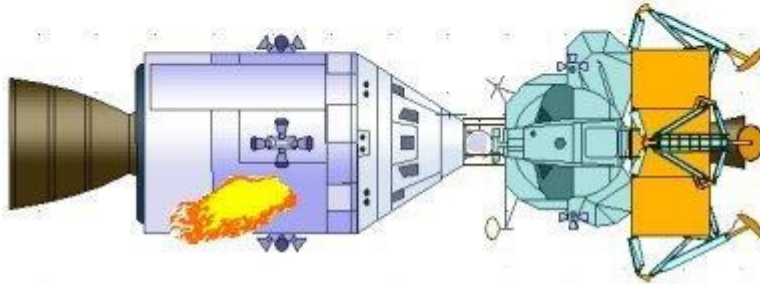
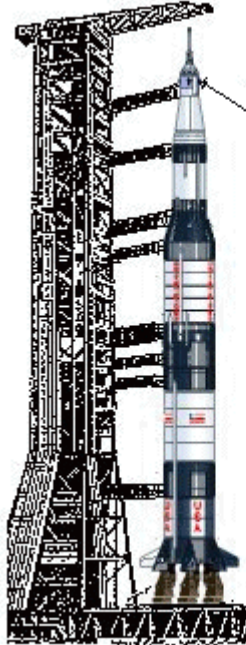


# "HOUSTON, WE'VE HAD A PROBLEM "




## WHAT REALLY HAPPENED TO APOLLO 13

Authored by: Jerry Woodfill (281) 483-6331  
Johnson Space Center  
National Aeronautics & Space Administration  
Houston, Texas 77058



Apollo 13 stands ready for its launch to the Moon.

Location of Oxygen Tank 2.



Got to be real careful with this stuff...

ROCKET FUEL DANGEROUS !!!

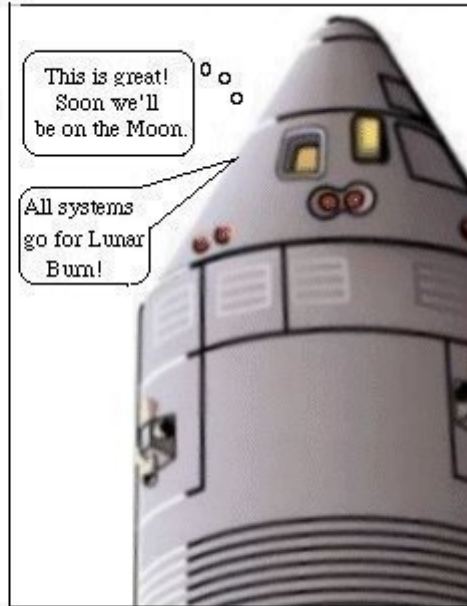
Unknown to NASA, a possible explosion lurks within the innards of the Apollo 13 mooncraft as it prepares to launch for the moon on April 11th, 1970.

A frayed electrical wire inside Oxygen Tank No. 2 may ignite an explosion at any moment.



The crew launches safely on April 11th, 1970.

Won't need the launch escape rocket. A.O.K!



This is great! Soon we'll be on the Moon.

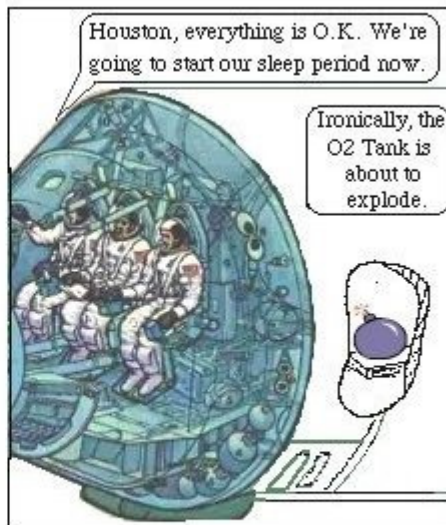
All systems go for Lunar Burn!

Checked the Lander. A.O.K. Its hatch is open.



