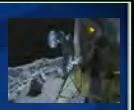
ORION

Orion Crew Exploration Vehicle



Wes Geiman
Crew Module Structures Manager
April 2010

LOCKHEED MARTIN

NASA's Plan for Space Exploration

- Safely fly the Space Shuttle and complete the International Space Station
- Develop and fly the Orion crew exploration vehicle no later than 2015
- Promote international and commercial participation in exploration

Orion Crew Exploration Vehicle

Orion will support Space Station and Lunar Missions

- Designed to operate for up to 210 days in Earth or lunar orbit
- Separate crew and service modules
- Vehicle designed for 4 crewmember lunar missions
- Could be upgraded to accommodate up to 6 crew
- Deliver pressurized and unpressurized cargo to space station

A New Era in Space Exploration

Apollo

- Moon as a destination point
- Three person crew – two on the moon
- Three-day mission
- Equatorial region landing only

Orion

- Moon as an outpost and stepping stone to Mars
- Four person crew – four on the moon
- Six-month mission
- No limits on landing sites, including polar regions

Greater operational capacity and science potential

Support to the International Space Station

- Transport 4 crew on Orion for crew rotation
- 210 day stay time
- Emergency lifeboat for entire ISS crew
- Deliver cargo for ISS resupply

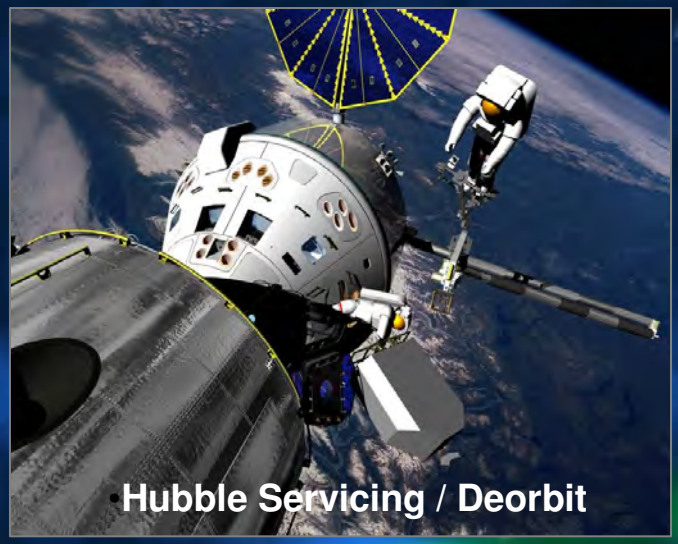
Alternative Missions for Orion

- Science Missions

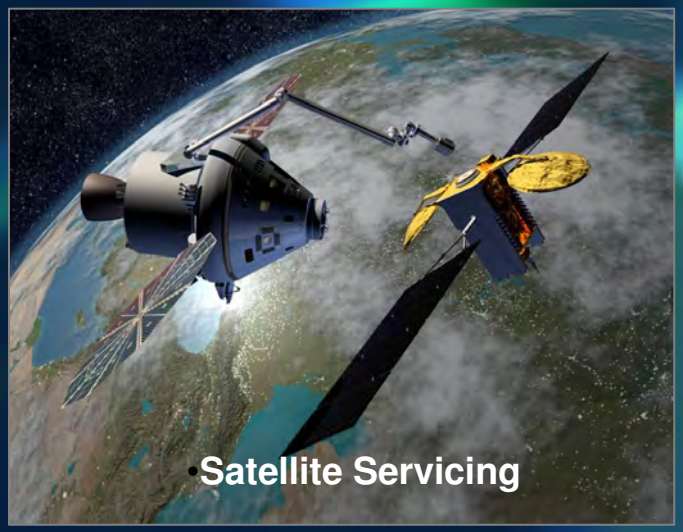
Crewed visit to Asteroid

Micro Gravity Experiment

- Satellite Servicing Missions



•Hubble Servicing / Deorbit



•Satellite Servicing

Orion Crew Exploration Vehicle

Crew Module
Crew and cargo transport

Spacecraft Adapter
Structural transition to
Ares launch vehicle

Launch Abort System
Emergency escape during launch

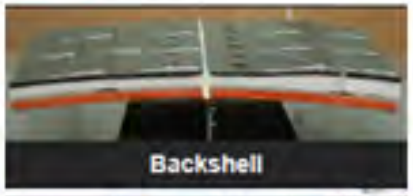
Service Module
Propulsion, electrical power,
fluids storage

