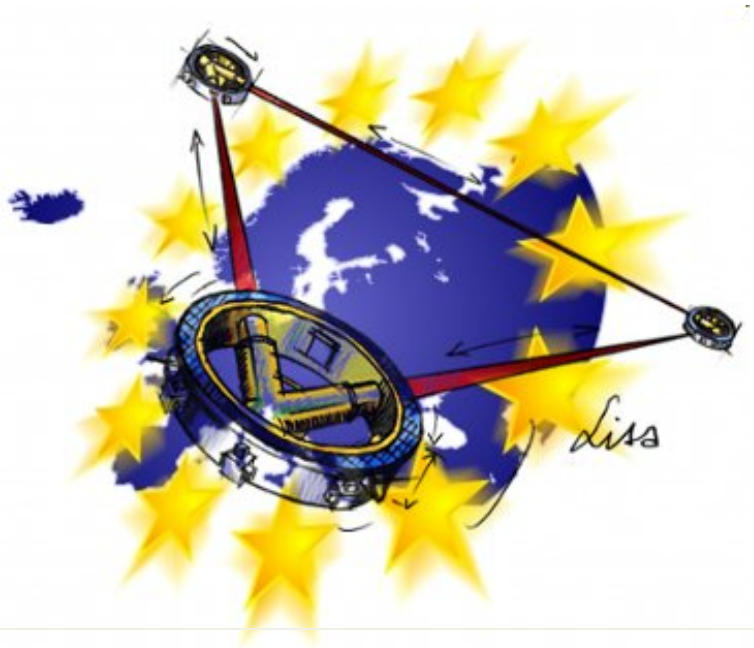


Status of ESA's Next Gravitational-Wave Observatory (NGO, a.k.a. LISA Light, EuLISA)

Robin Stebbins, Goddard Space Flight Center

NAC Astrophysics Subcommittee Meeting

13 July 2011

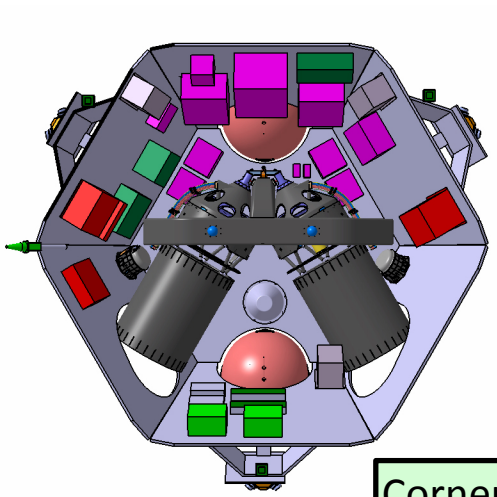
Activities

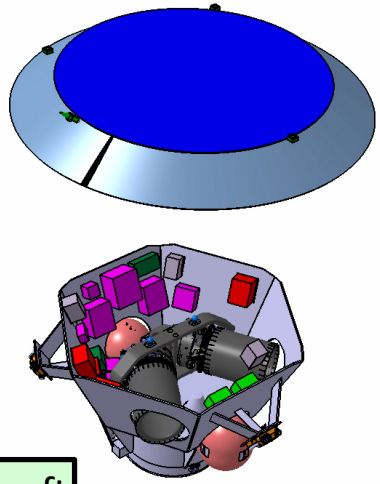
- Core design team
  - Members: Danzmann, Vitale, Jennrich, McNamara, Gianolio, Bender, Stebbins + others
  - Weekly telecons March-July
- Science team meetings April 14th, May 17th, July 9th
- Science performance task force
  - About 30 people, including 8 U.S. researchers
  - Eight telecons April 21st – July 12th
  - Collaboration wiki at lisa-light.aei.mpg.de/
- Concurrent Design Facility (CDF) study, May-July
  - Information meeting, 6 study sessions, final report July 8th
- Astrium industrial study July 13th – October 31st
- NASA engineering support on orbits, trajectories and systems engineering

