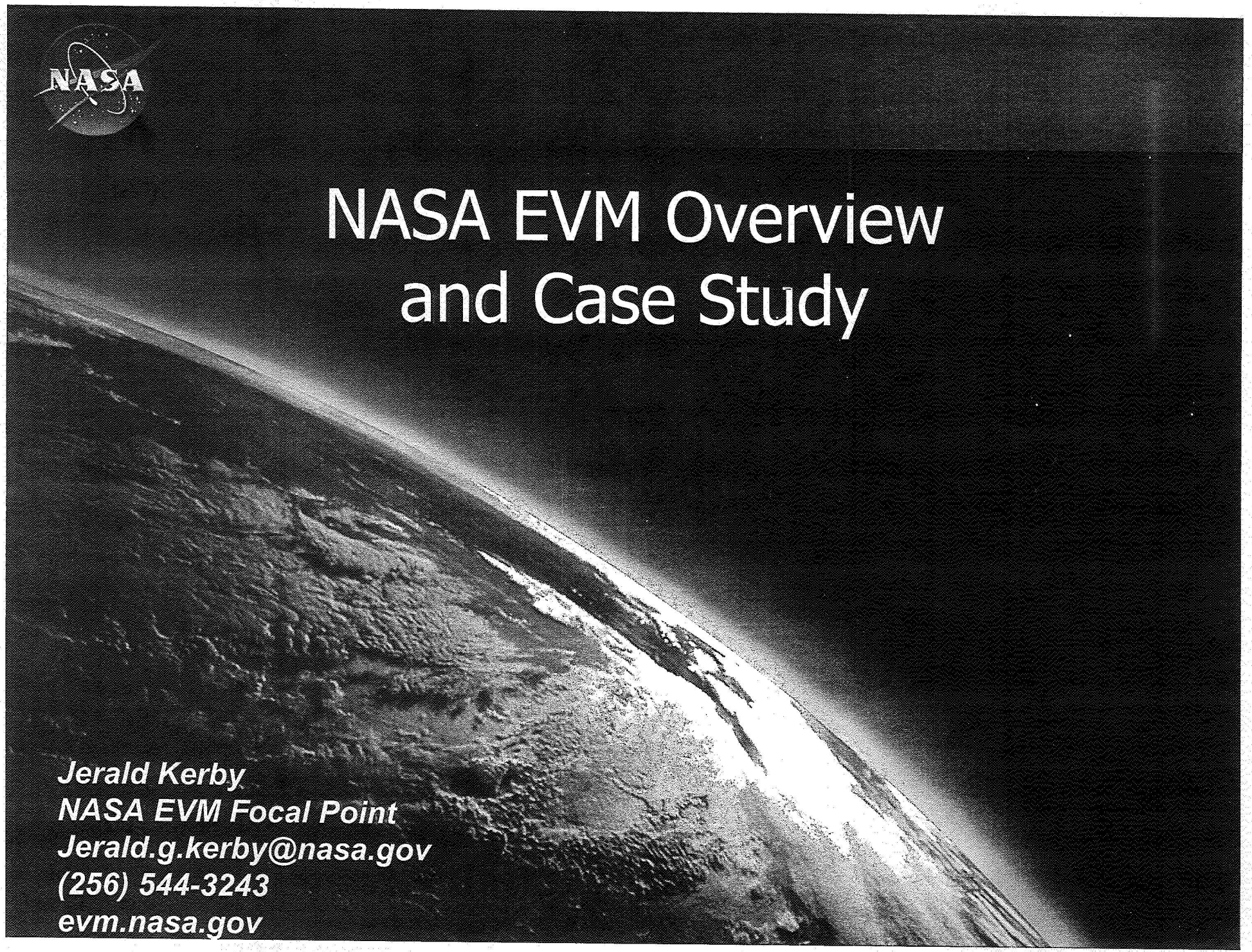
The presentation gives an overview of the National Aeronautics and Space Administration (NASA) Earned Value Management (EVM) structure. We briefly talk about the current EVM high-level policies within NASA and the EVM governing structure. It touches on the roles and responsibilities of EVM Focal Points within the Agency.

We will also discuss the approach that MSFC followed in implementing EVM and better data analysis within the Habitat Holding Racks (HHR) Project. We will address the approach used at the Marshall Space Flight Center (MSFC) to effectively equip and support MSFC projects in applying a sound EVM and data analysis process. In addition, we will show metrics associated with the HHR project before and after the implementation of EVM on the project. We will discuss the monthly report, using sample data, that the project manager used each month to assess the performance of the project. The data received from EVM helped create a solid method for assessing the project's performance. The use of EVM data analysis can be an effective and efficient tool in today's environment with increasing workloads and downsizing workforces. EVM provides project managers with information that can be used in the decision making process.



