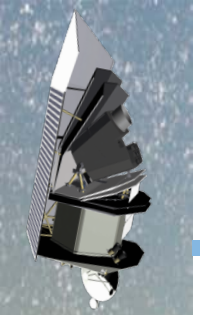
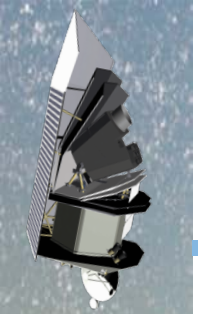


B612 FOUNDATION

The B612 Foundation Sentinel Mission

Ed Lu

CEO, B612 Foundation

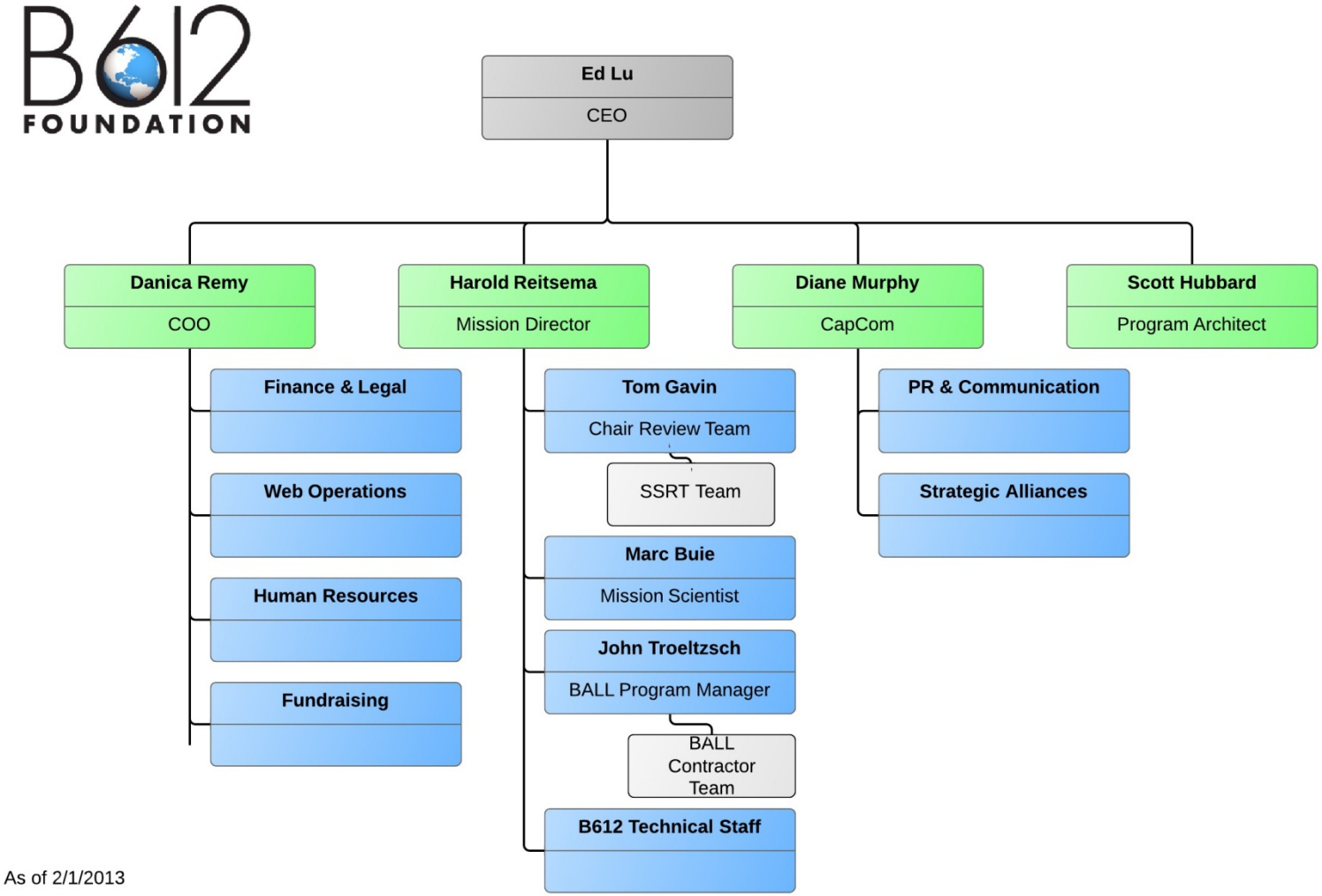


B612 FOUNDATION

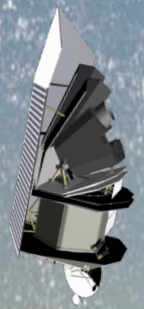
The B612 Foundation

- Silicon Valley based nonprofit 501(c)3
- Founded 2002
- Mission is to protect humanity by preventing future asteroid impacts on Earth while opening up the frontier of Space.

