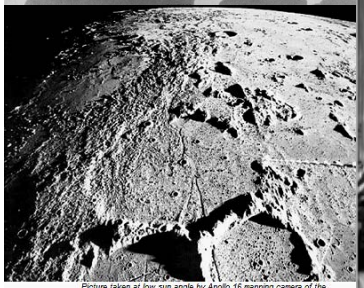
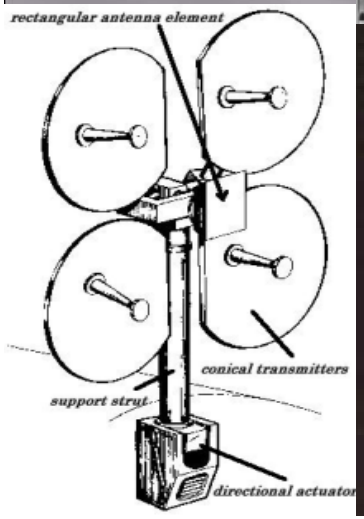


Picture taken at low sun angle by Apollo 16 mapping camera of the Fra Mauro Formation draping over the ancient crater Fra Mauro. NASA photo # AS-16M-1419

13 Things
That Saved Apollo 13

Jerry Woodfill
Former NASA
Apollo 11 and Apollo 13
Warning System Engineer



13 THINGS THAT SAVED APOLLO 13

JERRY WOODFILL
FORMER APOLLO 13 WARNING SYSTEM ENGINEER

A Failed O2 Tank 2 Sensor

A failed quantity sensor in O2 Tank 2, not related to the failure which caused the tank to explode. Had the sensor failed on the ground, Apollo 13 might have been lost, not saved.

A Failed O2 Tank 2 Sensor

Kranz and Lunney Hand-Over

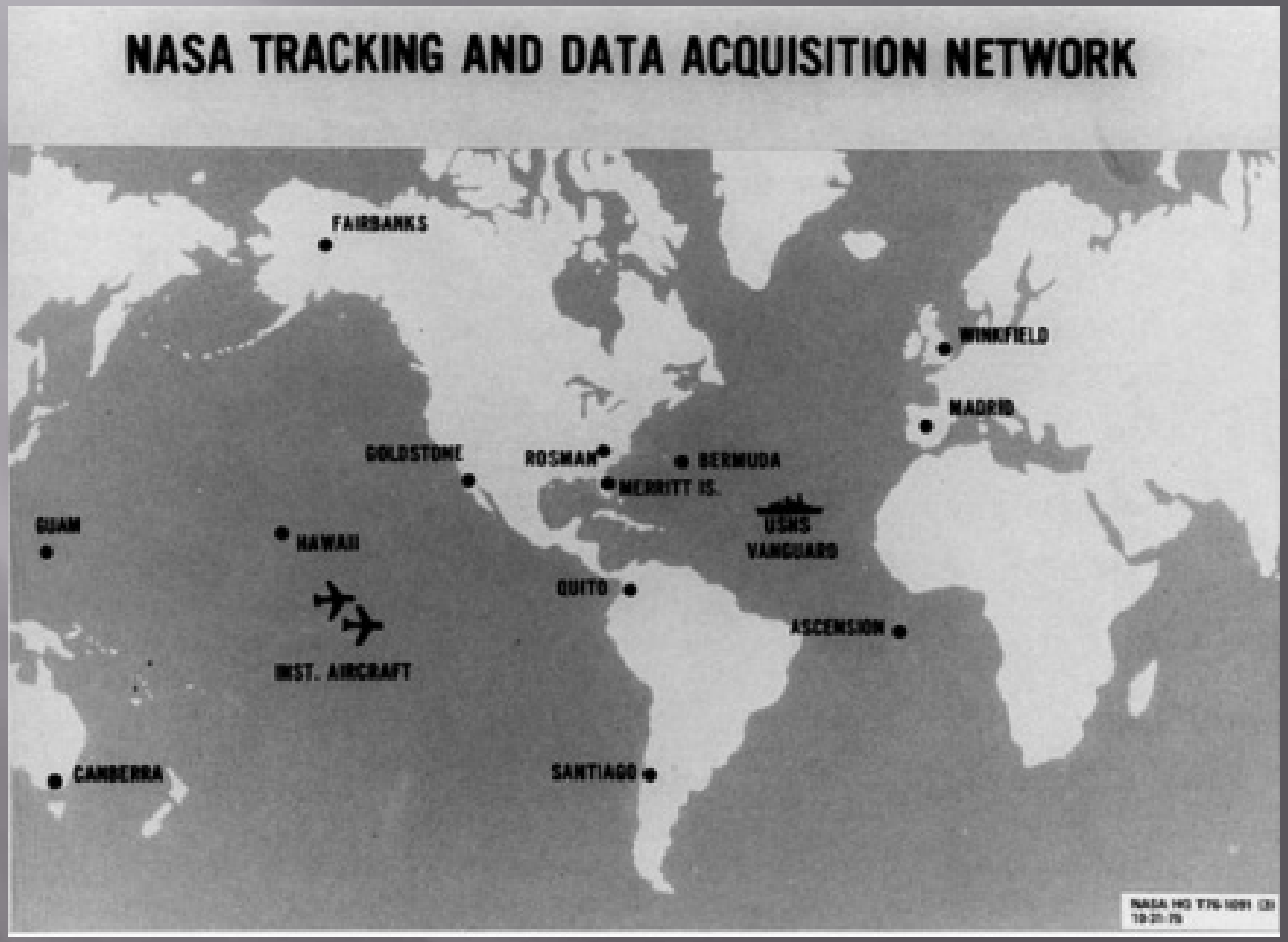
Gene Kranz and Glynn Lunney present at the flight controller hand-over time, just after the moment of the explosion. (These were the most experienced flight veterans equal to Dr. Christopher Columbus Kraft.)

