ATA Applied Technology Associates
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Optical Inertial Reference Units

Applied Technology Associates, Inc. (ATA) has over 30 years experience solving difficult state-of-the-art acquisition, tracking and pointing (ATP) problems. ATA has developed and implemented technologies such as components and systems that have enabled essential advances in precision ATP for the Airborne Laser Laboratory, the Wide-band Angular Vibration Experiment (WAVE), Geostationary Operational Environmental Satellites (GOES), Advanced Land Observing Satellite (ALOS), and the Mars Laser Communications Demonstration. ATA's unique experience base and patented component technologies have lead to the development of **the best performing family of optical IRUs in the world today.**

All IRUs Provide:

- Inertial angular rates, ΔVs and ΔΘs
- An Optical Reference Beam (ORB) for optical system alignment, pointing and stabilization
- Relative angular rates and positions for gimbal/platform control feedback signals
- Lowest noise floor of any optical IRU ever produced
- Vibration isolation better than 40 dB (1-1000 Hz) and better than 80 dB at 1 Hz
- Very low linear acceleration susceptibility

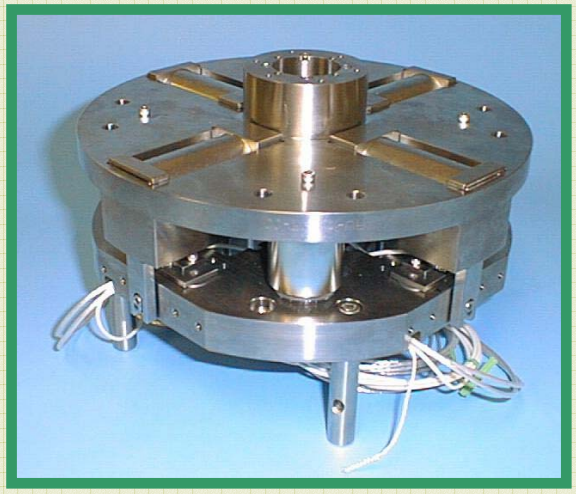
Custom IRUs Feature:

- Mission Specific DC Sensor (Gyro, GPS, etc.)
- Flexible host communication interface (Low Voltage Differential System (LVDS), Ethernet, 1394(b) Firewire, etc.)
- ATA's MHD Angular Rate Sensors and actuators
- Your Choice of ORB Wavelength and Power
- Separate Inertial and Electronics Units for Flexible Mounting

Magneto-hydrodynamic Stable Reference (MSTAR) + Inertial Reference Unit (IRU) = MIRU II

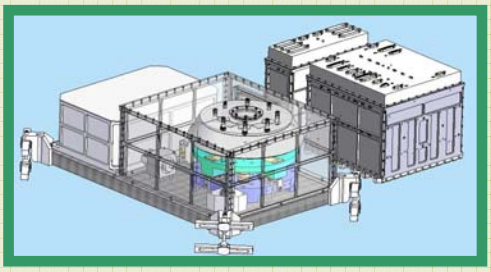
MIRU II is a second generation design that has been subjected to linear and angular base motion disturbances and has proven performance in line with engineering predictions and design goals. To date, **three MIRU II's have been built** with one delivered to Massachusetts Institute of Technology/Lincoln Lab (MIT/LL), the second to the ATA vibration test lab, and the third is slated to be installed in the Starfire Optical Range (SOR) at Kirtland AFB.

Integrated System Performance Metric / Criteria	Units	MIRU-II Test Results
Unrejected Angular Jitter, 1 Sigma, 1-Axis - Quiescent	μrad	< 0.045
Angular Jitter, 1 Sigma, 1-Axis - w/ Environment	μrad	< 0.093
Active Stabilization Servo Bandwidth (Open Loop Crossover)	Hz	> 300
Angular Rate Capability	rad/s	> 0.2
Angular Acceleration Capability	rad/s^2	> 0.2
Angular Sensor Output Data Rate	Hz	10,000
Sensor /Electronics Separation Distance	m	> 3
Integrated Inertial Platform Mass	kg	< 5.9
Integrated IRU Platform with Electronics Total Mass	kg	< 16.9
Power Consumption, Integrated Inertial Platform (w/o Heaters)	W	< 5.6
Power Consumption, Total with Electronics (w/o Heaters)	W	< 108
Operating Temperature Range	deg C	-18 to 50
Survival Temperature Range	deg C	-18 to 50
Radiation Hardness (Total Dose)	Krad	> 100

