

Remote Operations: Common Concerns and Opportunities

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Keck's Unattended Nighttime Operations Project (UNO)

- **Scope**

- New tools to support unattended operations needs
- Improvements to existing equipment to eliminate the need for summit presence.
 - Reliability
 - Remote monitoring and fault detection
 - Remote control
 - Remote recovery

- **Top level requirements**

1. *Operation of both Keck telescopes from WMKO HQ without staff present at the summit*
2. *UNO shall be at least as efficient as current operations*
3. *The UNO project shall manage associated safety risks*

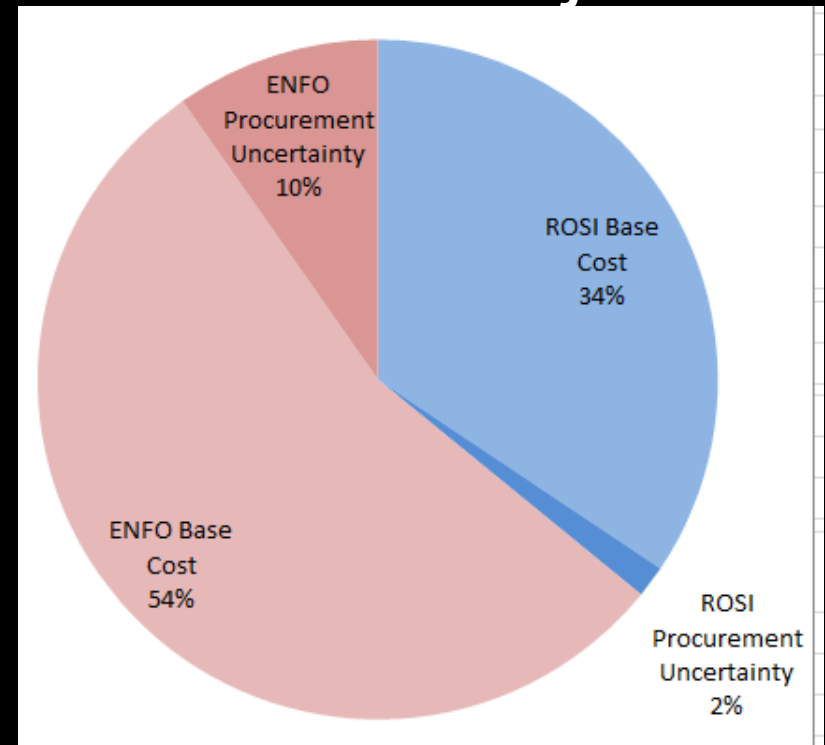
Keck's Unattended Nighttime Operations (UNO)

The portion of work to develop new tools and capability specifically because the entire nighttime staff will be at HQ.

The portion of work that provides improved overall reliability, remote monitoring capability, and remote control of our existing equipment.

This is a 3 year project

The UNO Project



UNO Project Methodology

Step #1: Establish a clear vision of
what needs to be done

Reliability

Power
Autonomous
AI
Earthquakes
Transition
Automated
Unknowns
Use Cases
Unattended
Robotic
Dust
Probability
Stakeholders
Release
Fear
Intuition
Recovery
Risk
Cost
Checkout
Unmanned
Staff
Remote Observing
Detection
Safety
Communication
Exception Handling
Weather
Security
Justification
Expert Systems
Insurance
Software
Deadlines
Users
Shutters
Buy-in
Monitoring
Culture
Fog
Faults
Lasers and aircraft

