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The Mercury flight of chimpanzee Ham

By 31 January 1961, the United States was a nation undergoing radical cultural and ethical upheaval. Changes were swirling in the wind. On that day James Meredith, an African-American, applied for admission to the all-white University of Mississippi, known as "Ole Miss," and so began a hard-fought legal action that would end in the desegregation of the university and the post-graduation shooting and wounding of Meredith by a white supremacist. That same day, a federal district court ordered the admission of two black students into Georgia University, and the State of Georgia repealed its long-standing laws which segregated the races in its public schools. The university was subsequently desegregated.

Also on that memorable date in American history, space science was on the verge of taking a huge leap forward as a Redstone rocket stood fully fueled on launch pad LC-5 at Cape Canaveral. All was in readiness for the launch of a suborbital mission designated Mercury-Redstone 2 (MR-2). It was hoped that this flight would provide the first major test of several new designs in the Mercury spacecraft, including the environmental control system (ECS), as well as a pneumatic landing bag intended to absorb much of the impact shock when a returning capsule hit the water.

But this time, as America prepared to send a man into space, there was a fully trained passenger on board the spacecraft, namely a 37¼-pound chimpanzee. NASA has always had qualms about giving personable names to animals involved in space research missions lest there be fatal accidents, so during the flight training process – as with his fellow chimps – this one was only supposed to be identified as "Subject 65." He had been allocated this number instead of the mildly offensive "Chop Chop Chang" by which he had been known early in his training, but to his handlers he was unofficially called Ham.

Immediately after his safe recovery, the chimpanzee would be publicly identified in the agency's press releases not by his subject number, but as Ham. According to popular history, this name was derived from the acronym for the Holloman Aero Medical Research Laboratory, but as his chief handler, M/Sgt. Edward C. Dittmer,

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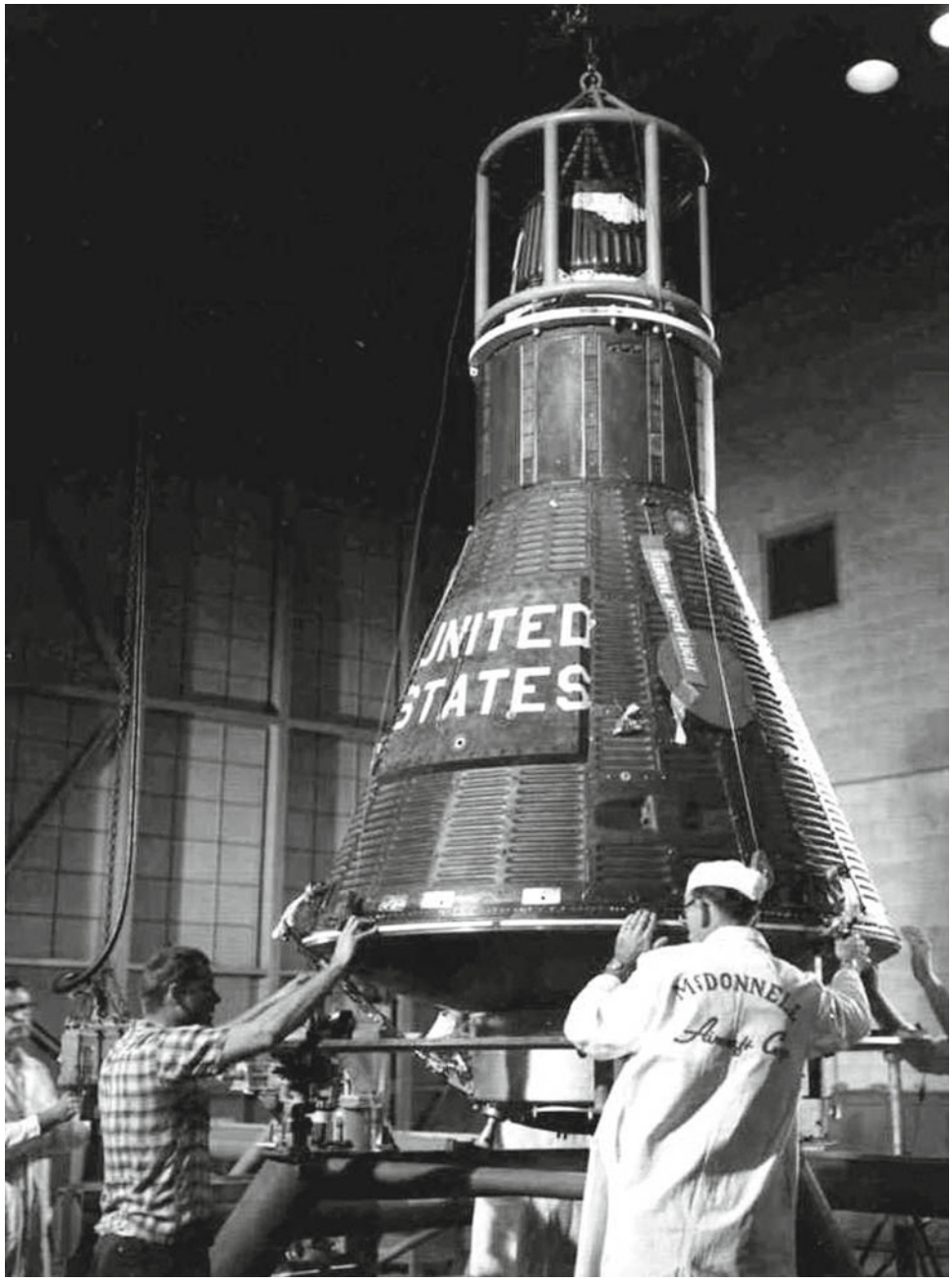
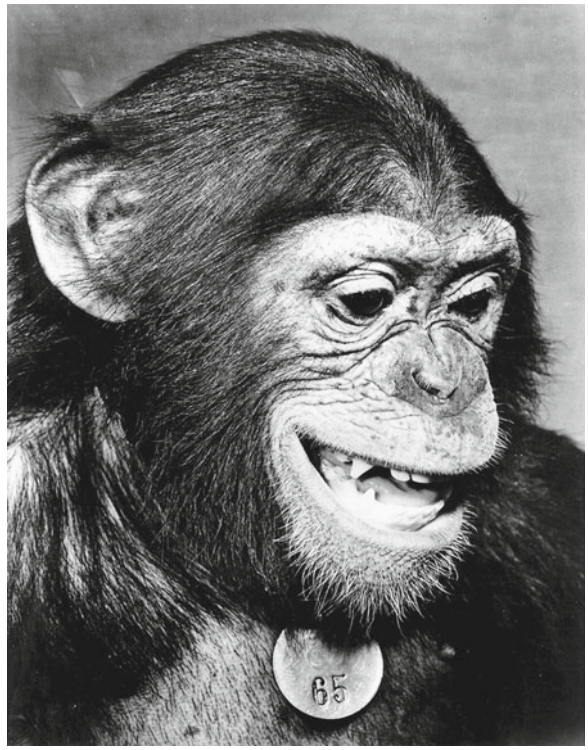


The MR-2 capsule undergoing finishing work at the McDonnell Aircraft Corporation in St. Louis, Missouri. (Photo: McDonnell Douglas Corporation)



"Subject 65," also known as Ham. (Photo: NASA)

wryly pointed out to the author, "Our lab commander at that time was a Lieutenant Colonel Hamilton Blackshear, whose friends called him Ham, so there may have been a dual purpose behind that particular name."

