

Thirty Meter Telescope – status and update

Michael Balogh

Chair, CASCA/ACURA TMT Advisory Committee

1. CATAC (25 min)
 - Timeline and process – what happens after Astro2020?
 - VLOT landscape
2. Fengchuan Liu, Project Manager (40 min)
 - TMT status
3. Discussion (25 min)
 - Stefi Baum will moderate

CATAC Website: https://casca.ca/?page_id=8347



Canadian LRP

Dec 2020

Recommended Ground-Based Facilities: Large (>\$30M) Investments In Near-Term Projects			
Priority	Project	Anticipated Cost to Canada (New Construction/Operations)	Estimated Operational Date
1	VLOT (TMT) ¹³	TBD ¹⁴ / US\$7M ¹⁵ per year	2033 or later
2	SKA1	Observatory: \$80M ¹⁶ / \$8M ¹⁷ per year SKA1 Regional centre: \$65M ¹⁸ (construction plus ops)	2026 (science verification)

US Astro2020

Nov 2021

Recommendation: The 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, with a target level of at least 25 percent of the time on each telescope. If only one project proves to be viable, NSF should aim to achieve a larger fraction of the time, in proportion to its share of the costs and up to a maximum of 50 percent.

CASCA/ACURA statement (Nov 2021)

Unless the TMT project has consent from the Native Hawaiians, Canada’s astronomical community cannot support its construction on Maunakea.

So what happens now?

Construction has not restarted

TMT is technically mature, but construction requires:

- Significant additional funding
- A site with both the legal right to construction and the support of the local community

Astro2020 recommendation was a necessary step to enable NSF partnership in the US ELTP (TMT, GMT, NOIRLab).

- 25% participation by NSF in TMT would alleviate the funding shortfall and (together with site assurance) give the stability needed to secure any remainder
- The rigorous federal review process, together with ongoing engagement in Hawai'i (see more from Fengchuan in a moment), are important steps on the path to site selection.



NSF process

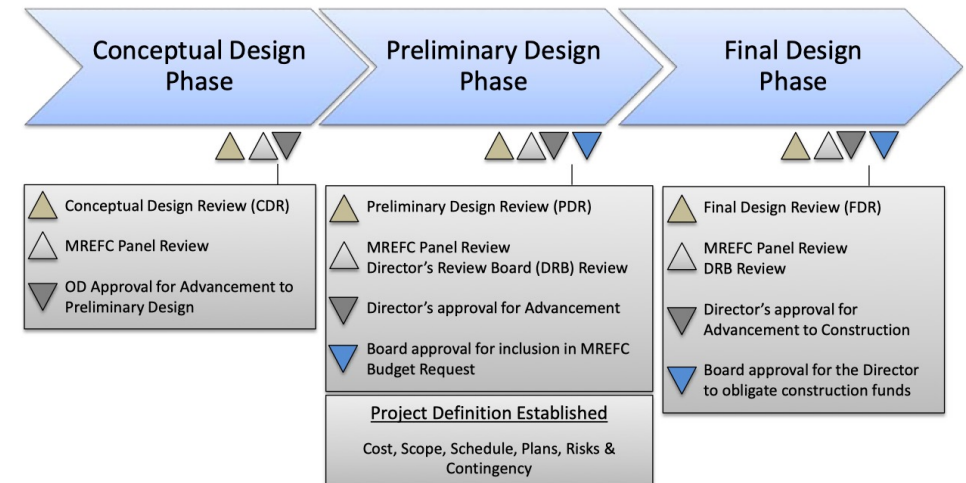
NSF to decide whether or not to accept the US-ELTP into the MREFC (Large Facilities) queue, on recommendation from NSF Director.

- This has not happened yet. Not necessarily unusual for such a large, complex project

If accepted, it will trigger a well-defined procedure that includes:

- Environmental and cultural impact statements
- Project reviews:
 - PDR, including a proposed governance model (that will affect cost)
 - FDR, including a final Cost review
- Funding request

Figure 2.1.3-2 Progressive Phases in the Life Cycle Design Stage, showing review and decision points for advancement to the next phase and NSB approvals for budgeting and award.





