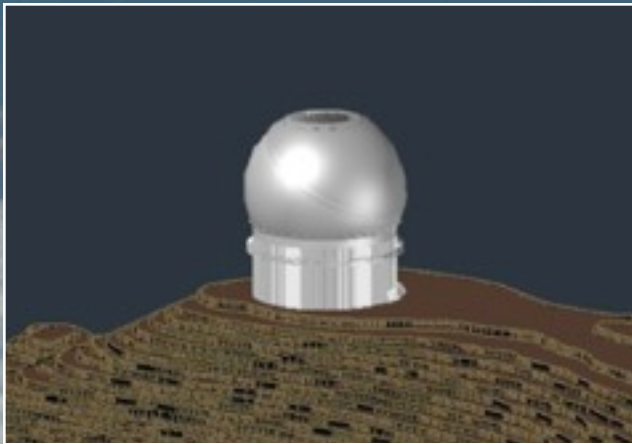


The Next Generation CFHT *

Alan McConnachie

NRC Herzberg Institute of Astrophysics
Victoria, Canada

**This name will change!!!*



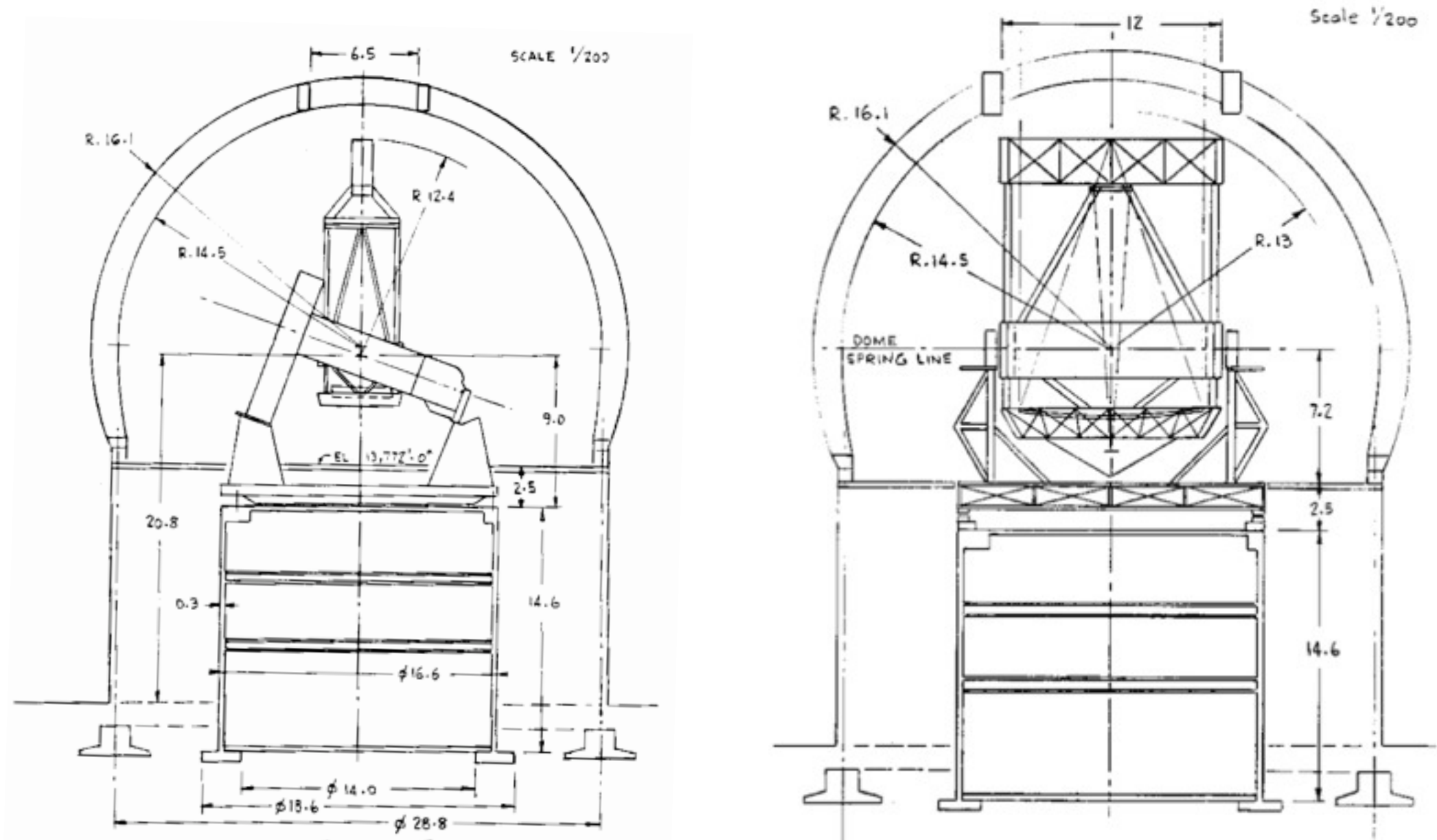
NGCFHT: the idea

- NGCFHT is an ambitious proposal that began as a grassroots, science driven movement in late 2010 (originally conceived during the Canadian LRP2010 process). Concept introduced to the CFHT community at the 2010 Users Meeting in Taipei

- **Create a new and expanded partnership to**

- replace the existing 3.6m telescope with a 10m-class telescope, mounted on the existing pier and within the current 3D envelope of the current dome
- install a dedicated wide-field (1.5 sq.deg) multi-object spectrograph that can simultaneously collect spectra for more than ~300 sources
- do this by the early 2020s and immediately begin spectroscopic surveys

Upgrading CFHT is not a new idea
(1990s: Canada, France TMT/EELT precursor studies)



2011-12 Feasibility Studies I. Science

Download full report at <http://ngcfht.org>

SWGs formed spanning 10 science fields, including 60+ scientists from Canada, France, Hawaii, Australia, Brazil, China, India, Japan, Rep. of Korea, Taiwan, USA



1. Exoplanets

- Magali Deleuil (Lab. d'Astrophysique de Marseille, France)
- Francois Bouchy (IAP, France)
- Ernst de Mooij (Toronto, Canada)
- Norio Narita (NAOJ, Japan)

2. The Interstellar Medium

- Rosine Lallement (GEPI/Observatoire de Paris, France)
- Patrick Boissé (Institut d'Astrophysique de Paris, France)
- Ryan Ransom (Okanagan College, DRA, Canada)

3. Stars and Stellar Astrophysics

- Kim Venn (University of Victoria, Canada)
- Katia Cuhna (NOAO, USA)
- Patrick Dufour (Montreal, Canada)
- Zhanwen Han (Yunnan Observatory, China)
