Outer Space Lessons for Earthside Safety

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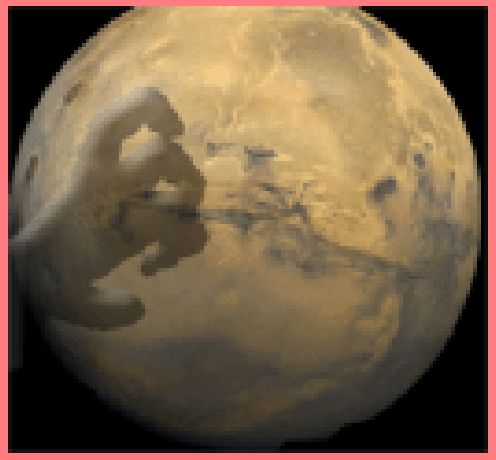
"Getting to Mars is tough"

The Great Galactic Ghoul



Artistic impressions of a hungry, evil demon lurking out near Mars to feed on passing spacecraft -- amusing, until used as a ‘real excuse’

Spaceflight has inherent unique hazards

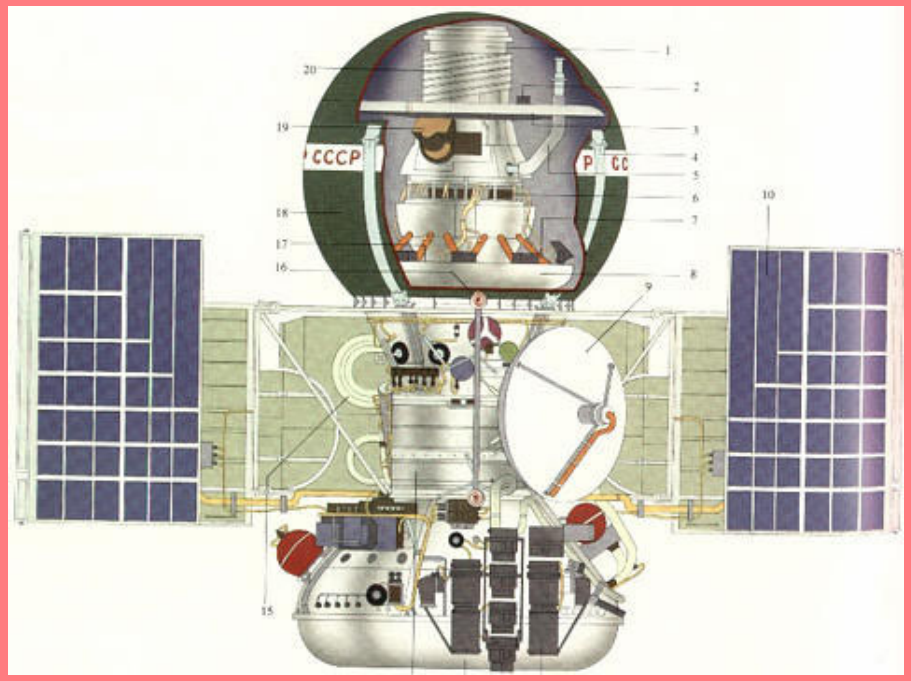
- Harsh environmental conditions
- Sometimes unexpected conditions
- Severe weight/power limitations
- Minimal experience with equipment
- Minimal insight into developing problems

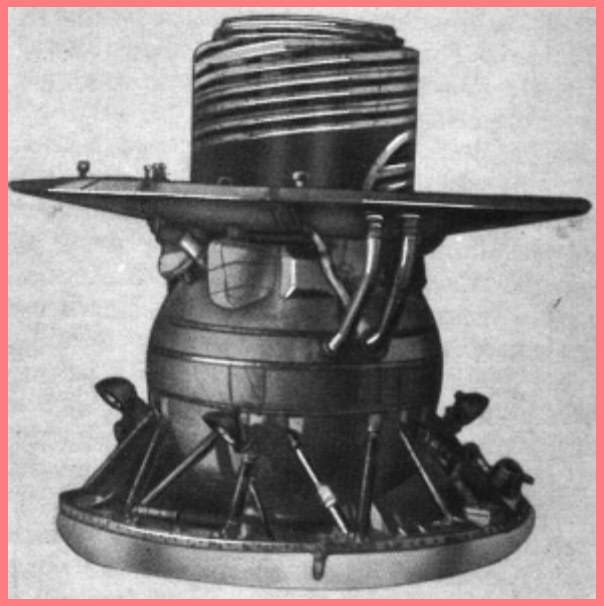
- Doing many difficult things for the first time in human history

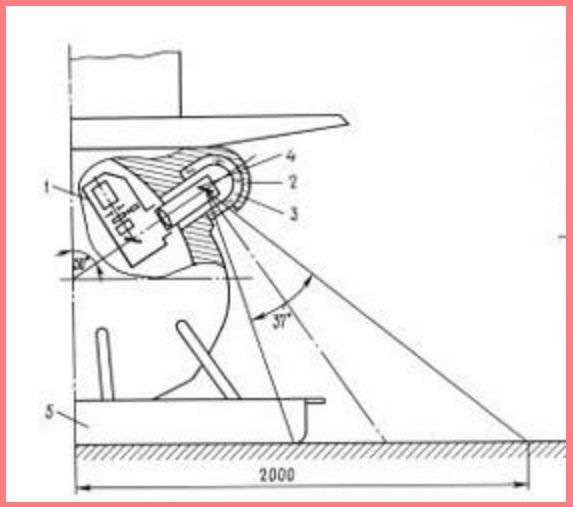
Outer Space may be ‘unearthly’, but safety and reliability are universal

- Experience has shown that the same principles of controlling hazards are effective in space as on Earth
- Experience has shown that the same mistakes that lead to failure on Earth can and do lead to failure & disaster in space.
- Awareness of the kind of ‘safety culture’ needed for safe spaceflight broadens the foundations of our own earthside safety.

Many space accidents aren't all that 'unearthly' [e.g.,Venera landers]

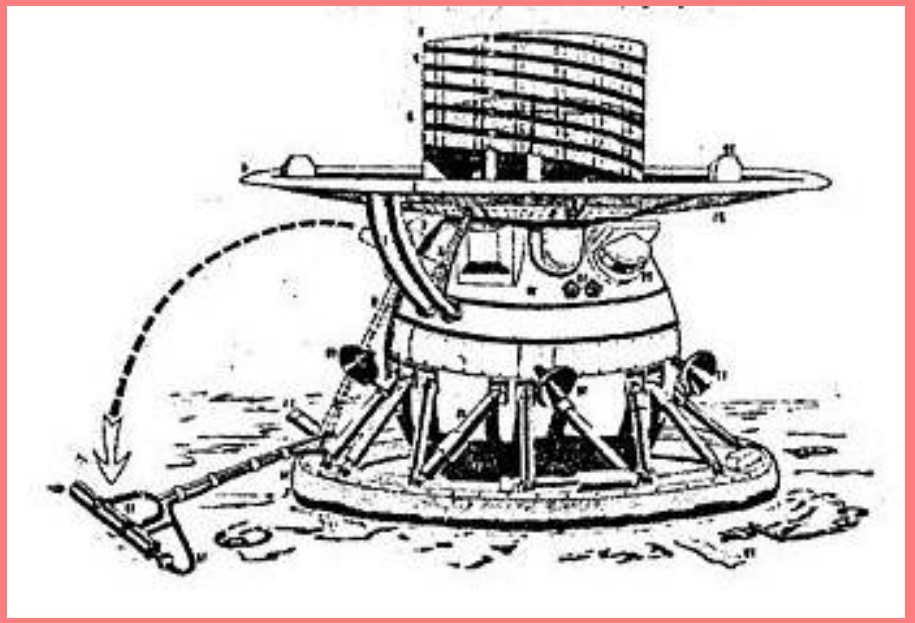




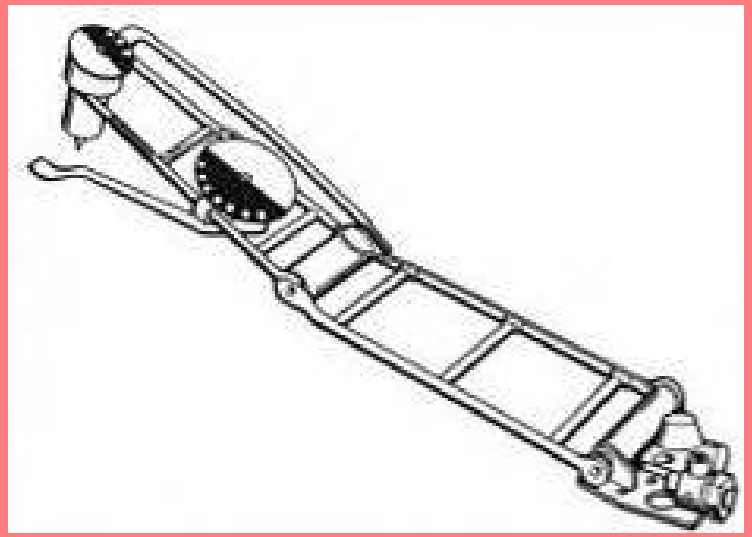


Moscow launches series of 5-ton probes (above) to land capsule on Venus (top rt) and take TV views of surface (right)

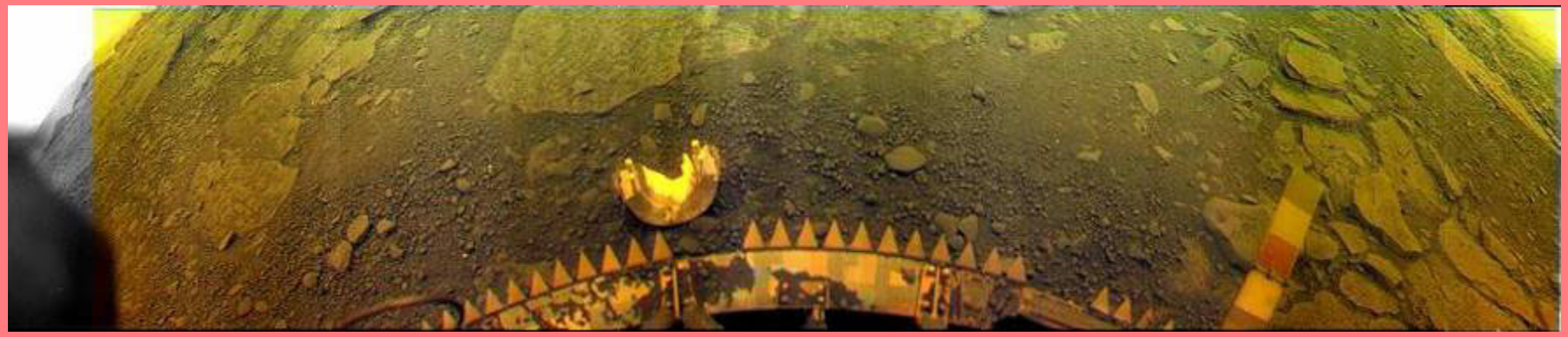
On auto-timer, probe jettisons lens covers, then deploys test arm



In the few minutes after landing, the probe would jettison lens covers (left side and right side) and take images, then unfold test-arm to drive sensor head into Venus soil to test hardness & cohesiveness.



