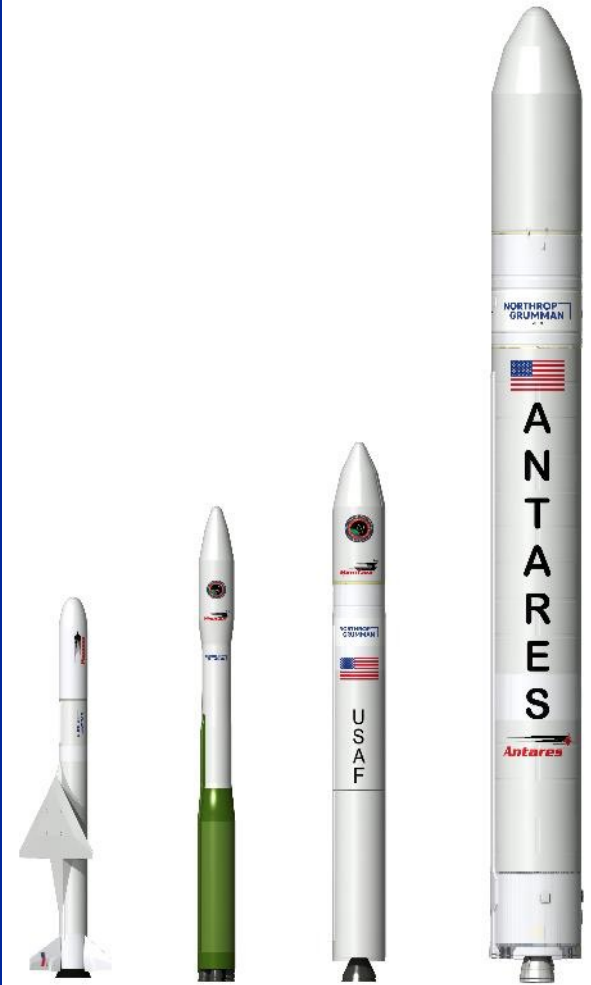


Northrop Grumman Space Systems

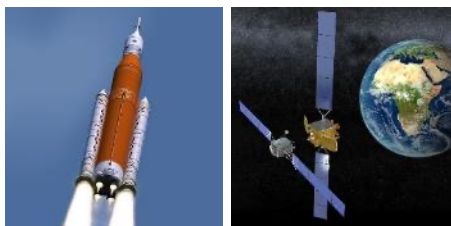


Kurt Eberly
Director

Space Launch Programs

Northrop Grumman's Four Operating Sectors

Space Systems



Launch Vehicles

Propulsion Systems

Commercial Satellites

Military and Civil Space Systems

Science and National Security
Satellites

Human Space and Advanced
Systems

Space Components

Missile Defense

Space Exploration

Space ISR Systems

GBSD

Next Generation Interceptor

Defense Systems



Integrated Air & Missile Defense

Defensive Cyber and Information
Operations

Platform Modernization and Fleet
Operations Support

Advanced Weapons

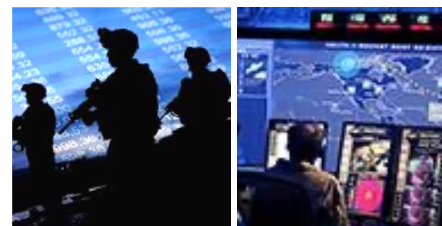
Precision Munitions

Software Systems Modernization
and Sustainment

Training and Simulation

Propulsion Systems

Mission Systems



Airborne Sensors and Networks

Artificial Intelligence/Machine
Learning

Cyber and Intelligence
Mission Solutions

Navigation, Targeting and
Survivability

Maritime/Land Systems and Sensors

Engineering & Sciences

Emerging Concepts Development

Multi-domain C2

Agile/DevSecOps Systems

Aeronautics Systems



Autonomous Systems

Aerospace Structures

Advanced Technologies and
Concepts

Aircraft Design, Integration and
Manufacturing

Long-range Strike

Multi-Domain Integration and
Operations

Intelligence, Surveillance
and Reconnaissance

Battle Management

Launch Vehicles Leadership Team



Mike Pinkston
Vice President



