

**Status Update:**

**United States Extremely Large Telescope (US-ELT) Program**

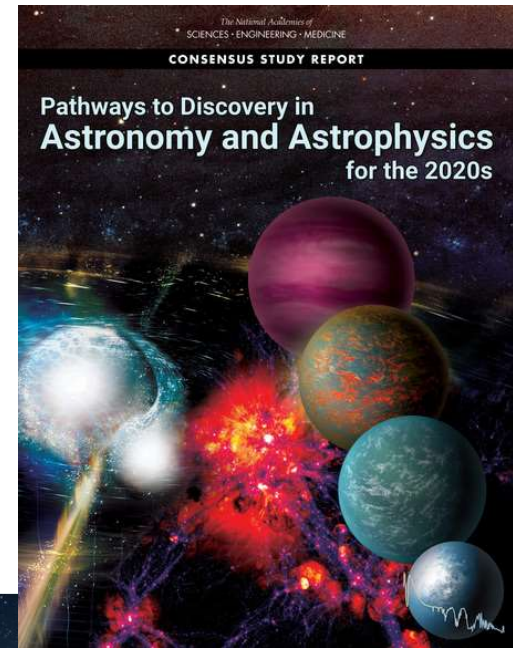
Dave Boboltz, Program Director, Div. of Astronomical Sciences



National Science  
Foundation

# Astro2020 Decadal Survey

- The Decadal Survey for Astronomy and Astrophysics, “Astro2020” was issued in November of 2021
- The Astro2020 report stated:
  - *“U.S. ELT is a critical priority for investment for ground-based astronomy in the coming decade.”*
  - *“National Science Foundation (NSF) should achieve a federal investment in at least one and ideally both of the two extremely large telescope projects—the Giant Magellan Telescope and the Thirty Meter Telescope.”*



# Astro2020 Decadal Survey Science Themes

## Worlds and Suns in Context

## New Messengers and New Physics

## Cosmic Ecosystems

*A US-ELT Program can contribute to discoveries across these themes*

*Stars & Planets and the Search for  
Life Beyond the Solar System*

Understanding star and planet  
formation and identifying earth-like  
extra-solar planets.

*Explosive Transients, New  
Messengers, Dark Energy*

Combining time-resolved EM  
data with particles and GW to  
probe black holes, neutron stars,  
explosions and mergers.

*From Gas and Dust to  
Stars and Galaxies*

Linking the cosmic web of gas  
and dust to the formation and  
evolution of galaxies.



# The Power of Two ELTs



Full-sky Coverage: discoveries *wherever* and *whenever* they occur

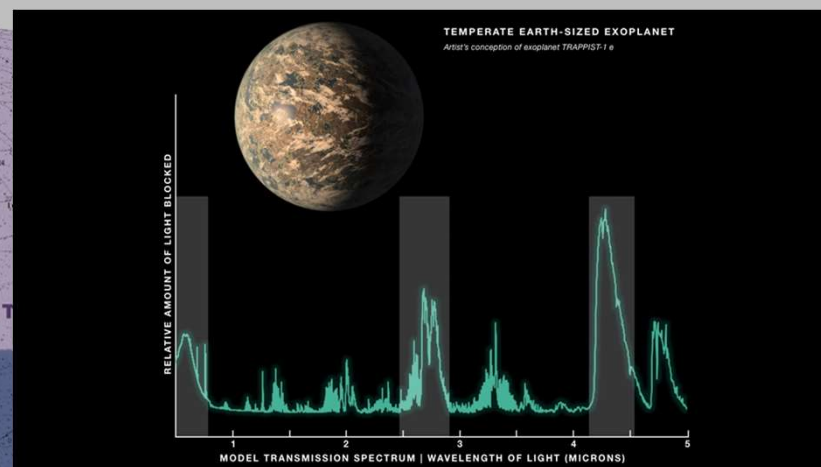
A diverse suite of telescope technologies and instruments  
both TMT and GMT

More nights on sky for the U.S. community



# Full Sky Coverage - Exoplanets

The *BEST CANDIDATE* might appear in either hemisphere  
Two ELTs would guarantee we can study it



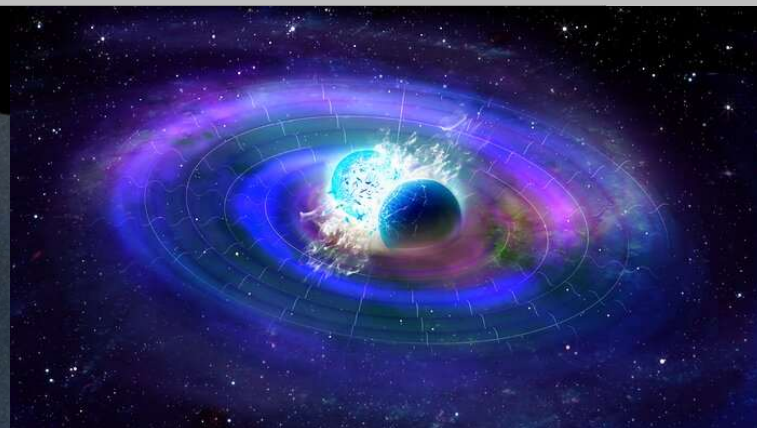
Spectroscopy probes the atmospheres of transiting exo-Earths for potential signs of life

ELTs are the only facilities in current development that can obtain sufficient signal to find signs of life outside our Solar System



# Full Sky Coverage – Gravitational Waves

April 8, 2019 18:18:02 UTC  
GW190408\_181802  
3.52 Gyr ago



*Multi-Messenger Astrophysics*

Detection of *optical counterparts of gravitational wave events* that occur anywhere on the sky may lead to new physics discoveries



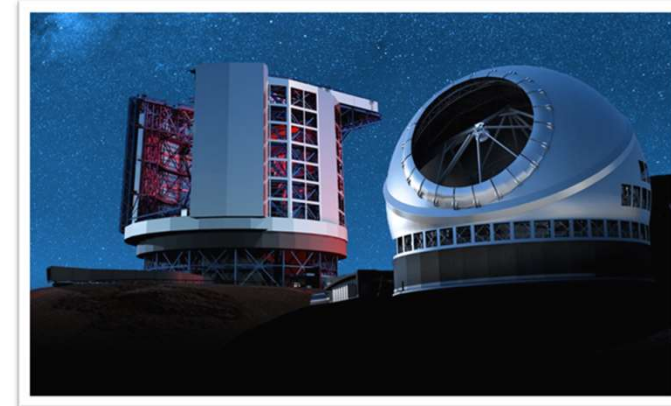
EGO VIRGO

GWTC-2: Gravitational-Wave Transient Catalog – Sky Localizations



# What a Federal Investment Would Buy

- 30% - 50% share of observing time (dependent on fractional investment) on a bi-hemisphere ELT system
- Access to cutting-edge facilities **for U.S. astronomers at any institution**
  - Levels the playing field
- Maintains U.S. scientific leadership in OIR astronomy
- Leverages substantial investments from private institutional and international partners
  - NSF doesn't have to go it alone