B612 Foundation Leadership Org Chart

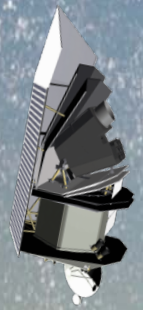


As of 2/1/2013



Sentinel Technical Leadership Team

- **Ed Lu –** CEO B612, physicist and astronomer, former NASA astronaut, former director Advanced Projects Google Inc.
- **Harold Reitsema** –B612 Mission Director. former Director Science Mission Development, Ball Aerospace. 26 years experience in planetary astronomy and flight project management.
- **Scott Hubbard** – B612 Mission Architect. first "Mars Czar", former Director NASA Ames. Currently Professor of Aeronautics and Astronautics, Stanford University. Director of Stanford Center of Excellence for Commercial Space Transportation.
- **Tom Gavin** –B612 Sentinel Special Review Team Chairman. former Associate Director for Flight Projects and Mission Success, NASA JPL. Oversaw all JPL flight projects and responsible for mission assurance.
- **Marc Buie** – B612 Mission Scientist. Planetary Astronomer specializing in instrument development and observations of asteroids, comets, and Kuiper Belt Objects.
- **John Troeltzsch** – Ball Aerospace Sentinel Program Manager. Former Program Manager Kepler Space Telescope



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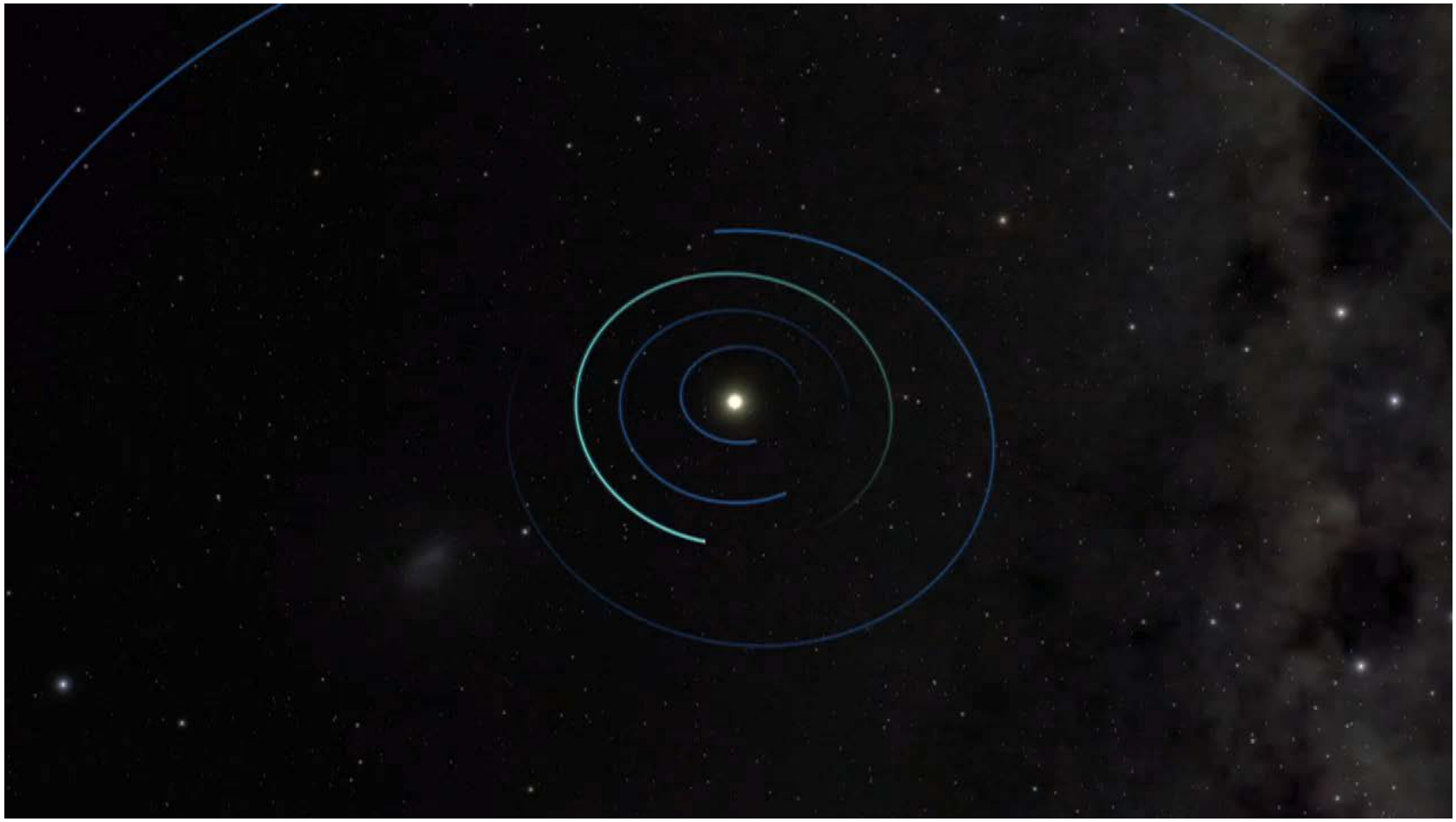
Sentinel Special Review Team

