air-LUSI: How we flew a lab instrument on an airplane at 70,000 feet

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Outline

1. **Blah**
2. **Blah, blah**
3. **Blah, blah, blah**
4. **Really cool pictures and videos**
5. **Questions**

NASA ER-2

…video goes here.

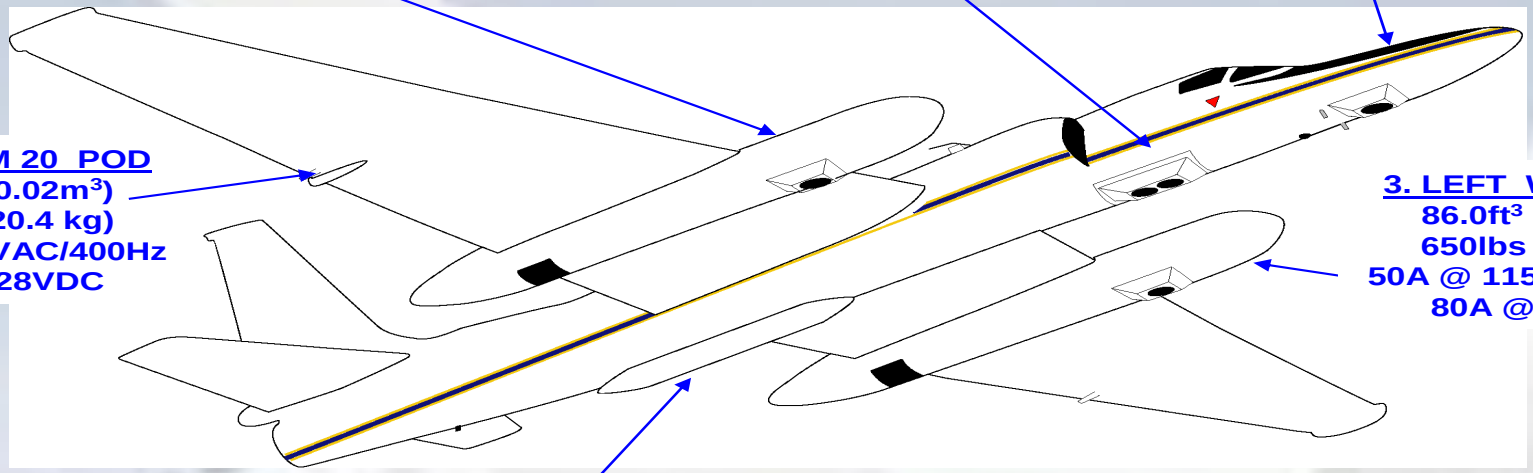
Remember the movie ET where the boy Elliot and ET flying on a bike in front of the moon.