All shows fine here too.

Looks like a normal mission again.



Houston, everything is O.K. We're going to start our sleep period now.

Ironically, the O2 Tank is about to explode.

It was 9:00 p.m. in Houston and everything appeared normal, but a moment later...



The Oxygen tank No. 2 has exploded 210,000 miles from Earth. Though no one knows the seriousness of the explosion, this could be the crew's fate.



Chief Flight Controller Gene Kranz hears in his headset...

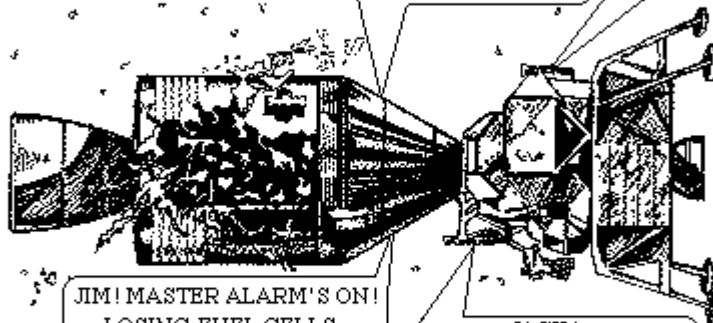
**Houston, we've had a problem.**



No one can see the huge hole in the mother ship caused by the explosion. Soon the capsule will die as the fuel cells stop getting oxygen from the ruptured plumbing.

Fred! Did you make that noise? Quit joking!

Not me, Jim. I just checked the lander. It's fine.



JIM! MASTER ALARM'S ON!  
LOSING FUEL CELLS...  
LOST DC BUS.

JACK!  
Maybe the cabin of the lunar lander ruptured, and we are losing oxygen.

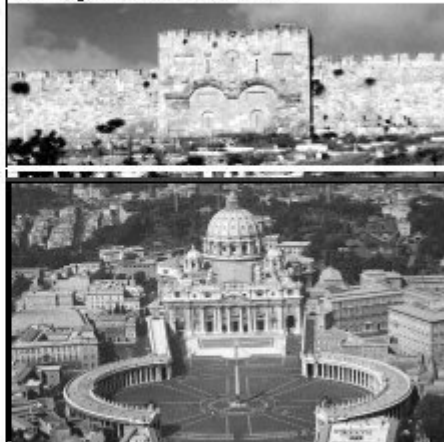
In minutes the situation becomes very grave. The crew switches to emergency batteries as fuel cells go.

The press alerts the world to Apollo 13's great need.



Millions follow the life threatening drama by radio and TV, in homes, schools, offices, and factories.

People worldwide express concern for the astronauts. Prayers were said at Jerusalem's wailing wall and elsewhere...



"We hope that at least their lives can be saved." Pope Paul at St. Peter's Basilica.

The United States Senate issues a resolution to urge businesses to make time for prayer!

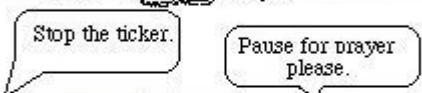
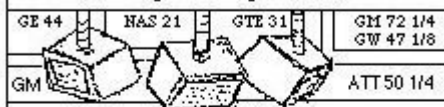


And so America looks to the heavens and prays.



The NEW YORK TIMES describes on page one special prayer services held in the city.

Even stock exchanges pause for a moment of prayer for the safety of the stranded men on board the Apollo 13 spacecraft.

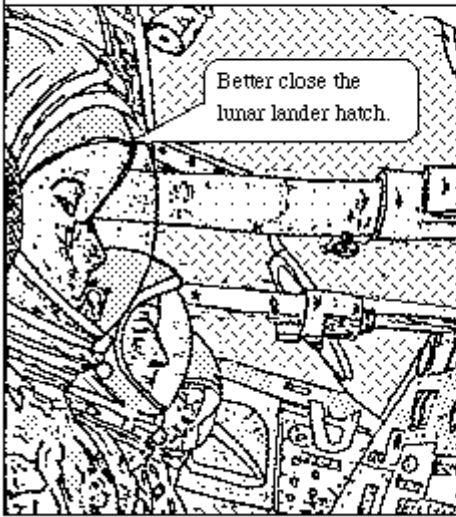


Apollo 13 has been called, "the Mission when the whole world prayed."

