InSight Mission Status

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2 March, 2016
InSight Mission Status – “Plan B”

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Understand the formation and evolution of terrestrial planets through investigation of the interior structure and processes of Mars.

Specific measurements:
- Crust thickness and layering
- Mantle composition and layering
- Core size, density and state
- Heat flow from the interior
- Frequency and location of marsquakes
- Frequency of meteorite impacts
InSight Spacecraft

Cruise Configuration
- Cruise Stage
- Backshell
- Lander
- Component Deck/Cover
- Heat Shield

Landed Configuration
Spacecraft in Cruise Configuration (VAFB)
InSight uses a near-copy of the successful Phoenix lander

- Launch: March 4-30, 2016 from Vandenberg AFB, California
- Very fast, type-1 trajectory: 6.5-month cruise to Mars
- Landing: September 28, 2016
- Two-month deployment phase
- Two years (one Mars year) science operations on the surface; repetitive operations
- Nominal end-of-mission: September 26, 2018
Original InSight Mission Plan

• June 25, 2015: Begin SEIS integration; complete performance and environmental testing

• Sept. 4, 2015: Deliver SEIS to Lockheed-Martin for integration onto lander

• Dec. 12, 2015: Ship lander to VAFB for final launch assembly

• Mar. 4, 2016: Launch

• Sept. 28, 2016: Land on Elysium Planitia (L_s = 232)
  – 42-sol deployment phase
  – 1 Mars year of science operations

• Sept. 26, 2018: End of nominal mission
Original InSight Mission Plan

- June 25, 2015: Begin SEIS integration; complete performance and environmental testing
- Sept. 4, 2015: Deliver SEIS to Lockheed-Martin for integration onto lander – Vacuum failure detected on Aug. 25
- Dec. 12, 2015: Ship lander to VAFB for final launch assembly
- Mar. 4, 2016: Launch
- Sept. 28, 2016: Land on Elysium Planitia (L_s = 232)
  - 42-sol deployment phase
  - 1 Mars year of science operations
- Sept. 26, 2018: End of nominal mission
VBB (Very Broad Band) Sensor

- Differential Capacitive Sensor (DCS)
- Balancing Mechanism
- Pendulum (Mobile Structure)
- Spring
- Pivot
- Fixed Structure
- Thermal Compensator (TDCM)
- Voice Coil Actuator
- Feedback Electronics

Must be operated at a pressure less than $10^{-2}$ mbar in order to achieve required sensitivity
SEIS Sphere/EC (Evacuated Container)

22 cm
• **First Leak in Evacuated Container**
  – 8/25: Leak first detected during SEIS performance testing after system TVAC
  – 9/14: Leak localized to 37-pin electrical feed-through for VBB10
  – 9/22: Leak further localized to one pin (pin 7) of feed-through
  – 10/2: Sealing compound applied to pin 7, successfully stopped the leak

• **Second Leak**
  – 10/7: Found second leak (factor of ~10 smaller) on pin 11 of same feed-through
  – 10/9: Sealing compound applied to pin 11, only temporarily stopped the leak
    (failed four days later during subsequent cold temperature cycle)
  – 11/10: Encapsulated entire feed-through, successfully stopped the leak

• **Third Leak**
  – 11/14: Detected third leak during cold cycle of sphere, later localized to queusot (evacuation tube) pinch-off
  – 12/10: New queusot welded to sphere

• **Fourth Leak**
  – 12/20 – Fourth leak detected during cold cycle of sphere; later localized to encapsulated VBB10 feed-through
Since the beginning of January, we have undertaken a complete replan of the InSight mission:

- Started on new mission design: Launch, cruise, EDL for 2018 Mars launch opportunity
- Intensely studied failure of SEIS Evacuated Container, began process of modifying the design
- Put together preliminary schedule and budget for move to 2018
- Subjected both SEIS and overall mission to critical external reviews – goal is to reduce mission risk wherever practical

New plan was presented to NASA on March 1:

- With this information in hand, SMD is considering options for continuing (or canceling) the mission
New InSight Mission Plan – Milestones

- Oct. 2016: Complete design modification, fabrication and test of SEIS Evacuated Container
- May 2017: Complete SEIS environmental/performance testing
- June 2017: Begin spacecraft integration and test
- Feb. 26, 2018: Ship lander to launch site for final assembly
- May 5, 2018: Launch from Vandenberg Air Force Base, CA
- Nov. 26, 2018: Land on Elysium Planitia ($L_s = 296$)
  - 42-sol deployment phase
  - 1 Mars year of science operations
- Nov. 24, 2020: End of nominal mission