First lander -- complete success



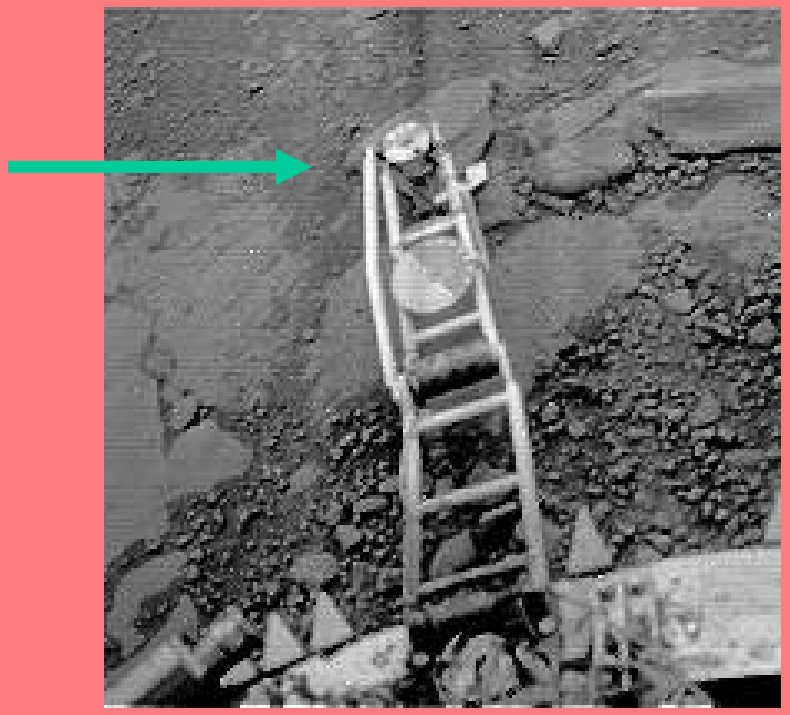
TOP: Arm-less side shows lens cover, color-calibration arm, and ‘teeth’ along edge of spacecraft to create retarding turbulent flow during thick-atmosphere descent.

BOTTOM: Same hardware plus impact arm, successfully deployed into dirt.

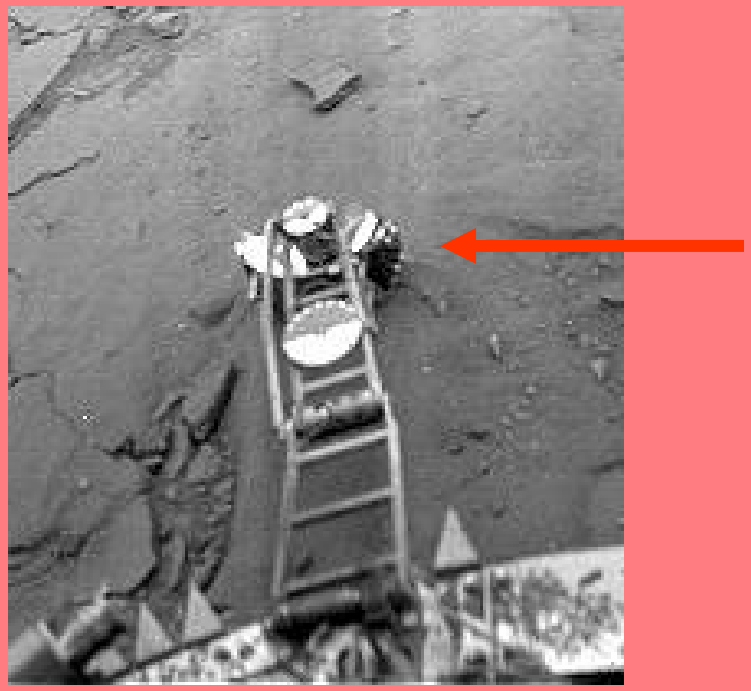
Second lander -- where's the 2nd lens cover?

...and why did the impact sensor say Venus was SO HARD?

Murphy's Law:
Valid for other planets, too



Right way: First test arm reaches Venus surface correctly, gets good data



Wrong way: Second test arm hits randomly-deployed lens cover, fails to touch Venus

Well-known and lesser-known spaceflight catastrophes -- and their causes and cures -- have Earthside safety implications that help us see clearer

- Challenger shuttle (1986) -- seven dead
- Columbia shuttle (2003) -- seven dead
- Mars robot fleet (1999) -- 4 lost
- Shuttle-Mir Calamities (1997)

- Remote-Control RESCUE of ‘Huygens’

‘Challenger’ catastrophe -- January 28, 1986

"All the News That's Fit to Print"

The New York Times

Late Edition

NEW YORK, WEDNESDAY, JANUARY 29, 1986

THE SHUTTLE EXPLODES

6 IN CREW AND HIGH-SCHOOL TEACHER ARE KILLED 74 SECONDS AFTER LIFTOFF

11:39:13 A.M.

11:39:17 A.M.

Thousands Watch A Rain of Debris

From the Beginning to the End

How Could It Happen? Fuel Tank Leak Feared

After the Shock, a Need to Share Grief and Loss

Reagan Lauds 'Heroes'

Francis R. Scobee

Michael J. Smith

Judith A. Resnik

Ellison S. Onizuka

Ronald E. McNair

Gregory B. Jarvis

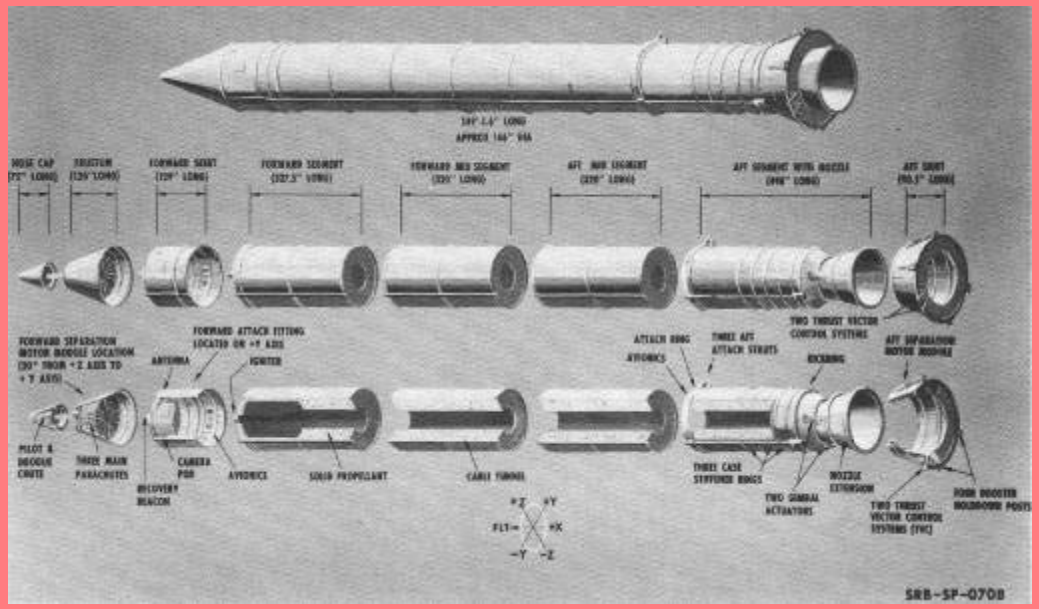
Christa McAuliffe

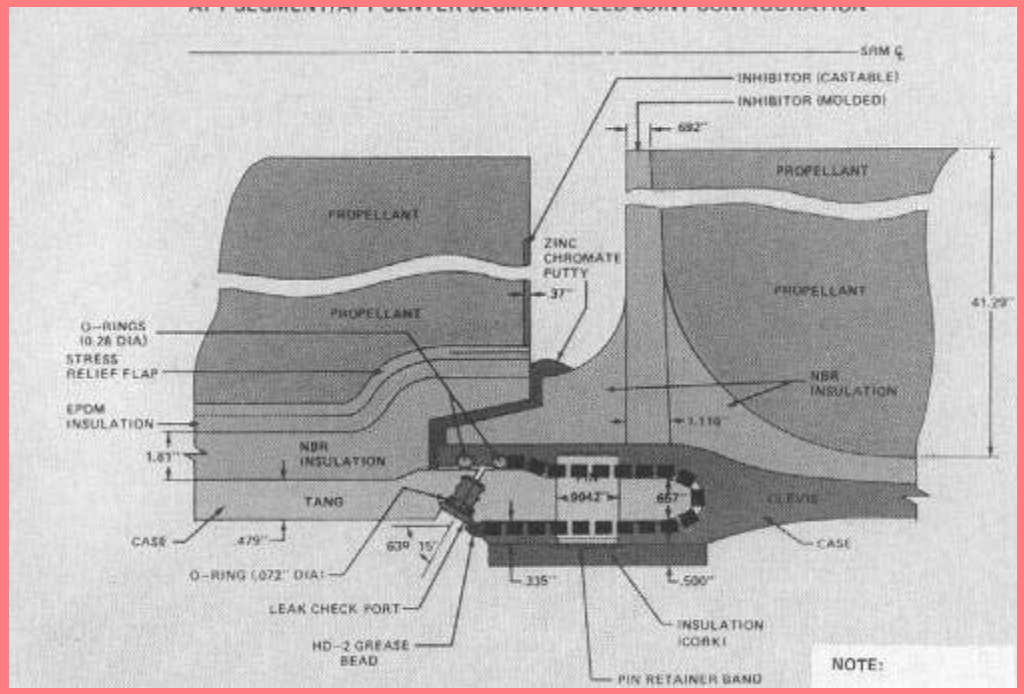
- After 25 successes in five years, launch disaster
- Mission to launch comsat and science probe
- Five NASA astronauts, plus teacher-in-space and payload specialist, killed
- Shuttle grounded for two and a half years

Conspiracy of circumstances, capped by one flawed decision

- Coldest-ever launch day
- New pad, and on-shore wind carried chilled air across the strut area of solid-booster
- Engineers objected to launch but management overruled
- Cold-stiffened O-ring failed to seat at ignition, opening path for leaking flames
- During ascent, steering thru high wind shear layers
- Burn-through occurred just opposite attachment strut

Why even WERE there segments?





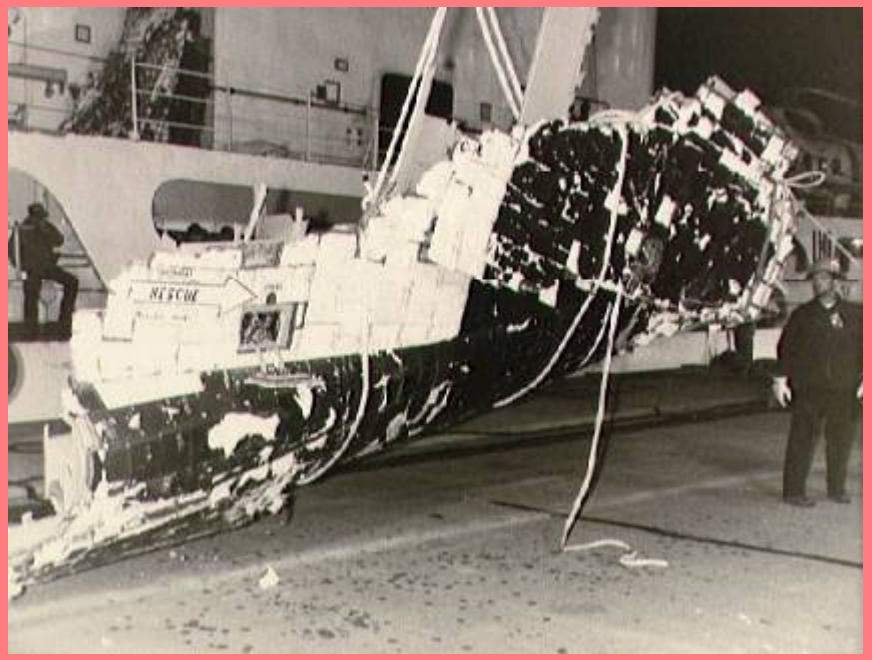
- One company could build full-length tubes, but others had to use rail transport
- Contract bidding process required a design that allowed multiple contenders
- Safety implications subordinate to acquisition regs

The “launch decision”

- Numerous ‘scrubs’ had led to schedule pressure, impatience, and news media mockery.
- NASA’s new administrator was on Capitol Hill meeting with congressmen that day
- Two upcoming planet missions had irrevocable launch dates (“windows”), could not slip
- Engineers said that weather was colder than ever tested and trended ‘away from goodness’
- Officials ordered them to ‘take off their engineering hats and put on management hats’
- Demanded they ‘prove it is NOT safe’ to launch

What happened to the spaceship and its crew?