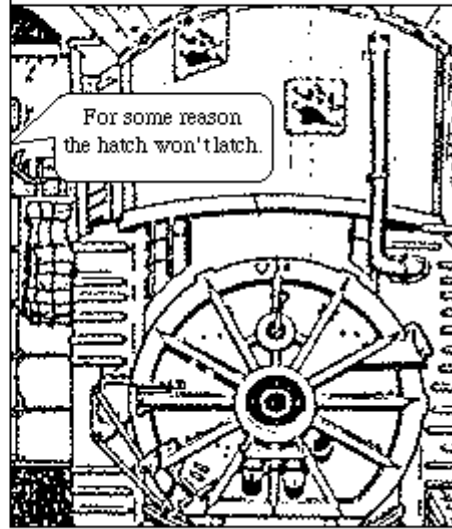
Answers are quickly forthcoming as the rescue unfolds in space and at the space center.



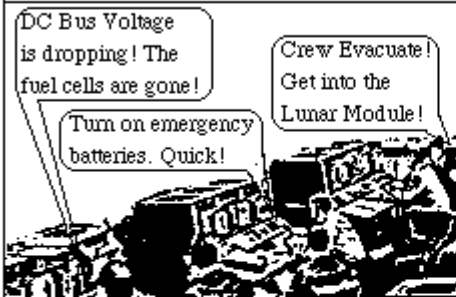
Puzzled, the astronauts think a hole exists in Apollo 13's lunar lander. They nearly remove their only hope for survival.



When they try to close a perfectly designed and much tested hatch....



The open hatch is fortunate because a moment later...



The Lunar Module keeps the crew alive for now, but how long will it last?




Immediately still another future danger is uncovered. Too much Command Module battery power was used while the lander was powered up.



The NASA Power Engineer is called.  
Awakened by the phone, he listens.

This is Mission Control. We don't  
have enough battery power to reenter.


Strange I just watched "Marooned" about  
astronauts trapped in space.



A procedure begins to form...

Suddenly, a fix comes to mind.

I'll jumper power  
from the lander to  
those batteries!

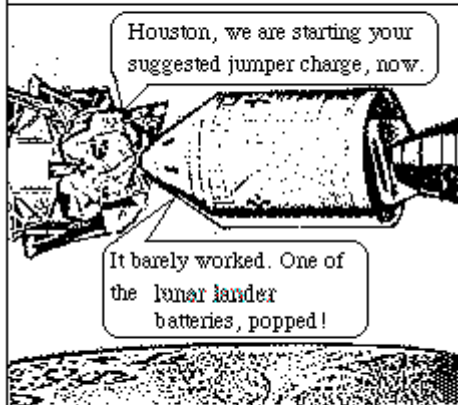


But when the "jumper charge"  
of the Command Module batteries  
by the large Lunar Module batteries  
is tested on the computers at  
Mission Control....

The computer  
says, it won't work!



Regardless of what the computer says, this is the crew's only hope for enough battery power to reenter Earth's atmosphere later.



Houston, we are starting your suggested jumper charge, now.

It barely worked. One of the lunar lander batteries, popped!

Another technical miracle has occurred and the crew will be able to reenter if they can get back to Earth .

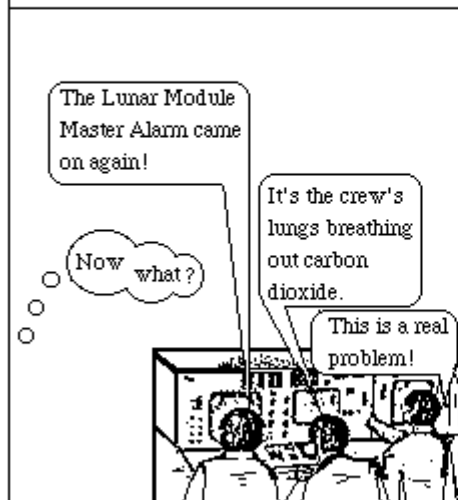
A later search of the power engineer's files failed to find the procedure. Yet, that April night in 1970, the needed fix had come to mind...