Orion Crew Exploration Vehicle

Orion Crew Module

- Provides a safe habitat from launch through landing and recovery
- Re-enters and lands as a stand alone module
- Common interface with International Space Station

Pressure Vessel



Backshell

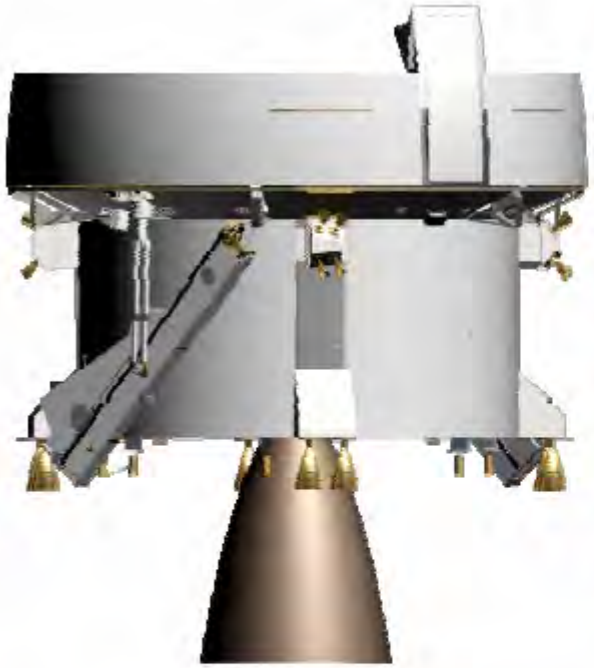
Heatshield

Console Display

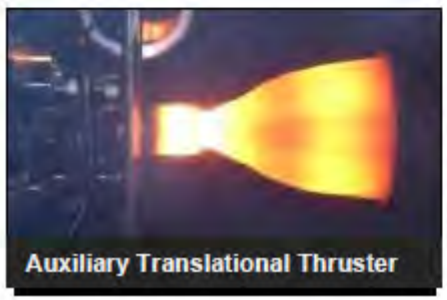
Low Impact Docking Capture Ring

Orion Crew Exploration Vehicle

Orion Service Module



- Supports crew module from launch through separation
- Maneuvers vehicle to the ISS or Lunar orbit and back
- High altitude ascent abort propulsion after Launch Abort System jettison
- Provides orbital maintenance and attitude control
- Supplies power, storage, and consumables
- Primary thermal control while mated with crew module
- Accommodates ISS un-pressurized cargo and Lunar mission science equipment