- Disintegration at 73 sec (48,000 ft up, Mach 1.9)
- Once fuel tank broke apart, ‘Challenger’ was thrown into tumble
- Aero stresses tore it into many separate sections including intact cabin
- Lofted to 65,000 ft
- Crew lost consciousness from loss of air, and then died on impact (2m14s after breakup)



Loss of ‘Columbia’ shuttle


EXTRA

Houston Chronicle

SHUTTLE DISASTER

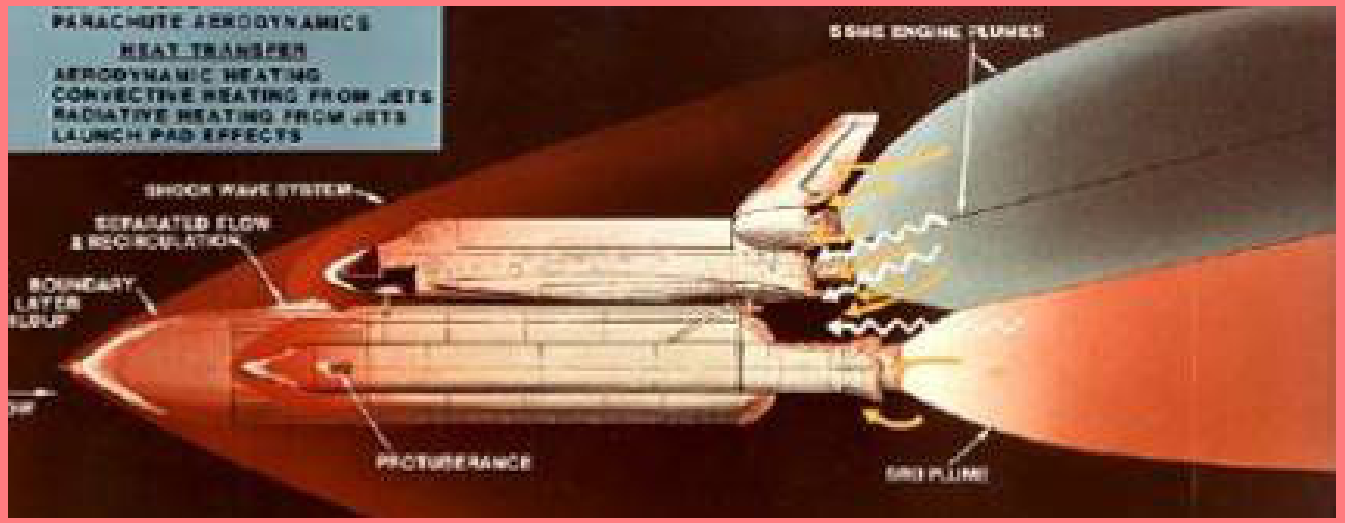
- Columbia breaks up over Texas on re-entry
- All seven astronauts declared dead
- White House: Terrorism unlikely

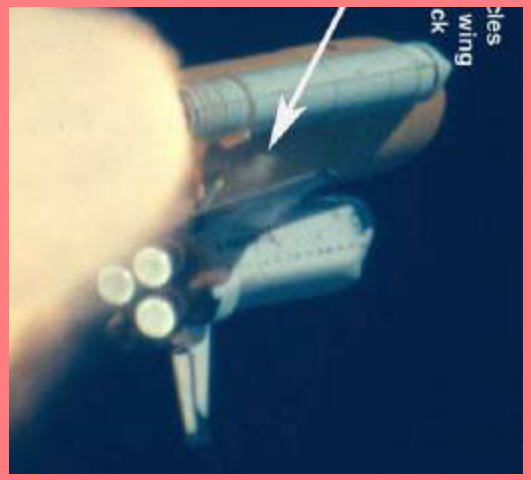
EIGHT PAGES OF EXTENDED COVERAGE

What were the causes?

- NASA ‘got used to’ insulation falling off the tank and damaging shuttle heat shield
- Even when a bigger-than-usual piece was seen to hit wing during launch, NASA didn’t see need to take extra steps to investigate damaged area
- NASA officials made convenient assumptions about ‘how bad it could be’ for return
- Even after an unusual anomaly, NASA did not elevate its ‘situational awareness’ in order to detect potential clues to something bad.
- NASA made no move to ‘think about’ rescue or repair options needed if something bad occurred

Debris Impact during Ascent





Views from ascent tracking camera shows ‘splash’.

Insulation hunk like one that came off

Where Did It Hit?

Preliminary Debris Transport Assessment of Debris Impacting Orbiter Lower Surface in STS-107 Mission

January 21, 2003

Carlos Ortiz (281)
Arturo Green (281)
Jack McClymonds (
Jeff Stone (714) 93
Abdi Khodadoust (

Subcontract 1970483303
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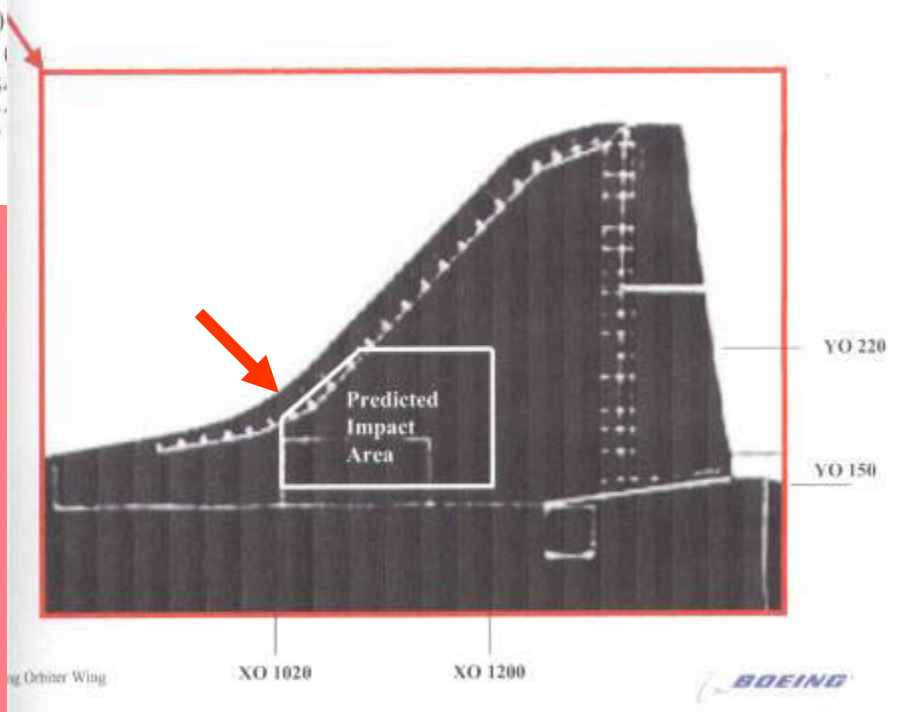
STS-107 Debris Impacting Orbiter Wing

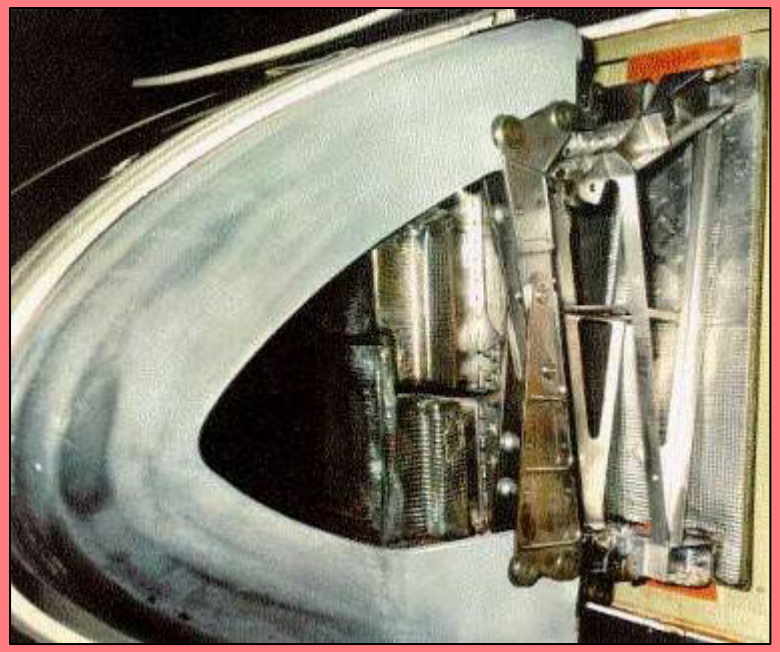
Impact Area Derived from Film Observations and Trajectory Analysis

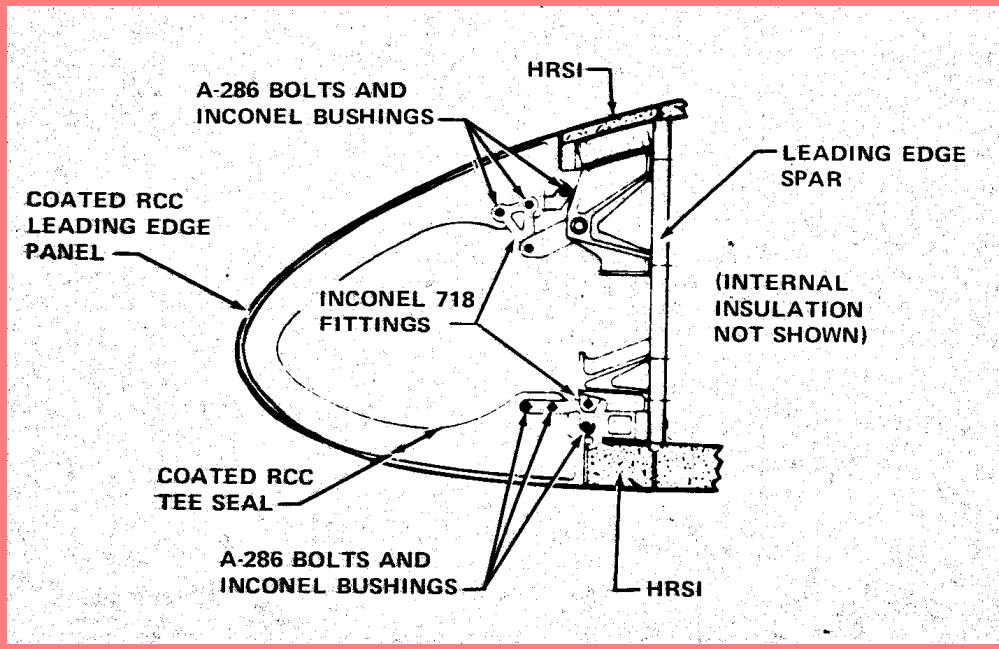


Assessment of hazard by engineering team (above) advised that threat was not very high, based on some assumptions and on use of earlier impact test data.

Location map (rt) also missed actual impact (red arrow) just at boundary of new material

The Hardware That Was Hurt....





Unlike quartz-foam insulation tiles on aluminum skin, high-temp leading edge insulation was made of ‘RCC’ (Reenforced Carbon-Carbon) layers

‘RCC’ Had Never Been Impact-Tested - photos of hole

Only safety concern for RCC was high-speed meteorite hit, not for ‘slow’ insulation impact

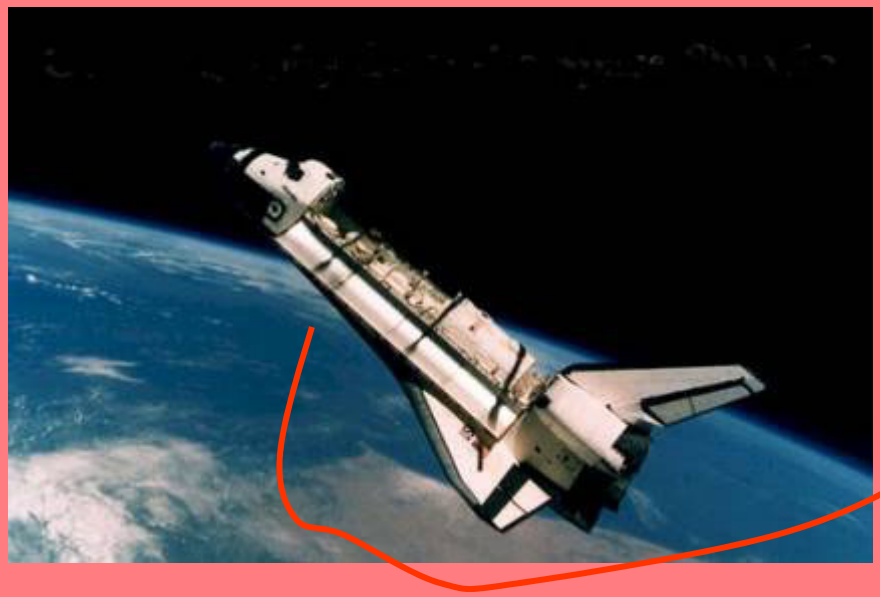
July 7, 2003 -- test knocks head-sized hole in front edge.

