



PREDICTING OUR SUN'S MOOD SWINGS.

The Sun enables life. It can also do harm. Sometimes our nearest star sends bursts of radiation that threaten power grids, satellite systems, and space travelers. That's why Lockheed Martin works closely with NASA and academia, building instruments and spacecraft to decipher the Sun's dazzling complexity. Together, mission by mission, we're learning how to predict and mitigate the hazard of "space weather."

www.lockheedmartin.com

100 YEARS OF ACCELERATING TOMORROW



EARLIER EARLY WARNING

Something's brewing in the night sky. Is it harmless weather or a tornado? To help solve this mystery, the GOES-R satellite system will detect the number and frequency of lightning events over large areas. The Global Lightning Mapper is just one way GOES-R will deliver comprehensive weather data for North America with no gaps in coverage. GOES-R, because lives and livelihoods depend on it.

lockheedmartin.com/maven

LOCKHEED MARTIN
We never forget who we're working for.

WHY TAP LIMITED RESOURCES? WHEN WE HAVE OCEANS OF ENERGY

OCEAN ENERGY - LEARN MORE

100 YEARS OF ACCELERATING TOMORROW

LOCKHEED MARTIN



Lockheed Martin in California and Harwell

December 4, 2014

Dr. Jim Mulroy

Director, Space Science and Instrumentation, Advanced Technology Center
Space Systems Company

Space Systems Company Portfolio



Strategic & Missile Defense



Adv Programs



Strategic Missiles



Missile Defense

Civil Space



NASA Human Exploration



Planetary Exploration



Weather & Environment

Military Space



Protected Comms



Narrowband Comms



Navigation



Weather



Early Warning



Space Protection

Special Programs



Commercial Space



Remote Sensing



Commercial SATCOM

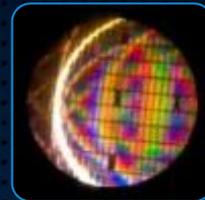


Wind Energy Management

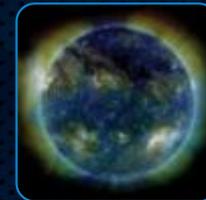
Advanced Technology Center



Optics, RF & Photonics



Adv. Materials & Nano Systems



Space Sciences & Instruments

Subsidiaries



Civil Space



Expanding the frontiers of space exploration and Earth observation

- Human space exploration
- Robotic deep space exploration
- Mars orbiters and landers
- Weather and environmental sensing
- Advanced Programs – new frontiers



Image courtesy of NASA



Civil Space Scope



- NASA
- NOAA
- DARPA
- U.S. Air Force
- AFRL
- International

Space Science

DISCOVER

 Spitzer
 NIRCam
 Hubble
 OSIRIS-REx
 InSight
 Juno
 MRO
 MAVEN

Human Space Flight & Exploration

 Orion
 Space Launch System elements
 Exploration Missions
 Dream Chaser

Weather & Earth Observing

PROTECT

 GOES-R/S/T/U
 GOES Instruments

EXPLORE

 Regenerative Energy Storage
 Cryogenic Storage
 Structural Composite Joint Technology
 Entry Systems
 Responsive Lift
 Sample Handling & Transfer
 Solar Electric Propulsion
 Enabling Technologies

Orion - Multi Purpose Crew Vehicle



- ❑ Designed to take humans safely beyond LEO ... and return them safely back to Earth
- ❑ Lockheed Martin Space Systems Company – the prime contractor

