The Impact of Space Event Closures on Keck LGSAO

Randy Campbell CfAO Retreat October 2011

Photo Credit: Andrew Cooper http://www.darkerview.com

Safety

- Many years of safe operation
 - Aircraft safety, FAA
 - Development of automated safety measures
 - Paul Stomski is a member of the SAE G10-T
 - Aerospace Standard #6029 (AS-6029)
 - Performance Criteria for Laser Control Measures
 - Used for Aviation Safety
 - Laser Traffic Control, LTCS
 - Used at many sites
 - US StratCom and Laser Clearing House, LCH
 - Spiral-3 automation
 - Excellent Cooperation with Regards to PA

The Impact of PA Restrictions on Astronomical Observatories

- Dr. Kramer's Report to the NSF, 2010:
 - … has not significantly affected the quality or quantity of science…
 - ...no evidence of science that was not done due to restrictions...
- Keck had no disagreement with the conclusions based on the situation at the time
- However, the situation has changed....

Two Distinct Types of Closures

Predictive Avoidance

- Deconfliction of a laser beam and the known
 - location of a satellite as a function of time.
- Creates "open windows" for laser propagation

Space Event

- Satellite launch or maneuver
- Uncertain satellite location
- All laser windows closed, "Blanket Closure"





Recent 10 Week Period, 9 Blanket Closures





Risk of "Space Event" Damage

- Kramer Report, 2010:
 - 1x10⁻¹⁰, probability of a laser hitting satellite in 1 sec
 - 1x10⁻⁴, when illuminated, probability of satellite damage
 - 16,560 sec (4.6 hr), average Keck blanket closure
- Thus, probability of hitting and damaging a
 - satellite during a space event =
 - 10⁻¹⁰ * 10⁻⁴ * 1.7x10⁴ =



Impact on Science

- Tiantian Yuan, IfA Graduate Student, Lost
 - 2.5 nights in Sep 2011
 - 1.0 night 11 Apr 2011

Tiantian writes:

" If it were not for the space command closure, I would have obtained crucial data to 1) constrain the disk formation scenario of galaxies, and 2) be the first ever observation on the metallicity gradient of a highredshift merger system. The loss of these nights have made it **impossible to proceed with the second half of my thesis**. This has put me in a very negative position of the post-doc job application this year. "

Value of Astronomical Observations

Historical Example

 Tycho Brahe
 Johannes Kepler





Orbital eccentrics

Summary

- The situation has change and space event blanket closures are now causing significant science losses at Keck
- Risk of damage to a satellite is minuscule
- Value of astronomical observation is not negligible compared to value of satellite
- As a community, what can we do to bring
 - about a more equitable policy that
 - addresses both the needs of science and
 - satellite protection?





Keck AO Time Line