Vikki Robles
Executive Administrative
Assistant



Kasey Henderson
Business
Management



Trina Patterson
Communications



Amy Davis
Human
Resources



Amy Peters
Safety & Mission
Assurance



Kevin Wilder
Advanced
Programs



Dennis Dabney
GMD



Kurt Eberly
Space Launch



Brian Autry
Sentinel



Charles Buckley
Information
Systems



Jon Snyder
Contracts



Kevin Richardson
Business
Development



Lou Amorosi
Targets



Mark Haynie
Operations



Mike Dorsch
Chief Engineer



Tim Kettner
Engineering



Mark Ogren
Strategy

Pegasus

Minotaur

Antares

Upper Stages

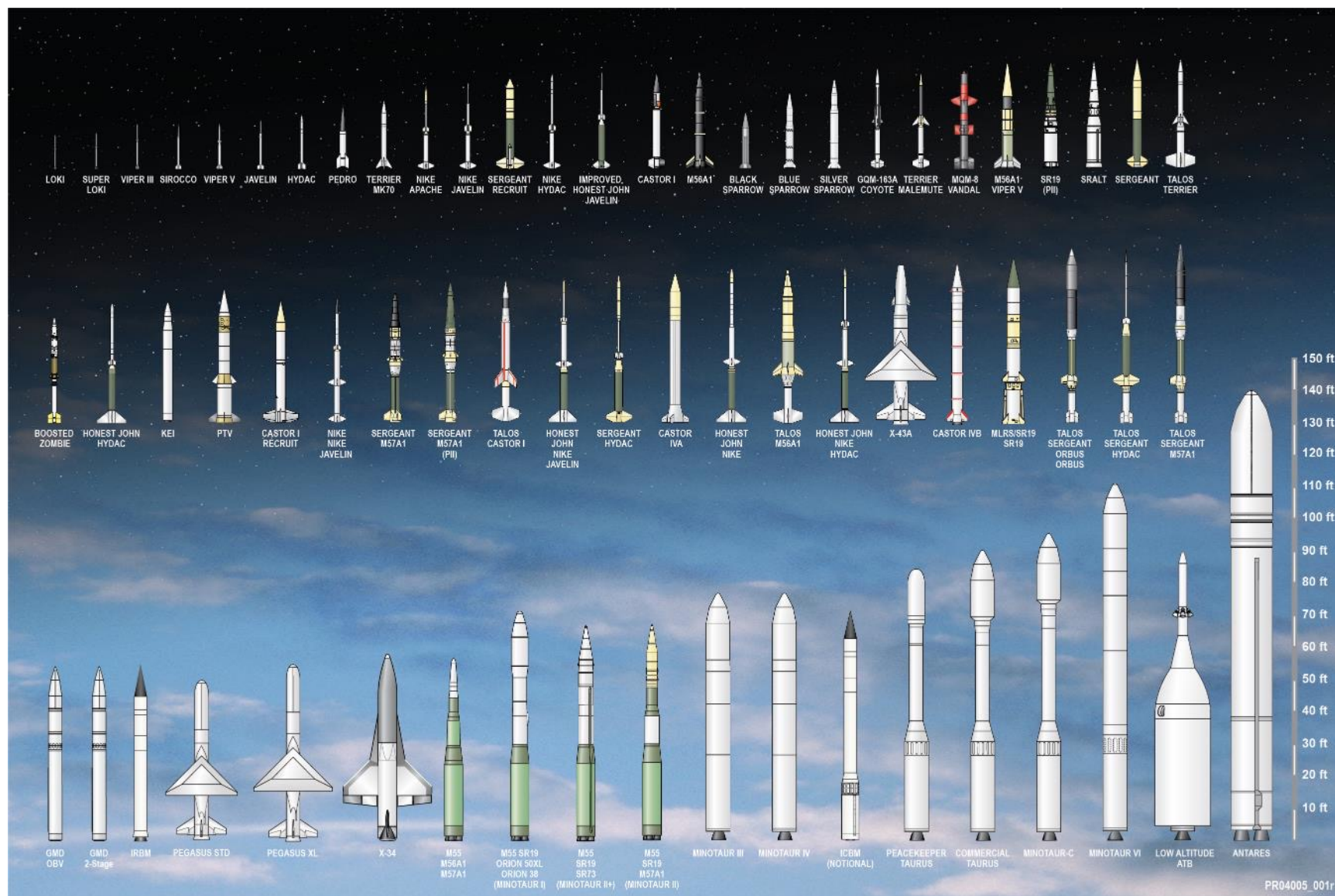
Effective: September 2022

Launch Vehicle Business Unit (LVBU) Locations



PR02003_001_r9

Over 65 Booster Configurations Flown with More Under Contract



PR04005_001r

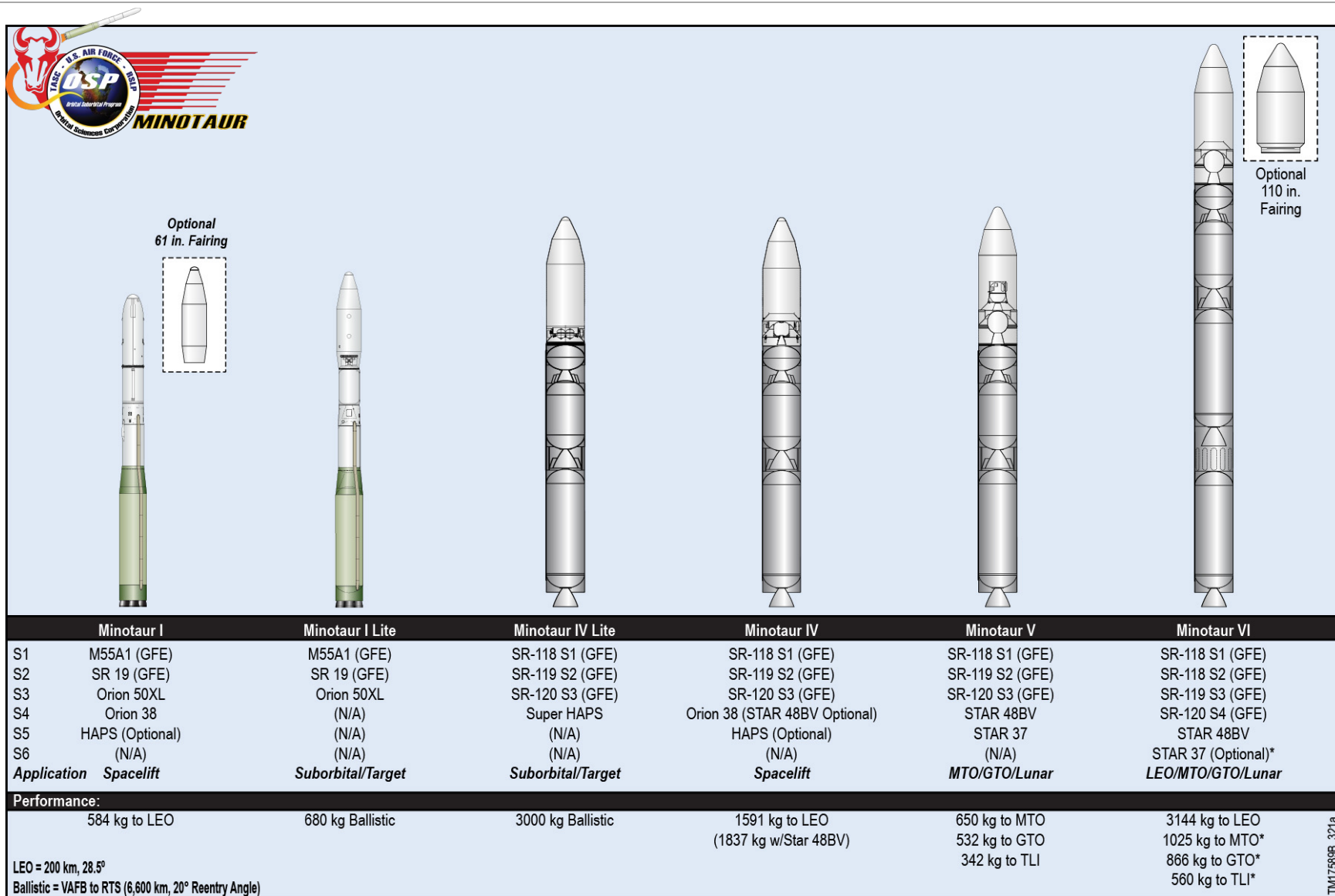
Minotaur Overview Highlights

- 97% Success Rate
 - Minotaur I and II: 20/21 Successful Launches
 - Minotaur IV and V: 8 Successful Launches
- Range Safety Approved
 - Qualified Range Safety Components Allow Minotaur to Launch from any US Launch Site
 - New Autonomous FTS Developed and Qualified
- Flight Proven
 - Minotaur Maximizes Use of Heritage and Common Hardware Across All Minotaur Vehicles to Minimize Risk
- Flexible Solutions and Mission Tailoring
 - Multi-Payload Adapters and Dual Orbits
 - Mission Specific Guidance Schemes
 - Complex and Challenging Mission Scenarios
 - Mission-Unique Structures, Stages, Sep Systems, and Avionics