Launch Abort System

- Protection for the CM
- Jettison after first stage flight

KEY DATES

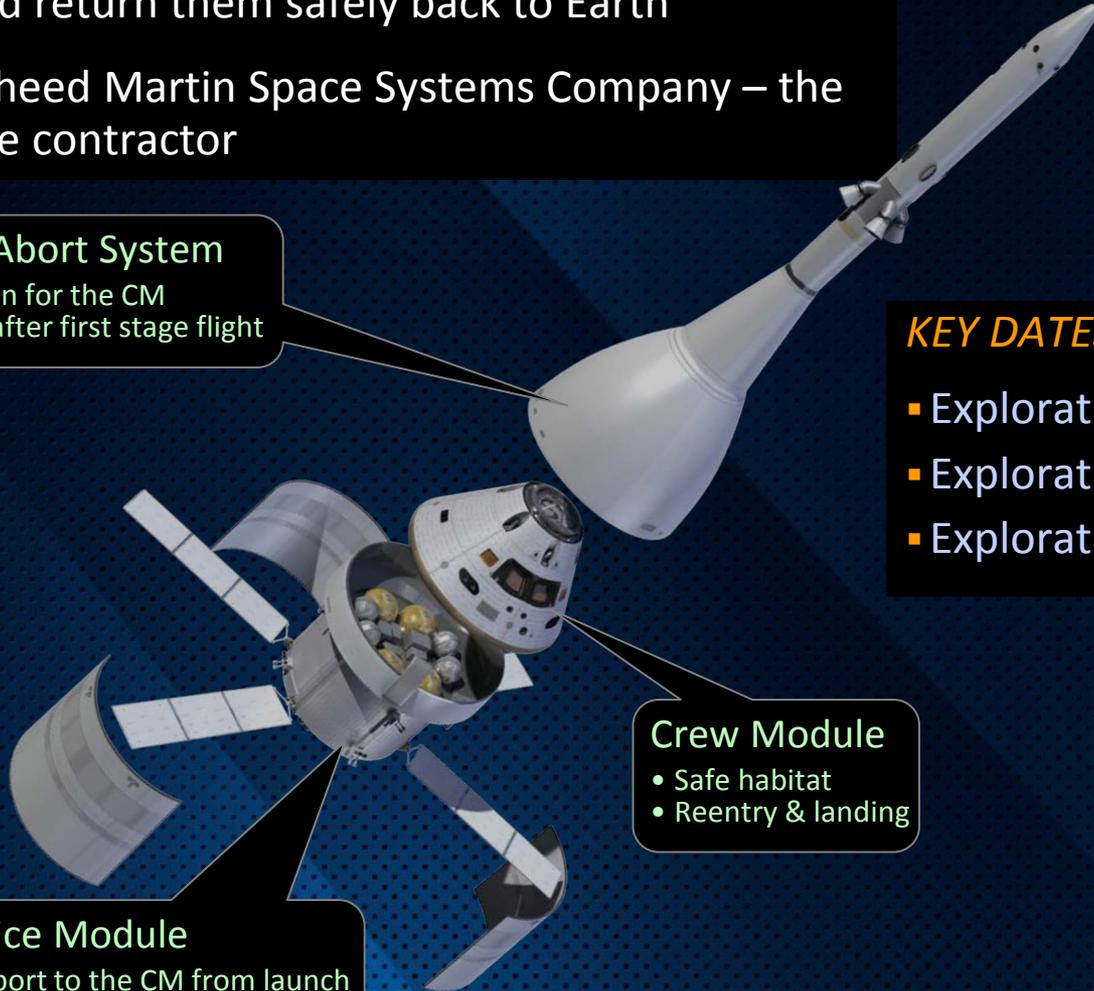
- Exploration Flight Test 1: Dec 2014
- Exploration Mission 1: FY 2018
- Exploration Mission 2: FY 2021

