Welcome

- First TMT Forum: gathering of broad scientific communities of the TMT partner countries
  - Revisit the science potential of the TMT
  - Strengthen the partnership through new forming astro-aquaintances and renewing old ones
  - Generate excitement for the vast potential of the TMT
  - Particular welcome to the members of the broader US (beyond UC, Caltech and Yale) brought to the meeting via the NSF-TMT Cooperative Agreement to investigate potential future partnership in TMT by the NSF

Welcome II

- Speakers: get your talks to Tony
- Posters: we have 23 excellent posters available for both days of the meeting
- Lunch: on the upper deck
- Dinner: on your own
- Wireless:


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TMT Operations

Scientist Perspective

TMT Forum

22 July 2013

Waikoloa, HI

TMT Operations Model Planning Process

- Initial plan developed and costed by Project based on Chile site
  - Direct science support
  - nuts and bolts ops
  - development of new capabilities

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TMT Operations Model Planning Process

- Fall 2010, Board established a TMT Ops Discussion Group to:
  - Bring all the partners up to speed with and into the planning process
  - Raise the priority of establishing details of the operations plan in anticipation of TMT proposals going to funding agencies
  - Improve the costing of the operations model
- M. Bolte (UC and Chair)
  - Peter Gray (TMT)
  - Eric Peng (China)
  - Judy Cohen (Caltech)
  - Tomonori Usuda (NAOJ)
  - Ram Ramaprakash (India)
  - Tim Davidge (Canada)

TMT Operations Discussion Group Activities

- Ops Plan was developed and documented over 8 months 2010/11
  - Peter Gray visits to Keck, Gemini, E-ELT and Subaru operations people
  - Initially the plan and cost as a mix of bottom-up and comparison with Keck costs, moving toward larger and larger fraction of bottom-up
  - Kim Gillies came on board has been taking a larger and larger role in estimating software efforts
  - Working to translate plans into requirements
- Extensive discussions in three SAC meetings
- Significant policy issues brought to TMT Board
- Brought all these activities together to produce a TMT Level 1 document that was subject of June 2011 External Review

Operations Review

- Excellent committee
- Thorough review
- Thoughtful report
- “deliberately lean”
- Report highlights (science support)
  - Diverse community considerations
  - Data pipelines may be underscoped
  - Need to address visitor instruments
  - Need to have ToO policy
  - Need to resolve available instrument issue
  - Data archive may suffer from lack of QA
  - Observatory metrics program is important

TMT Ops Principles/Model

- TMT Observatory operates on behalf of the partners: it will not be a standalone scientific center
- Partners control their time
  - Each partner will run independent time allocation process and provide TMT Obs with list of PIs/programs/acceptable calendar window
- TMT will provide full suite of proposal preparation, pre-observing, observing and post-observing support tools
- Multiple instruments can be scheduled for a single night (pre-defined)
- Flexibility to accommodate conditions-based observing will be facilitated on PI and Partner levels
  - The capability for a conditions-based, TMT-wide adaptive queue will be enabled, but not implemented in the early years of operations
- Cadence observations will be accommodated by scheduled service observing nights
- Target of Opportunity observations will be accommodated across the partnership

Astronomer Level Services

- Instrument/telescope simulators for proposal preparation. Exposure time and overheads planning. Technical feasibility provided by TMT
- Full scripting capabilities for night-time observing
- Instrument/telescope status and performance data will be monitored and posted
- Support Astronomer liaison assigned for each run
- Instrument teams provide quicklook reduction software, TMT maintains software
- TMT-standardized and maintained full-remote and evesdrop software available for remote observing
- Searchable archive of raw observations, headers and metadata maintained on line. Auto association with appropriate calibration data sets.

