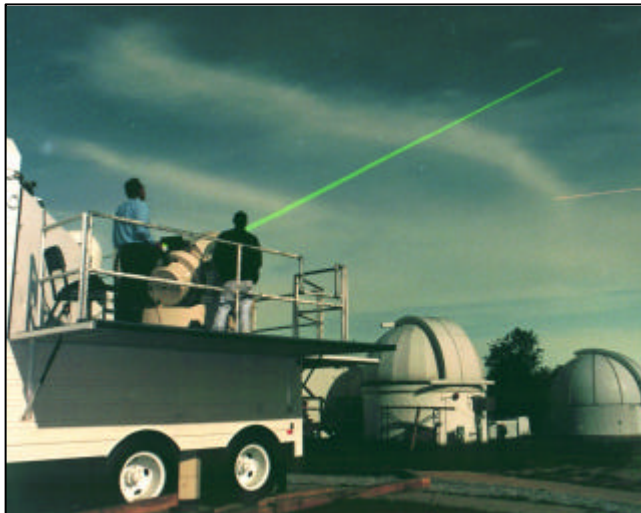
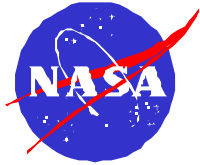


Status of the NASA Satellite Laser Ranging Network





Status of the NASA Satellite Laser Ranging Network

David Carter

NASA Satellite Laser Ranging Program Manager

**NASA Code 920
Goddard Space Flight Center
Greenbelt, Maryland USA**

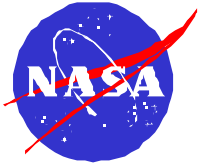
Contributors:

**Howard Donovan, Daniel Nugent, Donald Patterson, Loyal Stewart
Honeywell Technology Solutions Incorporated
Lanham, Maryland USA**

**12th International Workshop on Laser Ranging
Matera, Italy
November 13-17, 2000**



NASA SLR Meteorological Measurement System Upgrade



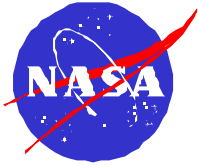
Old Meteorological Measurement System

Comprised of 2 Separate Devices

- **Paroscientific Barometric Unit - Automated**
- **Sling Psychrometer - Manual**

Drawbacks

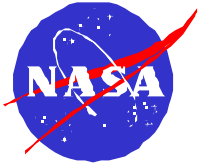
- **Temperature and Humidity Measured Once per Hour**
- **Temperature and Humidity Entered Manually**
- **Possible Data Entry Anomalies**
- **Inefficient use of System Operator**



New Meteorological Measurement System

Comprised of 1 Device

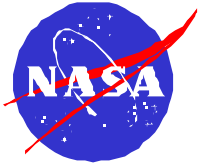
- Paroscientific MET 3
- Totally Automated
- Measurements Made and Recorded every 10 seconds
- NIST Certified Calibration
- Accuracy
 - Temperature £ 0.5 degree C
 - Pressure £ 0.1 millibar
 - Humidity ± 2%



MET 3

GGAO Field Deployment



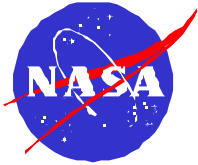


NASA SLR Network MET 3 Installation

- **SLR 2000** **July** **1997**
- **TLRS-4** **June** **1998**
- **TLRS-3** **November** **1998**
- **MOBLAS-6** **August** **1999**
- **HOLLAS** **September** **1999**
- **MLRS** **September** **1999**
- **MOBLAS-5** **September** **1999**
- **MOBLAS-8** **September** **1999**
- **MOBLAS-7** **February** **2000**
- **MOBLAS-4** **April** **2000**

