Performance of the GLAS, ALR and ISIR Space Flight Experiments

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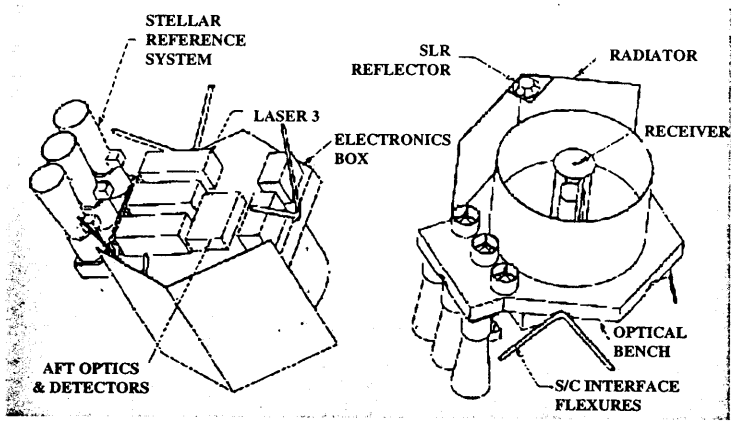
The Geoscience Laser Altimeter System (GLAS) is scheduled to be launched in 2001 for a three to five year mission to measure the height structure of land surfaces, ice sheets and atmospheric cloud and aerosols. Extensive modeling of performance, and development of data algorithms, is in progress. As 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 LaserAltimeter System