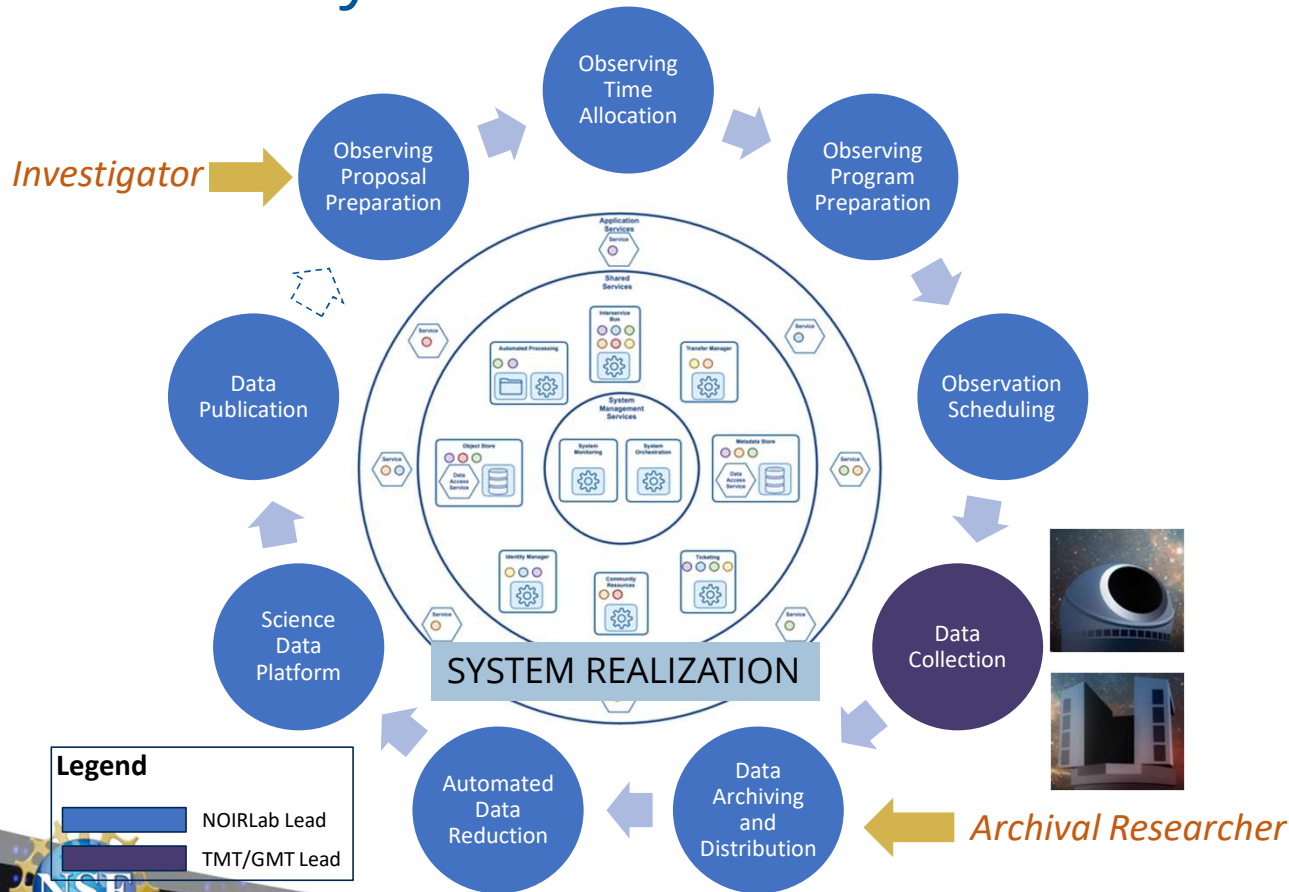
# Role of NOIRLab: Enabling the US-ELT Science Data Lifecycle



As NSF's FFRDC for OIR astronomy, NOIRLab would be NSF's primary interface to the community

Providing:

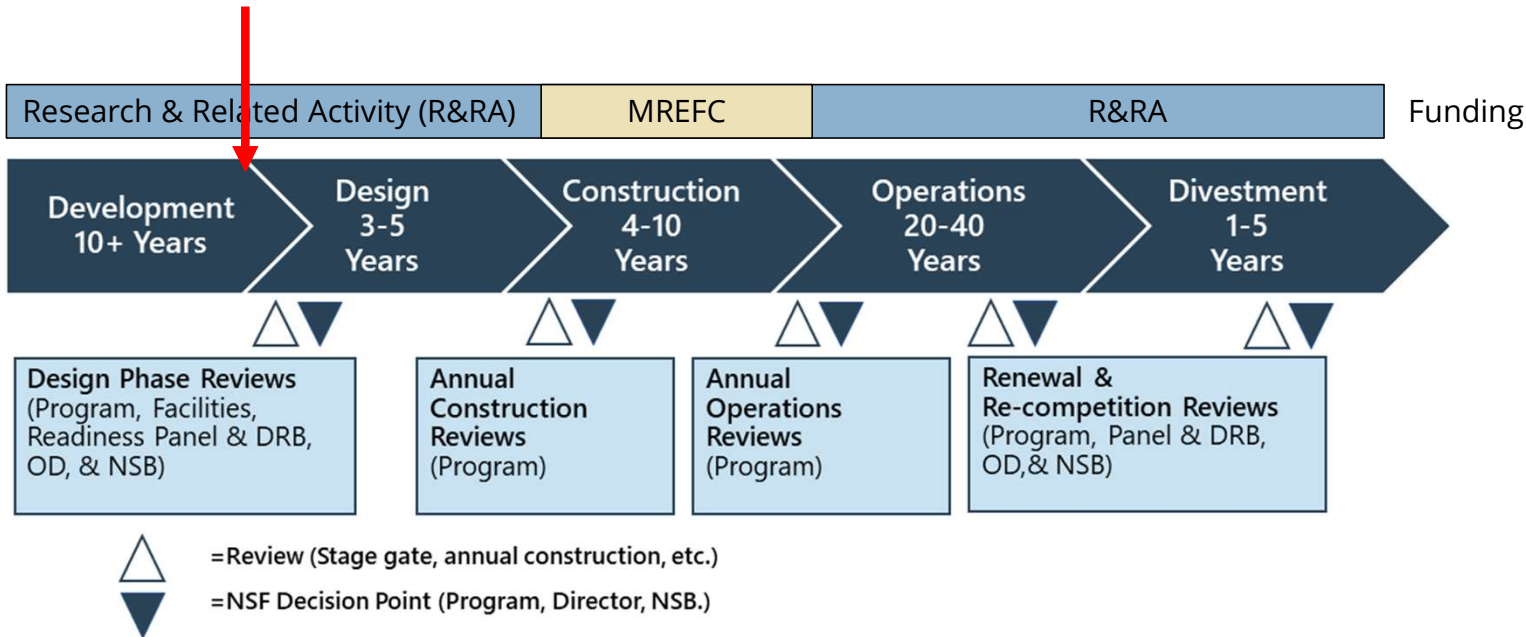
- Support for Key Science programs
- Easy to use proposal tools
- A common interface to both telescopes
- Ties into U.S. "OIR system"
  - Gemini, DES, Rubin, DESI
- High quality data pipelines
  - Science ready data
- Fully searchable science archive
  - Access to ALL TMT & GMT data





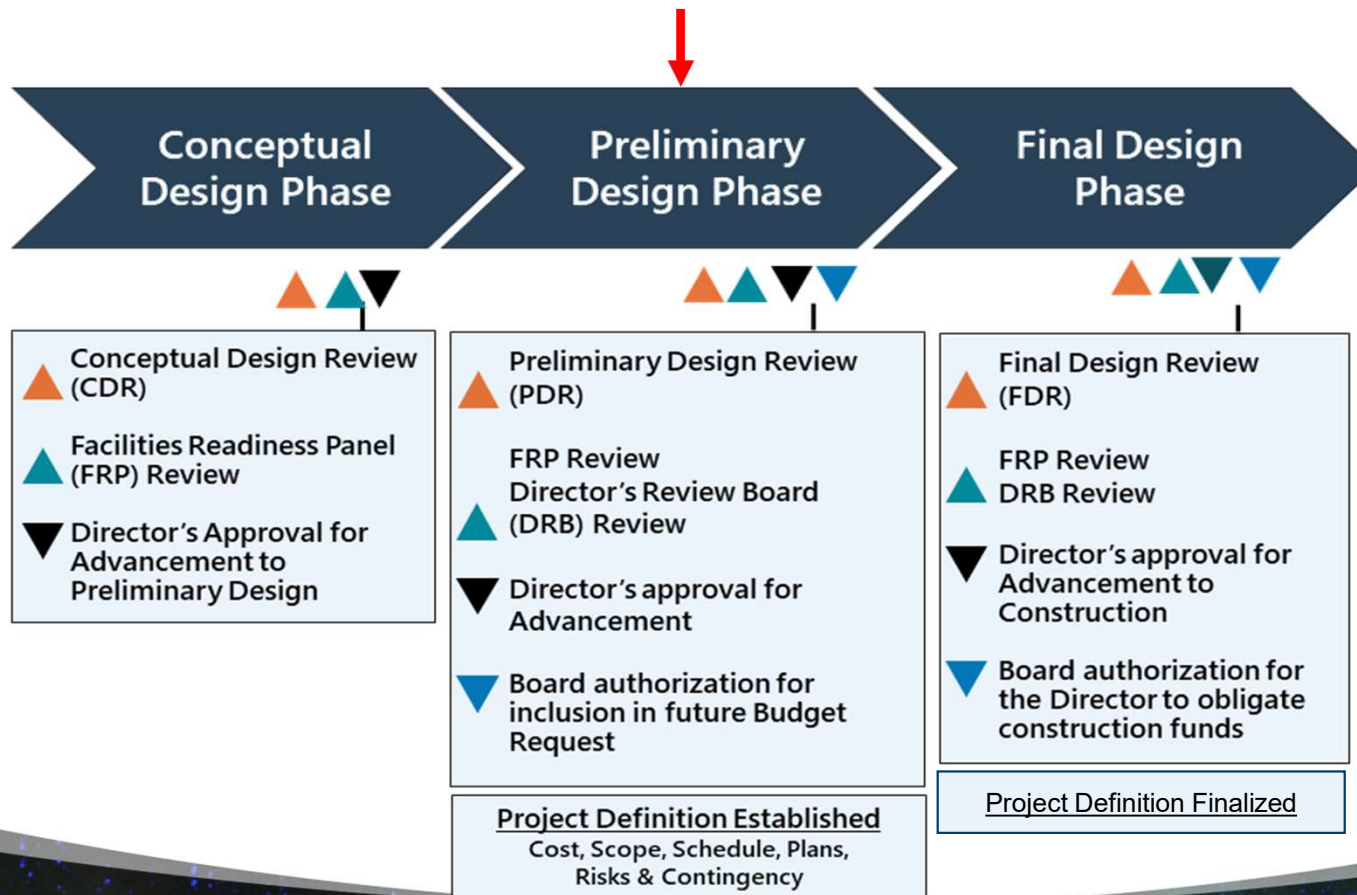
# The NSF Major Facility Lifecycle as Defined in the RIG

