CONFIGURATION MAP

SLR

NASA SLR Operations
18th ILRS Workshop
Japan

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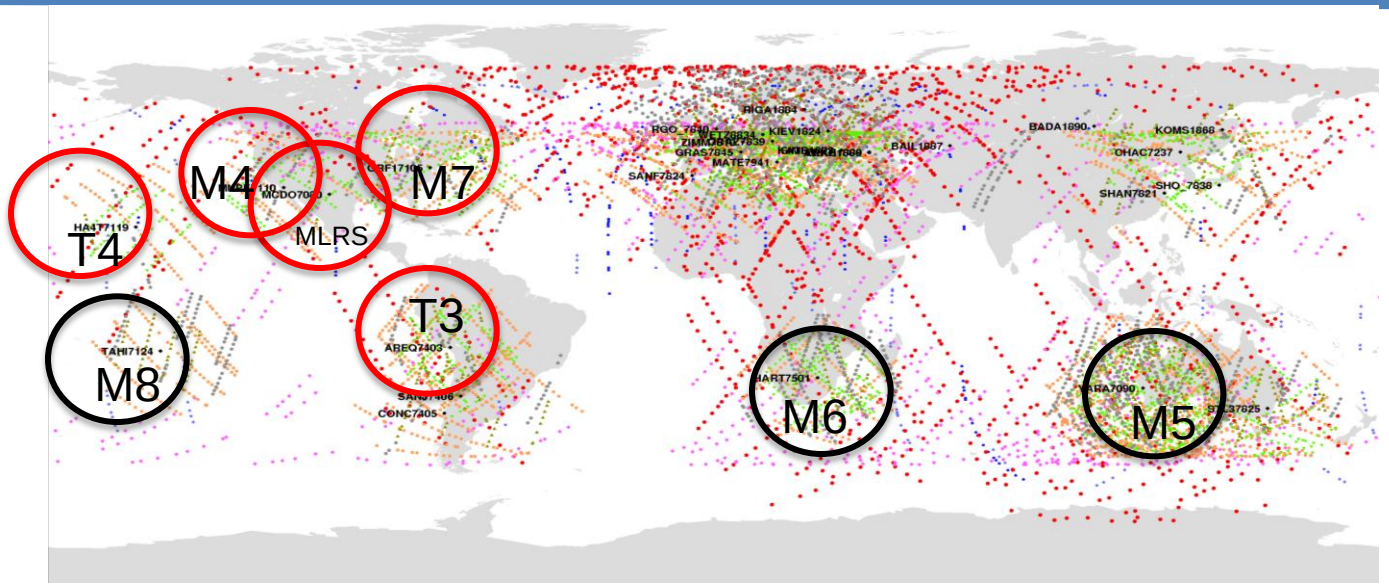
November 2013
Presentation: 13-0206

SLR Operations Status Summary



Station Operations

- Maryland (M7)
- California (M4)
- Texas (MLRS) - Low Yield (tracking issue)
  - testing changes, Engineering visit planned (laser, radar)
- Maui (T4) - Low Yield (tracking issue) - testing
- Peru (T3)
- Tahiti (M8) (CNES)
  - 2nd shift recently added
- S. Africa (M6)(HARTRAO)
- Australia (M5) (GA)

Network Sustainment

- Obsolescence Replacement
- Resources - few network Engineers
- Site Ties and Monuments - Maui one cal pier - 2nd planned
  - M6 survey overdue - in planning stage

