

Reflections
Apollo 11 and 13
Caution and Warning Experience
for Artemis
by the Apollo Space Craft
Caution and Warning Engineer

Apollo Warning System History 1965-1972

Philosophy:

A fourth virtual astronaut looking over the backs of the Apollo crews from launch to landing reflecting

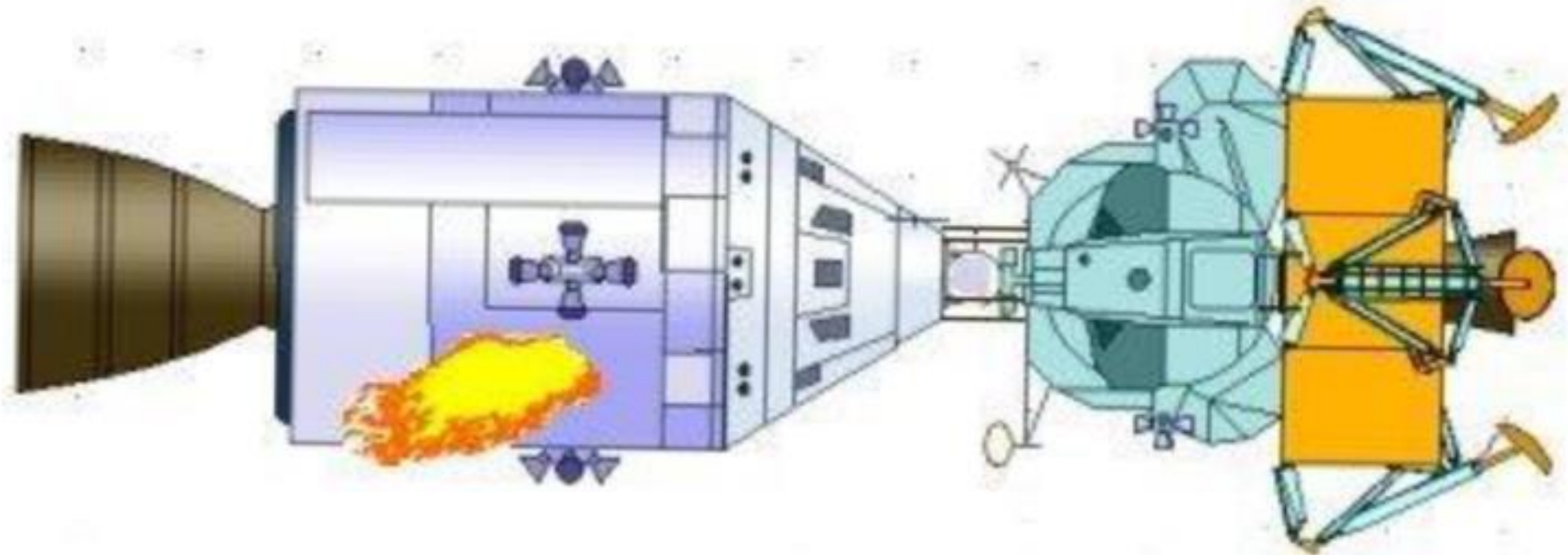
President Kennedy's charge to:

“land a man on the Moon and (most importantly)
to:

RETURN HIM SAFELY TO THE EARTH.”

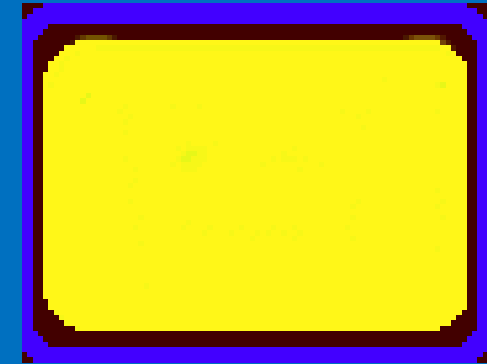
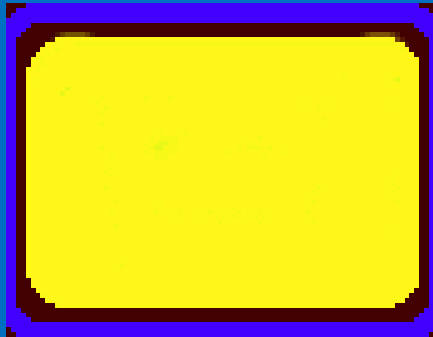
The Apollo Alarm System's Finest Hour

"HOUSTON, WE'VE HAD A PROBLEM"



Approach

Annunciator Panels/Master Alarm and Tone



Major Difficulties

- **Nuisance Alarms, momentary alarms , distracting alarms, coordinated subsystem and alarm criteria engineering, i.e., no overall Alarm System Subsystem Manager.**
- **Examples: System activation or switch changes, master program alarms on Apollo 11 landing, landing radar temperature alarm during landing or EVA, O2 Flow hi alarm during urine dumps, and many more requiring individual reviews with subsystem managers by the Apollo Spacecraft Warning System Engineer.**

Operational Mission Alarms

- **Apollo 11**

- O2 Flow Hi
- Program Alarm
- Potential Landing and EVA alarms.

- **Apollo 13**

- Main Bus B Undervolt Alarm
- CO2 Hi Alarm

Practices and Approaches for Artemis

- The Command Module and Lunar Module's Master Alarm Tones were unique such that the alarm could immediately be determined to be isolated to the vehicle needing attention: Artemis vehicles would benefit from this approach.
- The Apollo Alarm System Master Alarm was inhibited during crucial maneuvers so as not to cause the crew to make a sudden error or inadvertent switch actuation caused by the alarm tone.
- An alarm system overseer/manager group would be good to coordinate all caution and warning operations of spacecraft, Gateway systems, and lunar surface systems.