MARS Update

Virginia Senate Finance Committee
Subcommittee on Transportation
Wallops Flight Facility Site Visit
August 20th, 2013

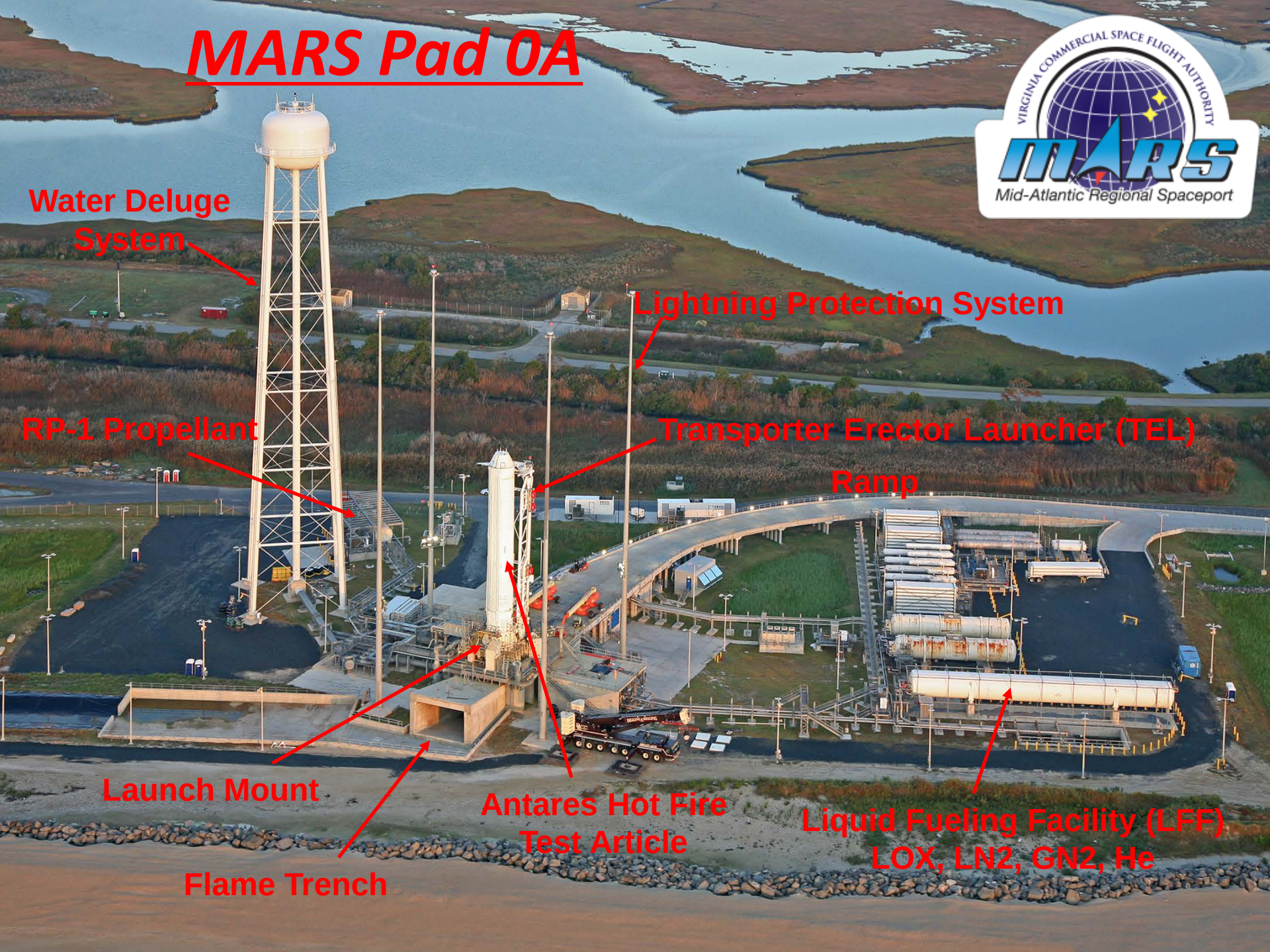
Dale Nash
Executive Director
Virginia Commercial
Space Flight Authority (VCSFA)

VCSFA Critical Missions

- Support Cargo Re-supply of International Space Station (ISS)
  - Critical National mission
  - Only one of two providers in the USA
  - Need to level playing field on funding with Florida
- Continue to Make the Orbital Antares Program a Success
- Support DoD: Air Force/Operationally Responsive Space (ORS)
  - Critical National missions
  - Providing urgent capabilities globally
- Attract New Customers for Virginia Economic Development
  - VCSFA is in ongoing talks with other major Launch Providers
  - Recent launches (Antares, ORS-1), state of the art launch facilities, and competitive prices make MARS very attractive to new customers

MARS Pad 0A Description

- Mid-Class Launch Facility (MCLF)
- Piling-reinforced Launch Pad (LP) and ramp
- Liquid Fueling Facility (LFF): LOX, LN2, GN2, GHe, RP-1 (geographically separated for safety)
- LO2 Subcooler
- Deluge System: 200,000 gal fresh water for cooling and acoustic suppression
- Launch Mount (LM) / Flame Trench
- Hydraulic System for erecting TEL
- Environmental Control System (ECS) for Payload / Launch Vehicle (LV)
- Gross Lift-Off Weight (GLOW): 1 Million+ lbs
- Licensed for Payloads to LEO: 11,100 lb


MARS Pad 0A
VIRGINIA COMMERCIAL SPACE FLIGHT AUTHORITY
MARS
Mid-Atlantic Regional Spaceport
Water Deluge System
Lightning Protection System
RP-1 Propellant
Transporter Erector Launcher (TEL)
Ramp
Launch Mount
Antares Hot Fire Test Article
Liquid Fueling Facility (LFF)
LOX, LN2, GN2, He
Flame Trench