- Chiaki Kobayashi (ANU, Australia)
- Rolf-Peter Kudritzki (IfA, Hawaii, USA)
- Else Starkenburg (Victoria, Canada)

4. Milky Way Structure and Stellar Populations

- Piercarlo Bonifacio (GEPI, France)
- Nobuo Arimoto (NOAJ, Japan)
- Ken Freeman (ANU, Australia)
- Bacham Eswar Reddy (IIA, India)
- Sivarani Thirupathi (IIA, India)

5. The Local Group

- Alan McConnachie (HIA, Canada)
- Andrew Cole (Tasmania, Australia)
- Rodrigo Ibata (Strasbourg, France)
- Pascale Jablonka (Observatoire de Paris, France)
- Yang-Shyang Li (KIAA, China)
- Nicolas Martin (Strasbourg, France)

6. Nearby Galaxies and Clusters

- Michael Hudson (University of Waterloo, Canada)
- Richard de Grijs (KIAA, China)
- Simon Driver (ICRAR, Australia)

6. Nearby Galaxies and Clusters (cont'd)

- Eric Peng (Peking University, China)
- Yen-Ting Lin (IPMU, Japan)

7. Galaxy Evolution

- Michael Balogh (University of Waterloo, Canada)
- Sebastien Foucaud (NTNU, Taiwan)
- Damien Le Borgne (IAP, France)
- Karl Glazebrook (Swinburne, Australia)
- Lihwai Lin (ASIAA, Taiwan)
- Changbom Park (KIAS, South Korea)
- Swara Ravindranath (IUCAA, India)
- Marcin Sawicki (St. Mary's, Canada)
- Luc Simard (HIA, Canada)

8. The Intergalactic Medium

- Céline Péroux (Lab. d'Astrophysique de Marseille, France)
- James Bolton (Melbourne, Australia)
- Sara Ellison (Victoria, Canada)
- Raghunathan Srikanth (IUCAA, India)

9. QSOs and AGNs

- Pat Hall (York University, Canada)
- Len Cowie (IfA, Hawaii)
- Scott Croom (Sydney, Australia)
- John Hutchings (HIA, Canada)
- Patrick Petitjean (AIP, France)
- Thaisa Storchi-Bergmann (UFRGS, Brazil)
- Ting-Gui Wang (USTC, China)
- Chris Willott (HIA, Canada)
- Jong-Hak Woo (Seoul, South Korea)
- Xue-Bing Wu (Peking University, China)