Dittmer also revealed that he enjoyed a great relationship with Ham. "He was wonderful: he performed so well and was a remarkably easy chimp to handle. I'd hold him and he was just like a little kid. He'd put his arm around me and he'd play … he was a well-tempered chimp." [1]

OUT OF AFRICA

Ham was a *Pan troglodyte* chimpanzee, said (through dental analysis) to have been born around July 1957, and was one of several animals captured by trappers at a very young age in the dense tropical rainforests and savannah of the French Cameroons in Equatorial Africa. According to an article in the April 1962 issue of *The Airman*, three members of the U.S. Air Force had flown to the French Cameroons to pick up a number of animals.

M/Sgt. Ed Dittmer assisted Ham in his flight training. (Photo courtesy of Edward C. Dittmer)

As one of these men recalled, “When the chimps were captured, they were very small and usually ranged in age from 10 to 18 months. The natives tie them with strips of bamboo when they capture them, and make no particular arrangements for holding or feeding the young animals. When the vendor, who sells them to us, finally obtains them, they are quite heavily parasitized and malnourished.” [2]

Following their transportation to the United States in 1959, Ham and the other young chimpanzees were temporarily housed at the now-defunct Rare Bird Farm in Miami, Florida. Eventually this latest batch of chimps was delivered to Holloman AFB’s Air Development Center in New Mexico to join an established colony, where they were assigned identifying subject numbers and unofficial training names such as Caledonia, Chu, Duane, Elvis, George, Jim, Little Jim, Minnie, Paleface, Pattie, Roscoe, and Tiger.

Dittmer was one of several aeromedical technicians assisting in bioastronautics research for the Air Force Systems Command at Holloman AFB, reporting directly to Capt. David Simons at the Space Biology Branch of the 6571st Aero Medical Research Laboratory.

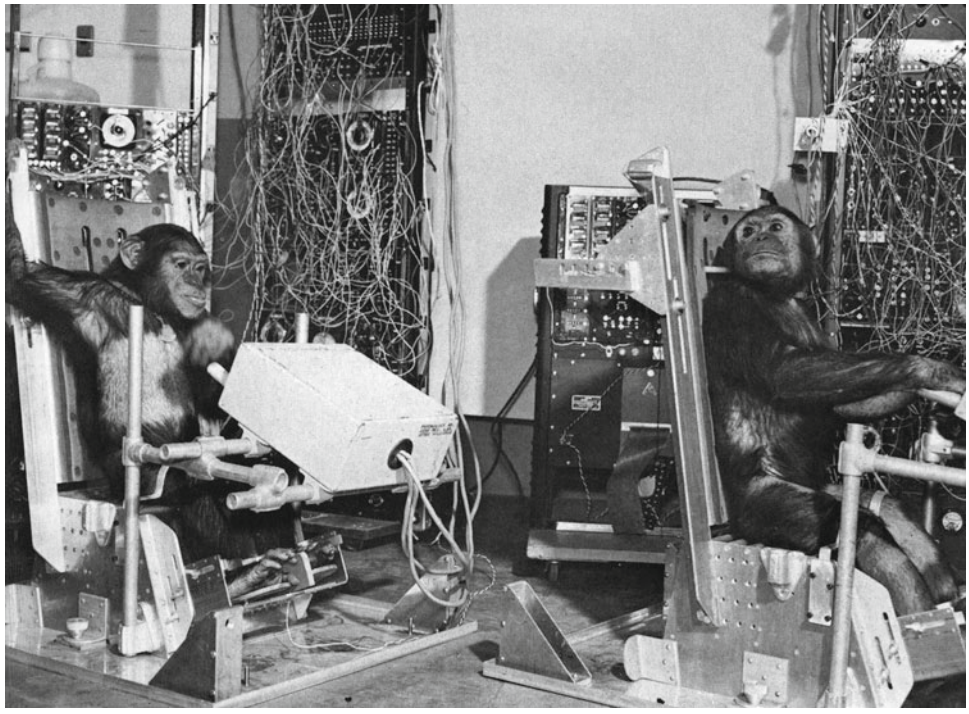
Another member of the Holloman research team was Dr. James P. Henry, who had earlier been involved in studies of blood action under heavy gravity weights and had conducted pioneering work in developing high-altitude protective clothing. Dr. Henry

Chimpanzee space candidates Duane, Jim, and Chu enjoy a snack while training to endure prolonged periods strapped into a capsule couch at Holloman AFB. (Photo: USAF)

was appointed as an Air Force representative to a NASA committee charged with defining and setting in motion plans and procedures for animal flights within Project Mercury. He was assigned the role of coordinator for these flights under Lt. Col. Stanley White, a physician and the leader of the Mercury medical team, and he became part of NASA's Space Task Group at Langley Field, Virginia.

Henry's specific responsibilities included the establishment of an animal flight test protocol, developing the operational flight plans, and overseeing the design and manufacture of the flight hardware. He would also monitor the chimpanzee regime at Holloman, where personnel from the research laboratory had been training animals for space flight since July 1959. Initially, the plan was to train and test ten suitable chimpanzees from the colony. As with earlier programs, they began by incrementally conditioning the animals to accept the restraint conditions to which they would be subjected in a spacecraft [3].

Ed Dittmer became involved in working with the chimpanzee colony under the Space Biology Branch at Holloman, where he was the officer in charge. "Back then we got these small chimps from Africa – they were about a year old – and we started a training project," he recalled. "Of course a lot of things were classified back then, so



The test subjects had to learn to sit in metal chairs and move levers. Ham is seated at the rear; the chimp at front is Enos, who would fly an orbital mission in November 1961. (Photo: NASA)

we had no real idea what we were training these chimps for, but we were teaching them to sit up and work in centrifuges, so it was quite evident that we were training them for use in missiles.

