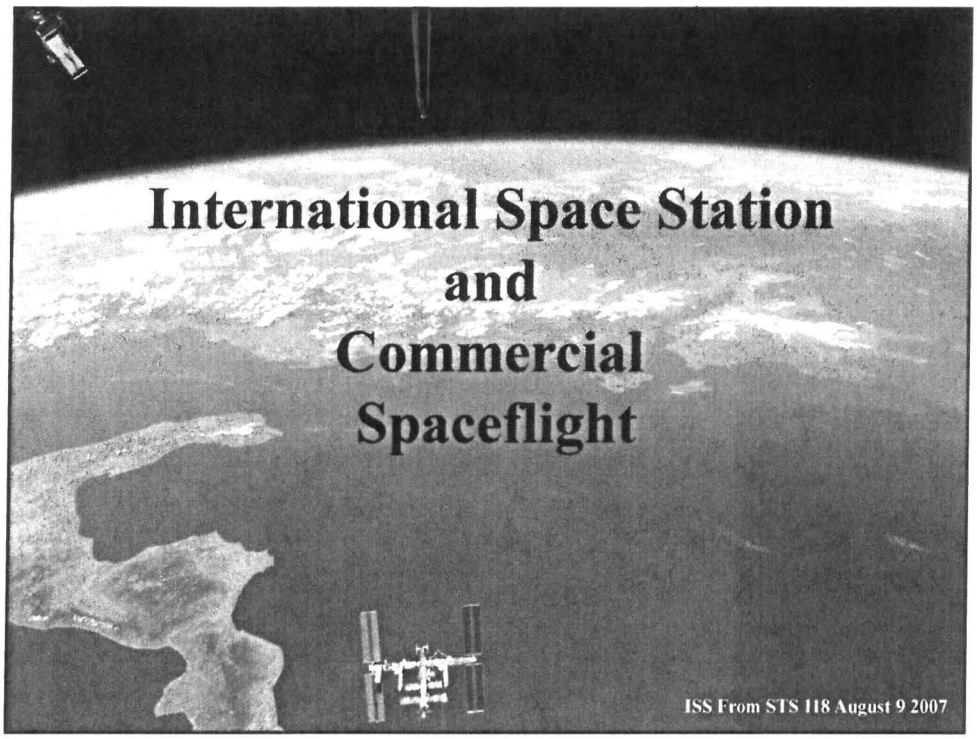
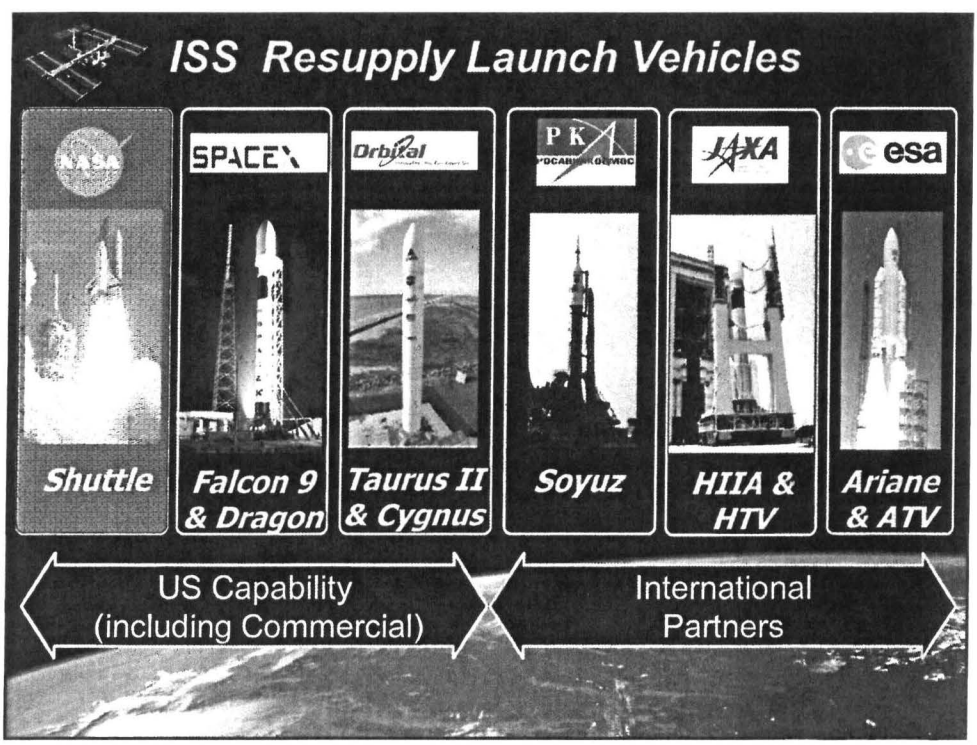

International Space Station
and
Commercial
Spaceflight
ISS From STS 118 August 9 2007


ISS Resupply Launch Vehicles
Shuttle
Falcon 9
& Dragon
Taurus II
& Cygnus
Soyuz
HIIA &
HTV
Ariane
& ATV
US Capability
(including Commercial)
International
Partners

Space Transportation System (STS)

Orbital Vehicle

External Tank (ET)

Solid Rocket Boosters (SRB's)