Observing Modes

- Classical Observing by Principle Investigator (PI)
  - PI operates the *instruments* & executes the observations directly
    - Fully capable mainland observing stations will be an option as will observing from Hilo TMT Headquarters
  - Observing Assistant operates telescope & AO/LGS systems
  - Support Scientist available for answering pre-observing questions, startup and night-time support
  - Use of multiple instruments per night (including for backup programs) is allowed and part of semester scheduling
    - Tools provided for PI- or partner-run “adaptive queue”

Observing Modes

- Service Observing by TMT Support Astronomers
  - Observations on behalf of PIs from combined list of observing blocks from all partners.
  - Schedule is fixed.
  - May be most useful for combining cadence observations from different programs.
  - Will be most useful if all partners participate allowing best combinations of programs to be scheduled in terms of common calibrations and optimizing observations over moon phase and airmass

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Facility renewal

- In operations: $750k facility refurbishment plus $500k per year for instrument improvements (new gratings, filters, etc.)
- New instruments/major upgrades planning
  - Project has a document under development defining selection and development process
  - Board policy questions:
    - TMT partner preference for instrument contracts
    - Instrument team incentives (time and $)
    - Assignment of value for externally-funded projects
- $21M/year (FY10) for “Detailed Science Case Suite”
  - $12M/year of this that is an obligation of partners

Data Processing/Archive updates

- All instruments delivered with standard data reduction software pipelines
  - TMT maintains after delivery with assistance of instrument builders
  - TMT supports community-led development & enhancement
- Data pipelines used during observing for quick-look
  - also provide quality control checks to monitor telescope & instruments
- TMT Data Archive
  - main system used by observers to retrieve their science data
  - searchable with associated metadata and calibration frames
  - science data accessible to public after proprietary period
    - Partner agreement is 18 months. Sub-set of metadata available earlier
  - archive hosted under contract with partner in off-island location (operations budget line item $300K/yr.). Or could be established in Hawaii & run by TMT
  - reduced data products (2D spectra, etc.) kept in TMT Archive & associated with data

User Support
Workshops & Training Courses

- TMT Support Astronomers (SA) provide direct assistance to TMT observers before, during & after observing run
  - each PI-Directed observer assigned a SA to guide process of preparing for observing run, followed by real-time assistance while observing as required
  - interaction in preparing information for service observations, possible eavesdropping during the scheduled service observing & data distribution
- TMT would work with partner institutions to provide assistance and training to new potential observers during proposal preparation stage
  - help organize joint workshops & training sessions for astronomers from partner countries to communicate the capabilities & status of TMT & its instruments
  - technical tutorial sessions: imaging, spectroscopy, data reduction, TAC process, etc
- Assistance during proposal preparation stage via a Helpdesk, FAQ & active updates to telescope/instrument information web pages

Instrument Simulators

- TMT will provide a comprehensive suite of software simulators for its instruments to assist observers to prepare for observing
- Users provided with simulators at proposal stage e.g. exposure time calculators to determine the feasibility of their proposed observation
  - simulations done for different seeing and sky conditions under a range of parameters such as instrument aperture size, slit widths, detector readout formats and modes
- Training for new users. Option to allow simulator to mimic a real observation with an actual instrument GUI interface exactly as will be seen during observing
  - new users more familiar with the observing process before arriving at the telescope & able to observe more efficiently
  - experienced users benefit from refresher sessions on instrument operation & any new features which may have been added to the observing interface

