

A vertical decorative strip on the left side of the slide, featuring a large image of the planet Mars in the upper half and a smaller image of Earth and the Moon in the lower half.

# ***Vision for Space Exploration***

## **Concept Exploration and Requirements**

**CER Contract Kick-off Meeting  
13 September 2004**

**Overview Presentation by:  
Raytheon Corporation**



# Raytheon Team Enterprise

**Raytheon**

*Customer Success Is Our Mission*



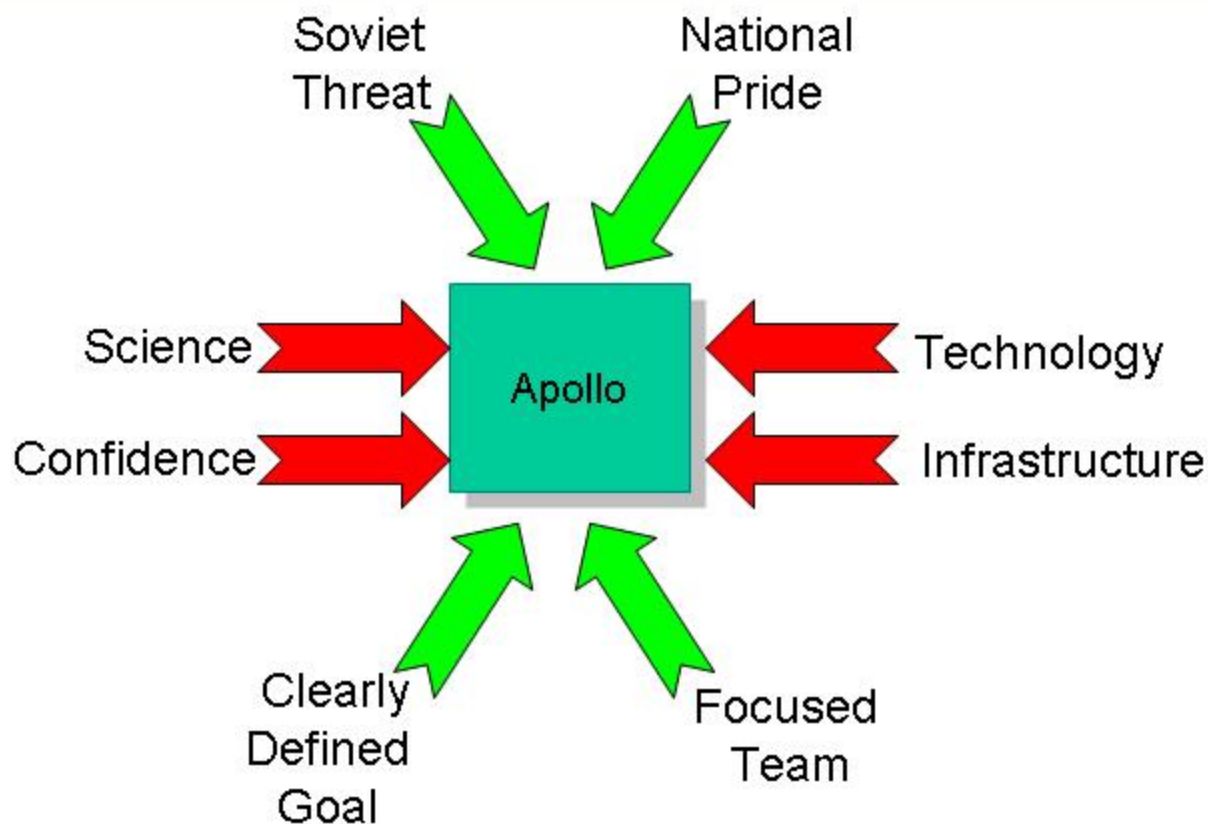
**World Class Engineering and Integration Expertise**