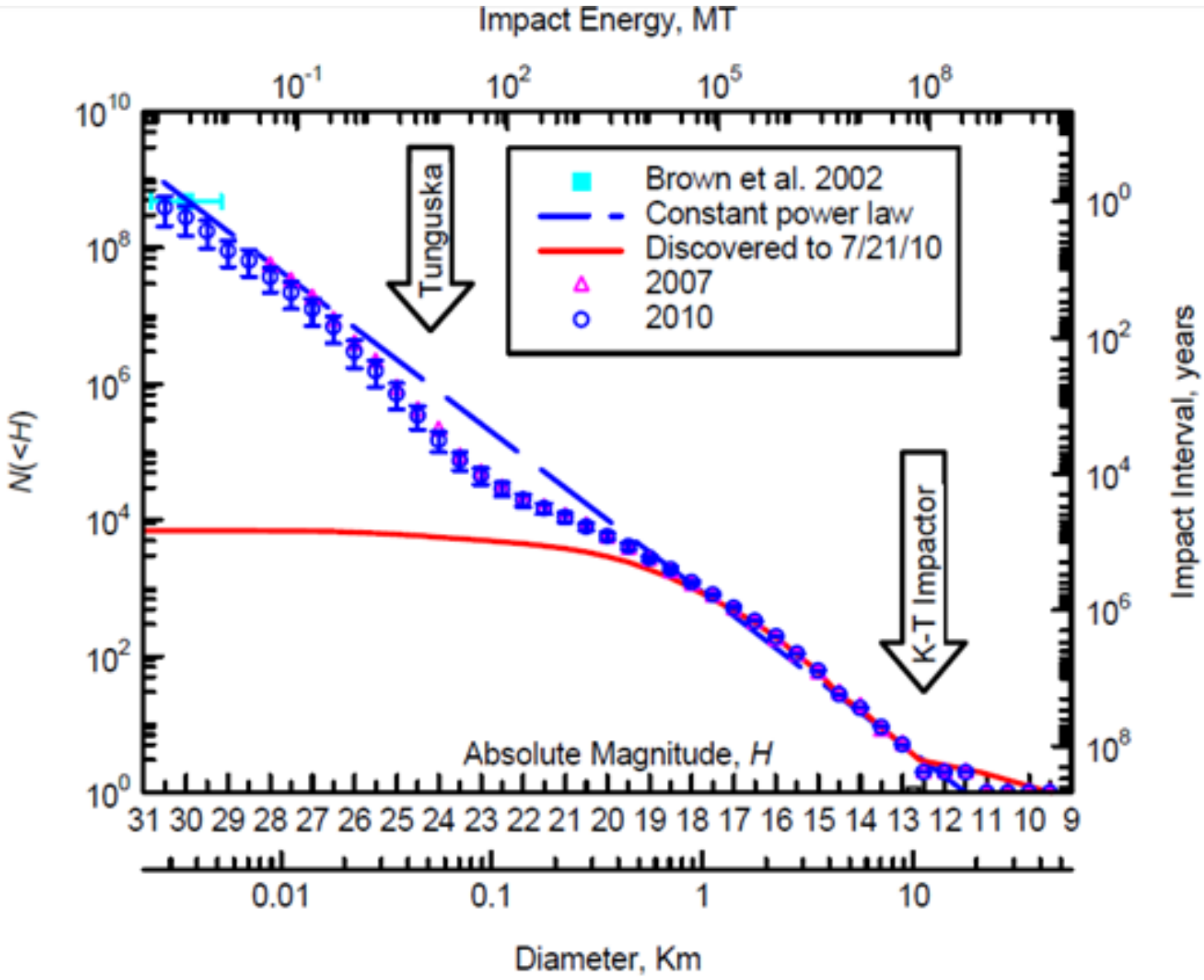
- John Casani – Project Manager for Voyager, Galileo, and Cassini missions. Member National Academy of Engineering.
- Bob Berry – Director Space Exploration Systems, Lockheed Martin. Program Manager Mars Odyssey, Cassini Propulsion Module.
- Orlando Figueroa – Chief Engineer for Systems Engineering, NASA Goddard Spaceflight Center. NASA Mars Czar. Director Solar System Division of Space Science, NASA HQ.
- Steve Francois – Program Manager for Launch Services, NASA Kennedy Space Center.
- Paul Jones – Chief Engineer for Titan Launch Vehicles, Lockheed Martin.
- George Pace – JPL Project Manager, Mars Odyssey. Chairman of MAVEN mission Standing Review Board.
- Mark Saunders – Director Independent Program Assessment, NASA. Program Manager of Near-Earth-Asteroid-Rendezvous, Mars Pathfinder, Lunar Prospector, and Stardust missions.
- Steve Battel – President Battel Engineering. Member of Space Telescope Institute Council and National Academies Space Studies Board. Served on over 60 technical review boards.
- Robert Jedicke – Professor, Institute for Astronomy. Panoramic Survey Telescope and Rapid Response System.
- Glenn Cunningham – Deputy Manager Mars Exploration Directorate, JPL. Project Manager for Mars Global Surveyor and Mars Observer missions.