NASA EVM Overview and Case Study

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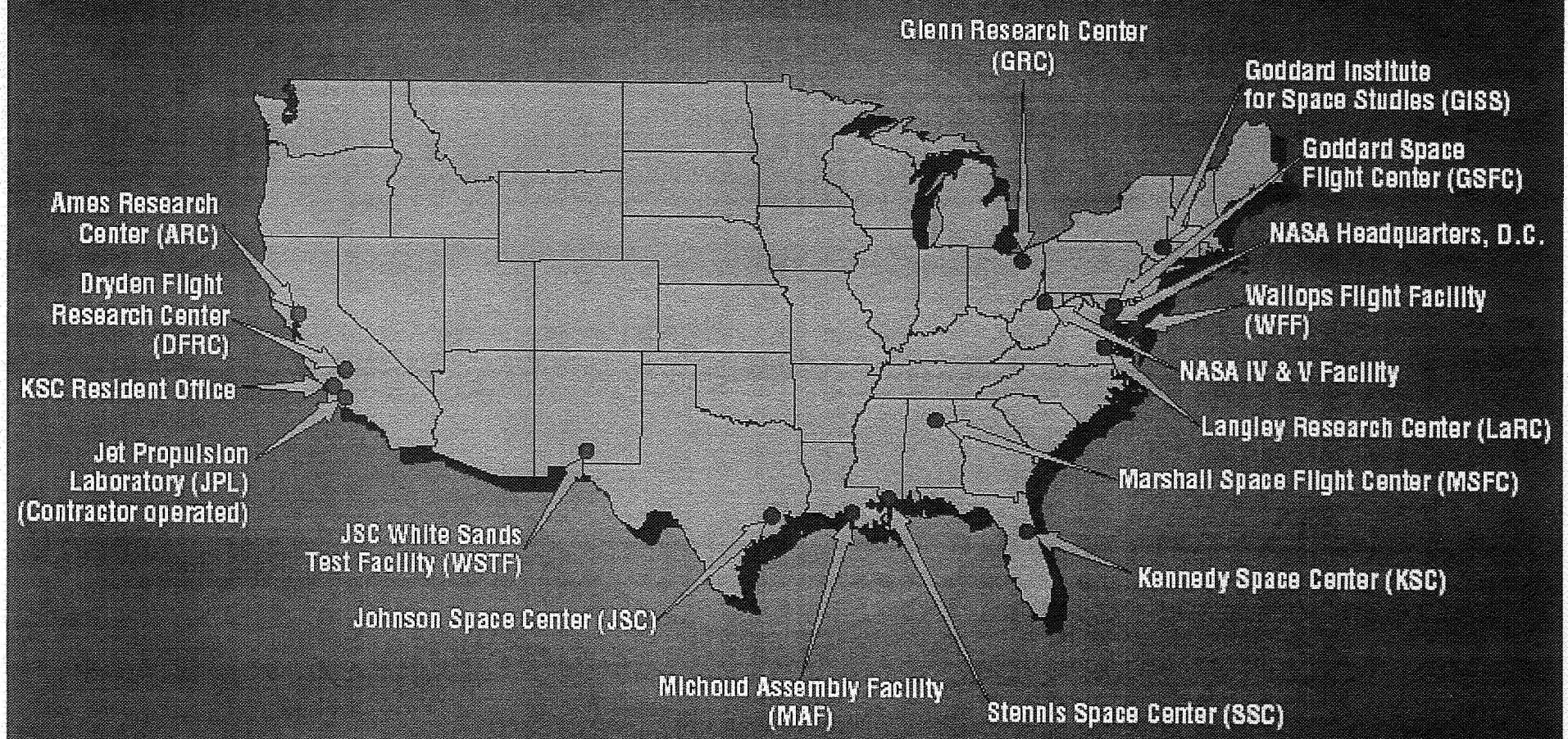
Outline

- NASA Organizations
- Current Policies
- EVM Governing Structure
- Focal Point Goals, Roles and Responsibilities
- NASA - Overall Implementation Approach
- Case Study – Habitat Holding Racks (HHR)
- HHR Project Overview
- Implementation Approach
- Performance Data
- Benefits to Project
- Sample HHR Monthly EVM Report

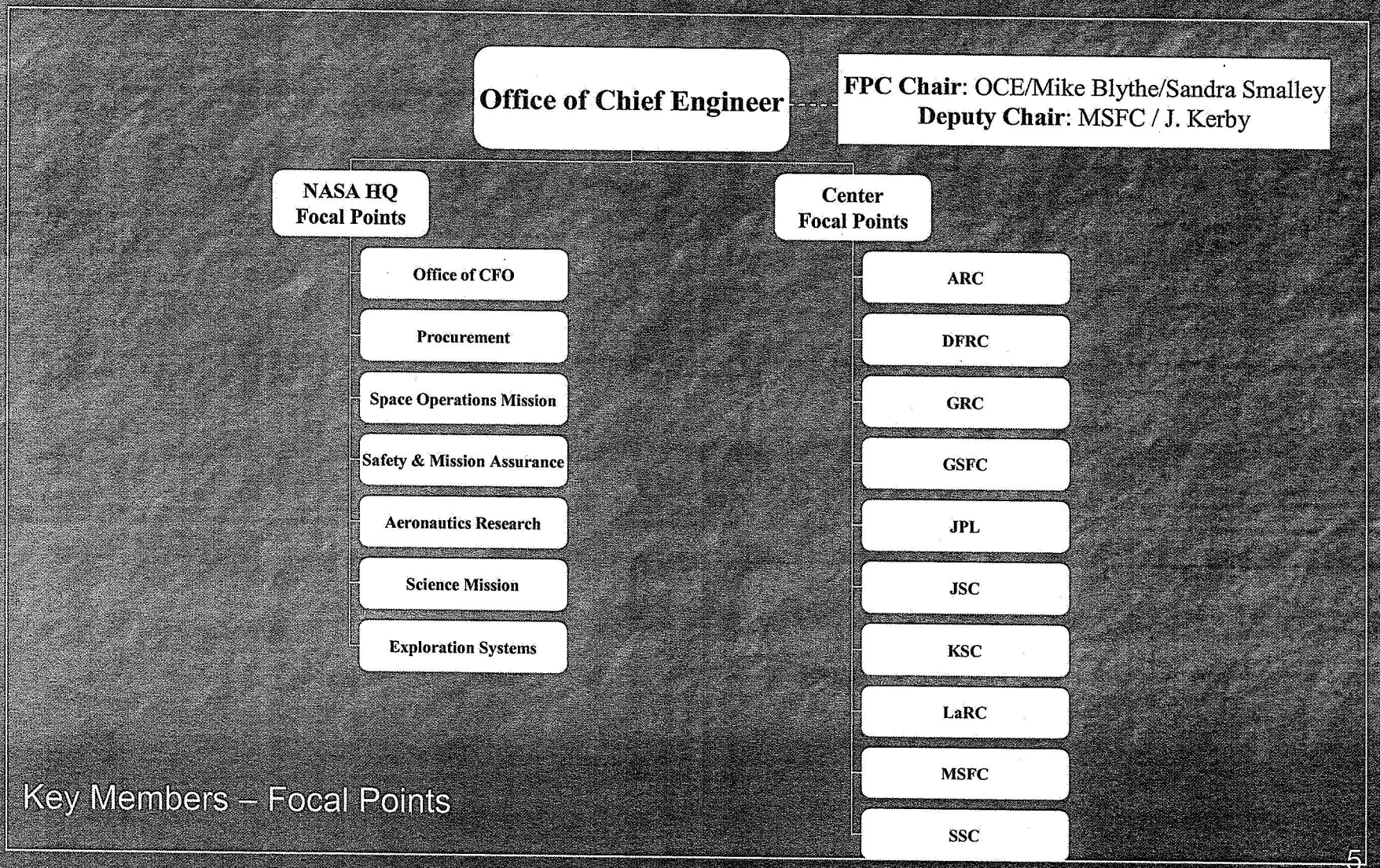
NASA Major and Component Installations



Current NASA Policy

- Apply EVM principles to all projects (contractor and civil service) exceeding $20M, but less than $50M total project cost
  - Plan all work scope
  - Breakdown scope for control of technical schedule and cost objectives
  - Integrate scope, schedule and cost into a performance measurement baseline
  - Use actual costs incurred in accomplishing work performed
  - Objectively assess accomplishments
  - Analyze variances and prepare estimate at completion
  - Incorporate EVM into decision making and review processes
- Full EIA-748-A guideline compliance shall be applied to all projects (contractor and civil service) exceeding $50M total project costs
- Use of EVM is not required on contracts with research institutes and in grants of any type.
- Project Manager can require the use of EVM on any contract regardless of value of type.

