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Popular Science

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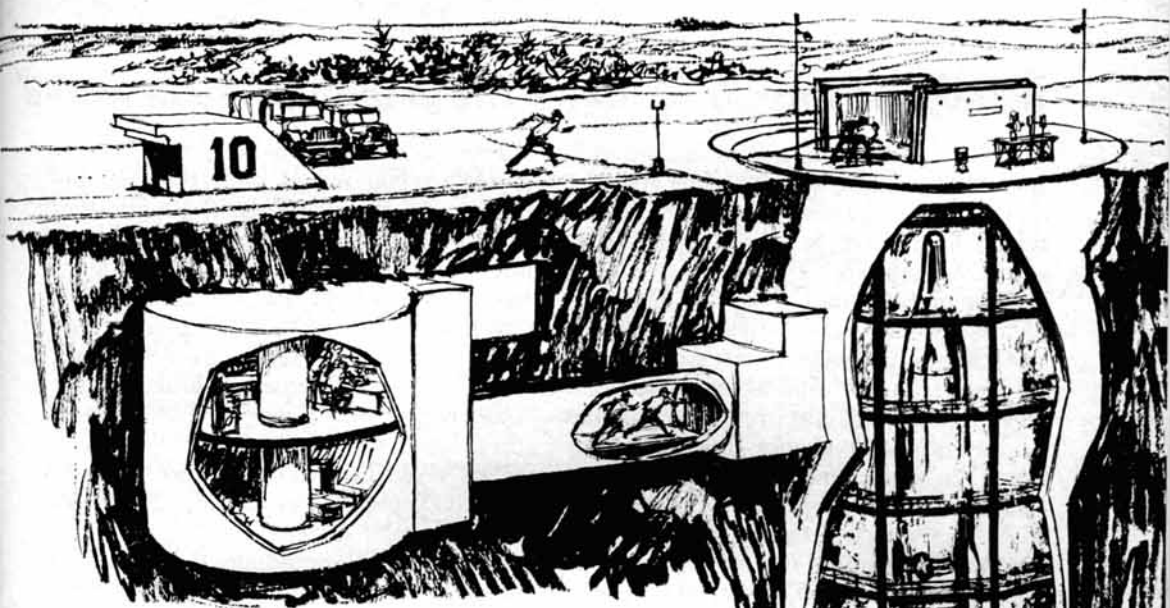
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CLOSE CALL IN SILO 10

By James Joseph

THE voice from 60 feet underground—from Silo 10's Atlas missile-launch center—shot across the communications net:

"The bird won't nest . . . repeat . . . the missile has failed to nest. Keep your positions. Do not move."

The time was 7:35 p.m. The place: Silo 10, Dyess Air Force Base, near Abilene, Tex. For only the second time in the missile age, a fully fueled and flight-ready "bird"—an eight-story-high Atlas F ICBM, loaded with more than 30,000 gallons of volatile liquid oxygen (LOX) and kerosene-like RP-1 fuel—had jammed in its launching silo.

Moments later came more bad news: "TV scan cameras see no boil-off vent . . . the missile has apparently lost its GOX vent" (for gaseous oxygen).

The bird was set to explode.

The "book" said they should abandon the haywire missile, but they gambled their lives to save the giant bird and its nest

CONTINUED

If they let their bird blow—the clean-up squad would

It had begun, that final countdown, routinely enough, shortly after six p.m. The five-man tanking team signaled they'd loaded the last of 19,000 gallons of LOX. Already aboard were 12,000 gallons of RP-1 fuel. Now the bird was cleared for lift-out.

At his above-ground observation post 600 feet from the silo, assistant foreman Nels E. Erstad, 30, reported to the Launch Control Center—the LCC—below, "We're standing by—and watching." Helping Erstad keep check on the missile's breathing was Lanny Rees, another assistant foreman on General Dynamics/Astronautics' "sell-off" team. (Before a missile is "sold"—accepted by the Air Force—it's put through a final launch-ready demonstration.)

"Doors opening," the LCC reported, as the silo's two 70-ton reinforced-concrete doors, each 30 inches thick, opened slowly.

"SHE'S breathing," Rees told the LCC as billowing white GOX clouds suddenly swirled around the rising missile's nose. The bird was a live one.

