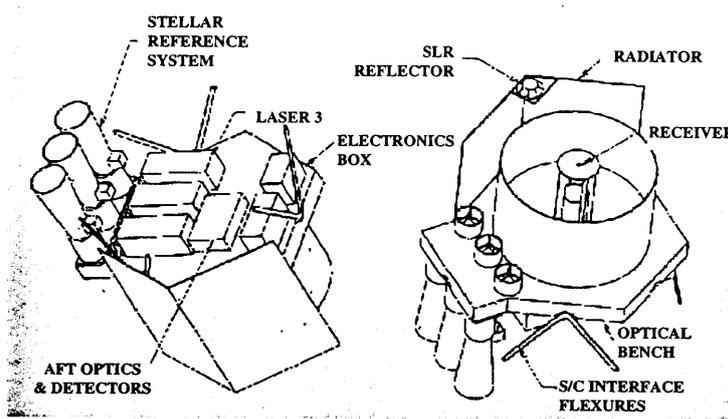


## **Performance of the GLAS, ALR and ISIR Space Flight Experiments**

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The Geoscience Laser Altimeter System (GLAS) is scheduled to be launched in 2001 for a three to five year mission to measure the height structure of land surfaces, ice sheets and atmospheric cloud and aerosols. Extensive modeling of performance, and development of data algorithms, is in progress. As part of the space lidar effort, the Atmospheric Lidar Receiver (ALR) is in construction as an addition to the Shuttle Laser Altimeter (SLA) and Infrared Spectral Imaging Radiometer (ISIR) space shuttle hitchhiker experiment. SLA and ISIR were flown on STS-85 in August 1997 as a combined laser radar, passive imager experiment. ALR will use the SLA transmitter to provide data in order to test processing algorithms for GLAS. The combined ISIR/SLA/ALR is expected to be flown in 1999 as a further pathfinder experiment for future long-term cloud missions.

# Geoscience Laser Altimeter System



**PARAMETERS:**

Blue - Atmosphere Channel  
Red - Surface Channel

Laser Pulse Energy	<u>532 nm</u>	<u>1064 nm</u>
Laser PRF	50 mJ	100 mJ
Telescope Diameter	40 Hz	40 Hz
Receiver FOV	0.9 m	0.9 m
Optical Bandwidth	0.14 mrad	0.18 mrad
Detector Quantum Efficiency	< 0.013 nm	< 0.05 nm
Detection Scheme	0.6	0.3
Surface Ranging Accuracy	Photon Counting	Analog
Pointing Knowledge		10 cm
		3 arcsec

Fig. 1 Specifications of the Geoscience Laser Altimeter System

## GLAS Cloud and Aerosol Measurement Requirements

Measurement	<u>Spatial Requirement</u>		Cross Section Range (m-sr) <sup>-1</sup>	Accuracy Requirement
	Small Scale	Large Scale		
Dense Clouds		0.2 km	10 <sup>-4</sup> - 10 <sup>-2</sup>	10%
Cirrus	>2 km	<20 km	10 <sup>-6</sup> - 10 <sup>-4</sup>	5%
Thin Cirrus	>10 km	<50 km	10 <sup>-7</sup> - 10 <sup>-5</sup>	10%
PBL Aerosol	>2 km	<100 km	10 <sup>-7</sup> - 10 <sup>-4</sup>	10%
Upper Trop. Elevated Aerosol	>10 km	<100 km	10 <sup>-7</sup> - 10 <sup>-6</sup>	10%

Fig. 2 Table of the science measurement requirements from the GLAS project requirements document.

Saturation = 10  
 10 Shot Average

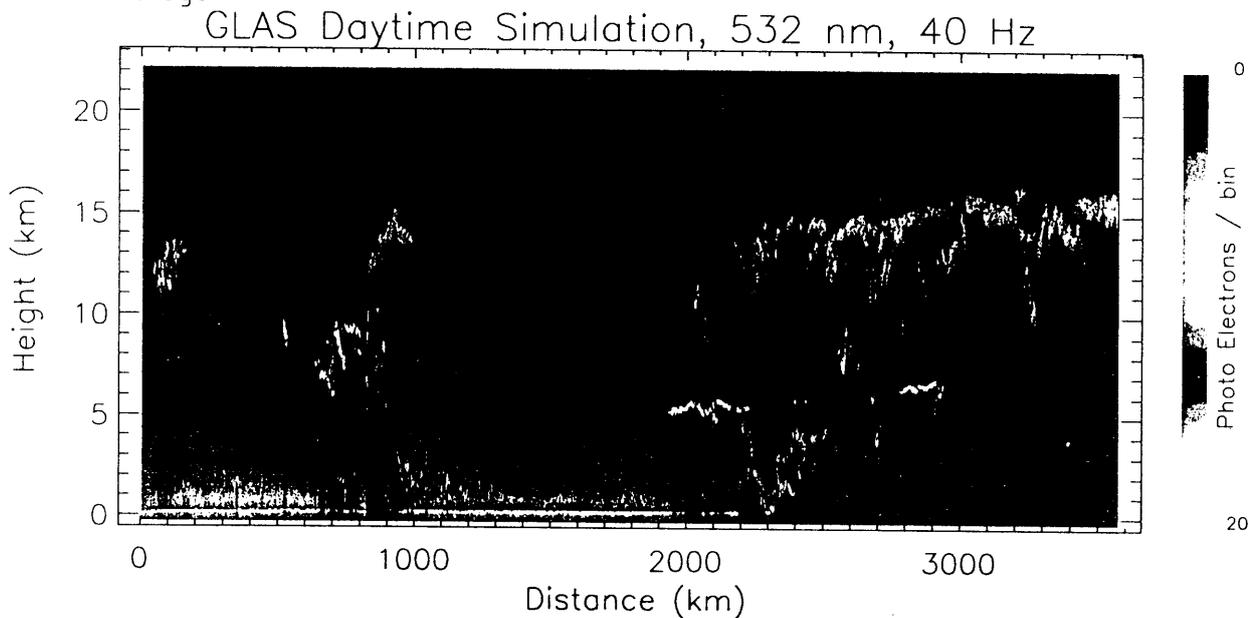
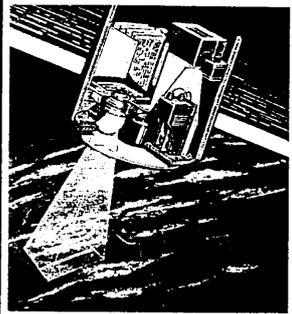