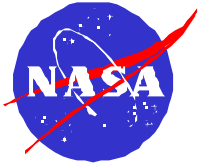


NASA SLR MOBLAS Encoder Upgrade



MOBLAS Mount Encoder Upgrade

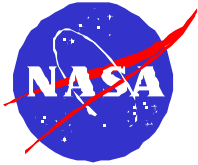
- **A new encoder system was introduced this year by the manufacture Brashear LP that could be easily adapted to replace the system currently used in all MOBLAS systems.**
- **Increasing difficulties in maintaining the old systems due to parts obsolescence, non- existent spares, and frequent failures make this upgrade necessary for dependable network operations. (Current encoder systems have been in the field for over twenty years).**
- **The upgrade would duplicate the existing encoder data format and *not require* any software changes to the current servo controller.**
- **Total material cost per station for an encoder upgrade ~\$20K.**



MOBLAS Mount Encoder Upgrade

Current System

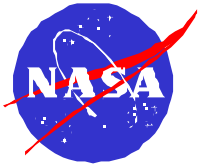
- **Model 30J Modular Precision Angular Control System (MPACS)**
- **12.25 inch high rack mounted chassis**
- **System uses outdated analog/digital circuits comprised of discrete components.**
- **Position Output: Parallel 21 bit (0.62 arc second) binary output per axis at a 20PPS rate.**
- **Transducer Excitation Signals: Two channel- one inductosyn, one resolver per axis**
- **Position Input: Two channel - one inductosyn, one resolver per axis**
- **Power: 110Vac**



MOBLAS Mount Encoder Upgrade

Upgrade System

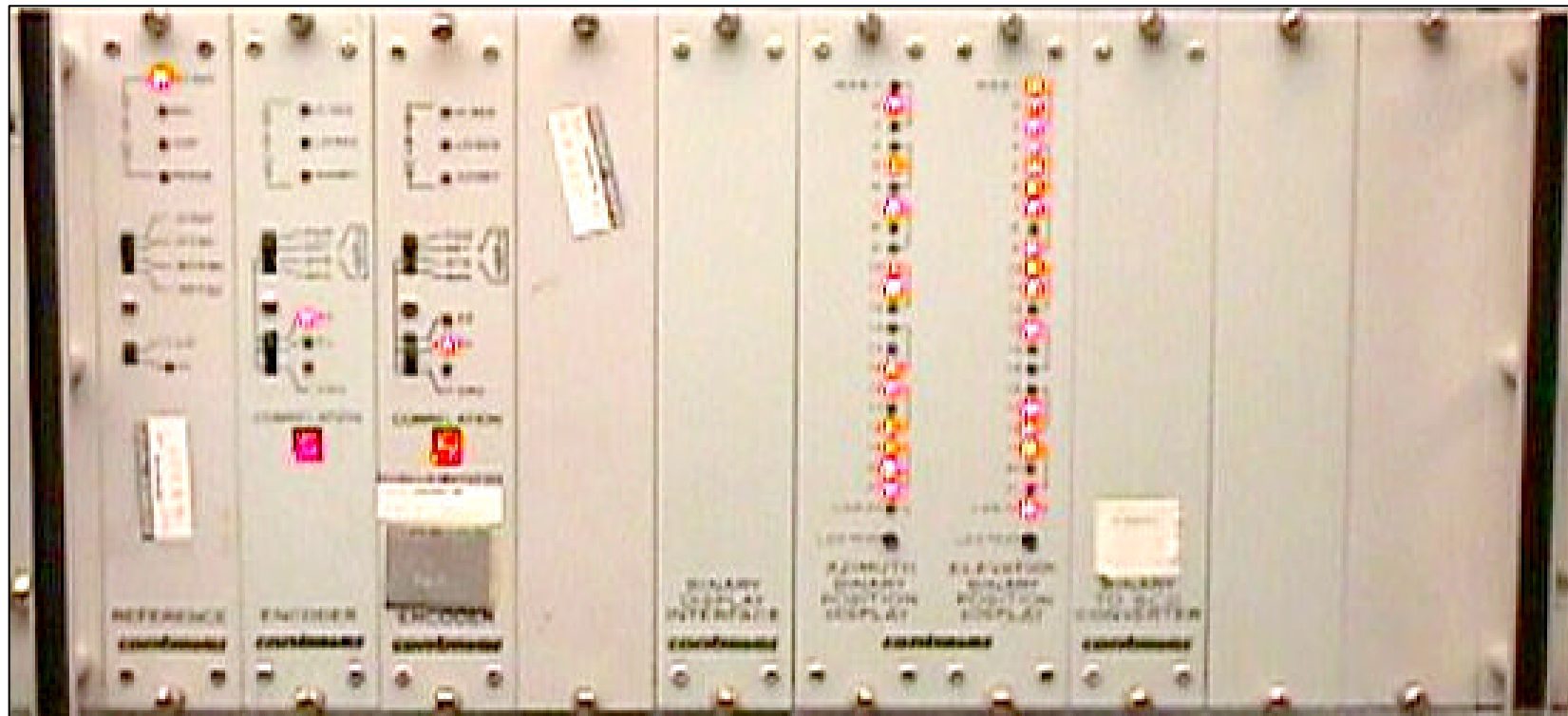
- **Comprised of two sub-systems:**
- **Two Axis Converter Modules (ACM) and a serial to parallel data converter chassis (SPC). The ACM interfaces with the inductosyn and resolver transducers and outputs serial position data. The SPC accepts the serial data from the ACM and converts it to a parallel format exactly the same as the MPACS produces.**
- **SPC Specifications:**
- **Manufacture Honeywell**
- **1.5 inch high rack mounted chassis**
- **Position Input: Two serial RS485 1Mbaud channels (azimuth and elevation axis)**
- **Position Output: Parallel 21 bit (0.62 arc second) binary output per axis at a 20PPS rate.**