"We started out by teaching them to sit in these little metal chairs, set about four or five feet apart so that they couldn't play with each other. We'd dress them in little nylon web jackets which went over their chests, and then fasten them to their chair. We'd keep them in the chairs for about five minutes or so and feed them apples and other fruit, and we'd progressively put them in their seats for longer periods each day. Eventually they'd just sit there all day and play quite happily." [4]

Each of the chimpanzees was kitted out with one of these nylon "spacesuits," and soon came to accept wearing them. During lengthy training exercises, a diaper would also be worn beneath the nylon suit.

TRAINING FOR SPACE

After the chimpanzees had become familiar with sitting in the steel chairs, Dittmer's team began securing them in individually molded aluminum couches. These were smaller versions of contour couches that the astronauts would one day occupy in the Mercury spacecraft. Next, the animals were introduced to a device mounted across their lap that was called a psychomotor, a small machine specifically designed to test their reflexes and responses.

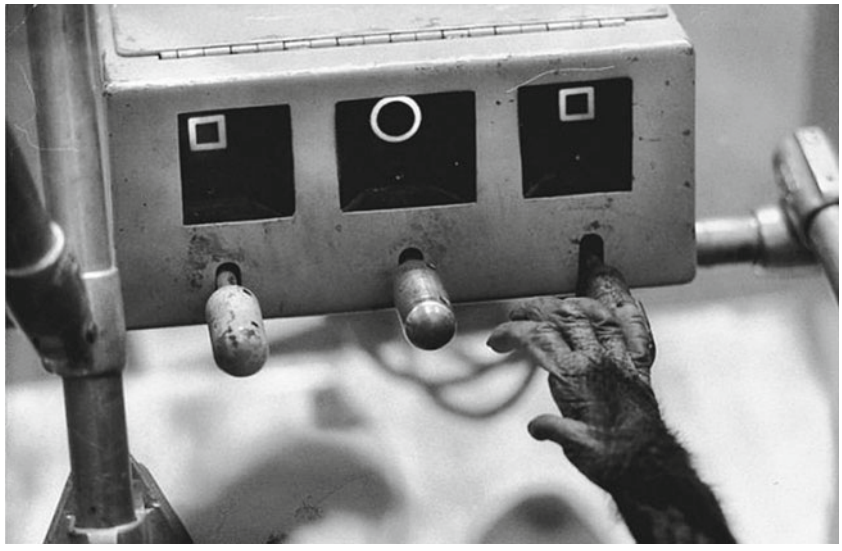
Apart from participating in tests of the spacecraft's life support systems, one of the main tasks that the MR-2 chimpanzees had to master was pushing levers on the psychomotor in sequence throughout a brief suborbital flight, in order to prove that astronauts would be able to perform similar tasks satisfactorily.

There were three lights, with three levers directly below them on the device. One light was a red "continuous avoidance" signal which glowed all the time. Another was a white light that would illuminate when the test animal pushed the lever below. If they didn't do this every twenty seconds a mild electric shock flowed through metal plates attached to the soles of their feet. The third light was blue, and it would glow for five seconds at irregular periods every two minutes. The lever beneath this had to be pushed before the light went out or the chimp would receive a light shock. On an actual mission, this test was set up to begin at liftoff and continue through the flight, transcending periods of high g-loads and acceleration, weightlessness, and reentry.

In the post-flight *Review of Biomedical Systems for MR-3 Flight*, it was noted by Stanley C. White, M.D., Chief of the Life Systems Division, Richard S. Johnston, his assistant, and Gerard J. Pesman of the Crew Equipment Branch of the Life Systems Division, that the chimpanzee program was designed to parallel that of the human program.

"Its primary goal was the qualification of the man support systems," the report said. "Through this approach, the objective of flying first unmanned, followed by an animal flight, would give the logical sequence for the qualification of the spacecraft for manned flight.

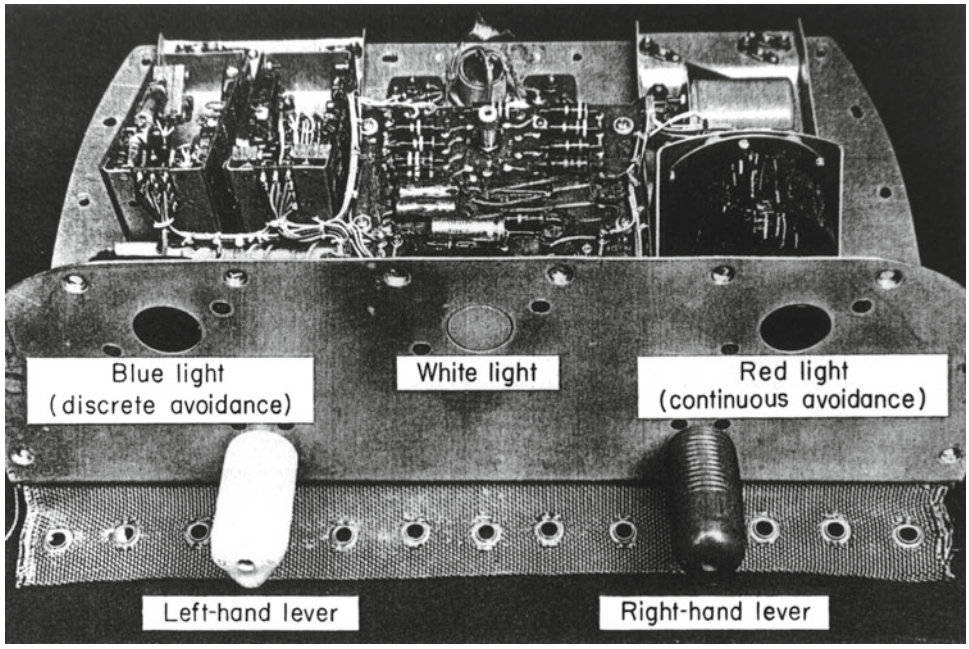
Dressed for space, Ham demonstrates to his handler that he is ready to be considered for the MR-2 mission. (Photo: NASA)



Flight training for the chimpanzees involved learning to push levers in sequence with cueing illumination. (Photo: USAF)

Ham, strapped into his couch and fully enclosed within his space container. Note the psychomotor panel and levers in front of him. (Photo: NASA)