Crew Module

- Safe habitat
- Reentry & landing

Service Module

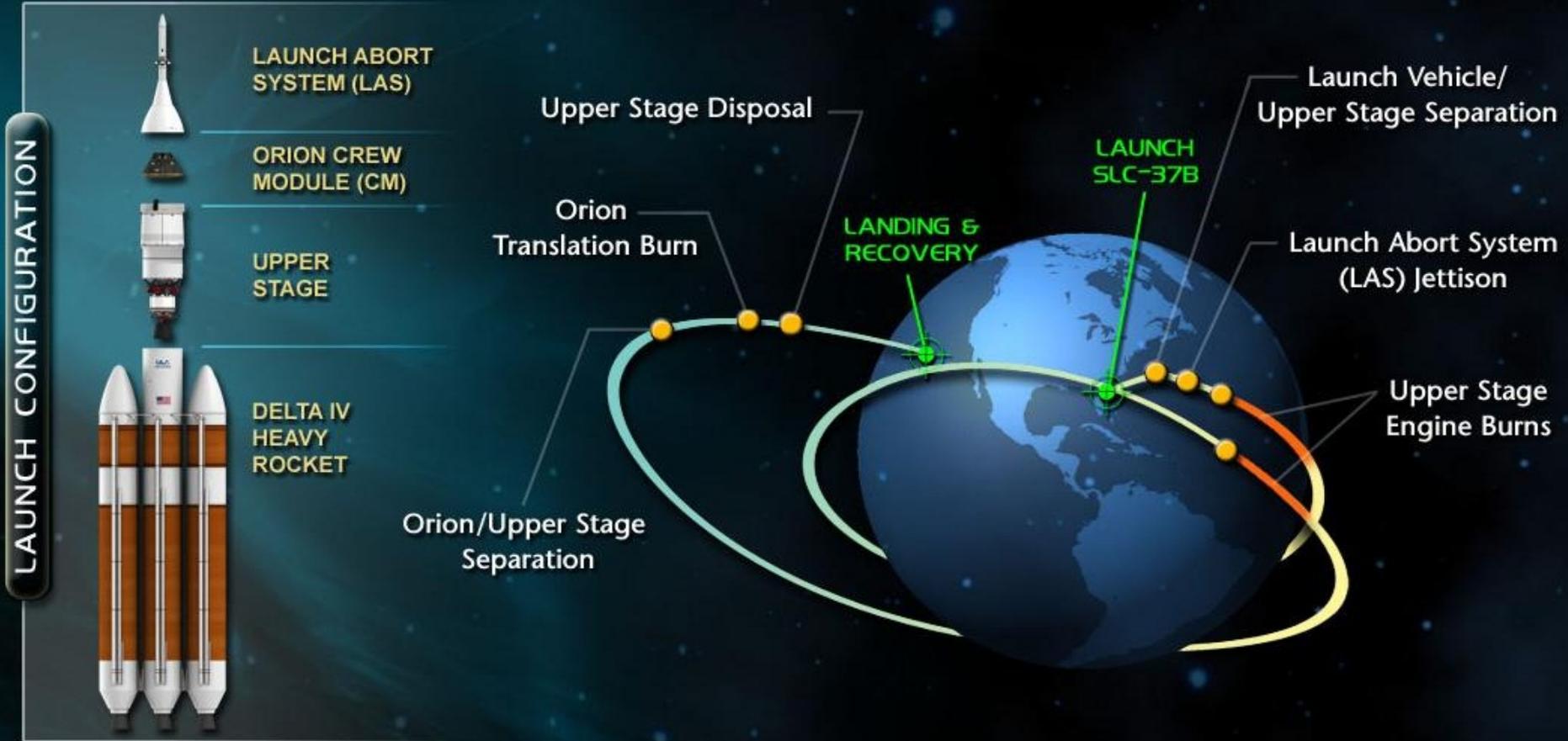
- Support to the CM from launch through CM separation



Exploration Flight Test – 1



TWO ORBITS • 20,000 MPH ENTRY • 3,671 MILE APOGEE • 28.6 DEGREE INCLINATION



2014

LM SSC UK Operations



LMUK Strategic Systems (Coulport & Faslane)
Focus: Strategic Weapon System In Service Support to Vanguard SSBN at HM Naval Base Clyde



LMUK Amthill Special Projects
Focus: AWE support, Targets, Reentry Vehicle Technologies



Harwell



New SSC Footprint
LM SSC Space Technology Office
Focus: Space Science and Innovation