OV-099
Challenger

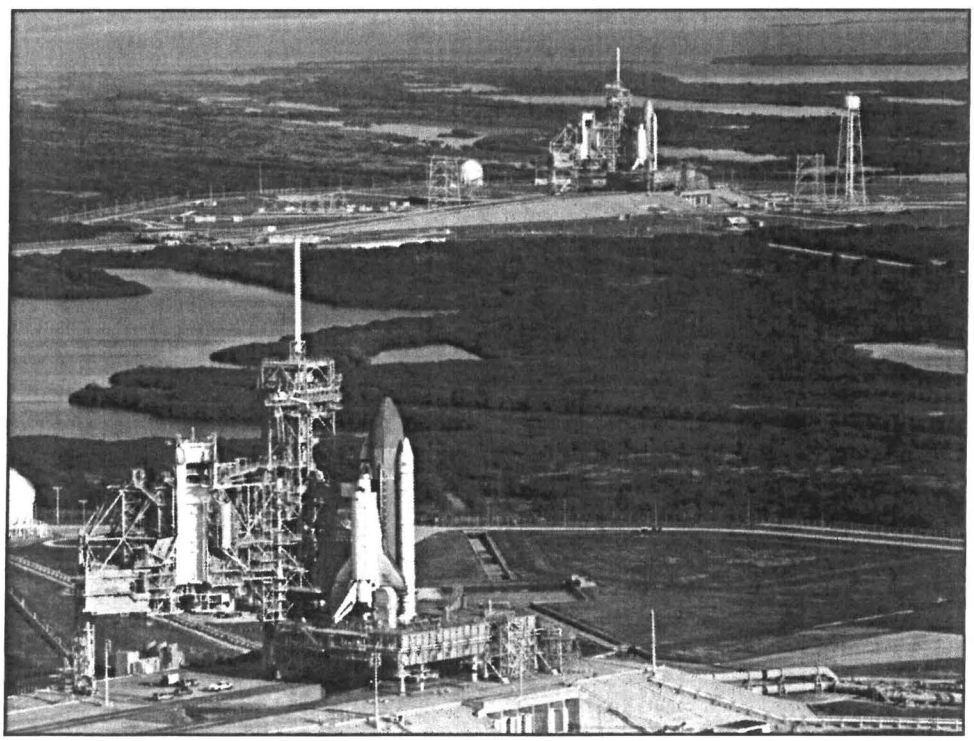
OV-102
Columbia

OV-103
Discovery

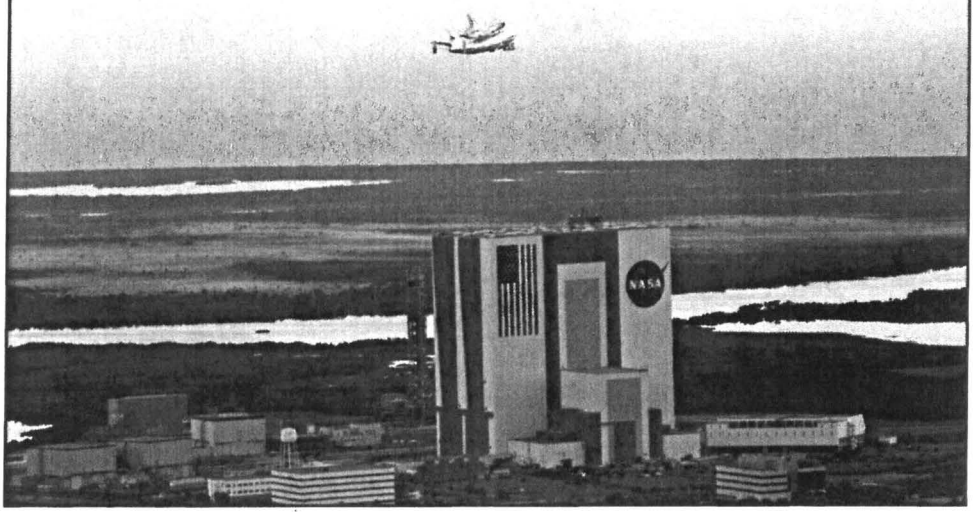
OV-104
Atlantis

OV-105
Endeavour

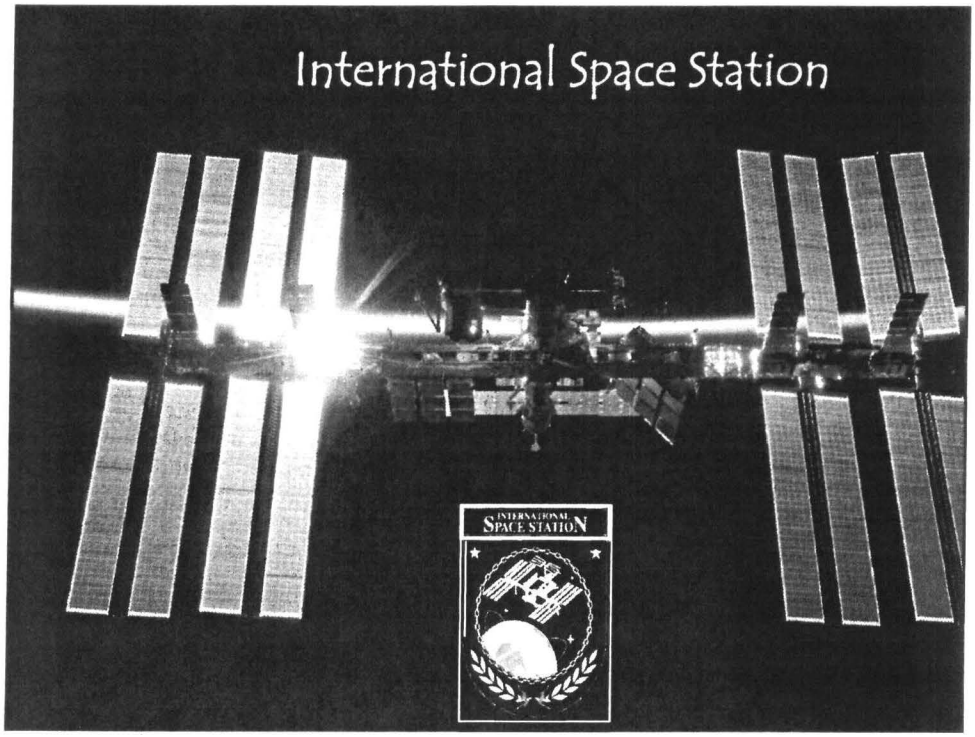
OV-101
Enterprise
(development)

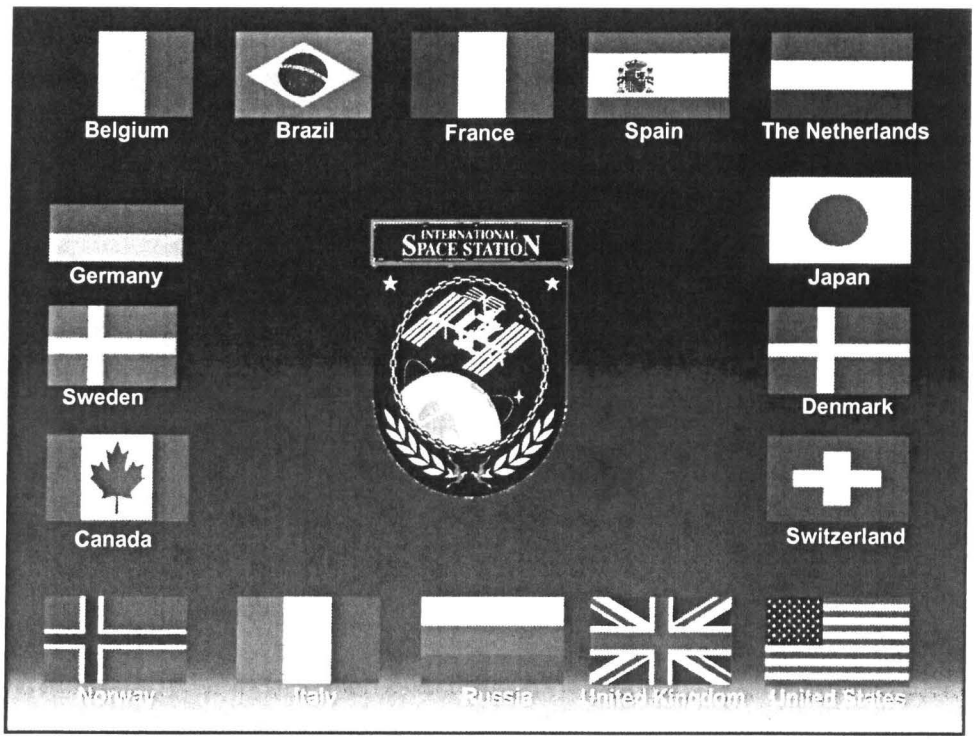


Shuttle Discovery destined for Dulles, VA (April 2012)