Were Decisions Wrong?

Impacted Lower Surface Location Thermal Predictions

Case	Location	Assumptions	Results
1	Access Panel (one tile missing)	Loss to last layer of TMM Densified layer ~ .2 inches	Temperature of Al Tube Carrier 790 °F No issue
2	RCC Panel 9 Lower Flange OML (Coating Missing)	Coating loss and Carbon substrate exposed	Substrate thickness: 0.193 inches Loss .09 inches No issue
3	Main Landing Gear Door (one tile missing)	Loss to last 2 layers of TMM Densified layer ~ .4 inches	Temperature of Structure 540 °F No issue
4	Lower Wing Area (one tile missing)	Loss to last 2 layers of TMM Densified layer ~ .4 inches	Temperature below 350 °F design req. No issue
5	Lower Wing Area (32 x 7.2 x 2.8 inch) Damage	Loss to last layers of TMM Densified layer ~ .2 inches	
6	Main Landing Gear Door (several tiles Lost)	Loss to last layers of TMM Densified layer ~ .2 inches	

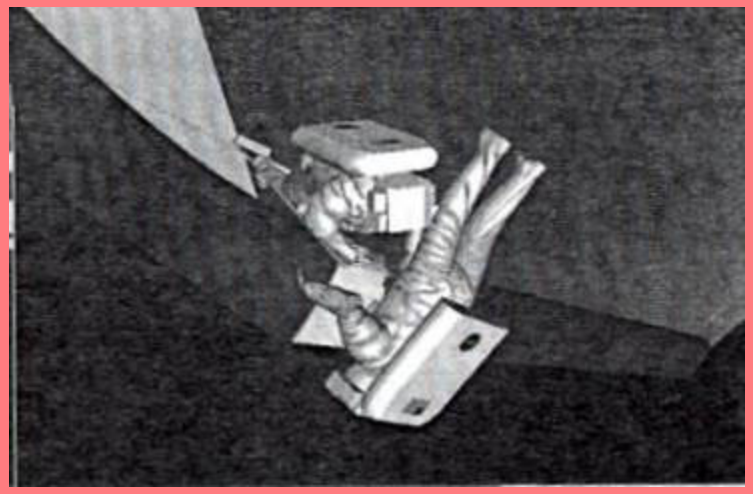
Presentation by Boeing team to NASA's Mission Management Team (MMT) about the threats from impact of ET debris left out 'worse case' results (lower rt) and in hindsight relied on optimistic 'stretching' of very limited test data.

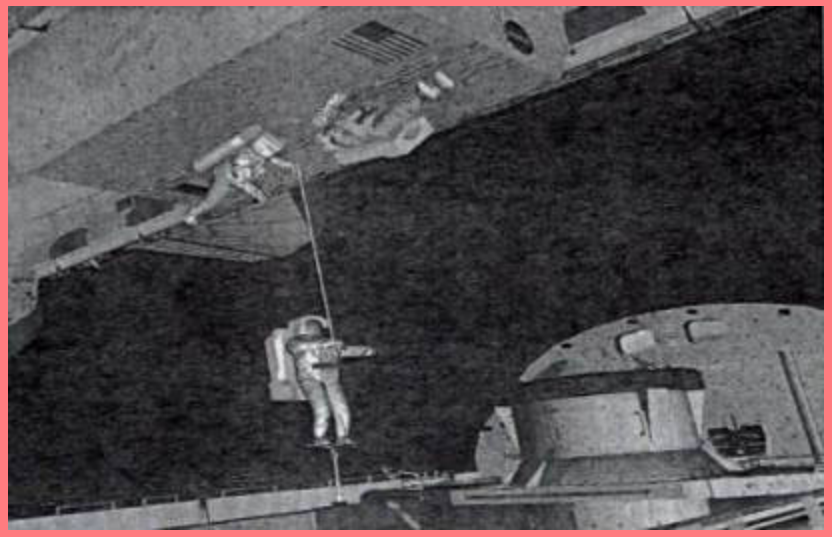


What clues were ignored or overlooked?

*

1. Clear launch view from ground cameras not available
2. Images from Pentagon ‘assets’ not requested
3. Pentagon tracked an unusual small object floating away from shuttle in orbit -- but nobody paid attention
4. Astronauts could have made spacewalk to look over the ‘garage door’ right at the suspected area -- but this was too much trouble (loss of full day’s work) to even be proposed.





What repair /rescue chances were lost?

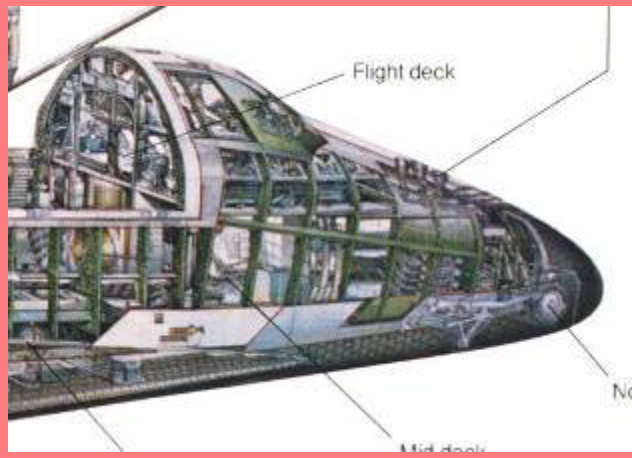
1. If the hole in the wing had been known, Mission Control would mobilize

2. Some would study all possible methods to repair hole with on-hand material

3. Others would study ways to stretch flight duration while rushing launch of next shuttle

What Did The Crew Do?

Seven crewmembers were in crew cabin wearing pressure suits with parachutes



1. Mach 16 at 207,000 ft over Texas
2. High drag on wing caused snap spin
3. Radio links lost while shuttle went end-over-end several times
4. Main sections tore apart
5. Crew cabin subjected to high temperatures and air-braking stresses
6. Astronauts died from blunt trauma or from asphyxiation
7. One to two minutes short of point they might have survived in free fall

(Apollo entry artwork)

Columbia Accident Investigation Board

Admiral Gehman: “We sought the cultural background for this accident... 80% of our final report could have been written before the accident occurred.”

Even now, NASA struggles with ‘Return-to-Flight’

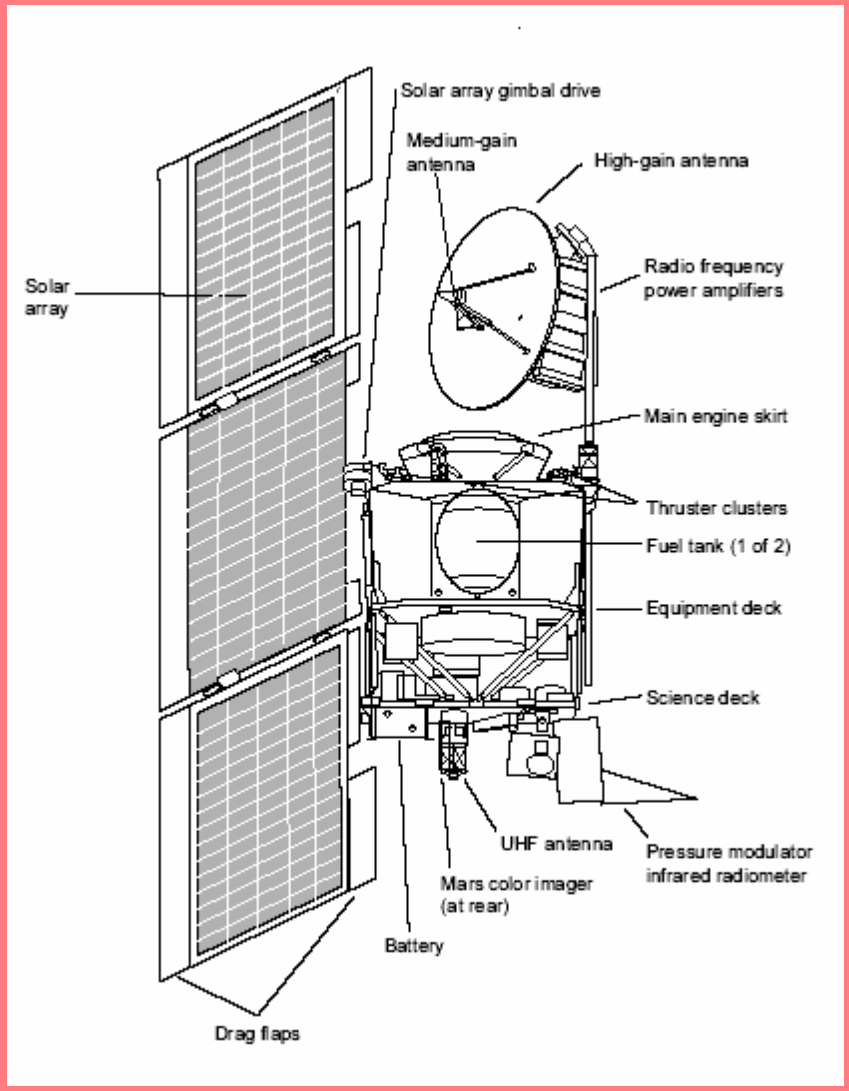
- Shuttle mission in July 2005 also had foam shedding although less severe than before
- Additional observation methods guaranteed that heat shield damage would be detected
- Additional backup procedures -- repair and refuge -- available in case of such damage
- Follow-on flights delayed repeatedly based on more thorough testing and understanding

Mars 1999- Four NASA spacecraft all lost

- Mars Climate Orbiter -- Incorrect steering commands crashes it into atmosphere
- Mars Polar Lander -- Software flaw turns off engine 100 ft above surface (maybe)
- Deep Space 2A -- Lander probe vanishes
- Deep Space 2B -- Lander probe vanishes

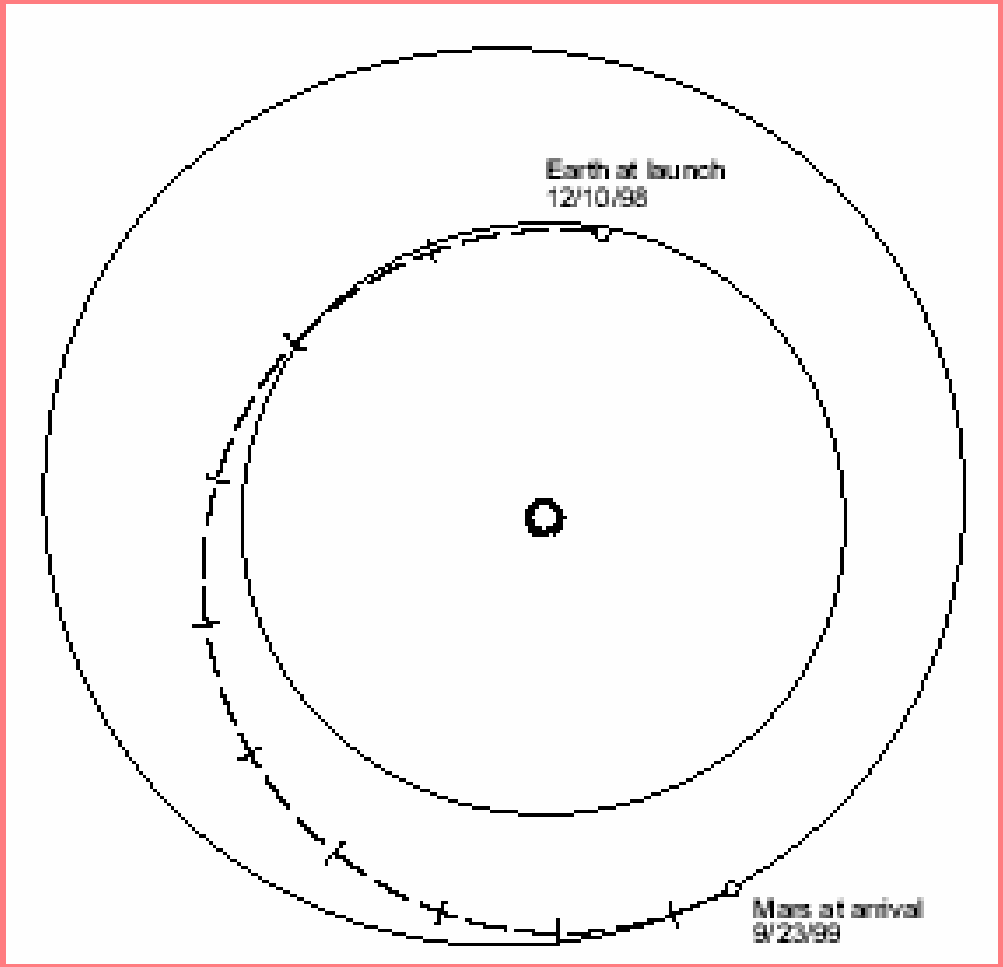
Official excuse: units mixup (English/metric)

Probe had one solar panel that resulted in gentle torque from ‘solar wind’, requiring small jet thrusters to fire every few days. Thrusters also pushed probe slightly off course. This was expected, but size of push was delivered in wrong units (so was about 5 times too small).