Kranz and Lunney Hand-Over

Tracking Station Program

A little known computer program found to coordinate tracking station communications created by a NASA Goddard Spaceflight Center employee years prior. (Without it, communications between tracking stations could not have been preserved.)

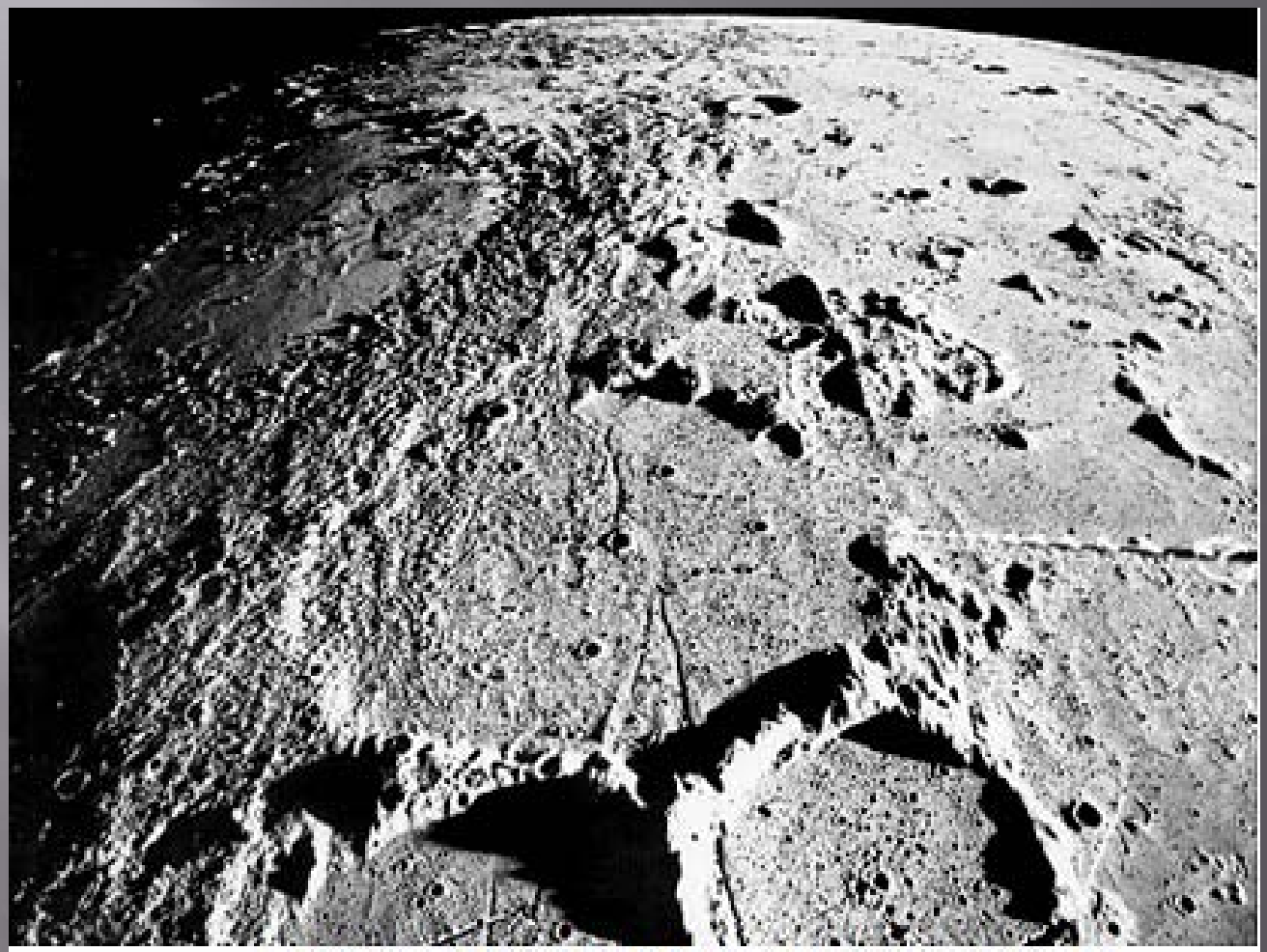
Tracking Station Program



Frau Mauro Destination

That Apollo 13's destination was the lunar highlands of Frau Mauro causing additional descent propulsion fuel to be onboard the lunar lander providing greater latitude of use of the lander's descent engine in the rescue. (Had the explosion occurred on Apollo 8, Apollo 10, and perhaps, Apollo 11 or Apollo 12 the outcome would have been dire.)

Frau Mauro Destination



Picture taken at low sun angle by Apollo 16 mapping camera of the Fra Mauro Formation draping over the ancient crater Fra Mauro.
NASA photo # AS-16M-1419

