

## **Experiences with Launch Vehicles**

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The presentation "NASA Experience with Launch Vehicles" is a compilation of Mr. Dumbacher's career experiences with the Space Shuttle Program, the Delta - Clipper Experimental flight test project, the X-33 demonstrator project, and recent experiences with the Orbital Spaceplane Program and the current NASA effort on Exploration Launch Systems. Mr. Dumbacher will discuss his personal experiences and provide lessons learned from each program. The accounts provided by Mr. Dumbacher are his own and do not necessarily represent the official NASA position.



# EXPERIENCES WITH LAUNCH VEHICLES

PRESENTED BY

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# Lessons Learned

- ◆ **Play the game with the right Team!**
  - Communicate
  - “We not I”
- ◆ **Stay focused on the Goal!**
- ◆ **Get the Requirements right, even if it takes extra time!**
  - Always ask “Why”!
- ◆ **Have Fun through the tough times, and there will be tough times.**



## Lessons Learned (cont'd)

- ◆ **Testing, in the right environments, trumps analysis every time.**
- ◆ **Be aware of what the team doesn't know, and fill the gaps.**
  - Constantly work to find what you don't know.
- ◆ **Celebrate successes, large and small, along the way.**



1978 - 1985

## Space Shuttle Main Engine (SSME) System

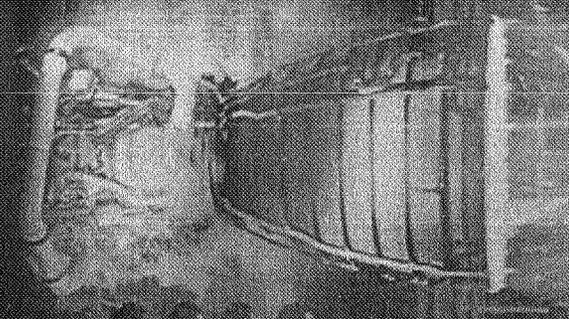


### ◆ Technical Accomplishments:

- Assessed hardware acceptability for ground testing and flight
- Verified flight hardware redlines based on acceptance test data and predicted performance
- Performed anomaly resolution and participated in incident investigations
- Supported real-time launch decisions at Huntsville Operations Support Center

### ◆ Management Lessons:

- Always deal with the facts.
- Call it as you see it.
- Respect the data.



*Gaining Insight into NASA and Complex Systems*

1987 - 1989

## SSME Project Chief Engineer's Office

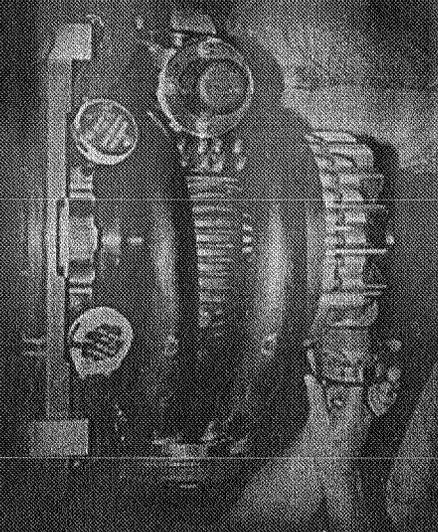


### ◆ Technical Accomplishments:

- Integrated technical concepts to Preliminary Design Review
- Developed requirements and Design Verification System
- Initiated subcomponent test activities consistent with verification plan

### ◆ Management Lesson:

- Integrate technical requirements & resources with Government Team.
- Plan for verification activities up front.



*Learning from Apollo's Wise Owls*

1989 - 1991

## SSME Technology Test Bed Project



- ◆ **Technical Accomplishments:**
  - Demonstrated performance of eventual SSME Block II configuration with large throat main combustion chamber and alternate turbopump
  - Demonstrated acceptability of reduced SSME acceptance test series
  - Measured internal SSME performance parameters for first time in history of the program
- ◆ **Management Lesson:**
  - Communicate, communicate, communicate!

*Applying Technical Knowledge*

1991-94

## Shuttle Program/SME Project Office



- ◆ **Technical Accomplishments:**
  - Ensured flight readiness
  - Assured technical requirements met within cost and schedule constraints
- ◆ **Management Lesson:**
  - Dedication will help you persevere through tough times.