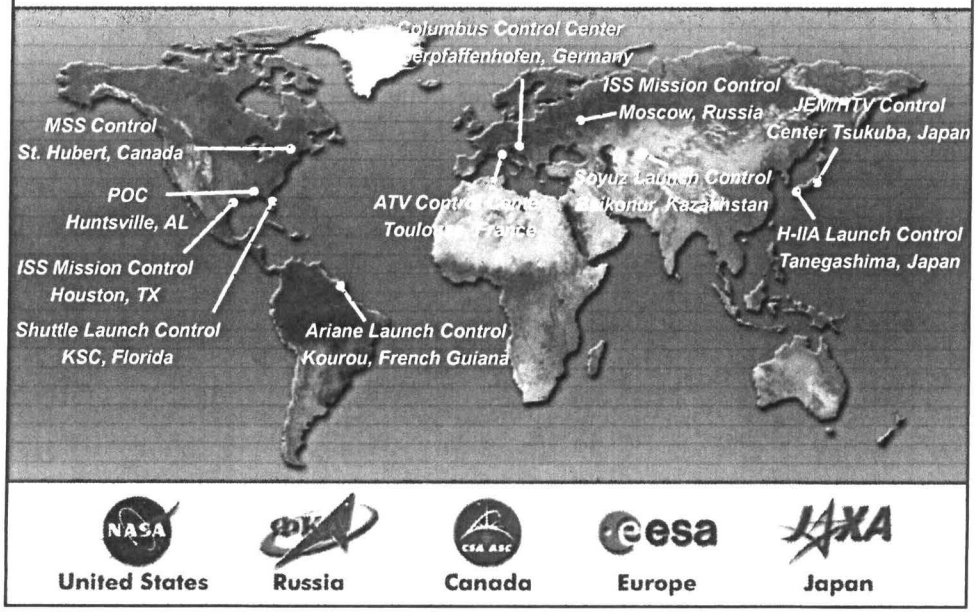


Shuttle Retirement Locations


International Space Station
INTERNATIONAL SPACE STATION


Belgium
Brazil
France
Spain
The Netherlands
Germany
INTERNATIONAL SPACE STATION
Japan
Sweden
Denmark
Canada
Switzerland
Norway
Italy
Russia
United Kingdom
United States

NASA and International Partner Operations Scope



ISS Overview & Capabilities

Wingspan End-to-End -- **361 feet**

Operating Altitude -- **220 mile average**

Length -- **199 feet**

Weight -- **Approx. 900,000 lbs**

Inclination -- **51.6 degrees to the equator covering 90% of the worlds population**

Volume -- **Approx 25,000 cubic feet of pressurized living today**

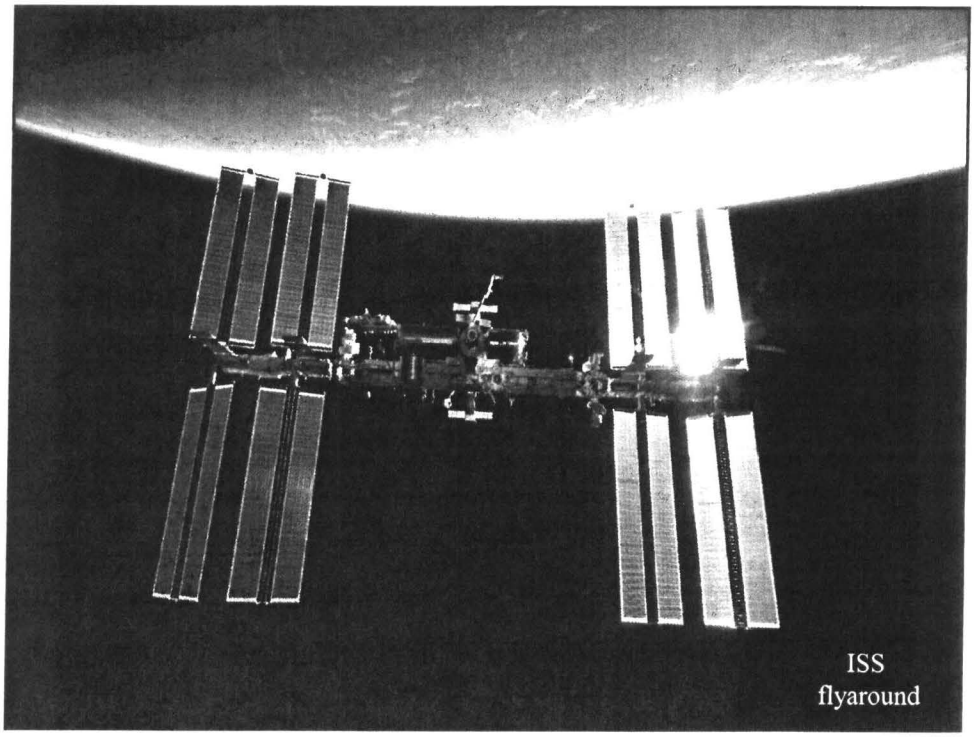
Crew -- **6 people living and working on the ISS**

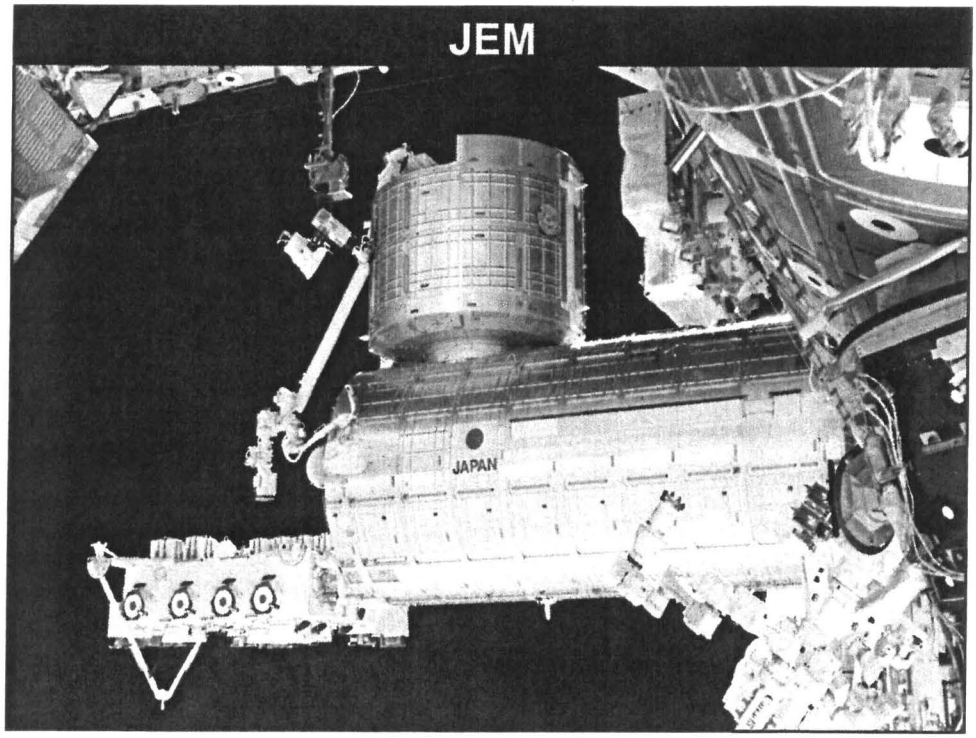
Atmosphere -- **14.7 pounds per square inch (same as Earth)**