**US-ELT is here**

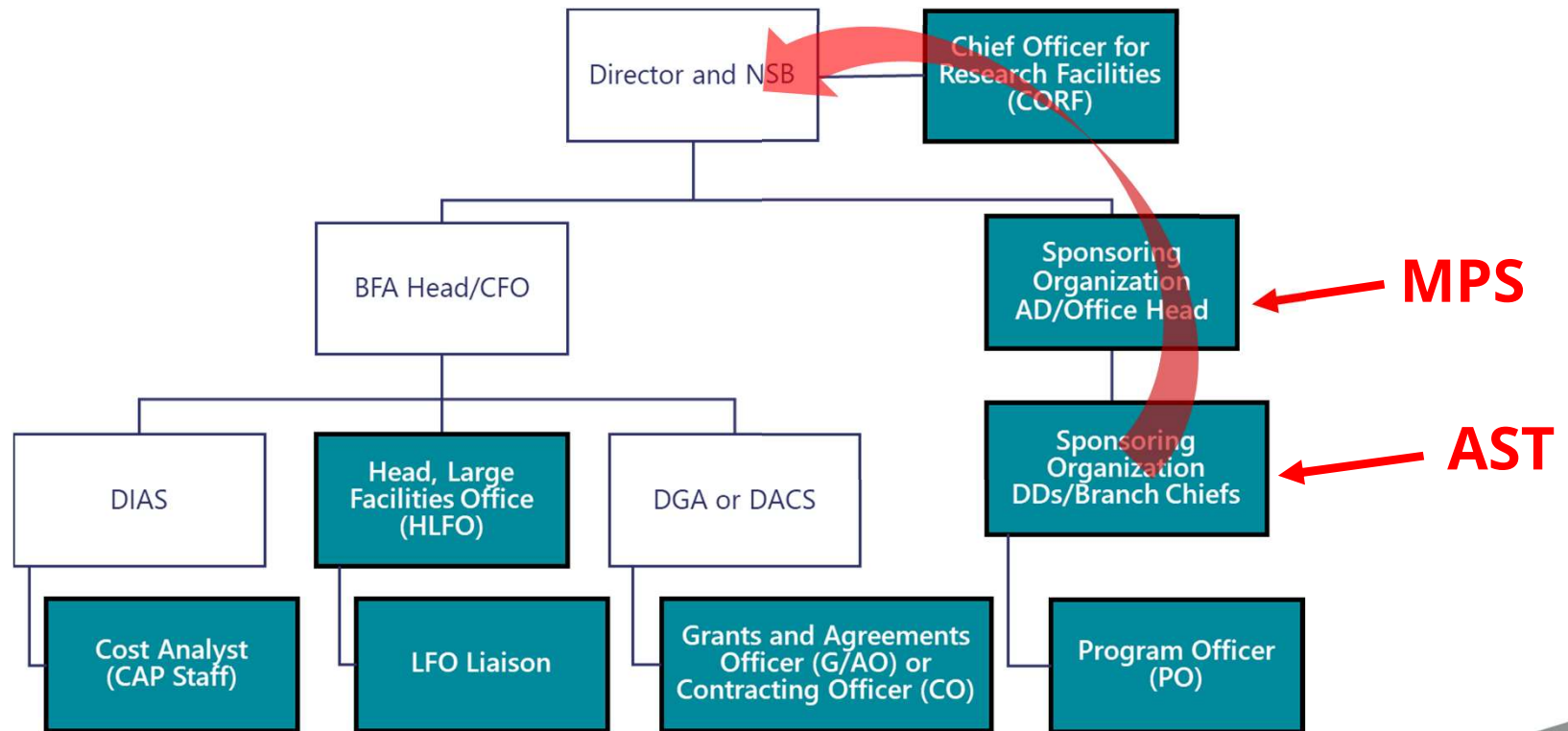


# NSF's Major Facility Design Stage

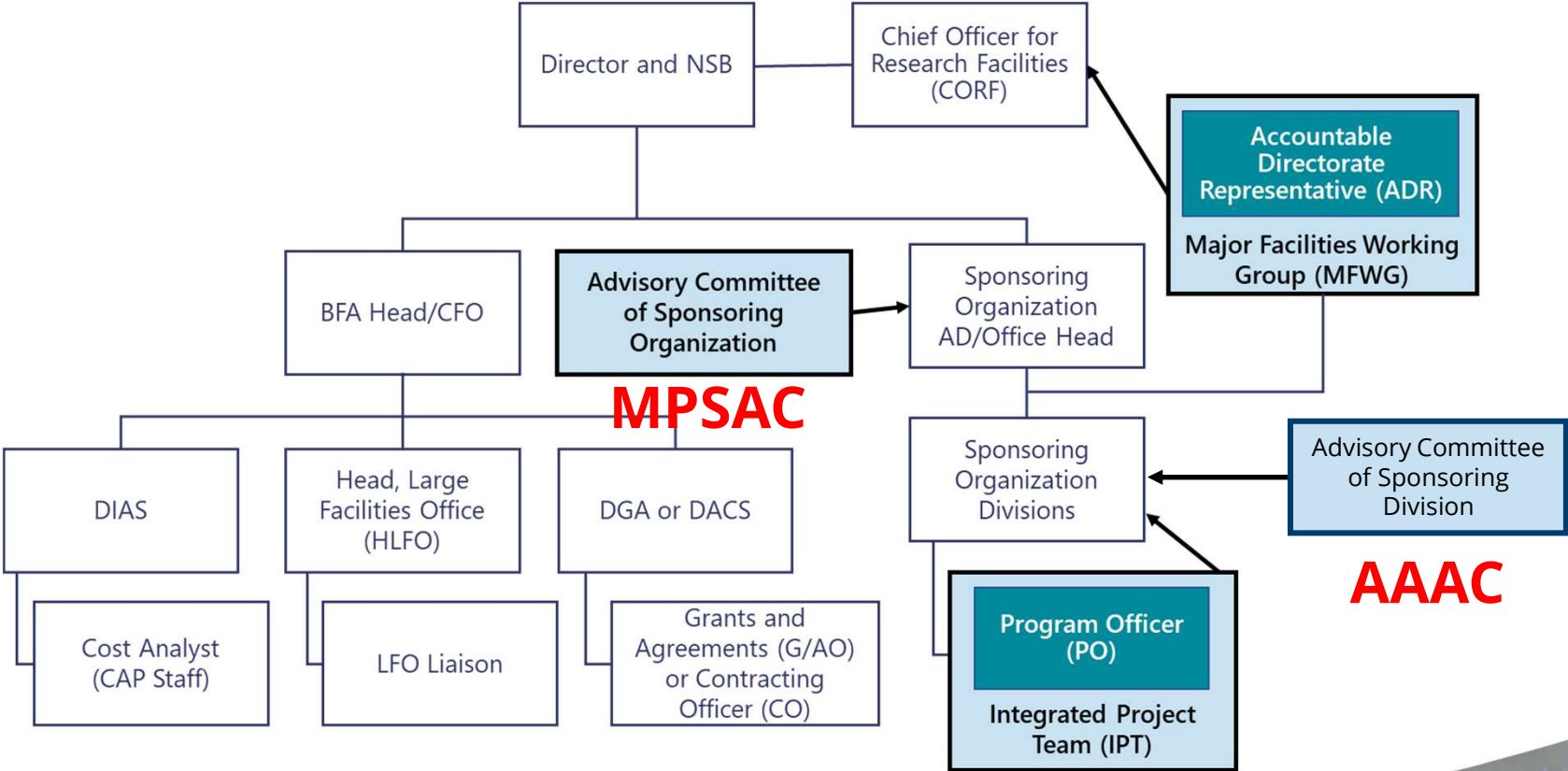
**TMT/GMT would like to enter here**



# NSF Organizational Structure for Major Facility Design, Construction, and Operations Oversight



# The Role of Advisory Committees



# Entry into NSF's Major Facility Design Stage

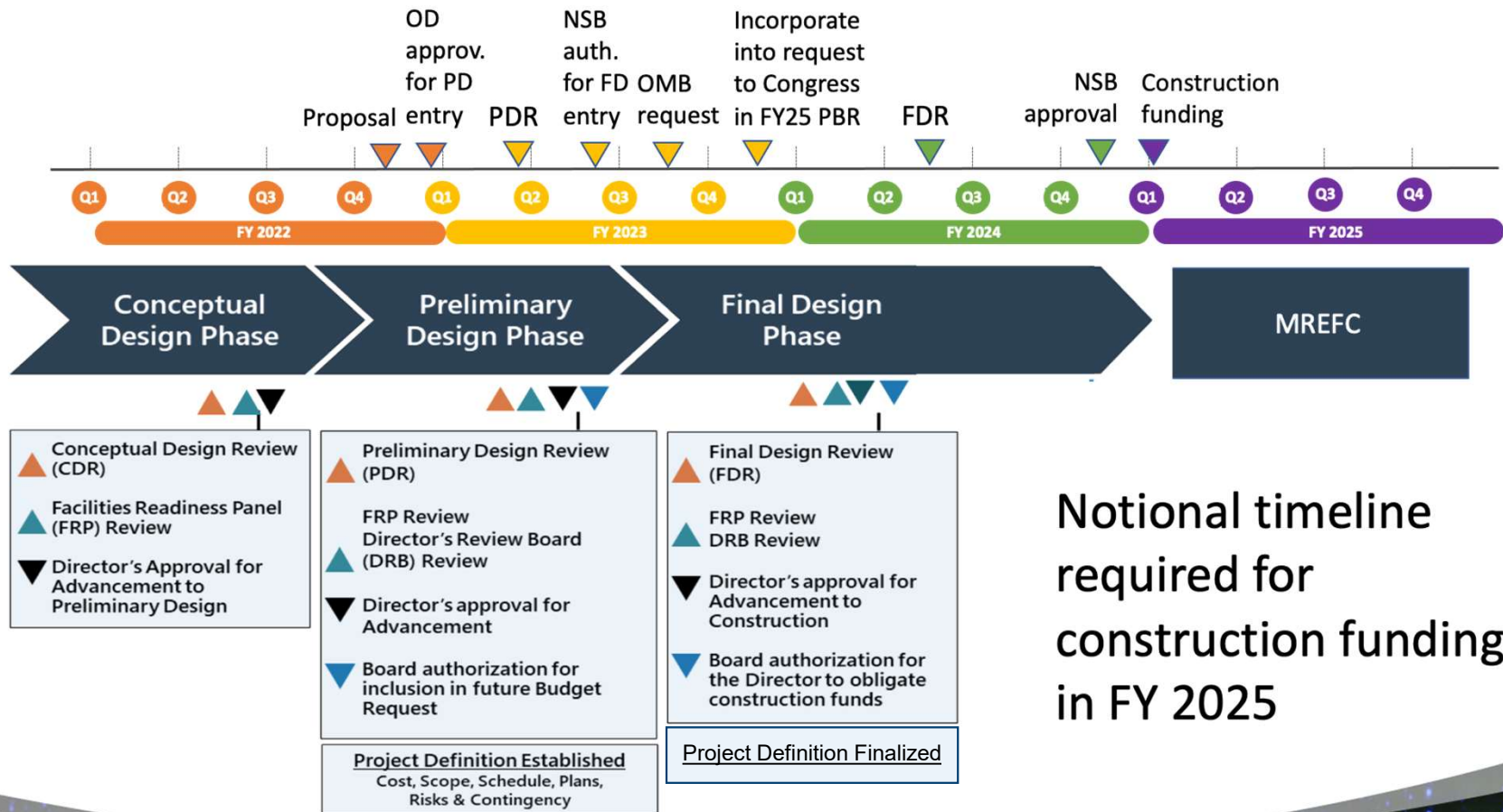
From NSF's Research Infrastructure Guide:

Regardless of whether the project enters at the beginning of the Conceptual Design Phase or a more advanced phase of technical readiness, formal start of the Design Stage occurs following a recommendation by the Chief Officer for Research Facilities (CORF) with input from the Facilities Governance Board (FGB) and other senior agency officials and written approval by the NSF Director. This process is initiated by a request from the Sponsoring Organization to the Director's Office once a project is determined to be ready. Generally, such a request is made when the Sponsoring Organization has determined that:

1. **the project is a high scientific priority,** ← **Astro2020**
2. **the project is eligible for MREFC funding (see criteria in Section 2.1.2 of this Guide) and the MREFC funding route is preferred, and**
3. **the Sponsoring Organization is committed to begin explicit investment in more detailed design activities in the current or upcoming budget cycle using Directorate or Divisional funding (R&RA).**



# Design Stage and the Budget Cycle



Notional timeline required for construction funding in FY 2025

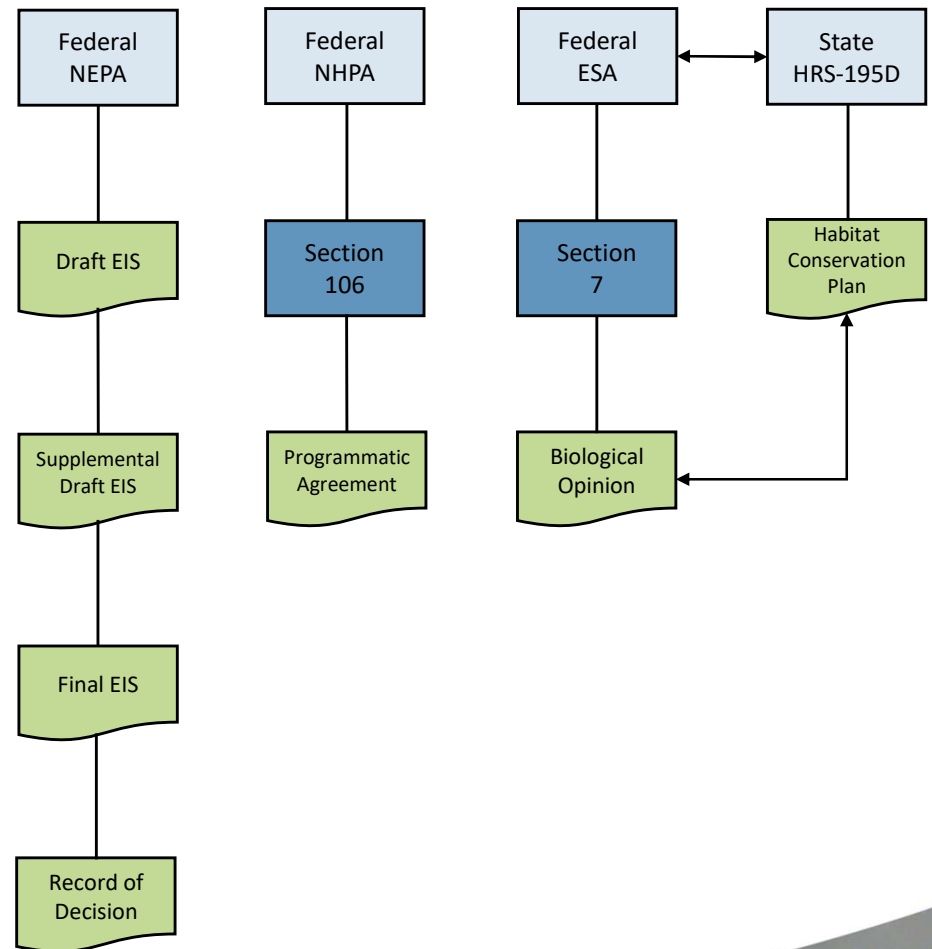


