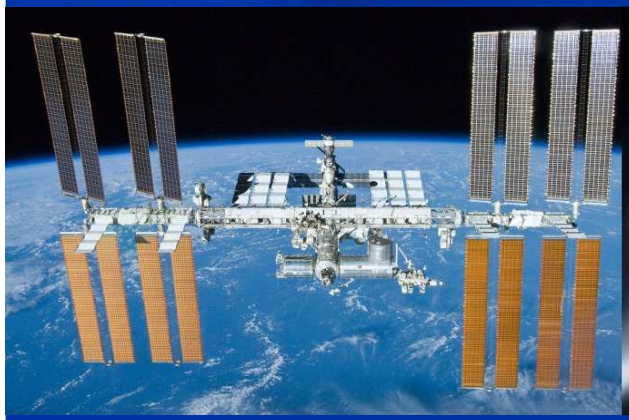
US Space Exploration



Dr. Mark A. Skinner
PM, Commercial GBSSA
The Boeing Company

Feb 2016

Agenda

- Why explore space?
- Legacy system: the ISS
- CST-100, the “Starliner”
- SSA support for commercial space operators
- SLS & Destination Mars

Human Space Exploration
Innovation Improving Life on Earth

JOBS

LEADERSHIP

DISCOVERY

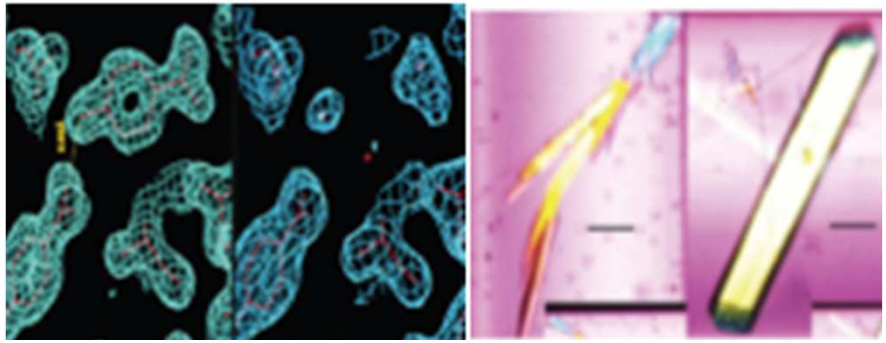
EDUCATION

PROSPERITY

The International Space Station

International Space Station Benefits to Humanity

Advanced Diagnostic Ultrasound Imagery



Macromolecular Crystallization Duchenne's Muscular Dystrophy

Commercial Biomedical Testing and Development

Methicillin-resistant Staphylococcus (MRSA) Treatments

Access to Low-Earth Orbit

Low-Earth Orbit (LEO) is the destination for CST-100 commercial space exploration

- Bigelow Aerospace, Space Adventures and NASA have all teamed up with Boeing to transport both astronauts and civilians LEO. The first flights for Boeing's Crew Space Transportation (CST)-100 vehicle will be in 2017.
- CST-100 spacecraft:
  - Developed as part of NASA's Commercial Crew Program.
  - Accommodates up to 7 passengers, OR
  - mix of crew and cargo
  - Near-term destinations:
    - International Space Station
    - Bigelow's planned station.
  - Innovative, weld-less design
  - Features Boeing LED "Sky Lighting," wireless internet and tablet technology for crew interfaces.
    - Wireless Internet to assist with crew communication, entertainment, & docking with ISS.
  - Pusher abort system that provides safe crew escape throughout the launch and assent phase of the mission.
  - Will launch initially on Atlas V rocket, yet is launch vehicle agnostic

CST-100 Starliner Status

Commercial ground-based space situational awareness for decreased operational costs and increased safety-of-flight