# Space Exploration – Historical View

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Von Braun/  
Colliers

L-5 Society  
/  
O'Neill

Next  
Logical  
Step

National  
Commission  
On Space

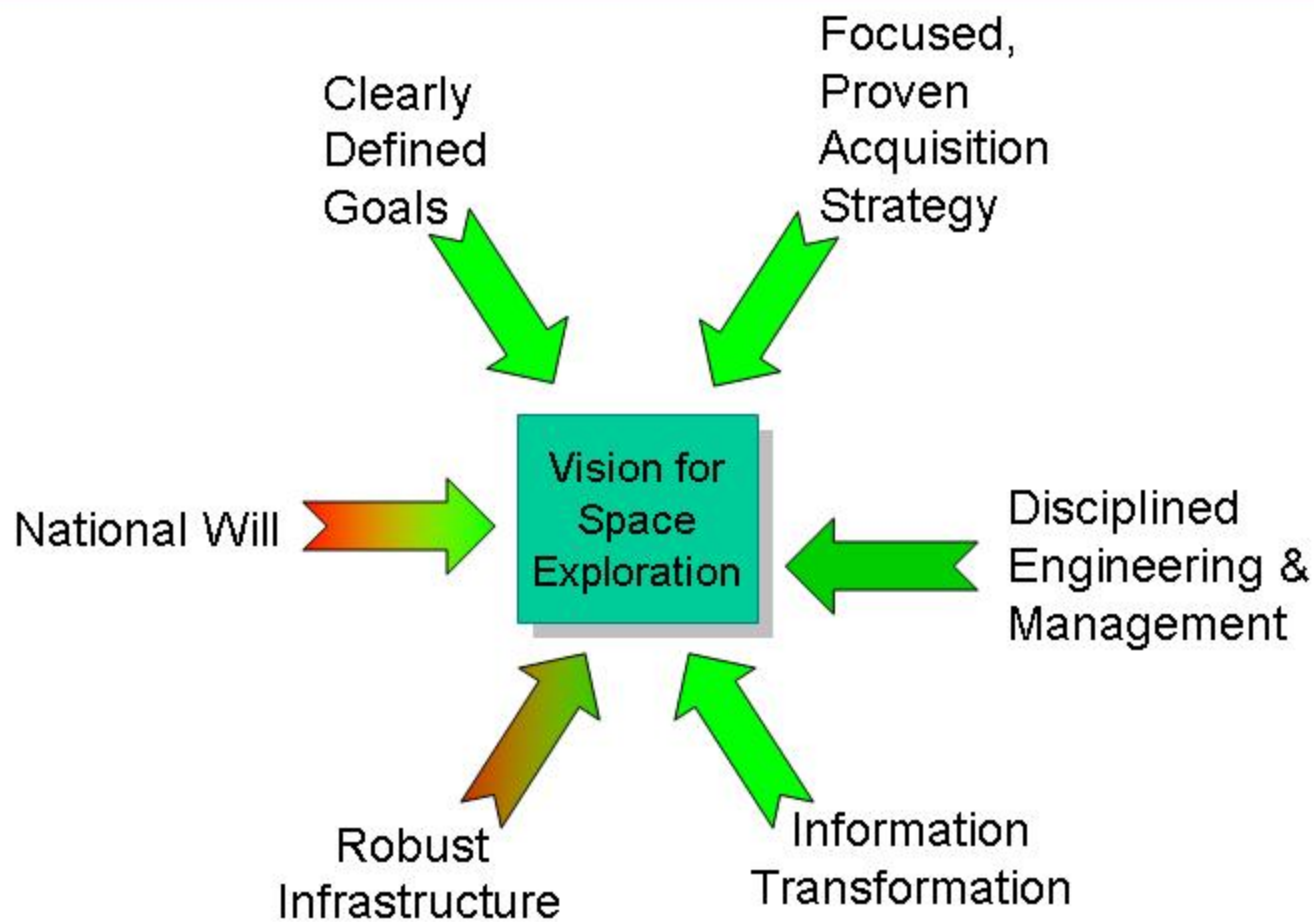
Space  
Exploration  
Initiative



# New Opportunity!

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40 years of Architecture Studies





# Vision ➡ Objectives ➡ Strategy

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## Vision

Advance U.S. Scientific, Security, and Economic Interests through a Robust Space Exploration Program

