Jason-3 Launch Vehicle Configuration

- **Vehicle:** Falcon 9 v1.1 with a payload fairing (certified to Cat 2) and reusability package
- **Mission requirement:**
  - Launch Site: VAFB
  - Launch Date: July 22, 2015
  - Orbit Requirements:
    » 1336 km circular orbit altitude
    » 66 deg inclination
  - S/C Mass: 540 kg (max)
- **Mission Unique Services**
  - Ruag 937S Payload Adapter with clampband separation system
    » Mounting brackets for electrical connectors
    » 4 separation springs
  - Isolation system to mitigate loads
  - 37 pins Deutsch electrical (CNES Provided)
  - SpaceX Payload Processing Facility
Since SQR

Flight experience

• SpaceX has executed 5 successful launches in 2015
  – 13 total consecutive successful flights of the v1.1 since Sept 2013
  – 1 additional F9 v1.1 flight planned prior to Jason-3

• Launch date revised to July 22, 2015
  – New launch date takes into consideration
    » LV production
    » open work from certification
    » LV software risk mitigation
    » Reusability vehicle configuration change (fins and legs) Range availability
    » Some schedule margin
Status of Jason-3 LV Hardware

- Stage 1 at McGregor Texas - completed full duration test and is expected at the launch site in mid-May
- Stage 2 arrived to the launch site on May 1st
- Payload fairing arrived at launch site on April 24
- Interstage estimated to ship out of Hawthorne on 6/10/15
- Isolation system has been at the launch site since Feb 2015
- PAF and Ruag Payload Adapter at the launch site
- Launch Vehicle Systems Readiness Review planned for May 28th at SpaceX – objective is to review all hardware assigned to Jason-3 and wrap up hardware pedigree reviews

Assessment: Jason-3 Hardware is on track to support the July 22 launch date
Falcon 9 Certification

• The following elements of Certification for Category 2 have been completed successfully:
• DCR reconvene held in Jan, April, and May
• Detailed status presented to the NASA Flight Planning Board on Feb 13, 2015 and NASA Administrator on April 10, 2015
  » Certification accomplishments and overall certification status was very well received by both audiences and stakeholders
• Remaining Open work from certification is minimal and expected to be closed by end of May:
  » Evaluation of 3 propulsion components – ECD 5/29
  » Flight margin verification spinoff ERB to address a flight observation – ECD 5/22

Assessment: Certification activities are on track to support the July 22, 2015 launch date
Software Risk Mitigation status

• Developed a risk mitigation strategy for the Jason-3 mission that involves two key elements:
  – LSP to perform independent stress testing of the Jason-3 mission specific configuration files utilizing LSP’s Hardware Out Of The Loop (HOOTL) simulation testbed
  – SpaceX to perform traceability of configuration files to source documentation
• Requires SpaceX to lockdown and deliver the Jason-3 software and configuration files by L-60 days to enable tests, data review, resolution of findings, etc

Status
• Weekly telecons with SpaceX software team has yielded very positive results
• LSP’s HOOTL capability is fully operational
• Peer review of the software test plan is complete
• Flight 8 stress tests of core software and configuration files complete- no major findings identified
• Some additional testing performed on Flight 15 and Flight 18 with no issues/findings
• Jason-3 software and mission specific configuration files expected to be delivered to LSP on May 11, 2015
• LSP team is postured to start HOOTL testing of the Jason-3 software and configuration files as soon as delivered
• LSP contracted Aerospace to conduct some HITL (hardware in the loop) tests for added confidence
• Parameter traceability of configuration files progressing on schedule

Assessment: Plans and resources are in place to enable completion of this effort by FRR (July 10th), HOOTL testing of software/config files of Flight 8 did not identified any significant issues
• LSP is tracking a schedule risk for software since the potential still exists for late findings from the stress tests and/or late changes that SpaceX decides to introduce after the software lockdown
F9 Reusability Package

- Falcon 9 vehicle “reusability” (legs and fins) configuration option-detailed assessment via LSP’s Engineering Review Process is complete
- ERB’s held on 1/9/15, 4/8/15 and 4/24/15
  - LSP board deemed technical solution acceptable and determined that solution does not pose increased technical risk to Jason-3 mission
  - Effects of the reusability vehicle configuration on the Jason-3 environments are understood, flight validated, and are within the spacecraft qualification levels
    » LSP loads and environments team has reviewed all applicable flight data and has determined that Jason-3 CLA results remain valid