But an Atlas must prove it can be held in launch readiness for an hour to pass Air Force scrutiny. Rees and Erstad crouched close by, watching the bird's boil-off valve, the complex remotely controlled breathing mechanism high up on its nose. That GOX valve is to a liquid-fueled missile what a blowhole is to a whale. Without it, an Atlas can't breathe. And it must—or explode.

Pressure—the precisely right amount—keeps the thin-skinned (thinner than a dime) bird literally inflated. Too much, and it can explode. Breathing relieves the ever-building pressure of its tanked LOX. Close that boil-off valve and pressure zooms within the bird until it can burst the Atlas' skin—or worse: rupture the almost-as-thin bulkhead, all that keeps those 30,000 gallons of liquid oxygen and fuel from catastrophic mixing.

For even so much as a teaspoon of liquid oxygen mixed with the fuel becomes one of man's deadliest explosives—with twice the power of nitroglycerine, and so touchy that merely running a hand through your hair can set it off.

But even with the missile breathing normally, things were—as always—tricky. For the big bird's breath is lethally cold, —297 degrees F.

ELEVATED out of its silo, a bird's GOX evaporates harmlessly. Nested, its breath is piped out safely by a 10-foot-long, 18-inch-diameter aluminum pipe—the GOX vent.

But when the bird's ultralow cold breath runs wild, it can freeze and blind a man, and make the steel cage and elevator cables that suspend the bird in its silo dangerously brittle. And, if they cracked, the missile might plunge from its perch, its fuel and oxygen uniting to produce a holocaust.

So Rees and Erstad kept a close watch until the LCC ordered them back a quarter-mile from the silo just before the test was scheduled to end. Their job was done. During the missile's descent—when, briefly, its breathing would be shut off to avoid contaminating the silo with COX—a TV camera would keep an eye on things.

Below ground—as above—all systems were "go!"



Beheler and Pajak stared. Fuel lines, valves, and lift had been clobbered.

scrape up the pieces

Pleased Air Force observers nodded their acceptance. At the master console, strapping Alois F. Pajak, the test director, pressed the abort button. Slowly, the great bird began its descent at 7:22 p.m.

Seconds later the TV camera blurred out of focus. It caused no alarm, though. The camera had failed before. But complacency disappeared when an Air Force officer announced, "We have a lift failure!" A console light, supposed to flash green when the bird finally nested, had instead flashed a warning red. Worried now, Pajak ordered a second camera focused on the bird's boil-off vent. What the camera saw made him gasp. "GOX vent is missing."

The time was 7:35 p.m. The ordeal had only begun.

But as Pajak huddled with his engineers, he knew time was fast running out. For the bird's breathing had been shut off just before it had begun its descent. Now, with the GOX vent missing, opening that boil-off valve would flood the silo with lethal GOX.

"Let her breathe in there," an engineer gestured toward the silo, "and her GOX may torch things. Hold her breathless, and she'll blow the coop."

It was as deadly as that.

"Get the hoses and pumps going," supervisor Jack E. Kay ordered, and Erstad took off for the silo's apron.

As he did, the monitor from below reported, "Beheler . . . is going in."

Wayne Beheler, engineer and onetime college fullback, who'd supervised the installation of the silo's elevator, went below to investigate what had gone wrong. With him went Pajak and two Air Force officers.

They wore protective clothing, static-proof shoes, and emergency breathing packs (inhale GOX and you can black out from too much oxygen).

Inside, they stood and stared.

They found that the silo's 12-by-15-foot safety platform, normally locked



The gas hit Rees. He rubbed it off while fending off the swinging GOX vent.

flush to the silo's side during launching, had somehow been sheared off by the descending elevator and had fallen 15 stories, making a shambles of the silo and its delicate gear. The 3,000-pound platform had torn loose the GOX vent and mangled the lift mechanism. It had clobbered fuel lines and valves. Worse, it had cut clean through a 500-gallon fuel tank on the silo's very bottom. Now a dangerous pinkish flood of kerosene-like RP-1 rose ankle-deep in the silo.

MINUTES later six other volunteers entered the silo. By the book they needn't have been there. A missile whose LOX can't be drained is expendable. The instructions in the launch-procedures manual are clear: Evacuate the "hole" and its LCC, and let her blow—\$10,000,000 silo and all.