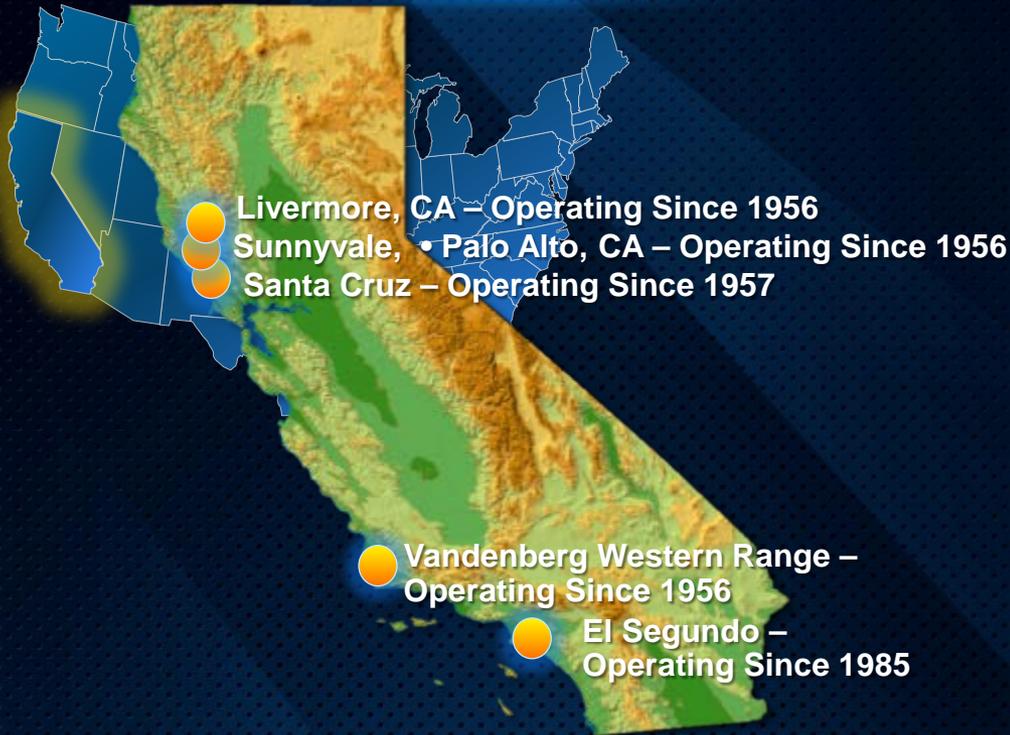
AWE (Aldermaston and Burghfield)



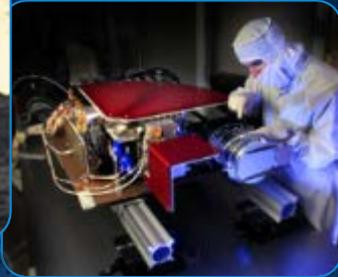
- Meeting Space/Field Office for LM Collaborations with the UK Space Community
 - Industry
 - University
 - Government & Labs
- Operating Node for Contract Effort for UK SA and other UK space-faring organizations
- Interests:
 - Responsive Lift / SpacePort – for small satellites
 - Science missions
 - Military SATCOM



Space Systems California Operations



- 5,550 employees
- Facilities:
 - Manufacturing
 - Satellite integration & test
 - Advanced simulation
 - Laboratories
- Programs and Operations:
 - Military communications satellites
 - Special programs
 - Environmental satellite systems
 - Strategic & missile defense systems
 - Research & development
 - Launch operations

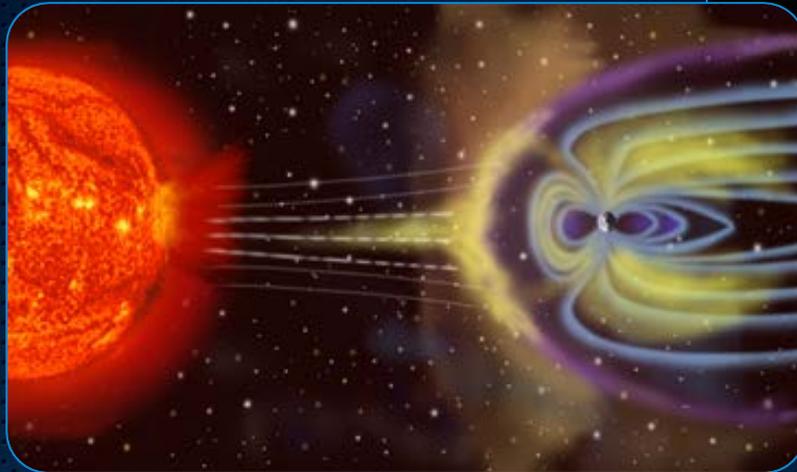


Advanced Technology Center (ATC)