Auxiliary Translational Thruster

Solar Array Testing

Attitude Control RCS Thruster

Propellant Tank

Orion Crew Exploration Vehicle

Orion Launch Abort System

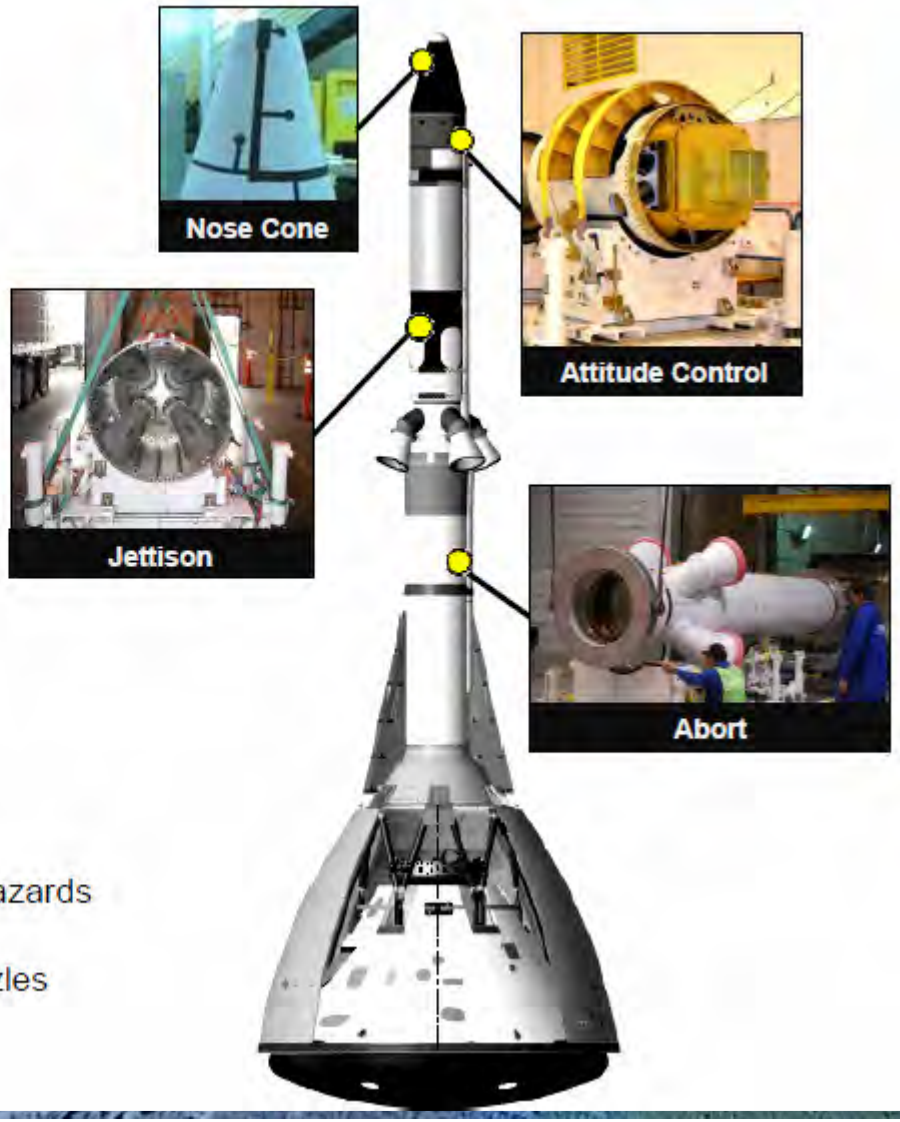
♦**Launch Abort System**
- Safely removes the crew from launch vehicle on the pad through first stage flight
- Jettisons after successful operations

♦**Nose cone**
- Aero fairing for control motor

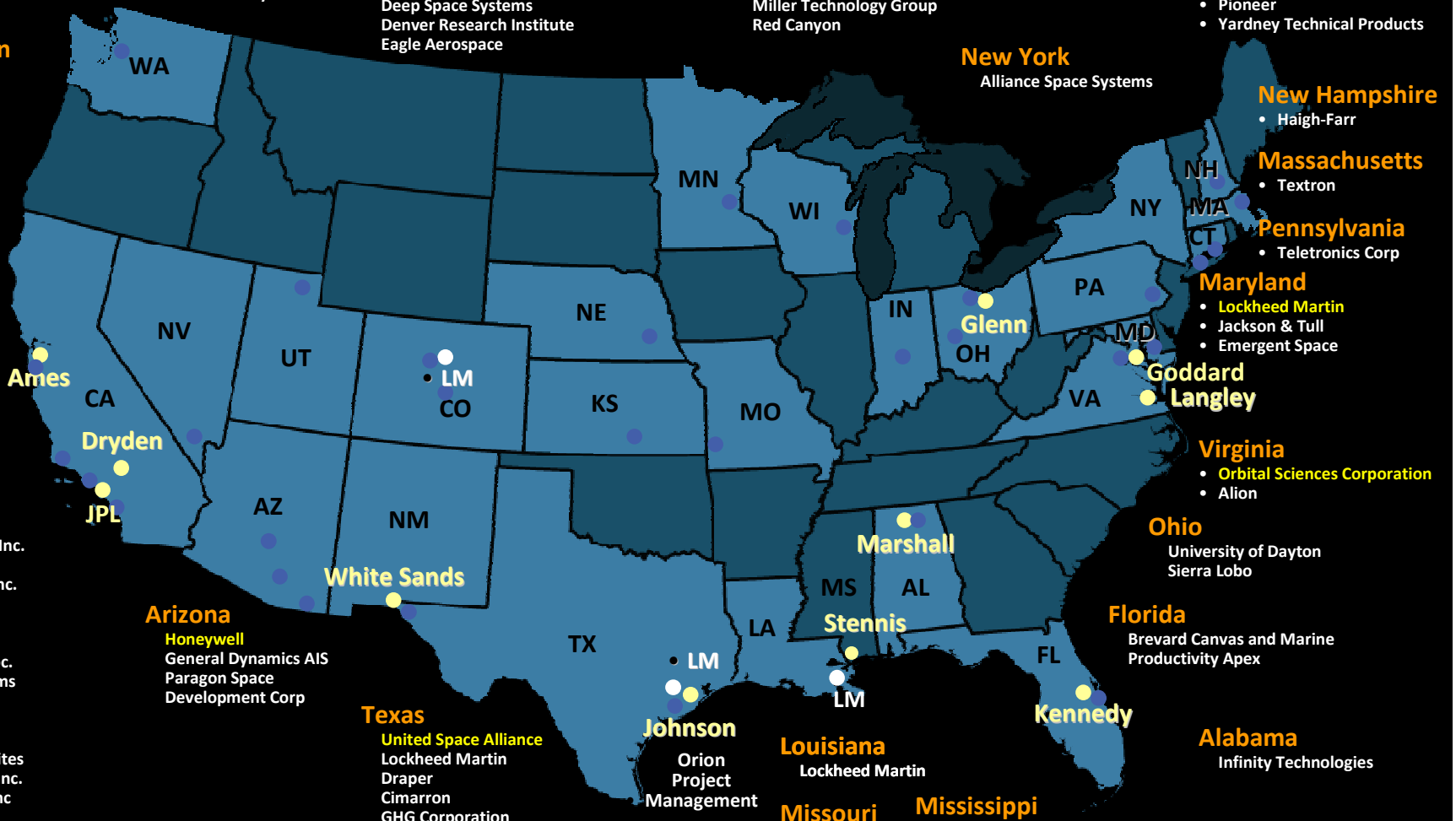
♦**Attitude control motor**
  - Provides active control during flight
- Performs reorientation prior to jettison
- Solid rocket motor with 8 nozzles

