Jun 4th, 3:30 PM

Cape Canaveral Air Force Station Support to Commercial Space Launch

Thomas Ste. Marie
Vice Commander, 45th Space Wing

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Cape Canaveral Air Force Station
Support to Commercial Space Launch

Colonel Thomas Ste. Marie
Vice Commander, 45th Space Wing
CCAFS Launch Customers: 2013

Complex 46: Space Florida, Navy*
Complex 41: ULA Atlas V (CST-100)
Complex 40: SpaceX Falcon 9
Complex 37: ULA Delta IV; Delta IV Heavy
Skid Strip: NGIS Pegasus
Atlantic Ocean: Navy Trident II*

Black text – current programs; Blue text – in work; * – sub-orbital
CCAFS Launch Customers: 2013

- **Complex 46:** Space Florida, Navy*
- **Complex 37:** ULA Delta IV; Delta IV Heavy
- **Complex 40:** SpaceX Falcon 9
- **Complex 41:** ULA Atlas V (CST-100)
- **Complex 39B:** NASA SLS
- **Atlantic Ocean:** Navy Trident II*
- **Skid Strip:** NGIS Pegasus

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CCAFS Launch Customers: 2014

SpaceX Landing
Launch Complex 13/BOA
May 6, 2014

Complex 39B: NASA SLS
Complex 41: ULA Atlas V (CST-100)
Complex 40: SpaceX Falcon 9
Complex 37: ULA Delta IV; Delta IV Heavy
Complex 46: Space Florida, Navy*
Landing Zone 1: SpaceX landing
Skid Strip: NGIS Pegasus
Atlantic Ocean: SpaceX Landings; Navy Trident II*

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CCAFS Launch Customers: 2014

- Complex 36: Moon Express
- August 11, 2014

- Complex 39B: NASA SLS
- Complex 41: ULA Atlas V (CST-100)
- Complex 40: SpaceX Falcon 9
- Complex 37: ULA Delta IV; Delta IV Heavy
- Landing Zone 1: SpaceX landing
- Complex 36: Moon Express
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Complex 46: Space Florida, Navy*
Complex 37: ULA Delta IV; Delta IV Heavy
Landing Zone 1: SpaceX landing
Complex 36/11: Blue Origin New Glenn
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Air Force X-37/OTV
Shuttle Landing Facility
May 20, 2015

Complex 36/11: Blue Origin New Glenn
Complex 37: ULA Delta IV; Delta IV Heavy
Complex 40: SpaceX Falcon 9
Complex 41: ULA Atlas V (CST-100)
Complex 46: Space Florida, Navy*
Landing Zone 1: SpaceX landing
SLF: X-37 Landings
Complex 39B: NASA SLS
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CCAFS Launch Customers: 2015

Complex 46: NASA AA-2*, Navy*
Complex 37: ULA Delta IV; Delta IV Heavy
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Complex 41: ULA Atlas V (CST-100)
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Complex 36/11: Blue Origin New Glenn
Complex 46: NASA AA-2*, Navy*
Atlantic Ocean: SpaceX/Blue Origin Landings; Navy Trident II*
Skid Strip: NGIS Pegasus
SLF: X-37 Landings
NASA Ascent Abort (AA-2) Launch Complex 46
July 27, 2015

Black text – current programs; Blue text – in work; * – sub-orbital

DRIVE TO 48
CCAFS Launch Customers: 2016

Complex 37: ULA Delta IV; Delta IV Heavy
Complex 40: SpaceX Falcon 9
Landing Zone 1: SpaceX landing
Complex 36/11: Blue Origin New Glenn
Complex 39B: NASA SLS
Complex 41: ULA Atlas V (CST-100)
Complex 40: SpaceX Falcon 9
Complex 47: Minotaur IV, NASA AA-2*; Navy*
Complex 41: ULA Atlas V (CST-100)
Landing Zone 1: SpaceX landing
Complex 36/11: Blue Origin New Glenn
Complex 46: Minotaur IV, NASA AA-2*; Navy*
Skid Strip: NGIS Pegasus
Atlantic Ocean: SpaceX/Blue Origin Landings; Navy Trident II*

Orbital ATK Minotaur IV
Launch Complex 46
January 11, 2016

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CCAFS Launch Customers: 2016

Complex 37: ULA Delta IV; Delta IV Heavy

Complex 40: SpaceX Falcon 9

Landing Zone 1: SpaceX landing

Complex 36/11: Blue Origin New Glenn

Complex 46: Minotaur IV, NASA AA-2*; Navy*

Complex 17/18: Moon Express*

Atlantic Ocean: SpaceX/Blue Origin Landings; Navy Trident II*

SLF: X-37 Landings

Complex 39B: NASA SLS

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ULA Vulcan Centaur
Launch Complex 41
August 2, 2016