"The chimpanzees considered for the Redstone program were thoroughly trained using the calculated flight dynamics. The centrifuge and heat chambers were used. The physiological training was incorporated with the psychomotor tasks to be done by the chimpanzee during flight. It was found that early in the training program the chimpanzee would cease working during the accelerative periods, and assume his normal

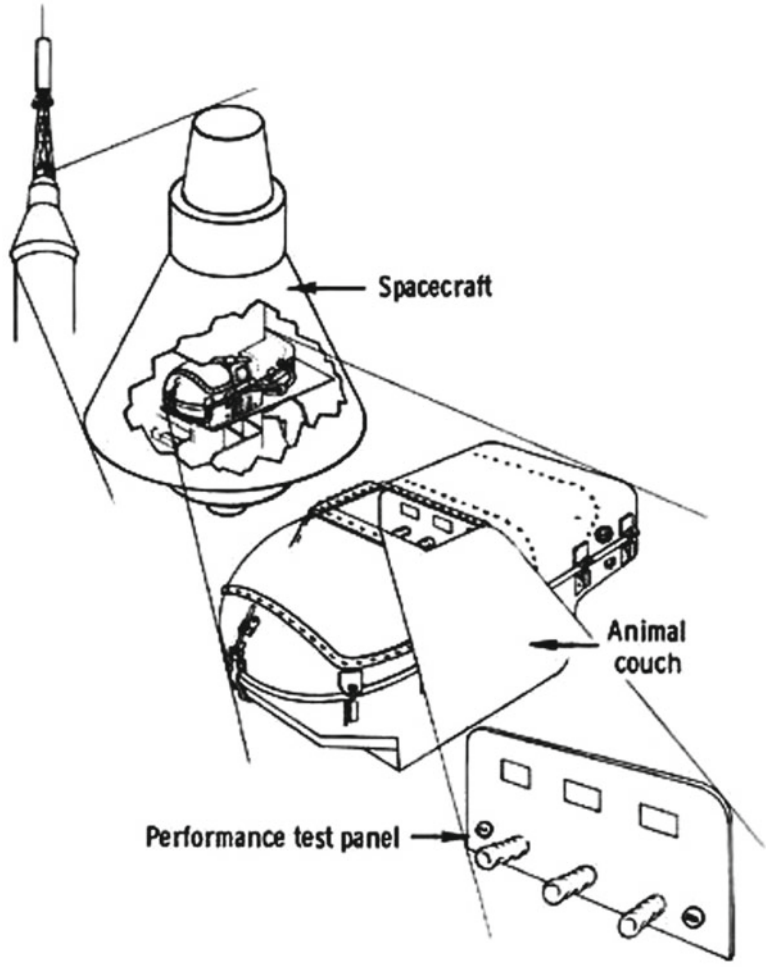


The MR-2 psychomotor panel. (Photo: NASA)

trained pattern promptly after the forces were released. However, subsequent training indicated that the chimpanzee could accept these new stresses and continue performance at a high level through all normal stress loads." [5]

Throughout the chimpanzees' training, a corps of veterinarians closely monitored their health and well-being, tracking their skeletal development with periodic exams and X-rays, as well as ensuring that they were free of any parasites. The animals also received regular checkups of their heart and muscular reflexes. Diet and dietary supplements were an important aspect of these tests, so the animals were fed small doses of antibiotics stirred into their favorite treat – liquid raspberry gelatin. In fact some of the primates enjoyed the diet and attention so much that they began to pack on excess weight, eventually washing them out of the program when they exceeded the specified limit of fifty pounds.

Even though Ham/Subject 65 trained well and was fast becoming one of the top candidates for the MR-2 shot, there were many physical, stress and readiness factors involved in the final selection – which was to be made on the eve of the mission. In preparation for MR-2, six of the most promising candidates along with 20 Holloman scientists and technical personnel were flown to Cape Canaveral on 2 January 1961 in order to acclimatize the chimps to a change in environment and to undergo final preparation for the flight, scheduled for the end of that month. Here they would be given 29 days of intense training under the supervision of Maj. Dan Mosely, DVM, in charge of Holloman's vast Aeronautical Branch.



Layout of the MR-2 spacecraft. (Drawing: NASA)

Facilities at the Cape for quartering, training, and preparing the six chimpanzees consisted of seven specially designed trailers in a fenced-off enclosure adjacent to Hangar S, in which the astronauts' quarters were situated. To prevent any possible spread of disease amongst the animals they were isolated in separate cages. One of the trailers was a combined clinical and surgical facility for physical examinations, clinical laboratory analysis, minor surgery, and treatment of illness or injury. It was also used for the installation of biosensors, donning the restraint garment, and the placement of each chimpanzee in its personalized couch.

According to a report on MR-2 operations compiled post-flight by Capt. Norman Stringely and Maj. Mosely of the Air Force, and Charles Wheelwright from NASA,

A helmeted Ham in the lower section of his couch container. (Photo: NASA)

"Five practice countdowns were conducted by the medical preparation team for the MR-2 flight. They consisted of preparing the subject and couch, and proceeding up the gantry. The couch was either placed outside or inserted into the spacecraft and connected to the spacecraft environmental control system and electrical system. One countdown was for a telemetry check, one for a spacecraft-pressure check, one for a radio-frequency compatibility test, and two were simulated flights." [6]

PRELUDE TO FLIGHT

Three days prior to the launch of MR-2, newspaper reports across the United States were abuzz with a mounting air of excitement and expectation, as the flight of the chimpanzee was rightly being viewed as a prelude to the first flight of a human into space. An Associated Press report on Friday, 28 January 1961, described the build-up to the mission at Cape Canaveral, stressing that good visibility at the launch site and crucial points down the Atlantic test range was an essential requirement for the liftoff to proceed:

> In another 24 hours, if there are no delays, scientists will take a final look at six chimpanzees in their quarters here and pick one for the honor of being the nation's first animal astronaut to check out a Mercury spacecraft like those human astronauts will ride in later launchings. Then, six hours before launch time, the chimp will be packed into its own special space couch in a pressure chamber inside the nine-foot-high Mercury capsule.
>
> If the shot goes, this chimp – a mild-looking member of a specially trained team of four females and two males – will discover for science in a space of 16 minutes whether an animal, much like man in many ways, can tolerate the fantastic stresses of rocket flight under conditions of weightlessness in airless space.
>
> The launching vehicle will be a special Redstone missile which will hurl the chimp 115 miles up and 290 miles downrange at a speed hitting a peak of 4,000 miles an hour.
>
> If chimp and spacecraft make the flight okay, a human astronaut will try it in the next three months. Then, if a host of other trials go well, another chimp will be fired into orbit, and another astronaut will follow his trail, late this year or early next [7].