But eight of them had said to hell with it. Now their only lifeline was a phone linked with the LCC. Over it, assistant foreman Sam Lovell, reading his pressure gauges, droned the bad news that minute by minute was growing worse: "LOX pressure rising . . . fuel-tank pressure falling."

They formulated a desperate plan to steady the bird's internal pressure, and get her breathing safely again. If they got that far they'd take a desperate stab at detanking the LOX.

First Rees, Jack Sutton, a rough-handed assistant foreman, and Jack Kay set about boosting the fuel tank's plunging pressure.

"Don't hit that valve, Lovell—or I'm dead!"

Meanwhile Erstad reached the pump and fire hoses to begin the plan's crucial second phase: wet down the bird's steel cage and form an insulating ice sheath about it. This was needed to prevent the cold breath from snapping the metal.

But those high-pressure hoses left no margin for error. Hit the bird instead of its cage, and they'd freeze that GOX valve tight, strangling the bird's breathing. That, or maybe cut through the bird's thin skin.

Scarcely was Erstad topside than the LCC reported that Rees and his crew had got the fuel pressure rising.

And then ominously: "LOX pressure critical . . . going to bust the boil-off . . . ready or not."

UP TOP, they were ready—Wayne Beheler, big "Dutch" Gritzmacher, Erstad, and a couple of others.

"Aim straight," Beheler yelled, his voice drowned in the screech of escaping GOX, as the LCC remotely busted open the boil-off. At the same instant, Erstad took aim at the elevator cables whitening with the cold 40 feet below, and let fire.

The powerful stream hit the target squarely, saw it turn to ice—and then the GOX fog closed in, obscuring the target.

"Keep dousing," a voice urged through the fog. Actually, they had no choice. Hold fire and the bird'd be gone—and so would they. Desperately, by blind instinct more than anything else, they fired their watery barrage point-blank through the fog. For minutes that seemed hours they poured it on. Then, suddenly, it was over—at least for the moment.

"LOX pressure safe," the LCC's gauge watcher boomed, as he hit the button that choked off the bird's breathing. Inevitably, of course, the pressure would build again. And again the LCC would have to bust that valve—and they'd have to pour it on. But for the moment . . .

As the GOX cleared, Silo 10's haggard

crewmen were jubilant—but not for long. They'd dead-eyed that steel all right, insulating it with ice without hitting the bird. But far below, a thick blanket of GOX had settled deep in the silo. If it condensed, if it mixed with that flood of fuel . . .

But they didn't have time to think of that. In the minutes—perhaps 10 at most—that remained before the LCC would again have to crack that boil-off valve, they had a critical job: find and refit the shattered GOX vent, then vent the bird's breath safely from the silo.

The vent lay in a puddle of fuel. As Gritzmacher bent to retrieve it, a jagged place on the vent ripped his hand. But Dutch scarcely noticed as he headed for Level 2, where Rees and Erstad had rigged a makeshift sling from electric-light cord, the only "rope" they had. Slowly, they hefted the fat GOX vent, fitted it to the sling, and carefully—so as not to puncture the missile's skin—inched it toward the GOX valve.

They'd scarcely got started when Lovell, from the LCC, warned, "Hold it . . . LOX pressure's up . . . I'm hitting the button!"

REES, staring down the GOX valve's four-inch-diameter orifice, whirled, and shouted desperately over the intercom, "Don't hit that valve, Lovell . . . if you do, I'm dead."

All of them, for that matter, were working within hand's reach of the boil-off. If it let go now, they'd be washed with a lethal, high-pressure blast of the —297-degree stuff. And frozen alive in their tracks.

"Get back!" Lovell pleaded. "I can't hold it. Here she goes."

They vaulted backwards, but some of the gas hit Rees. He rubbed it off on his clothing and desperately fended off the cumbersome GOX vent. The steel pipe swung wildly in its sling, threatening at any moment to rupture the bird. For 20

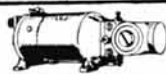
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Close Call in Silo 10
[Continued from page 88]

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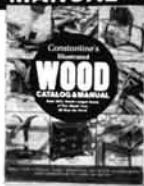
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minutes they struggled to fasten the vent's valve to the pipe that'd carry the bird's breath up and safely out of the silo.