Actual contributory cause: Demonstrate NASA's sexy Faster-Better-Cheaper mantra by deep staffing cuts and abbreviated S/W testing

Most of long space cruise was occupied with getting guidance software completed and loaded



Long Earth-to-Mars flight path (right) gave control time plenty of time to diagnose and correct navigation flaw

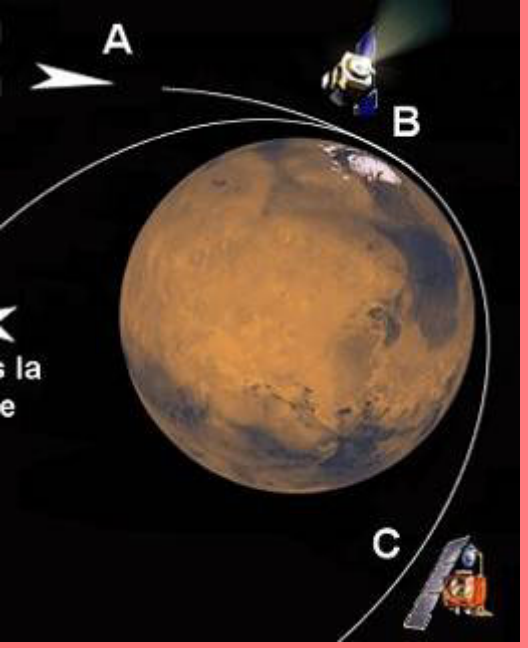
Actual Immediate Cause: Disregard intuitive anxiety from navigation team

1. Navigation team detected 'unusual' deviations when calculating periodic course corrections.

2. They even correctly estimated error factor (5X) but did not understand what was causing it.

3. Approaching Mars, they suggested taking a wider turn because they weren't sure about course.

4. ***Management told navigators that if they could prove they were off course, then a different path would be chosen. Otherwise, assume all OK.***



1. (Left) Probe approached from ‘A’, fired braking rocket at ‘B’ to enter orbit around Mars (‘C’). BUT it was off course enough to hit atmosphere.

2. (Center) Air drag was severe enough to cause meteoric heating until probe crushed by high G-forces [artist license]

3. (Right) Mission Control had made better navigation fixes during final approach, realized course problem too late to maneuver; only hope for recontact was for a miracle.

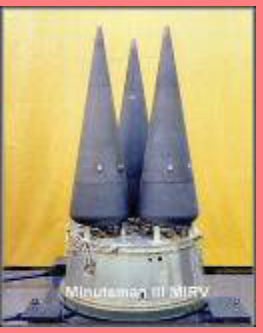
Mars Polar Lander

- Once MCO was lost and NASA realized it was human error, ‘tiger team’ thrown at follow-on probe to identify hazards
- Several likely-fatal flaws were identified, and workaround procedures developed
- Probe disappeared anyway -- no signal, and no useful information on cause of loss
- Months later, testing backup vehicle found an even more inescapable show-stopper

MPL used braking rockets for soft landing on Mars

1. Engine fed hydrazine over a catalyst bed to ‘explode’ it, thus generating thrust to change speed.

2. Post-MCO loss, analysts realized the ‘cat beds’ were too cold to safely handle first ignition -- so heaters were used to warm them partially.



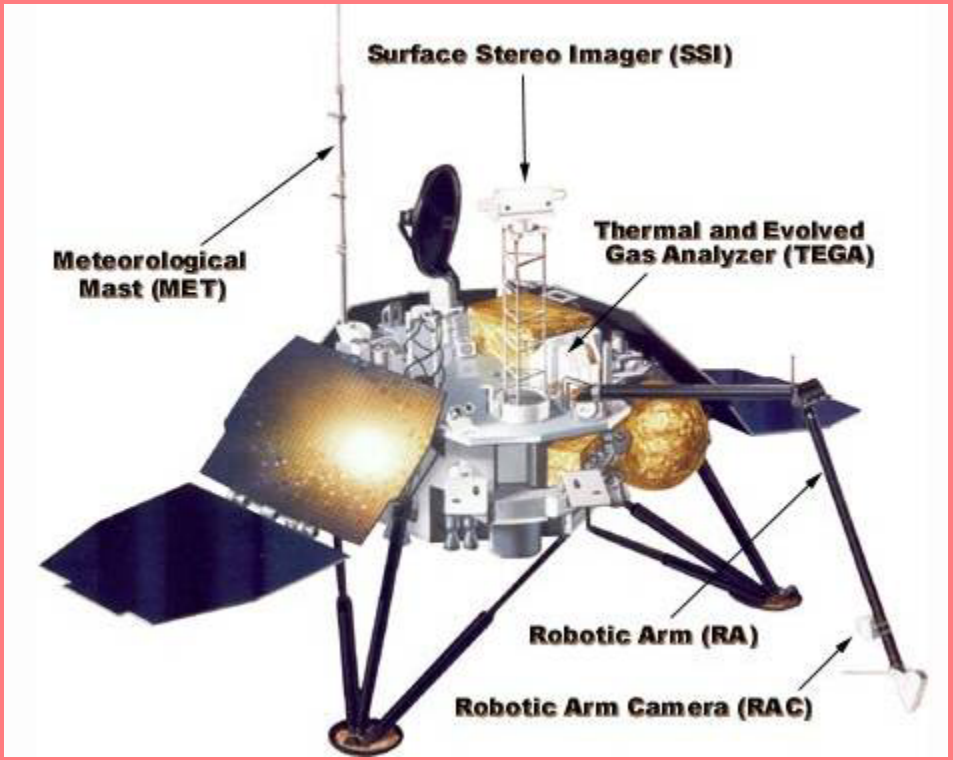
3. Engine design had been copied from another space vehicle and therefore had not been thoroughly tested -- and had never been tested at low temperatures like those experienced arriving at Mars.

4. Nobody really knew if ‘warming’ was enough, there was no time to test it. And not enough battery power to warm any longer.

Probe's disappearance was baffling, but not surprising to NASA insiders

NASA conducted two major accident studies, one for the specific hardware lost this time, and one to assess the overall NASA 'safety culture' behind the mistakes.

“Most likely’ cause found by accident (landing leg ‘bounce’)



1. Probe was designed to enter atmosphere inside protective ‘aeroshell’.

2. Once slowed, probe jettisoned shell and let landing legs hinge open.

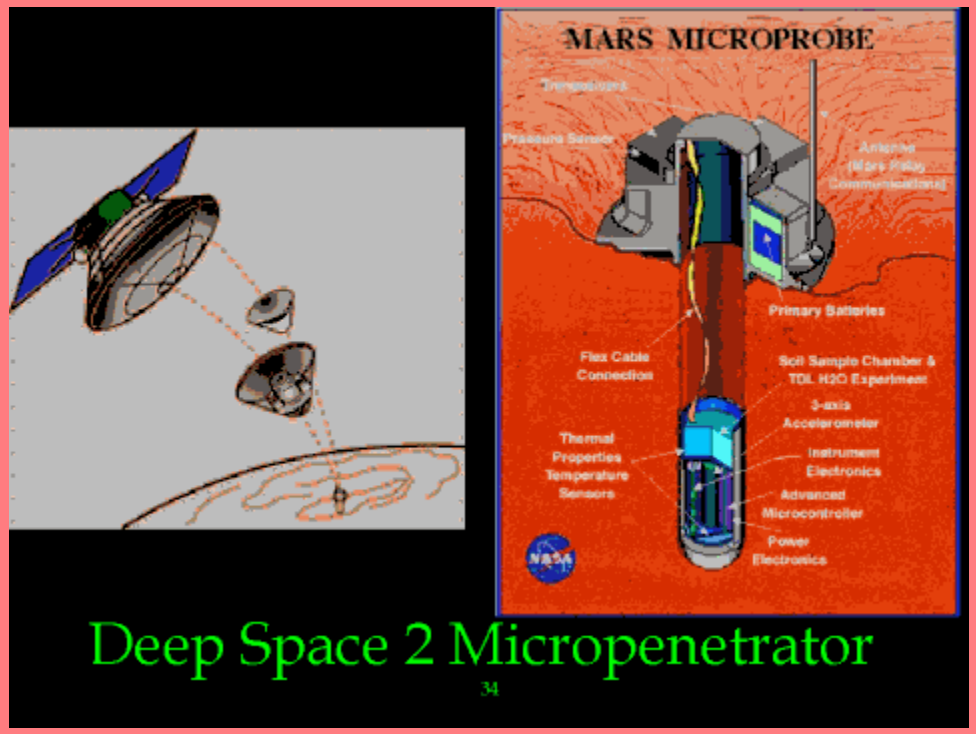
3. Computer fired braking rocket until legs flexed on landing, setting indicator.

4. Ground tests of sister spacecraft showed that the original hinging open would often falsely set indicator.

5. Software assumed that indicator started at ‘zero’

Also doomed -- pair of ‘penetrators’

Deployed from descending lander -- named ‘Scott’ and ‘Amundsen’ -- never heard from again.



Accident investigation final report concluded there were far too many different failure modes to ever know exactly what had gone wrong.

Where did NASA learn to behave this way?
-or- Where did NASA UN-learn to behave the old way?

Safety awareness decays...

- From lulling of anxiety through success
- From self-hypnosis based on superstitious statistical myths and ‘momentum’
- From loss of respect (fear) for past experience and near-misses
- From elevation of other measures of goodness higher than safety

Mid-1990's -- Russia Joins NASA's International Space Station program

- Symbol of post Cold War relationship
- Seen as bail-out for out-of-control budget on NASA-led project, 'Freedom'
- Several US station components cancelled to save money, including life-support, propulsion, and emergency rescue
- Russian role said would save money, be quicker, be safer, and be higher quality
- NASA would 'gain from Russia's long experience with space station missions

Effect of ‘New Priorities’ on way that risks were assessed

- Russia would be responsible for safety assessment of its systems, US of its own
- NASA would accept all Russian statements as accurate and complete, ‘to show trust’
- NASA workers would not rely on any other sources of info on Russian technology
- Russia told NASA that officials too familiar with Russian space technology would be seen as ‘former CIA spies’, not welcome

Case Study 1 -- Fire on Mir

- Long history of small fires on Russian space stations, but never officially documented
- Russians use chemical oxygen-generation system deemed ‘too dangerous’ by NASA
- NASA officials explicitly stated that no previous fires had ever happened
- NASA officials later treated near-disaster as a lucky break, a ‘learning experience’

Feb 23, 1997 -- Mir Station: Fire nearly kills 6 crewmen

Very smoky fire (MORE than in this private artwork) chokes crew, injures men closest to it.