♦**Jettison motor**
  - Separates the Launch Abort System from the crew module
  - 1 solid rocket motor, 4 nozzles

♦**Abort motor**
- Pulls the crew module and crew away from hazards during a pad or mode 1 ascent abort
  - Solid rocket motor with 4 reverse flow nozzles



4000 Orion Team Members Nationwide



Nevada
- Arcata Associates

Utah
- Utah State University

Washington
- Corsair
- Safeware
- Engineering

Wisconsin
- Strohwig

Indiana
- Major Tool

Kansas
- Benecor, Inc.

Nebraska
- General Dynamics ATP

Minnesota
- Goodrich Sensor Systems

Colorado
- Lockheed Martin – Space Systems Company
- Advanced Solutions Inc.
- Ball Aerospace
- Cullimore & Ring Technologies, Inc.
- Deep Space Systems
- Denver Research Institute
- Eagle Aerospace
- EMA
- Glass Parametric
- ISYS Technologies
- Instar
- Miller Technology Group
- Red Canyon
- SEAKR Engineering
- Syzygyx
- TTJ&B Inc
- VTT

New York
- Alliance Space Systems

Connecticut
- Hamilton Sunstrand Space Systems International
- Ensign Bickford Aerospace & Defense
- Pioneer
- Yardney Technical Products

New Hampshire
- Haigh-Farr

Massachusetts
- Textron

Pennsylvania
- Teletronics Corp

Maryland
- Lockheed Martin
- Jackson & Tull
- Emergent Space

Virginia
- Orbital Sciences Corporation
- Alion

Ohio
- University of Dayton
- Sierra Lobo

California
- Aerojet
- Alejo Engineering, Inc.
- AMRO
- ATA Engineering, Inc.
- ATK-Goleta
- Eloret
- Hi Shear
- Humphreys & Assoc.
- JFA Avionics Systems
- KPM Engineering
- Midcom
- Process Fab
- San Diego Composites
- Specialty Devices, Inc.
- Stellar Solutions, Inc

Arizona
- Honeywell
- General Dynamics AIS
- Paragon Space Development Corp

Texas
- United Space Alliance
- Lockheed Martin
- Draper
- Cimarron
- GHG Corporation
- MEI Technologies
- MRI Technologies
- Odyssey Research (UT El Paso)