Finally, exhausted, they did it. Up top, somebody reported: "She's COXing." The time was nine p.m., an incredible hour and 40 minutes since she'd gone wild.

Considering she still held about 13,000 gallons, she might breathe herself dry in another 7 to 10 hours—with luck.

Their luck held only four hours. By one a.m., when most of the crew had been sent home, the bird quit COXing because the whole shaft was clouded in GOX. Dousing the bird's cage, they'd hit the GOX-vent's fan, which was supposed to suck the lethal stuff out of the silo. Water had seeped into the enclosed motor housing and had frozen solid. Now GOX billowed solidly below them and the fan—fitfully turning—was all but dead.

"She's gone," Erstad diagnosed, switching off the motor. If they let her run she'd short out—and ignite the GOX.

NOW they had no choice. The bird would have to be drained—and there wasn't a moment to lose.

Ed Bradley, a detank specialist, was sure that, with care, he could do it—somehow align the bird's liquid drain pipe with the silo's defuel tank.

"I'm for it," Earl Coon, the overall supervisor said. Rees, Beheler, and Erstad cast their votes with Coon. Pajak made it unanimous—they'd detank.

Win this one and they'd be in clover. Lose—and the clean-up squad would scrape up the pieces.

"I'll go along to carry Ed out if there's trouble," grinned 200-pound Dutch Gritzmacher, the crew's nimblest hand. The problem was: Who'd carry out Gritzmacher? But they never thought about that.

The rest of the team made up a kind of combo, there in the LCC: Rees on the pressure gauges, Beheler on the TV monitor, Pajak at the master console, Erstad at the tanking panel.

Grimly, Pajak started the tape recorder. It would monitor every silo transmission as Bradley and Gritzmacher described—if only for posterity—each move they made. If the thing blew, they'd at least have it recorded, and nobody would make the same mistake again.

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Close Call in Silo 10

Silently, Bradley and Gritzmacher, looking like a couple of space-age plumbers in their gear, adjusted breathing masks, stuffed nonsparking beryllium tools into their kits, and headed for the hole.

As the minutes tensed by, the intercom relayed every calculated move: the ever-so-cautious alignment of those gaping missile-to-storage-tank pipes; the bypass arrangement Bradley concocted to bridge the gap; the simultaneous rigging of repressuring nitrogen lines to keep the bird's oxygen tanks under pressure as its LOX drained—and the final clipped moments:

Bradley: "I have a chill on the transfer lines." (Proof LOX was flowing.)

Gritzmacher: "No line leaks." (The patchwork was holding.)

Bradley (excitedly): "She's detanking . . . no sweat." (The bird was draining.)

Gritzmacher: "Frost mark dropping." (The telltale frost line on the missile's liquid oxygen tank was visibly lower, confirming a dropping LOX level.)

And from Rees at his tank-pressure gauges: "LOX pressure dropping . . . going down . . . down (and finally) . . . we are below critical pressure now. I am closing the GOX valve."

THEY'D saved the bird. Deep underground an audible sigh ran through Silo 10. For 7 1/2 hours they had fought a losing battle—but they had finally won.

For their part in saving the Atlas and Silo 10 on Sept. 19, 1962, 11 members of the sell-off team received Air Force commendations. Erstad, Kay, and Pajak won the Exceptional Service Award, the Air Force's highest civilian commendation. The others received Scrolls of Appreciation. ■■

Where it comes from . . .

CORK is the outer bark of the cork oak tree which grows on the southern shores of Spain and Portugal. It's stripped from the trees when they are 20 to 30 years old, and about every 10 years thereafter. The trees live about 150 years. Natural cork is composed of tiny hollow, 16-sided cells. It is waterproof, buoyant, and a natural insulator. In U.S. factories, it is granulated and then mixed with a glue glycerine or other binder and cooked into large slabs, which are then sliced into sheets. The sheets are cut into gaskets for all kinds of machinery. Most cork in the U.S. is consumed by the auto industry, but it also goes into insulation, missiles and rockets, shoes, ceiling tile, flooring, costume jewelry, linoleum, and—naturally—bottle corks.