NSF: Environmental Considerations

- NSF's funding for the construction or modification of facilities constitutes a Federal Action that triggers compliance with:
 - the National Environmental Policy Act (NEPA)
 - the National Historic Preservation Act (NHPA)
 - the Endangered Species Act.
- The National Historic Preservation Act ([NHPA](#)) and the National Environmental Policy Act ([NEPA](#)) are two separate laws which require federal agencies to “stop, look, and listen” before making decisions that impact historic properties and the human environment.
 - NEPA compliance will require a federal Environmental Impact Statement (EIS).



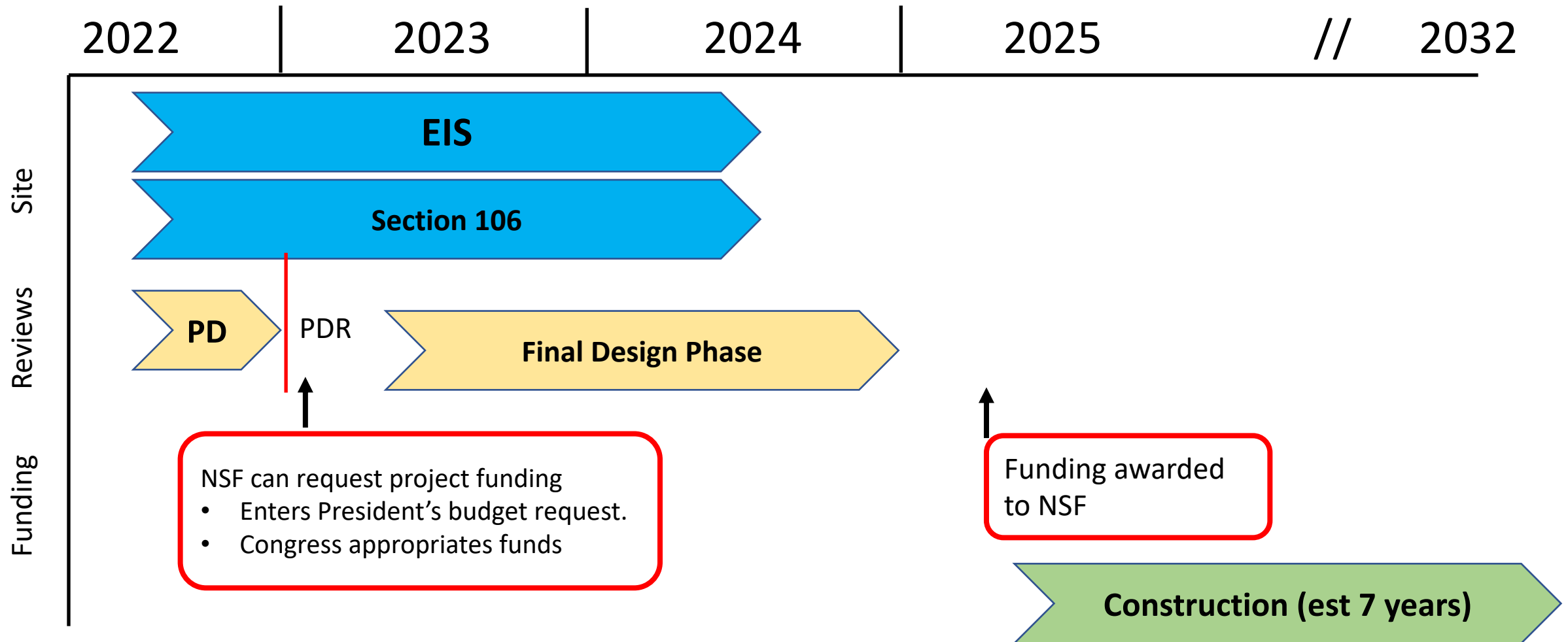
The National Historic Preservation Act

Section 106 of the NHPA requires federal agencies to take into account the effect of undertakings they carry out, license, approve, or fund on historic properties