EVM Governing Structure



Key Members – Focal Points

FP Goals

- To set priorities and direction for Agency EVM activities.
- To guide the implementation of EVM in a *consistent, practical, and value-added* manner, in order for it to be utilized as a key integrated *management* process for NASA *projects*.

Roles and Responsibilities of FP Members

- Serve as the EVM consultant and expert advisor to their respective organization.
- Support the Project Manager to help ensure that:
  - Contracts include applicable EVM requirements and that an EVM compliant system is utilized in accordance with policy requirements and thresholds.
  - EVM data are analyzed and assessments are developed and utilized in management reviews.
  - EVM analysis results are integrated into risk management mitigation processes.
  - Initiatives are implemented – Integrated Baseline Reviews (IBRs), in-house EVM, implementation assessment, EVM metric data development, consistent processes for analyses and utilization of automated analysis tools.

EVM IMPLEMENTATION APPROACH

- NPG 7120.5
- EVM Handbooks
- Scheduling Handbook
- Standardized WBS, etc.

POLICY , HANDBOOKS, GUIDANCE

MISSION

PROGRAM / PROJECT

REQUEST

Mission Directorate & Center EVM Focal Point

RESOURCES, SYSTEMS, TOOLS

- Principal Center
- Automated Tools
  - EVM Engine
  - wInsight/Data Analysis
- APPEL Training
- DCMA - Surveillance
- EVM Focal Points

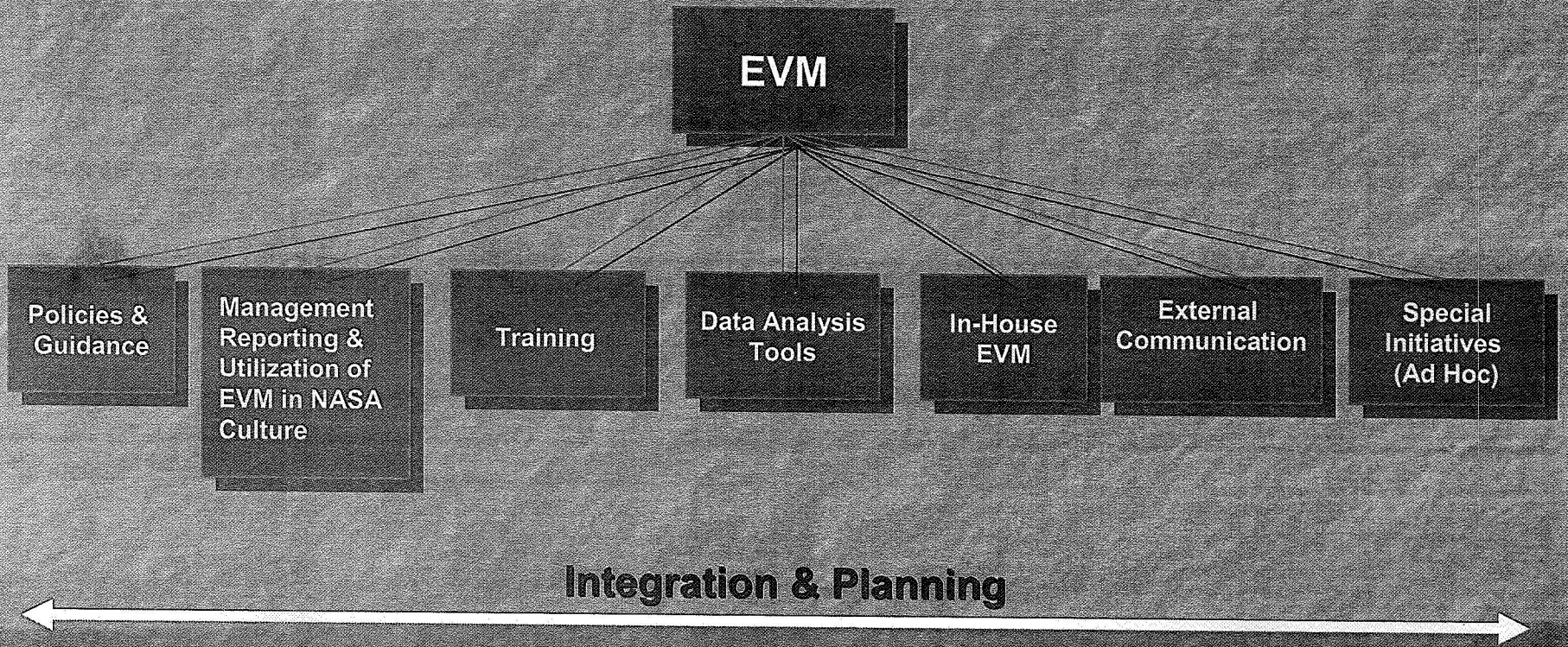
PRODUCTS & SERVICES

Guidance & Consultation for:

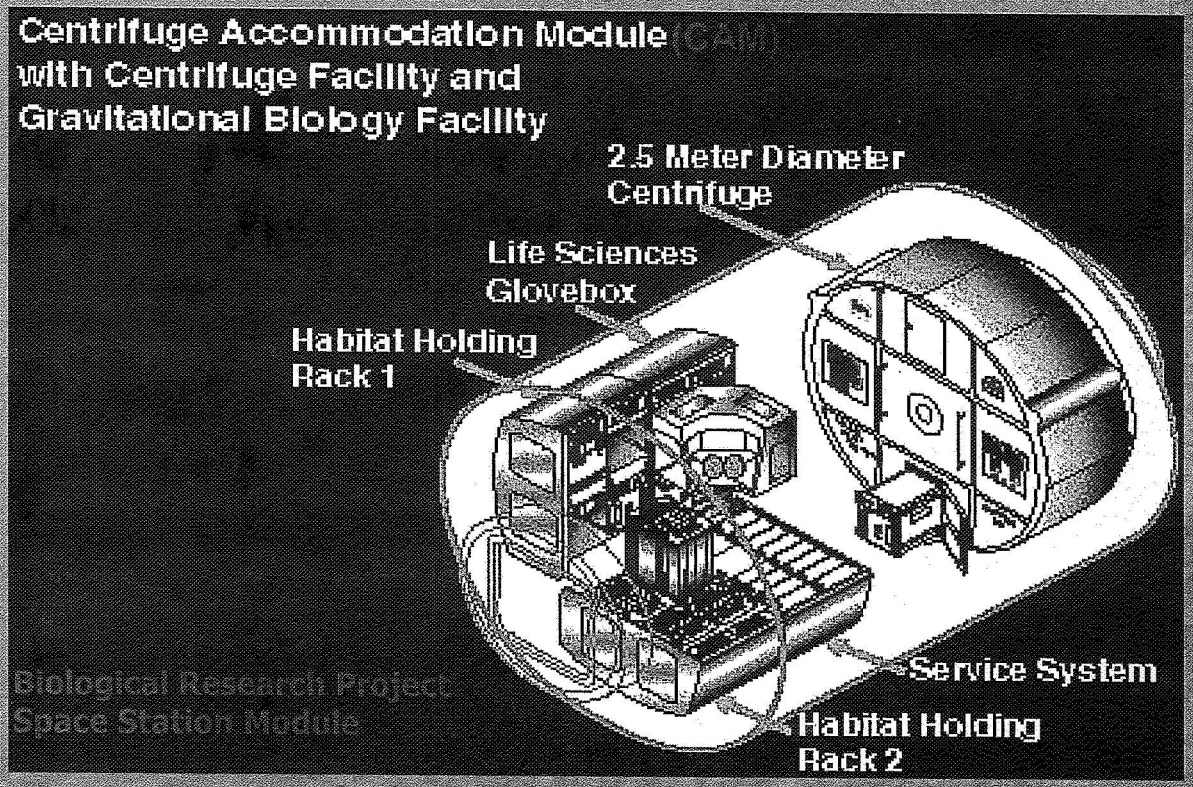
- EVM Policy & Procedures
- Training
- RFP Development
- SEB EVM Evaluation
- IBR Support
- Data Analysis / Tools
- Surveillance
- In-house EVM
- Metrics

Components for Implementation

Key Components



Implementing EVM Data Analysis: Adding Value from a NASA Project Manager's Perspective



