Far-IR Surveyor (FIRS) Decadal Mission Study

What is "executable mission" for Far-IR Surveyor?

Face-to-Face Meeting #1

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“executable mission” for Far-IR Surveyor

- Study office solicited executable mission criteria/definition to STDT members
  - 7 STDT members responded
- The purpose of this exercise is;
  - To help reach consensus on “fuzzy” boundary conditions for the Far-IR Surveyor mission
    - Constrains the solution space, enabling efficient use of limited study resources

Inputs from STDT

- General Comment:
  - Covers all aspects of the mission
  - Mission that does not need any tooth fairies
  - Technically feasible
  - Need careful defining of a mission "worth executing"
  - Need to develop a mission concept that lays out a path and the cost for full development with a Phase A starting in mid-2020's
  - Focus on one key architectural concept agreed by STDT
  - A solid, fleshed out plan to support the mission: the proposed mission is doable within the next decade or within the time frame that we propose it to be completed
  - If we do not have the technology to the level we need, then we include in the plan how to get it there for the mission.
  - Able to be successfully built, launched and operated within the prescribed budget and timescale
  - Any technological developments necessary to fulfill the first criterion are judged to be feasible with fairly conservative assumptions about the future state of the technology
  - Existing concepts and/or studies can be used to inform this process, but should not constrain the thinking of the STDT.
  - An executable mission is one that has a well justified budget for a rational timeline to fulfill technology requirements, a successful launch, and operations that can achieve all the major science goals within the mission lifetime.
  - Considerations for mission lifetime should be addressed in the development including cryogen, fuel, orbit/station keeping, power, etc. Readiness/availability of a proper launch vehicle

Inputs from STDT - continued

- Science:
  - Science case and imaging capability that will stimulate public support
  - Converge on a set of high-priority science goals that has broad appeal within the astronomical community
  - High relevance in the 2030-2035 time frame and uniquely achievable with the Far-IR Surveyor
  - Broad science reach and an observing technique that allows a large number of general observing program
  - Meets needs of the full astronomical community
  - First and foremost the FIR Surveyor should have a broad and visionary scientific scope, commensurate with the most pressing scientific questions at the time of launch. This mission should also have the flexibility to attack new science goals that are difficult to envision now, but will undoubtedly appear in the coming decade

Inputs from STDT - continued

- Technology Readiness:
  - Prefer TRL 4 or 5 in all mission-enabling technologies before the Decadal Survey
  - No foreseen obstacles to reaching TRL 6 by PDR, can be completed (phase A-F) at a cost and schedule
  - All critical elements are at or beyond TRL 6 by PDR
  - Technically feasible on the time-scale of the mission: technology exists, under development and achievable
  - Technology development and readiness can support mission launch in early 2030
  - Either reached an acceptable level of technology maturity by the time of the decadal survey, or has a clear path toward achieving that goal
  - Readiness of new technology (TRL levels) in a reasonable amount of time for implementation and preliminary tests/characterization with spacecraft (or launch configuration) prior to launch.

Inputs from STDT - continued

- Mission Cost:
  - $3B maximum, unless compelling science case with broad-based support in the community requires greater than $3B
  - Less than JWST cost
  - Falls within allowable budget
  - Mission cost should be computed but is not a driver
  - The cost and scope of this mission should be studied in detail by the STDT, and this requires all parties to come to an agreement on the basic concept for such a mission so that the key technological hurdles can be overcome and/or a plan to overcome them can be laid out and reviewed by the decadal committee.
  - Budget that does not exceed the available resources, but also inclusive of all necessary costs for the mission to successfully complete its science objectives within the scope of the mission design and lifetime.

“Executable” Discussion

Open Discussion

Back-Up

Input #1:

- Science case and imaging capability that will stimulate public support (sexy science; image objects that have never before been imaged);
- Technology readiness: no foreseen obstacles to reaching TRL 6 by PDR, and preferable to be at TRL 4 or 5 in all mission-enabling technologies before the decadal survey;
- Mission lifecycle cost not to exceed $3B unless necessary for the mission to have a compelling science case with broad-based support in the community.