## Objectives

Safe

Sustainable

Affordable

Extend Human Presence

Enable Innovation

International and Commercial Participation

## Strategy

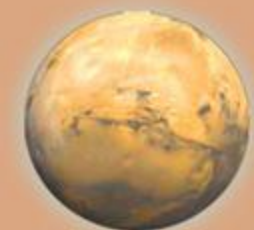
Results Driven

Open Systems Culture

Collaborative Environment

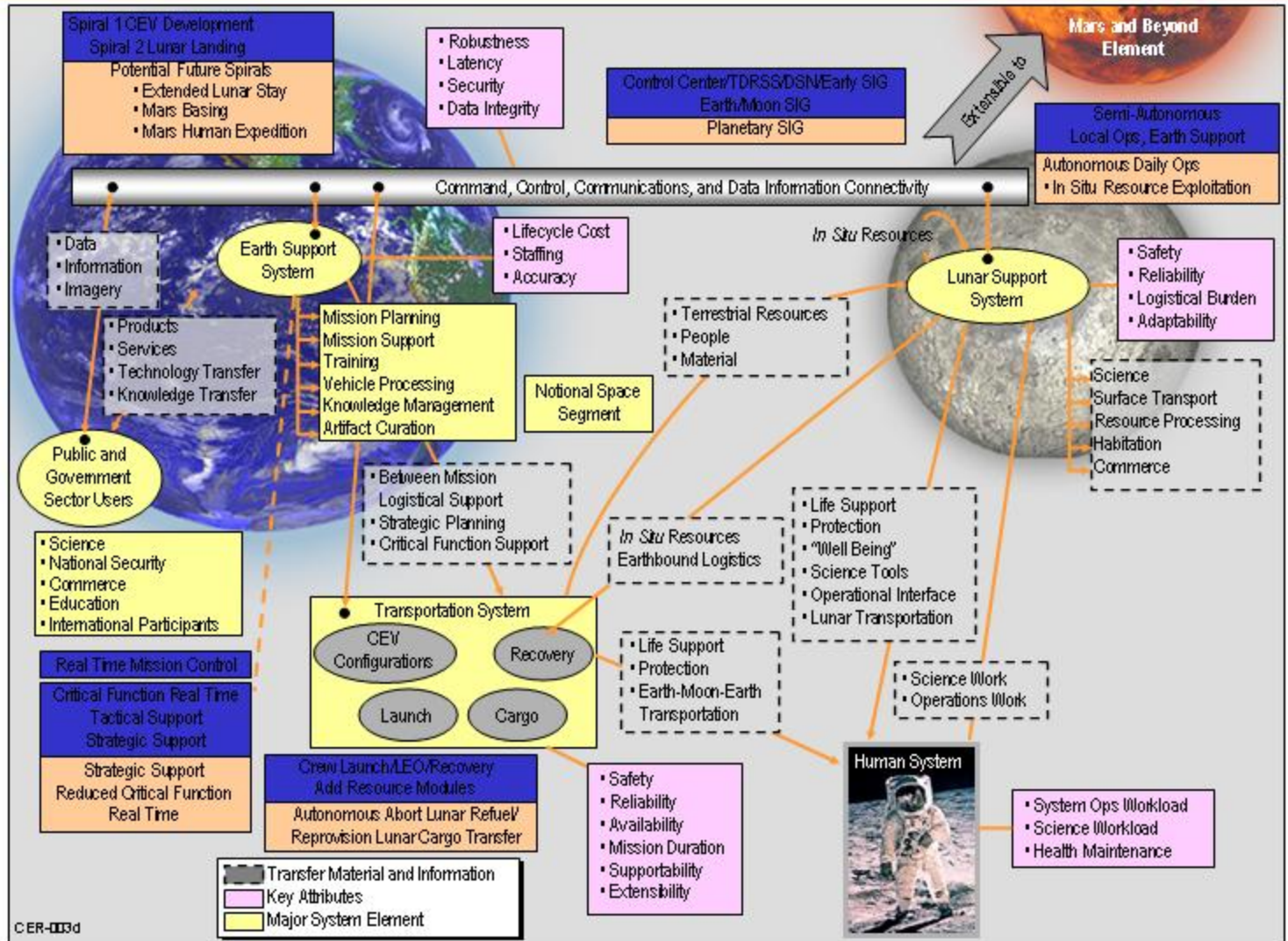
Disciplined Simulation Based Acquisition

Network Centric Operations





# Architecture Approach



**CEV Requirements derived from Overall Architecture**



# Architecture Attributes

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## Operations Centric

- Focus on outcomes
- CEV is a vital element, but not the centerpiece of the enterprise
- Lifecycle cost / performance key parameters
- Leverage emerging operations concepts to minimize standing support
- Maximize knowledge transfer and availability
- Open information systems
- Modular, open spacecraft systems

## Open Enterprise

- Enable participation by commercial, and international partners
- Interagency leverage