NASA ER-2 Basic Configuration

4. RIGHT WING POD
86.0ft³ (2.43m³)
650lbs (294 kg)
50A @ 115VAC/400Hz
80A @ 28VDC

2. Q-BAY
64.6ft³ (1.83m³)
1000lbs (454 kg)***
100A @ 115VAC/400Hz
140A @ 28VDC

1. NOSE
47.8ft³ (1.35m³)
700lbs (317 kg)***
50A @ 115VAC/400Hz
70A @ 28VDC



5. SYSTEM 20 POD
0.74ft³ (0.02m³)
45 lbs (20.4 kg)
30A @ 115VAC/400Hz
30A @ 28VDC

3. LEFT WING POD
86.0ft³ (2.43m³)
650lbs (294 kg)
50A @ 115VAC/400Hz
80A @ 28VDC

6. CENTERLINE POD
14.0ft³ (0.40m³)
350lbs (159 kg)
Electrical Shared with Q-Bay

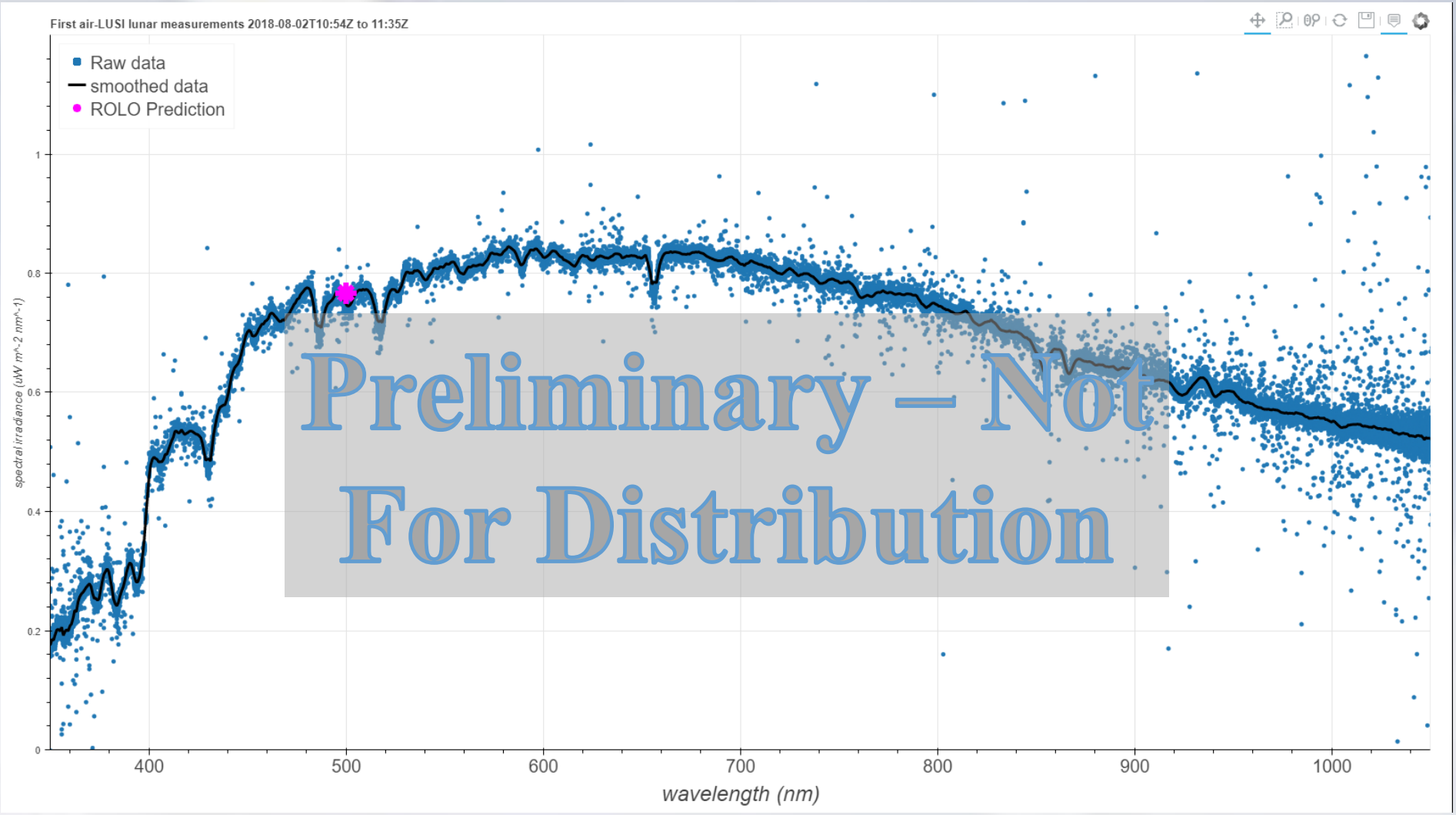
*** - Max combined Q-Bay and Nose payload cannot exceed 1300lbs

Specifications

Crew:	One Pilot
Length:	62 feet, 1 inch
Wingspan:	103 feet, 4 inches
Engine:	One General Electric F-118-101 engine
Altitude:	Above 70,000 feet
Range:	Over 6000 nautical miles, subject to pilot duty time limitations
Duration:	Over 10 hours
Cruise Speed:	~400 knots above 65,000 feet altitude (~210 Meters/sec)

NASA ER-2 Cockpit

First Look at air-LUSI Data Aug 2, 2018



air-LUSI Upload

What the experience was like…

…extraordinary and unique group, each person with certain skills that were all used; everyone "saved the day" at least once.

…like the movies we had a crisis once or twice a day: pass weight limit, safety review, installation issues (physical-2 plates and electronic-pilot switch connector to plane), flight safety review after uploading, software problems, hardware problems.

…communication between team members (when is it OK to turn off the power?)

Extraordinary Team…

just like in the Mission: Impossible movies.

…each with unique skills that were used;
each person “saved the day” at least once.

I could be talked into doing (almost) anything…

Software Requirements...