10. Cosmology and Dark Energy

- Jean-Paul Kneib (Lab. d'Astrophysique de Marseilles, France)
- Carlo Schmid (LAM, France)
- Charling Tao (CPPM, France and Tsinghua, China)
- Martin Makler (Rio de Janeiro, Brasil)
- Keiichi Umetsu (ASIAA, Taiwan)

2011-12 Feasibility Studies I. Science

Download full report at <http://ngcfht.org>

	ISM	Stellar Astrophysics	Milky Way / Galactic Archaeology	Local Group

For maximum scientific impact, the facility must be able to obtain efficiently very large numbers ($>10^6$) of low- ($R \sim 2\,000$), moderate- ($R \sim 6\,500$) and high-resolution ($R \sim 20\,000$) spectra for faint ($20 < g < 24$) science targets over large areas of the sky ($10^3 - 10^4$ sq.deg) and spanning blue/optical to near-IR wavelengths ($0.37 - 1.3\mu\text{m}$).

At the highest resolutions, it should have a velocity accuracy of $<\sim 1$ km/s.

At low resolution, complete wavelength coverage should be possible in a single observation.

Other notes	Early-type stars preferred	Time resolved spectroscopy of Kepler fields (115 sq. degrees)	RV accuracy to match that of Gaia transverse velocities at the faint end. Extension to NIR and higher resolution desirable for bulge science	Foreground contamination likely high in outer regions of galaxies (identify gravity sensitive features)
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2011-12 Feasibility Studies II. Technical

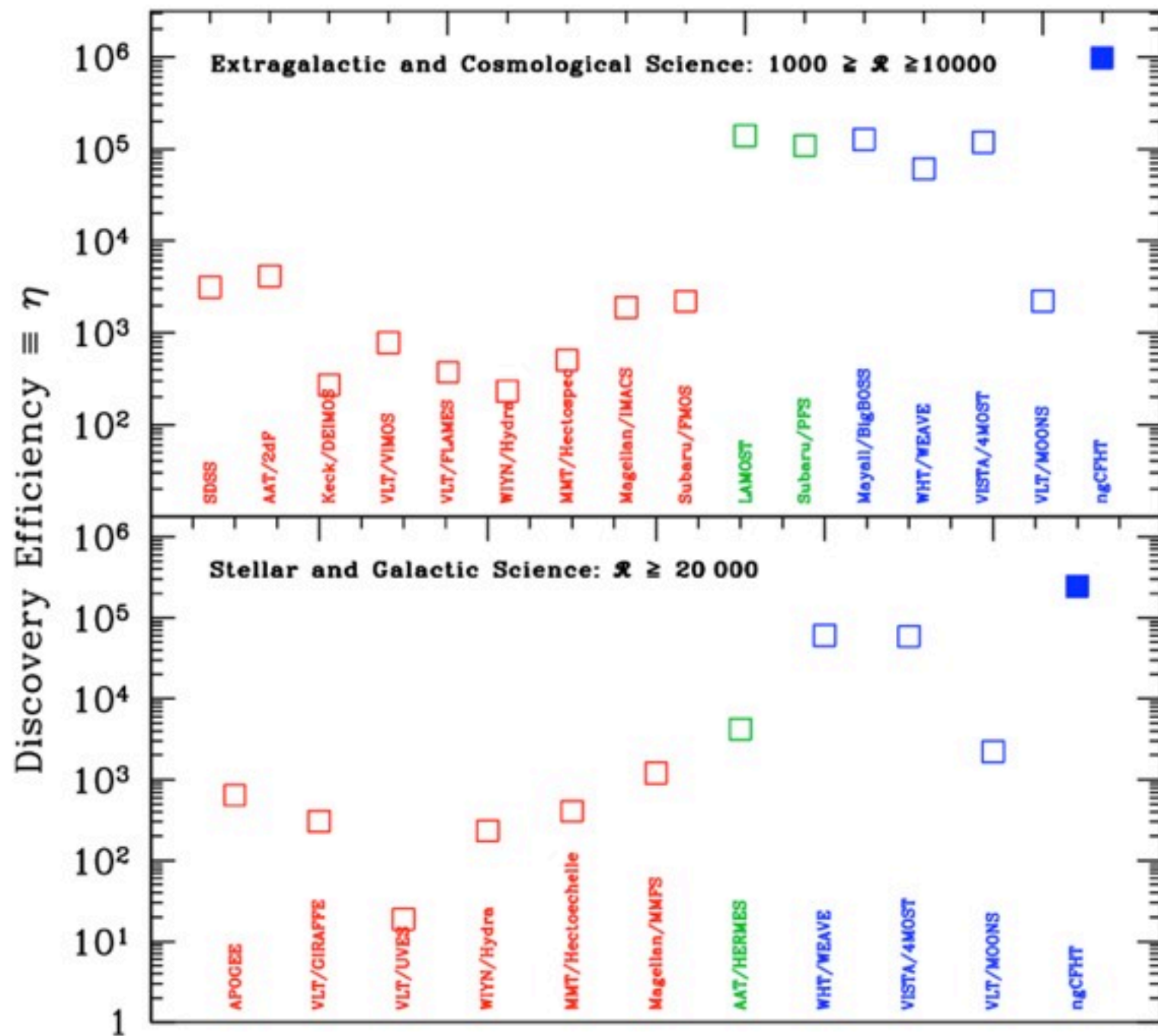
Download full report at <http://ngcfht.org>