Blue - Atmosphere Channel
Red - Surface Channel

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

Fig. 1 Specifications of the Geoscience Laser Altimeter System

GLAS Cloud and Aerosol Measurement Requirements

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

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

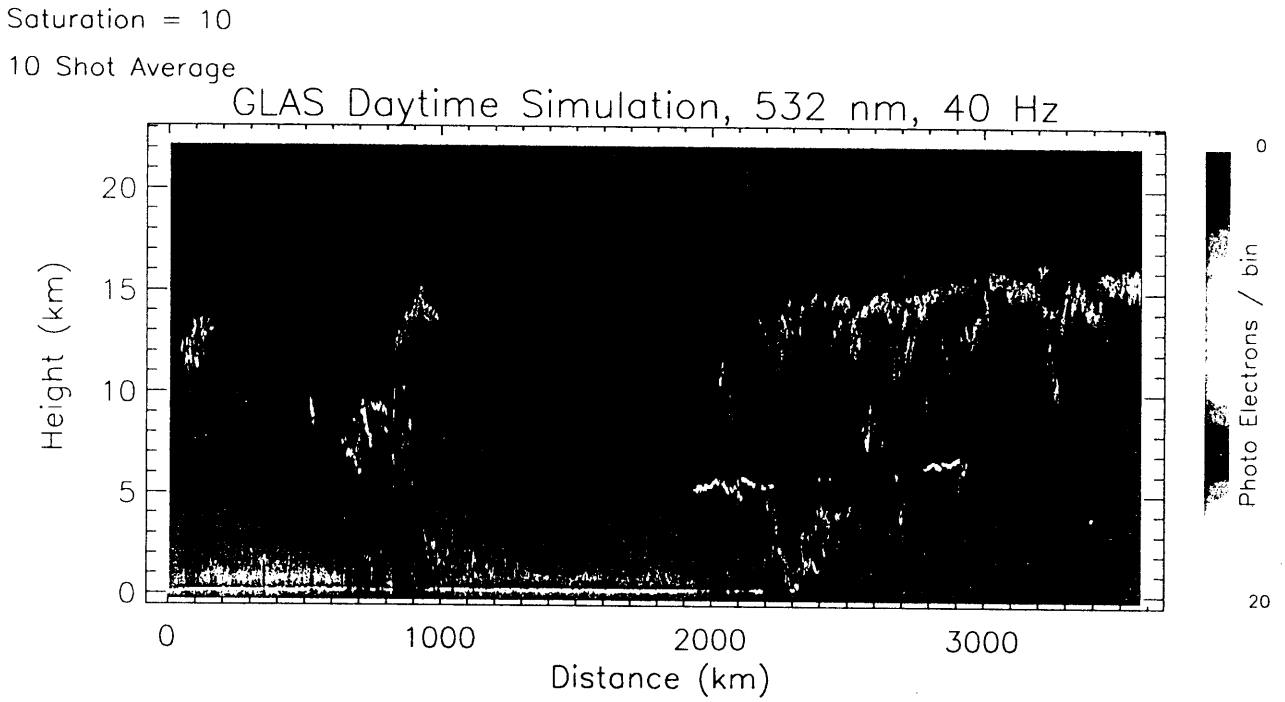


Fig. 3 A simulation of the expected signal performance for the GLAS satellite mission. The simulation is based on high altitude ER-2 aircraft data from the tropical west Pacific.

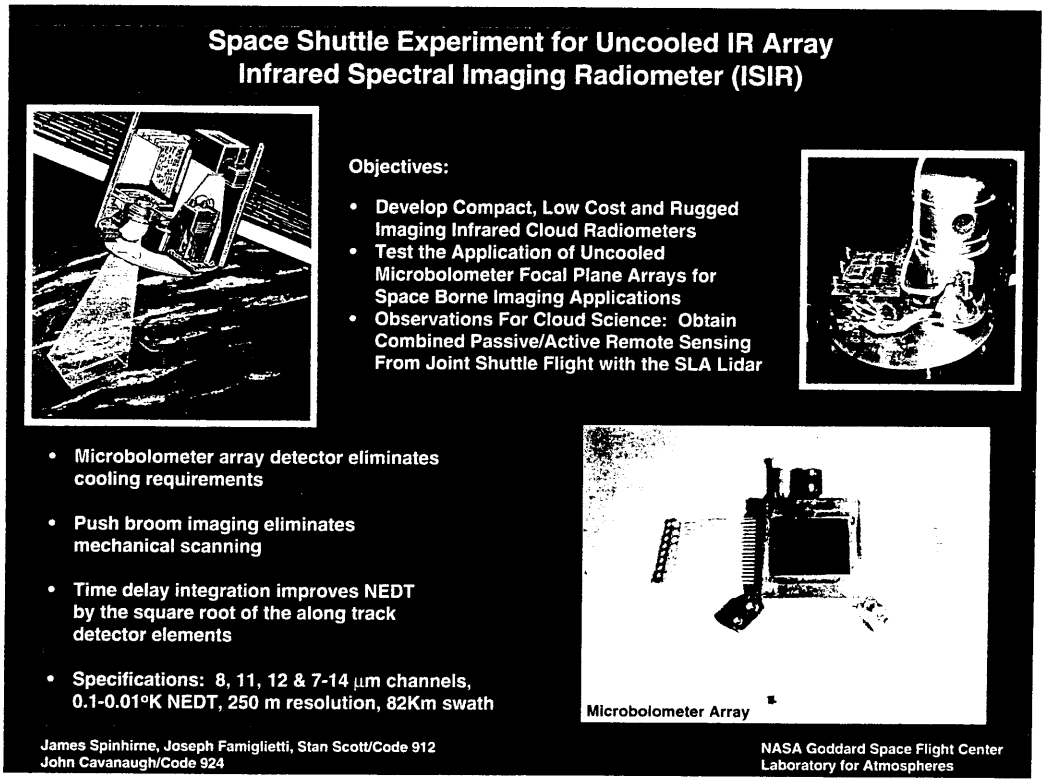


Fig. 4 A summary chart for the objectives, parameters and technology of the Infra Spectral Imaging Radiometer experiment that was flown on the STS-85 shuttle mission in August, 1997.