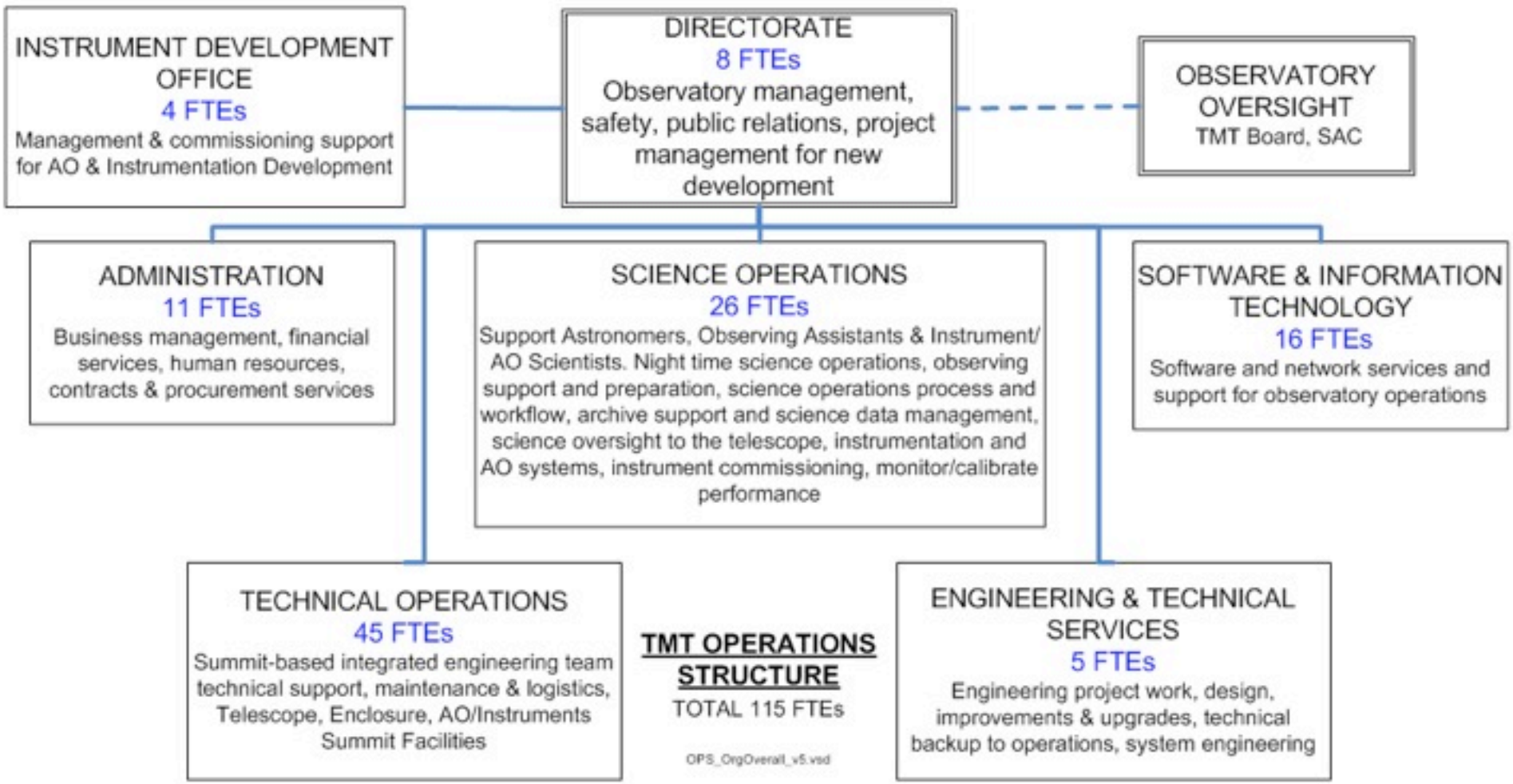
Target of Opportunity ToO

- A Target of Opportunity process will be included in TMT Operations
- TMT has ability to rapidly acquire objects & switch quickly between instruments
  - up to eight instrument are available, but 3-4 instruments will be scheduled to be fully prepared and supported on any planned night
- Challenges to include the capacity to override observations
  - PI-Directed Mode: partners agree to have their observers give up to a predetermined amount of time on any one night. All partners must agree.
    - time used deduced from partner share next semester at 1.5x rate
  - Service Mode: more challenging to schedule

Observatory Metrics

- Operations review recommendation:
  - "appropriate metrics for the benchmarking of the operational efficiency, and the foreseeable impact of its possible improvements"
- Propose to track usual observatory metrics:
  - weather loss, technical downtime, shutter open time, etc.
  - use similar criteria as used by other major observatories, no standard exists
- Observing software will accurately track & log time spent on each observation and observing sequence. Logging such things as:
  - Slew time, acquisition, guiding, integrating, read-out & instrument configuration
  - See: http://www2.keck.hawaii.edu/inst/metrics/
  - metrics used to monitor & refine performance of telescope/instruments/process
  - assess potential future efficiency improvements & enhancements