# More Detailed Potential Schedule for Design Stage



# Legal Authorities for Environmental Compliance

- National Environmental Policy Act (NEPA)
- National Historical Preservation Act (NHPA)
- Endangered Species Act (ESA)
- Hawaii Revised Statute (HRS) 195-D





# Example: DKIST Env. Compliance

- Total Number of Agreements – 10
- Total Number of Obligations – Over 150
- Completed Obligations for Construction – 100%
- Continuing Obligations for Operations
  - Decommission telescope in 50 years
  - Periodic enclosure coating evaluation
  - Telescope time for Native Hawaiian scientists
  - Petrel mortality reporting
  - Survey prior to ground-disturbing maintenance
  - Rodent control
  - Invasive species control

**Habitat Conservation Plan**  
for  
**Construction of the**  
**Advanced Technology Solar Telescope**  
at the Haleakala High Altitude Observatory Site  
Maui, Hawai'i

October 29, 2010

**STATE OF HAWAII**  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
DIVISION OF FORESTRY AND WILDLIFE  
100 HONOLULU AVENUE, ROOM 404  
HONOLULU, HAWAII 96813  
808.725.2000

Dr. David A. Boboltz  
Program Director, NSO/DKIST  
Division of Astronomical Sciences  
National Science Foundation  
2415 Eisenhower Ave.  
Alexandria, VA 22314

Dear Dr. Boboltz,

This letter provides the Division of Forestry and Wildlife's (DOFAW) decision to approve early termination of the Daniel K. Inouye Solar Telescope (DKIST) Habitat Conservation Plan and associated Incidental Take License. This decision was made following the recommendation of the Endangered Species Recovery Committee (ESRC) at its March 6, 2010 meeting.