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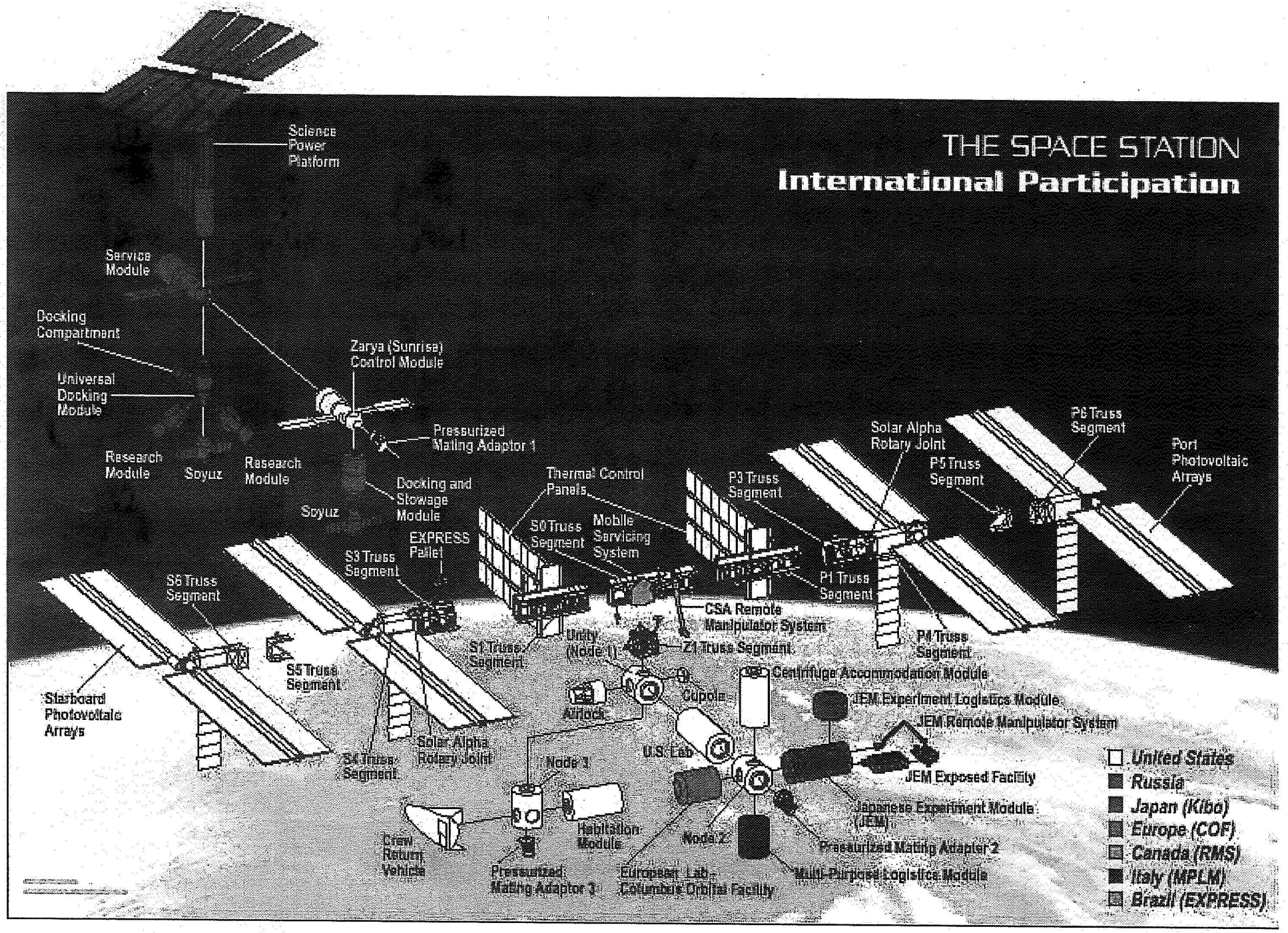
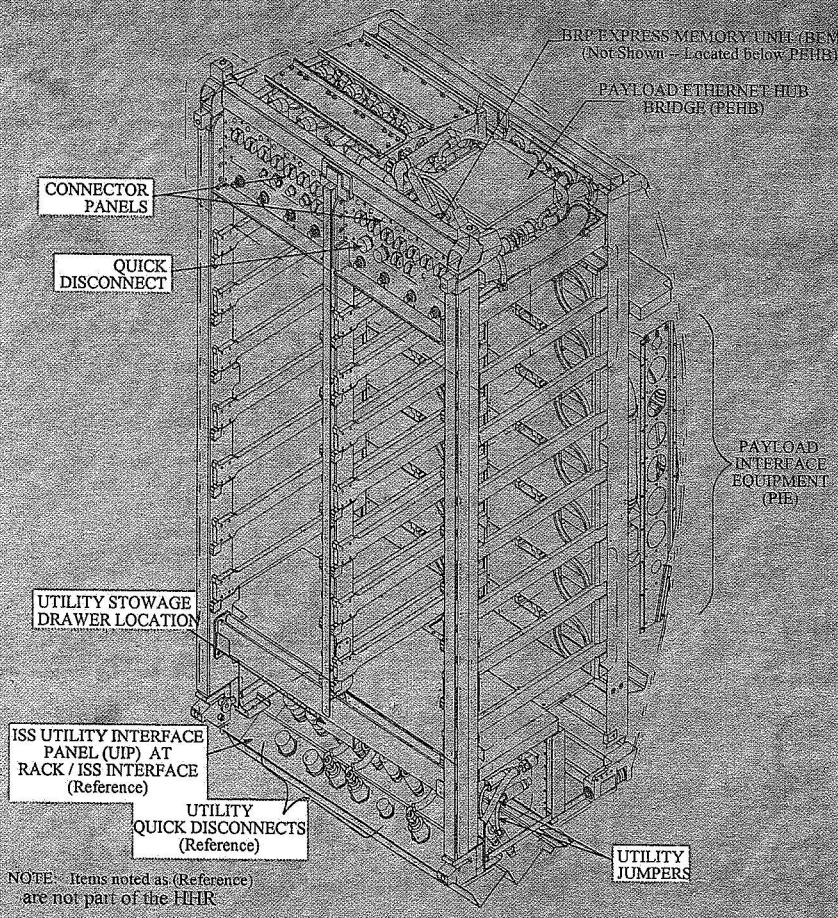
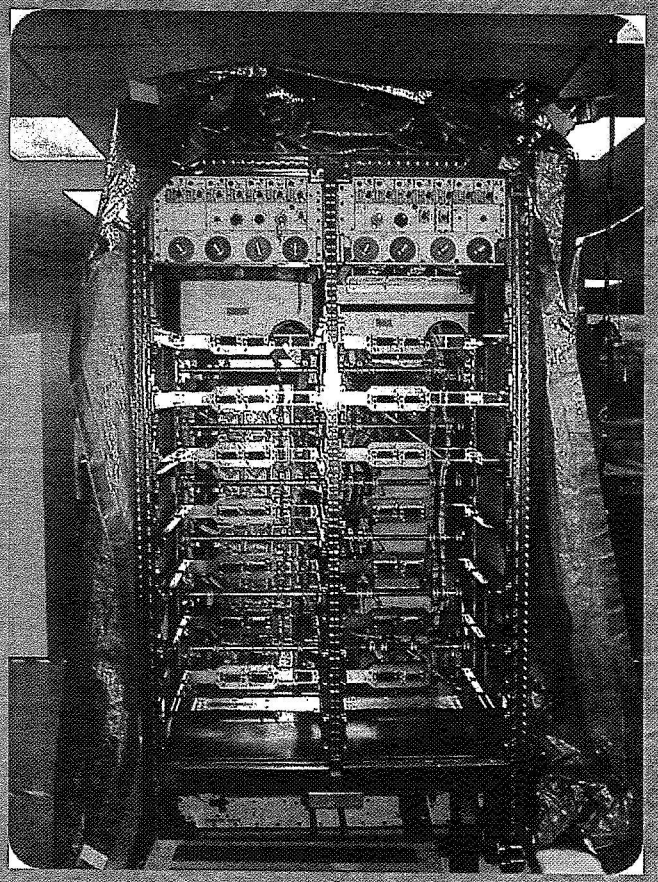

THE SPACE STATION
International Participation
Science Power Platform
Service Module
Docking Compartment
Universal Docking Module
Research Module
Soyuz
Research Module
Soyuz
Zarya (Sunrise) Control Module
Pressurized Mating Adaptor 1
Docking and Stowage Module
EXPRESS Pallet
S3 Truss Segment
S6 Truss Segment
S5 Truss Segment
Starboard Photovoltaic Arrays
S4 Truss Segment
Solar Alpha Rotary Joint
Thermal Control Panels
S0 Truss Segment
Mobile Servicing System
P3 Truss Segment
Solar Alpha Rotary Joint
P5 Truss Segment
P6 Truss Segment
Port Photovoltaic Arrays
P1 Truss Segment
CSA Remote Manipulator System
S1 Truss Segment
Unity (Node 1)
Z1 Truss Segment
P4 Truss Segment
Centrifuge Accommodation Module
Cupola
JEM Experiment Logistics Module
Airlock
JEM Remote Manipulator System
U.S. Lab
Node 3
JEM Exposed Facility
Japanese Experiment Module (JEM)
Crew Return Vehicle
Habitation Module
Node 2
Pressurized Mating Adaptor 2
Pressurized Mating Adaptor 3
European Lab Columbus Orbital Facility
Multi-Purpose Logistics Module
United States
Russia
Japan (Kibo)
Europe (COF)
Canada (RMS)
Italy (MPLM)
Brazil (EXPRESS)

Habitat Holding Rack





Habitats

- Advanced Animal Habitat
  - Research environment for laboratory mice and rats
- Aquatic Habitat
  - Research environment for small fresh water organisms
- Cell Culture Unit
  - Research environment for cell and tissue cultures
- Insect Habitat
- Avian Development Facility
  - Research environment for Japanese quail and domestic chicken eggs
- Plant Research Unit
  - For support of plant growth

Overall Implementation Approach

- **Three step approach**
  - Equip
    - Tools
    - System
    - Knowledge
  - Support
    - Standard Reports
      - 5 Pager
    - Training
    - Hands-on
  - Assess
    - Spot Check for Process Discipline