At 8:00 p.m. (EST) on Monday night, James Henry and John Mosely were on hand to select the prime and backup candidates. According to Ed Dittmer, "We didn't know which chimp would be going until the day before launch. There were six of them that were selected and they were all good, but Ham easily stood out as the best of the bunch." [8] Henry and Mosely agreed with Dittmer's judgment, selecting Ham because of his solid work under test conditions, as well as his general good nature, physical well-being, and alertness at the time. He was also declared to be the best prepared of the six finalists, having amassed 219 hours of training over a 15-month period, including being subjected to simulated Redstone launch profiles on the centrifuge at the Air Force Aerospace Medical Laboratory in Dayton, Ohio. The preferred backup chimpanzee, one of the four females, was Subject 46, known to her handlers as Minnie. She would be prepared to replace Ham at short notice should he develop any late abnormalities.

GOOD TO GO

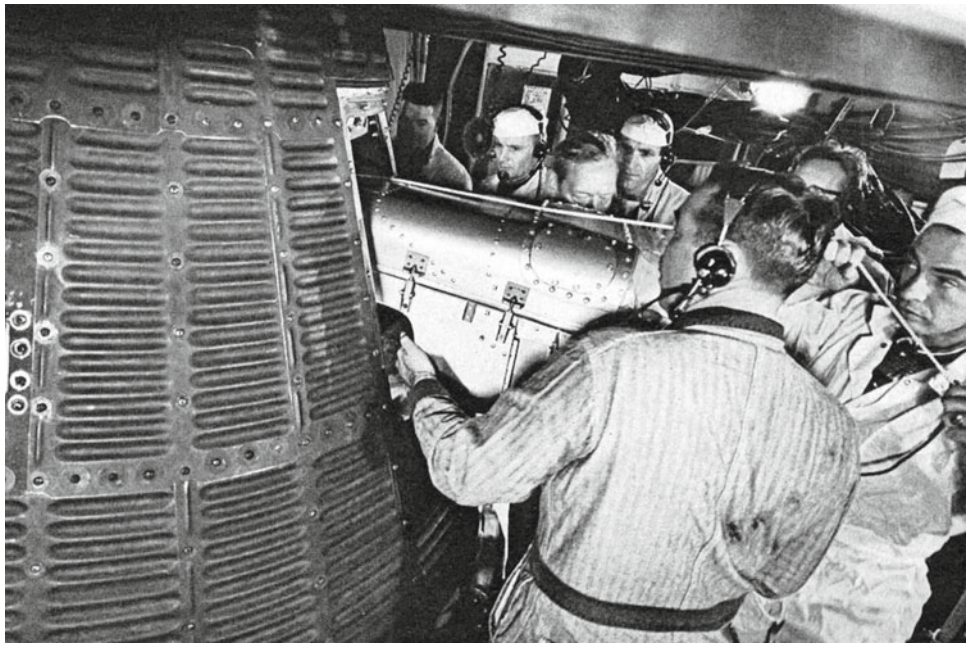
In the very early hours of Tuesday morning, 31 January, Ham and Minnie were given a final physical examination. At 1:45 a.m., having been fitted with biomedical recording sensors and dressed in disposable diapers and plastic waterproof pants, both animals

Ham seated in his couch with backup Minnie looking on. (Photo: NASA)

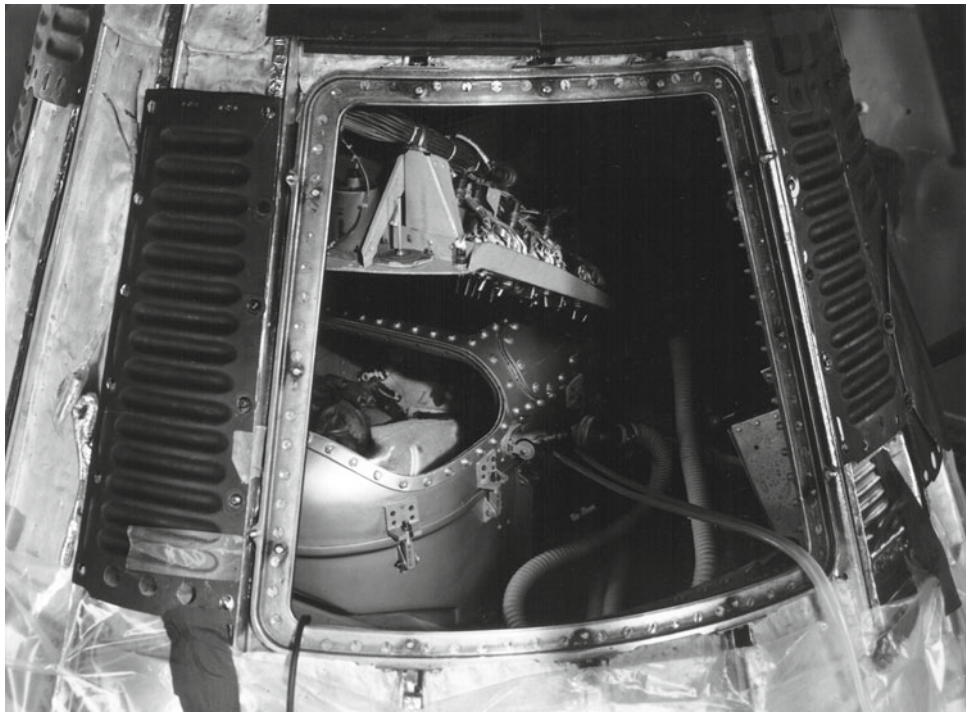
waited patiently as an operational test was conducted of the sensors. They were then dressed in their spacesuits and firmly zipped and strapped into their individual contour couches. Psychomotor stimulus plates were then attached to the soles of each animal's feet and electrically checked for continuity. Their arms were left free in order that the one who flew the mission would be able to undertake the assigned psychomotor tasks aboard the spacecraft.

As preparations continued around them just after 3:00 a.m., Ham and Minnie enjoyed a prescribed breakfast consisting of some cooking oil and flavored gelatin, half a fresh egg, half a cup of baby cereal, and several spoons of condensed milk. All the tests had determined that Ham remained the better behaved and more animated of the two chimpanzees, and his place in space flight history seemed assured.

