Small Class Vehicle Architecture Overview

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Ground Systems Development & Operations (GSDO)

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The GSDO Program Vision
Launching the world’s most powerful, advanced launch vehicles and spacecraft.

The GSDO Program Mission
To be the driving force that transforms the Kennedy Space Center into the world’s premier multi-user launch and landing spaceport.

GSDO Mission, Vision and Goals

Goal 1: Provide sustainable, affordable and safe ground operations and integration capabilities required to extend the human presence across the solar system.

Goal 2: Drive operability into flight and ground systems development.

Goal 3: Optimize ground operations capabilities to enable multiple users.

Goal 4: Share GSDO mission internally and externally.

Goal 5: Strengthen GSDO Program community.
From the beginning of spaceflight, NASA has been at the forefront of technology development to send payloads and astronauts into space.

Because of the cost to develop and maintain rockets, flight hardware, and launch sites, spaceflight could only be achieved through government funding.

From Mercury through Shuttle, and soon SLS, the Kennedy Space Center has been the iconic symbol of spaceflight.
Commercial companies such as Lockheed Martin, Boeing, ULA, and Space-X were some of the first to create a means for companies to launch satellites into space at a more affordable cost.

With the advancement in technology, capabilities to manufacture, test, and launch satellites has become a new reality for commercial companies.

Following the retirement of Shuttle, NASA observed these opportunities and in an effort to become a true multi-use spaceport, NASA in a small class vehicle launch architecture.

By providing a launch site, infrastructure, fueling capability, and controlled air space, the Kennedy Space Center is enabling this emerging market.
Small Class Vehicle Launch Site Layout at Pad B

Figure 2: Deployable Launch System Site Location
Design of Construct Deployable Launch System (DLT) Site

LC-39B location
Small Class Launch Site Flight Path

CLEAR FLIGHT PATH
Small Class Vehicle Architecture

- Universal Propellant Servicing System (UPSS)
- Liquid Oxygen System
- Liquid Methane System
- Deployable Launch System Launch Mount with Flame Deflector
- SCV Pad Apron

Small Class Vehicle Launch Site located at Pad 39B
Small Class Vehicle Launch Site Construction

- View from Pad surface looking ESE
- Concrete pad pour is complete and construction continues
- Site development completion targeted for late May/Early June 2015
Small Class Vehicle Launch Site Artist Concept
Universal Propellant Servicing System (UPSS) Specifications

- LOX and LCH4 pressure fed propellant transfer systems
  - Up to three stage vehicle servicing
  - Systems rated at 200 psig MOP
  - Approximately 400 gpm max system flow total
    - ~300 gpm max flow for first stage
- Expandable Storage Volume
  - Commercially available ISO shipping containers
  - Current design supports approx. 30 kgal useable propellant each:
    - LOX: (6) ISO container connections; 180 psig MOP; 5 kgal each
    - LCH4: (3) ISO container connections; 115 psig MOP; 10 kgal each
  - Design can be modified for additional manifold connections
Portable Propellant Storage

Five ISO storage containers on-hand at KSC
- (3) LOX (~5400 gallons each)
- (2) LCH4 (~11,000 gallons each)
UPSS Fuel Skids
Launch Structure Specifications

- Maximum Thrust (flame deflector can withstand): 200,000 lbs.
- Vehicle Weight: 132,500 lbs.
  - Includes fueled vehicle, payload, customer provided launch mount
- Umbilical Tower Weight: 47,318 lbs.
  - Includes tower structure, fluid lines, cables, umbilical arms
- Kamag Capacity: 365,000 lbs.
  - Total transportable weight (see KAMAG ConOps)
- Design is at 100% complete
  - If customer desired such a launch mount, NASA could provide the drawings to them to have it built
**Concept of Operations: Clean Pad**

- **Clean Pad Integration (components customer provided) → Launch**
  - Customer transport vehicle to launch site on flatbed equipped with vehicle erector
  - Vehicle erector erects vehicle on launch mount/flame deflector
  - For liquid engine vehicles, cryogenic propellant servicing would be provided via UPSS
Concept of Operations: VAB Integration

- **Vehicle Integration in the VAB → Rollout → Launch**
  - Vehicle processing and integration with the DLS in a VAB highbay by use of cranes/scaffolding
  - Rollout to the Pad B SCV launch site via KAMAG Transporter
  - For liquid engine vehicles, connection to the UPSS would occur once rollout and set up is complete at Pad B
Concept of Operations: Stack on Pad

Vehicle Integration at Pad B → Launch

- Vehicle integration would be accomplished using mobile cranes.
- For liquid engine vehicles, cryogenic propellant servicing would be provided via UPSS.