Apr 30th, 8:30 AM - 11:00 AM

Panel Session III - Future Roles of the Space Shuttle in Support of Human Space Flight

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Future Roles of the Space Shuttle in Support of Human Space Flight

Presented to the 40th Space Congress
Access to Space: L.E.O. & Beyond
By John M. Lounge
Boeing NASA Systems
NASA Integrated Space Transportation Plan

International Space Station

US Core Complete
IP Core Complete

ISS Extend?
Future Exploration beyond LEO?

Operate Thru Mid Next Decade
Extend?
Extend Until 2020+

Further Extend as Crew/Cargo Vehicle?

Orbital Space Plane

Design
FSD Decision
Orbital Tech Demo

Development
ISS Crew Return Capable
Crew Transfer on Human-Rated EELV

Operations
OSP Primary Crew Vehicle?

Next Generation Launch Technology

Tech
Launch System Decision (Based on Reqt, $, DoD)
Risk Reduction
FSD Decision

Long-Term Technology Program
1st Flight
OSP Bridge To New Launcher

Build and Operate Through Mid Next Decade
Extend Until 2020+
Further Extend as Crew/Cargo Vehicle?

Update: 10/24/02

Orbital Tech Demo
Crew Transfer on Human-Rated EELV
OSP Primary Crew Vehicle?

ISS Crew Return Capable
FSD Decision
1st Flight
OSP Bridge To New Launcher

Orbital Space Plane

Space Shuttle

International Space Station
Access to Space: LEO & Beyond

Shuttle Derived Heavy Lift?

OSP for Crew
Shuttle for Cargo

OSP for Crew
New Vehicle for Cargo

Columbia Replacement?

2nd Gen Launch Vehicle?

Shuttle SLEP
Shuttle Service Life Extension

• SLEP Objectives:
  – “Assure That All Critical Assets Are in Place to Safely and Efficiently Fly the Space Shuttle Through at Least the Middle of the Next Decade”

• SLEP Approach:
  – Use the Summit Process to Identify Safety, Sustainability, Performance, Operations and Infrastructure Initiatives
  – Combine Those Initiatives Into a Comprehensive Strategy and Implementation Plan
Industry Panel Recommendation: Multi-Element Approach

- **Element #1 – “Safely Support the ISS to 2022”**
  - Must maintain the current capabilities by addressing: investment backlog in infrastructure and obsolescence, workforce issues, revitalization of supplier base, safety improvements. This forms the basis for flying Shuttle to 2022 with increased safety.

- **Element #2 – “Expanded ISS Support”**
  - Improve the Shuttle capability to ISS by investing in performance enhancements to support ISS. Use SSP to continue assured ISS access and phase in of uncrewed orbiter

- **Element #3 – “Expand HSF support and enhance SSP mission model”**
  - Provides investment to define systems improvements beyond those found in Element #2 that lead to a Shuttle-based Heavy Lift Vehicle and expanded mission model.
## Still Missing: Top Level Shuttle Program Requirements

### Goals & Objectives

<table>
<thead>
<tr>
<th>Goals &amp; Objectives</th>
<th>‘04</th>
<th>‘10</th>
<th>‘16</th>
<th>‘22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fly Safely</td>
<td>• LoV/C 1 in 265</td>
<td>• LoV/C 1 in 400</td>
<td>• LoV/C 1 in 500</td>
<td>• LoV/C 1 in 600</td>
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<tr>
<td>Meet the Manifest</td>
<td>• 14 kts crosswind restriction, no autoland</td>
<td>• 20 kts crosswind restriction, no autoland</td>
<td>• 20 kts crosswind restriction with autoland</td>
<td>• 20 kts crosswind restriction with autoland</td>
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<td>• TAL Weather restrictions</td>
<td>• TAL Weather restrictions removed</td>
<td>• RTLS Weather restrictions removed</td>
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<td>• T+250s Intact ATO no engine out</td>
<td>• T+0s Intact ATO no engine out</td>
<td>• T+0s Intact ATO with engine out</td>
<td>• T+0s Intact ATO with engine out</td>
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<tr>
<td>Improve Supportability</td>
<td>• Service Life = 2015</td>
<td>• Service Life = 2022</td>
<td>• Service Life = 2030</td>
<td>• Service Life = 2030</td>
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<td></td>
<td>• Backlog index = X</td>
<td>• Backlog index = 0</td>
<td>• Infrastructure Invest = 2% of asset value</td>
<td>• Infrastructure Invest = 3% of asset value</td>
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<tr>
<td></td>
<td>• Infrastructure Invest &lt; 1% of asset value</td>
<td>• Infrastructure Invest = 1% of asset value</td>
<td>• Infrastructure Invest = 2% of asset value</td>
<td>• Infrastructure Invest = 3% of asset value</td>
</tr>
<tr>
<td>Improve the System</td>
<td>• Long duration ISS stays = 16 days</td>
<td>• Long duration ISS stays = 30 days</td>
<td>• Long duration ISS stays = 60 days</td>
<td>• Long duration ISS stays = 90 days</td>
</tr>
<tr>
<td></td>
<td>• Station upmass = 37K lbs</td>
<td>• Station upmass = 40K lbs</td>
<td>• Station upmass = 45K lbs</td>
<td>• Station upmass = 50K lbs</td>
</tr>
<tr>
<td>Support New Programs</td>
<td>• High energy upper stage deployment of 7.5K lbs @ 15,000 fps delta V</td>
<td>• Shuttle-derived HLV with lift capability of 160K lbs</td>
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<td>• Shuttle-derived HLV with lift capability of 160K lbs</td>
</tr>
</tbody>
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Access to Space: LEO & Beyond

- OSP for Crew
- Shuttle for Cargo
- OSP for Crew
- New Vehicle for Cargo
- Columbia Replacement?
- Shuttle Derived Heavy Lift?
- 2nd Gen Launch Vehicle?
- Shuttle SLEP
Current Boeing internal R&D effort evaluating schedule and cost to produce a “build to print” replacement using 21st Century manufacturing capabilities
Modern Avionics with IVHM

Advanced Structures & TPS

Non-Toxic OMS/RCS

Non-Toxic Power & Electric Actuation

Informed Maintenance On Demand

Standardized Payload Interfaces

Human Access to Space Though 2025 and Beyond

Mitigate Obsolescence
Improve Safety/Reliability
Reduce Operating Costs
Enhance Mission Flexibility

Crew Escape

Blk II SSME
Phase 2B AHMS

Blk II SSME
Phase 2B AHMS
Access to Space: LEO & Beyond

OSP for Crew
Shuttle for Cargo

OSP for Crew
New Vehicle for Cargo

Shuttle Derived
Heavy Lift?

2nd Gen
Launch Vehicle?

Columbia Replacement?

Shuttle
SLEP
Shuttle Derived Cargo Vehicles

- Unmanned Orbiter: 60K lbs to LEO
- Fly Back Second Stage: 100K+ lbs to LEO
- Expendable Heavy Lift: 200K lbs to LEO
Future of Shuttle

• The Space Shuttle will be a part of the future of Human Space Flight

• Robust, requirements driven SLEP is the foundation

• Detailed studies of alternate configurations and operations concepts should be started as soon as possible