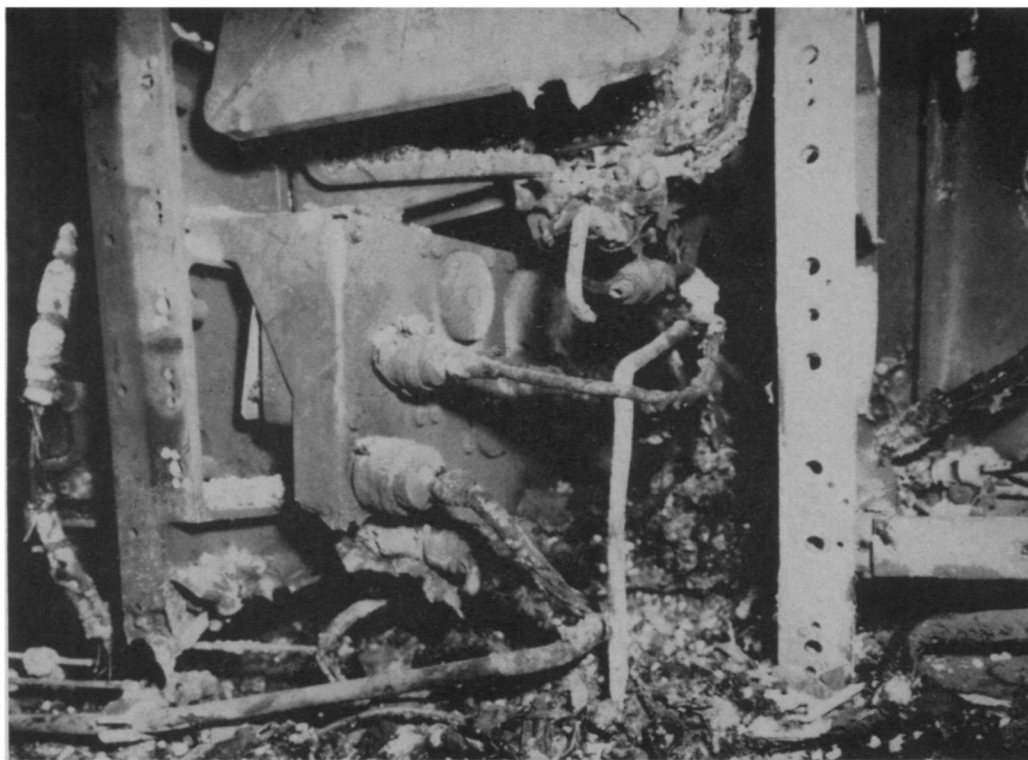


The Apollo Story: 'We Never Thought...'



NASA

This charred remain is all that is left of the fire's probable source.

After 10 weeks of study of the Jan. 27 accident, NASA's board reports; now Congress is looking.

"If any man in this room asks for whom the Apollo bell tolls . . .," began National Aeronautics and Space Administration chief James E. Webb last week, and indeed every man in the room was doing just that. Ten weeks before, three astronauts had died when their Apollo spacecraft suddenly turned into an inferno, and the resulting investigation, finally completed, filled a 3,000-page report that weighed some 15 pounds.

Last week the report was delivered simultaneously to NASA and to Congress. This was done, Webb told the House Subcommittee on NASA Oversight, to avoid any chance NASA would influence the blue-ribbon investigative board's statement of its findings.

House hearings that began on Monday, combined with Senate hearings beginning a day later, kept Webb and his aides hopping around Capitol Hill.

Whether NASA exerted any influence or not, the board was unanimous in its conclusion: Apollo was a sloppy spacecraft.

- Current-carrying wires were clustered together like "rats' nests" without three-dimensional jigs to keep them straight. The wires were subject to abrasion and short circuiting, and some were so poorly placed as to make it

very difficult to get at equipment behind them.