The decision procedure that allowed this early termination was based on approval of amendments to the Habitat Conservation Plan to allow consideration of early termination by the Board of Land and Natural Resources at its March 23, 2010 meeting pursuant to HRN 1925-2506(1). The process approved was that upon receipt of a satisfactory final report from DKIST the ESRC could recommend termination after which DOFAW's Administrator could approve the termination.

**DAVID G. SMITH**  
Administrator

cc: Chairperson, Board of Land and Natural Resources  
DLNR Land Division

**United States Department of the Interior**  
FISH AND WILDLIFE SERVICE  
Pacific Islands Fish and Wildlife Office  
300 Ala Moana Boulevard, Room 3-112  
Honolulu, Hawaii 96850

February 22, 2010

Re: Reply letter to  
HFD-10-001-14-005  
HFD-10-001-14-016

David Boboltz, Ph.D.  
Program Director, Daniel K. Inouye Solar Telescope  
Division of Astronomical Sciences  
National Science Foundation  
2415 Eisenhower Avenue  
Alexandria, Virginia 22314

Subject: Completion of Project Activities and Conservation Actions for the Biological Opinion for the Daniel K. Inouye Solar Telescope, Maui

Re: Dr. Boboltz:

The U.S. Fish and Wildlife Service (Service) signed the *Biological Opinion for the Construction and Operation of the Advanced Technology Solar Telescope (ATST)* (since renamed the Daniel K. Inouye Solar Telescope (DKIST)) at the Haleakala High Altitude Observatory Site on June 15, 2010. The Biological Opinion was amended on July 29, 2014, to modify the monitoring requirements associated with endangered Hawaiian petrel (*Pterodroma sandwichensis*) carcass searches along the perimeter of the mitigate exclusion fence. The Service received your Draft *Daniel K. Inouye Solar Telescope (DKIST) Habitat Conservation Plan and Biological Opinion Final Report* on December 18, 2018. Following our review of this report, the Service indicated via email that we have no further comments or concerns. Based on our records, we have confirmed that all of the terms and conditions in the Biological Opinion, including performance of all mitigation obligations, have been satisfied. This letter has been prepared under the authority of and in accordance with provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.), as amended.

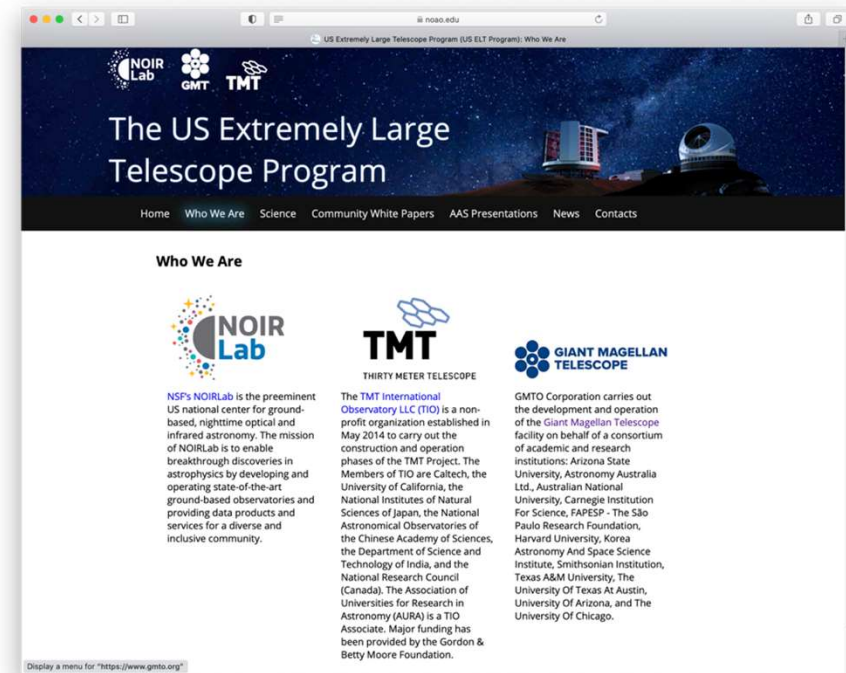
Project activities analyzed in the Biological Opinion, as well as conservation actions intended to minimize and offset adverse impacts to listed species, were implemented and completed by the end of the 2018 Hawaiian petrel breeding season. It is understood that DKIST will continue to conduct annual invasive species inspections and maintain the rodent control grid directly adjacent to the facilities as agreed upon in the Biological Opinion as detailed below:

From page 21 of the Biological Opinion:  
**Invasive Species Interdiction and Control**  
Invasive species may be unintentionally moved to the ATST project site by astronomers and maintenance crews during the telescope's operational lifespan. To minimize the likelihood of an



# The Start of NSF Engagement

- NSF received three Planning and Design proposals for the the US-ELT Program – **May 2020**
  - NSF's NOIRLab, TIO, GMTO
- NSF did not want to influence Astro2020 Decadal Survey
- Issued a statement on the AST website – **August 13, 2020**
  - NSF understands that potential **construction of TMT on Maunakea is a sensitive issue and plans to engage in early and informal outreach** efforts with stakeholders, including Native Hawaiians, to listen to and seek an understanding of their viewpoints. If NSF ultimately initiates a formal federal environmental review process, this advance outreach would serve as a precursor to it.



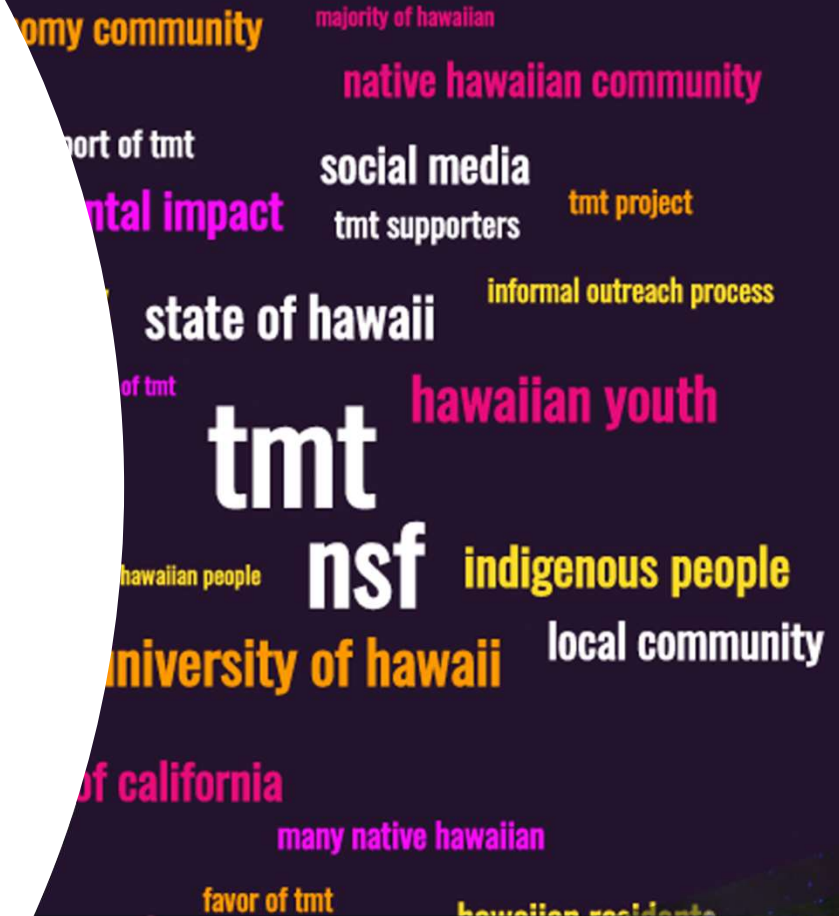
# Construction on Maunakea a Sensitive Issue.

