NASA's Preparations for ESA's L3 Gravitational Wave Mission

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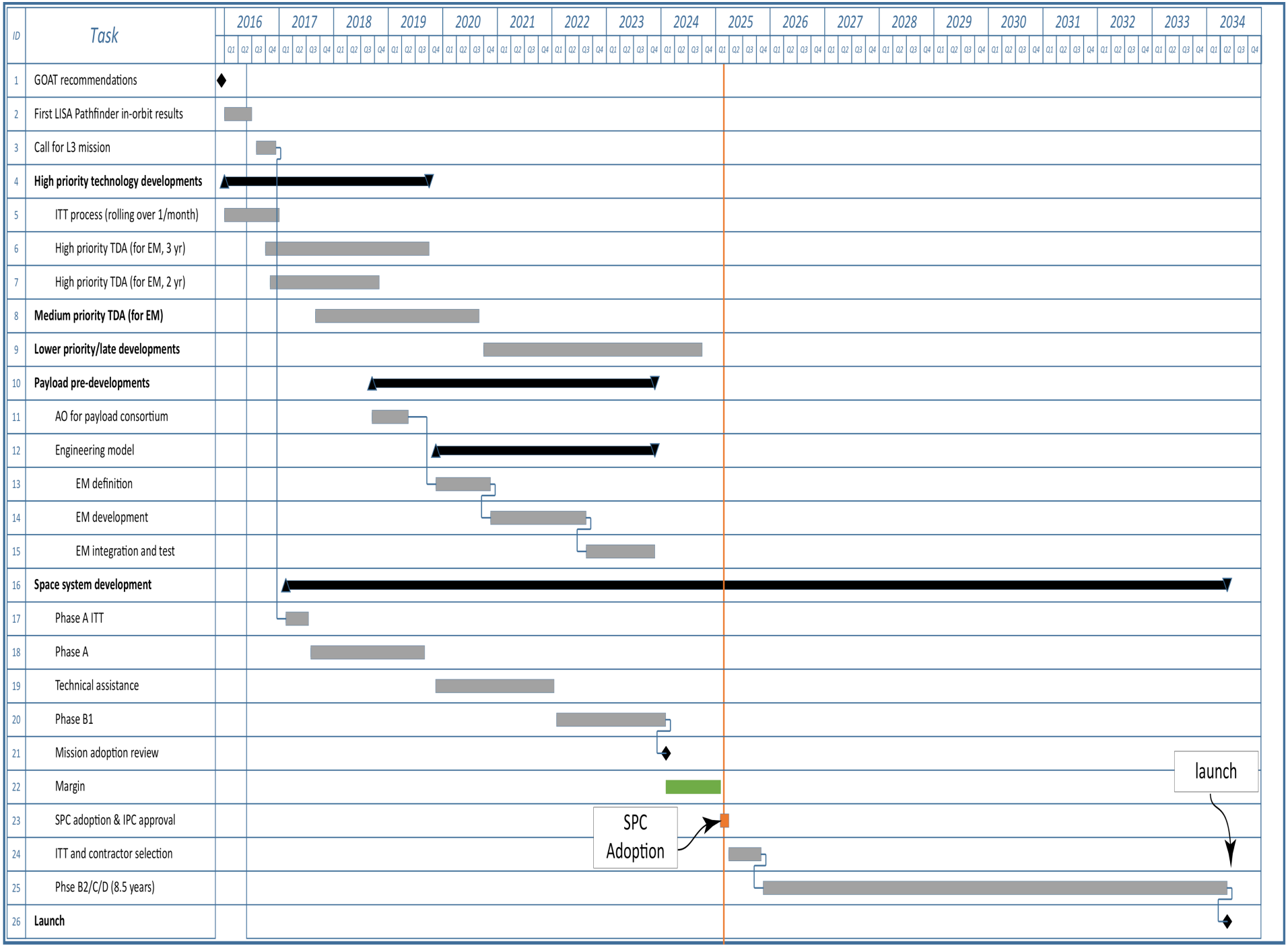
Topics

- ESA's L3 mission
- Technology development
- LISA Pathfinder
- NAS/NRC Reviews
- NASA's L3 Study