- Pipes, carrying corrosive and combustible ethylene glycol, suffered "chronic leakage due to poorly welded joints and fittings."

The Source

The board named no cause for the fire, but it did single out a "most likely" candidate. The sharp bottom edge of the door giving access to the lithium hydroxide canisters used for air purification was in a position to wear away the insulation around a bundle of wires passing underneath it. "It is most probable," said the report, "that the fire was initiated by an electric arc either in this location or in some other region near the environmental control unit." The power cable from which the arc might have come was completely burned away for about 12 inches, so the investigators were unable to establish conclusive proof.

- Standard procedures called for crewmen to connect and disconnect circuits while power was flowing through them.

- "The overall (spacecraft-to-ground)

communications system was unsatisfactory."

- There were numerous "deficiencies in design, manufacture, installation, rework and quality control."

Besides the poor wiring and plumbing, the board said that the other conditions contributing to the disaster were the sealed, oxygen-filled cabin and the fact that there were inadequate provisions either for the crew to get out or for rescuers to get in. The only astronaut on the investigating board, Gemini 7 command pilot Frank Borman, blamed the tragedy directly on the fact that no one—NASA, prime contractor North American Aviation, or even the astronauts—thought of the test during which the fire took place as a hazardous one. "None of us gave serious concern to a fire in the spacecraft," he said. "We tried to identify every hazard we could find, but this was one we missed."

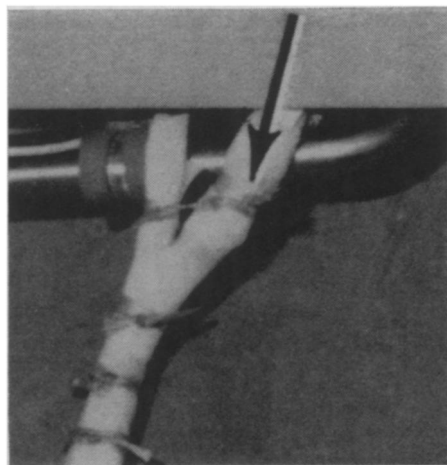
North American's vice president for research and engineering, John F. McCarthy, told the House Subcommittee that this attitude was "one of the greatest errors we ever made." It was because the ground exercise took place with an unfueled booster and was not considered hazardous that no rescue teams were available, although one was stationed two miles away in prepara-

tion for an "emergency egress test" that was to take place later.

The investigators, headed by Dr. Floyd L. Thompson, director of NASA's Langley Research Center, had little trouble in boiling their copious, 10-volume report down to three concise pages of findings and recommendations. Those three pages could be summed up in three even more concise phrases: sloppy design, sloppy workmanship and sloppy procedures.

Even before the report was made public, drastic changes were being felt in the Apollo program. The hatch and environmental control systems were started on the road to change, and all manned flights were suspended indefinitely pending final policy and engineering decisions.

The Apollo program manager, Dr. Joseph Shea, was sent to Washington as



NASA

Poor wiring and poor insulation.

deputy associate administrator for manned space flight, while the second-in-command at the Manned Spacecraft Center in Houston, George Low, took over the Apollo post. Both appointments, made public on April 5, became effective five days later, on the first day of Congressional hearings about the Apollo accident report.

The future for Apollo is uncertain. Administrator Webb contends that a moon landing by 1970 is still a possibility. But the change in hatches will occupy several months, and if the change is made to a two-gas atmosphere the delay could be even longer. However, Astronaut Borman maintains that a pure oxygen system is perfectly adequate, provided that all flammable materials are either placed away from possible ignition sources or designed out of the cabin altogether.

Despite the inevitable questions from Congress about the predominance of NASA personnel on the board (only two outsiders were present), most legis-

lators seemed to agree that the space agency had attempted to do a fair job of reporting on its own shortcomings. This could mean that NASA will get by on its own recommendations, most of which are procedural changes and relatively simple cabin modifications such as redistribution or elimination of flammable material.