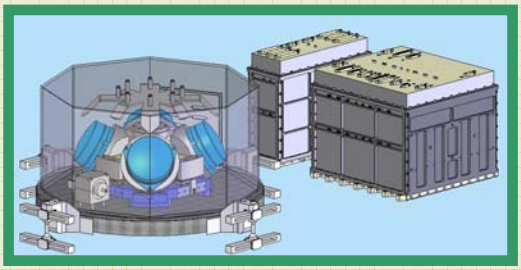


Advanced Inertial Reference Unit (aIRU)

The aIRU incorporates the stable platform design legacy of MIRU, with a flexible approach for gyro integration, thus providing both LOS stabilization and inertial attitude knowledge (IAK). The designs for aIRU included three variants for airborne and space applications.

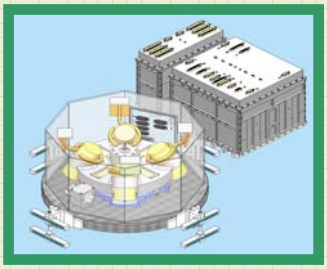


Hybrid Airborne Design - This design features modular gyro integration and Separate electronics unit for integration flexibility. The first Hybrid aIRU is slated for installation on a large telescope used for ATP.



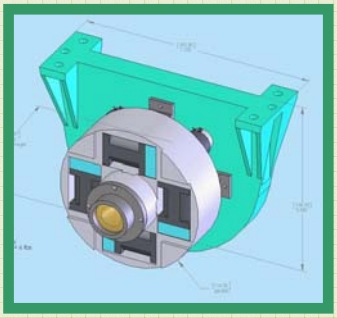
Air-on-Platform Design - This design was developed to be used on optical payloads carried by large aircraft. In this case, the gyros are integrated directly on the stable platform.

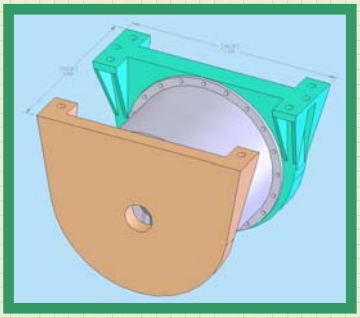
Space-on-Platform Design
This design was developed to be used on spacecraft with precision inertial attitude knowledge requirements coupled with stringent line of sight stabilization requirements.



MIRU III

The MIRU III is being developed for MIT/LL to provide line of sight stabilization for **Mars Laser Communications Demonstration**. MIRU III is a direct descendant of MIRU II but comes in at **less than half the weight** and will be **space qualified** in 2006. ATA will deliver a qualification unit and two flight units to MIT/LL.





Integrated System Performance Metric / Criteria	Units	aIRU Air-on-Platform Predications	aIRU Space Platform Predictions	MIRU III Design Goal
Unrejected Angular Jitter, 1 Sigma, 1-Axis - Quiescent	μrad	< 0.076	< 0.009	< 0.045
Angular Jitter, 1 Sigma, 1-Axis - w/ Environment	μrad	< 0.136	< 0.068	< 0.093
Active Stabilization Servo Bandwidth (Open Loop Crossover)	Hz	> 350	> 300	> 300
Angular Rate Capability	rad/s	> 2.1	> 0.2	> 0.2
Angular Acceleration Capability	rad/s^2	> 1.5	> 0.2	> 0.2
Angular Sensor Output Data Rate	Hz	10,000	10,000	10,000
Sensor/Electronics Separation Distance	m	> 3	> 3	> 3
Integrated Inertial Platform Mass	Kg	< 21	< 20	< 3.2
Integrated IRU Platform with Electronics Total Mass	Kg	< 33	< 34	< 6.6
Power Consumption, Integrated Inertial Platform (w/o Heaters)	W	< 81	< 109	< 3.2
Power Consumption, Total with Electronics (with Heaters)	W	< 220	< 230	< 30
Operating Temperature Range	deg C	-30 to 0	-20 to 0	-54 to 32
Survival Temperature Range	deg C	0 to 55	0 to 55	-60 to 70
Radiation Hardness (Total Dose)	Krad	Unknown	> 100	> 100