It's really amazing I remembered that jumper procedure...

Now that the crew has the power in their reentry batteries to survive, another very grave threat is discovered...

Though the battery charge worked, the air in the crew cabin is becoming saturated with carbon dioxide from the crew's lungs...



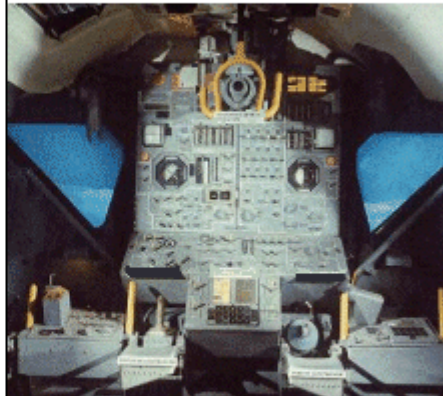
The Lunar Module Master Alarm came on again!

Now what?

It's the crew's lungs breathing out carbon dioxide.

This is a real problem!

As the carbon dioxide level rises the master alarm light in the crew's cabin illuminates also alerting the crew to the danger.



The Lunar lander has carbon dioxide filters to sustain a two man crew for two days, but the trip to Earth is four days for 3 men.



Are you sure the alarm is accurate?

Yes.... It's accurate.

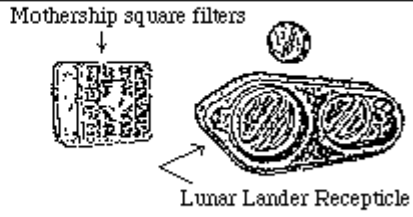
There are too few lunar module CO<sub>2</sub> filters for the trip back to Earth. The crew senses the urgency and leaves the filters in as long as possible before changing to new ones.



The CO<sub>2</sub> cal curve shows the problem.

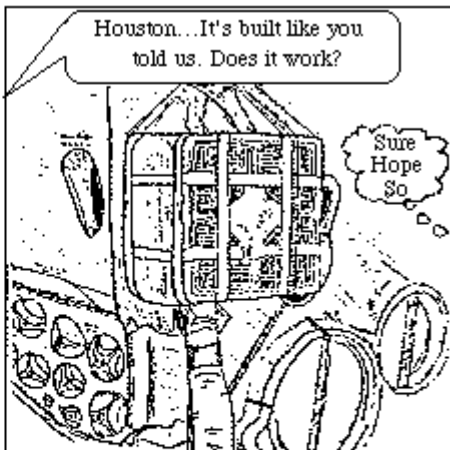
Tell the guys we need a fix fast.

The problem is that there is a plentiful supply of the square command module carbon dioxide filters, but they will not fit into the round receptacle in the lunar lander system.



The guys came up with this thing.

*A group of engineers puts all the items they know are on board Apollo 13 on a table. Suddenly, a man sees how to put the items together into a device which uses:*  
 1) Gray tape, 2) Cardboard logbook covers, 3) Suit hoses, 4) Moon Rock Bags, and of course 5) Square CO<sub>2</sub> Filters from the Mother Ship.



Houston... It's built like you told us. Does it work?

Sure Hope So

*In "Betty Crocker" cookbook fashion the crew has put the device together following radioed instructions from Earth.*



The crew and Mission Control monitor the Carbon Dioxide light and gauge.

Houston!  
It's working.  
CO2 levels are  
dropping.

