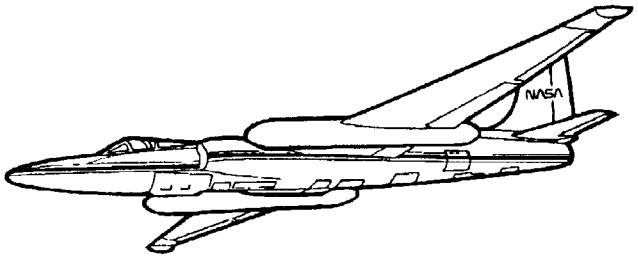
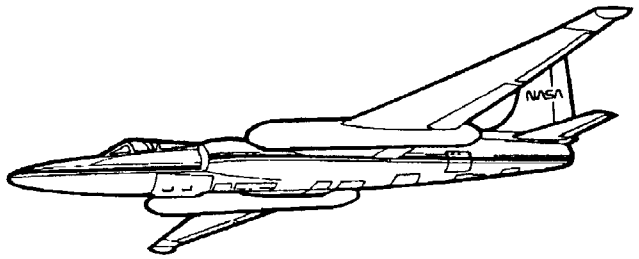


Chapter 8:
High altitude aircraft radiance measurements



Chapter 8:
High altitude aircraft radiance measurements

OBJECTIVES

1. To provide vicarious <u>absolute</u> MODIS calibrations in reflective bands:

   -to verify MODIS on-board calibrator results,
   -to improve MODIS error budget;

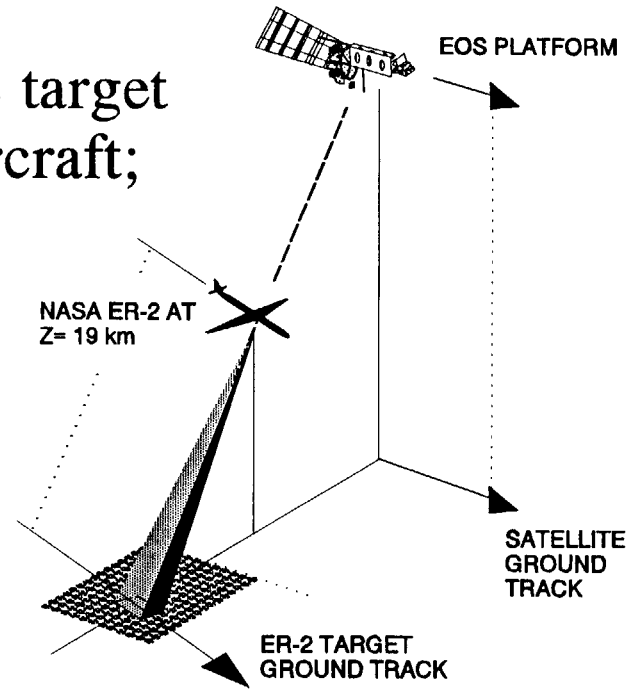
2. To calibrate MODIS with fast response and data turnaround time

METHODOLOGY

-Record several radiance spectra of a suitable target with a well-calibrated spectrometer on an aircraft;

-Fly above 90% of the atmospheric mass using an ER-2 aircraft flying at 19 km to minimize atmospheric path correction;

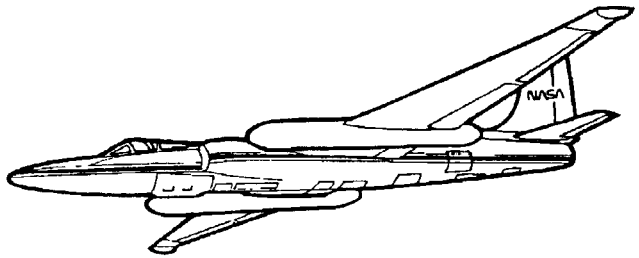
-Underfly MODIS, which observes the target with congruent geometry;



-Convolve each spectrum with each MODIS reflected-solar spectral response function. Correct to satellite altitude with LOWTRAN-7;

-Fine-tune navigation with spatial correlations between MODIS band counts and equivalent radiances;

-Compare MODIS counts integrated across the spectrometer's footprint with radiance at MODIS altitude to derive gain.

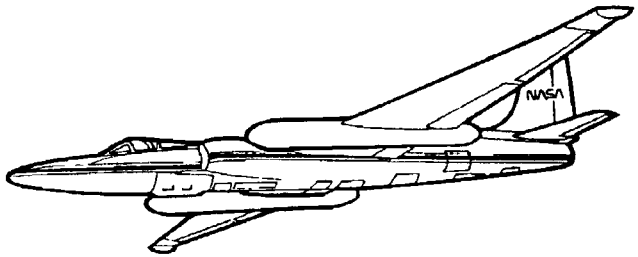


Chapter 8:
High altitude aircraft radiance measurements

ERROR BUDGET

1. Present system, $\pm 3.8\%$, limited by system design:
   - -Data sampling pattern
   - -Information content
   - -Spatial registration