Products

- wInsight
- Schedules
  - Filters
- Training - EV, wInsight, Schedule
- Policies, DRs, etc.
- CPRs
- Training – EV, wInsight, Schedule, Data analysis, etc.
- Schedule Support
- Summary Reports

EVM Implementation Process for HHR

- Mini-IBR (Integrated Baseline Review)
  - Review across project functions
    - Resources
    - Schedule
- Re-established schedule for current environment and performance
- Adjusted EAC according to new schedule
- Monthly meetings with Contractor to review EVM data

Habitat Holding Rack Performance Data

April 1996 Program Operating Plan (POP) Submit		$X
April 1998 POP Submit		8% increase
November 2000		78% increase
September 2001 (reduced scope)		17% decrease
January 2002		9.6% increase
March 2002	New Project Manager – EVM Implemented	
Final		11% increase

% Increase before utilization of EVM	87.6% excluding de-scope
Percent Increase after utilization of EVM	1.4%

Contract End/Flight Hardware delivery on October 31, 2004

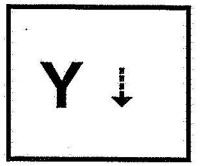
Benefits of EVM Data Analysis

- NO SUPRISES!
- EVM provides a more realistic approach to cost planning based on statistical data
- EVM provides a tool for Project Managers to utilize in reviewing Contractor data
  - Direct comparisons between contractor data and wInsight data is very beneficial
- Provides a solid means to forecast future cost requirements based on previous contractor performance
- Shows Valid History
  - Looks at both total contract and new baseline performance
- Provides estimate of required contractor performance to maintain budget within project schedule
  - Provides projections/justifications for future budgets
  - Provides good Estimates at Completion (EAC)
- Provides trends analysis to reflect whether contractor performance is decreasing or increasing
- Identifies Cost/Schedule drivers
- Helps determine risks to project
- Information to support hunches

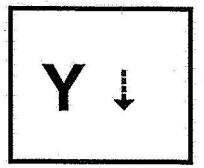
Sample HHR Monthly Report

SAMPLE DATA

SCHEDULE PERFORMANCE



COST PERFORMANCE



TO MEET BUDGET AT COMPLETION (BAC)

TO MEET CONTRACTOR'S LATEST REVISED ESTIMATE (LRE)

Performance Indicator Key		At Completion Indicator Key
Worse than -10%		TCPI > CPI by more than 5%
Between -10% and -5%	Y	TCPI > CPI by less than 5%
Better than -5%	G	TCPI < CPI
Change Threshold = 5%		

EVM Quick-Look Report

SAMPLE DATA

Dollars in Thousands

$$ in Thousands	BCWS	BCWP	ACWP	Schedule Variance			Cost Variance		
Current Pd.	1,645	1,509	1,707	-136	-8.3%	Y ↓	-198	-13.1%	■
Cumulative	7,279	6,851	7,350	-428	-5.9%	Y ↓	-499	-7.3%	Y ↓

	NASA	Ktr.	
BAC		20,796	↑
EAC	22,480	20,761	↑
VAC		35	↓

EAC Forecast	Min.	Max
	22,022	23,385

Percent Scheduled	35.0 %
Percent Complete	32.9 %
Percent Spent	35.3 %

3 Mo. Avg Spend Rate	1,441	(7%)
6 Mo. Avg Spend Rate	1,067	(5%)

Variance Status Indicator Key

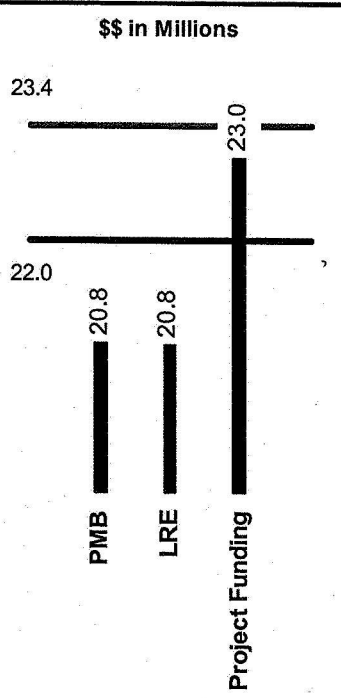
■ Worse than -10% | C Better than -5%

Y Between -10% and -5% | Change Threshold = 5%

SPI	Current	0.92	↓
	Cumulative	0.94	↓
CPI	Current	0.88	↓
	Cumulative	0.93	↓

3 Mo. Avg CPI	0.95	
6 Mo. Avg CPI	0.92	
To Compl Perf Index (TCPI) BAC	1.04	↑
To Compl Perf Index (TCPI) LRE	1.04	↓

Funding Status



Top Issues Summary

Top Schedule Variances

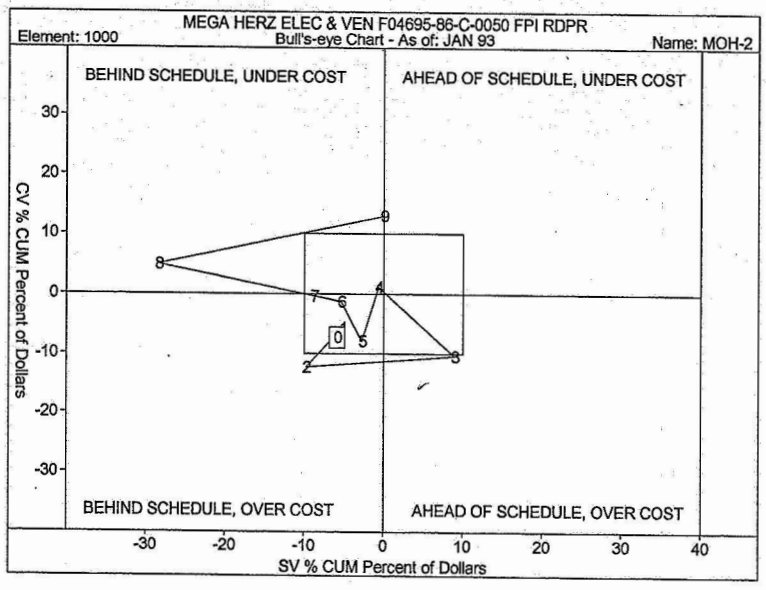
	WBS	Description	SV	CV	VAC	CPI	TCPI-LRE	CPI to LRE	SV	CV	BAC	LRE	% Budget
1	3200	COMMUNICATIONS			G ↔	0.84	1.03	-0.19	(203)	(131)	2,043	2,130	9.8%
1	3700	DATA DISPLAY		G ↔	G ↔	1.00	1.00	0.00	(113)	0	388	388	1.9%
1	3300	AUX EQUIP		G ↓	G ↓	1.13	0.96	0.17	(93)	78	2,418	2,410	11.6%
1	3100	SENSORS	Y ↑	G ↓	G ↔	0.97	0.99	-0.02	(37)	(11)	1,728	1,750	8.3%
1	2100	PROJ MANAGEMEN	G ↑	Y ↔	G ↔	0.94	1.04	-0.10	(12)	(17)	618	622	3.0%