1. **Load capacity** studies of telescope and enclosure piers.
2. **Telescope and enclosure** configuration studies.
3. **Aero-thermal** study.
4. **Telescope optical designs**.
5. **Spectrograph conceptual designs**.
6. Telescope **downtime** study (deconstruction and construction).
7. **Cost, schedule** and development plan.

Primary Outcomes

- Redevelopment could utilize the existing pier and building with only minor modifications.
- The conversion would not increase the visual footprint of CFHT on Mauna Kea.
- **No technical “show stoppers” with the telescope, enclosure, spectrograph, fibre-feed system, or operations model.**

$$\eta \equiv D_{M1}^2 \Omega N_{\text{mos}} f / IQ^2$$



Cost breakdown (including contingency)

Item	Cost (\$M)
design and management	10
M1 optics	10
M1 support system	5
wide field corrector	10
software and control	12
<i>25%-30% contingencies on above items</i>	12
removal of telescope and dome	6.6
enclosure pier structural upgrade	2.7
telescope structure	30.8
enclosure	28.1
facility redevelopment & commissioning	10
spectrograph system	76.1
Total	206.3

Feasibility Studies submission and availability

Feasibility studies submitted to CFHT SAC and Board for review in their Fall 2012 meetings

Science Feasibility Study (131 pages)

Technical Feasibility Study (273 pages)