The next step in the proceedings was to install and bolt down the lids covering the chimpanzees, following which inlet and outlet air hoses were fitted and the air flow initiated. The containers were then checked for any air leakage, but all proved to be in order. At 5:04 a.m., after all the pre-flight tests had been satisfactorily completed, the handlers were instructed to drive the transfer van over to the launch pad, arriving 25 minutes later. Once there, Ham's container was switched from the transfer van's air supply to a portable oxygen supply, then carried to the gantry and up the elevator to the spacecraft level. After being gently inserted and secured into the capsule it was connected to the onboard environmental control system and electrical system. The physiological monitoring of Ham was then switched over to the blockhouse. Hatch closure was completed at 7:10, with an anticipated liftoff time of 9:30 a.m.



Ham's container is carefully inserted into the Mercury spacecraft. (Photo: NASA)

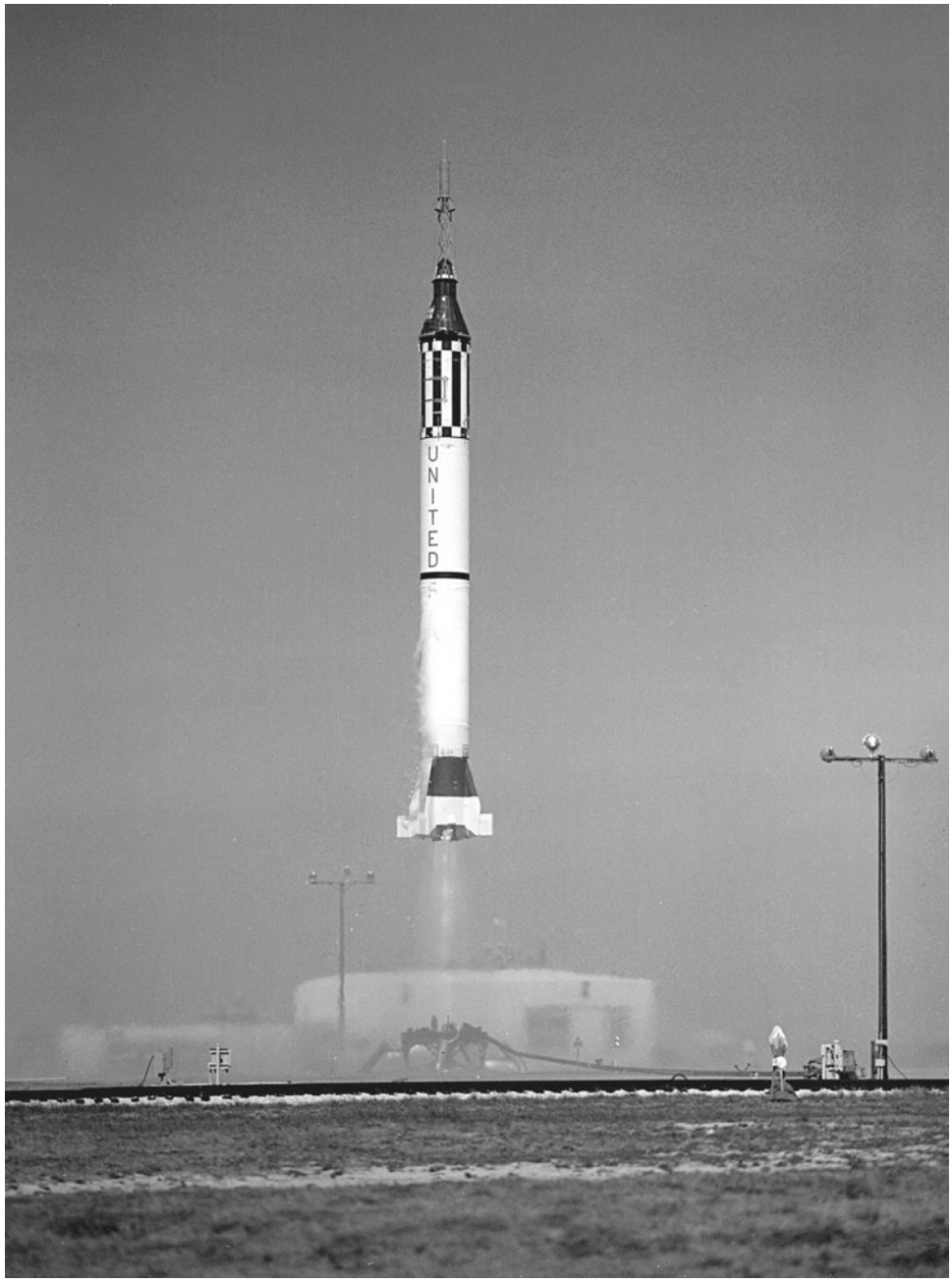


The interior of the spacecraft prior to hatch closure. (Photo: NASA)

Before the gantry was removed from the Redstone rocket at 8:05 a.m., the transfer van, with the fully prepared backup chimp still aboard, was moved a safe distance away, adjacent to the blockhouse. Still enclosed in her container, Minnie would be monitored up until 30 minutes prior to liftoff, at which time the container with its portable air supply and all her attending personnel would exit the van and move into the blockhouse.

At 9:08 a.m., the count was recycled and the gantry rolled back along its tracks into position. The spacecraft hatch was then opened to cool an overheated electronic inverter which was causing the temperature in Ham's container to rise. Technicians worked frantically to clear up a number of minor difficulties as concerns grew over a band of stormy weather closing in on the Cape. Repairs were soon completed and the countdown resumed at 10:15 a.m. But as the pad crew were evacuating the gantry its elevator jammed and had to be hurriedly fixed.

Liftoff finally occurred at 11:54:51 a.m. By then, Ham had spent nearly five hours strapped on his back inside the spacecraft. Two Mercury astronauts observed the ascent from the air, with Deke Slayton and Wally Schirra circling the launch area in F-106 jets.