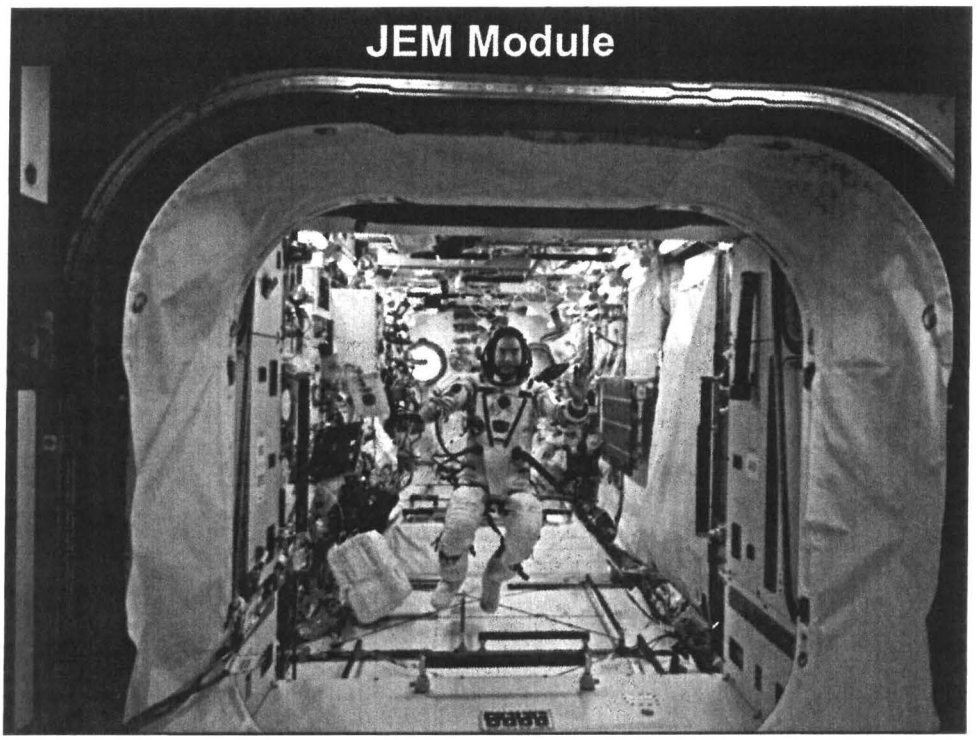
Speed -- **17,500 mph orbiting the Earth 16 times a day**