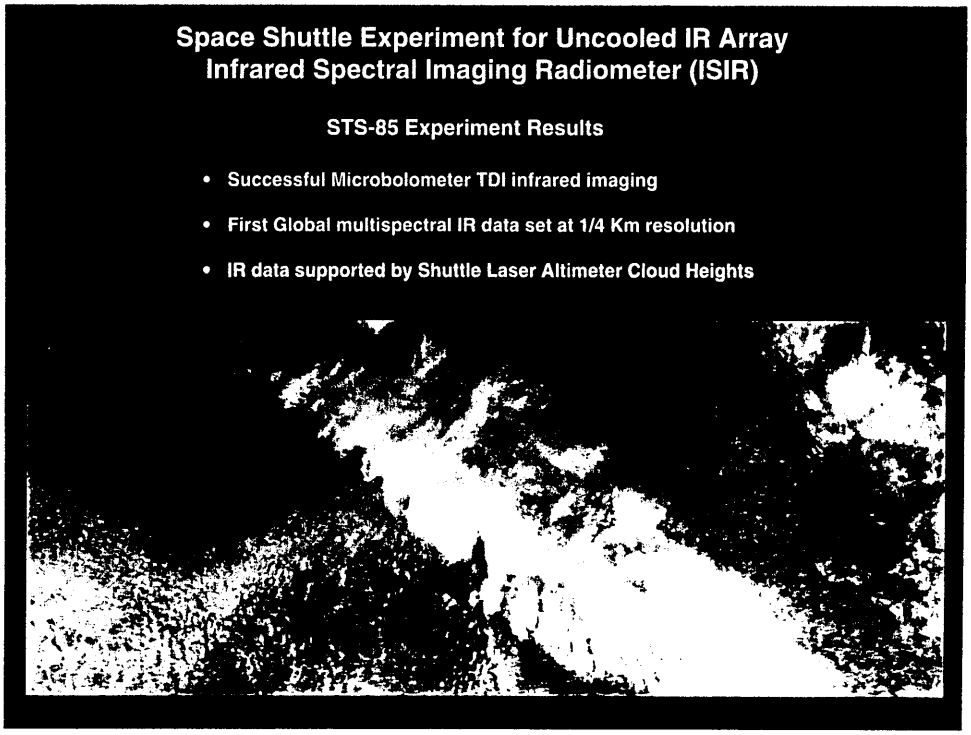


Fig. 5 Example of data from the ISIR shuttle hitch hiker experiment.

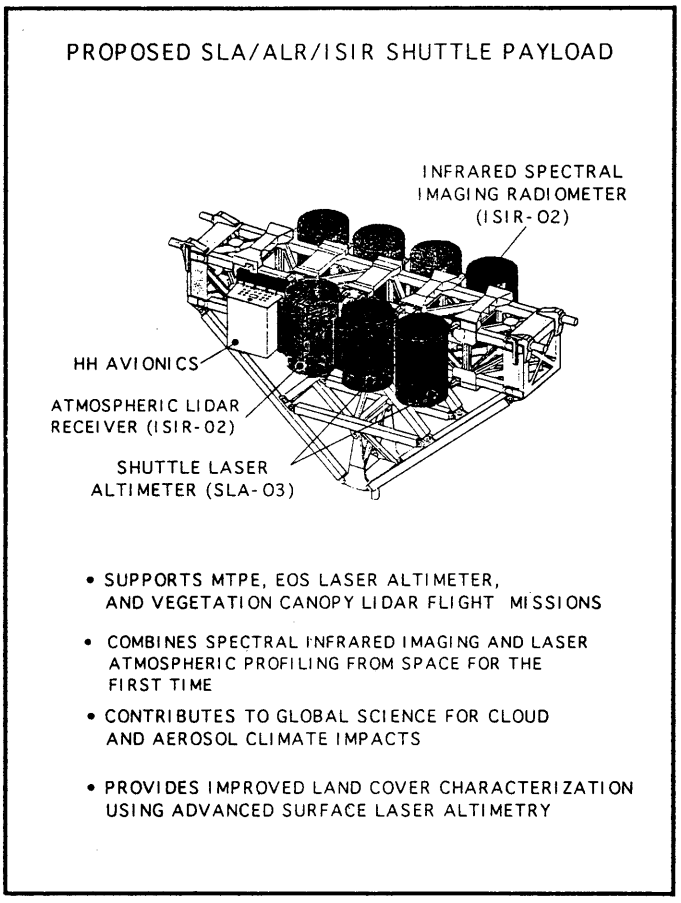


Fig. 6 The Shuttle Laser Altimeter flew along with ISIR on the STS-85 mission.