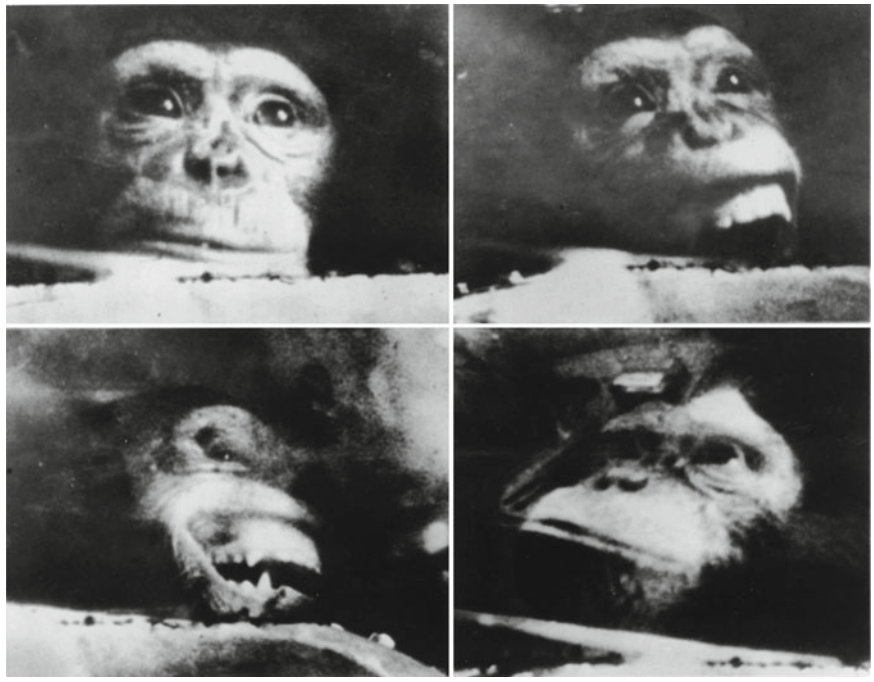


Liftoff of the MR-2 mission. (Photo: NASA)

A TROUBLED FLIGHT INTO SPACE

The Redstone roared into the sky on what started out as the planned trajectory, but flight telemetry indicators soon began to show problems. A faulty valve was causing the fuel pump to inject too much liquid oxygen into the engine, inducing it to deliver an excess of thrust and accelerate faster than expected. As a result, the Redstone did more than was expected of it and, by burning its fuel faster than expected, triggered a chain of events which added several miles to the intended peak altitude and tacked 130 miles on to the range. Meanwhile, Ham was calmly pulling away at the levers as he had been trained to do.

When the booster exhausted its fuel supply, the Mercury spacecraft was meant to sequentially separate and coast to a peak altitude of 115 miles before falling into the Atlantic some 298 miles downrange, where a flotilla of eight ships were waiting to retrieve it. But the anomaly had caused a "thrust decay" when the rocket's fuel was depleted. That caused the spacecraft's emergency escape system to trigger an abort sequence. By then, the spacecraft was traveling at around 4,000 miles an hour. The emergency escape rocket reacted as it was meant to do, hauling the spacecraft away from the booster. In doing so, it accelerated to a speed of more than 5,000 miles an hour. Ham was suddenly subjected to a gravitational force of around 17 g's, driving him hard into his couch and making him temporarily forget his psychomotor duties. As the spacecraft finally entered a state of weightlessness a couple of small electrical jolts through the soles of his feet reminded a bewildered Ham of his responsibilities and he resumed tugging at the levers. But there were still more dangers to overcome.



Still images from a film taken of Ham during his space flight. (Photos: NASA)

As Flight Director Chris Kraft and his Mercury Control Center team continued to monitor the progress of MR-2, he was informed that the fuel problem and resultant over-acceleration might carry the spacecraft an extra 42 miles higher and about 124 miles further downrange, adding two more minutes of weightlessness to the mission. Of more immediate concern to Kraft was the fact that a faulty relief valve had caused the spacecraft's pressure to suddenly drop from 5.5 to 1 psi. Fortunately, this would not affect the occupant, as Ham was sealed in a pressurized container with his own air supply. Added to this was the unhappy fact that the retro-pack had prematurely jettisoned when the spent escape tower was jettisoned. Consequently, the spacecraft would reenter excessively fast and splash down even further downrange.

William Augerson, a physician on duty in the Cape blockhouse, was monitoring Ham's physiological progress. He reported that despite all the onboard dramas, Ham was performing his tasks just as he had been trained. Weightless for more than six minutes, he only received two small electric shocks throughout the entire journey for neglecting to push the correct levers on time. In this respect, it was an almost perfect rehearsal for a manned mission, proving that a human would easily be able to carry out maneuvering tasks even if things did not go according to plan during the flight.

As MR-2 plunged backwards toward the sea, Ham began to experience a crushing 14.7 g's. Then, at 21,000 feet, a six-foot drogue chute automatically deployed, which in turn dragged the 63-foot main parachute from its stowage at 10,000 feet, rapidly slowing the spacecraft's rate of descent. A search and rescue and homing (SARAH) beacon had been activated earlier, when the escape tower pulled the capsule off the spent booster. Tracking aircraft monitored this signal and steered the ships of Task Force 140 to the predicted point of impact, around 416 statute miles downrange – an error of some 127 miles.

Seventeen minutes after lifting off, the capsule smacked down hard in rough seas beyond the far end of the Atlantic Missile Range. As intended, the landing bag had deployed and this helped to minimize the shock of striking the water. Immediately after splashdown the main parachute was automatically jettisoned, fluorescent green dye was released in order to aid visual sighting, and a high-intensity light on top of the capsule began to flash.

On impact with the water, a rim of the lowered heat shield had snapped back so violently onto the hull that it breached the titanium pressure bulkhead in two places, enabling sea water to penetrate the spacecraft. A cabin relief valve had also jammed open, allowing even more water to seep in. Then, just to compound matters, the heat shield tore loose from the bottom of the landing bag and sank. MR-2 slowly began to tilt and settle ever deeper into the tumultuous seas.

Shortly after splashdown, NASA was reporting that the floating capsule would be recovered within three hours. Although telemetry indicated that Ham was alive as the capsule approached splashdown, the radio telemetry circuits were disabled on impact so no one knew how he was doing. A subsequent NASA bulletin stated, "The Mercury spacecraft in today's test reached a velocity of more than 5,000 miles an hour, a peak altitude of about 155 statute miles, and landed some 420 statute miles downrange. Higher than normal booster thrust produced the extra velocity, altitude, and range.

The capsule has been sighted in the water by an aircraft. A recovery ship should reach the spacecraft within three hours. Telemetry received during the flight indicates the chimp performed satisfactorily." [9]

SPACECRAFT RECOVERY

Meanwhile the landing ship dock USS *Donner* (LSD-20), which had previously been involved in Mercury-Redstone recovery trials, was proceeding at flank speed to the reported landing area, together with Task Force destroyers USS *Ellison*, *Borie*, and *Manley*. Twenty-seven minutes after splashdown, airman technician Jerry Bilderback aboard a Navy P2V Neptune patrol plane became the first person to spot the capsule pitching around in white-capped seas. Unfortunately, the overshoot meant that the *Donner* was still some 60 miles away and it was almost an hour before the helicopter dispatched by the ship with pilots John Hellriegel and George Cox was able to reach the scene.