UNO Project Methodology

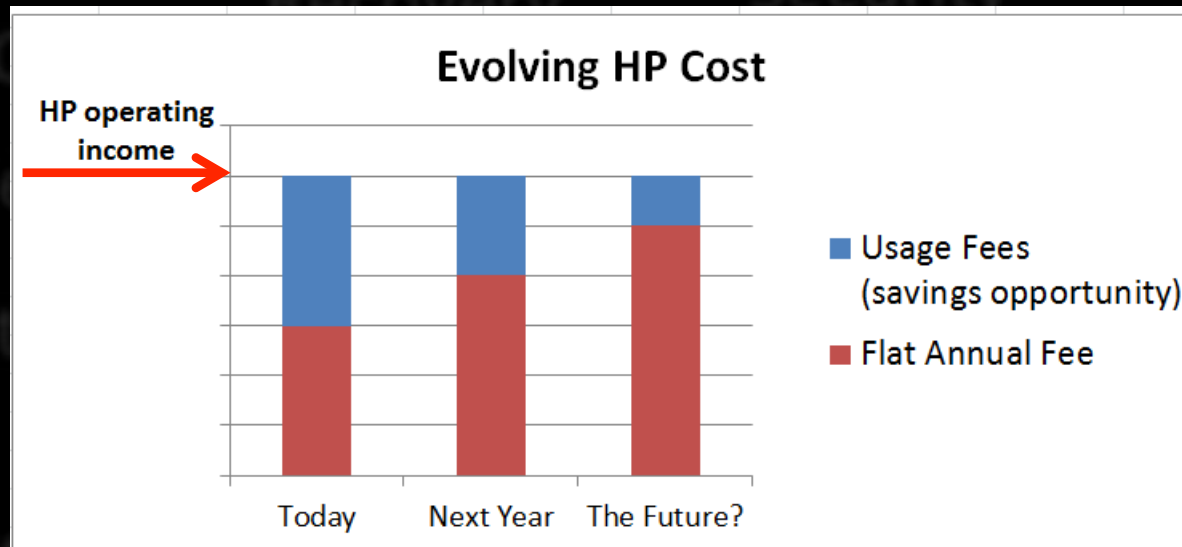
Step 2: Seek help from colleagues

- A. Justification
- B. Safety in numbers
- C. Security
- D. Laser / aircraft protection
- E. Weather

Justification: Maximizing big bang for the buck

Contributors to savings:

- More efficient staffing
- Reduced auto fleet expenses
- Reduced HP expenses (ever evolving)



Safety in numbers

- Summit night crews know they can depend on each other for help
- We each provide a safety net for the others
- With fewer facilities staffed at night, the safety net is less robust for those who still have staff on the mountain.

Security


1. Prevention
2. Threat detection
 - Alarm systems (indoor)
3. Immediate engagement
 - Paging system + microphone equipped cameras
4. Post-event
 - Auto & facial recognition video

Protecting Aircraft From Lasers

- Both WMKO and Gemini automated aircraft protection systems already received “no objection” by FAA
- HOWEVER...
 - FAA recently denied NASA Table Mountain request for “no objection” to their proposal for use of an unattended laser system because the unattended system decides when to resume propagation after an protection event
- SAE-G10T is working on a recommendation for rules for remote / unattended laser operations.

Weather Sensing

1. To each their own
 - We all have our own sensors.
 - We all wish we could have more/better sensors
2. What's mine is yours
 - Sharing of sensor data is already happening
 - Recent proposal to MK weather center to provide quantifiable sensor data on-line in a format appropriate for real time threat detection and decision making.
3. A balancing act
 - What is the right balance of being master of our own destiny and being dependent on our neighbors?

A word cloud in the background of the slide, featuring various terms related to autonomous systems and operations. The words are in different sizes and orientations, creating a textured effect. Some prominent words include 'Power', 'Checkout', 'Shutters', 'Stakeholders', 'Staff', 'Autonomous', 'Release', 'Remote Observing', 'Detection', 'AI', 'Earthquake', 'Fear', 'Communication', 'Transition', 'Automated', 'Exception Handling', 'Weather', 'Monitoring', 'Unknowns', 'Use Cases', 'Justification', 'Culture', 'Unattended', 'Risk', 'Expert Systems', 'Fog', 'Robotic', 'Remote Operations', 'Faults', 'Dust', 'Insurance', 'Software', 'Deadlines', 'Users', 'Cost', 'Probability', 'Reliability', 'Intuition', 'Buy-In', 'Lasers and aircraft', and 'Deadlines'.

That's all I have.
Discussion?

More weather presentations
next...