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Panel Session IV - Launch Vehicle Options for Exploration

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Launch Vehicle Options for Exploration

Dan Collins
Vice President
Delta Programs

April 28, 2004

04HB04001_1

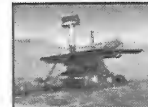
Delta 2003 Mission Successes

Delta Top Launcher in 2003

Launcher	Success	Failure
Delta	9	0
Soyuz	8	0
Atlas	6	0
Long March	6	0
Proton	5	0
Ariane	4	0
Titan	4	0
Pegasus	4	0
Cosmos 3M	3	0
Sea Launch	3	0
H-2A/M-5	3	1
GSLV/PSLV	2	0
Molniya M	2	0
Rocket	2	0
Strela	1	0

NASA's Workhorse

Mars Missions



Spirit



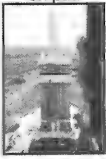
6/10/03

Opportunity

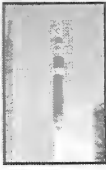


7/07/03

Delta IV Heavy on pad



DSCS III B6



8/29/03

100% NASA Mission Success

04HB04001_2

Substantial Delta Investments are Available to Jump Start NASA's Exploration Vision

Delta IV Heavy

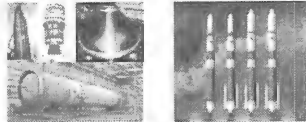


Heavy configuration to satisfy USG heavy-lift requirements

Rocketdyne RS-68



First new U.S. booster engine in over 20 yrs per USG requirements



Delta IV Rocket Development



Decatur, AL

1.5m sq. ft. state-of-the-art manufacturing facility and tooling



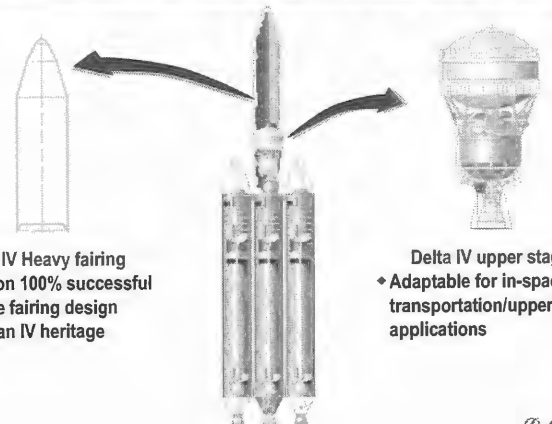
SLC 37 at CCAFS

New launch pad and infrastructure

Boeing Has Invested Billions in Design Development and Infrastructure

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Delta IV Heavy Subsystems May Also be Used for Other Exploration Launch Options



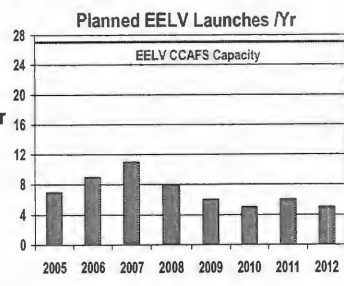
Delta IV Heavy fairing
 ♦ Based on 100% successful heritage fairing design
 ♦ Titan IV heritage

Delta IV upper stage
 ♦ Adaptable for in-space transportation/upper stage applications

04HB04001_4

Delta IV – Affordable & Sustainable Exploration Support

- ♦ Robust capabilities minimizes near-term investment
- ♦ Decatur Manufacturing Facility
 - Designed to produce 40 CBCs/year
- ♦ RS-68 developed and flight-proven
 - Production capability sized to support Delta-IV production
- ♦ SLC 37-B designed for 15 launches per year



Delta IV Support Of EELV And Other NASA/Civil Programs Assures Launch And Manufacturing Proficiency

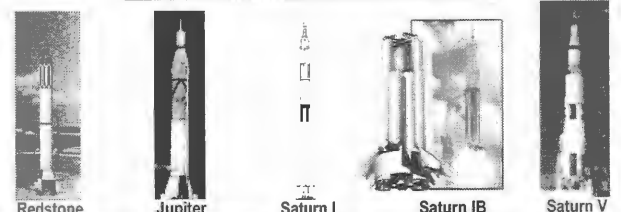
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We've Been Down This Path Before . . .

- ♦ Apollo/Saturn programs built upon incremental steps to achieve an extraordinary objective
- ♦ Saturn program built upon the solid achievements of much smaller precursor launch systems



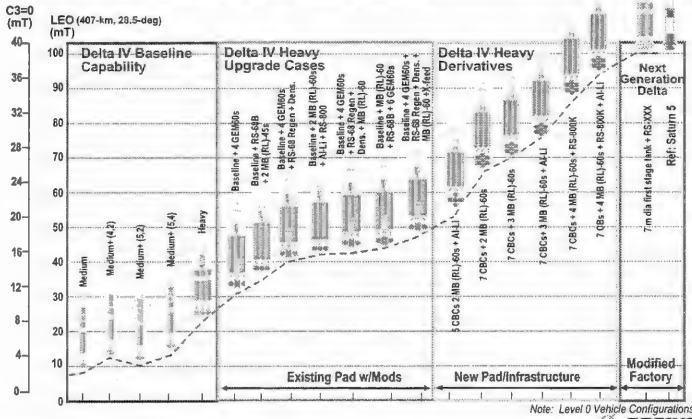
Saturn Launch Vehicle Evolutionary Development