*Contributing Technical and Managerial Expertise*

1994-96

## **Delta Clipper-Experimental Advanced (DC-XA) Project**



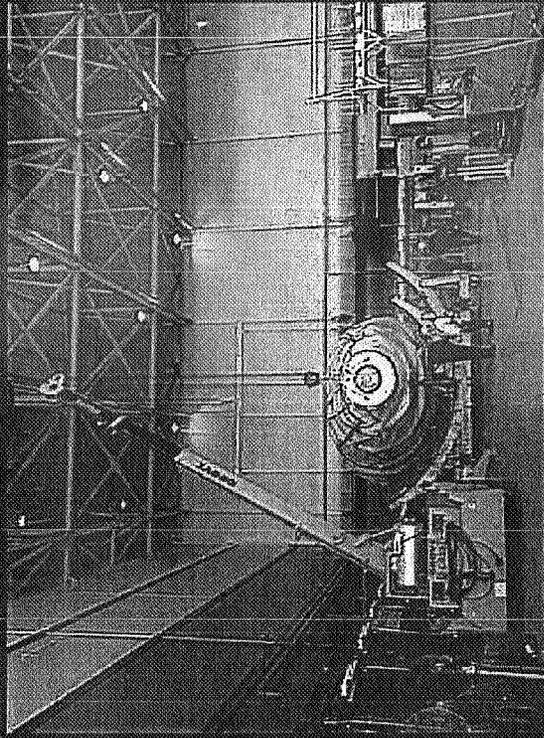
### ◆ **Technical Accomplishments:**

- Developed and tested new launch vehicle technologies (rapid prototyping composite liquid hydrogen tank, Al-Li liquid oxygen tank, composite structure)
- Exceeded technical requirements (2 flight tests in 26 hours, turnaround maneuver, etc.)
- Completed flight tests on schedule, under ran budget by 10%

◆ **Management Lesson: You only learn through trying  
— sometimes it works, sometimes it doesn't.**

*Expanding the Envelope of Experience*

# 1996 - 1997 X-33 Program



## ◆ Technical Accomplishments:

- Developed concept to Critical Design Review
- Demonstrated new launch vehicle technologies (aerospike engine, composite structure, metallic TPS, rapid prototyping)
- Tested composite liquid hydrogen tank

## ◆ Management Lesson:

- Sometimes you can make the job too impossible.
- Do what you think is right

*Taking Technology to the Outer Limits*

2000 - 2001

## Space Launch Initiative (SLI), 2<sup>nd</sup> Generation RLV Program



### ◆ Technical Accomplishments:

- Developed multi-Center / Agency team and program formulation
  - System studies & architectures
  - Technology development
- Developed acquisition strategies
- Managed procurement and contracting activities
- Implemented Earned Value Management
- Conducted major staffing activity and benchmarking studies

◆ Management Lesson: Build the best team, and build credibility by executing the plan.

*Focusing on Stakeholder Satisfaction*

2001

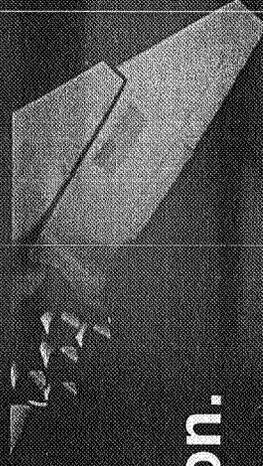
## SLI, Orbital Space Plane (OSP) Program



### ◆ Technical Accomplishments:

- Led multi-Center team
- Developed requirements via trade studies
- Developed necessary technologies
- Served as NASA Lead for Joint NASA / U.S. Air Force study

◆ Management Lesson: Teamwork is essential and requires open communication.



Addressing NASA's Vital Space Station Transportation Needs

2004

## Safety and Mission Assurance Directorate



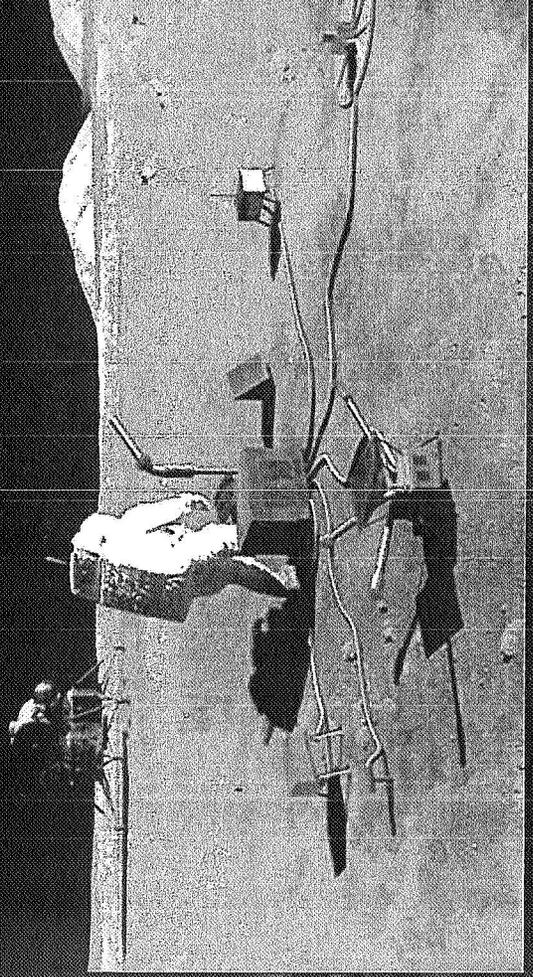
- ◆ **Technical Accomplishments:**
  - Return the Shuttle to safe flight as a strategic element of the Vision for Space Exploration
  - Ensure Shuttle propulsion efforts deliver technical excellence
  - Implement S&MA Shuttle propulsion procedures between MSFC and JSC
  - Assess performance
  - Develop and implement appropriate S&MA support across MSFC
- ◆ **Management Lesson: Develop agile workforce capabilities relevant to both the work at hand and for future needs.**