Harnessing technologies that enable the future

- Focus on customers' demanding requirements
- First-of-a-kind prototype payloads
- Solar and space physics instrumentation
- Expertise across numerous technologies
- Integrated multidisciplinary approach

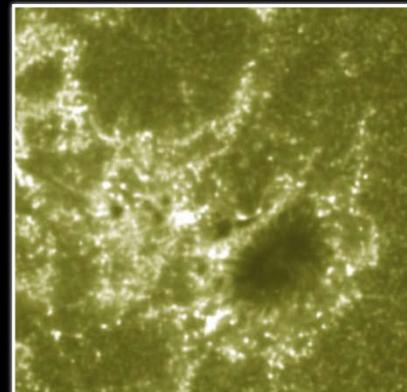


IRIS: Interface Region Imaging Spectrograph

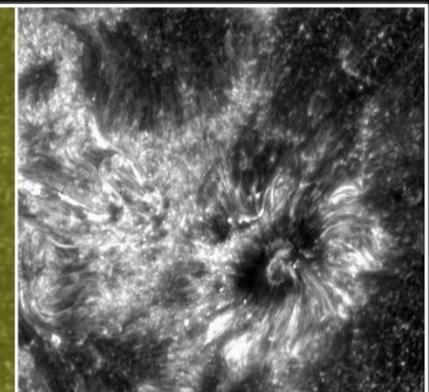


IRIS is a NASA Small Explorer

- PI is Sr. Fellow, Dr. Alan Title
- ATC designed instrument, & provides overall program management.
- Collaboration with Civil Space and NASA Ames
- Observatory Cost: \$120M



SDO AIA 1600



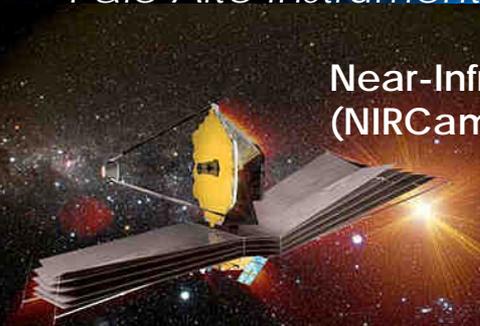
IRIS Si IV

Flight Instrument Programs

Palo Alto Instruments for the Civil Space Line of Business



Near-Infrared Camera
(NIRCam)



James Webb Space
Telescope (JWST)



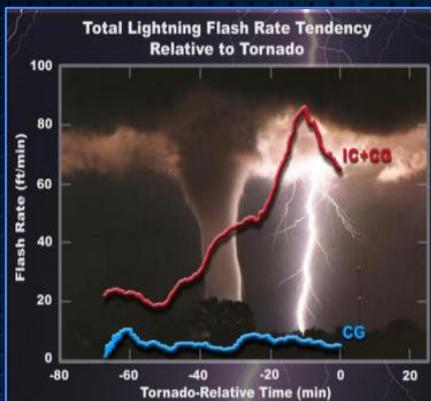
- NIRCam: JWST science imager + WF Sensor

- GLM: GOES-R (Geostationary Operational Environmental Satellite) Fast framing NIR camera for 10 minutes' earlier funnel cloud formation prediction.

- SUVI: GOES-R Continuous images the sun in six EUV wavelengths for space weather operations

- Spans: Astrophysics, Earth-Weather, Solar

Geostationary Lightning
Mapper (GLM)



GLM

Solar Ultraviolet Imager (SUVI)



Geostationary Operational
Environmental Satellite (GOES-R)

National Oceanic and Atmospheric
Administration's (NOAA)