Fig. 3 A simulation of the expected signal performance for the GLAS satellite mission. The simulation is based on high altitude ER-2 aircraft data from the tropical west Pacific.

### Space Shuttle Experiment for Uncooled IR Array Infrared Spectral Imaging Radiometer (ISIR)



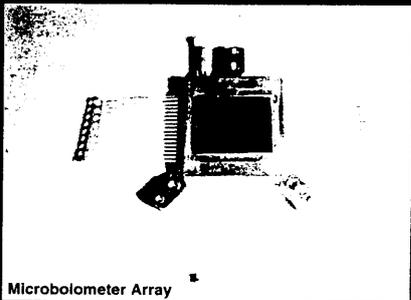
**Objectives:**

- Develop Compact, Low Cost and Rugged Imaging Infrared Cloud Radiometers
- Test the Application of Uncooled Microbolometer Focal Plane Arrays for Space Borne Imaging Applications
- Observations For Cloud Science: Obtain Combined Passive/Active Remote Sensing From Joint Shuttle Flight with the SLA Lidar



- Microbolometer array detector eliminates cooling requirements
- Push broom imaging eliminates mechanical scanning
- Time delay integration improves NEDT by the square root of the along track detector elements
- Specifications: 8, 11, 12 & 7-14  $\mu\text{m}$  channels, 0.1-0.01°K NEDT, 250 m resolution, 82Km swath

James Spinhome, Joseph Famiglietti, Stan Scott/Code 912  
 John Cavanaugh/Code 924



Microbolometer Array

NASA Goddard Space Flight Center  
 Laboratory for Atmospheres

Fig. 4 A summary chart for the objectives, parameters and technology of the Infra Spectral Imaging Radiometer experiment that was flown on the STS-85 shuttle mission in August, 1997.

## Space Shuttle Experiment for Uncooled IR Array Infrared Spectral Imaging Radiometer (ISIR)

### STS-85 Experiment Results

- Successful Microbolometer TDI infrared imaging
- First Global multispectral IR data set at 1/4 Km resolution
- IR data supported by Shuttle Laser Altimeter Cloud Heights



Fig. 5 Example of data from the ISIR shuttle hitch hiker experiment.

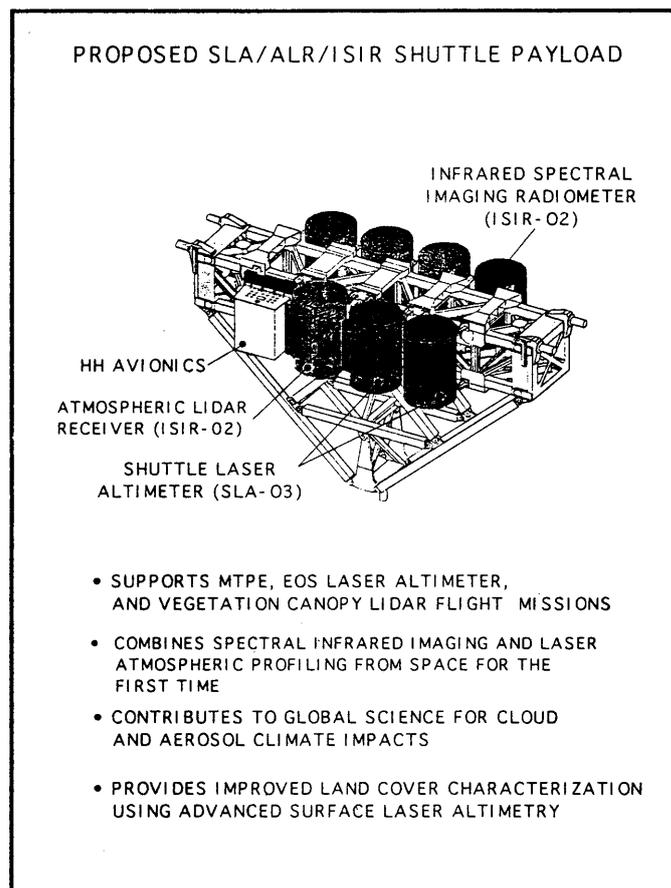


Fig. 6 The Shuttle Laser Altimeter flew along with ISIR on the STS-85 mission.