The Future of Commercial Space Transportation

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50 Years of Human Spaceflight
Suborbital Space Tourism
WhiteKnightTwo and SpaceShipTwo
An October Tragedy
SpaceShipTwo Tail # 2
Spaceport America in New Mexico
XCOR Lynx
Swiss Space Systems
ORB-3 Mishap
SpaceX F9R
Autonomous Spaceport Drone Ship
Commercial Crew Program

SpaceX Dragon

Boeing CST-100
MOU on Commercial Human Spaceflight

• Signed by the FAA and NASA on June 4, 2012.

• Establishes intent for all operational missions to the ISS to be licensed for public safety by the FAA.

• NASA will be responsible for crew safety and mission assurance.
Sierra Nevada Corporation
Blue Origin
LauncherOne
Orion Flight Test
Space Flight Training
Bigelow Expandable Activity Module
Bigelow Aerospace: The First Commercial Space Station?
Bigelow Lunar Base Concept
Space Adventures

Office of Commercial Space Transportation
Golden Spike
Inspiration Mars

Inspiration Mars
A Mission for America
### Human Space Flight Accident Statistics

<table>
<thead>
<tr>
<th>Program</th>
<th>Flights</th>
<th>Fatal Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-15</td>
<td>199</td>
<td>1</td>
</tr>
<tr>
<td>Mercury</td>
<td>6</td>
<td>0</td>
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<tr>
<td>Gemini</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Apollo</td>
<td>15</td>
<td>0</td>
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<tr>
<td>Space Shuttle</td>
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<td>2</td>
</tr>
<tr>
<td>SpaceShipOne</td>
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<td>0</td>
</tr>
<tr>
<td>SpaceShipTwo</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>375</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

The overall U.S. fatal accident rate is approximately one percent.
Congressional Direction

• “Space transportation is inherently risky, and the future of the commercial human space flight industry will depend on its ability to continually improve its safety performance.”

• “The regulatory standards governing human space flight must evolve as the industry matures so that regulations neither stifle technology development nor expose crew or space flight participants to avoidable risks as the public comes to expect greater safety for crew and space flight participants from the industry.”

• “The Secretary shall encourage, facilitate, and promote the continuous improvement of the safety of launch vehicles designed to carry humans, and the Secretary may, consistent with this chapter, promulgate regulations* to carry out this subsection.”

*Note: Issuing regulations is currently limited until October 1, 2015, under the “moratorium”
Potential Regulatory Path

Moratorium Expires, Industry Standards Developed

Routine Commercial Space Travel

Certificates
- Production
- Airworthiness
- Air Carrier
- Pilot
- Instruction
- Mechanic
- Dispatch
- Parts

Public Safety

Occupant Safety

Occupant Safety

Mission Assurance

Public Safety

Current FAA Licensing

Future Licensing of Human Spaceflight

FAA Certification

Time
Assessment of Current Environment

• Given the technical challenges involved and the limited flight data that is currently available, it will likely be several decades before it would be appropriate to certify launch vehicles in the same way that we now certify aircraft.
• Until that time, it makes sense to retain the "informed consent" regime for space flight participants.
• In the meantime though, there are several things we can do to enable safer human space flight operations.
Recommended Strategy

- Allow the Moratorium on issuing new regulations to expire in September of this year, so that if we were to identify a systemic issue with vehicle designs or operations, we would be able to quickly initiate the development of appropriate regulations to address the issue.
- Facilitate the collection and sharing of commercial space transportation data and analyses, including close calls, lessons learned, and best practices.
- Continue the ongoing dialog between government and industry, and promote the adoption and use of our "Recommended Practices for Human Space Flight Occupant Safety," which was published in August 2014.
- Encourage the development of industry consensus standards.
- Identify potential changes to statute and regulations that would enable and encourage increased training for both flight crew and space flight participants.
Conclusions

• With the Space Shuttle having been retired, the next few years will be a critical time for our nation’s space program.
• During this period, we will be seeing:
  • Regular commercial cargo deliveries to the ISS
  • Test flights, followed by the start of commercial crew operations to the ISS
  • The beginning of Suborbital Space Tourism operations
• Congress, through the Commercial Space Launch Amendments Act, has challenged the FAA to “encourage, facilitate, and promote” this new activity in a way that continuously improves its safety.
• The Office of Commercial Space Transportation is committed to doing our part to enable this exciting new industry.