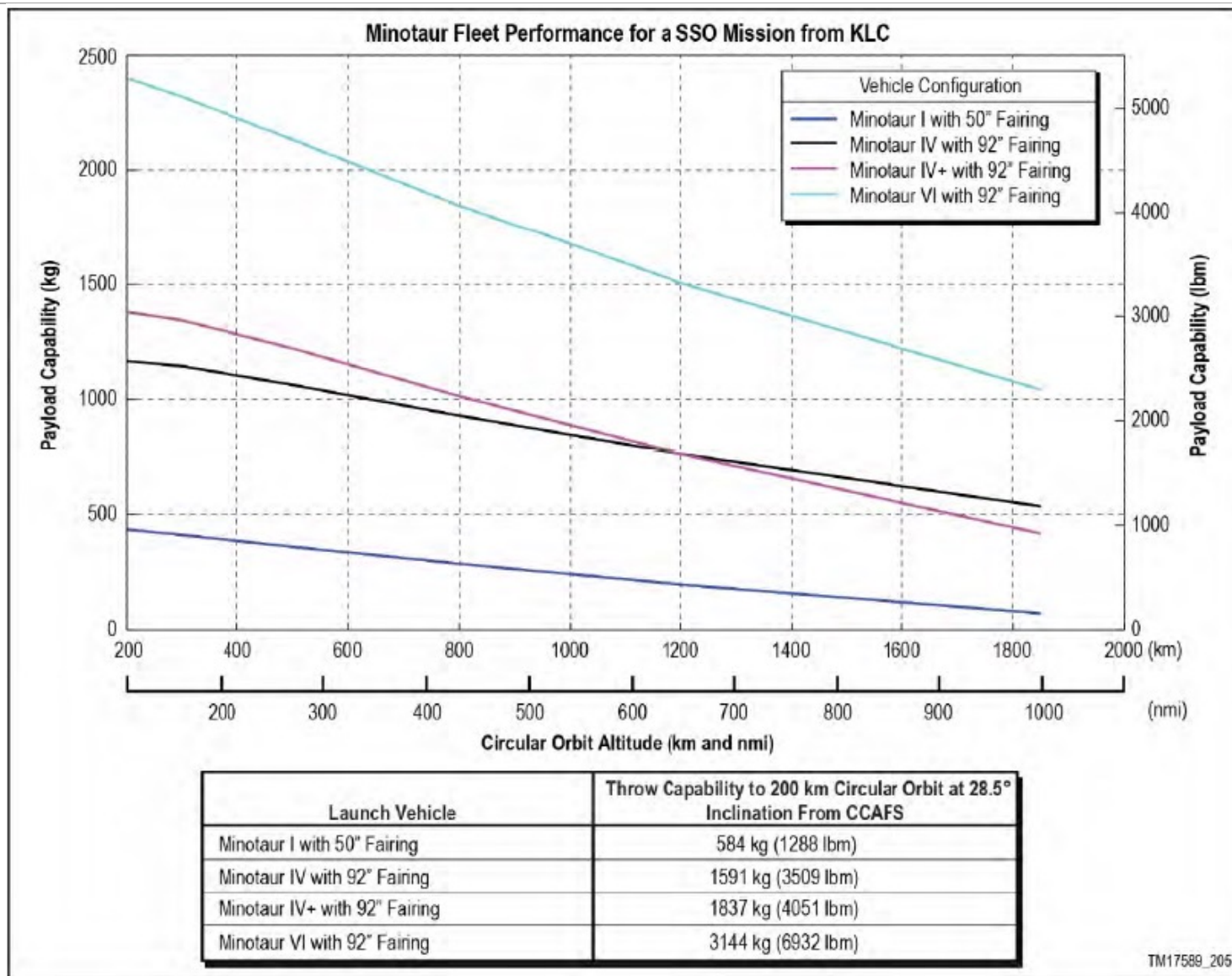


MINOTAUR IS A RELIABLE, FLEXIBLE, AND PROVEN LAUNCH SOLUTION

Minotaur Family of Launch Vehicles



Minotaur Fleet Provides a Wide Range of Space Launch Capability

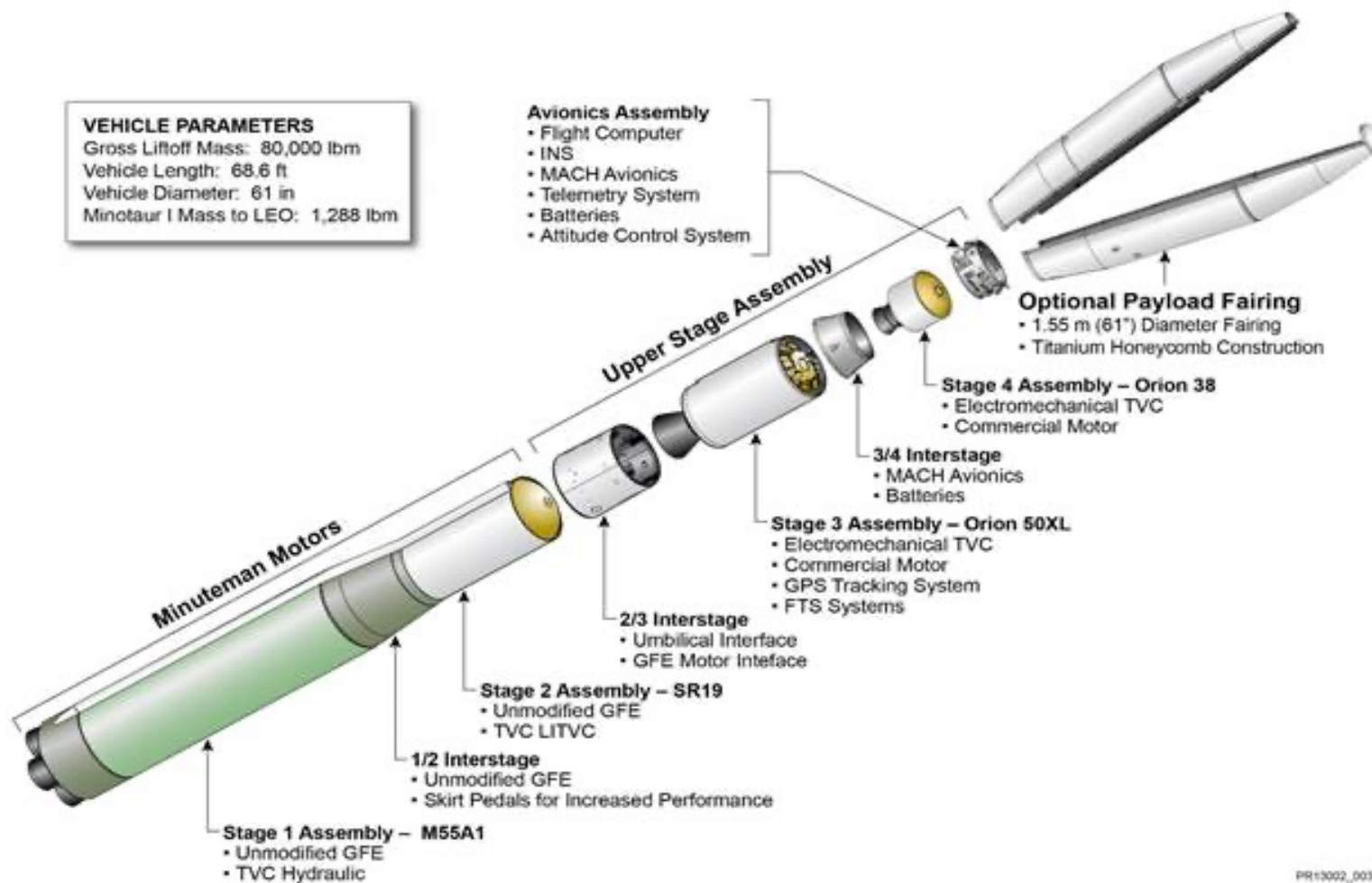


Minotaur I Recent and Current Manifest



- L-111 Mission
 - Minotaur I configuration launched successfully from Wallops Flight Facility Pad 0B on 15 June 2021
 - Launched for NRO via USSF OSP-3 contract
- Suborbital Test Mission
 - Minotaur I configuration
 - Currently planning to launch from Vandenberg SFB in 2023
- Minotaur I is available under USSF OSP-4