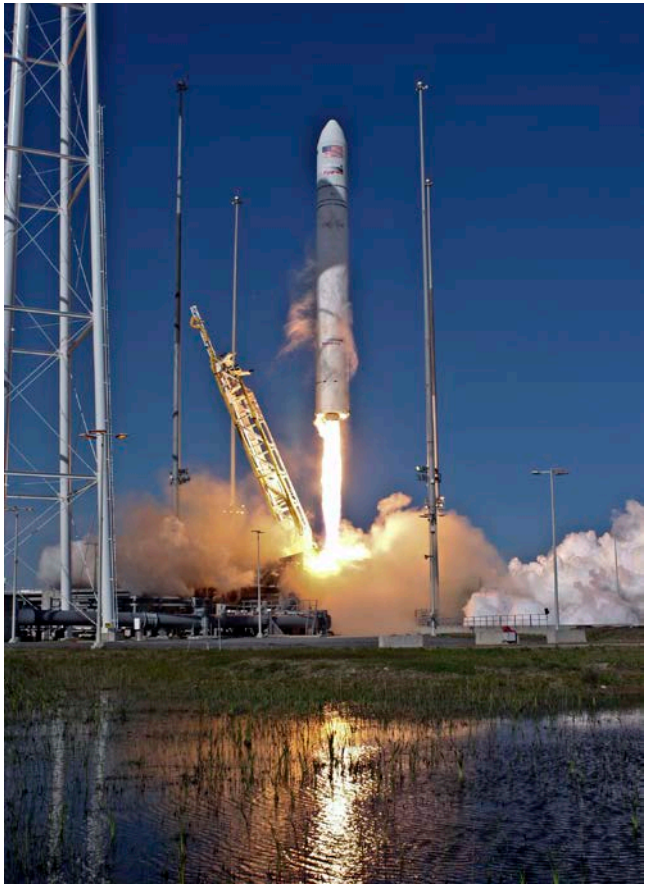
Pad 0A Development Key Takeaways

- Commonwealth Contribution
  - ~$80M Total Commonwealth Contribution to Pad 0A
- Pad 0A Development Timeline
  - June 2009 – MARS Pad 0A Groundbreaking
  - Spring 2010 - MARS Pad 0A Construction Starts
  - Fall 2010 - MARS Pad 0A Construction, Pad taking shape
  - Fall 2011 - MARS Pad 0A Construction, Subsystem level
  - Apr 2012 - Antares Rapid Retract Test
  - Oct 1, 2012 - Pad Turnover
  - Feb 22, 2013 - Successful Antares Hot Fire Test
  - April 21, 2013 - Antares A-ONE Test Flight
- Bottom Line Facts
  - First completely new liquid fuel launch facility built in about 30 years
  - Went through all processes, including tests with Orbital, working closely with NASA Wallops, Goddard, Johnson, Stennis, Marshall
  - Moves Commonwealth into the medium-class launch system market, which benefits Virginia and spills over into Maryland

Pad 0A Major Cost Drivers

- Pad Corrosion Mitigation (Continual)
  - Pad 0A is on the beach and is corroding quickly
- Post Launch Operations (Per Launch)
  - Conduct inspections, clean commodity lines, calibrate instruments, inspect and re-apply ablative coatings, replenish commodities, etc.
- Pad Improvements (Continual)
  - Upgrade ECS for summer operations, add fuel chilling system, improve aft bay access, add debris protection, optimize valve performance, etc.
- Liquid Fueling Facility (LFF) Certification (Continual)
- Pad Maintenance and Operations (Continual)
  - Conduct inspections, calibrations, and cycling of systems (ECS, RP-1, Deluge, LO_2, LN_2, GHe, GN_2, Launch Mount, Flame Trench, Electrical)
  - Must maintain the Liquid Fuel System at all times, and ensure vessels are filled with commodities (cryogenic liquids and high pressure gases)

MARS Pad 0A Operations



- Antares is transported from the HIF to Pad 0A on a TEL and transporters
- The hydraulic system at the base of the launch mount raises the TEL
- The TEL provides umbilical support then retracts at launch to clear rocket
- The deluge system cools and dampens acoustic shock, 200k gals fresh water

MARS Pad 0A Manifest

- Antares Test and Launch
  - COTS Demo
  - September 2013
- ISS Cargo Re-supply
  - CRS-1 to CRS-8
  - Beginning late 2013

MARS Pad 0B Description

- Accommodates variety of solid fueled Launch Vehicles (LVs), including Castor 120 based vehicles, USAF Minuteman and Peace Keeper based Minotaur vehicles, as well as small liquid and hybrid fueled launch vehicles similar size
- Piling-reinforced Launch Mount (LM), Flame Duct, and large Apron
- 133 ft Moveable Service Structure (MSS)
- Support Equipment Building (SEB)
- Launch Equipment Vault (LEV)
- GLOW: 750,000+ lbs
- Licensed for payloads up to LEO: 8400 lb

MARS Pad 0B Operations

- A 500 ton crane is used to stack the rocket motors onto the launch mount
- The gantry provides work platforms, HVAC, weather and lightening protection
- The gantry is pulled away to rotate clear of the mount prior to launch
- The umbilical mast and environmental blanket fall free of the vehicle at launch

MARS Pad 0B Manifest

- NASA LADEE
  - Lunar Atmosphere and Dust Environment Explorer
  - Launch to the Moon September 6th
  - First Minotaur V Launch Vehicle
- ORS-3
  - Launch to orbit November 2013
  - Minotaur I Launch Vehicle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