NASA attitude toward fire hazard

- NASA Space Station official James Nise (Dec 14, 1995): “NASA is satisfied with the safety and reliability of Russian [on-board fire suppression] hardware.”
- Press Office: “Small fire put out on Mir.”
- “Nobody ever told me about earlier fires on Mir,” astronaut Frank Culbertson, manager, Shuttle-Mir Program, to ABC News, 1998 [Culbertson was candidate for future mission]

AFTER the fire, safety team discovered memoes written before the fire

- OIG report: “Upon reviewing this debriefing, an outside group applying appropriately rigorous safety standards may have questioned the adequacy of fire procedures and drills, raised questions about the availability and suitability of the fire-fighting equipment, recommended the need for more fire drills, and specifically asked for details related to potential fire hazards... **These issues are better raised before, not after a life-threatening event**.”

June 25, 1997 Case Study 2 -- Collision in Space

actual

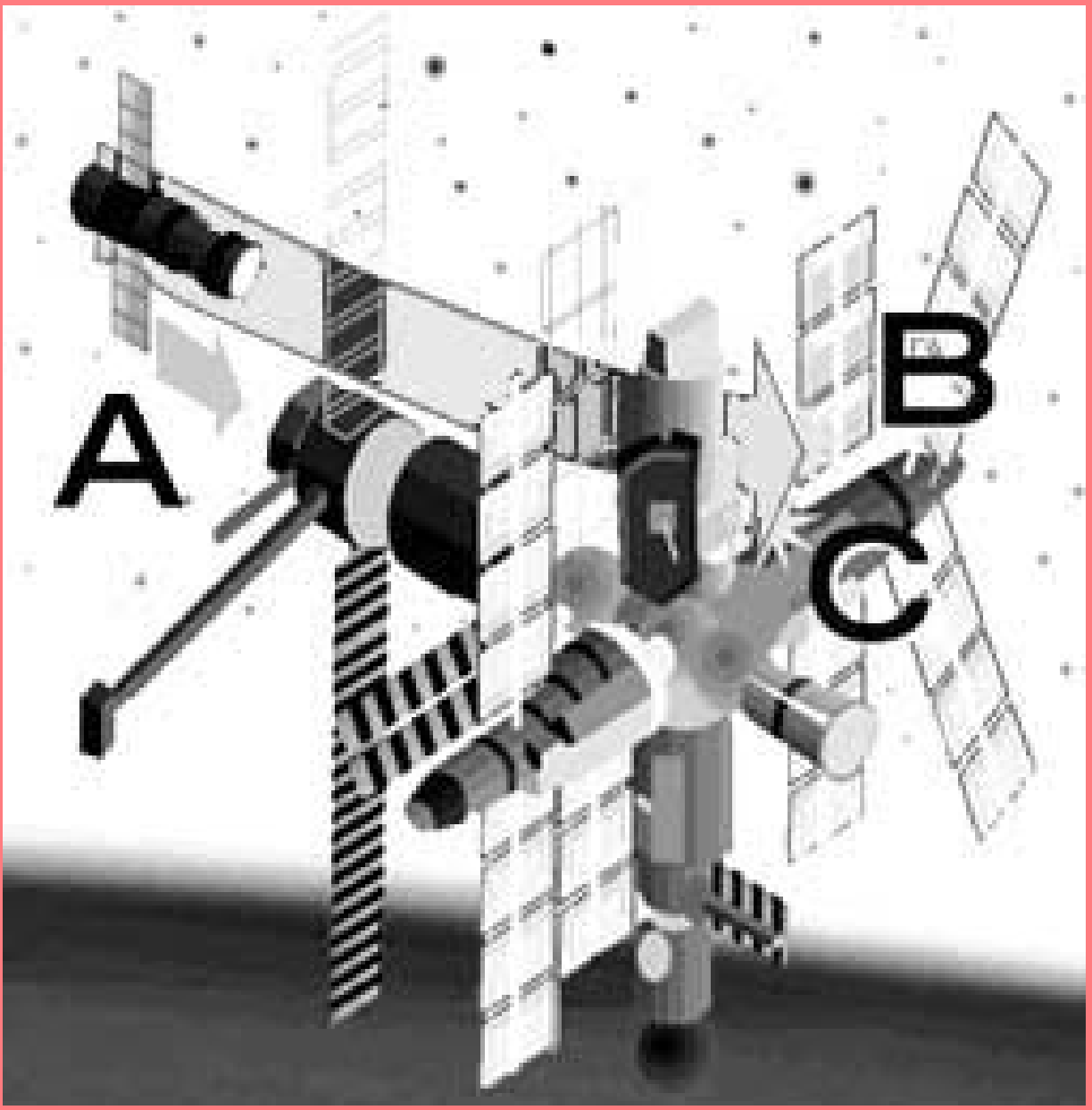
desired

‘Progress’ robot freighter was supposed to dock at far left end of station, but under manual remote control, missed

- Redocking test goes out of control
- Spacecraft collides with station module
- Rips hole in side -- air leak threatens lives of crew
- Crew luckily locates leaking module, closes air-tight hatch

NASA view pre-collision

- April 18, 1997 : “No new risks have been identified, and no problems are foreseen.
- NASA Moscow ops lead: “It looks like we’ve gone through the darkest part and we’re headed toward the light.”
- NASA ‘AA’ Ladwig: “We are very confident we are operating in a safe manner.”
- Mir astronaut Michael Foale: “I’m not worried. The safety is perfectly assured.”



Very nearly killed the whole crew

1. If hole had been twice as big, air would have leaked before crew could reach rescue ship.

2. If crew had not seen where it hit and closed correct hatch, may have had to leave men behind

Even after all these near-misses...

- NASA insisted it could predict future hazards
- NASA refused to blame Russian Mission Control for misjudgments and oversights
- Attitude grew in Russia and US that “nothing ELSE is left that can go wrong.”
- Negative views “not what the program wants”
- Officials advised not abandoning Mir unless Russians do too, “unsafe” or not
- “Accidents are GOOD for you!”

Space “Safety Culture” Trend

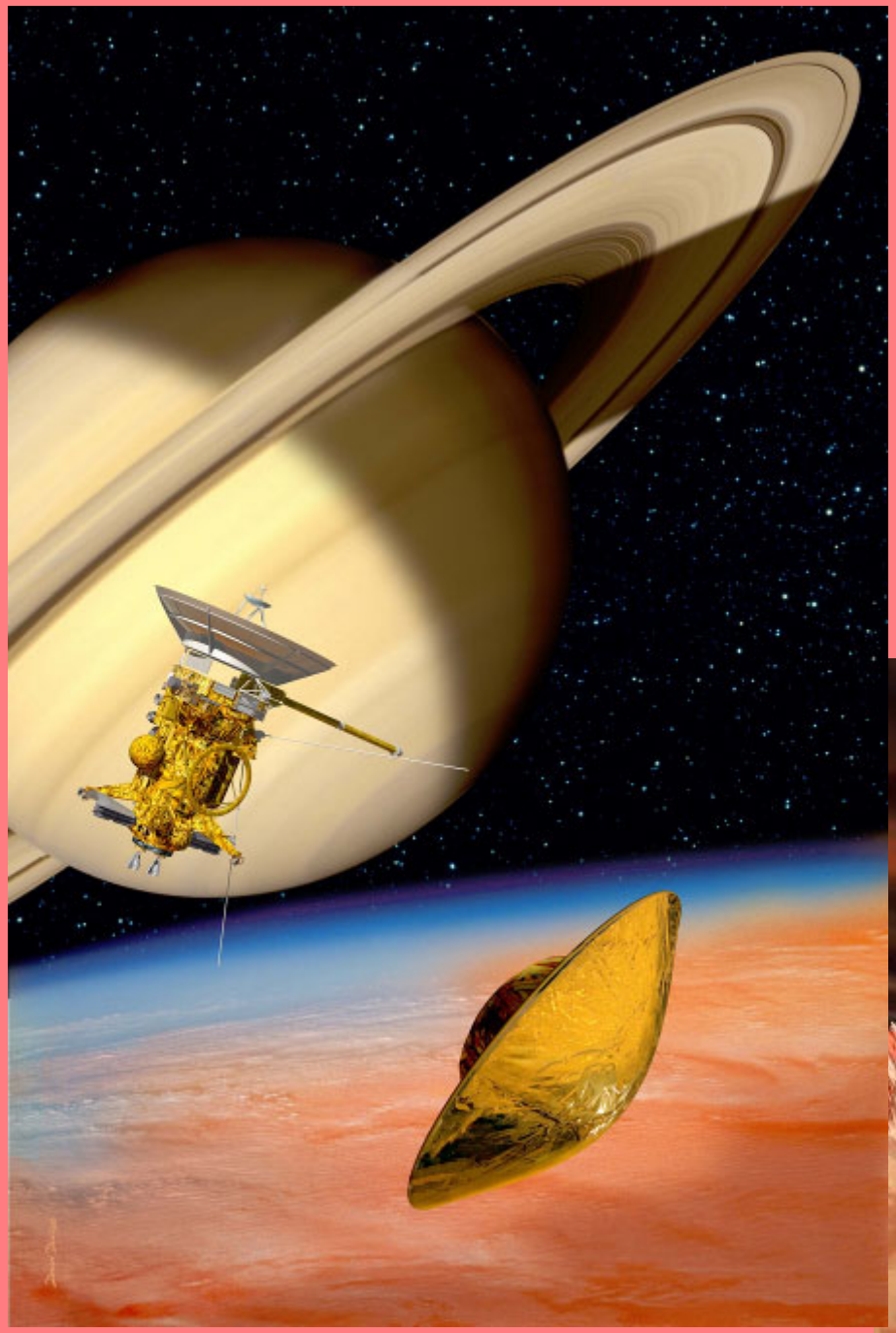
- If you can get away with it, it must have been safe, so next time is less dangerous.
- If nobody finds out about it, it’s safe.
- If you won’t like the answer, don’t ask the question -- it’s better off not knowing.
- Some management goals (e.g., diplomacy with Russia) are more important than safety.
- Managers prefer unanimity in error over lone objections from uppity worry-warts

Was the culture wrong? "Prove it is NOT safe...."

- HQ: "No new risks have been identified...."
- Rutledge: "Despite concerns, there is no hard evidence that Mir is currently unsafe."
- Wilhide: "The bottom line was that the experts that we asked, the majority of them, determined that there were no technical or safety reasons to discontinue the program."

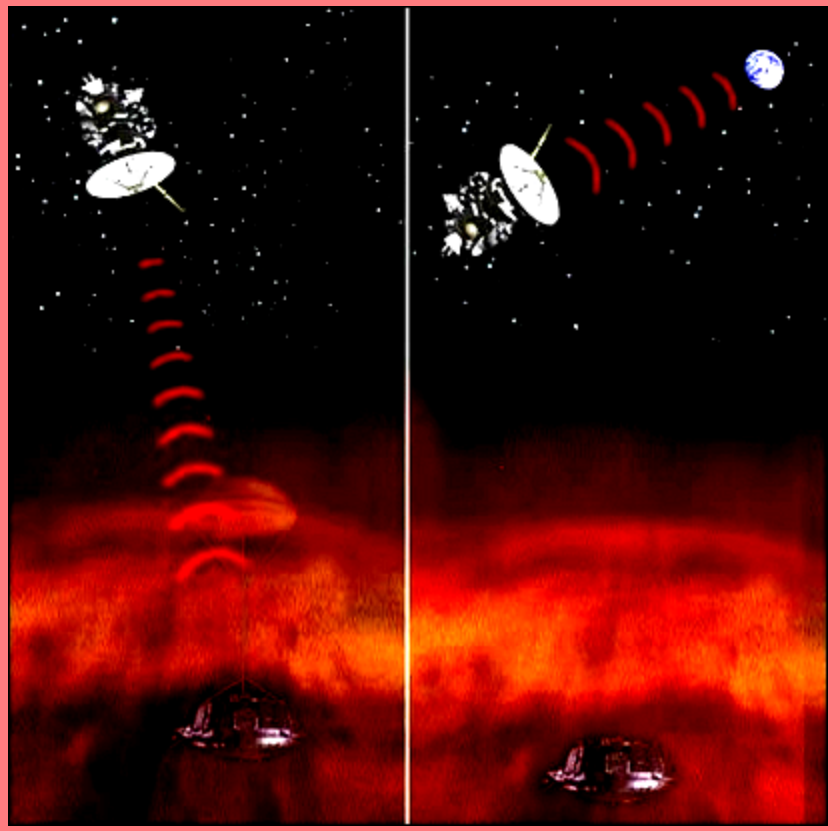
“The important thing is to stop lying to yourself. A man who lies to himself, and believes his own lies, becomes unable to recognize the truth, either in himself or in anyone else.”