The other extreme possibility is that NASA might have to resubmit its entire budget, together with redrawn timetables and reapportioned funds. This has been suggested as a possibility by some Congressmen. But if the report gets favorable reception, as it may when the tempers subside, NASA will probably be allowed to let its recommendations, or modifications of them, stand as guidelines.

Clean Air: Carrot and Stick

While speaking soft words of encouragement to major air polluters who show signs of cleaning up their aerial garbage, the Senate is preparing a big stick to urge on the laggards.

Just how big is evident from amendments to the Air Quality Act of 1967 offered by Senator Jennings Randolph (D-W. Va.) and expected to be the focus of new Senate hearings scheduled to open this week.

The amendments would toughen the package of clean-air proposals sent to Congress by President Johnson in February (SN: 2/11). They would raise the present \$100-a-day fine for noncompliance to \$1,000 a day and add to that a possible \$10,000 fine and a year in prison for the recalcitrant polluter.

The amendments also provide quicker enforcement, and require states to set air quality standards. If such standards are insufficient, the Federal Government would be directed to step in with its own rules. And to insure rigorous enforcement, the job would be taken away from the Public Health Service and a new Air Quality Administration would be set up within the Department of Health, Education and Welfare.

It was virtually identical steps two years ago by Senator Randolph's Senate Public Works Committee and its Subcommittee on Air and Water Pollution under Senator Edmund S. Muskie (D-Me.) that sparked the current water pollution control effort.

Each of the amendments tightens the legislative noose around the principal air polluters—now identified as about a dozen industries plus the nation's 90 million-odd automobiles.

The problem of the automobile, source of much of the smog that hangs

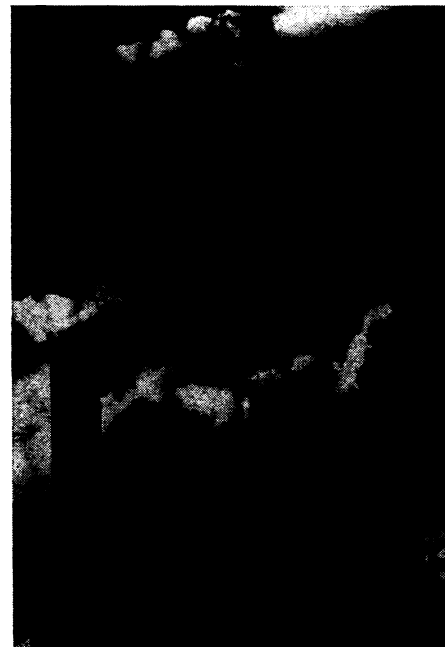
over American cities, is by no means solved, but seems to be merely a question of engineering. All major auto firms have said they can build cars with clean exhaust, but that it will take time.

Getting a wide variety of industries, each with unique problems that vary even from plant to plant, to clean up their emissions is another matter. Dealing with this nonuniformity could probably best be done under regional or local standards such as would be possible under Senator Randolph's amendment. Thus, a region with relatively clear air might adopt a more relaxed abatement procedure than an area suffering severe smog.

The concept of air quality standards, set for each region in question, would have a considerably different effect on industry than nation-wide Federal emission standards feared by industry.

Whether this year's final product includes Senator Randolph's big stick or not, it seems likely that a carrot in the form of tax incentives to construct pollution control equipment will be dangled before industry. A bill to that effect, introduced by Senator Randolph, has been co-sponsored by Senator Muskie and seems likely to attract additional co-sponsors. Similar legislation in the past has fallen before Internal Revenue Service opposition, but there are indications this year that enough Congressmen favor the carrot to override Administration opposition.

The sum of these efforts points to a repetition of the approach used to handle water pollution in 1965. All 50



Fuller

states have announced their intention to adopt standards under that legislation, although only 34 have yet filed reports with the Federal Government. The rest are expected by the June 30 deadline.