Current Concept

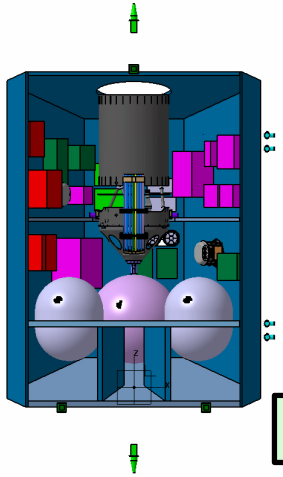
- Basic parameters
  - 1 Mkm arms
  - 10° heliocentric, drift-away orbits
  - Corner and two end spacecraft (4 links)
  - Launch on 2 Soyuz-Fregat from Kourou
  - Lunar gravity assist for end spacecraft, direct injection from sub-GTO for corner spacecraft
  - 2 yr science operations, consumables for 5 yr
- LISA payload (drag-free, laser power, telescope diameter, fixed measurement noise)
- Payload from member states

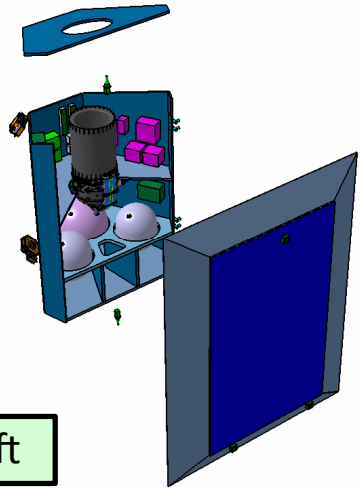
NGO Concept



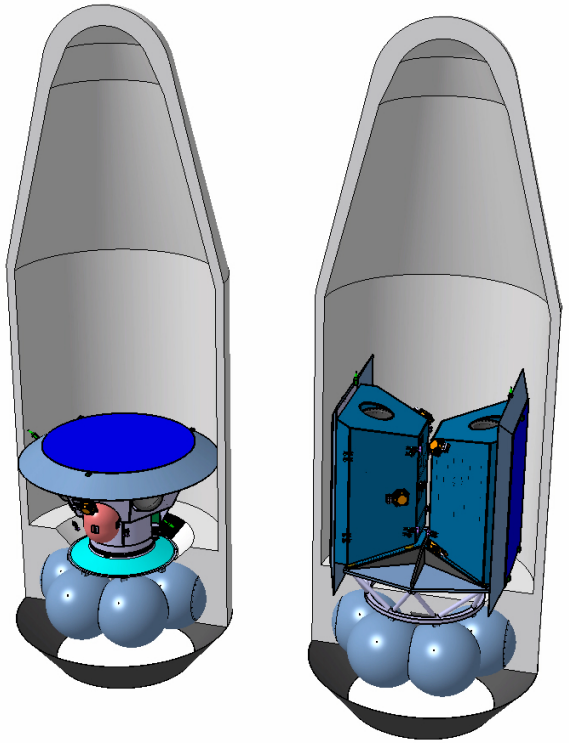


Corner Spacecraft



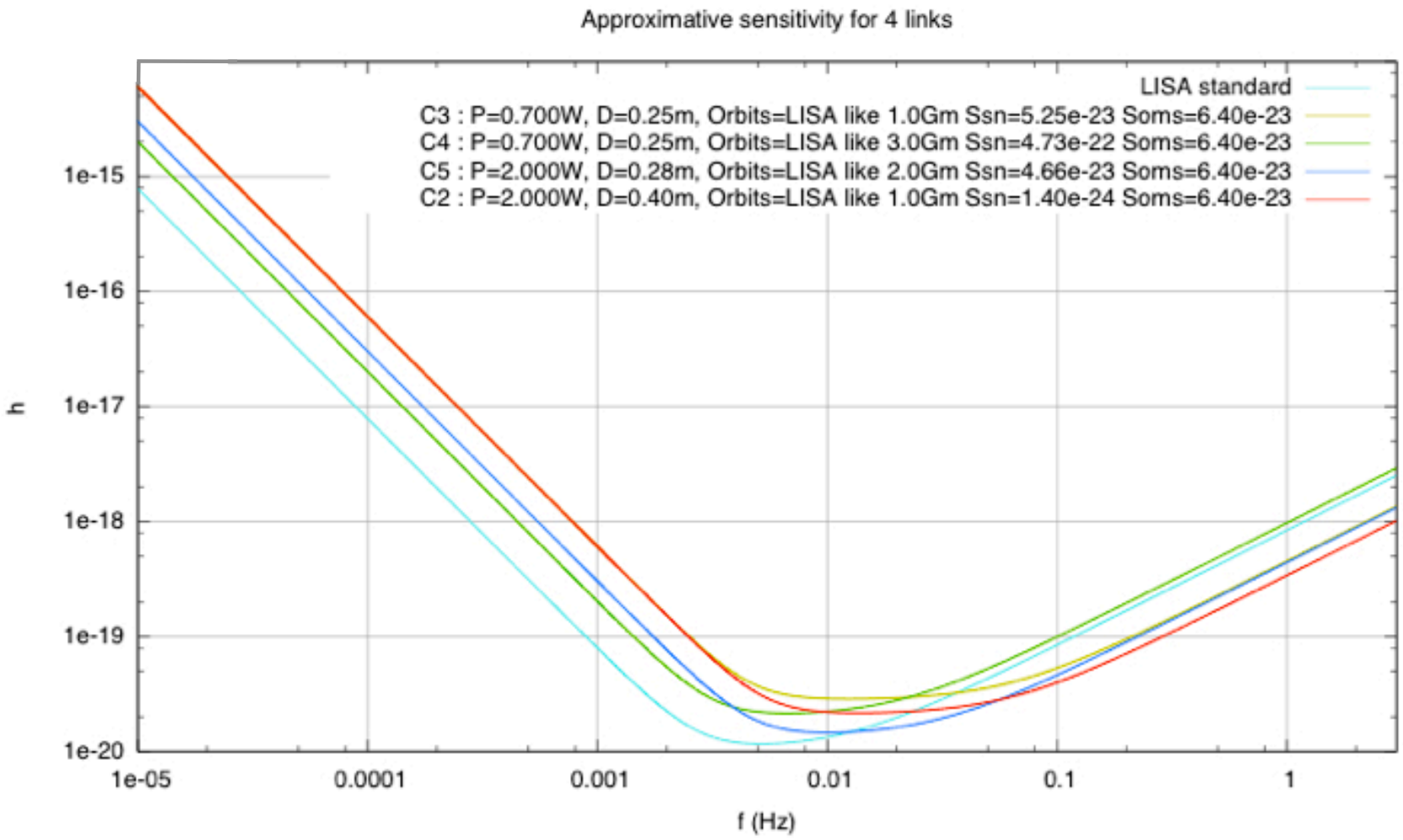


End Spacecraft



2 Soyuz
3 Spacecraft

Sensitivity Curve



Baseline Configuration: C2, red curve

Science Performance

Sources	NGO	LISA
Galactic binaries	~4,500	>20,000
Verification binaries	4	7
Massive Black Hole Binaries	34	Hundreds
Mean MBH mass uncertainty	0.1%	0.01%
Mean sky position uncertainty	TBD	30 arc min
Luminosity distance uncertainty, z~5	100%	20%
Extreme Mass Ratio Inspirals	Tens	Thousands

Notes:

1. Scientific performance is a complex function of instrument performance, requiring extensive calculations. Only initial rough calculations have been performed on the NGO baseline concept.
2. Including additional waveform physics will likely increase performance.
3. Projected performance of LISA-like detectors has been increasing for several years as additional physics has been included in waveforms.
4. Anticipated improvements in performance calculations should lead to better performance.

Planned Activities

- Industrial study, biweekly August through October
  - Review and revise CDF results (e.g., payload)
  - Additional analyses and design work
- Science performance task force
  - Re-do science performance calculation for baseline and 2 Mkm option
- Science team meeting September 13-14 in Paris
- Prepare Yellow Book (concept overview, science, requirements, payload, mission design, operations)
- Prepare Mission Concept Document (requirements, orbit analysis, launch vehicle, spacecraft, payload, operations)

Conclusions

- NGO can do extraordinary astrophysics.
- No known showstoppers, after a preliminary engineering study
- NGO is derived from well-studied LISA design, especially the payload
- NGO is compatible with LISA Pathfinder technology demonstration flight
- Did I mention that it makes the 850 M€ cost cap, and can be launched in 2022?