BUILDING ROCKETS FROM THE GROUND UP
What we’ve been up to…
Falcon 9 Overview

- Two-stage EELV-class launch vehicle
  - Designed to meet NASA man-rated safety margins and failure tolerances. Safety factor
  - Engine-out reliability, 1.4 factor of safety
- 1st Stage powered by 9 Merlin engines
  - Over 1,300,000 lbf thrust at liftoff
- 2nd Stage powered by Merlin Vacuum engine
  - Over 165,000 lbf thrust in vacuum
- Core Diameter 3.6 m (12 ft); Length 66.1 m (217 ft)
- Payload capability (from CCAFS)
  - 5.2 m (17 ft) fairing
  - 13,150 kg to LEO; 4,850 kg GTO
- Lowest mission price in this vehicle class - $54-$59.5M
  - Factor of 5 cost reduction compared to our domestic competitors

Structures, engines, most avionics and all ground systems designed and built by SpaceX
Falcon Heavy Overview

- Two and a half stage EELV-class launch vehicle
  - Designed to meet NASA man-rated safety margins and failure tolerances. Safety factor
  - Engine-out reliability, 1.4 factor of safety
- Three inline cores powered by 9 Merlin engines
  - Over 3,900,000 lbf thrust at liftoff
- 2nd Stage powered by Merlin Vacuum engine
  - Over 165,000 lbf thrust in vacuum
- Core Diameter 3.6 m (12 ft); Length 66.1 m (217 ft)
- Payload capability (from CCAFS)
  - 5.2 m (17 ft) fairing
  - 53 metric tons to LEO; > 20 to GTO, > 9.7 to GSO
- Lowest mission price in this vehicle class - $85-$125M
  - Factor of 5 cost reduction compared to our domestic competitors

Structures, engines, most avionics and all ground systems designed and built by SpaceX
Current Production Efforts

There are 8 Dragons currently in production for NASA CRS and Crew Efforts.

As CRS Dragons return, increased opportunities will exist with this platform.
SpaceX Perspective

• Share our perspective about the challenges and process of commercially booking a secondary flight aboard future SpaceX flight.
• Onus on launch providers to ensure opportunities are made available to the marketplace and sold with a clear understanding of services to be provided.
• Must be cost effective to create a sustainable, affordable launch cadence.
• Not delay, hinder, or harm the primary mission.
• SpaceX is standardizing its secondary launch processes, including establishing payload service providers and brokers for secondary payloads.
SpaceX Secondary Heritage

- F9-1: none
- F9-2: 6 P-PODs, 8 CubeSats
- F9-3: none, Dragon cargo capability demonstrated
- F9-4: Orbcomm satellite as secondary payload
- F9-5: none (two nanosats and four P-PODs de-manifested)
- F9-6: two AFRL payloads and a commercial 3U.
- F9-7: slots available
- F9-8: NASA ELaNa P-PODs
- F9…

- SpaceX is dedicated to the continued launch of secondary payloads
## Est. Small Satellite Launch Pricing Goals

<table>
<thead>
<tr>
<th>Product</th>
<th>LEO</th>
<th>GTO</th>
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<tbody>
<tr>
<td>PPOD</td>
<td>$200,000 to $325,000</td>
<td>$350,000 to $575,000</td>
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<tr>
<td>ESPA</td>
<td>$4,000,000 to $5,000,000</td>
<td>$7,000,000 to $9,000,000</td>
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<table>
<thead>
<tr>
<th>Vehicle:</th>
<th>Target Date:</th>
<th>Orbit:</th>
<th>Launch Site:</th>
<th>LTAN/DN:</th>
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<tbody>
<tr>
<td>Falcon 9</td>
<td>Q4 2012</td>
<td>325 x 1500km elliptical @ 80°</td>
<td>VAFB</td>
<td>TBD</td>
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<tr>
<td>Falcon 9</td>
<td>Q1 2013</td>
<td>600 km circular orbit @ 52°</td>
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<td>720km sun synch orbit</td>
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<td>Falcon 9/DragonLab</td>
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<td>TBD</td>
<td>TBD</td>
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<tr>
<td>Falcon 9</td>
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<td>Falcon 9</td>
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<td>600km sun synch orbit</td>
<td>VAFB</td>
<td>18:12 (AN)</td>
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Standard prices assume standard services and payments
Payments made over time subject to LIBOR +2.5% financing rate.
Standard price includes a SpaceX-developed and produced payload adapter and Light Band separation system.
Discounts to Standard Launch Services Pricing are considered on a case-by-case basis to address (i) inaugural launches, (ii) multiple launch service procurements.
Prices were valid through December 2011
Maximizing Opportunities

• Manifesting a secondary payload with SpaceX requires more than unused vehicle capability. We love standards!
• Also love clear expectations.
  – Integration analyses, FAA and Range safety, and all the catering required for the primary customer.
  – Labor surrounding integration of secondary payloads drives launch cost.
• Therefore, designing a payload which can be integrated without exotic requirements increases the likelihood of cost effective mission management and integration. For example:
  – No trickle charging, spot purging, or driving cleanliness requirements
  – Handle launch environments/deployments axially and laterally
  – Be horizontally or vertically integrated
• We understand not all science / missions fit this profile
  – We hope that such items are considered when developing secondary payloads.
Partnering with Service Providers

- Supporting various payloads from multiple customers presents a unique challenge: secondary payloads must be coordinated efficiently, reliably and unobtrusively to the primary payload.
- In addition, significant logistical and legal challenges may create higher barriers to entry when scaling up to larger numbers of secondary payload accommodations.
- Therefore, successful coordination of the secondary payload marketplace for a particular launch must be done harmoniously so that technical, logistical and legal requirements are met at a commercially sustainable price.
- To that end, SpaceX has begun to solicit for and engage payload brokers and service providers to help develop, coordinate, and address the requirements of multiple payloads and ultimately enable more launch opportunities for secondary payloads.
Final Remarks

• SpaceX is committed to providing reliable, timely, and cost-effective secondary launch services and will continue to innovate in this capacity.

• As the Falcon launch cadence builds, secondary opportunities will increase.

• Accommodation of known, accepted standards, with minimal impacts to the mission integration process increase manifest likelihood.

• Encouraging brokers and service providers to enter the marketplace and add their value / expertise.
Thank You!

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AIAA/Utah State University

Please come see us at booth XXX!

Questions?