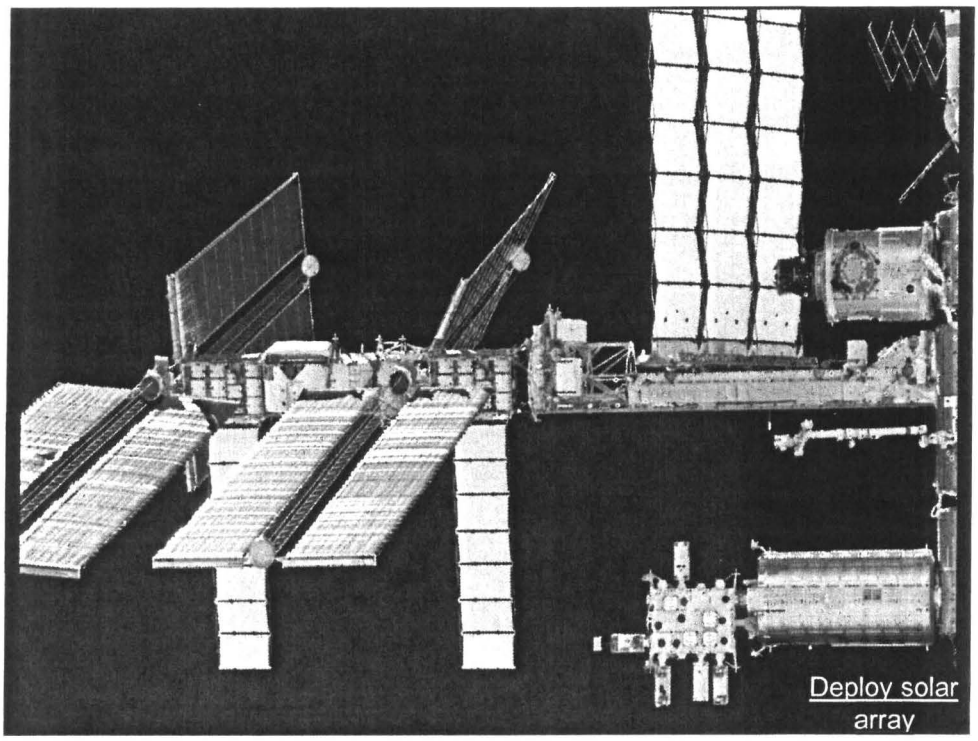
Nov 10, 2000 first humans on ISS

Mission Accomplished


ISS
flyaround

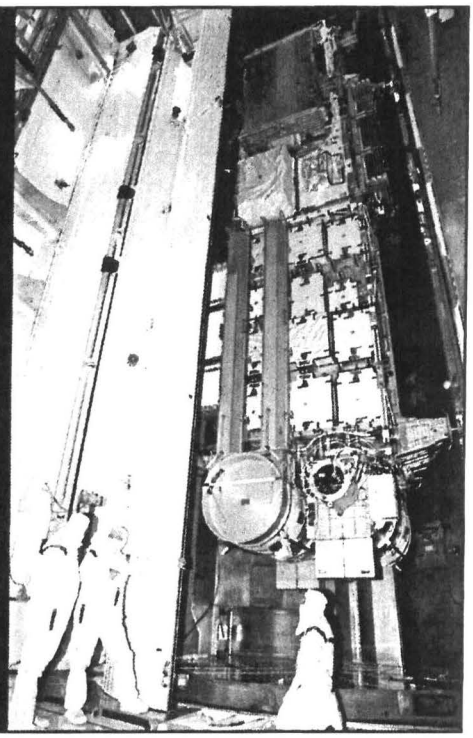

JEM
JAPAN


JEM Module

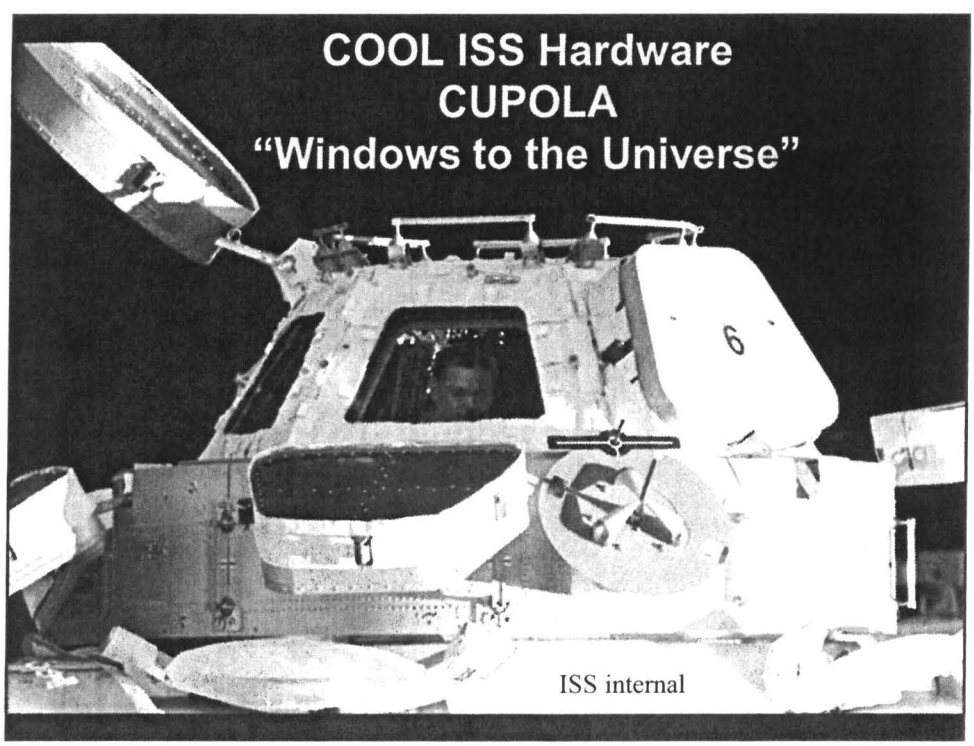

Deploy solar
array

Solar Arrays

- Eight photovoltaic solar arrays convert sunlight to electricity.
- Each solar arrays is 112 feet long by 39 feet wide.
- U.S. and Russian power system, generates 110 kilowatts (kW) total power,
- about as much as 55 houses typically use.
- Approximately 30 kW are available for research activities.



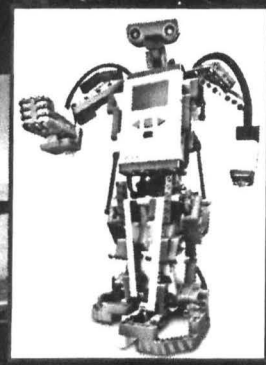
P6 Solar array in Payload Bay
STS 97, Endeavour Nov 2000



ISS internal

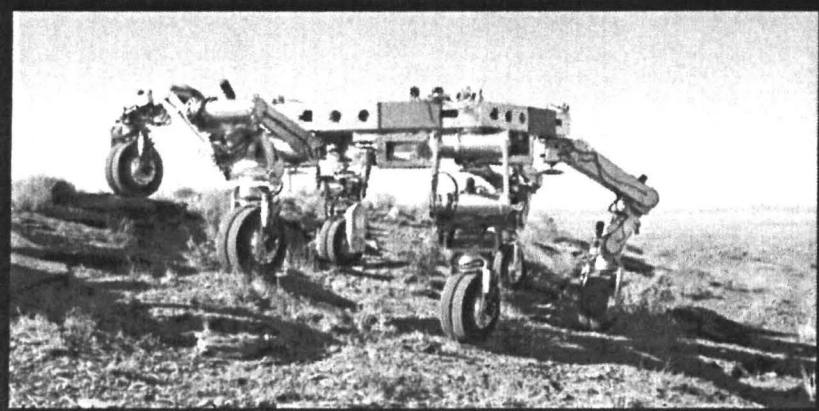
NASA and Robotics

- Robotics is the study of robots
- So what are robots?
  - Robots are machines that can be used to do jobs
- Robots are often broken into two categories:
  - Robotic devices
  - True robots



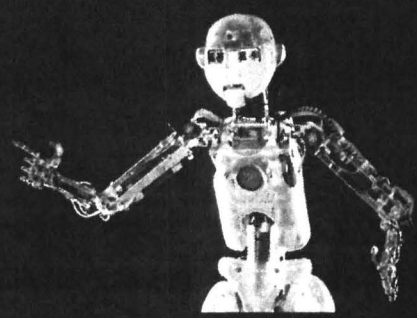
Robotic Devices

In order for these devices to be useful they must be controlled at all times

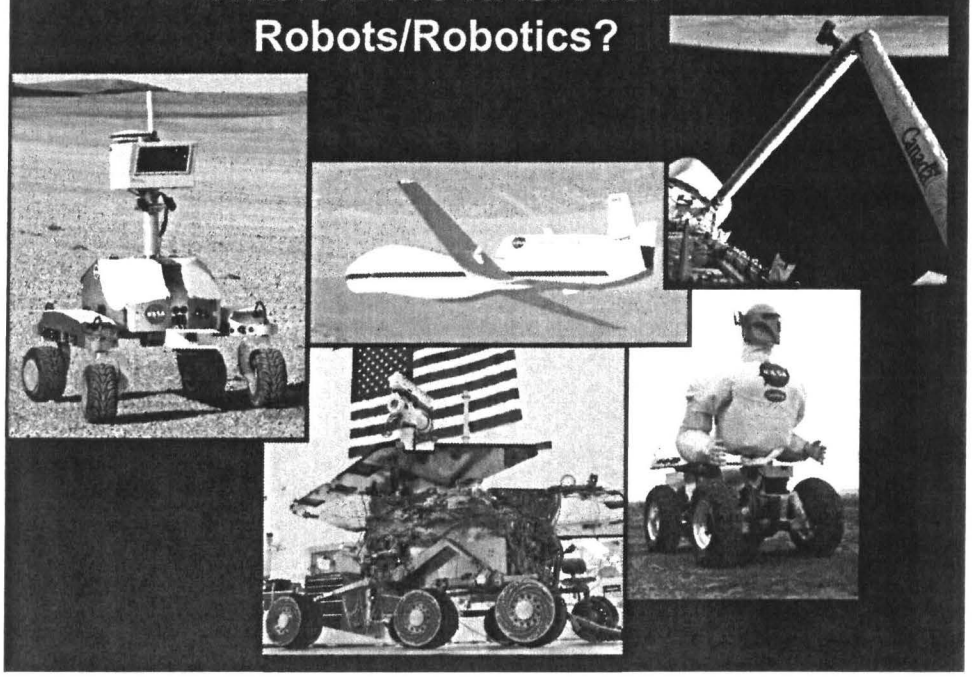


True Robots

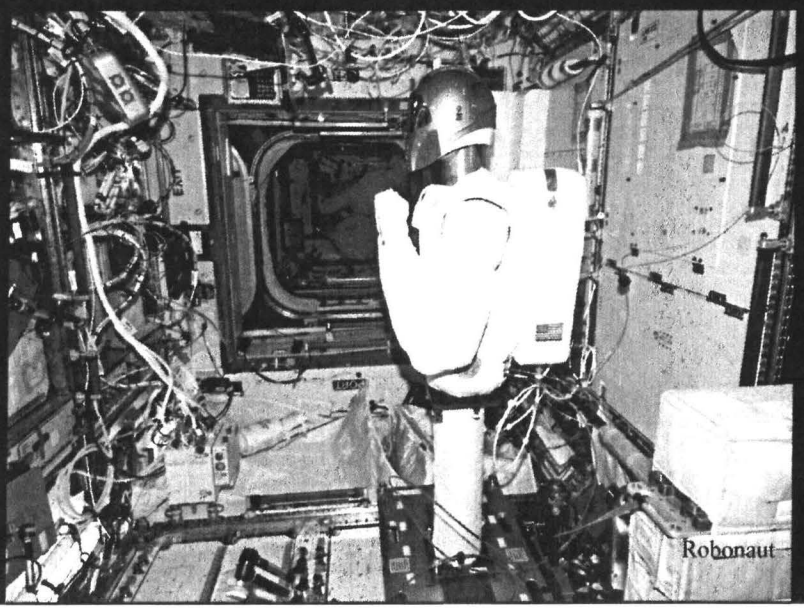
- True robots we would simply call "robots"
- These are devices that, once programmed, can perform on their own