Johnson
- Orion Project Management

Louisiana
- Lockheed Martin

Missouri
- Eagle Pichers

Mississippi
- Stennis

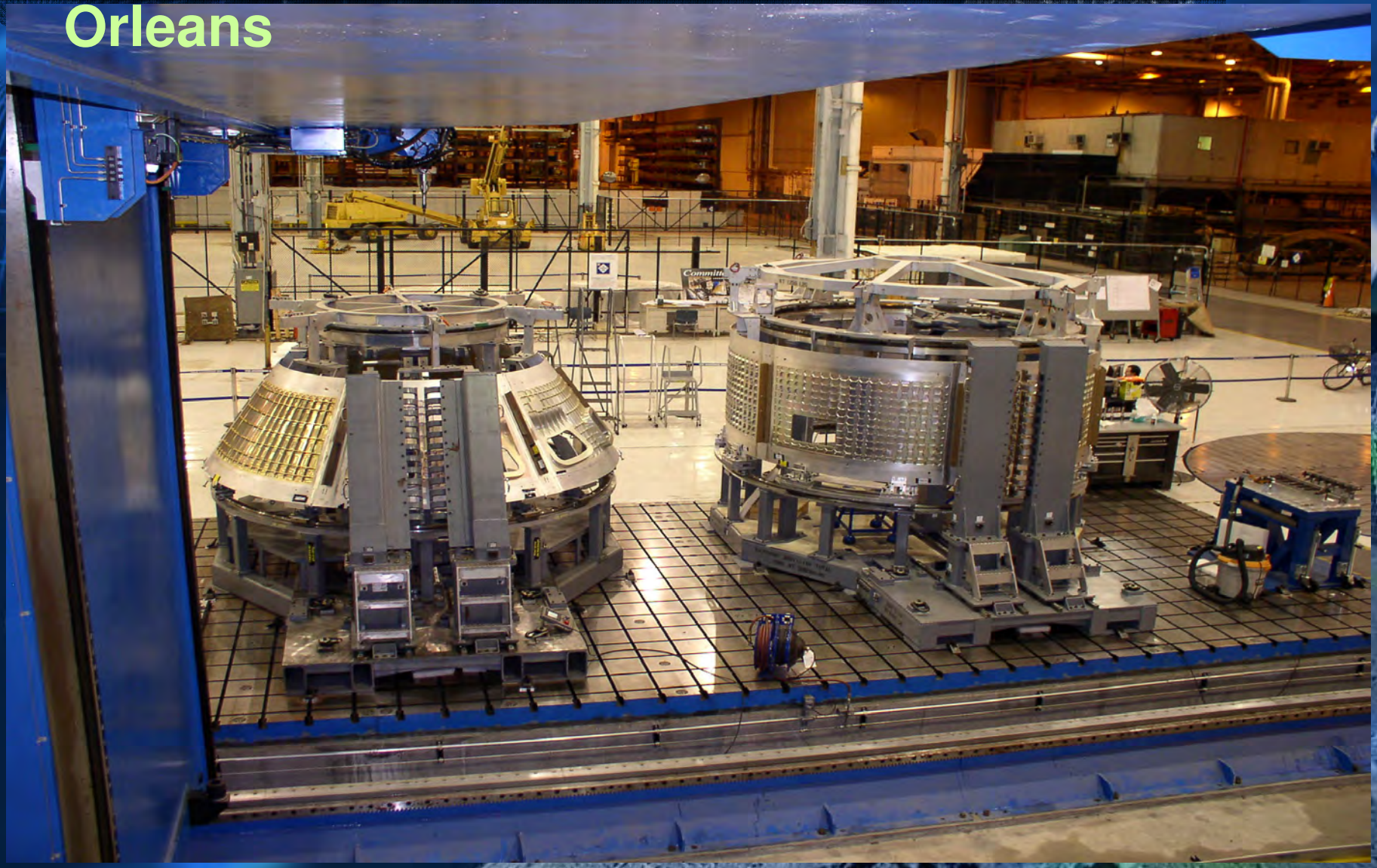
Florida
- Brevard Canvas and Marine
- Productivity Apex

Alabama
- Infinity Technologies

Progress Towards Pad Abort 1 Flight Test

- Scheduled for 2010
- Orion's Launch Abort System provides an emergency escape system for the crew
- The Launch Abort System demonstrates:
  - First in-flight of the solid rocket motors, a coordinated operation
  - Parachute landing system
  - Successful pathfinder for Orion system integration and ground operations procedures

Making Orion Happen! - Right here in New Orleans



Engineering, Procurement, Production, Quality Assurance

Benefits of Space Exploration

- Promotes innovation leading to new jobs, markets and technologies
- Improves quality of life on Earth
- Inspires future generations of scientists, engineers and explorers
- Addresses fundamental questions about the solar system, the universe, and our place in them
- Strengthens existing and creates new global partnerships

Tremendous return on investment for **less than 1%** of Federal budget

Questions & Answers

Images and content in this presentation provided courtesy of NASA, Aerojet & ATK

www.lockheedmartin.com/orion