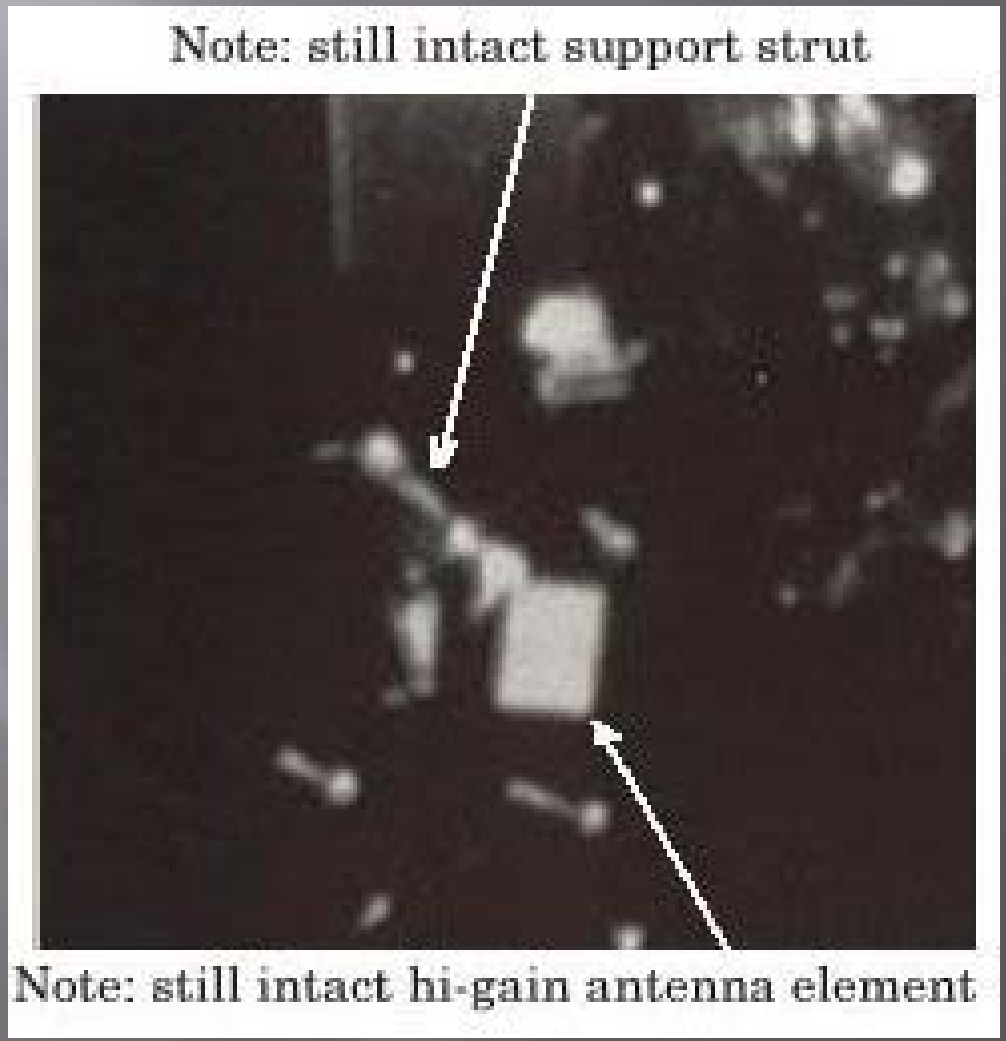
Lovell's Carrier Landing Skills

That Jim Lovell, a seasoned aircraft carrier naval aviator, was at the helm steering Apollo 13 through the initial gyrations after the explosion. Remarkably, Lovell avoided the dreaded "gimbal-lock." (A quick learner, Lovell was challenged in a greater measure than even landing on a carrier deck in storm-tossed seas. His skill in piloting Apollo 13 initially was akin to playing a video game with no warm-up.)

The Indestructible Hi-Gain Antenna

That deep space radio communication was maintained even though the principle hi-gain (directional) antenna was struck by the panel ejected by the Oxygen tank explosion. (Those of us who watched the telemetry display/monitors saw only a momentary flickering of the telemetry rather than scores of seconds without data to analyze. Such a loss of data would have resulted in an impaired ability to analyze the situation.)