TMT Operations Organization



Operations Cost Estimate

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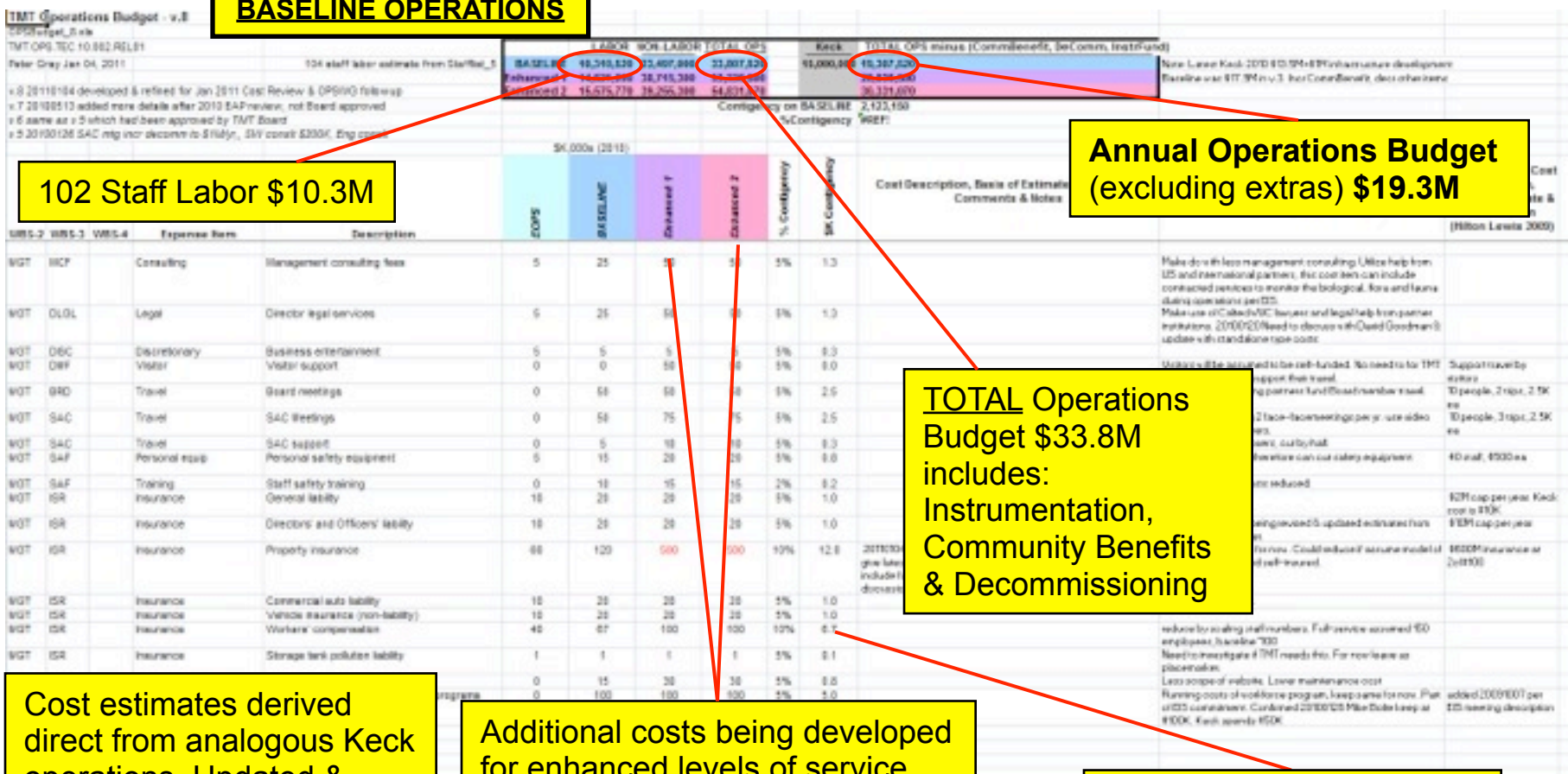
BASELINE OPERATIONS



102 Staff Labor $10.3M

Annual Operations Budget (excluding extras) **$19.3M**

TOTAL Operations Budget $33.8M includes: Instrumentation, Community Benefits & Decommissioning

