



Extended Mission

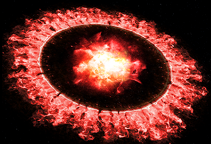
Presented by:

SOFIA Project Scientist
Naseem Rangwala

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Cover image shows magnetic field streamlines from SOFIA/HAWC+ superposed on image from the Spitzer Space Telescope of the Serpens South Cluster.

Image Credit: NASA/SOFIA/T. Pillai/Kauffmann; NASA/JPL-Caltech/L. Allen
Image Processing: L. Proudfit



Expectations for SOFIA's Extended Mission - 1 of 2

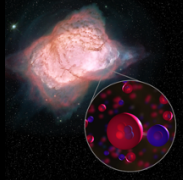


SOFIA's extended mission started in fall 2019 after the conclusion of the Flagship Mission Review (FMR)

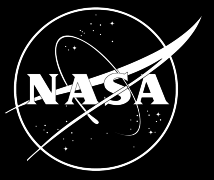
Expectations include:

- Fully transition from **development to mature operations**, with focus on increasing scientific output and impact
- Divert “development” resources (without impacting sustained operations of 4 flights per week) to:
 - **Increase scientific data collection** by flying more and minimizing downtime (e.g., moving to 1-year maintenance per the SOMER & FMR)
 - **Increase scientific productivity and impact** by hiring more post-docs, promoting archival research, and increasing community engagement
- Operate with **higher mission-assurance risk** to allow SOFIA to fit within a reduced annual planning budget
 - e.g., suitcase (or mini) Southern Hemisphere deployment conducted with a much smaller crew, which increases the risk posture. If something breaks, then we return home.
- Implement **operational efficiencies** to further reduce cost or to reinvest in science enhancing initiatives



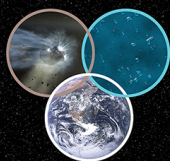


Expectations for SOFIA's Extended Mission - 2 of 2



Expectations continued:

- Move to **once-a-year annual maintenance** starting 2021
- **Observatory hardware and software development activities will be limited** to tasks required to sustain and maintain Observatory's ability to continue to collect high-quality science data
 - Non-mission-critical flight systems and science-instrument software development will be deployed once a year
 - Mission-critical changes or corrective tasks will not be impacted
 - New science instruments (SI) will be driven by the commissioning schedule and will not be managed under the once-a-year software deployment schedule until the new SI has been accepted as a facility-class SI



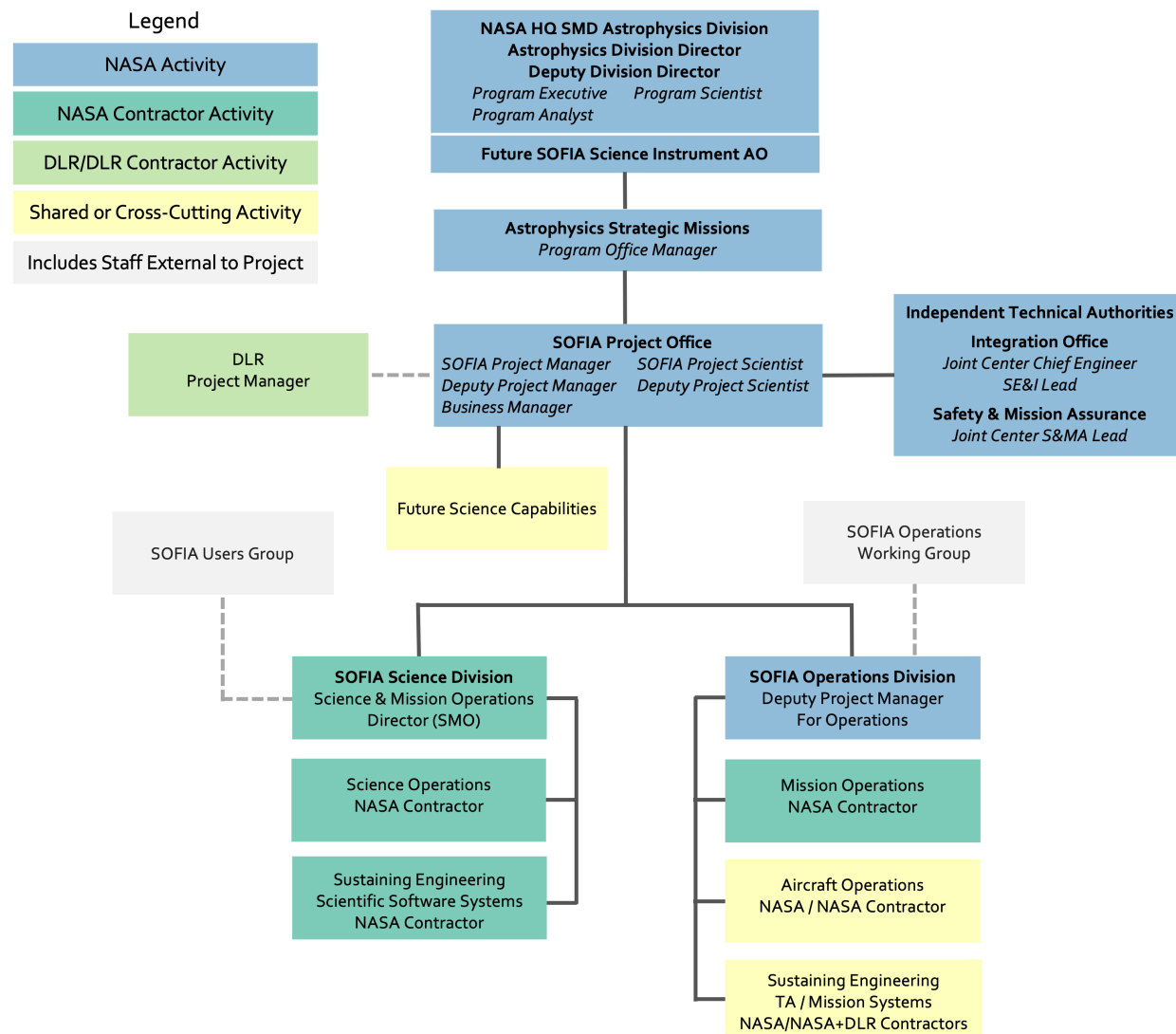
Modified NASA/SOFIA Organizational Structure as of Fall 2019