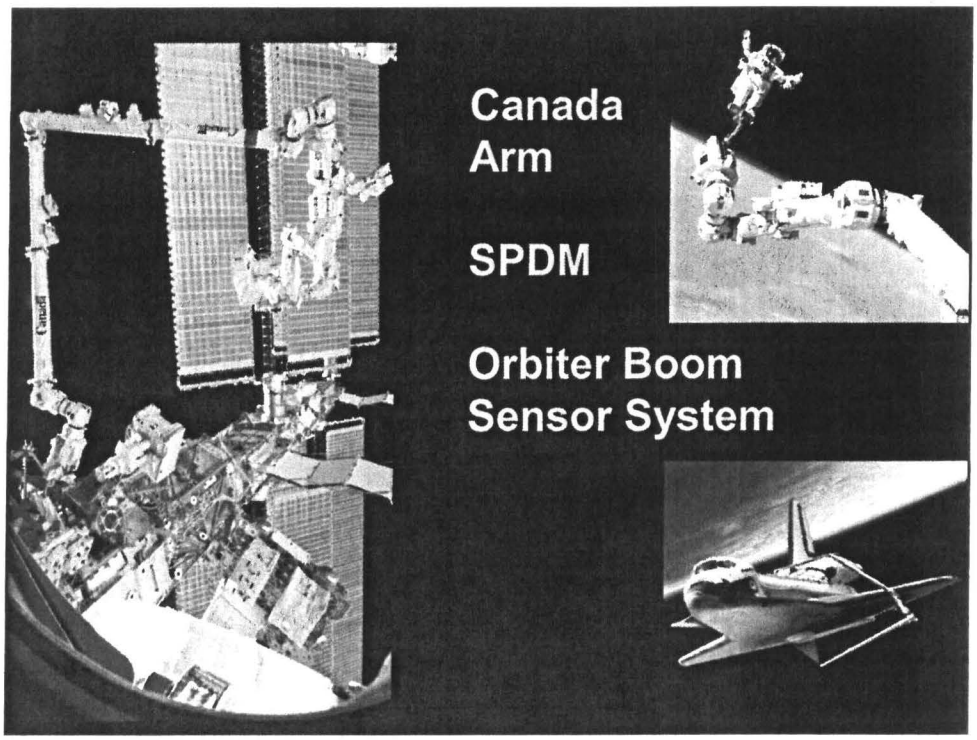


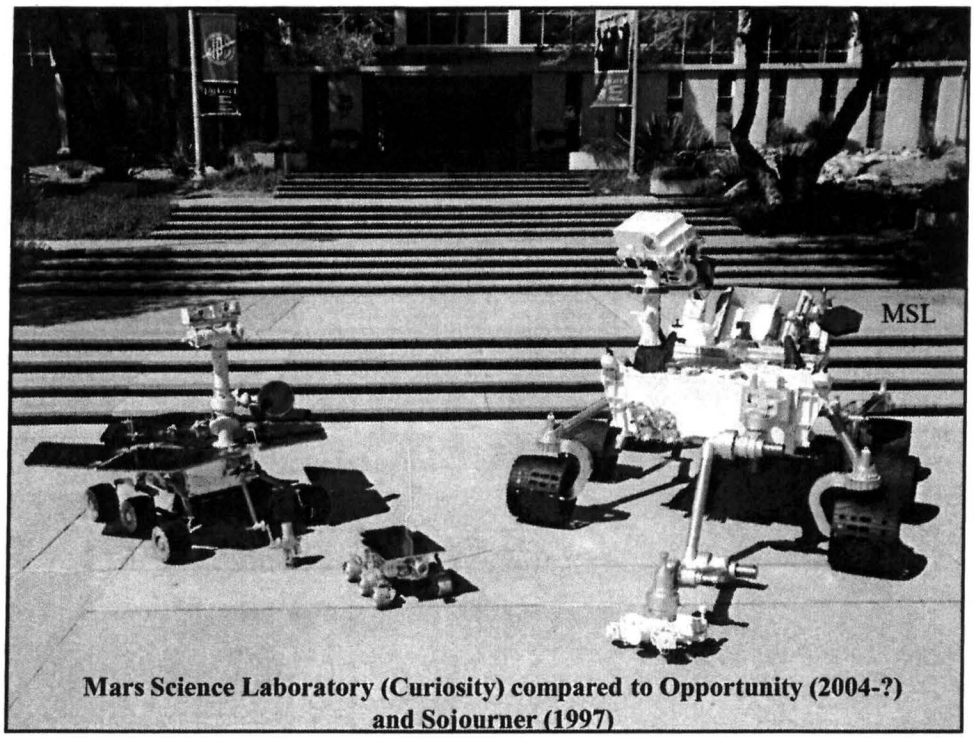
Where Does NASA use Robots/Robotics?



COOL ISS Hardware
Robonaut







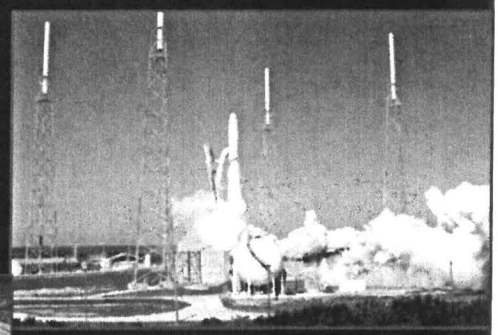
Mars Science Laboratory (Curiosity) compared to Opportunity (2004-?) and Sojourner (1997)