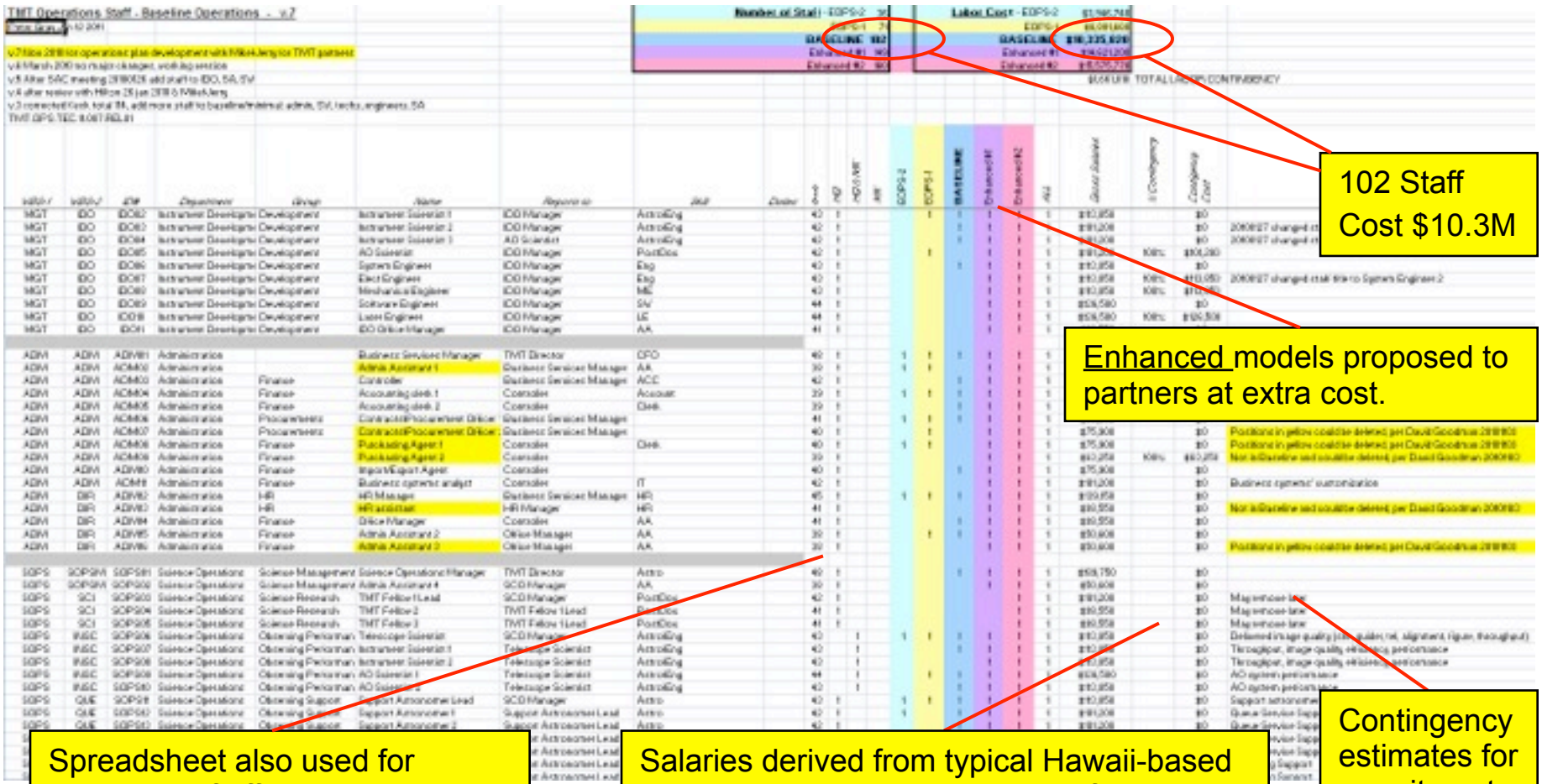
Cost estimates derived direct from analogous Keck operations. Updated & scaled for TMT operations

Additional costs being developed for enhanced levels of service

Contingency Estimates for each operations cost item

Operations Staff Labor Costs

EXAMPLE SPREADSHEET TOOL



102 Staff Cost $10.3M

Enhanced models proposed to partners at extra cost.

Contingency estimates for recruitment salary

Salaries derived from typical Hawaii-based observatories. Includes details of individual benefits loadings (summit allowance, etc.)

Spreadsheet also used for estimates of office space, summit facility, transportation, etc.

Key Projects

- With the current Ops principles, any cross-partner collaborations would have to grow organically
- Programs that require a large number of nights are therefore difficult to undertake
- Key Projects have proven to be very efficient with observing time and to have large impact in many areas of astronomy
- Do the TMT partners want to develop a policy/process that allows cross-partner projects
  - Competitive (super TAC)
  - Different data access rules for participants
- Process: SAC considers this with wide input from partner communities and makes recommendations to the Board