2. With new system, $\pm 2\%$ potential, limited by reference standards
   New system:
   - -Detector array
   - -Simplified optics, no moving parts
   - -In-flight calibration (λ, radiance)
     - * Standard detectors
     - * Integrating source
     - * Solar view



Chapter 8:
High altitude aircraft radiance measurements

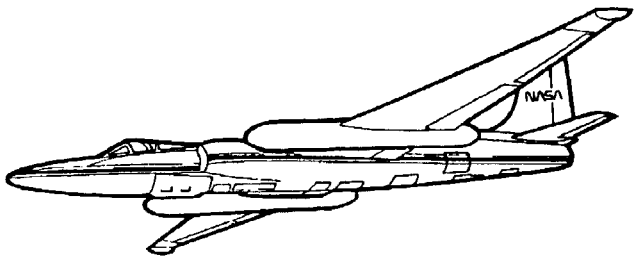
VERIFICATION

1. Error budget supported by NOAA-9, NOAA-11 AVHRR data collected over the past decade.

2. Multiple flights in a short time period to establish repeatability, precision.

3. Pre-flight, post-flight calibration in λ, radiance; in-flight calibration (new system).

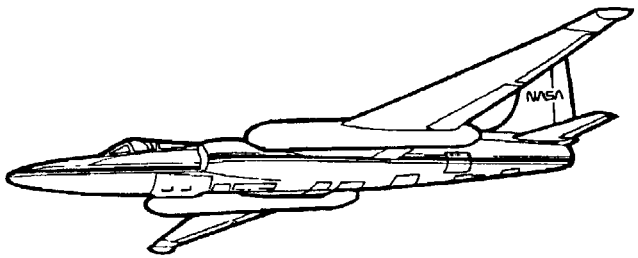
4. Consistency in results from different satellite sensors (MODIS, SeaWiFS, AVHRR, GOES), comparisons with other vicarious methods.



Chapter 8:
High altitude aircraft radiance measurements

PERSONNEL

This work will be performed in Code 925 (Sensor Development & Characterization Branch) at NASA/GSFC. Some contractor support will be required.



Chapter 8:
High altitude aircraft radiance measurements

SCHEDULE

Post-launch:

Flights at least three times a year, more frequently in the period immediately after launch.

Pre-launch:

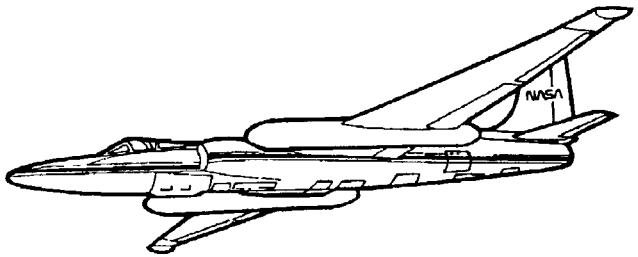
Underflights of AVHRR, SeaWiFS and GOES are necessary at least twice a year to develop confidence in the operation of the system and the analysis of data sets.

If a new system:

Additional flights would be necessary if a new system is constructed.

Underflight expeditions:

Take approximately 2 weeks on average, determined by the need to ship the system and its calibrators to the aircraft's home port, and unavoidable weather delays.



Chapter 8:
High altitude aircraft radiance measurements

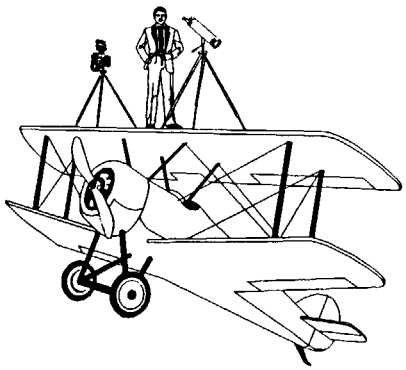
CALIBRATION SITES

REQUIREMENTS:
Extreme (high or low ends of the dynamic range) *visnir* radiance levels, strong temporal stability over times of several minutes, large spatial extent, high accessibility

SITES:

-White Sands, NM, strongly reflects solar *visnir* radiation, is often cloud-free, and is approximately 30 km in diameter.

-The Gulf of Mexico contains large areas of uniform low visnir radiance.



Chapter 8:
High altitude aircraft radiance measurements

RISK ASSESSMENT

RESOURCES RISKS:

It is likely that resources to build an entirely new system to reduce the error budget below the present 3.8% level will ***not*** be available.

If the present system is to be used, with minor improvements, there must be support for much more frequent flights than in the recent past to build up an adequate level of operational experience and to further validate the error budget.

SCHEDULE RISKS:

Special arrangements to fly on the ER-2 at short notice (i.e. several weeks). Weather-driven flight delays are expected to be less than a week. Scheduling the construction and testing of a new system, if funded, will become increasingly difficult as the task is delayed beyond 1994.

SYSTEM PERFORMANCE RISKS:

Can be reduced only through operational experience.