Rockets

Next Steps

NASA

explore and develop technologies and push the boundaries of space frontier



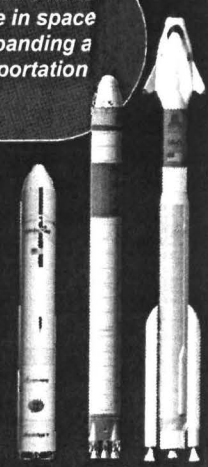
Commercial

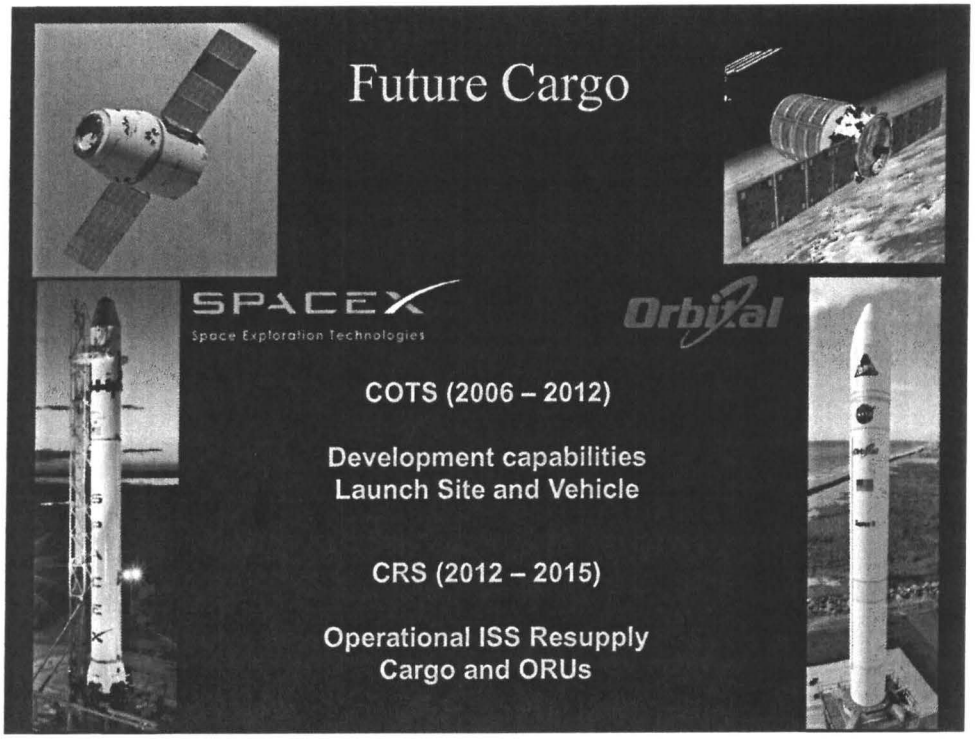
improve efficiencies, lower costs, and handle "routine" space flight

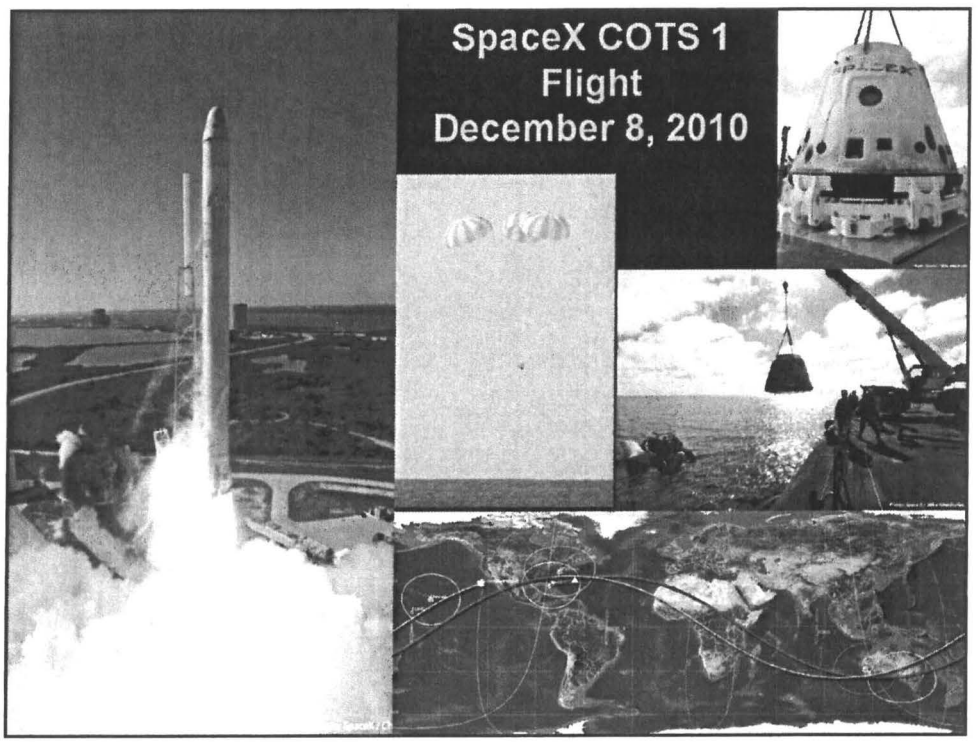
NASA Commercial Programs

- 1998 - Launch Services Program purchases ELV launch services from Commercial Providers
- 2005 - Commercial Cargo Program office established to provide an alternate commercial source to deliver cargo to the ISS
- 2011 - Commercial Crew Program office established to provide a commercial source for transporting NASA crew to the ISS

Commercial initiatives extend the human presence in space by enabling and expanding a robust space transportation industry



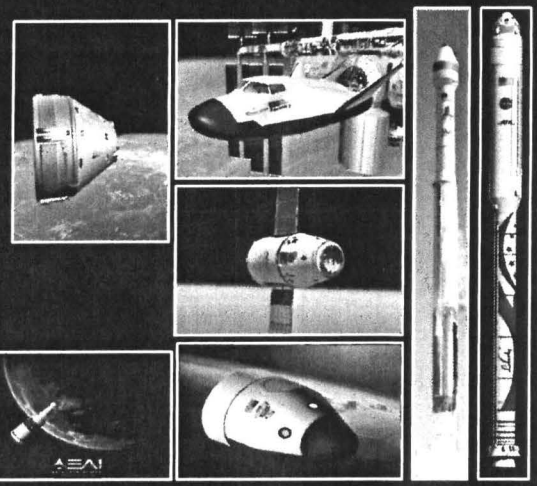

Future Cargo
SPACEX
Space Exploration Technologies
Orbital
COTS (2006 – 2012)
Development capabilities
Launch Site and Vehicle
CRS (2012 – 2015)
Operational ISS Resupply
Cargo and ORUs


SpaceX COTS 1
Flight
December 8, 2010

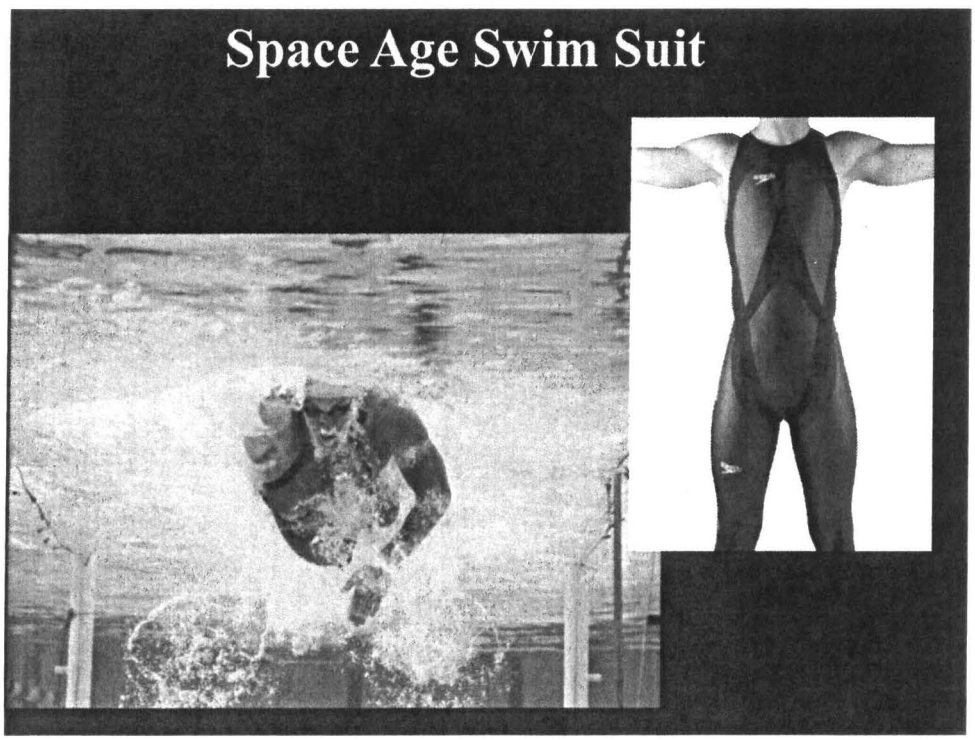
Commercial Crew Development (CCDev)
Maturing Designs