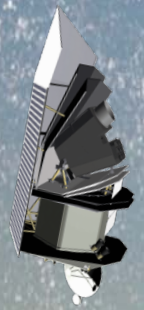
- + NASA assigned SSRT members

<1% of “Tunguska sized” Near Earth Asteroids Currently Tracked



Odds of Asteroid Impacts on Earth





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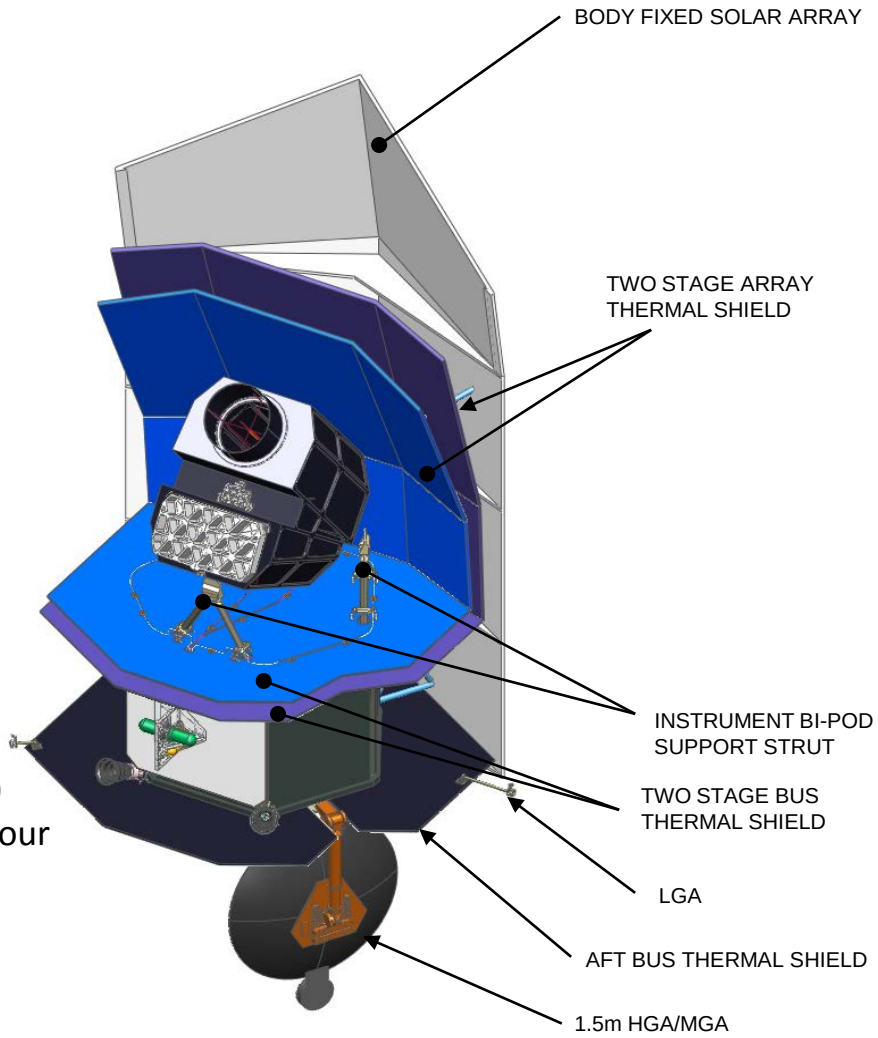
The Sentinel Space Telescope Project