Data Operations Center

- Hardware/software
- Hardening/improvements

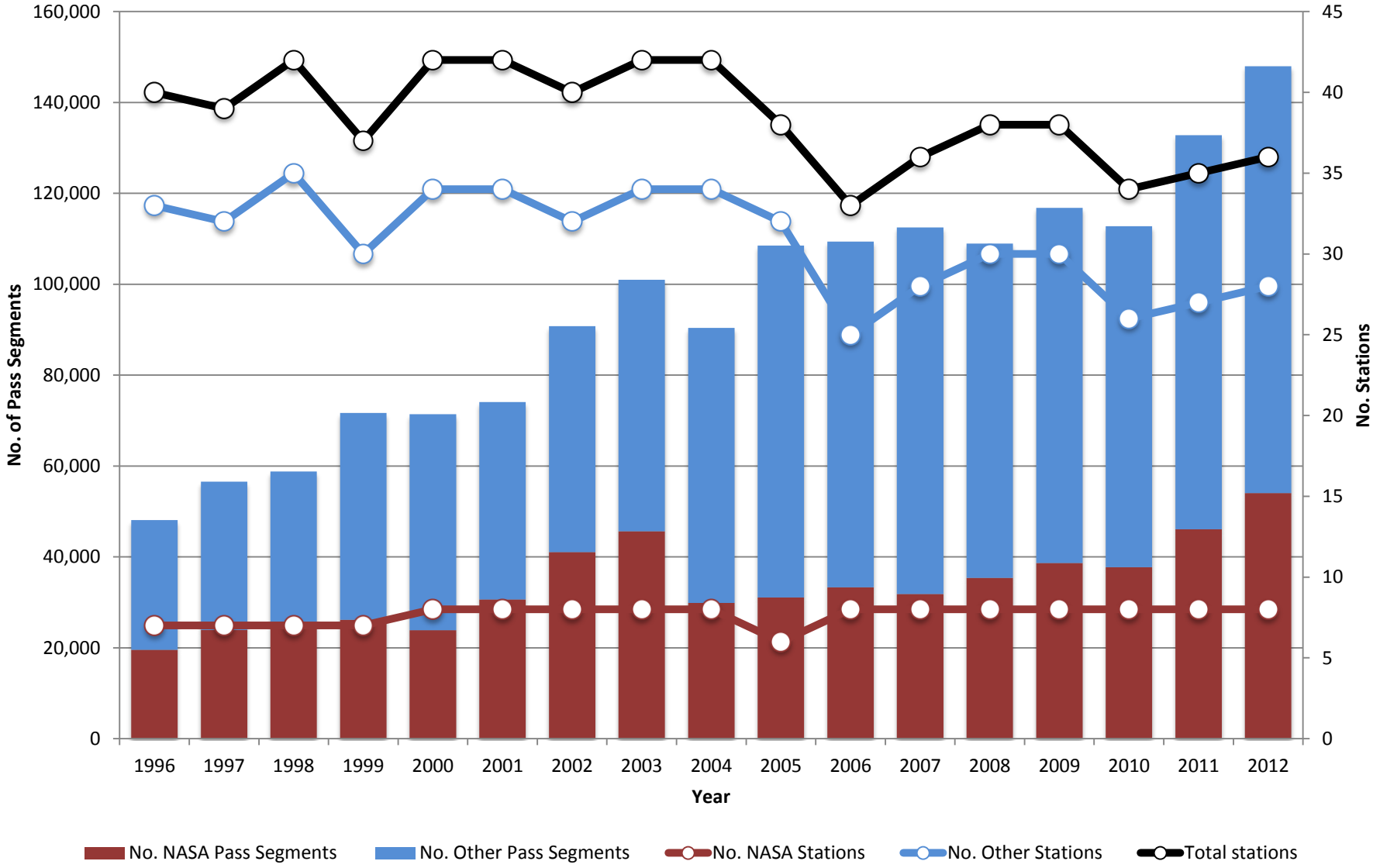
International Laser Ranging Service

- Liaison /Central Bureau Management
- Data Analysis

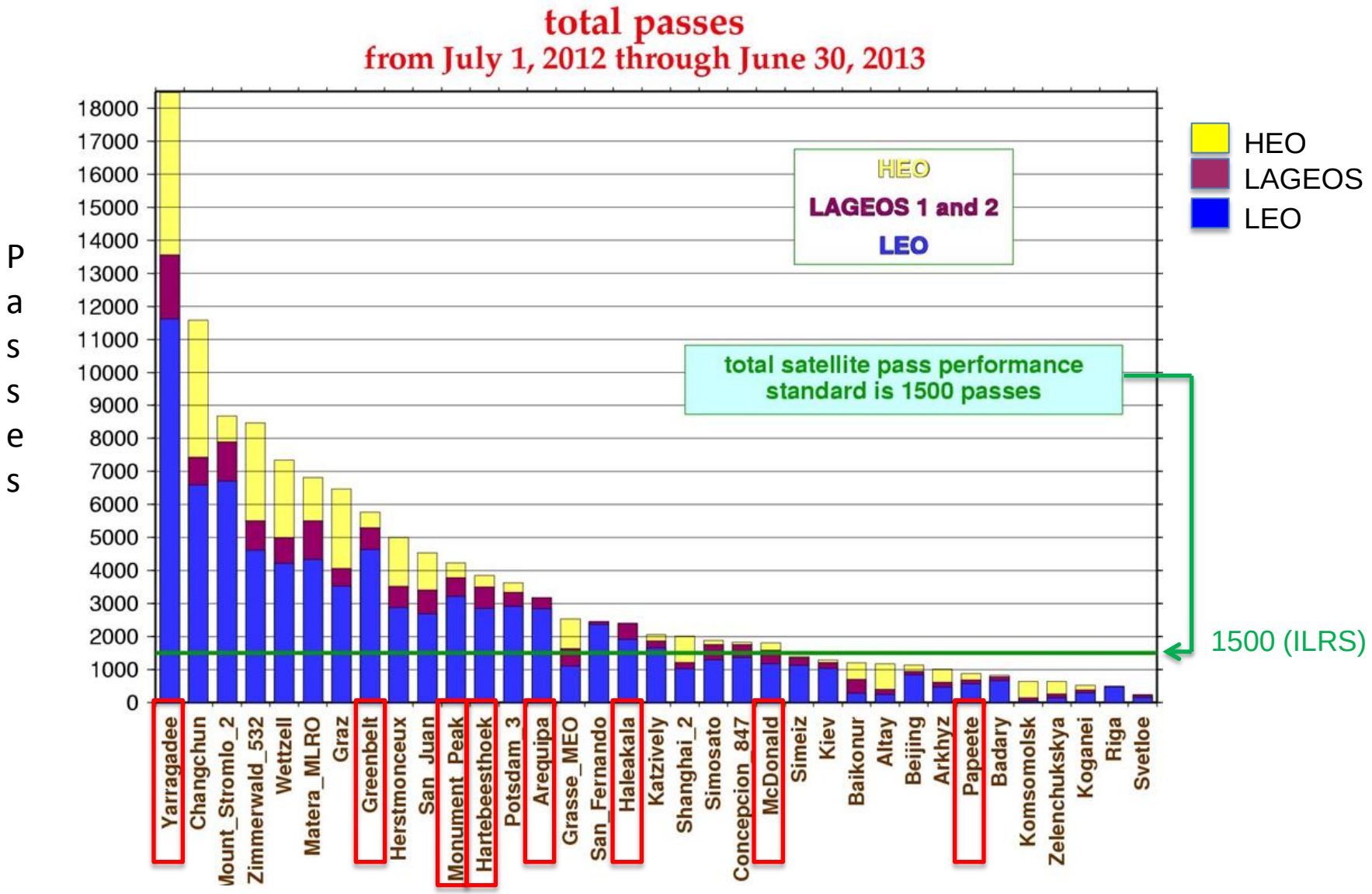
ILRS/NASA Yearly Data Yield

Network Manager code 453 September 2013

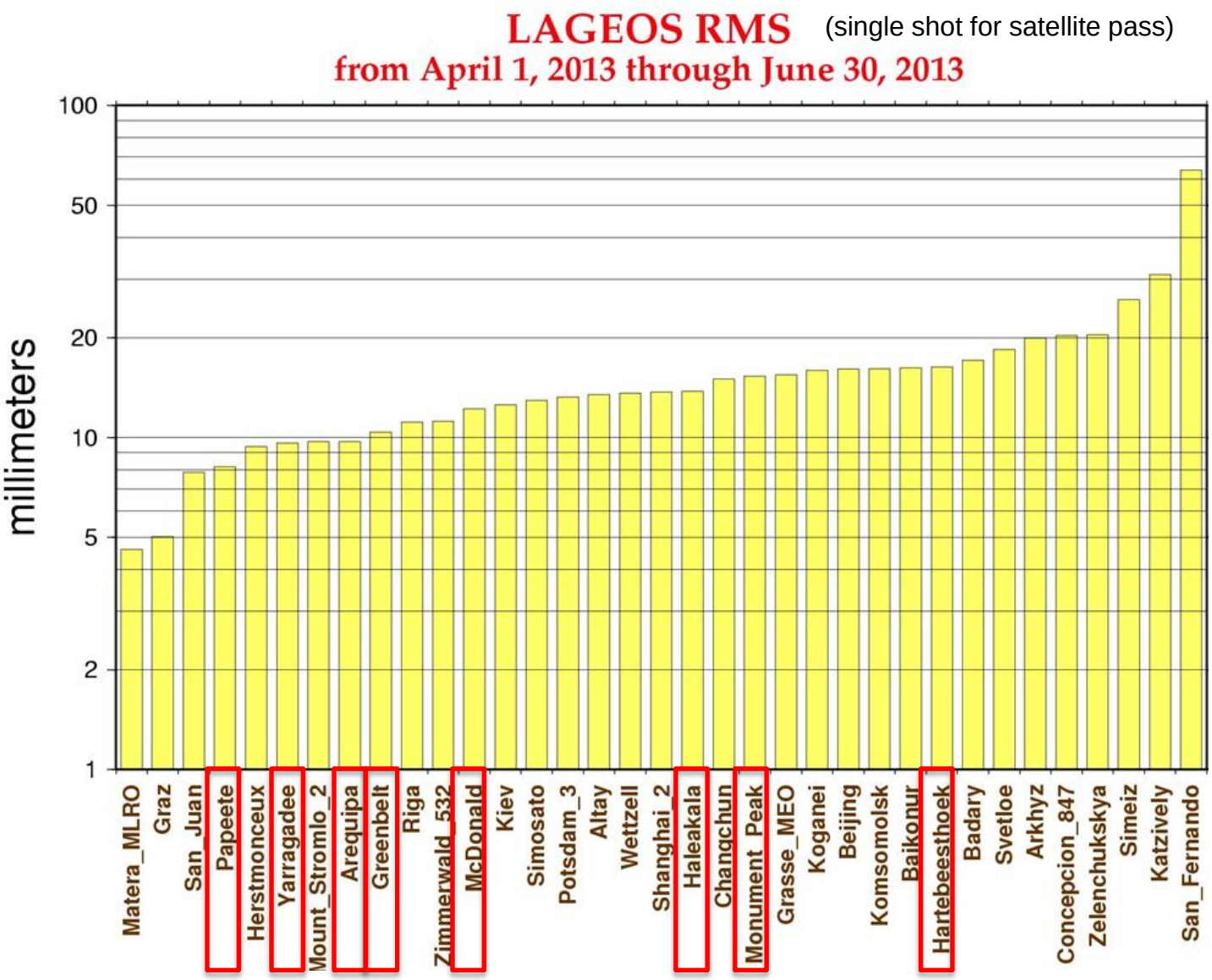
Graph by Carey Noll



SLR Data Quantity



SLR Data Quality



NASA Network Quality

Meets ALL ILRS guidelines:

LAGEOS RMS
(1 cm NP Precision)

Short term bias stability
(2 cm)

Long term bias stability
(1 cm)

NASA/ILRS Data Operations Center

- The NASA DOC advances since the last ILRS workshop
  - Conversion to CRD format processing (May 2012)
  - Daily analysis products require 24/7 connectivity/support
    - Improved redundancy and monitoring capability
    - Hardening of systems and management of processes
  - IT Security to industry standards
  - EDC/CDDIS comparison
  - QC standardization
  - Configuration Management of Hardware/SW/Processes
  - Re-Engineering Project
    - Obsolescence mitigation, process streamlining, reliability
    - Primary computer hot spare, added UPS for FTP server
    - Automation of manual processes, URL interface is planned