- agencies identify historic properties, assess effects to historic properties, consider alternatives to avoid, minimize, or mitigate any adverse effects, and document their resolution.
- Agencies are required to facilitate a stakeholder engagement process known as consultation – discussing and considering the views of consulting parties, including State Historic Preservation Officers (SHPOs) and/or Tribal Historic Preservation Officers (THPOs), Indian tribes, Native Hawaiian organizations, and others, while also providing opportunities for public input.

Timeline estimation (optimistic)

Assuming the USELTP enters the MREFC queue soon:



Alternative sites

Failure to find a path forward on Mauna Kea is a significant risk. A secured site will be required for the final cost analysis and FDR.

Could another site be considered?

ORM, La Palma

- Construction permit for ORM was rescinded after successful appeal by Ben Magec (environmental group)
 - Appeal process underway. Awaiting publication of decision
- There are motivated environmental groups opposing TMT on La Palma. Has its own set of complexities environmental/political/social etc
- Not clear if NSF would partner. Need a congressional champion.

What about a site in Chile?

- A key element of US-ELTP is access to both hemispheres for the US community

Who makes the decisions?

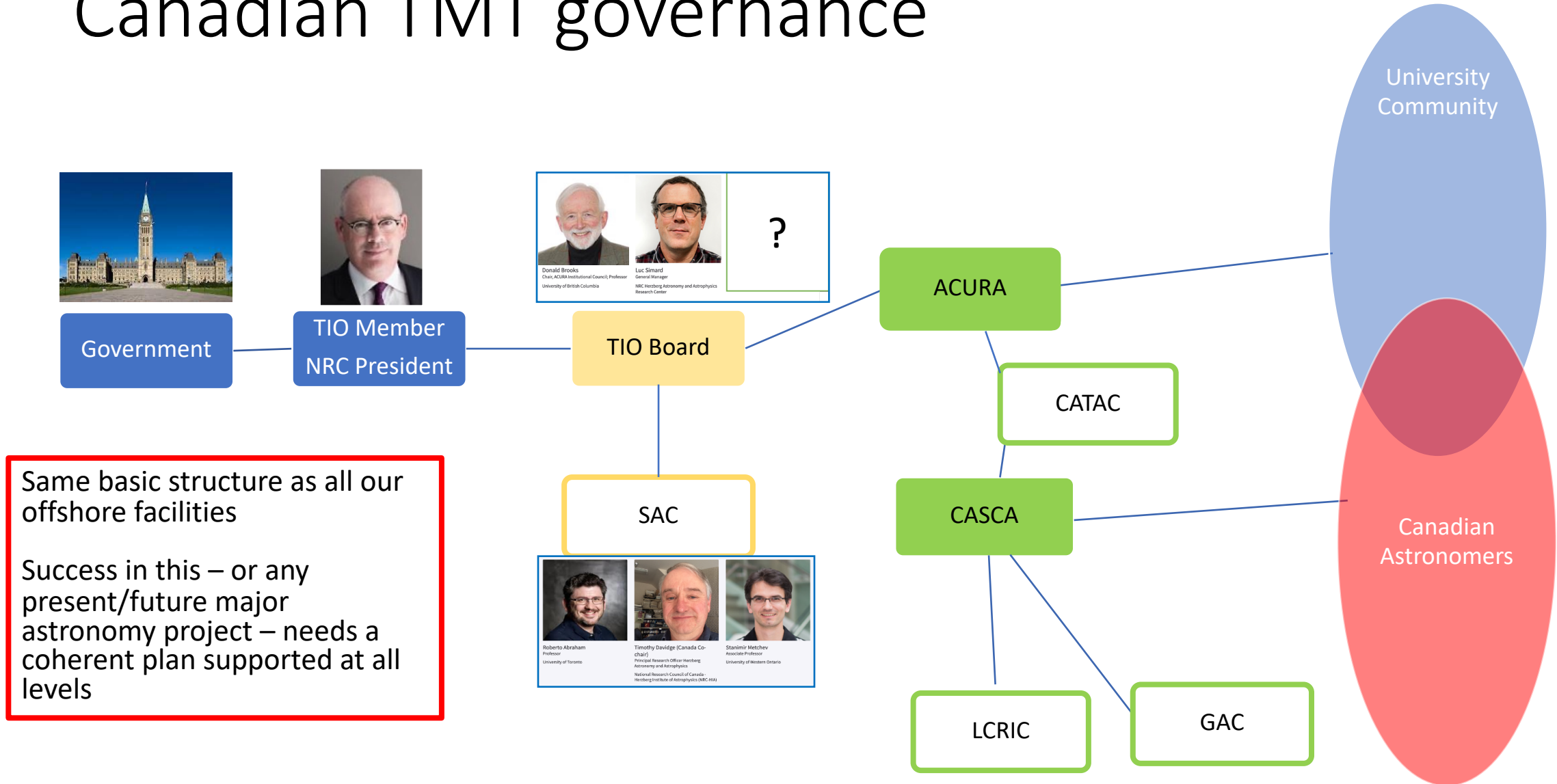
TMT International Observatory is a corporation with international partners:



The partners are signatories to the Master Agreement.

- A member cannot withdraw from agreement without significant financial compensation to other members
- Agreement can be changed or dissolved only with unanimous approval from all partners

Canadian TMT governance



The VLOT Landscape

The US Extremely Large Telescope Program

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GMT

- 8 US Universities and science institutions
- KASI (Korea)
- Weizmann Institute
- ANU/AAL
- FAPESP (Brazil)

TMT

- National participation: Canada, India, China, Japan
- University of California and Caltech



NOIRLab

Many uncertain elements

- Will NSF accept the proposal?
- Will sufficient funds be available?
- What will be the impact on governance?
- Could TMT be built on another site?
- What will be the impact on instrumentation planning?
- What will be the impact on operations?
 - NOIRLab is developing software systems that will be critical for operations

The US Extremely Large Telescope Program

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2017

2022

2024

2025

2027

2030

2032

2035

Expect NSF to launch formal, comprehensive Preliminary Design Review.

Final Design Review

Earliest possible construction start

Earliest possible date of first light (IRIS+NFIRAOS)

Construction start + 10 years

Construction start

Technical first light

First four instruments commissioned and ready for science three years after TFL

May see first post-FL instruments appear

2017

2022

2024

2025

2027

2030

2032

2035

Community input

- CATAC is always available to hear your opinions or to answer your questions (or redirect them appropriately). Email mbalogh@uwaterloo.ca
- Look for CATAC updates in every edition of eCassiopeia. Links to these, as well as our regular reports to CASCA and ACURA Boards, are all available on https://casca.ca/?page_id=8347

Please consider attending the TMT Science Forum in Vancouver June 18-21, 2023



TMT status

Project Manager Fengchuan Liu



Extra slides

Early light instrumentation

See most recent CATAC report to the CASCA/ACURA Boards for an update to our 2019 instrumentation report.

	Type of Instrument	TMT	GMT	E-ELT
Optical	Multi-Object Spectrometer	WFOS Preliminary Design	GMACS <i>Preliminary Design</i>	
	High-resolution Spectrometer		G-CLEF Fabrication	ANDES <i>Phase A</i>
Near-IR	AO-assisted Imager	IRIS Final design	GMTIFS <i>Preliminary Design</i>	MICADO Final design
	IFU spectroscopy			HARMONI Final design
	AO-assisted Echelle Spectrometer	MODHIS <i>Conceptual design</i>	GMTNIRS <i>Preliminary Design</i>	ANDES <i>Phase A</i>
Mid-IR	AO-assisted Echelle Spectrometer			METIS Final design

Instrumentation