- Following years of litigation which ultimately led to a ruling in their favor, construction vehicles began driving up Maunakea to begin full-scale construction of TMT - **July 2019**
- Wide-scale protests ensued
- Multiple attempts were made to resolve the issues; ultimately, TIO decided to pause the construction of TMT



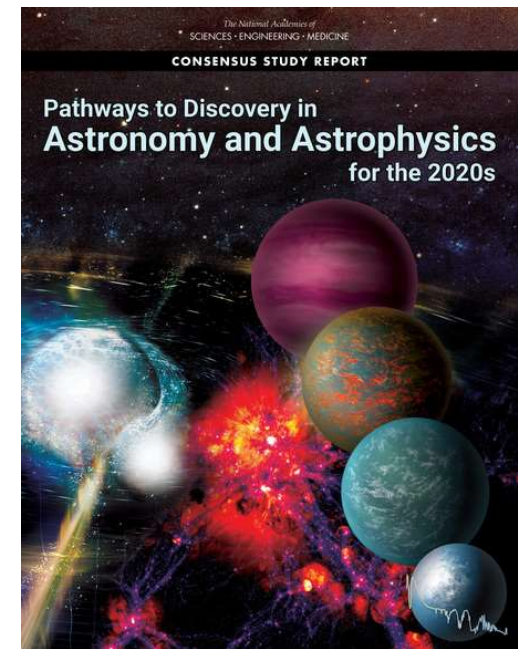
# Informal Outreach Effort

- August 2020 – November 2021
- NSF initiated an informal outreach effort to gain an understanding from those who have a connection with Maui
- The outreach effort focused on the proposed TMT investment and the future of astronomy on Maunakea
- NSF conducted sessions with more than 150 individuals and received approximately 140 written comments during the 16-month outreach effort
- Feedback received during the informal outreach effort informed the development of the Draft Community Engagement Plan (CEP) and will inform the Environmental Impact Statement (EIS)



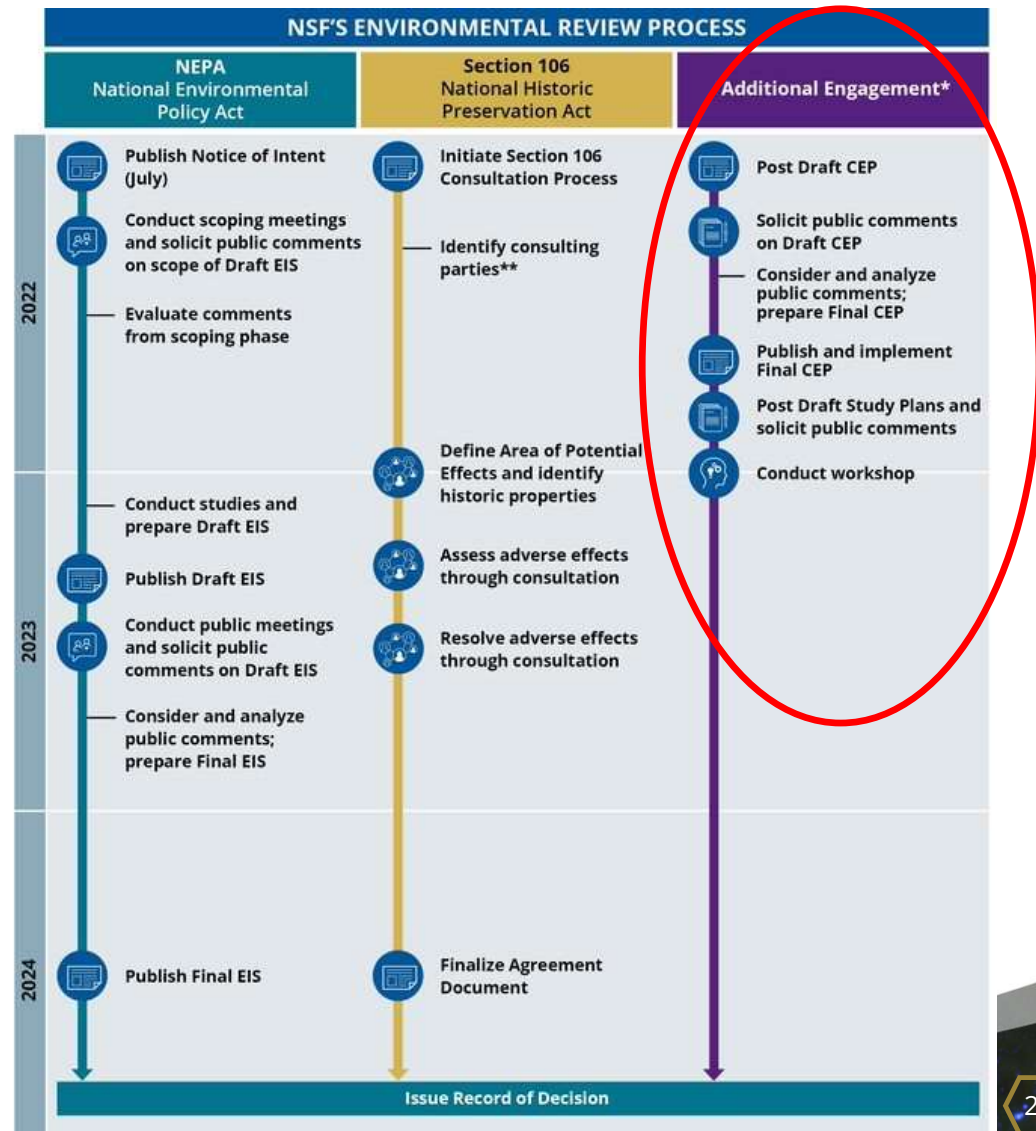
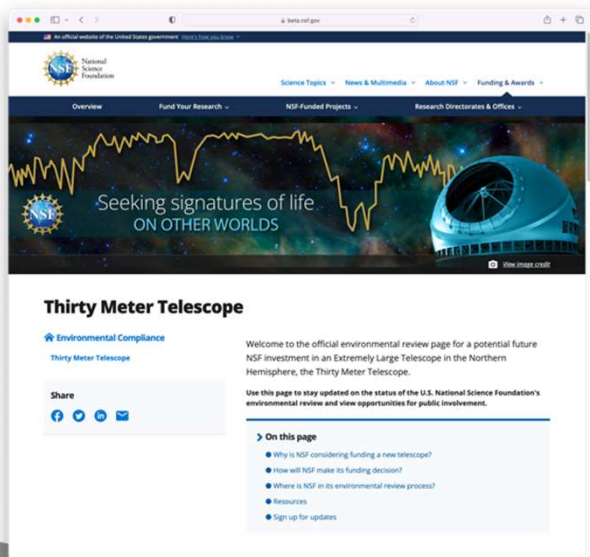
# Astro2020 on Engagement with Indigenous Communities

- For the first time, the Decadal Survey expressly mentioned the need for the astronomy community to engage with Indigenous Peoples potentially impacted by astronomical facilities.
- **Recommendation:** The astronomy community should, through the American Astronomical Society in partnership with other major professional societies (e.g., American Physical Society, American Geophysical Union, International Astronomical Union), work with experts from other experienced disciplines (such as archaeology and social sciences) and representatives from local communities to define a Community Astronomy model of engagement that advances scientific research while respecting, empowering and benefiting local communities.



# NSF's Environmental Review Process

- In 2022 NSF began to seriously consider an investment in US-ELT
- Notice of Intent (NOI) published July 19, 2022
- <https://beta.nsf.gov/tmt>



## Preliminary Proposed Alternatives in NOI

### No Action Alternative

No investment in the construction and operation of an ELT in the Northern Hemisphere

### Action Alternative 1

Investment in the construction and operation of TMT (as the ELT in the Northern Hemisphere) located on Maunakea, Hawai'i Island, Hawaii

### Action Alternative 2

Investment in the construction and operation of TMT (as the ELT in the Northern Hemisphere) located on Maunakea, Hawai'i Island, Hawaii, with an NSF-facilitated plan to define and practice responsible astronomy in Hawaii in partnership with the Mauna Kea Stewardship and Oversight Authority, the Maunakea Observatories, and the affected Hawaiian community

### Action Alternative 3

Investment in the construction and operation of TMT (as the ELT in the Northern Hemisphere) located on the Roque de los Muchachos, La Palma, Canary Islands

*\*These preliminary proposed alternatives will be refined through public input*



# Proposed Additional Engagement Steps

- Draft Community Engagement Plan available for public review through September 17
- Draft Study Plans will be available for a 30-day public review
- Proposed a workshop to be held on defining and practicing responsible astronomy in Hawaii

It became clear to NSF during its Informal Outreach Effort that any environmental review process related to TMT and Maunakea must provide additional, meaningful, and easily accessible opportunities for the widely varying viewpoints on this proposed project to be heard.



