

# Failure is not an Option

(NASA missions) by Gene Kranz (2000)

Gene Kranz flew in the Air Force in the Korean War & later as a test pilot

4oct57 Russia launched Sputnik into orbit

2nov60 Gene started his new job at NASA in Cape Canaveral, FL

April 1961 Russians put the 1<sup>st</sup> man [Yuri Gagarin] into space

25may61 Pres Kennedy announced his goal to send a man to the moon this decade

June1962 NASA mission control moved to Houston, TX

## Launch date

21nov60	Mercury-Redstone 1 put a chimp in space
25apr61	Mercury-Atlas 3 was destroyed in flight
5may61	Mercury-Redstone 3 put the 1 <sup>st</sup> US man [Alan Shepard] in space
13sep61	Mercury-Atlas 4 put a chimp up for 3 orbits
29nov61	Mercury-Atlas 5 put a chimp up for 2 orbits
20feb62	Mercury-Atlas 6 put John Glenn up for 3 orbits
24may62	Mercury-Atlas 7 put Scott Carpenter up for 3 orbits
3oct62	Mercury-Atlas 8 put Wally Schirra up for 6 orbits
15may63	Mercury-Atlas 9 put Gordon Cooper for 22 orbits [34 hr]
8apr64	Gemini-Titan 1 was a test flight
19jan65	Gemini-Titan 2 launched [media lights caused a power out at mission control]
23mar65	Gemini-Titan 3 put Gus Grissom & John Young up for 3 orbits
3jun65	Gemini-Titan 4 put Jim McDivitt & Ed White up for 4 days & did a space walk
21aug65	Gemini-Titan 5 put Gordon Cooper & Pete Conrad up for 8 days
15dec65	Gemini-Titan 6 Wally Shirra & Tom Stafford rendezvous with another spacecraft
4dec65	Gemini-Titan 7 Frank Borman & James Lovell spent 14 days [206 orbits] in space
16mar66	Gemini-Titan 8 Neil Armstrong & Dave Scott were 1 <sup>st</sup> to dock on space
3jun66	Gemini-Titan 9 Gene Cernan & Tom Stafford had issues
27jan67	Apollo 1 crew were burnt to death before they had liftoff
11oct68	Apollo 7 was the 1 <sup>st</sup> manned Apollo mission
21dec68	Apollo 8 Borman, Lovell & Anders were 1 <sup>st</sup> to see the far side of the moon
3mar69	Apollo 9 McDivitt, Scottt & Schwesckart had 31 lunar orbits
16jul69	<b>Apollo 11</b> Aldrin, Armstrong & Collins land on the moon
14nov69	Apollo 12 Beam, Conrad & Gordon
11apr70	Apollo 13 Hayes, Lovell & Swigert
31jan71	Apollo 14 Shepard, Roosa & Mitchell left 2 golf balls on the moon
6dec72	Apollo 17 Cernan, Schmitt & Evans were the last of lunar exploration

Mercury rockets were 83' tall [+CSM] & 6' diameter weighing 66,000 lbs & 78,000 lb thrust.

Gemini rockets were 109' tall [+CSM] & 10' diameter weighing 340,000 lbs & 430,000 lb thrust.

Saturn V rocket was 363' tall [+CSM] & 33' diameter weighing 6.5M lbs & 7.7M lb thrust.

It was the world's most powerful machine. It consumes 23 tons of kerosene & oxygen before they start to move & 5.5 million pounds of fuel in the 1<sup>st</sup> 2 minutes & 40 seconds.

A spacecraft travels at 5 miles/sec & orbits west to east [16 orbits/day]. The Command & Service Module (CSM) on top of it was 34' & weighed 30 tons & cost \$75 million. The lunar module was 23' tall. 30,000 miles from the moon they leave Earth's gravity field. There is a 3 second delay in communications from Earth to the moon. Simulator training was vital for the preparations for critical situations in space. The moon is a moving target traveling at 2287 mph in its orbit 245,000 miles from Earth. And the Earth is traveling at 66,000 mph around the sun [while spinning on its axis].

Cryogenic oxygen & hydrogen mixed & reacted to provide electrical power & water. These fuel cells need to be stirred from time to time. In **Apollo 13** there was a short in the wiring inside the tank & the spark caused an explosion 200,000 miles after leaving Earth. They lost critical oxygen [not only for fuel & breathing, but also the water it created]. NASA worked on a survival plan to get the crew home. One big problem was getting a round filter from the Lunar Module (LM) to fit a square canister in the CSM so they could breathe. The crew had to run on only 12 amps [so it was cold in there]. They kept attached to the LM & used it & its battery power as a lifeboat home. Before reentry, they jettisoned the SM & could see one panel missing. Reentry slowed the CM down from 5 mps to 100 mph before the parachutes open [slowing down to 22mph before splashdown].

#### Quotes:

"Always hire people who are smarter & better than you & learn with them." [GK]

"...somehow my entire life has been shaped by a power greater than me to bring me to this place, at this time." [GK]

"The Eagle has landed" & "That's one small step for man, one giant leap for mankind." [Neil Armstrong ... 20jul69]      **"Houston, we have a problem."** [Lovell]

#### Note:

CSM = command & service module

CM = command module [cabin]

SM = service module [propulsion]

LM = lunar module