Autonomous and Manual modes

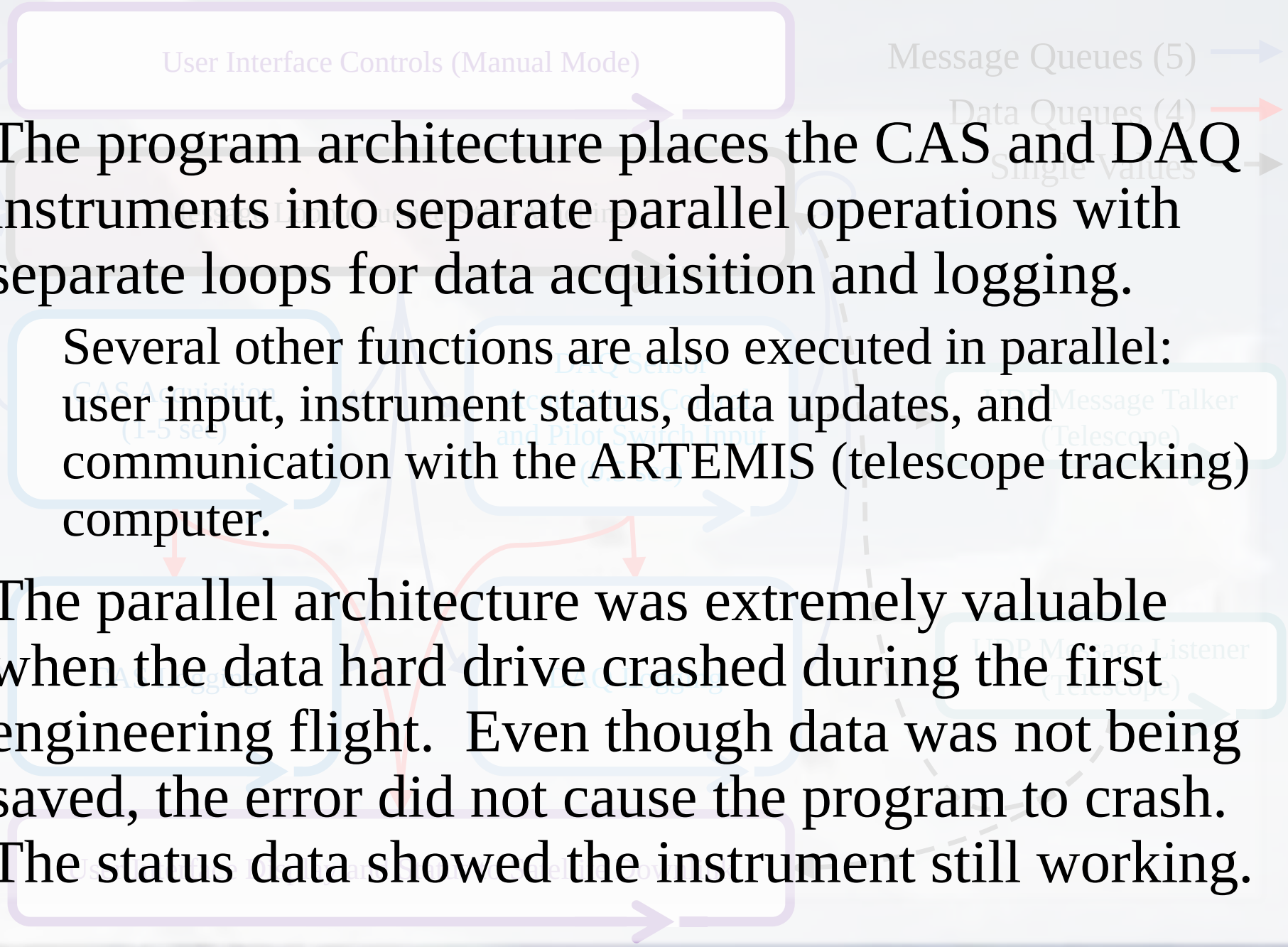
- Computer must boot, start collecting data, and shutdown without operator input from the ground

"Read" the state of the Pilot Switches (on/off)

Two separate functions CAS and DAQ run at different rates: CAS (1-5 sec); DAQ (approx. 0.5 sec)

Operate program remotely and download data over the airplane's network (calibration in hanger)

Send status messages to the ground and the telescope pointing computer (ARTEMIS)



The program architecture places the CAS and DAQ instruments into separate parallel operations with separate loops for data acquisition and logging.

- Several other functions are also executed in parallel: user input, instrument status, data updates, and communication with the ARTEMIS (telescope tracking) computer.

The parallel architecture was extremely valuable when the data hard drive crashed during the first engineering flight. Even though data was not being saved, the error did not cause the program to crash. The status data showed the instrument still working.

What the experience was like…

Flight day schedule:

12 pm CAS calibration in hanger

10 pm CAS calibration in hanger (preflight)

12 am Hands off / Crew briefing

2 am Test satellite communication with airplane

3-5 am Flight (Track flight and monitor status data)

6 am Crew debriefing

What the experience was like…

Second engineering flight, mid-path at 70,000 feet.

What the experience was like…

…slideshow video goes here.

Next up

Educational science slides