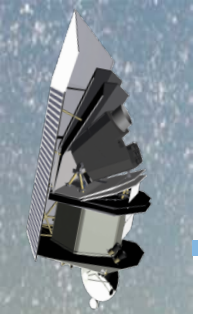
- Goal of B612 originally to do research on asteroid deflection – generally accepted to be possible given decades of advance warning
- Goal changed in 2011 to: Find and Track Asteroids that Threaten Earth
  - Extend surveys down to smaller, more numerous, and yet still dangerous asteroids
  - Track orbits accurately enough to give Earth decades of warning of an impending impact so that deflection is possible
  - Create the most comprehensive dynamic map of the objects in the inner solar system

Sentinel Will Find and Track >500,000 Near Earth Asteroids

Sentinel Key Features

Launch: July 2018
Falcon 9
Orbit: 0.6 by 0.8 AU Heliocentric
Mission Life: 6.5 years
Spacecraft: 7.7 m (25.4 ft) tall
3.2 m (10.5 ft) across
1,500 kg (3,300 lbs)
2.0 kW solar array
24 Ahr battery
3-axis stabilized
1.5 meter high gain antenna
Instrument: 50-cm telescope
5-10.2 µm wavelength
HgCdTe detector cooled to 40 K
24 million pixels
65 microjanskies sensitivity
Field of View 11 deg^2 (2x5.5 deg)
Sky Coverage Rate: 165 square degrees per hour
Astrometric Accuracy: 0.2 arc seconds
On-Board Data Storage: 96 GB





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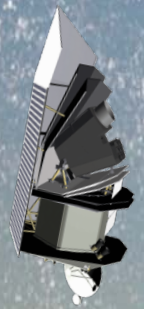
The Sentinel Space Telescope Project – An innovative approach to managing an interplanetary mission

- Small experienced team focused on a single project
  - Rapid decision making as smart customer
- Stable high level requirements – find 90% of asteroids larger than 140 meters in 6.5 years
- Experienced contractor (Ball Aerospace)
- High heritage – based on Kepler, Spitzer telescopes
- Commercial terms procurement – firm fixed price
  - Benchmarked process with relevant experience (e.g. Worldview S/C)
  - Detailed milestone payment schedule key to FFP management
- Public-private partnership – NASA Space Act agreement
- All-star independent review team



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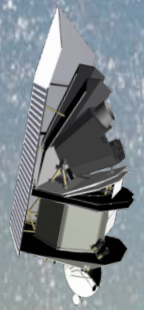
Why we believe our approach will be successful

- Driving requirement (George E Brown Act) has been well vetted and studied for years – well understood and stable
- Single minded focus (planetary defense vs. “science”)
- No big technology development
- Targeted risk reduction by B612 for detectors
- Ball Aerospace has extensive experience with similar spacecraft as well as commercial procurement
- Best possible technical advice
- In-plant B612 representatives during development

Progress thus far has been excellent.



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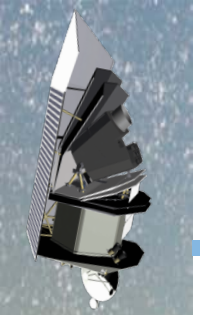
Sentinel Project Status

January 2013

- Passed first major technical review – Concept and Implementation Review Sept. 2012
- Prototype infrared detectors fabricated and in-test

June 2012

- Technical leadership team among most experienced in world
- Preliminary spacecraft and mission design complete
- Firm fixed price proposal submitted by Ball Aerospace (enabled by early infrared detector work funded by B612)
- Experienced Ball contractor team previously built Kepler Space Telescope, Spitzer Space Telescope, Deep Impact Mission, Hubble Space Telescope instrumentation
- NASA Space Act Agreement to provide communications, tracking, technical support
- Observing strategy endorsed by NRC report on asteroid hazard, and NASA Advisory Council



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Sentinel Milestones

Program Concept and Implementation Review (PCIR) Complete Sept. 2012

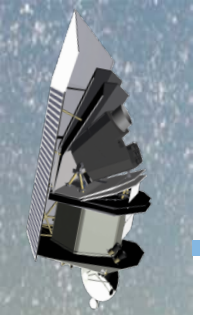
This review assesses the conceptual mission / spacecraft design and open system trades if any as well as the suitability of the processes to be used in the development of reliable space systems for the Sentinel mission.

System Requirements and Mission Definition Review (SRR/MDR) NET 3rd Quarter 2013

The SRR/MDR assesses the key mission performance requirements, architecture and the flow down of requirements to all system functional elements (S/C, Instrument, GDS, and MOS) to ensure that the overall concept is complete, consistent and meets the needs of the Sentinel mission.

Spacecraft and Instrument Preliminary Design Review (the MOS/ GDS can be held as part of the Project PDR)

The S/C and Instrument PDR assesses the system architecture and design approach including software to verify that the requirements of SRR/MDR can be met .This include system margins, new technology / detector needs and implementation plans including qualification ,acceptance test and calibration plans.