- Jason-3 will be the 5th mission with reusability package

Assessment: Vehicle change approved and all analytical and hardware products are on track to support July 22, 2015 launch date
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Location</th>
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<tr>
<td>Mission Specific Acceptance Readiness Review</td>
<td>27 May</td>
<td>Hawthorne</td>
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<tr>
<td>Launch Vehicle Systems Readiness Review</td>
<td>28 May</td>
<td>Hawthorne</td>
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<td>Launch Vehicle Readiness Review</td>
<td>11 June</td>
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<td>Safety &amp; Mission Success Review</td>
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<tr>
<td>Launch Readiness Review</td>
<td>20 July</td>
<td>VAFB</td>
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Summary

• Most of the launch vehicle hardware is at the launch site and final processing and checkouts have started
  – Stage 1 expected to arrive at VAFB on 5/13 and interstage on 6/10

• LV Certification activities are wrapping up- expect to be fully completed by end of May

• Software- resources and capabilities ready to initiate final phase of testing on May 12

• F9 Reusability configuration- assessments complete and approved for Jason-3

• All launch vehicle elements are tracking on schedule to support LRD
  ✓ Launch Vehicle Production
  ✓ Certification
  ✓ Software mitigation
  ✓ F9 reusability configuration
Launch Vehicle ICD Compliance

JASON3 Pre Shipment Review
12 May 2015
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<th>Requirement</th>
<th>Compliance status</th>
<th>Document</th>
<th>SpaceX Reference</th>
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<td>Fairing compatibility</td>
<td>Compliant</td>
<td>Jason-3 Fairing Final Clearance Analysis</td>
<td>Jason-3 Fairing clearance analysis 2015-03-09</td>
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<td>Mechanical interfaces (MICD)</td>
<td>Compliant</td>
<td>Jason-3 Compatibility Drawing</td>
<td>Drawing Number 00130339-523</td>
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<td>Electrical Interfaces (EICD)</td>
<td>Compliant</td>
<td>Jason-3 Payload Interface Control Document</td>
<td>AV2115</td>
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<td>Orbit insertion parameters</td>
<td>Compliant</td>
<td>Falcon9 PGAA#3 Update for Jason3</td>
<td>GNC-TRAC-02426 Rev 64014</td>
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<td>Separation parameters</td>
<td>Compliant</td>
<td>Separation Analysis Final</td>
<td>Jason-3 Final Separation Analysis 3 Feb 2015 Rev4</td>
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<tr>
<td>Mechanical/ structural loads</td>
<td>Compliant</td>
<td>Coupled Load Analysis Report</td>
<td>Jason-3 CLA Rev6 Results 20141204 Intl Version, LSWG#13_LSP Intl, Jason-3 ICD Waiver 01</td>
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<tr>
<td>RF compatibility</td>
<td>Compliant</td>
<td>Jason-3 EMC/RF/EED Compatibility Report</td>
<td>ES9008-900 Rev F, Jason-3 EMC/EMI Intl Version</td>
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<td>Thermal</td>
<td>Compliant</td>
<td>Integrated Thermal Analysis</td>
<td>Jason-3 ITA Results – Intl Version 4 May 2015</td>
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<td>Payload fairing venting</td>
<td>Compliant</td>
<td>Fairing venting analysis</td>
<td>Jason-3 Fairing Venting Analysis 2013-05-21</td>
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<tr>
<td>Fit check</td>
<td>Compliant</td>
<td>Fit Check Test Report</td>
<td>STR-00022503 Jason-3 Shock Test/Fit Check Report</td>
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</table>
ICD Verification Status Summary

- All Jason-3 SC data has been received to support ICD verification closures through SC Pre-ship
- International versions of Analysis/Reports have been delivered to CNES/Thales for review
- Final verification for many requirements will be accomplished during launch site checkouts and integrated operations (i.e. payload mate to adapter/PAF, encapsulation, mate to LV, and PLF closeouts)

- ICD requirement verifications are on track to support the launch campaign operations for Jason-3