*Focusing Talent and Resources to Achieve NASA's Vision and Mission*

# The U.S. Vision for Space Exploration

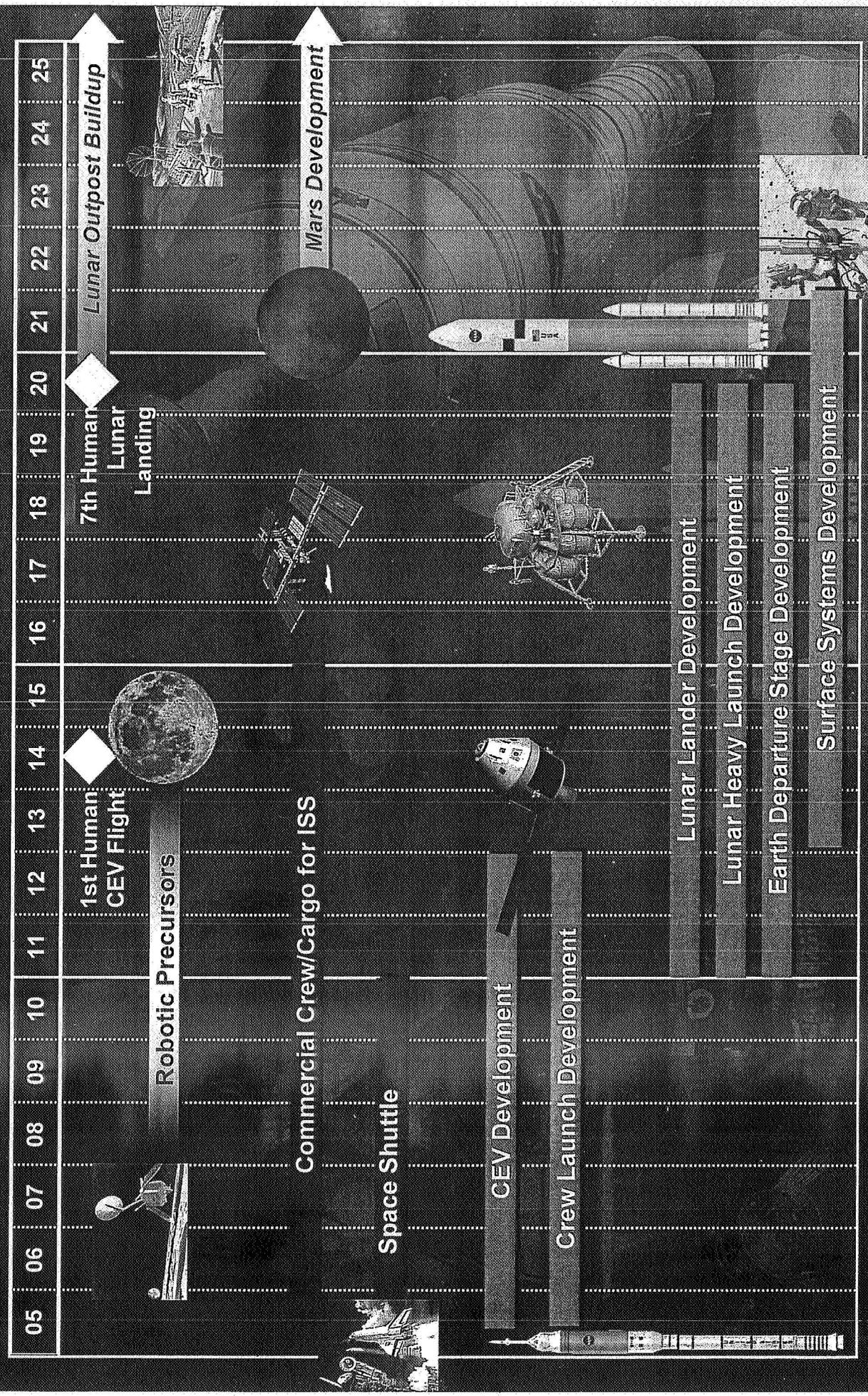


- ◆ Implement a sustained and affordable human and robotic program to explore the solar system and beyond.
- ◆ Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for the human exploration of Mars and other destinations.
- ◆ Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration.
- ◆ Promote international and commercial participation in exploration.





# NASA'S Exploration Roadmap



# Lessons Learned

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## **Lessons Learned (cont'd)**



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## Summary

- ◆ **PERSONAL INTEGRITY**
- ◆ **Treat others as you want to be treated**
- ◆ **Communicate**
- ◆ **Use the experience that has lived through the “wars” (hardware development experience)**

*Contributing Capabilities for Mission Success*