Greenbelt Operations Team

NASA Network Stations

- Peru (TLRS3) - Universidad Nacional de San Agustin (3 x 5 shifts)
  - REGINA collocated including survey
  - New LASER, EL axis repair
  - Improved yield
- Hawaii (TLRS4) – University of Hawaii (2 x 5 shifts)
  - Telescope mount refurbishment including survey
- California (MOBLAS 4) – EXELIS (2 x 5 shifts)
  - Site Survey performed
  - Refurbished RADAR

NASA Network Stations

- Australia (MOBLAS 5) – Geoscience Australia (3 x 7 shifts)
  - RADAR at NASA for refurbishment
- South Africa (MOBLAS 6) – HARTRAO (3 x 5 shifts)
  - NASA training 2012
  - Refurbished RADAR
- Maryland (MOBLAS 7) –EXELIS (3 x 5 shifts)
  - Refurbished RADAR
  - Refurbished Mount Slip Ring
  - Supported Successful collocation with NGSLR
  - VLBI Mask (for RFI impingement)

NASA Network Stations

- Tahiti (MOBLAS 8) - CNES, Universite Franciase du Pacifique
  - Repaired RADAR, servo system, HEO ranging amplifier
  - FTLRS Collocation 2011
  - 2 shift operation 2013
- MLRS – University of Texas, CSR (2 x 5 shifts)
  - Telescope adjustment, Revised controller software
  - Pending: New LASER, Radar refurbishment
  - Continued Leadership in Lunar Ranging and SLR Analysis

NASA Network Stations Upgrades

- Obsolescence Mitigation
  - Limited funding
  - Highest risk components

Laser	TX_RX Electronics	Telescope	Met Sensors	Computers, SW	LHRS	Facility
Oscillator	Photodiode	Mechanics-Bearings	Pressure	Controller	Radar Tranceiver	Power
Amplifier	MCP-PMT	Electrical-Slip Ring	Temp	Processor	Local Controller	HVAC
PUs	Amplifier	Optics-Primary Mirror	Humidity	Peripherals	Remote Controller	Grounding
CBs	CFD	Optics-Secondary Mirror	*Wind	CAMAC	Power Supplies	Communications
Optics	Quad Integrator	Optics-Window		DAC - Servo	Antennae	Security
HV cables	NIM Bin	Servo-MPACS		UPS	Encoders	Vans
Chiller	Time Interval Counter	Servo-amplifiers		Control SW	Harmonic Drive	Cal Piers
	Star Camera	Servo-Tach sensors		Processing SW	Servo-amplifiers	Survey Equipment
	Large FOV Camera	Servo-Limit Switches			Laser Beam Block	
	LRC	Servo-motors			20 Degree Switch	
	Console				Radome	
					LHRS FW	

- RADAR
  - Depot Level Refurbishment, Standardized Configuration
  - Improved Testing and Restricted Operational Modes
- MOBLAS servo system
  - Testing at NASA
- Event timer
  - Replaces time interval counter for all stations
  - Introduction 2014

NASA Lunar Laser Communications Demonstration

- LADEE spacecraft Launched September 6, 2013
  - Lunar Atmosphere and Dust Environment Explorer
- Lunar Laser Ground Terminal
  - ILRS Engineering Station
  - White Sands New Mexico
  - 4ea 15 cm transmitting telescopes
  - 4ea 40 cm reflective receive telescopes

- Passively tracked AJISAI several times allowing identification and correction of software issues
- Actively tracked AJISAI to check boresight alignment
- Immediately communicated with LADEE spacecraft for successful demonstration: 622 MBps downlink

SLR Operations Summary

- NASA SLR Network is functioning well
  - Deployment of obsolete component replacements will reduce risk of major network decline near term
  - Improvements in data quantity and quality are expected in 2014
- ILRS management and data analysis are functioning well
- Goals
  - Reduce risk of network downtime/failures by improving processes and proactively addressing obsolescence etc.
  - Improve data yield and quality
    - Event timer etc.
  - NASA DOC support ILRS daily data delivery with high proficiency

July 8 Wildfire Monument Peak, CA

PHOTO Courtesy of HPWREN

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