Science Operations Modes & Mixes

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Science with Giant Telescopes

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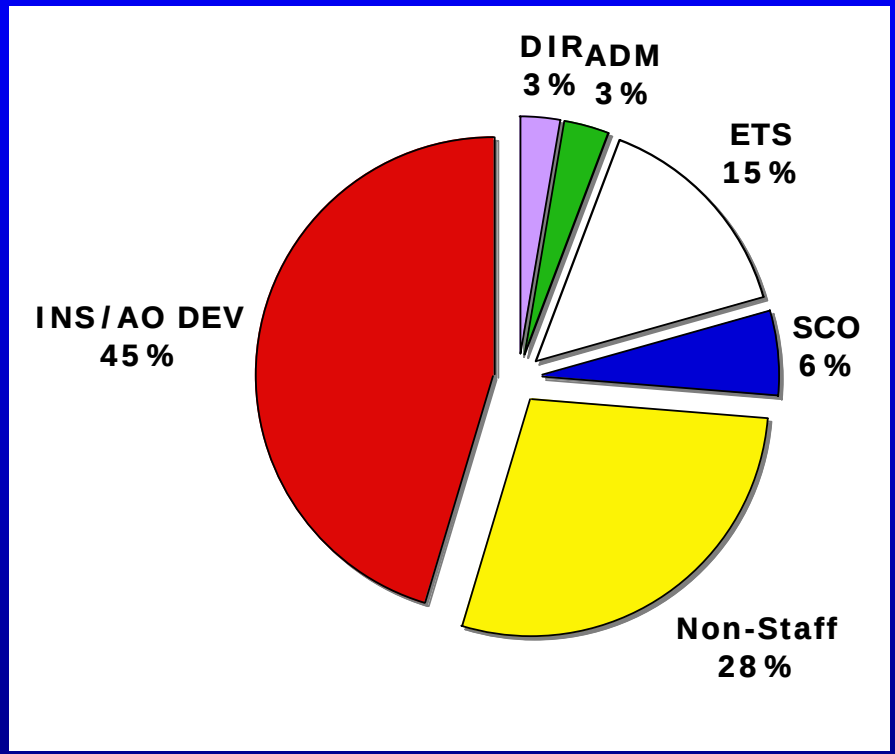
Focus: Science Operations

- What is ignored here…
  - Directorate
  - Administration
  - Facility operations
  - Engineering/maintenance
  - Development (facility, instrumentation)
- …contains majority of core (unavoidable) cost

- Science Operations budget driven by number and type of user services
  - More services, more cost

Example: TMT ops budget estimate

Illustrative, most classical observatories similar



- Staff costs
  - Science Operations (SCO)
    - Classical only, minimal archive, no observatory-based data processing
  - Directorate (DIR)
  - Administration (ADM)
  - Engineering/Technical Services (ETS)
- Non-staff costs
  - Utilities, service contracts, transportation, etc, etc
- Development
  - Instrumentation (INS)
  - Adaptive optics (AO)

Meta-issues

- Total 25 yr ELT life-cycle cost: 1 – 3 billion $USD
  - Space observatory class investment
- Key question: what mix of science operations modes will maximize science return?
  - Related issues
    - Small vs. large team projects
    - Real-time user creativity vs. structure processes with delayed (or null) gratification
- What have we tried so far…?

Classical

- Fixed schedule, user on-site (or close, a la Keck/Waimea)
  - Keck (100%), Subaru (100%), Magellan (100%), MMT (~90%)
  - VLT (40%), Gemini (10%)
- Positives
  - Self-contained observing
  - Direct user/staff and user/facility interactions
  - Fixed (known) observing schedule
- Negatives
  - Users have to travel to site
  - Users at mercy of weather, technical problems
  - Hard (but not impossible) to support time-domain, ToO

Remote
Classical variant

- Fixed schedule, users off-site, active participants
  - Keck (~ 20%?), Subaru (small), Magellan (small), MMT (small)
  - VLT (0%), Gemini (0%)
- Positives
  - Self-contained observing
  - Semi-direct user/staff and user/facility interactions
  - Fewer users at altitude, less user travel
  - Fixed (known) observing schedule
- Negatives
  - Users at mercy of weather, technical problems
  - Hard (but not impossible) to support time-domain, ToO

Delegated
Classical variant

- Fixed schedule, observations by staff, user may or may not interact remotely
  - Small fraction for everyone
- Positives
  - Self-contained observing
  - Fewer users at high-altitude, less user travel
  - Fixed (known) observing schedule
- Negatives
  - Users at mercy of weather, technical problems
  - Hard (but not impossible) to support time-domain, ToO
  - Facility/user disconnect possible

Queue
A.K.A. service mode, dynamic scheduling

- Dynamic scheduling of individual observations
  - Keck (0%), Subaru (small?), Magellan (0%?), MMT (0%)
  - VLT (60%), Gemini (90%)
- Positives
  - Complete highest science priority observations first
  - Match observations to conditions
  - Optimal use of rare (valuable) atmospheric conditions
  - (More) uniform quality datasets
  - Fewer users at high-altitude, less user travel
- Negatives
  - Much more expensive (need more people, software, process)
  - Larger preparation overhead for users, without guaranteed return (and declining with TAC grade)
  - Higher probability of user/staff and user/facility disconnect

Summary

What mix should ELT have?

Answer connected to data products discussion on Tuesday

	Classical			Queue
	Pure	Remote	Delegated	
VLT	40%	0%	Small	60%
Keck	80%	20% (?)	Small	0%
Gemini	10%	Small	Small	90%
Magellan	100%	0% (?)	Small	0%
MMT	???	???	???	0%