SUVI



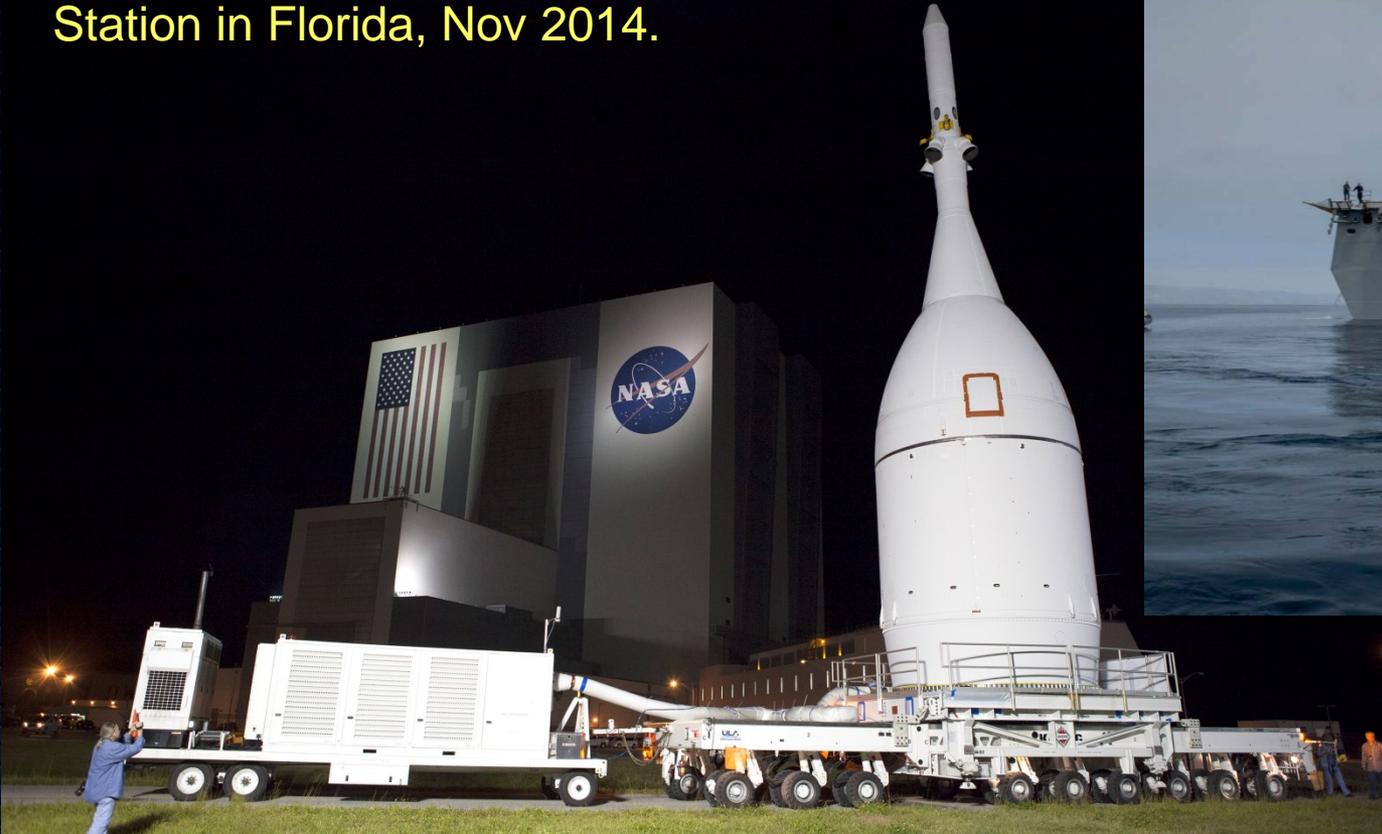
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ORION – Ready for Dec. 4, 2014 Launch



@ Cape Canaveral Air Force Station in Florida, Nov 2014.

Recovery Tests – Summer 2014



Photos: NASA

Space Systems Company



Richard Ambrose
Executive Vice President

BUSINESS AREA LEADERSHIP



Tim Cahill
Vice President & GM
Strategic & Missile
Defense Systems



James H. Crocker*
Vice President & GM
Civil Space



Mike Hamel
Vice President & GM
Commercial Space



Kathryn Tobey
Vice President & GM
Special Programs



Mark Valerio
Vice President & GM
Military Space



Carl Marchetto
Vice President
Business Transformation

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President & CEO
United Launch Alliance



Paul J. Hommert***
President &
Laboratories Director
Sandia Corporation



Kevin Bilger
Managing Director
Atomic Weapons
Establishment (AWE) plc.