Available online at <https://beta.nsf.gov/tmt>







**Public Scoping Meetings:**  
**Environmental Impact Statement for the Potential National Science Foundation (NSF) Investment in an Extremely Large Telescope (ELT) Located in the Northern Hemisphere**

*Maunakea, Hawai'i Island, Hawaii*  
*August 9-12, 2022*



National Science Foundation



# Purpose of the Public Scoping Meetings

- The scoping process is conducted as the **first step in NSF's formal environmental review process** to solicit public comments and identify issues that will be analyzed in an Environmental Impact Statement (EIS).
- NSF welcomes public comments on potential alternatives, information, and analyses relevant to the environmental review.
- The comments received during these meetings will play a key role in
  - (1) determining the list of alternatives to ultimately be evaluated in the Draft Environmental Impact Statement (DEIS);
  - (2) informing the scope of the analysis, including any necessary studies and significant issues to be evaluated in the DEIS; and
  - (3) determining appropriate ways to engage the community in a meaningful and effective manner during NSF's environmental review.



# Public Scoping Meetings – August 9-12

- **NSF:**

- Caroline Blanco
- Dave Boboltz
- Kristen Hamilton
- Karen Pearce
- Elizabeth Pentecost

- **Jacobs Engineering:**

- Michelle Rau
- Madeline Almodovar
- Christina McDonough
- Lori Price
- Richard Manz

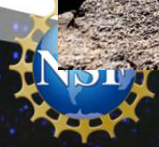
The Team



**Jacobs**



# TMT Site Visit – August 8



# Public Scoping Meetings

## Kona

August 11, 2022

Outrigger Kona Resort & Spa,  
Kaleiopapa Convention Center,  
78-128 'Ehukai St., Kailua-Kona, HI  
96740

## Nā'ālehu

August 10, 2022

Nā'ālehu Community Center  
95-5635 Hawai'i Belt Rd.,  
Nā'ālehu, HI 96772

## Kamuela (Waimea)

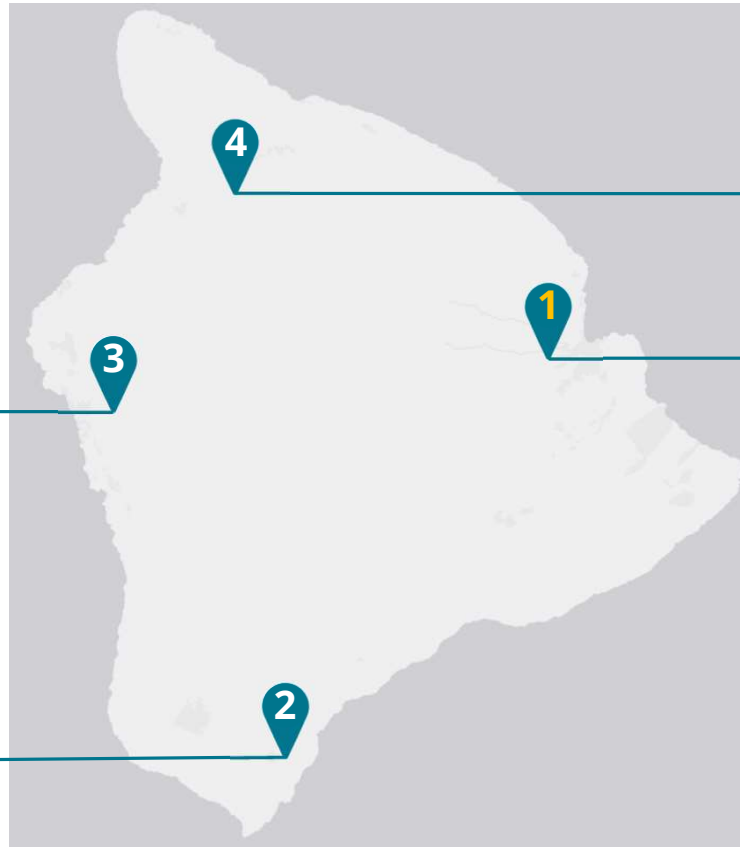
August 12, 2022

Kahilu Town Hall  
67-1182 Lindsey Rd.,  
Kamuela, HI 96743

## Hilo

August 9, 2022

Grand Naniloa Doubletree  
by Hilton Hotel, Crown  
Room, 93 Banyan Dr., Hilo,  
HI 967204







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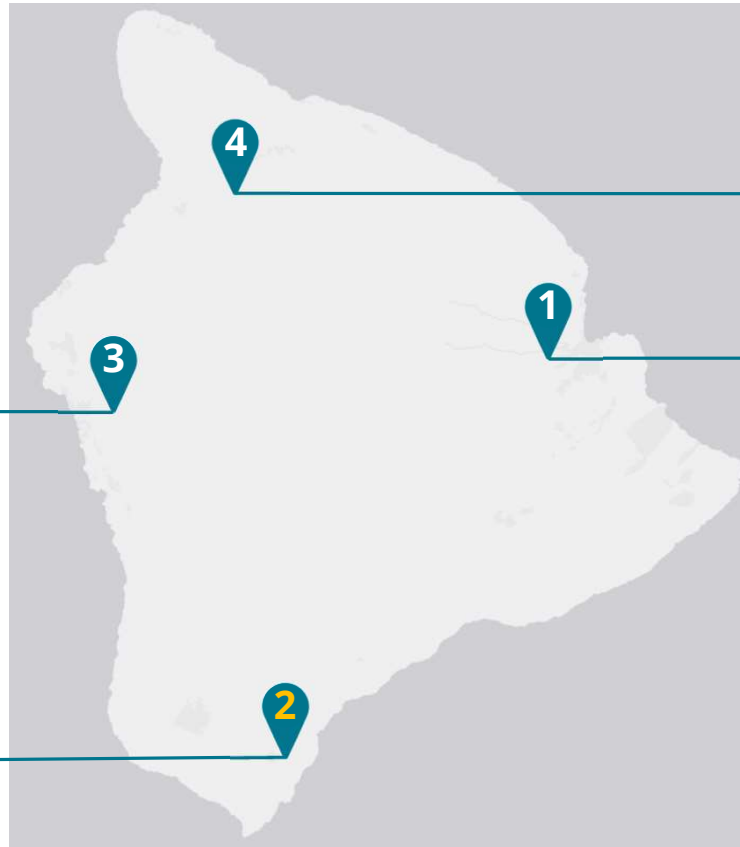
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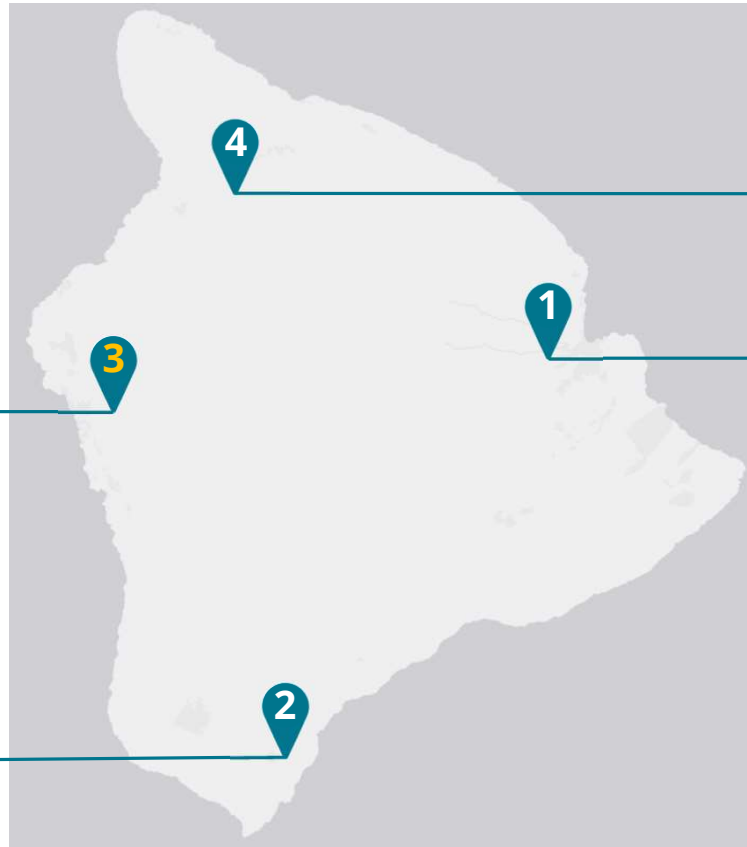