The Boeing Neighborhood Watch

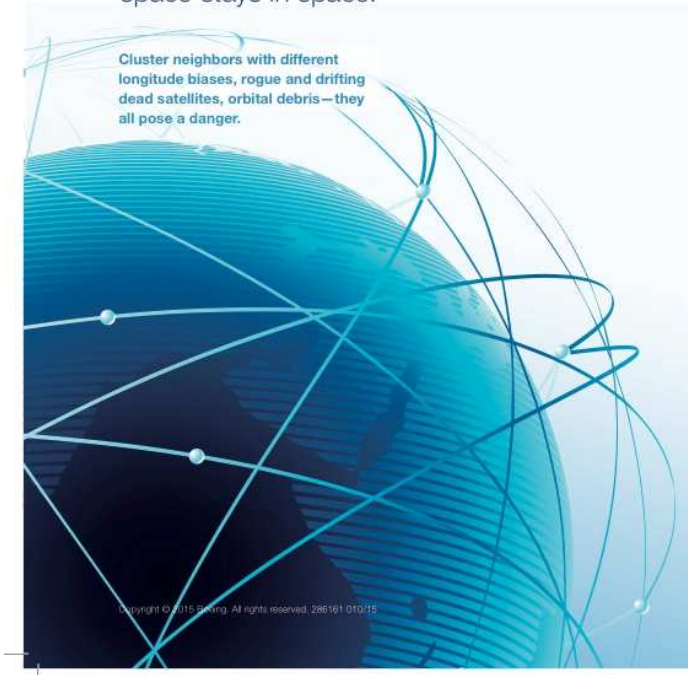
Keeping an eye on the crowded skies.

For two decades, The Boeing Company has supported the US Air Force (e.g., MSSS, SOR, SBSS) and others in keeping track of what's in orbit. With our ground-based space situational awareness (GBSSA) network, we'll do the same for you—helping you keep what you have in orbit safe from collisions.

B2B tailored services for commercial space operators

Let Boeing provide you actionable SSA information

Viewing, understanding, and predicting the location of objects in orbit are vital for avoiding collisions. It's called space situational awareness. That's what The Boeing Company's world-wide GBSSA network of electro-optical sensors delivers: a constant, ground-based eye on what's up there, so your investment in space stays in space.



Get—and pay for—only what you need.

Tailored Neighborhood Watch positional-monitoring services:

- Celestial-based trajectory information of objects in your neighborhood
- Conjunction assessment (CA) of objects like debris and drifters
- Response to Space Command conjunction summary messages (CSM)
- High accuracy measurements of space objects

Change detection

Regulatory compliance (as needed)

Command verification (as needed)

Anomaly resolution (as needed)

Contact information:

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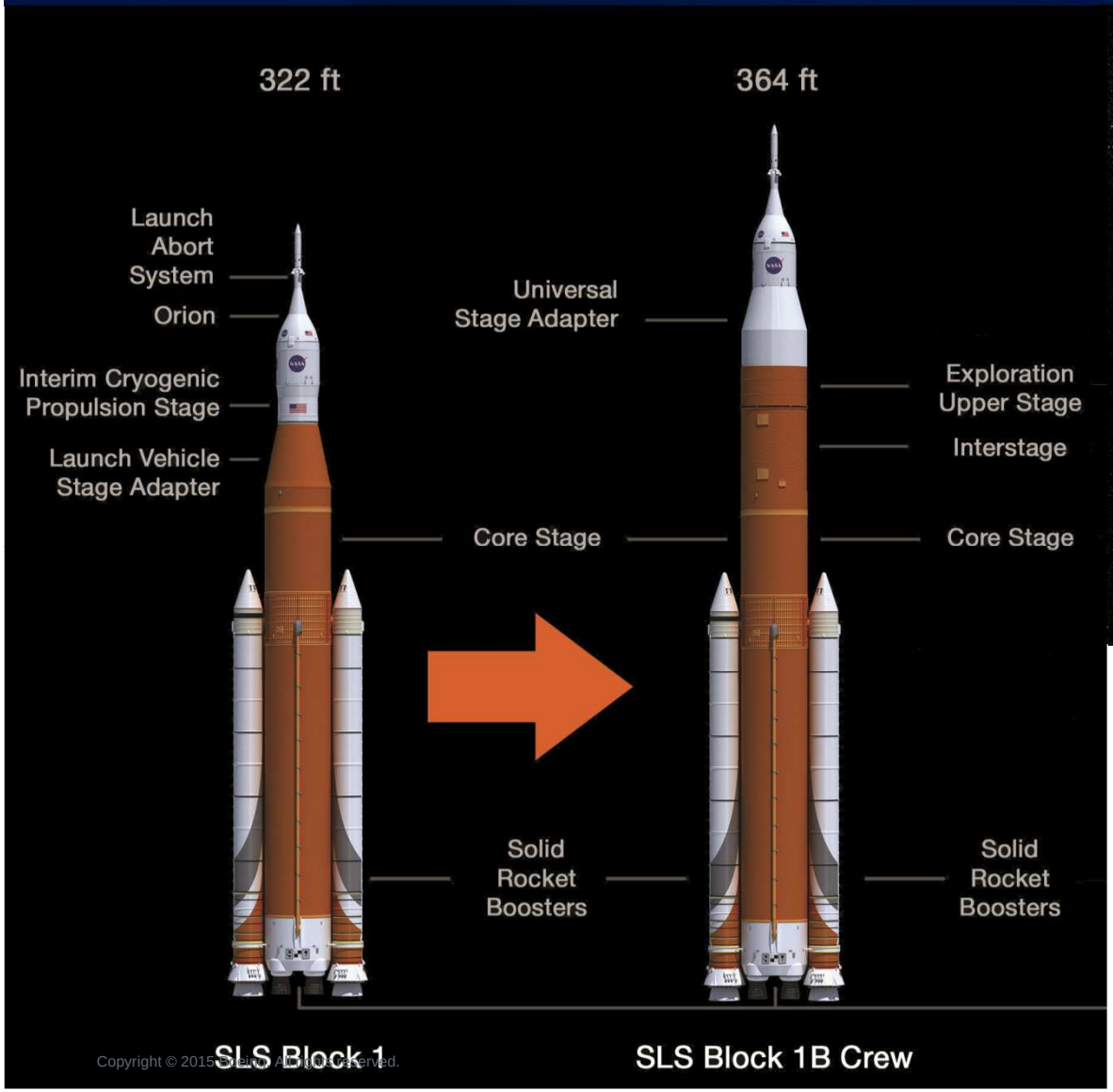
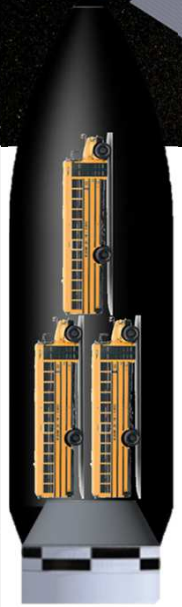
Space Launch System Overview