Top Cost Variances

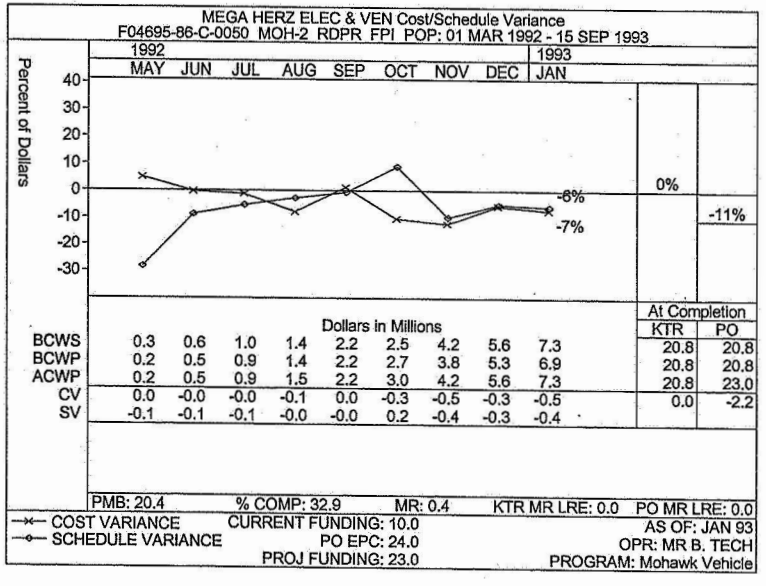
	WBS	Description	SV	CV	VAC	CPI	TCPI-LRE	CPI to LRE	SV	CV	BAC	LRE	% Budget
1	3600	PCC	G ↓		G ↔	0.85	1.03	-0.18	(11)	(296)	5,801	5,988	27.9%
2	3200	COMMUNICATIONS			G ↔	0.84	1.03	-0.19	(203)	(131)	2,043	2,130	9.8%
3	2200	SYS ENGINEERING	G ↔		G ↔	0.90	2.65	-1.75	6	(26)	283	283	1.4%
4	3800	I & A	G ↓	G ↓	G ↔	0.96	1.00	-0.05	83	(24)	1,440	1,465	6.9%
5	2100	PROJ MANAGEMEN	G ↑	Y ↔	G ↔	0.94	1.04	-0.10	(12)	(17)	618	622	3.0%

Top LRE Issues

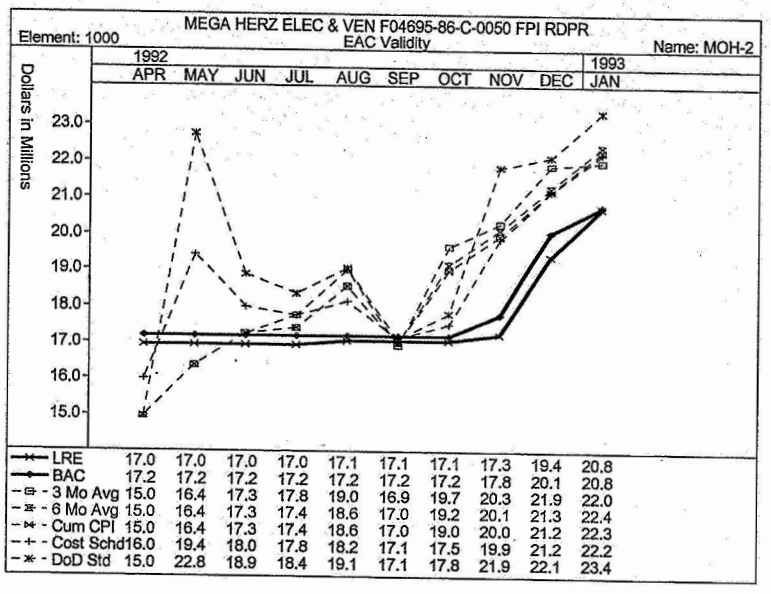
	WBS	Description	SV	CV	VAC	CPI	TCPI-LRE	CPI to LRE	SV	CV	BAC	LRE	% Budget
1	3600	PCC	G ↓		G ↔	0.85	1.03	-0.18	(11)	(296)	5,801	5,988	27.9%
2	3200	COMMUNICATIONS			G ↔	0.84	1.03	-0.19	(203)	(131)	2,043	2,130	9.8%
3	4000	SPARES	G ↑	Y ↑	G ↔	0.95	1.00	-0.06	1	(8)	756	762	3.6%
4	2100	PROJ MANAGEMEN	G ↑	Y ↔	G ↔	0.94	1.04	-0.10	(12)	(17)	618	622	3.0%
5	2200	SYS ENGINEERING	G ↔		G ↔	0.90	2.65	-1.75	6	(26)	283	283	1.4%



- The Bulls-Eye Chart provides overall status at a glance. The point labeled '0' represents the status for the current month. The point labeled '1' represents the status one month ago.
- The project is currently behind schedule.
- The project is currently over cost.
- Normally, a negative schedule variance will have a negative impact on cost by program completion. Special attention should be paid to cost for behind-schedule elements as the contract approaches completion.



- The Cost/Schedule Variance Chart graphically depicts the cost and schedule variances in percentages, and provides the associated values in dollars (in thousands).
- Currently, the contractor has an unfavorable schedule variance of -428 (-6%) and an unfavorable cost variance of -499 (-7%)
- The Budget at Completion (BAC) is 20,796 and the effort is 33% complete.
- The contractor's Latest Revised Estimate (LRE), which depicts their Estimate at Completion (EAC), is 20,761, which is 35 less than the BAC.