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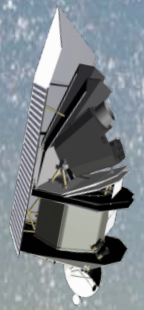
Sentinel Milestones (continued)

Project Preliminary Design Review (PDR)

The Project PDR demonstrates that the preliminary Mission and System design meets all Sentinel performance requirements. A necessary part of the Project PDR is the various trades to reach the selected design option. Separate reviews may be held for each functional system e.g. S/C PDR but the Project system interface design and verification plans must be complete and presented at the Project PDR.

Project Critical Design Review (CDR)

In the period following the completion of the System PDR's the subsystem and instrument CDR's will be conducted. At the subsystem and component level the CDR releases the design to fabrication. At the latter review all design analysis, drawings and relevant procedures are required to be under change control. At the completion of all lower level CDRs the Project level CDR will be conducted. The Project level CDR is to assure that the as designed functional elements are consistent with the intended usage. The final Verification and Validation plan is an important part of the project CDR.



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Sentinel Milestones (continued)

Spacecraft/ Instrument (Observatory) Integration Readiness Review

This review establishes the Spacecraft has completed all required functional tests, system and subsystem environmental tests, all plans, procedures, flight hardware and GSE are available in time for the required integration.

Observatory Pre-Environmental Review

The Pre-Environmental Review determines that the Observatory is ready for the full complement of environments, all problem reports have been disposition and required personnel have been trained, facilities are ready for use and procedures have been certified.

Pre-Ship Review (PSR)

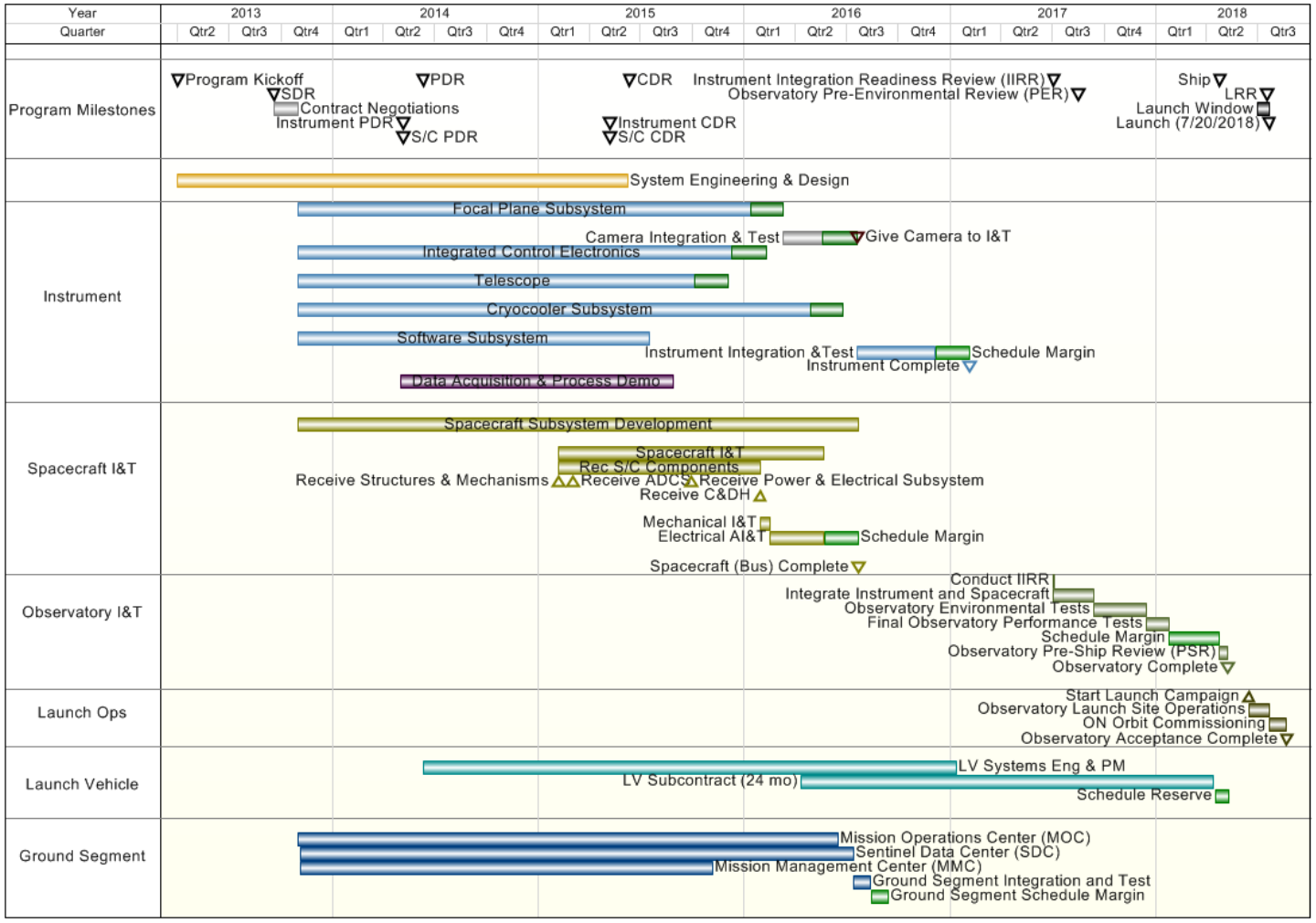
The PRS is held one week prior to shipment of the launch site and establishes that all required work has been completed or plans exist to complete at the launch site.