Available for download at <http://ngcfht.org>

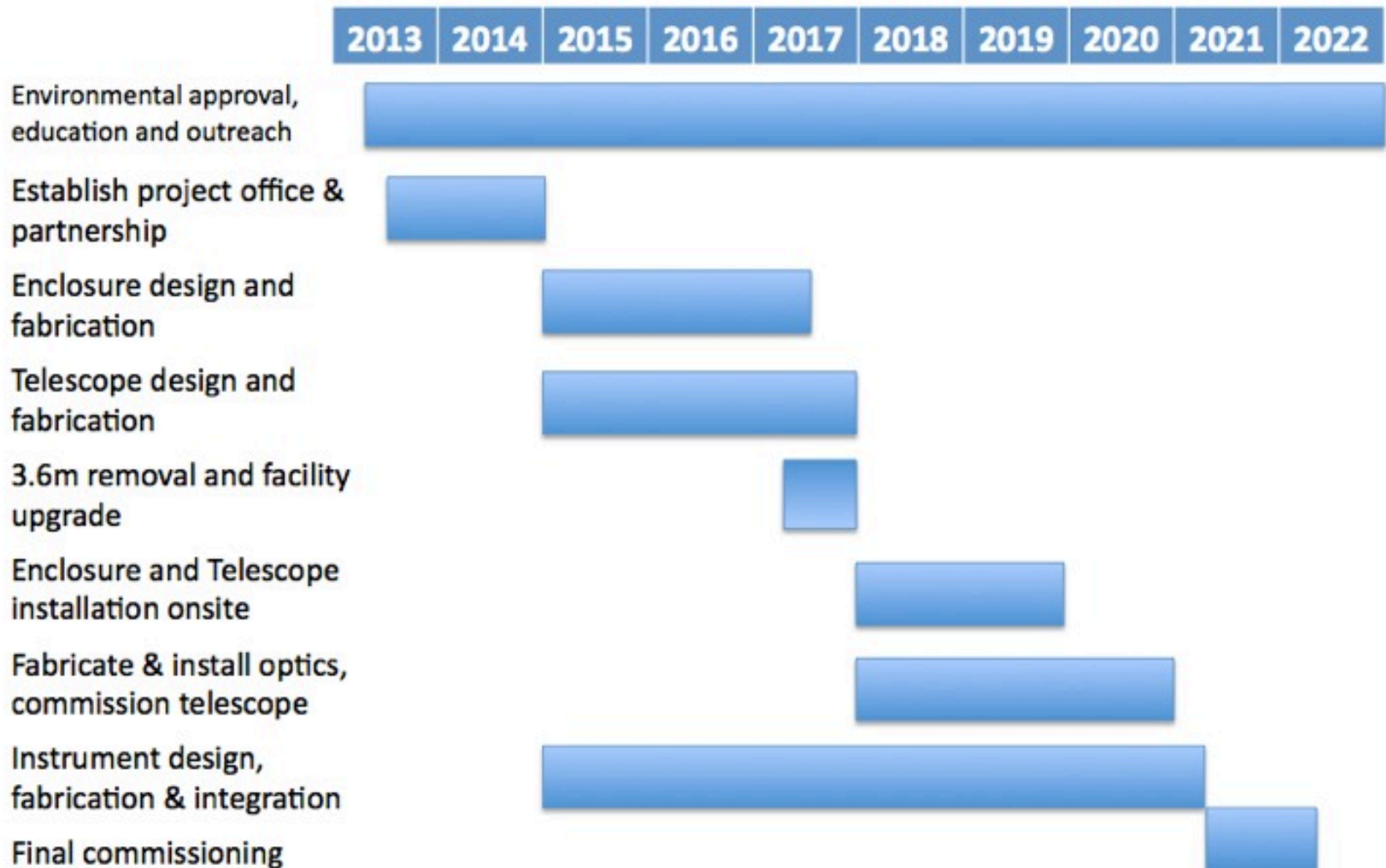
“The envisioned facility would meet the outstanding need for dedicated, wide-field, large-aperture spectroscopic follow-up of the various large-scale imaging surveys now in the implementation or planning stages. Although the present CFHT Corporation would not be able to fund such a major upgrade to the observatory, the SAC recognizes that the proposed science is of the highest quality and that many transformational studies would be enabled by such a facility.”

“The Board agreed that the ngCFHT concept offers a viable, scientifically exciting, possible future for CFHT and affirms its willingness to pursue the expanded partnership that would be necessary to follow this long-term transformative goal. The establishment of an ngCFHT Project Office at CFHT is a matter that will be considered among other possible uses of available development resources arising from the 2013 Users Meeting.”

A3. Development Schedule Considerations



Technical schedule stemming from previous slides



The ngCFHT Workshop

27-29 March 2013, Hilo, Hawaii



Workshop webpages at <http://ngcfht.cfht.hawaii.edu/>

See also <http://ngcfht.org>

~100 participants; *majority were not previously involved in the feasibility studies*

Broad international and scientific interests reflected particularly well in diverse range of presentations (available for download)

Workshop outcomes and next steps

- Scientific and technical development of the ngCFHT project was discussed, science cases and survey scenarios were presented, and discussion was initiated on the formation of an expanded partnership
- Confirmed broad scientific appeal of facility (phew!)
- **Baseline facility meets science needs** - surprisingly few modifications to requirements suggested
 - 10m aperture considered minimum that meets science requirements
 - strong interest in investigating possibility of an additional R~45K mode
- **The timely establishment of a Project Office in Waimea emerged as a clear priority (indeed, a necessity) for the continued development of this project and the new partnership**
- Learned that several of the communities represented at the meeting are starting to develop strategic plans for the near and medium term
- **Clearly important that people within all communities who want to be part of the ngCFHT facility help publicize and advocate the project during this crucial period**

2013

- On-going: visits and discussions to continue negotiations and develop details of new partnerships
- **May 6-8: CFHT Users Meeting on Vancouver Island**
 - consider attending and supporting ngCFHT
- October: Plans afoot for technical meeting
 - to exchange concepts and ideas among potential partners
 - discuss possible interests in technical development of ngCFHT
 - stimulate collaborations
- Commence discussion of work shares
- Start building project team
- **Essential to set-up project office within next 6 months - 1 year (~1.25 - 1.75M per year while partnership forms)**

More information

<http://ngcfht.org>

including download full science and technical feasibility studies, plus all workshop presentations

More details on recent workshop: <http://ngcfht.cfht.hawaii.edu>

Partnership (informal letters of interest are encouraged!)

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