--- Fyodor Dostoyevskiy



“Getting it right” The rescue of the Huygens probe

‘Cassini’ probe circled Saturn and in Jan 2005 dropped European-built lander into atmosphere of giant moon Titan



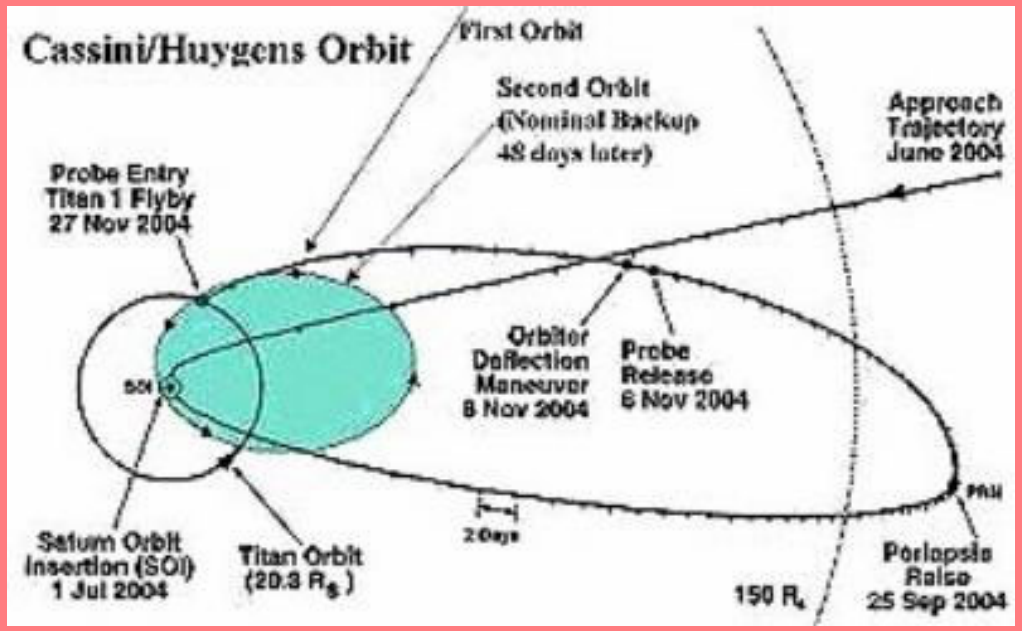
As Huygens probe descends by parachute, it was to send data and images to Cassini, for relaying to Earth. Possibly, probe would even survive landing on Titan and send back final data before Cassini out of range.

Fatal flaw discovered in hardware -- after launch!

- Radio “Doppler Shift” during landing was understood with regard to frequency change
- However, re-use of flown radio receiver did not account for ‘squeeze’ of data words
- Hence, bitstream would be unreadable since timing pulses would arrive unexpectedly early so that ‘frames’ could not be isolated
- Swedish engineer insisted on end-to-end transmission test even after launch
- Test was hi-fi enough to duplicate the way actual data would have been scrambled

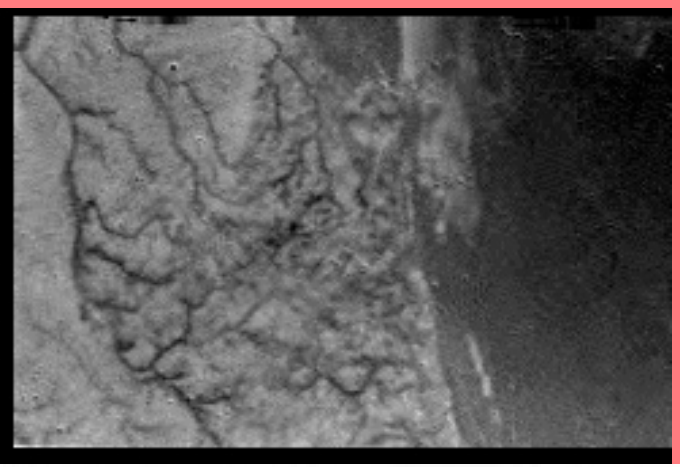
Alternate procedures developed -- so January 2005 landing could work

Timing control circuit could not be altered in flight (parameters were in ‘firmware’), and transmitter formats were also unalterable.

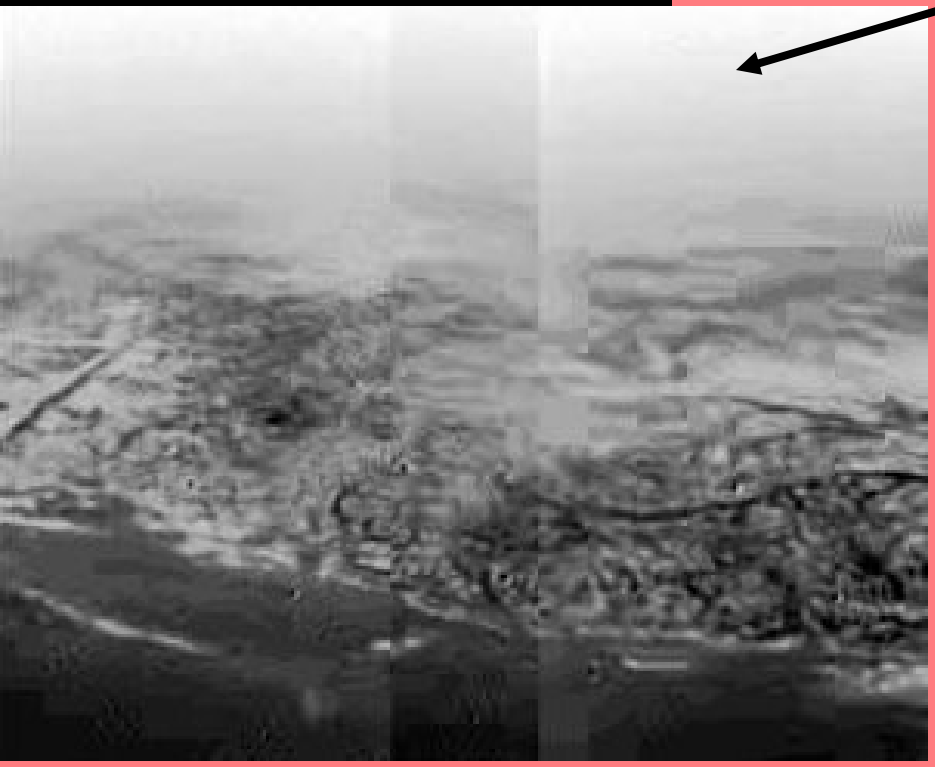


Solution was to reduce amount of Doppler Shift by changing geometry of relative motion during the descent; this involved some extra steering and fuel usage.

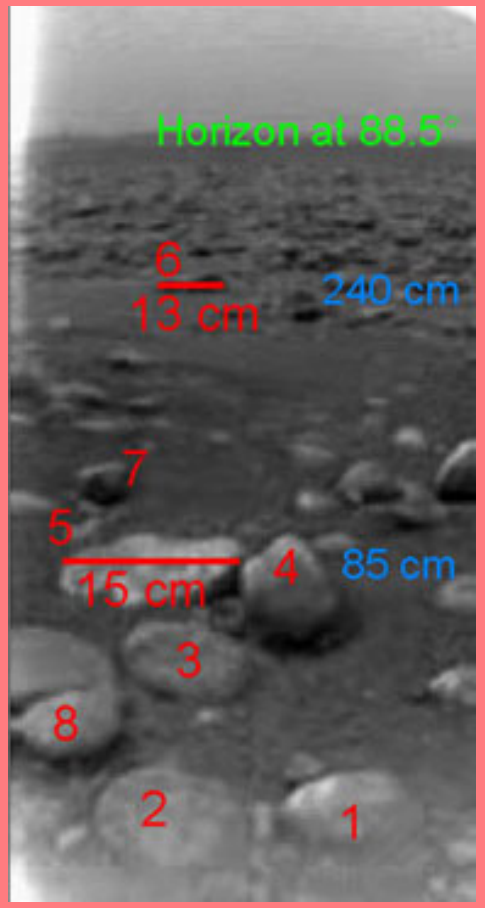
Fantastic success -- after one last bullet to dodge



Twin cameras observed landscape below during parachute descent -- BUT secondary radio channel never commanded “ON”.



Probe reached surface and sent close-up views of ‘ice pebbles’ on tarry ‘beach’



Conclusion

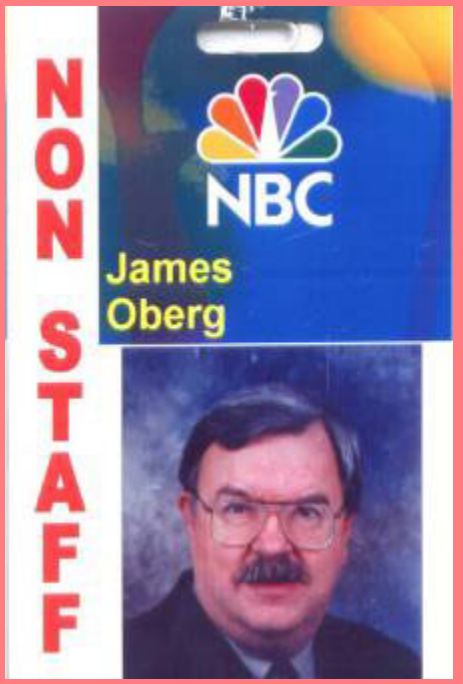
- Spaceflight will remain inherently dangerous -- but so are many other human endeavors
- Human nature allows additional dangers to be introduced unintentionally and invisibly
- Appropriate attitudes can reduce but never eliminate risk; paranoia shouldn’t get dull
- All technological risk is ‘related’ -- and lessons from space accidents (and avoidances) can dramatically drive home lessons on Earth

Last words:

"Quality must be considered as embracing all factors which contribute to reliable and safe operation. What is needed is an atmosphere, a subtle attitude, an uncompromising insistence on excellence, as well as a healthy pessimism in technical matters, a pessimism which offsets the normal human tendency to expect that everything will come out right and that no accident can be foreseen -- and forestalled -- before it happens."