Launch Readiness Review (LRR)

The LRR is held 3 days prior to the opening of the window and establishes that all elements of the Sentinel Mission are certified for flight.

Sentinel Schedule for 2018 Launch

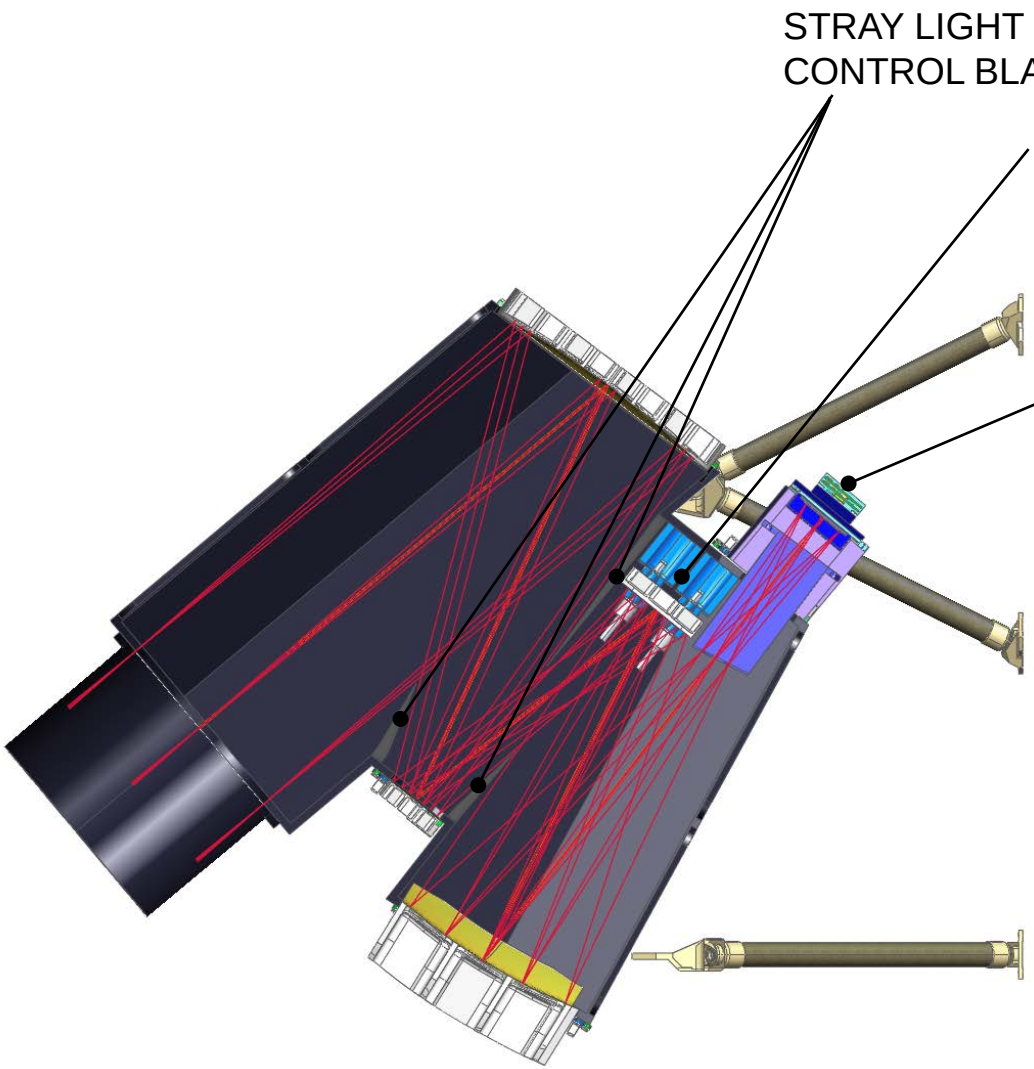
Sentinel Program Schedule



Sentinel Detector Prototype

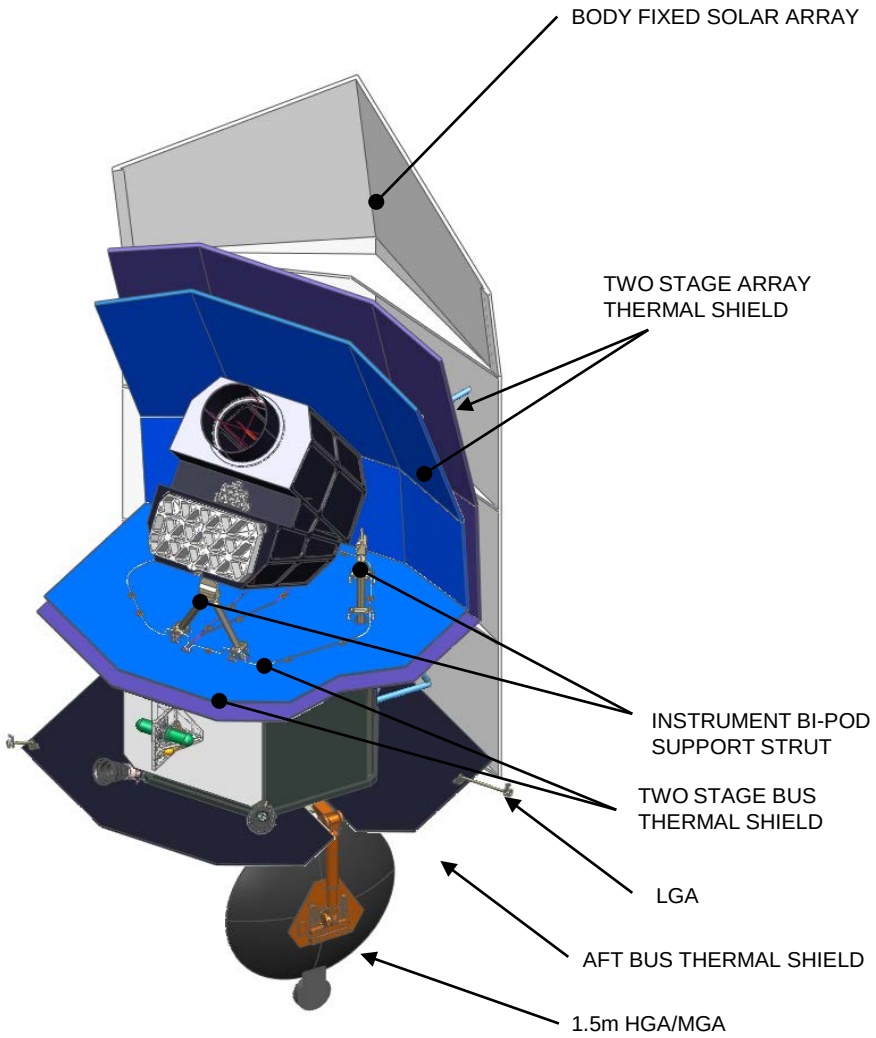
Fabrication completed 11/2/2012

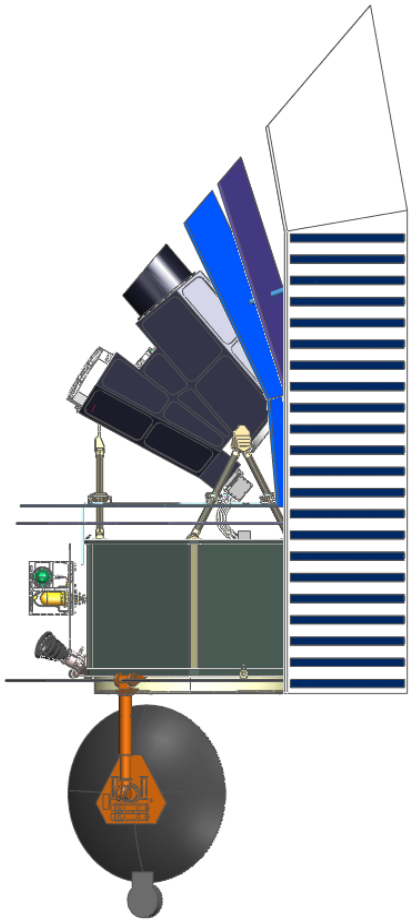
The *NEO Survey* Telescope in Cross Section

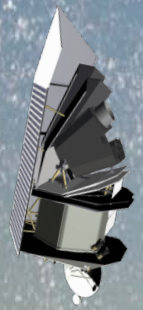


Unobscured off-axis design provides a 5.5 X 2 degree Field of View with low IR background

The Sentinel Spacecraft







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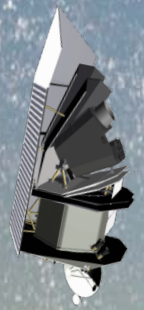
Backup Slides

Sentinel Infrared Camera System



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