Minotaur I Launch Vehicle Overview



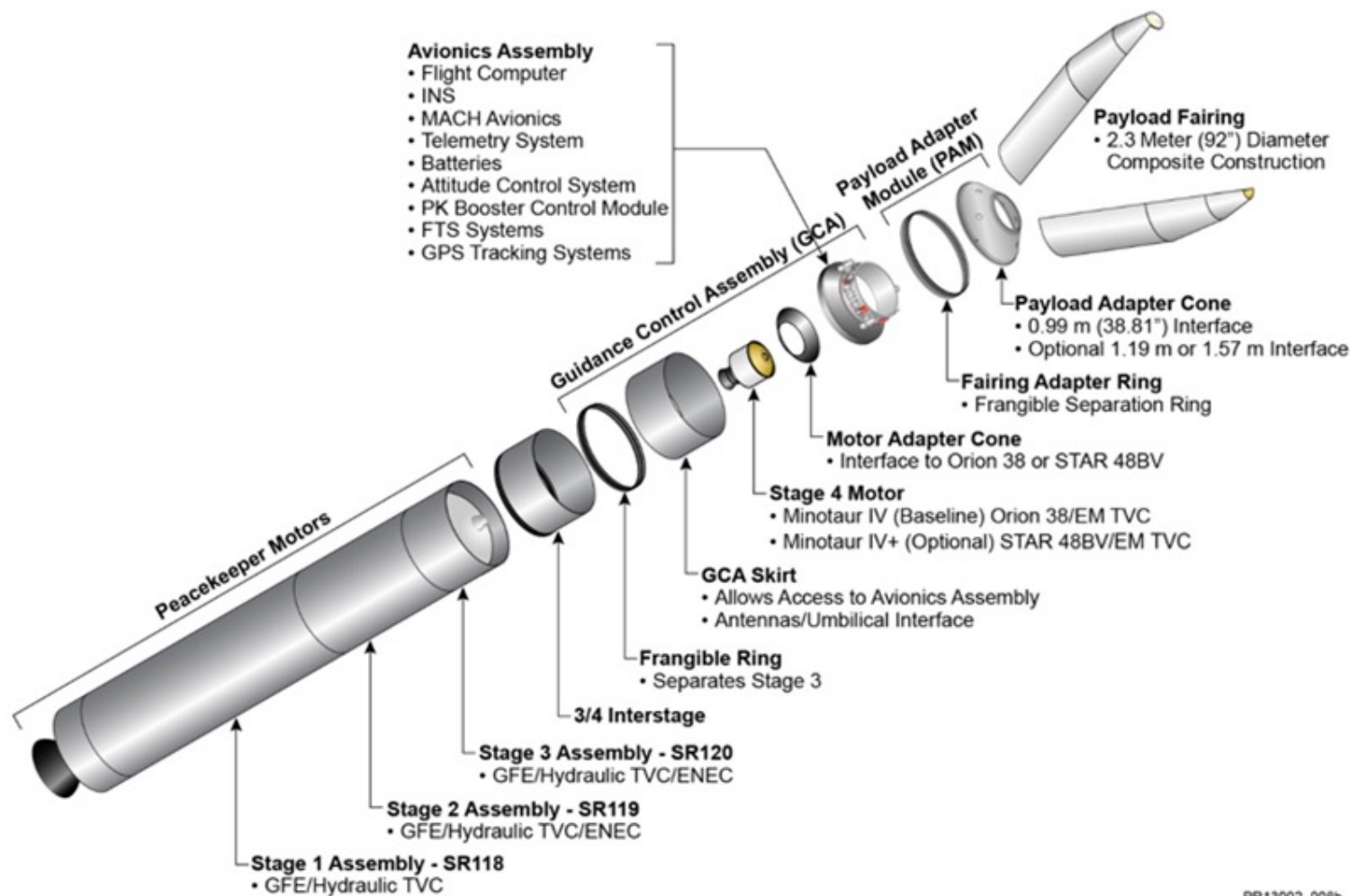
PR13002_003e

Minotaur IV Recent and Current Manifest



- L-129 Mission
 - Minotaur IV configuration launched successfully from Wallops Flight Facility on 15 July 2020
 - Launched for NRO via USSF OSP-3 contract
- L-174 Mission
 - Minotaur IV configuration
 - Currently planning to launch from Vandenberg SFB in Summer 2023
 - NRO launch via USSF OSP-3 contract
- Minotaur IV is available under USSF OSP-4

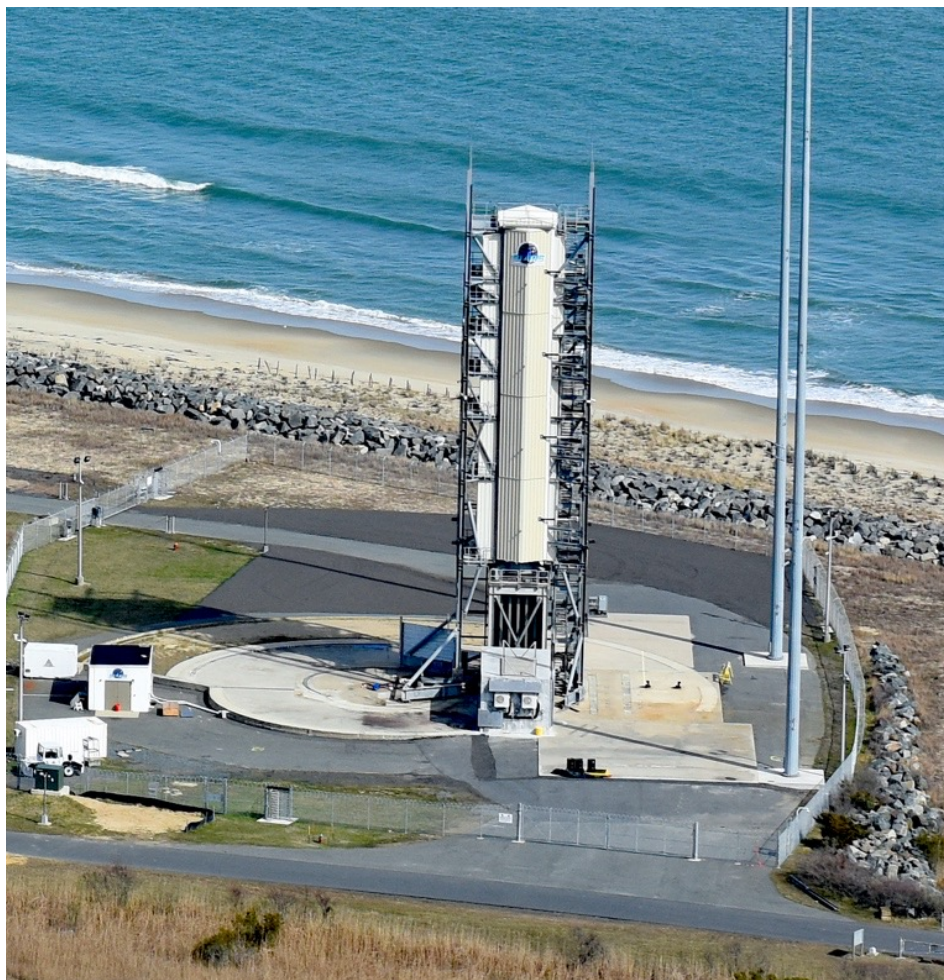
Minotaur IV Launch Vehicle Overview



PR13002_008b

Expanded View of Minotaur IV Launch Vehicle (Baseline)

L-129 Mission Utilized the MARS Payload Processing Facility (MPPF) and Pad 0B



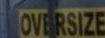
Pad 0B



MPPF



- NG is working under USSF to refurbish and operate SLC-08
 - Receiving support from VA Space