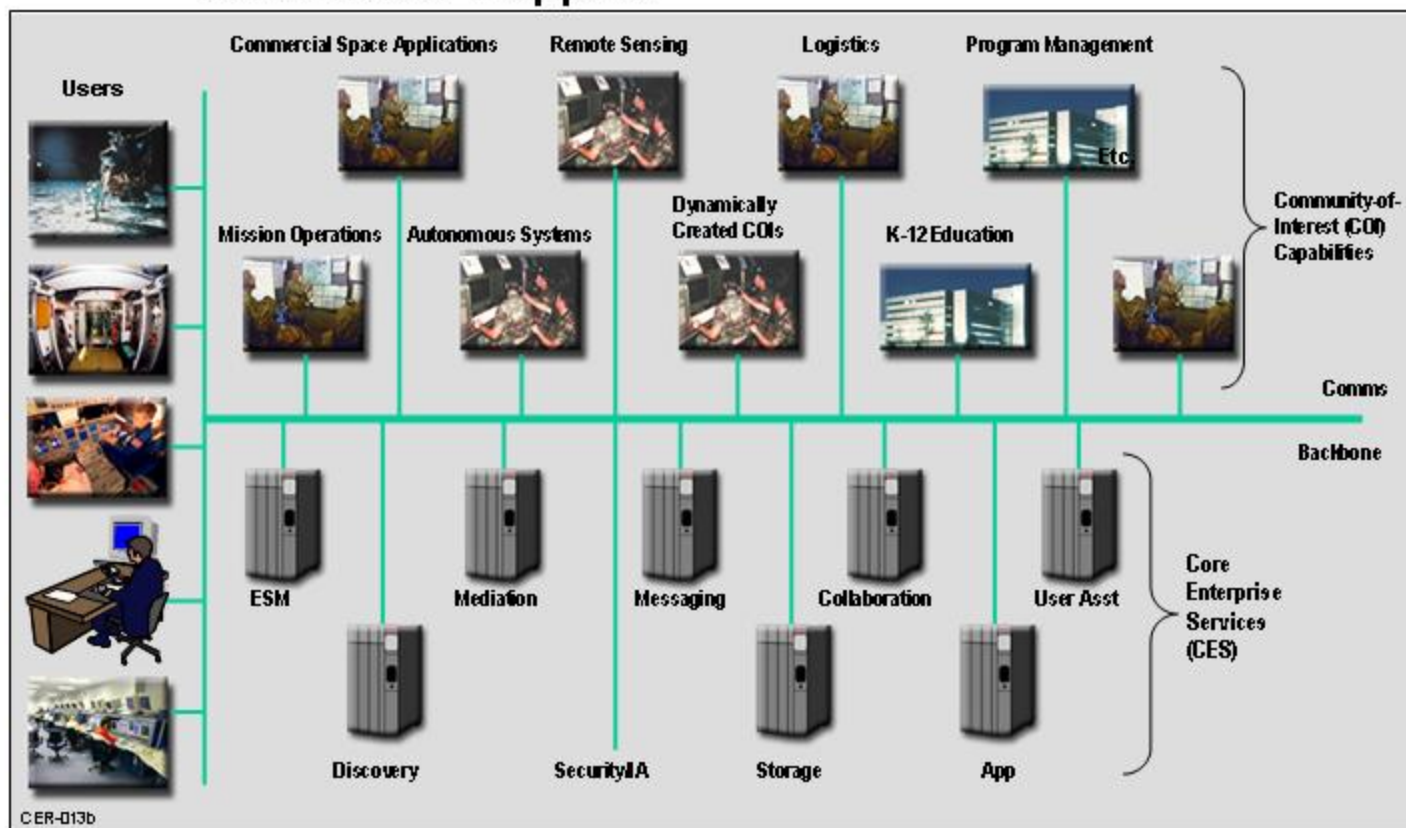
# Information System Concept

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## Knowledge Management Based

- Enables "Power to the Edge" Operations
- Enables opening the enterprise
  - Outreach
  - Distributed Support



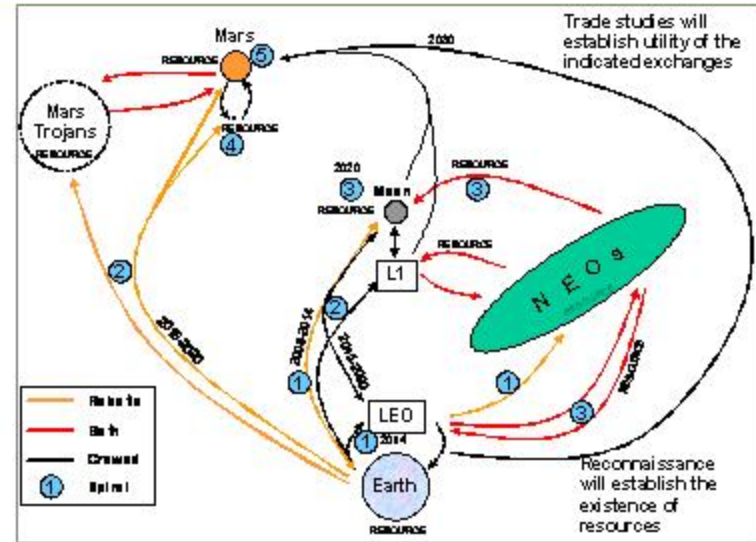




# Commonality and Extensibility

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## Modular spacecraft and robotics design