ESA's L3

- L3 – The third large mission in ESA's Cosmic Visions 2015-2025 Programme, planned for launch in 2034.
  - NASA and ESA have been discussing a collaboration for ~2 years
  - Gravitational Observatory Advisory Team (GOAT)
    - ESA study evaluating and recommending scientific performance trade-offs, detection technologies, technology development activities, data analysis capabilities, schedule and cost
    - US representatives: Guido Mueller, Mark Kasevich, Bill Klipstein, RTS
    - Started in October 2014, concluding with a final report in late March or early April 2016.
  - ESA solicited interest from ESA Member States in November 2015
- The Astrophysics Implementation Plan (2014) calls for a minority role in L3.
- NASA is continuing technology development support. ESA is restarting technology development activities.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1 GOAT recommendations
2 First LISA Pathfinder in-orbit results
3 Call for L3 mission
4 High priority technology developments
5 ITT process (rolling over 1/month)
6 High priority TDA (for EM, 3 yr)
7 High priority TDA (for EM, 2 yr)
8 Medium priority TDA (for EM)
9 Lower priority/late developments
10 Payload pre-developments
11 AO for payload consortium
12 Engineering model
13 EM definition
14 EM development
15 EM integration and test
16 Space system development
17 Phase A ITT
18 Phase A
19 Technical assistance
20 Phase B1
21 Mission adoption review
22 Margin
23 SPC adoption & IPC approval
24 ITT and contractor selection
25 Phse B2/C/D (8.5 years)
26 Launch
SPC Adoption
launch

Technology development

- Telescope Subsystem – Jeff Livas (GSFC): Demonstrate pathlength stability, stray light and manufacturability
- Phase Measurement System – Bill Klipstein (JPL): Key measurement functions demonstrated. Incorporate full flight functionality
- Laser Subsystem – Jordan Camp (GSFC): ECL master oscillator, phase noise of fiber power amplifier, demonstrate end-to-end performance in integrated system, lifetime
- Micronewton Thrusters – John Ziemer (JPL): Propellant storage and distribution, system robustness, manufacturing yield, lifetime
- Arm-locking Demonstration – Kirk McKenzie (JPL): Studying a demonstration of laser frequency stabilization with GRACE Follow-On
- Torsion Pendulum – John Conklin (UF): Develop U.S. capability with GRS and torsion pendulum test bed
- Multi-Axis Heterodyne Interferometry – Ira Thorpe (GSFC): Investigate test mass/ optical bench interface
- UV LEDs – John Conklin+ (UF): Flight qualify UV LEDs to replace mercury lamps in discharging system
- Optical Bench – Guido Mueller (UF): Investigate alternate designs and fabrication processes to ease manufacturability

LISA researchers at JPL are leading the Laser Ranging Interferometer instrument on the GRACE Follow-On mission.

LISA Pathfinder

- ESA and NASA payloads to demonstrate GW technology
- US researchers participating in data from both payloads
- Outstanding 'conditional' in all major reviews/ recommendations
- Launched December 3rd
- Currently in route to operational orbit around L1.
- Commissioning will continue through February
- Baseline operations March-September, extended operations likely.
- ESA will review the success with a separate committee (not GOAT) in late summer or fall.

NAS/NRC Reviews

- Midterm Assessment
  - 8-10 Oct. ‘15 – First meeting in Washington, DC
  - 12-14 Dec. ’15 – Second meeting/symposium in Irvine, CA
  - 11-13 Jan. ‘16 – Final meeting in Washington, DC
  - 1 May ’16 – Target delivery date for final report
- 2020 Decadal Survey
  - Likely to begin in late 2018, early 2019
  - Astrophysics Division is initiating a plan to study likely projects with the intention of having well-understood proposals
- NASA will conduct a study of its participation in L3:
  - The realization of the study promised in the plan for the 2020 decadal survey.
  - The study endorsed by the GWSIG, the PhysPAG and the Astrophysics Subcommittee

L3 Study

- Purposes
  - Phase 1: To advise Paul Hertz in his negotiations with ESA on a NASA role in L3.
  - Phase 2: To prepare a proposal to the 2020 decadal for NASA's role in L3
- Dear Colleague Letter and Charter released 7 Dec.
- L3 Study Team (L3ST) selections to be announced soon
- Phase 1 - FY16-17: Analyze the options for NASA participation in the L3 mission and work with the European L3 consortium on proposals to ESA.
- Phase 2 - FY17-18: Prepare a report to the 2020 decadal survey on NASA's participation, including possible options, in the L3 mission as a minority partner.

Summary

- Early activities for L3 are starting up.
- NASA is preparing to participate as a minority partner in L3
- LISA Pathfinder mission is underway. Results by the end of the summer
- NASA is participating in the Midterm Assessment and preparing for the 2020 decadal.
- NASA's L3 Study is being set up to prepare for negotiations with ESA and for the 2020 decadal.