Don White
President & CEO
Astrotech Space
Operations



John Nelson
President & CEO
Zeta Associates

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Julie A. Sattler*
Vice President
Programs and Quality



Dennis O. Little
Vice President
Production



Paul J. Regan
Vice President
Finance & Business Operations



Daniel A. McNulty
Vice President &
General Counsel



John Karas
Vice President
Strategy & Business Development



Andrea Greenan
Vice President
Communications



Scott Fouse
Vice President
ATC



John J. Kowalchik
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Mission Success



Mark Pasquale
Vice President
Engineering



Armando L. Castorena
Vice President
Human Resources



Laurence Ulrich
Director
Ethics and Business Conduct



Joseph Trench
Vice President
Delaware Valley



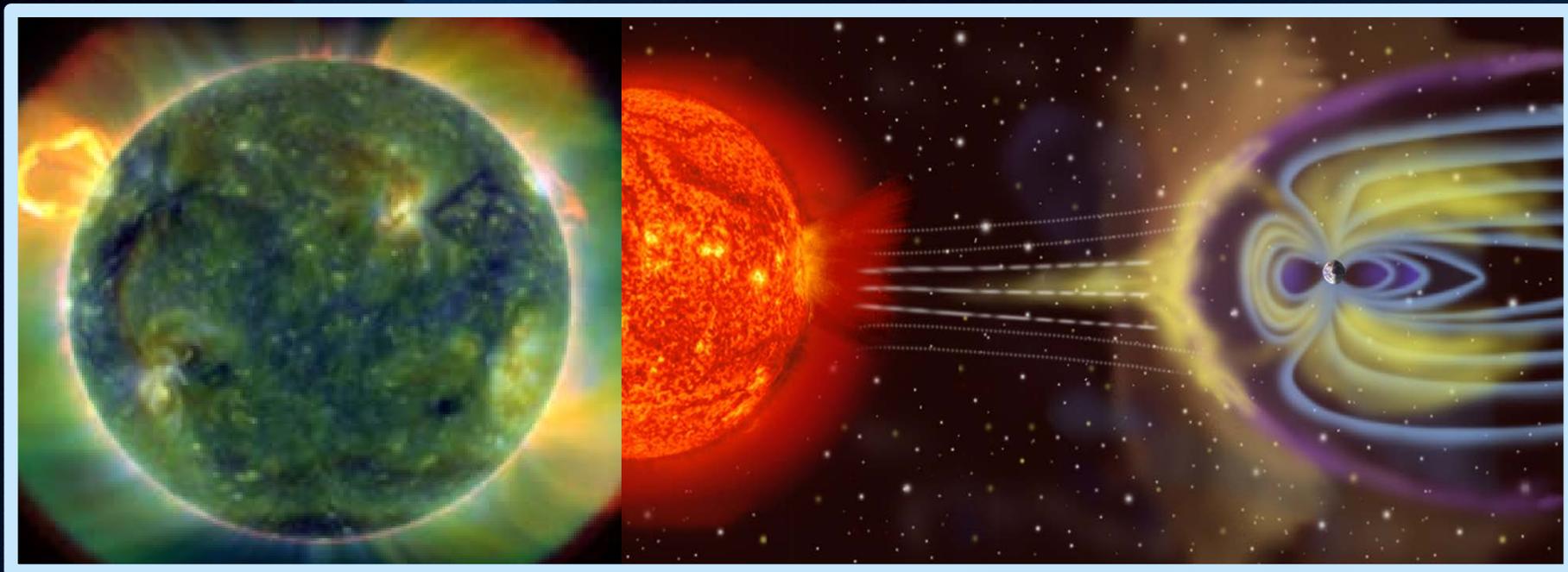
Eric H. Thoemmes
Vice President
Washington Operations

*Site Executive

**Reports to Board of Directors of ULA, a Joint Venture with Boeing Corporation

***Reports to Board of Directors of Sandia

Heliophysics – Understanding our Sun and the Sun/Earth Connection



Sandia / Atomic Weapons Establishment (AWE)



Advancing global security by sustaining the nuclear deterrent

- Research, design, surveillance assessment and certification of the US nuclear deterrent
- Stockpile modernization to ensure safety, reliability and effectiveness
- Maintenance and operation of the physical infrastructure
- Management of weapons site processes and procedures
- Design and maintenance of UK Trident nuclear deterrent