ULA
United Launch Alliance

Drive to 48
SpaceX Falcon 9 / Heavy
Launch Complex 39A
November 18, 2016

Black text – current programs;  Blue text – in work;  * – sub-orbital
CCAFS Launch Customers: 2016

Complex 37: ULA Delta IV; Delta IV Heavy

Complex 36/11: Blue Origin New Glenn

Complex 40: SpaceX Falcon 9

Landing Zone 1: SpaceX landing

Complex 41: ULA Atlas V (CST-100; Dream Chaser)

Complex 41: ULA Vulcan (CST-100; Dream Chaser)

Complex 17/18: Moon Express*

Complex 46: Minotaur IV, NASA AA-2*; Navy*

Landing Zone 1: SpaceX landing

Complex 36/11: Blue Origin New Glenn

Complex 40: SpaceX Falcon 9

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SLF: X-37; SNC Dream Chaser Landings

Complex 39B: NASA SLS

Complex 39A: SpaceX Falcon 9; Falcon Heavy

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Complex 37: ULA Delta IV; Delta IV Heavy

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Complex 46: Minotaur IV, NASA AA-2*; Navy*

Complex 17/18: Moon Express*

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Complex 37: ULA Delta IV; Delta IV Heavy

Complex 36/11: Blue Origin New Glenn

Complex 17/18: Moon Express*

Atlantic Ocean: SpaceX/Blue Origin Landings; Navy Trident II*

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CCAFS Launch Customers: 2017

Complex 37: ULA Delta IV; Delta IV Heavy
Complex 40: SpaceX Falcon 9
Landing Zone 1: SpaceX landing
Complex 36/11: Blue Origin New Glenn
Complex 46: Minotaur IV, NASA AA-2*; Navy*
Slid Strip: MDA MRBM Test*
Complex 17/18: Moon Express*
Atlantic Ocean: SpaceX/Blue Origin Landings; Navy Trident II*

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Relativity

Relativity Space Terran
Launch Complex 16
January 11, 2019
CCAFS Launch Customers: 2019

- Complex 37: ULA Delta IV; Delta IV Heavy
- Complex 39A: SpaceX Falcon 9; Falcon Heavy (Dragon 2)
- Complex 41: ULA Atlas V (CST-100; Dream Chaser)
- Complex 41: ULA Vulcan (CST-100; Dream Chaser)
- Complex 40: SpaceX Falcon 9
- Complex 36/11: Blue Origin New Glenn
- Complex 46: Minotaur IV, NASA AA-2*; Navy*
- Complex 17/18: Moon Express*
- Complex 39B: NASA SLS; NGIS OmegA
- SLF: X-37; SNC Dream Chaser Landings
- Complex 39B: NASA SLS; NGIS OmegA
- Complex 41: ULA Atlas V (CST-100; Dream Chaser)
- Complex 41: ULA Vulcan (CST-100; Dream Chaser)
- Complex 40: SpaceX Falcon 9
- Complex 37: ULA Delta IV; Delta IV Heavy
- **Complex 20: Firefly Alpha**
- Complex 16: Relativity Terran
- Landing Zone 1: SpaceX landing
- Complex 36/11: Blue Origin New Glenn
- Complex 17/18: Moon Express*
- Atlantic Ocean: SpaceX/Blue Origin Landings; Navy Trident II*
- Skid Strip: NGIS Pegasus
- Skid Strip: MDA MRBM Test*
- Firefly Aerospace Alpha
- Launch Complex 20
- January 24, 2019

Black text – current programs; Blue text – in work; * – sub-orbital
CCAFS Launch Customers: 2019

Complex 37: ULA Delta IV; Delta IV Heavy
Complex 40: SpaceX Falcon 9
Complex 39A: SpaceX Falcon 9; Falcon Heavy (Dragon 2)
Complex 41: ULA Atlas V (CST-100; Dream Chaser)
Complex 41: ULA Vulcan (CST-100; Dream Chaser)
Complex 39B: NASA SLS; NGIS OmegA

SLF: X-37; SNC Dream Chaser Landings
Complex 39A: SpaceX Falcon 9; Falcon Heavy (Dragon 2)
Complex 40: SpaceX Falcon 9
Complex 41: ULA Atlas V (CST-100; Dream Chaser)
Complex 41: ULA Vulcan (CST-100; Dream Chaser)
Complex 39B: NASA SLS; NGIS OmegA

Complex 16: Relativity Terran
Complex 20: Firefly Alpha
Complex 17/18: Moon Express*
Complex 36/11: Blue Origin New Glenn
Complex 46: Minotaur IV, NASA AA-2*; Navy*