Minotaur IV has Launched from 4 Different Launch Sites

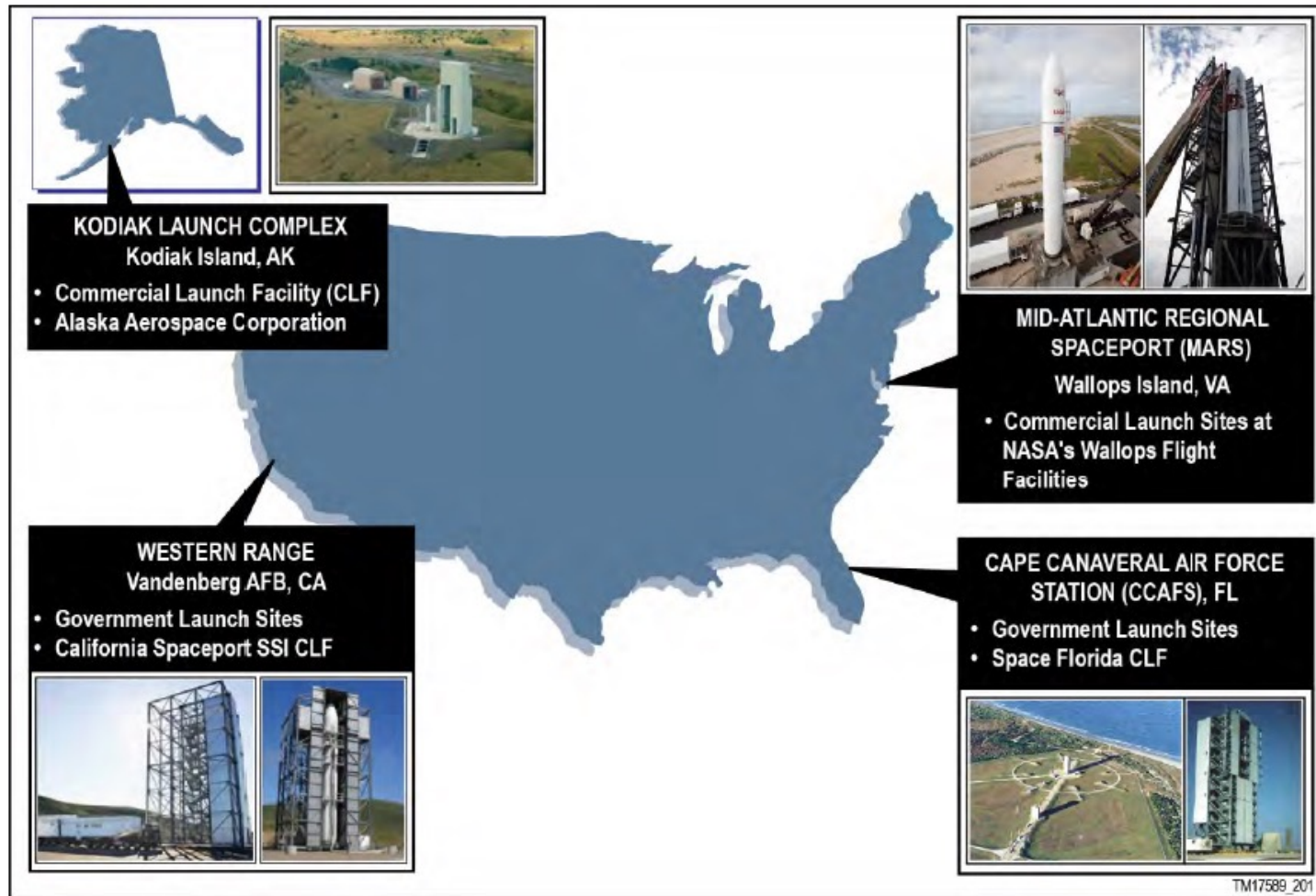


Figure 3.2-1. Flexible Processing and Portable GSE Allows Operations from Multiple Ranges or Austere Site Options