CO<sub>2</sub> Partial  
Pressure



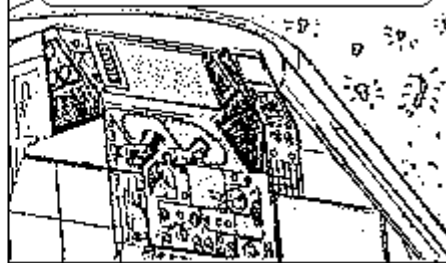
CO<sub>2</sub>



Our device really  
worked. Great!

*Yet, another life threatening challenge arises as the crew attempts to navigate home using a space sextant to position the spacecraft by sighting a star as a reference.*

HOUSTON! I just tried to sight a star to navigate. We can't find our marker with the sun reflecting off tank refuse.



The Earth waits while the team at the NASA Space Center is working very hard...

Apollo 13. Don't worry. We've found something in the computer to help.

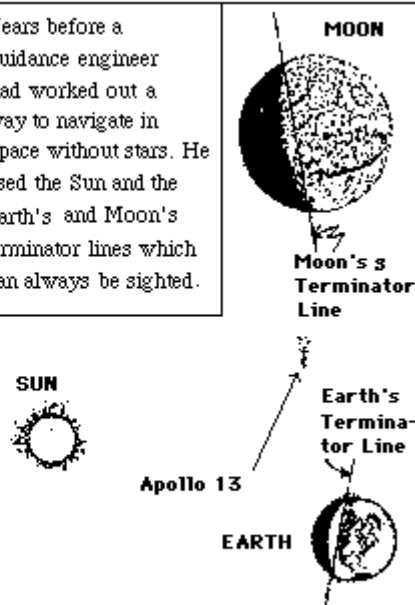
It's amazing we found this!

I hope this works.



*Astronauts must have computer programs to steer their spaceship. The programs need someplace to start, a point in space like a star.*

Years before a guidance engineer had worked out a way to navigate in space without stars. He used the Sun and the Earth's and Moon's terminator lines which can always be sighted.



To keep the men alive, the trip back to Earth must be shortened requiring the "lifeboat's" main engine be fired. But if the navigation fails, the crew will not survive.

Engine started.

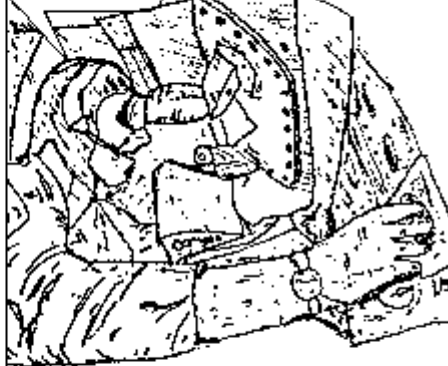


What a way to navigate!

Only one astronaut had tried this before. Jim Lovell had tried it using the computer on Apollo 8, Christmas of 1968. He tested this technique then. Most had forgotten it.

Lovell checks the navigation with the Sun.

IT WORKED!



It was a unique coincidence that not only was such a procedure found in the computers but the only person to have tried it before was the commander of Apollo 13, Jim Lovell.

*The last peril is, perhaps, the most threatening: a hurricane moving toward the landing site...*

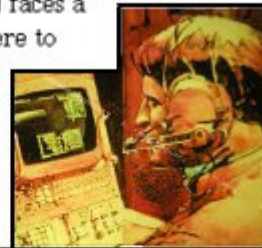
Hope we miss that fierce storm.



The fate of Apollo 13 hinges on the movement of Hurricane Helen.

At the Space Center, the reentry officer (Retro) faces a problem... where to land?

He asks the weathermen for advice.



Retro, better change the landing site!

No, I don't think we will.



Despite the prediction of the weathermen, the Apollo 13 crew lands calmly.



Beautiful! Only a few miles from the recovery ship.

Though the gyros had but a few hours to warm up, this was among the most accurate landings.



Something turned that hurricane. My decision was right.

**ST. LOUIS TIMES**

**APOLLO 13 ASTRONAUTS ARE SAFELY HOME AGAIN!**

*21 Years Aired In N. Viet Attack*      *Baby Spacecraft Could Slip Earth*      *Dunn's Man Crew*

**THE END.**