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August 11, 2022  
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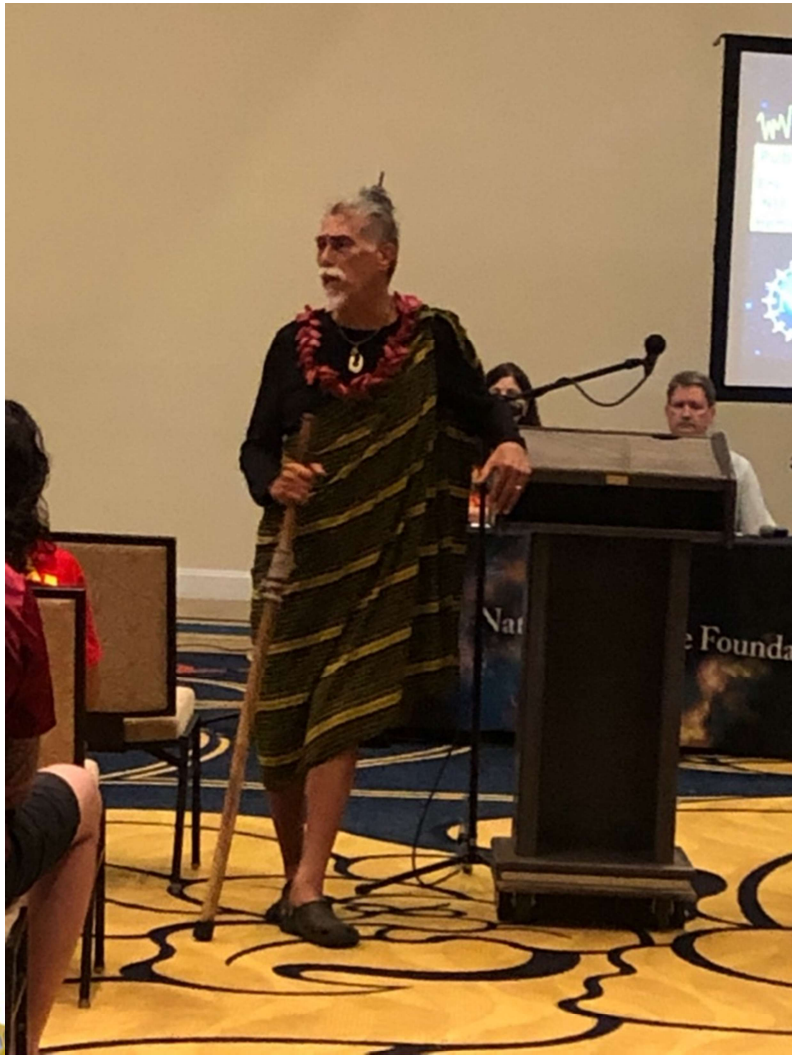


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# Scoping Meetings

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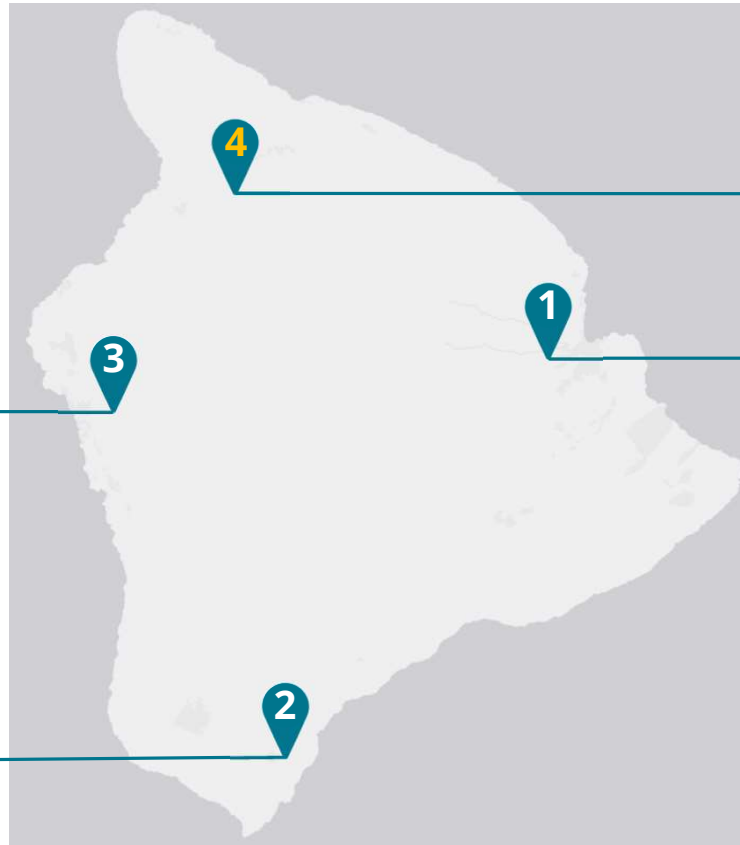
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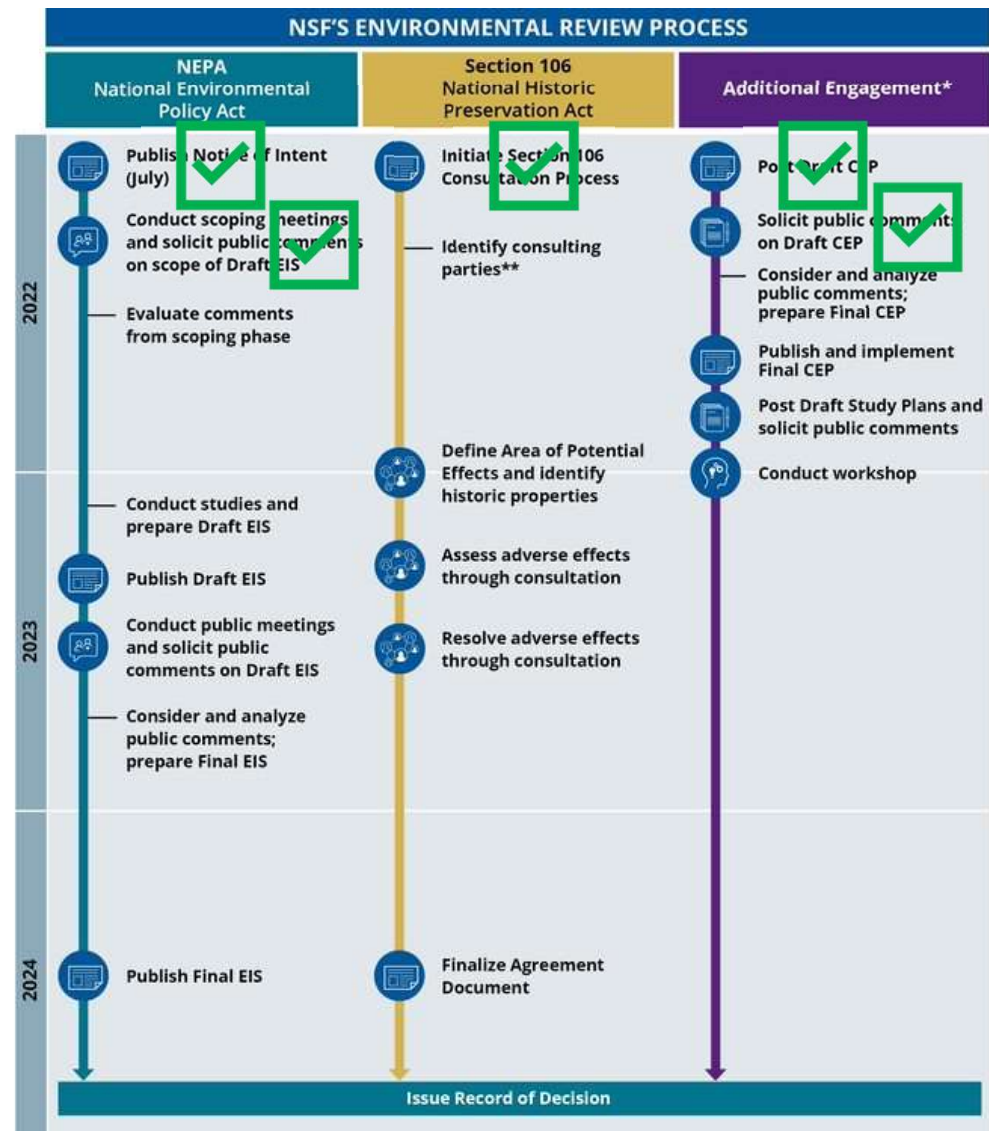






# Next steps in the Environmental Review process

- Public Scoping meetings ended August 12, 2022
- Public Scoping comment period closed September 17, 2022
- Over 1700 comments received via the online form
- Additional comments via e-mail and U.S. mail
- Currently digesting comments and looking at potential self-identified Consulting Parties for Section 106



Questions?



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