Spiral Development From Existing Systems Enabled Saturn V

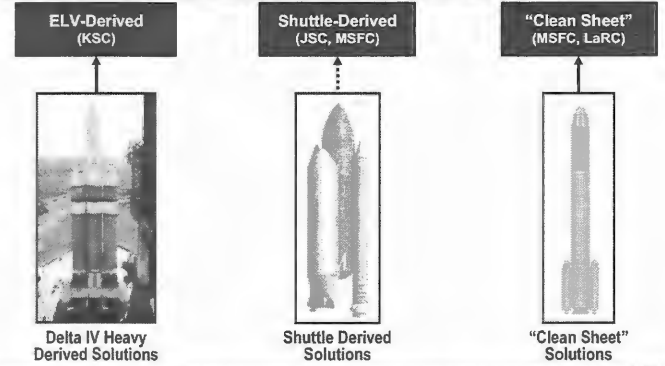
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Delta IV Can Meet Future Heavy-Lift Needs



04HB04001_7

Boeing is Supporting NASA Trade Studies



Boeing Space Exploration Systems Provides Integrated Perspective

04HB04001_8

Delta IV Provides Near-Term Benefits for Exploration

- ◆ Flight-proven Delta IV provides significant near-term capability
- ◆ Delta IV provides a low cost mechanism to jump-start exploration
 - Candidate low-risk upgrades identified may enable up to 45-mT to LEO
 - NASA Exploration and USAF EELV program synergy
- ◆ Delta IV upgrades also can support alternate development solutions for super heavy-lift capability



1st Delta IV Heavy Launch
Summer 2004



04HB04001_9

Shuttle-Derived Vehicle Heavy-Lift Options

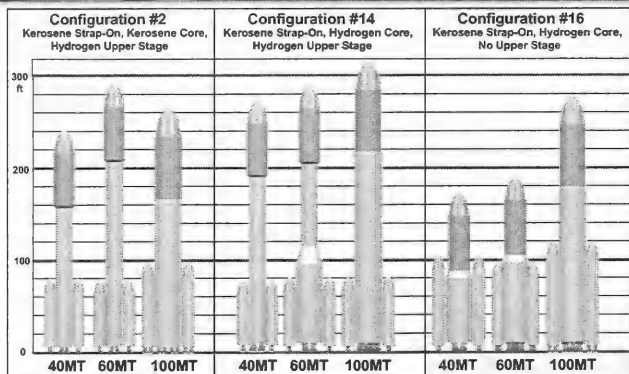
- ◆ Flight-proven Shuttle system could enable significant exploration capability
- ◆ Boeing is part of a collaborative Industry Study Team
- ◆ Shuttle-Derived Vehicle may provide a low development cost option for ~100-mT to LEO
 - SDV would greatly simplify operations and reduce costs
- ◆ Shuttle-Derived Vehicle supports spiral development of super heavy-lift capability

Focused On Providing Shuttle-Derived Options,
Not Recommending A Preferred Configuration



04HB04001_10

NGLT Funding Constrained "Clean Sheet" Study

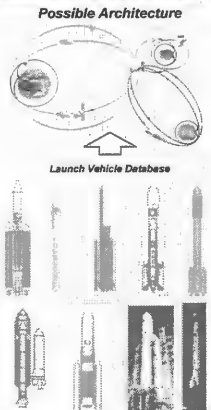


Boeing Phantom Works Assessing New LOX/Kerosene Vehicle Options Constrained to Existing Engines, Vehicle Tooling Size, etc. With a \$7B Non-Recurring Development Cost

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Boeing Launch Vehicle Exploration Architecture Study

- ◆ Launch Vehicles critically impact Exploration architecture development process
 - Drives destination sizing, cycle time and tonnage
 - Defines largest in-space transportation element
- ◆ Developed single Boeing Launch Vehicle database
- ◆ LV Database Trade Parameters
 - Life Cycle Cost
 - Performance
 - Spiral development
 - Ground infrastructure capabilities/constraints

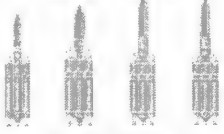


Boeing Will Provide NASA With Our Best Independent Launch Vehicle Assessment

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Space Transportation Options for Space Exploration

Delta IV Growth

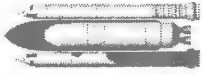


Existing/growth Delta IV, Shuttle-Derived or "Clean Sheet" options could provide substantial Exploration capability



Moon

Shuttle-Derived



"Best" Solution ?



Mars



Detailed trade studies based on NASA's exploration requirements, funding and other considerations will be needed to identify the best solution

"Clean Sheet"



04HB04001_13