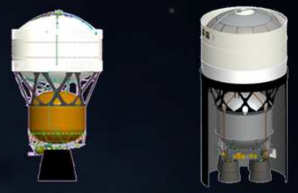


Europa Mission baseline SLS Launch in 2022

Launching America's Journey to Mars in 2018

Structures

Upper Stage Development



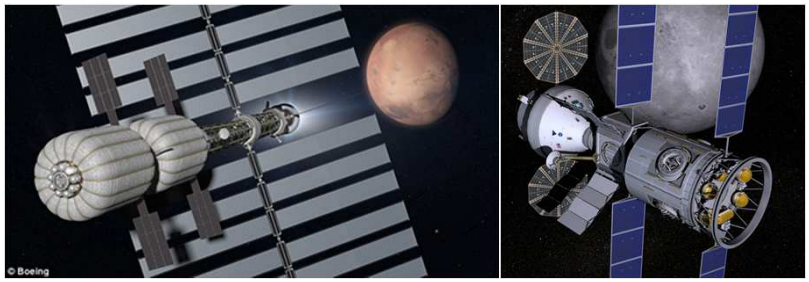
Propulsion

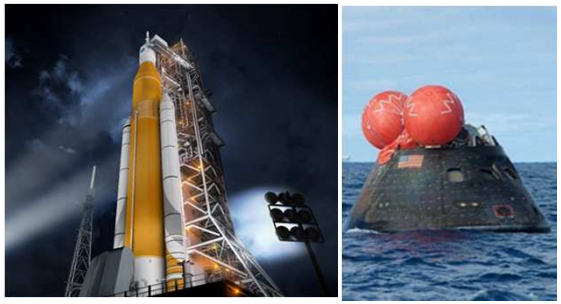
Avionics

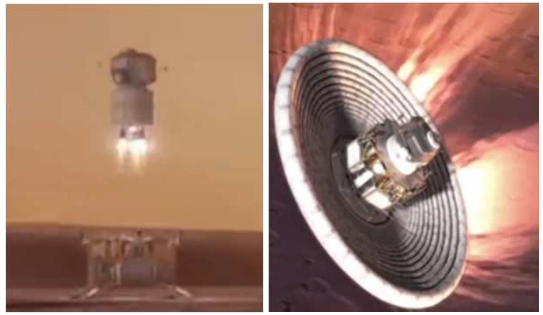
Manufacturing

Development Testing

Journey to Mars
Capability Roadmap







2020s → 2020s → 2030s

The Human Mission to Mars

Space Launch System lays the **Foundation** for the **Human Journey to Mars**