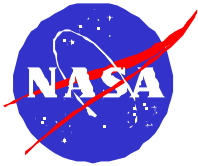


MOBLAS Mount Encoder Upgrade

Current System

Modular Precision Angular Control System - MPACS

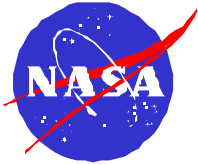




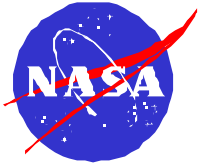
MOBLAS Mount Encoder Upgrade

Upgrade System Axis Converter Module - ACM





**NASA SLR
Transportable Laser
Ranging System
Computer Upgrade Project
(TCUP)**



TCUP

Old MIK-11/23 Controller Computer

- **Outdated 1980 Computer Technology**
- **Replacement Parts Are Difficult to Obtain**
- **Repair Facilities Are No Longer Available**

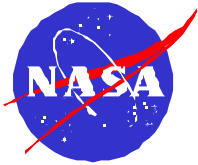
New Pentium Controller Computer

- **PC Compatible Pentium 166 MHz Controller Computer**
- **Similar to Moblas Controller Computer**
- **Enhance the TLRS Controller Capabilities**
- **Reduce Sustaining Costs**
- **Guarantee Component Replacement Availability**
- **Increase Network Standardization**

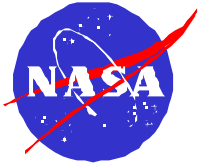


TCUP

- **Upgrade Integration and Verification Testing performed on TLRs-4 at the Goddard Geophysical and Astronomical Observatory in Greenbelt, Maryland**
- **Included Consolidation and Replacement of Other Subsystem Components Within the Mount Control and Data Acquisition Areas of the System Necessary to Facilitate the Integration of the New Controller Computer**

