



# **Anchoring the Space Economy**

How the International Space Station can lead the way to  
Commercial Exploitation of Low Earth Orbit

The image shows the International Space Station (ISS) in orbit against a starry night sky. The station's complex structure, including its large solar panel arrays, is clearly visible.

# Agenda

- **What's going on?**
- **ISS Benefits**
  - Science
  - Exploration Systems Testing
  - Enabling Commercial Crew/Cargo
  - International Partnerships
  - STEM
- **Spheres of Influence / Role of the Government**



# What's Going On?

- **EVA today**
  - Learn how to repair spacecraft under difficult circumstances
- **Series of 10 EVAs over the next year to reconfigure the ISS for Commercial Crew**
- **Year-long Increment begins next April**
- **BEAM is next Fall**
- **Program Direction to have Docking Adapter and Comm systems in place at start of 2016**



# Recent ISS Benefits -Science

- **First Rodent science on ISS – Muscle loss research**
- **Initial Earth Sciences instrument - RapidScat**
- **Laser communication experiment – Hello World!**
- **AMS Science published in Physical Review Letters (PRL)**
  - The positron fraction results from AMS indicate a new physical phenomenon. They are consistent with the existence of a hypothetical dark matter particle, the neutralino.



# ISS Benefits – Exploration

- **ISS testing and development of exploration systems reduces cost and risk for future missions**
- **Recent Examples**
  - Siloxanes
  - UPA
  - EMU Water intrusion
- **ISS Testing allows International standards to be established, reducing costs**
  - Docking System
  - Autonomous Rendezvous and Docking



# Standardization: Docking System



FACILITY CAM

155:14:02:24.373

Case 43 - Ry = 4.33", Yaw = -5.0,  
Vx = .15 ft/s - Facility Camera View



# ISS Benefits: Global Launch rate

- **World-wide orbital launches (all countries)**

<b>2013</b>	<b>79 successful</b>	<b>to ISS</b>
<b>2014</b>	<b>61 so far</b>	<b>to ISS + to go</b>
<b>2015</b>		<b>to ISS planned</b>

- **Between of orbital launches in a year are to the International Space Station**



# ISS Benefits: Global Launch rate

- **World-wide orbital launches (all countries)**

<b>2013</b>	<b>79 successful</b>	<b>12 to ISS</b>
<b>2014</b>	<b>61 so far</b>	<b>10 to ISS + 4 to go</b>
<b>2015</b>		<b>15 to ISS planned</b>

- **Between 15% and 20% of orbital launches in a year are to the International Space Station**

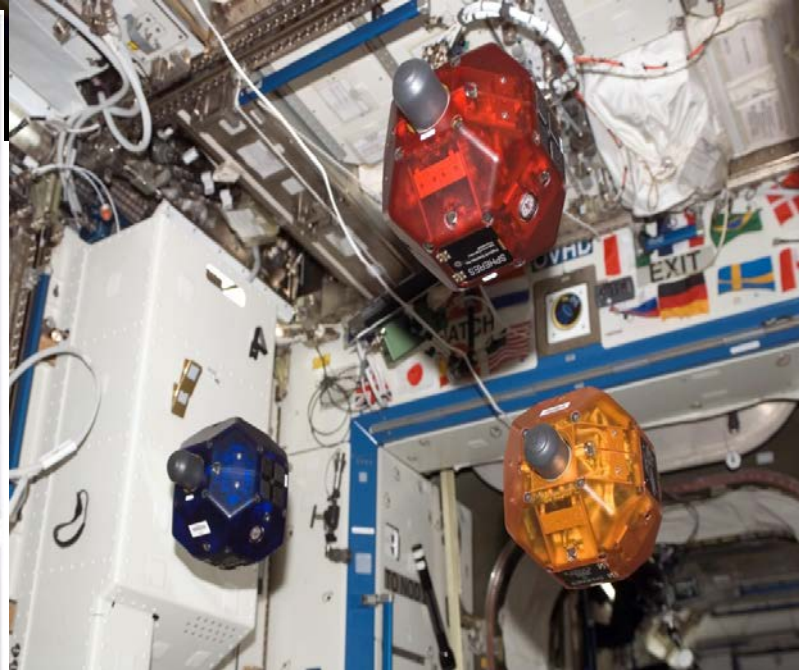
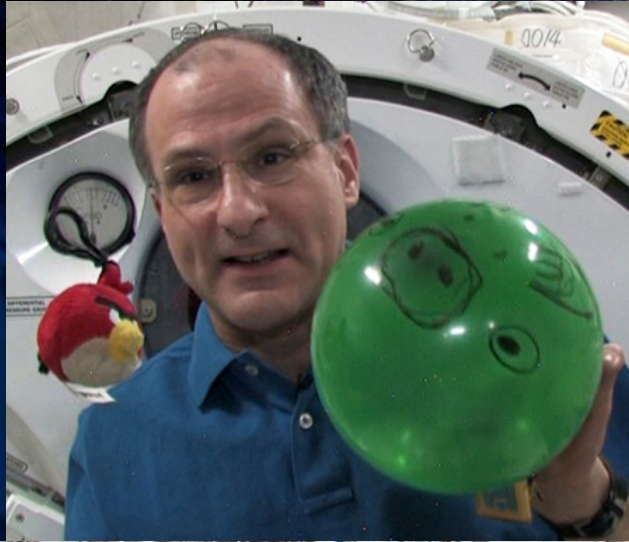




# ISS Benefits: Commercial Crew / Cargo

- **ISS has created a market for the development of crew and cargo vehicles**
- **Provides seed money for new systems**
  - New innovations
  - Trains a generation of rocket/spacecraft developers
  - Can reduce overall launch costs for other users
  - Provides redundant access in the case of an accident
  - Opens potential for other income streams associated with spaceflight
- **Great platform for deployment of cubesats**
  - Academia, small business access to space

# STEM - 43 Million Students and Growing...







# ISS Benefits – International Partnerships

- **Through ISS – Inter Governmental Agreement (IGA) and four MOUs have been established**
  - These agreements take a long time and a lot of effort between civil space agencies, Dept. of State, partner governments
  - Can be easily extended to future partnerships in Cis-Lunar or BLEO activities
- **Learn to work together as national space programs**
  - Civil as well as Business relationships
- **Save \$\$ by reducing redundancy and increasing standardization across the globe**

- **Compare Gov't and Private investment in:**
  - Suborbital
  - LEO
  - Cis-Lunar
  
- **ISS is the focal point for LEO – while enabling technology development for BEO**
  
- **What does the near future look like?**
  - Strong suborbital programs
  - LEO is the domain of commercial and public/private partnerships
  - Cis-Lunar, Lunar, and Mars are the focus of NASA programs