- Mission flexibility as the spirals unfold
- Technology insertion
- Enabler for wide participation in program
- Leverage between crewed and robotic spacecraft

## NASA, DoD and Commercial Elements































- Software standards
- Autonomous operations technology
- Communications technology standards



# Formal Architecture Approach

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WHAT	HOW	WHERE	WHO	WHEN	WHY	
DATA	FUNCTION	NETWORK	PEOPLE	TIME	MOTIVATION	
<p>List of Things Important to the Business</p>  <p>Entity = Class of Business Thing</p>	<p>List of Processes the Business Performs</p>  <p>Process = Class of Business Process</p>	<p>List of Locations in Which the Business Operates</p>  <p>Node = Major Business Location</p>	<p>List of Organizations Important to the Business</p>  <p>People = Major Organizational Unit</p>	<p>List of Events/Cycles Significant to the Business</p>  <p>Time = Major Business Event/Cycle</p>	<p>List of Business Goals/Strategies</p>  <p>Ends/Means = Major Business Goal/Strategy</p>	<p><b>SCOPE</b> (contextual)</p> <p>Planner</p>
<p>e.g., Semantic Model</p>  <p>Entity = Business Entity Relationship = Business Relationship</p>	<p>e.g., Business Process Model</p>  <p>Process = Business Process IO = Business Resource</p>	<p>e.g., Business Logistics</p>  <p>Node = Business Location Link = Business Linkage</p>	<p>e.g., Work Flow Model</p>  <p>People = Organization Unit Work = Work Product</p>	<p>e.g., Major Schedule</p>  <p>Time = Business Event Cycle = Business Cycle</p>	<p>e.g., Business Plan</p>  <p>End = Business Objective Means = Business Strategy</p>	<p><b>BUSINESS MODEL</b> (conceptual)</p> <p>Owner</p>
<p>e.g., Logical Data Model</p>  <p>Entity = Data Entity Relationship = Data Relationship</p>	<p>e.g., Application Architecture</p>  <p>Process = Application Function IO = User Views</p>	<p>e.g., Distributed System Architecture</p>  <p>Node = I/S Function (Processor, Storage, etc.) Link = User Characteristics</p>	<p>e.g., Human Interface Architecture</p>  <p>People = Role Work = Deliverable</p>	<p>e.g., Processing Structure</p>  <p>Time = System Event Cycle = Processing Cycle</p>	<p>e.g., Business Rule Model</p>  <p>End = Structural Assertion Means = Action Assertion</p>	<p><b>SYSTEM MODEL</b> (logical)</p> <p>Designer</p>
<p>e.g., Physical Data Model</p>  <p>Entity = Segment/Table, etc. Relationship = Primary/Key, etc.</p>	<p>e.g., Screen Design</p>  <p>Process = Computer Function IO = Data Element/Set</p>	<p>e.g., Technology Architecture</p>  <p>Node = Info System Software Link = Interface Specification</p>	<p>e.g., Presentation Architecture</p>  <p>People = User Work = Screen Format</p>	<p>e.g., Control Structure</p>  <p>Time = Event Cycle = Component Cycle</p>	<p>e.g., Info Design</p>  <p>End = Condition Means = Action</p>	<p><b>TECHNOLOGY MODEL</b> (physical)</p> <p>Builder</p>
<p>e.g., Data Definition</p>  <p>Entity = Field Relationship = Address</p>	<p>e.g., Program</p>  <p>Process = Language Statement IO = Control Work</p>	<p>e.g., Network Architecture</p>  <p>Node = Address Link = Protocol</p>	<p>e.g., Security Architecture</p>  <p>People = Identity Work = Job</p>	<p>e.g., Timing Definition</p>  <p>Time = Interval Cycle = Machine Cycle</p>	<p>e.g., Role Specification</p>  <p>End = Sub-condition Means = Step</p>	<p><b>DETAILED REPRESENTATIONS</b> (out-of-context)</p> <p>Subcontractor</p>
e.g.: DATA	e.g.: FUNCTION	e.g.: NETWORK	e.g.: ORGANIZATION	e.g.: SCHEDULE	e.g.: STRATEGY	<p><b>FUNCTIONING ENTERPRISE</b></p> <p>© John A. Zachman</p>





## Summary

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### Formal Architectural Framework Process:

- ✓ Enables Requirements Flow down to CEV and Launch System
- ✓ Facilitates evaluation of innovative technologies
- ✓ Frames the dialog for international and commercial participation
- ✓ Allows orderly maturation of exploration enterprise

This Process underpins disciplined communication and collaboration

**Full Partnership Enables Sustainable Exploration**