Skid Strip: MDA MRBM Test*
Landing Zone 1: SpaceX landing

Skid Strip: NGIS Pegasus
Atlantic Ocean: SpaceX/Blue Origin Landings; Navy Trident II*

Black text – current programs; Blue text – in work; * – sub-orbital
• Commercial space operations thriving at CCAFS
  • 45 SW agreements with eight commercial companies
  • Nine launch complexes leased/licensed to commercial/non-federal entities
    • ULA – Complex 37 and 41
    • SpaceX – Complex 40 and 13
    • Blue Origin – Complex 11 and 36
    • Moon Express – Complex 17 and 18
    • Space Florida - Complex 46
  • Two more launch pads pending
    • Firefly (Complex 20) and Relativity (Complex 16)
  • In preliminary talks with five more companies
  • Leased/licensed 102 facilities with over 930,000 square feet of space worth over $491M
Drive to 48

- Launch cadence climbing at steady rate
- Commercial represents an ever increasing percentage of launches
  - 2008 – 14%; 2018 – 54%
- Autonomous Flight Safety Systems allow for faster launch cadence
- New vehicles and large satellite constellations will push launch rates even higher
• Launch rate projected to continue climbing
  • 11 potential new launch vehicles in the next 5 years
  • Emerging satellite constellations from SpaceX, OneWeb, Kuiper (Amazon)
• Actual launch rates dependent on success of new companies
### Future Launch Vehicles

<table>
<thead>
<tr>
<th>Company</th>
<th>Launch Vehicles</th>
<th>Launch Year</th>
<th>SW Support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Firefly Aerospace</strong></td>
<td>Alpha &amp; Beta CX-20, CY21 launch</td>
<td>45 SW Support:</td>
<td>• Launch pad • Facilities • Safety • Range</td>
</tr>
<tr>
<td><strong>Relativity</strong></td>
<td>Terran 1 &amp; 2 CX-16, CY20 launch</td>
<td>45 SW Support:</td>
<td>• Launch pad • Facilities • Safety • Range</td>
</tr>
<tr>
<td><strong>Blue Origin</strong></td>
<td>New Glenn CX-36, CY21 launch</td>
<td>45 SW Support:</td>
<td>• Launch pad • Facilities • Safety • Range</td>
</tr>
<tr>
<td><strong>NASA</strong></td>
<td>SLS CX-39B, CY20 launch</td>
<td>45 SW Support:</td>
<td>• Safety • Range</td>
</tr>
<tr>
<td><strong>Northrop Grumman</strong></td>
<td>OmegA CX-39B, CY21 launch</td>
<td>45 SW Support:</td>
<td>• Safety • Range</td>
</tr>
<tr>
<td><strong>ULA</strong></td>
<td>Vulcan CX-41, CY21 launch</td>
<td>45 SW Support:</td>
<td>• Launch pad • Facilities • Safety • Range</td>
</tr>
</tbody>
</table>

### Future Sub-Orbital Test Vehicles

<table>
<thead>
<tr>
<th>Company</th>
<th>Test Vehicles</th>
<th>Test Year</th>
<th>SW Support</th>
</tr>
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<tbody>
<tr>
<td><strong>Aerojet Rocketdyne</strong></td>
<td>MRBM Skid Strip, CY19 test</td>
<td>45 SW Support:</td>
<td>• Facilities • Runway</td>
</tr>
<tr>
<td><strong>Motor Express</strong></td>
<td>MTV &amp; MX-1 CX 17/18; CY20 test</td>
<td>45 SW Support:</td>
<td>• Facilities • Safety</td>
</tr>
<tr>
<td><strong>NASA</strong></td>
<td>Ascent Abort 2 CX 46; 19 launch</td>
<td>45 SW Support:</td>
<td>• Launch pad • Safety • Range</td>
</tr>
<tr>
<td><strong>Boeing</strong></td>
<td>CST-100 CX-41, CY19 launch</td>
<td>45 SW Support:</td>
<td>• Safety • Range</td>
</tr>
<tr>
<td><strong>SpaceX</strong></td>
<td>Dragon-2 CX-39A, CY19 launch</td>
<td>45 SW Support:</td>
<td>• Facilities • Safety • Range</td>
</tr>
<tr>
<td><strong>SNC</strong></td>
<td>Dream Chaser CX-41, CY20 launch</td>
<td>45 SW Support:</td>
<td>• Safety • Range</td>
</tr>
</tbody>
</table>

### Cargo/Crew Vehicles

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<td><strong>ULA</strong></td>
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<td>CX-41, CY21 launch</td>
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<td>KSC SLF Landing</td>
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**On the Way to 48**