SOFIA Project reorganized (per NASA HQ guidance) to achieve sustainable operations within the \$80M planning budget. If additional funds are appropriated then they could be potentially used for instrumentation, major development, or flying more science flights

Sustainable operations model (in \$80M) was achieved in Fall 2019 by:

- 10% reduction in workforce while:
 - Maintaining staffing to operate the observatory at the cadence of four flights per week and to conduct an annual Southern Hemisphere deployment
 - Minimizing impact to science
- NASA SOFIA Project reduced to two divisions:*
 - Operations Division
 - Science Division
- Observatory systems upgrades, sustaining and development engineering were cut:
 - Consolidated under operations
 - Reduced management overhead
 - No new spares; utilizing current inventory
 - Accepted risk to the availability and reliability of the Observatory to collect science as Observatory Systems failures will take longer to troubleshoot and fix with smaller team
- Science & mission operations also underwent a reorganization



*The NASA SOFIA Project works in coordination with the DLR SOFIA project management and the DLR contractor management staff

Background: Extended Mission Paradigm for NASA Space Projects



"Mission Extension Paradigm" in the Senior Review Call for Proposals for NASA SMD Space Projects*

Missions Operate with significantly reduced annual funding with focus on sustaining operations and data collection

"Under this call, the budgets for mission extensions beyond the prime mission lifetime (in NPR 7120.5 parlance, Prime Phase E) will support, at a lower level, the activities required to maintain operations and continue to produce meaningful and significant science data, which is adequately described and accessible to the researcher."

Missions can operate with higher risk posture

"When a mission has completed its Prime Phase E, the NASA Astrophysics Division may accept higher operational risk, lower data collection efficiency, and instrument/mission degradation due to aging. Priority is given to maintain understanding of the instrument performance, to monitor progress toward accomplishing the objectives of science observations, and to involve the science community in formulating the mission observing program to make the best scientific use of NASA's Astrophysics missions; however, more limited funding may be available in this "minimal-science data analysis mode" for detailed analysis, data fitting, modeling, and interpretation."

"This paradigm, however, applies to the first mission extension only: it is not a requirement that a subsequent mission extension has a reduced operating cost over that which preceded it."

"It is assumed that, along with this reduced funding profile and greater risk, the cost to implement will be lower than that of Prime Phase E. The Astrophysics Division sponsors several competitive programs that support basic research, theory, and data analysis."

Streamline Operations

- Some NASA SMD Astrophysics Division "extended" missions streamline operations with the goal of reducing the overall funding needed to operate the mission; others (e.g., Hubble, SOFIA) use the extra funding realized from operational efficiencies to drive innovation in other areas.



* The definition of the SOFIA extended mission phase will differ from the extended mission paradigm for NASA space projects; however, some expectations may be similar

NASA-DLR MoU, Article 3d: Develop and provide the Modified Aircraft, the Mission Control and Communications System, and the Mission Support System, and integrate, test, verify, and operate the SOFIA System on a long-term, continuing basis

- SOFIA is NOT a Space Mission and the term “Extended Mission Lifetime” is therefore not fitting for SOFIA
- Regular Project Reviews are “healthy.” The Observatory should be reviewed—not separate parts of it.

DLR’s New Telescope Assembly (TA) Capabilities

- IF required by science AND development funds are available
- TA-Upgrades: When it is reasonable within the framework of obsolescence management
- New Observatory Capabilities: If needed by the observatory and not (yet) available
- New Aircraft Capabilities: If needed by the observatory and not (yet) available

DLR’s Maintenance

- Obsolescence management is essential for the TA and will be continued (As a reminder: The TA was delivered in 2003—17 years ago!)
- Preventative maintenance will be continued for TA
- Sustaining engineering will be continued for the TA
- Annual maintenance for the SOFIA aircraft—preferably on a long-term basis with LHT

“DLR’s overall approach to the next phase of SOFIA is similar to NASA’s extended mission philosophy”