Input #2

- 'Executable' to me means a mission that is technically feasible - i.e., all critical elements are at or beyond TRL 6 by PDR - and can be completed (i.e., Phase A through Phase F) at a cost and on a schedule consistent with the available resources. However, preceding 'executable' must be the careful defining of a mission 'worth executing'. The STDT must first converge on a set of high-priority science goals that has broad appeal within the astronomical community. These goals must be viewed as retaining high relevance in the 2030-2035 time frame and uniquely achievable with the Far-Infrared Surveyor - i.e., these questions cannot be addressed by existing instrumentation, such as ALMA or SOFIA, or facilities that will likely become available during the next 20 years, such as the Large Synoptic Survey Telescope, several 30-meter class optical/near-infrared telescopes (with adaptive optics), and the Square Kilometer Array. The mission architecture that best enables us to achieve these goals must then be evaluated to determine whether it is 'executable'. (If it is not 'executable', we must then determine whether the descopes necessary to making the mission 'executable' preserve sufficient science.)

Back-Up

Input #3

- To me, an executable mission is one that doesn't need any tooth fairies. Or to put a dollar value on it, a mission that has an estimatable cost that is less than JWST cost.

Input #4

- To me, an "executable mission" means that: 1) it falls within an allowable budget, to be determined, and 2) it is demonstrably technologically feasible on the time-scale of the mission. We will spend some time demonstrating feasibility in the study. Feasibility includes: 1) technology exists, 2) technology is under development with some major milestones underway, 3) it can convincingly be demonstrated that the technology is achievable, i.e. the process to achieve the technology is understood, and initial studies support this claim.

Input #5

- This means we have a solid, fleshed out plan To support that the mission we proposed is doable within the next decade or within the time frame that we propose it To be accomplished.
  If we do not have the technology to the level we need, then we include in the plan how to get it there for the mission.
  Mission cost should be computed but is not a driver.

Back-Up

Input #6

- We need a mission that is ready for launch in early 2030s. Executable covers all aspects of the mission. It should have a broad science reach and an observing technique that allows a large number of general observing programs to meet the needs of the full astronomical community. We need to develop that mission concept over the next three years and lay out a path and the cost for its full development with a phase A starting in mid 2020s. While existing concepts are likely even ready to go to phase A within the next couple of years, they fall below the threshold of transformative science requirements, while also satisfying the needs of the full astronomical community. With a focussed, fully funded and correctly-managed engineering study over the next two to three years, and focussing only on one key architectural concept agreed by the STDT, we should be able to put forward a mission concept to the 2020 Decadal that is executable in 2030.

Input #7

- able to be successfully built, launched and operated within the prescribed budget and timescale
- any technological developments necessary to fulfill the first criterion are judged to be feasible with fairly conservative assumptions about the future state of the technology

Back-Up

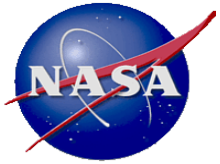
Input #8

- **executable**: First and foremost the FIR Surveyor should have a broad and visionary scientific scope, commensurate with the most pressing scientific questions at the time of launch. This mission should also have the flexibility to attack new science goals that are difficult to envision now, but will undoubtedly appear in the coming decade. An executable mission for 2030, like the FIR Surveyor, should be one that has either reached an acceptable level of technology maturity by the time of the decadal survey, or has a clear path toward achieving that goal. The cost and scope of this mission should be studied in detail by the STDT, and this requires all parties to come to an agreement on the basic concept for such a mission so that the key technological hurdles can be overcome and/or a plan to overcome them can be laid out and reviewed by the decadal committee. Existing concepts and/or studies can be used to inform this process, but should not constrain the thinking of the STDT. Previous work should be used, where appropriate, to facilitate the task set out in the management plan for the FIR Surveyor study. While there is certainly a limitation on the amount of funding that will be available for the Surveyor mission and therefore this must be weighed into the consideration of what is executable in 2030, we should not allow this to overly constrain or limit our thinking early in the study process. Compelling and visionary science should guide us, and will be the most effective argument to put forward to the decadal committee for the FIR Surveyor.

Back-Up

Input #9

- An executable mission is one that has a well justified budget for a rational timeline to fulfill technology requirements, a successful launch, and operations that can achieve all the major science goals within the mission lifetime. Considerations for mission lifetime should be addressed in the development including cryogen, fuel, orbit/station keeping, power, etc. Readiness/availability of a proper launch vehicle. Readiness of new technology (TRL levels) in a reasonable amount of time for implementation and preliminary tests/characterization with spacecraft (or launch configuration) prior to launch. Finally, a budget that does not exceed the available resources, but also inclusive of all necessary costs for the mission to successfully complete its science objectives within the scope of the mission design and lifetime.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