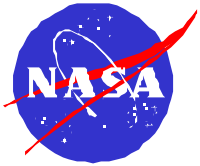


**NASA SLR
Transportable Laser
Ranging System 4
Mount Observer Automation
(MOA)**

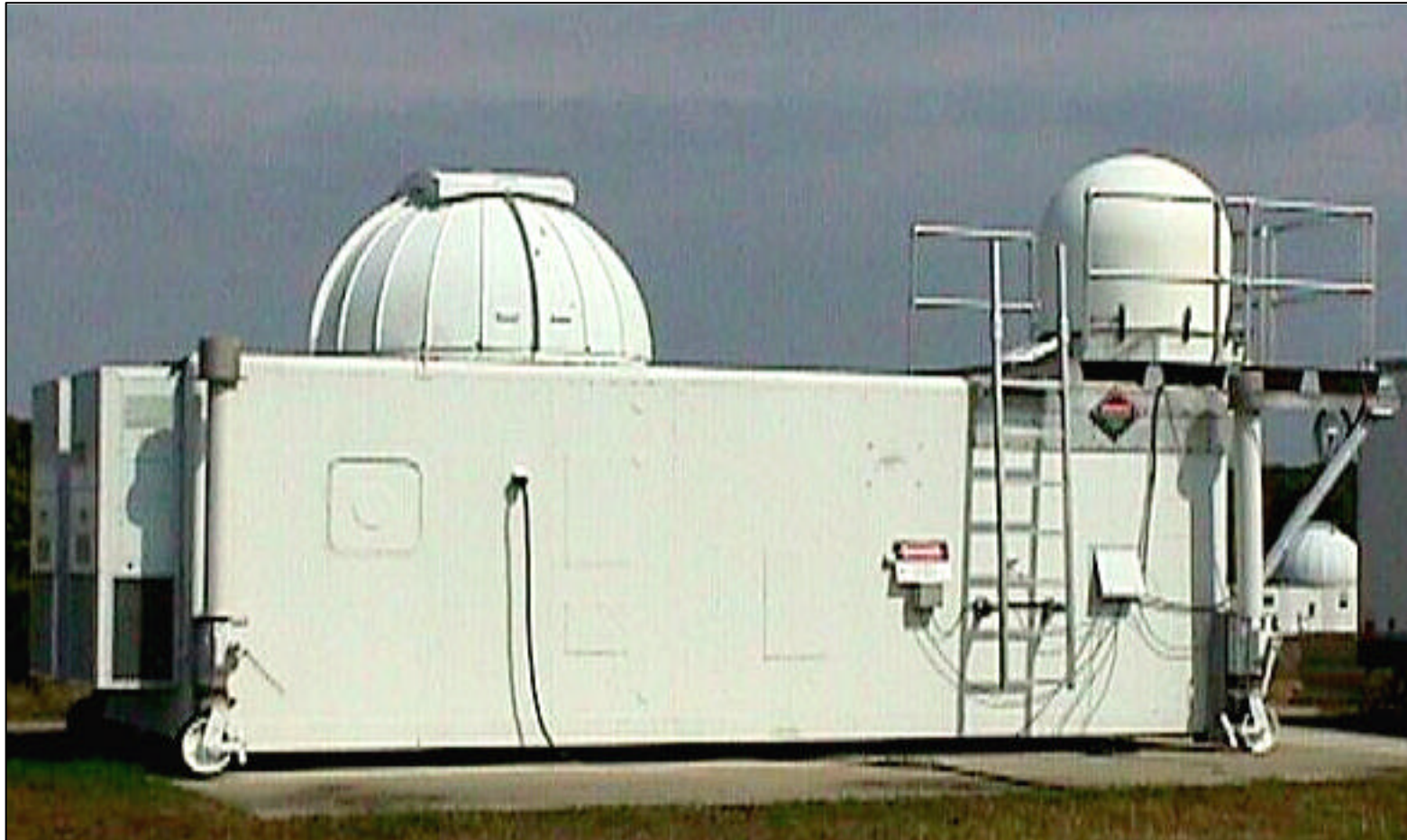


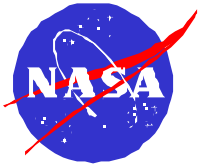
TLRS 4 MOA

- **Replacement of Mount Observer with 3rd generation Laser Hazard Reduction System**
- **Incorporation of Laser Interlock to automate abatement of transmitted laser energy**
- **Incorporation of Surveillance Camera for remote monitoring**
- **Remote monitoring sensors protect access to Instrumentation van interior and roof**
- **Enables TLRS 4 for Single Operator Automation**



TLRS 4 MOA





Other NASA SLR Network Upgrades

- **GPS Steered Rubidium Frequency Standard**
- **CNS Clock Independent Time Transfer**
- **HP Processor Computer Replacement**
- **OAM Controller Repackaged for Space Savings**
- **Y2K Software and Hardware Compliance**
- **HVAC Replacement**