Awarded in 2011
- Blue Origin
- Boeing Co.
- Sierra Nevada Corp.
- SpaceX

- ATK
- Excalibur Almaz Inc.
- United Launch Alliance

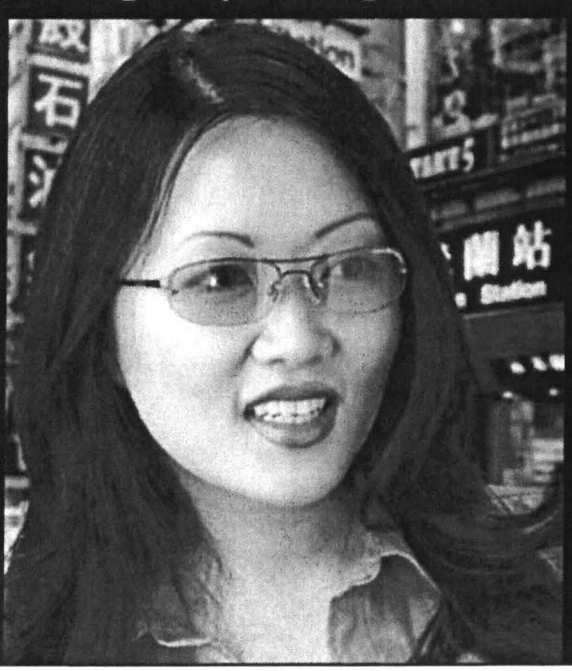



NASA
NASA Technologies
Benefiting Society


Space Age Swim Suit

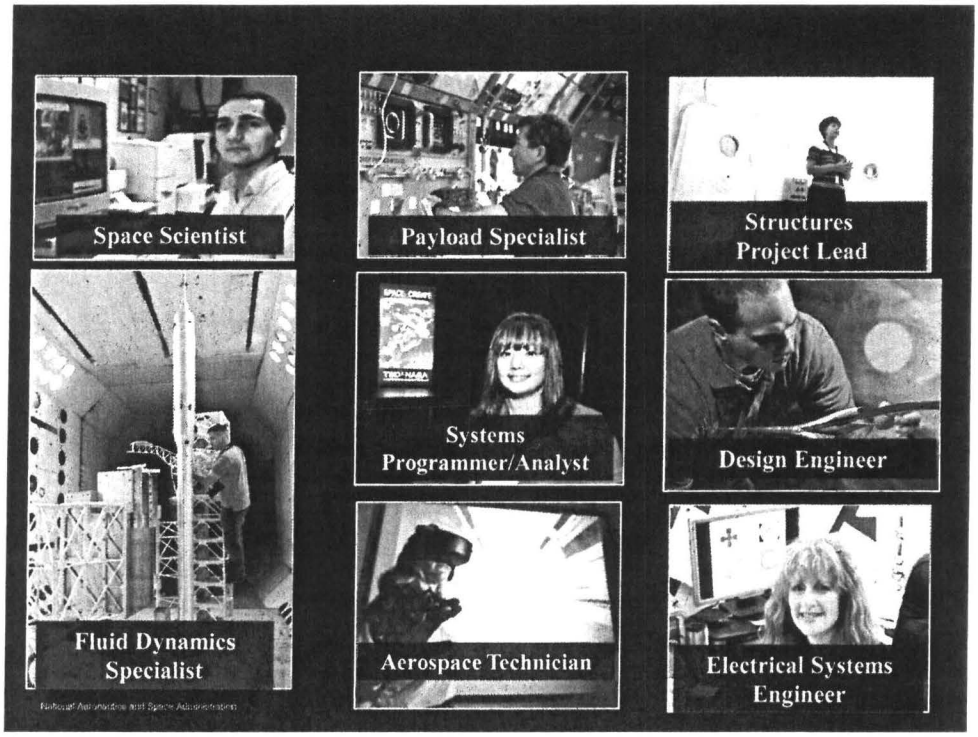
Liquid Metal Golf Clubs

Eagle Eye Sunglasses

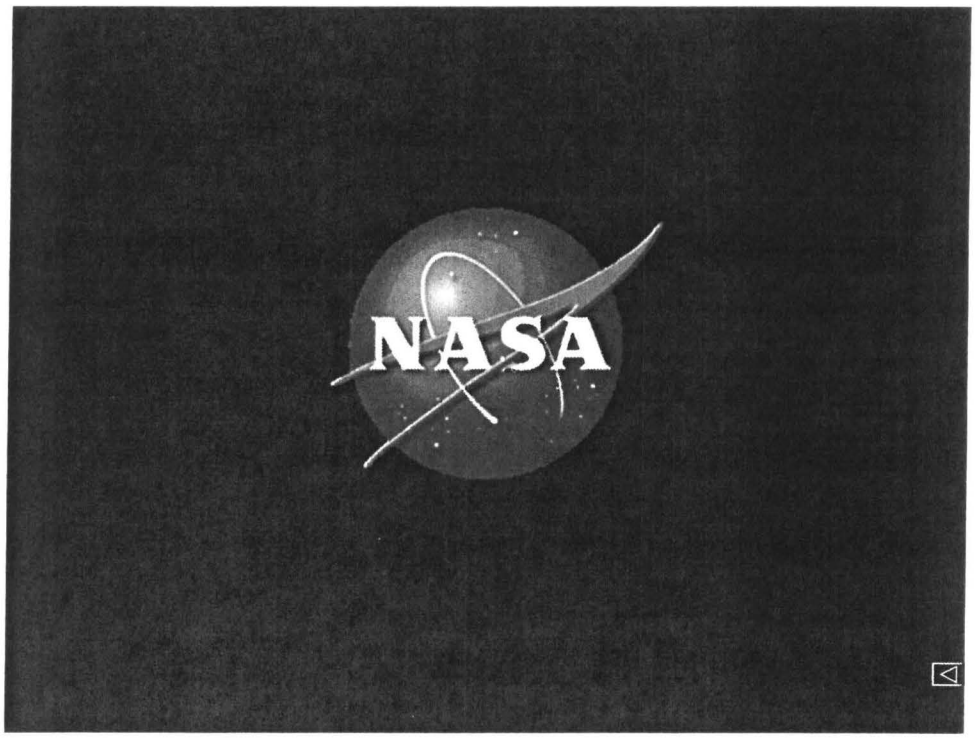


Airplane Winglets

Aerogel Insulation


Space Scientist
Payload Specialist
Structures
Project Lead
Fluid Dynamics
Specialist
Systems
Programmer/Analyst
Design Engineer
Aerospace Technician
Electrical Systems
Engineer


We live in exciting times
with many opportunities.
Seek out these opportunities,
and YOU will be richly rewarded!!


NASA