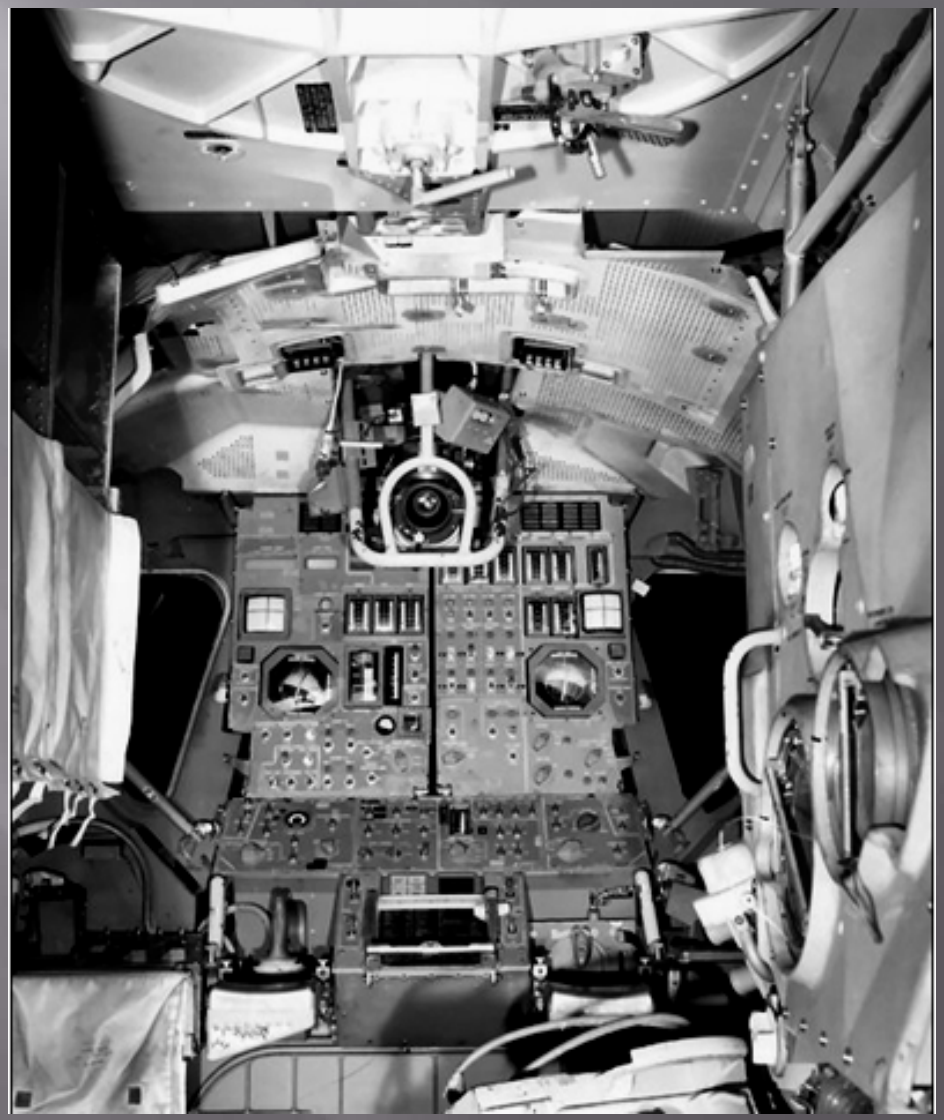
The Indestructible Hi-Gain Antenna



Expedited Crew Operations

That the crew had fortuitously expedited the operational procedures such that they had opened the lander's hatch and even gone inside and powered up certain systems prior to the explosion. (This was altogether fortuitous knowing how opening the lander, stowing the hatch, then powering up the rescue vehicle would have consumed precious emergency battery power in the entry module.)

Expedited Crew Operations



Postponed Sleep Period

This is related to the previous item: The crew was not sleeping at the scheduled time. Had they been asleep, they would have been awakened, confused by the alarm system and sound wrought by the explosion. (This would have resulted in a lethargic, drowsy response to an emergency "firehouse-like" alarm from the warning system.)

Postponed Sleep Period

Trench Consensus

The teamwork of the Apollo 13 band of TRENCH brothers (GUIDO, FIDO, and RETRO) coordinating navigational challenges in a fashion never accomplished before or after in the annals of lunar flight. (Failure to reach consensus quickly in performance of the PC+2 and other crucial "burns" would have been detrimental to rescue. In effect these men of the TRENCH served as a WWI-like fortification, a platoon of soldiers defending the Apollo 13 crew from an enemy intent on their demise.)

Trench Consensus

From The Trench of Mission Control to the Craters of The Moon

"The early years of America's human space program:
Stories from the men of Mission Control's Flight Dynamics Group: "The Trench"

The Caution and Warning System