Minotaur Launch Sites and Inclination Ranges

- These are rough estimates
 - For example, 65 deg is likely achievable from WFF

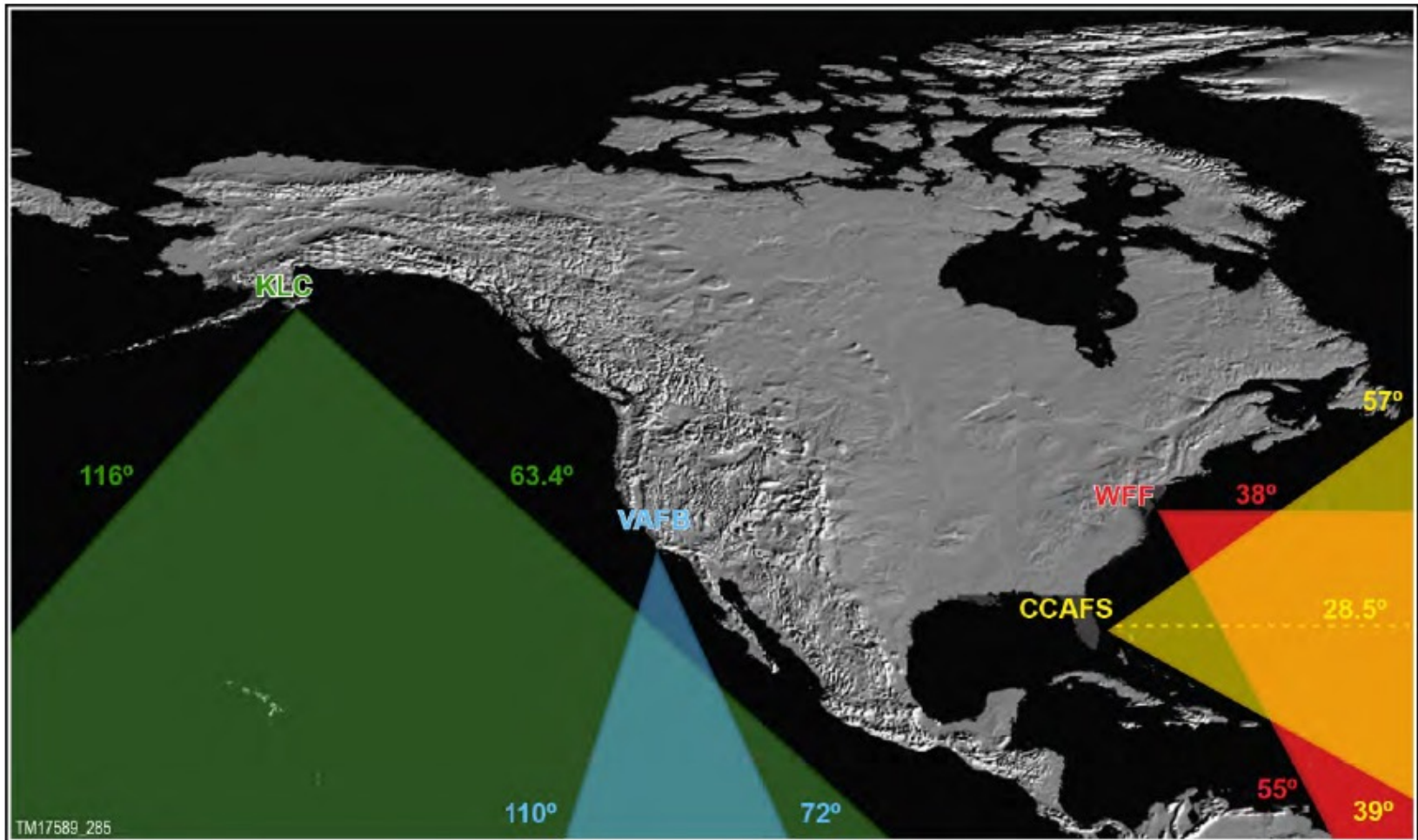
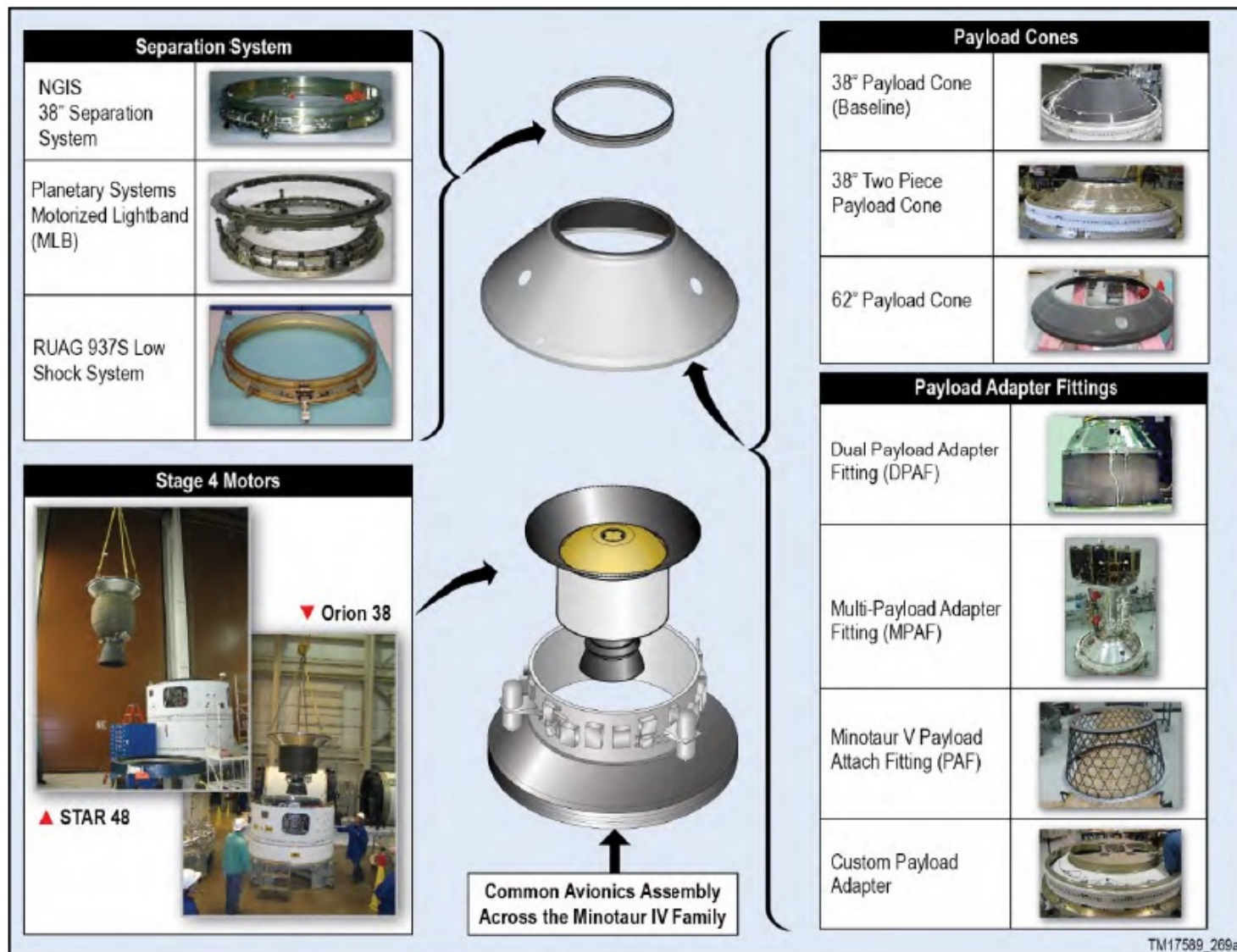