Admiral Hyman Rickover

NBC and Me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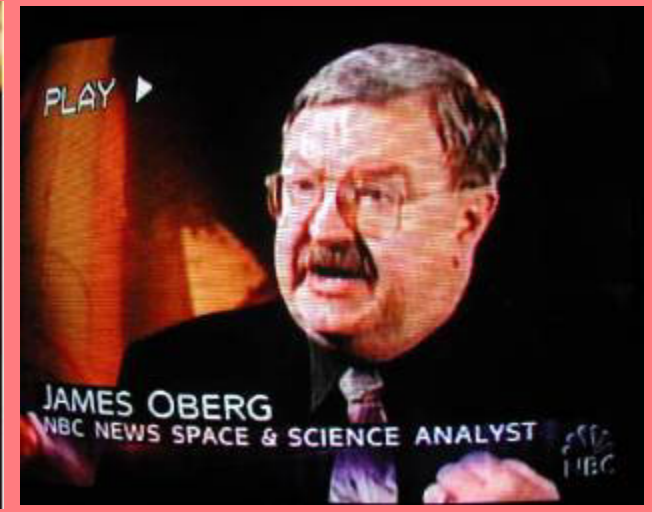
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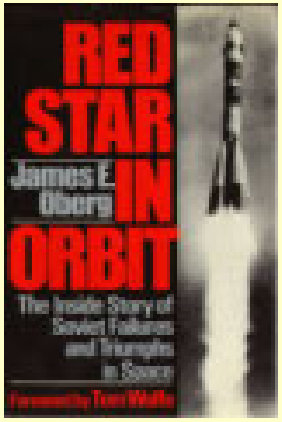

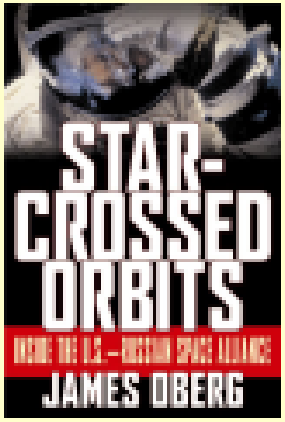

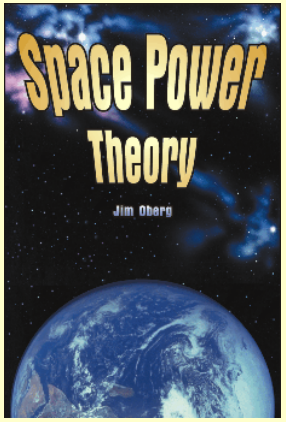

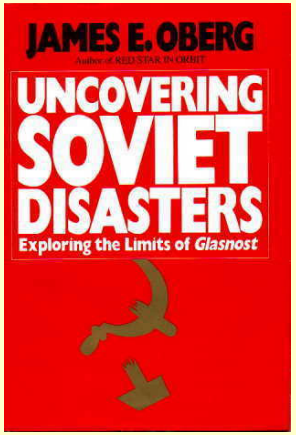

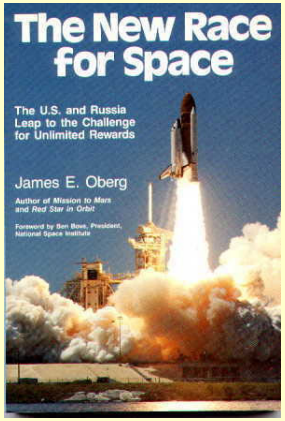

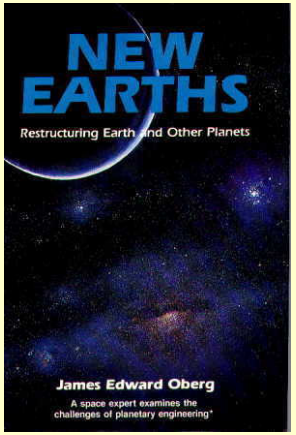

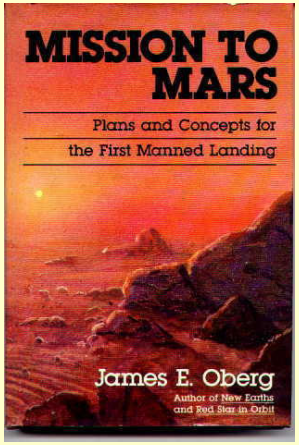

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Star-Crossed Orbits -- Inside the US-Russian Space Alliance

- Richard Truly, former astronaut and NASA Administrator: “Clear-eyed, cold-blooded look at the real costs and benefits of this joint endeavor. Don't miss this one!"
- Gene Kranz, Apollo Flight director: “A great piece of investigative journalism... A must read for program managers, engineers and scientists engaged in present and future projects with Russia. ”
- Sci-Tech Books: “Oberg combines riveting personal memoir with top-notch investigative journalism to tell the complete untold story of the U.S.-Russian space alliance. ”

(more)

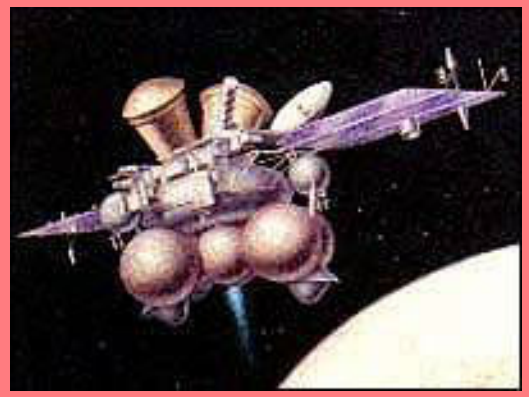
Star-Crossed Orbits (continued)

- Harrison ‘Jack’ Schmitt, Apollo moon walker and US Senator: “This remarkable book is must reading for anyone who wishes to understand the culture with which one must deal when attempting to cooperate with Russia ”
- *American Scientist:*: “His sleuthing and story-telling abilities make this a gripping narrative”
- Walt Cunningham, Apollo astronaut: "Finally, someone is telling it like it is about the Russian manned space program - the good, the bad and the ugly. I have relied on Jim for years because no one knows it or tells it like he does.”
- Gregory Bennett: “Riveting prose that grabs your attention and won't let loose”

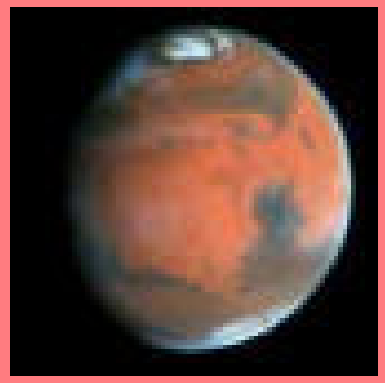
Post-Columbia: The NASA Space Safety "Cultural Revolution"

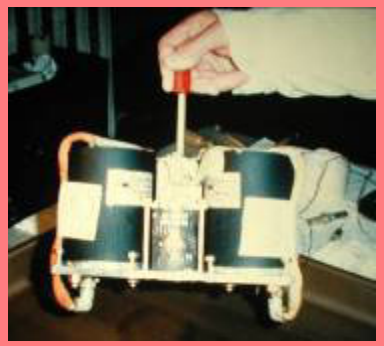
- Disaster forces discipline surge -- for a while
- Change must advance mind-by-mind since major personnel changes don't occur
- Main NASA officials in charge of safety before Columbia disaster were still in charge
- NASA sense of 'exceptionalism' -- nothing to learn from outside world -- is seductive
- Sean O'Keefe: "Safety is a work in progress"

Case Study 3: November 1996 -- ‘Feel-good Diplomacy’ trumps nuclear safety, and it works



Russian science probe with small nuclear batteries launched to Mars -- but rocket fails and payload falls back to Earth, hits atmosphere





Russia Mars probe crashes

Plutonium was concern as debris falls in Pacific

By Paul Hoversten

Where's the plutonium?

THE NEW YORK TIMES INTE

Russian Mars Craft Falls Short and Crashes Back to Earth

By TODD S. PURDUM

HONOLULU, Nov. 17 — The remnants of an unmanned Russian space probe that failed to break out of Earth's orbit re-entered the atmosphere above the southern Pacific Ocean west of South America shortly after 8:30 P.M. Eastern time tonight and apparently crashed into the sea, American officials said.

White House aides traveling with President Clinton here on his way to

pected to survive re-entry into the atmosphere.

A statement from the United States Space Command in Colorado Springs, Colo., said that the probe was believed to have re-entered the atmosphere in "a broad ocean area west of Chile" and that if any debris survived, it might have fallen into the ocean several hundred miles away. A senior White House official here said it appeared that the debris

The remains of a space probe fall into the South Pacific.

peared likely to land harmlessly in the Pacific Ocean.

Russian space officials confirmed

said, "this is a 1."

He said the dangers paled next to an incident in 1978, when the radioactive remains of a Russian satellite fell into northern Canada and forced the Canadian authorities to spend millions of dollars to clean it up.

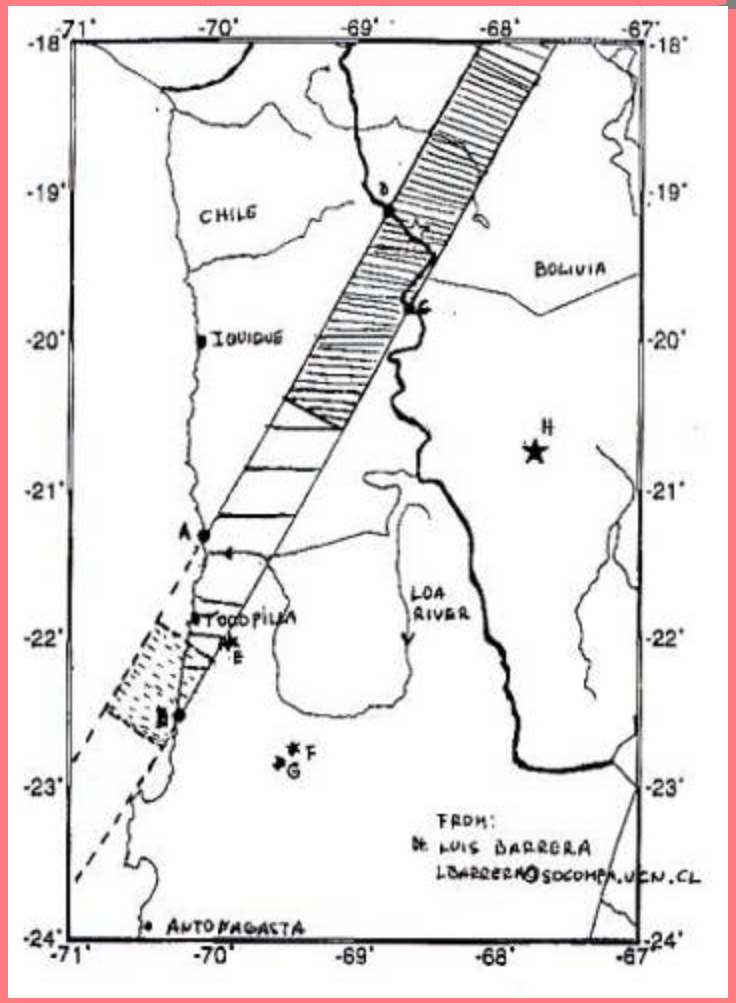
The failed Russian mission came 10 days after the American launching of the Mars Global Surveyor. The Russians' $64 million rocket-launched spacecraft was set to reach

White House calls foreign leaders with real-time warnings, then announces the danger is over -- and Russia agrees.

Mars '96 probe falls in Pacific

Nuclear fears put to rest

"The remains of the probe reached South America in the region of Tocopilla, Chile, in the direction of the city of Oruro, Bolivia." Luis Barrera, astronomer, Antofagasta.



Inconvenient eyewitness reports -- and heresies

Witnesses in Chile saw a fireball cross the coast, and tracking data later confirmed it was the falling probe -- but both Washington and Moscow stuck with the 'safe' Pacific splash story. *They had tracked the wrong fragment, and didn't want to embarrass each other by admitting a mistake by issuing a new warning*.

Andes Altiplano -- home of lost plutonium space batteries. . . .

First official US acknowledgement that debris ‘might’ have reached land was in press release issued 5 PM on the Friday after Thanksgiving (lower left), which received NO news media coverage. Four months later, this letter (lower right):

UNITED STATES SPACE COMMAND

News Release

DIRECTORATE OF PUBLIC AFFAIRS, HEADQUARTERS, US SPACE COMMAND, 250 S. PETERSON BLVD, STE 116, PETERSON AFB, CO 80914-3190 PHONE: (719) 554-6889 DSN: 692-6889

FOR IMMEDIATE RELEASE
Release No. 41-96

November 29, 1996

USSPACECOM UPDATE ON RUSSIAN SPACE PROBE

PETERSON AFB, COLO. -- U.S. Space Command (USSPACECOM) has developed new information indicating that the Russian Mars '96 spacecraft likely came down on Nov. 16 instead of Nov. 17 as earlier reported. Any debris surviving the heat of this re-entry would have fallen over a 200-mile long portion of the Pacific Ocean, Chile, and Bolivia. We now believe

"We were aware of a number of eyewitness accounts of the re-entry event via the media several weeks after the re-entry occurred. Upon further analysis, we believe it is reasonable that the impact was in fact on land." -- Major Stephen Boylan, Chief of the Media Division at the US Space Command in Colorado Springs