The Caution and Warning System, not for obvious reasons, but for flaws the system initially revealed in the manufacture of the poorly made initial Block One ill-fated Spacecraft 012. These flaws cost the Apollo One crew their lives in January of 1967. This resulted in the much improved, safer, more reliable Apollo 13 Command Module.

Doubting Weather Predictions

That the Retro-Officer ignored the weathermen's prediction of Tropical Storm Helen's course. (A change in the intended splash-down point might have been fatal considering the impaired nature of the vehicle for entry operations. No change to any of the intended entry assets was of paramount importance based on the outcome of the rescue's final phase.)

Doubting Weather Predictions

Retro Ignoring the Strange Shallowing after LM Jettison

The Retro's correct decision to ignore the entry shallowing angle at the moment of no return, even though he had no idea its cause was cooling vapor from the attached LM. An attached LM meant the shallowing would cease once the LM was jettisoned. So corrections would not have been needed at the "*point of no return*" but the RETRO could not have known. This was an altogether fortuitous decision.

The Mysterious "Black-out"

The mysterious added over a minute plus seconds of communication "black-out" was never experienced before or since during reentry of a manned spacecraft. This is, perhaps, a fortuitous if related to one of the most accurate landings in the Pacific Ocean with respect to the recovery carrier. It has not been understood even to this day. Analysis has defied a reasonable scientific explanation. It is an "*Inexplicable Phenomenon.*"