Figure 3.2-2. Launch Site Inclinations

Minotaur Features Flexible Vehicle Design to Meet a Wide Range of Missions

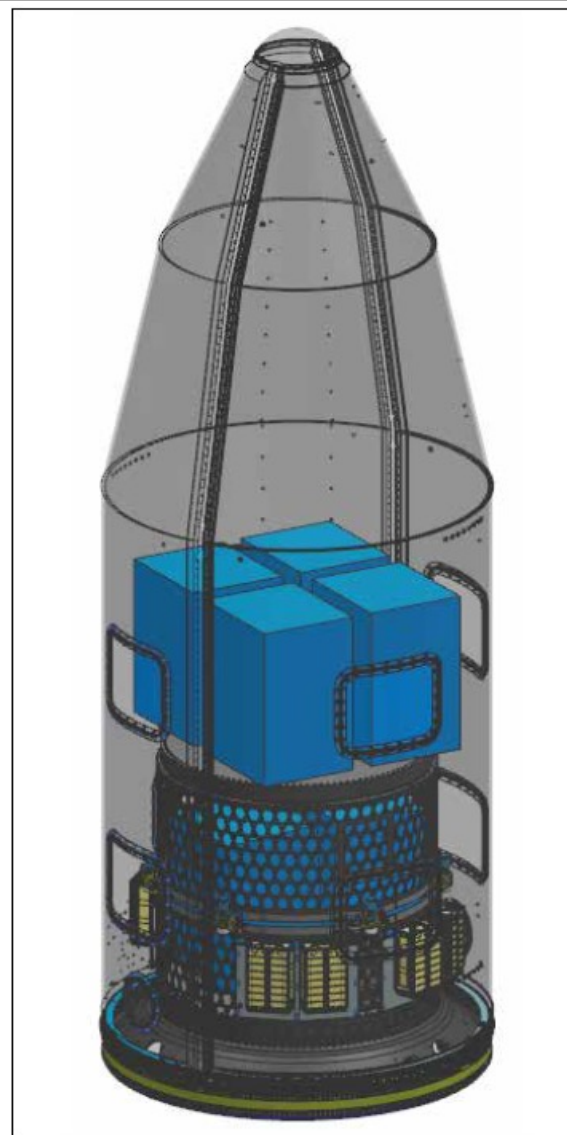
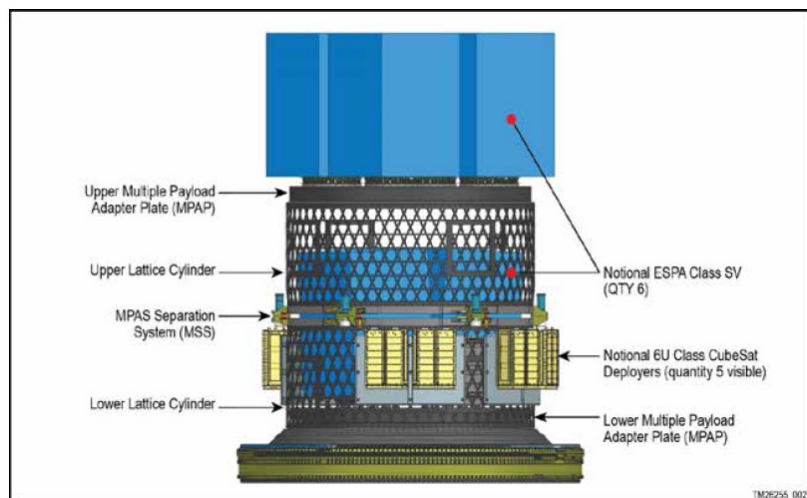
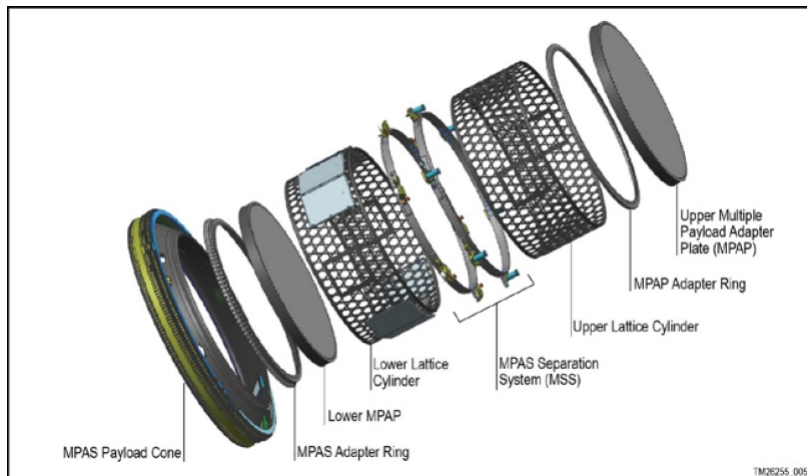


TM17589_269a

Multi-Payload Adapter System (MPAS) For Minotaur IV

- NG has recently developed and qualified a Multi-Payload Adapter System (MPAS) that allows the Minotaur IV LV to support numerous payload configurations and classes with a focus on:
 - EELV Secondary Payload Adapter (ESPA) Class SV
 - Larger than ESPA Class SV
 - CubeSat Deployers
 - Other
 - The flexibility and robustness of the design allows the system to support any class of space vehicle

MPAS is Designed to be Configurable to Support a Wide Variety of Multi-Payload Manifests



Contact points:

<https://www.northropgrumman.com/space/minotaur-rocket/>

Kurt Eberly	kurt.eberly@ngc.com	703-234-3932
Warren Frick	warren.frick@ngc.com	703-234-3935

NORTHROP
GRUMMAN

The logo graphic consists of a thick horizontal line extending from the end of the word "NORTHROP", followed by a 90-degree downward turn into a thick vertical line that extends past the baseline of the word "GRUMMAN".