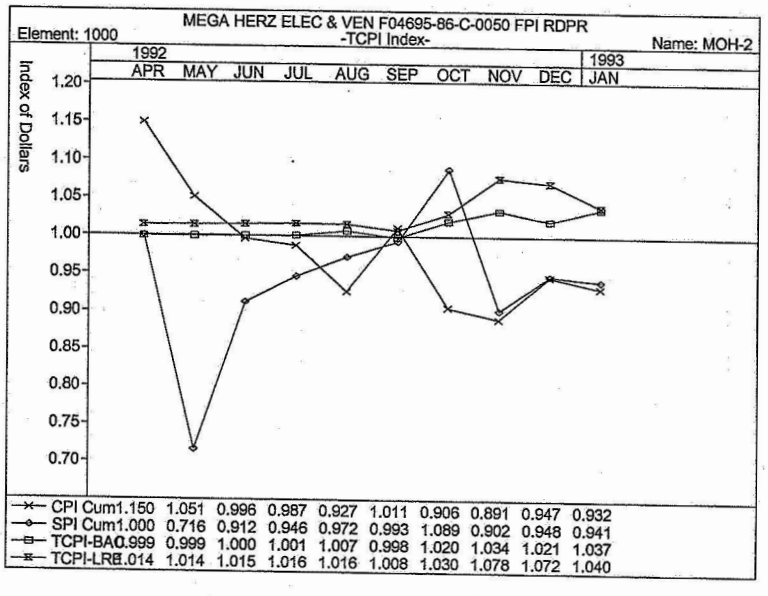


•The LRE Validity Chart compares the contractor's Latest Revised Estimate (LRE) to several statistically derived values for the Estimate at Completion (EAC). The LRE and EAC are terms that are often used interchangeably, representing the estimate of the total direct charges against the contract. The LRE should be somewhere within the range of the calculated values.

•Currently, MEGA HERZ ELEC & VEN LRE of 20,761 is 35 less than the BAC

•The LRE appears to be below the range of the statistically derived values.

•"Since the LRE falls outside the range of calculated values, the contractor should re-evaluate the LRE as soon as possible."



•The To Complete Performance Index (TCPI) chart illustrates the efficiency rate that the contractor must accomplish to meet the BAC or LRE, based on the contractor's performance to date.

•To date, the cost performance efficiency has been 0.932. In other words, for each dollar spent, the contractor has accomplished $0.93 worth of the work budgeted.

•To meet the BAC, the contractor must accomplish $1.04 of work for each dollar spent.

•Given the performance to date, it does not seem likely that the contractor will be able to meet the BAC.

•To meet the LRE, the contractor must accomplish $1.04 of work for each dollar spent.

•Given the performance to date, it does not seem likely that the contractor will be able to meet the LRE.

EVM Definitions

TERMINOLOGY

ACWP ACTUAL COST OF WORK PERFORMED (ACTUAL COST)
BAC BUDGET AT COMPLETION (ALLOCATED BUDGETS)
BCWP BUDGETED COST OF WORK PERFORMED (EARNED VALUE)
BCWR BUDGETED COST OF WORK REMAINING
BCWS BUDGETED COST OF WORK SCHEDULED (PLANNED VALUE)
CBB CONTRACT BUDGET BASELINE (TOTAL AUTHORIZED WORK)
CPI COST PERFORMANCE INDEX
CV COST VARIANCE (BCWP-ACWP)
EAC ESTIMATE AT COMPLETION (GOVERNMENT'S EAC)
ETC ESTIMATE TO COMPLETE
LRE LATEST REVISED ESTIMATE (CONTRACTOR'S EAC)
MR MANAGEMENT RESERVE
PMB PERFORMANCE MEASUREMENT BASELINE
SPI SCHEDULE PERFORMANCE INDEX
SV SCHEDULE VARIANCE (BCWP-BCWS)
UB UNDISTRIBUTED BUDGET

COMMON CAUSES FOR VARIANCE

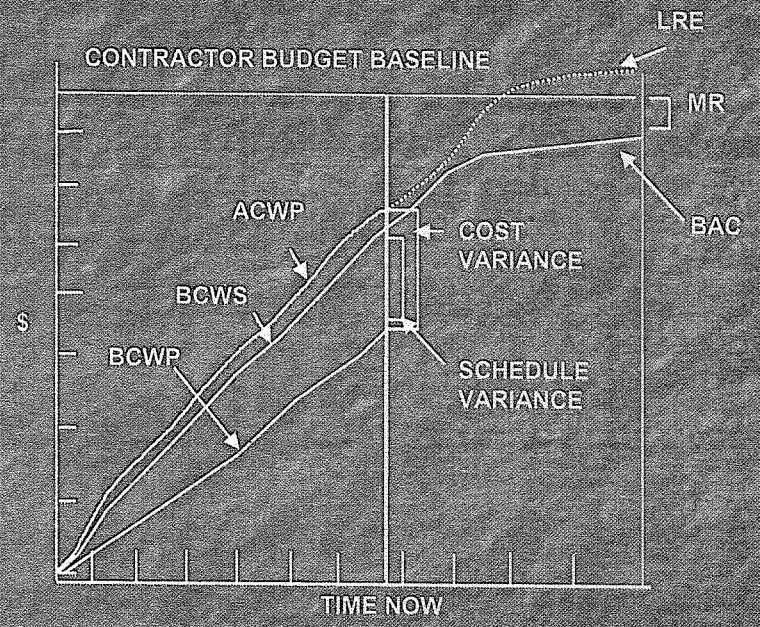
FAVORABLE

POOR INITIAL PLANNING OR ESTIMATING
TECHNICAL BREAK THROUGH
COST OF LABOR AND MATERIAL LOWER THAN PLAN
FRONT END LOADING
METHOD OF EARNING BCWP

UNFAVORABLE

POOR INITIAL PLANNING OR ESTIMATING
TECHNICAL PROBLEM
COST OF LABOR OR MATERIAL HIGHER THAN PLAN
INFLATION
NEW LABOR CONTRACTS
WORK STOPPAGE

USE OF CONTRACTOR PERFORMANCE MEASUREMENT DATA



CPR COST PERFORMANCE REPORT
C/SSR COST/SCHEDULE STATUS REPORT

PURPOSE: TO OBTAIN CONTRACT COST AND SCHEDULE STATUS INFORMATION ON WHICH TO BASE PROGRAM MANAGEMENT DECISIONS