Once they were hovering overhead, the pilots alarmingly reported that the capsule was tilted on its side in a seven-foot swell, and it appeared to be sitting much deeper than expected in the water. By now, the destroyer USS *Ellison* had reached the site. With no time to spare, two trained frogmen quickly jumped out of the helicopter and attached cables to fixed points on the wallowing spacecraft to help keep it upright in the water. As the helicopter hovered, Cox reached down from the lower cabin with a shepherd's hook and attached a towline from the aircraft to a loop on the capsule.

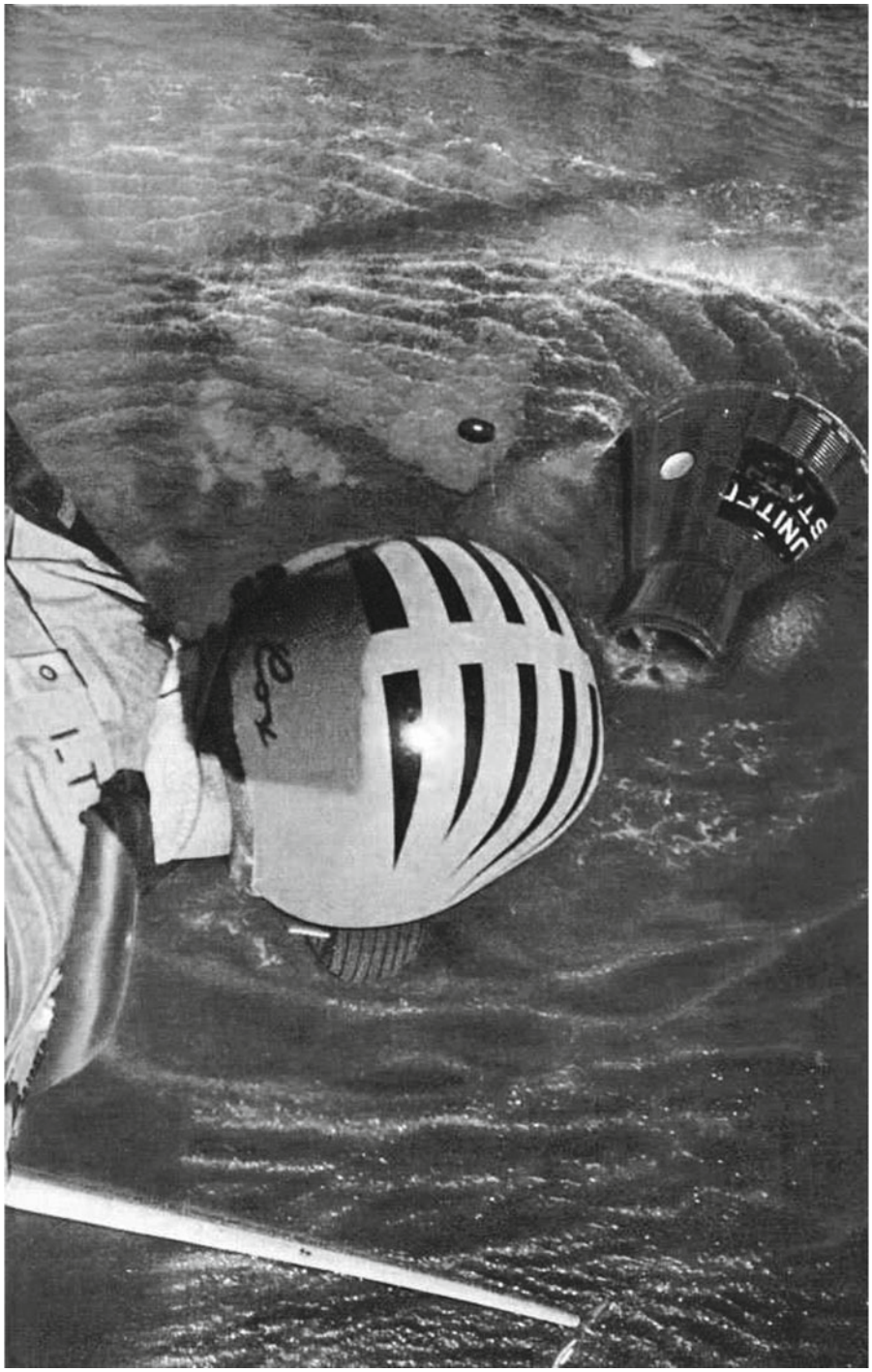
At 2:52 p.m. Hellriegel applied full power and slowly hoisted the MR-2 capsule, streaming seawater, into the air. The precious cargo was flown all the way back to the USS *Donner* and gently deposited onto the deck at 3:38 p.m., where willing hands soon secured it. This good news was relayed to Cape Canaveral nearly three hours after liftoff.

When it was safe to do so, the spacecraft's steel hatch was removed, exposing the canister with Ham inside. The sailors involved also noticed a foot and a half of salt water sloshing around inside the capsule. It was later estimated the spacecraft had taken on about 800 pounds of sea water, but was otherwise in good shape. Happily, the water had not infiltrated Ham's container. He was unaware of how close he had come to sinking ignominiously to the bottom of the Atlantic.

Meanwhile, doctors back at the Cape were deeply concerned that Ham might have been injured during the crushing forces of the flight, or through the hard splashdown. About 35 minutes after reaching the ship, Ham's container was resting on the deck. One very confused chimpanzee could be heard squealing his discontent from within. The window was fogged over, but it cleared when oxygen was fed in through a small hatch, and Ham came into view.

"He's alive," reported a relieved Maj. Richard Benson, an Air Force veterinary doctor. "He's talking to us." The sailors then opened a small porthole to enable the veterinarian to insert his hand. Ham cried steadily. "That could mean some anxiety," Benson told the surrounding sailors. "He's just vocalizing."

Ham's spacecraft (circled at top) with the recovery helicopter overhead. At bottom (also circled) are two men in a raft near the bow of the USS *Ellison*. Their task was to right the capsule and help to attach a tow line so that it could be hoisted out of the water. (Photo: U.S. Navy)



George Cox prepares to hook onto the wallowing spacecraft. (Photo: NASA)

Ham's spacecraft arriving by helicopter above the USS *Donner*. (Photo: U.S. Navy)

One sailor who got a glimpse of the animal was asked, "How does he look?"

"Fine," replied the sailor. "He's smiling at me."

Ham was turning his head from side to side, watching the onlookers curiously and licking his pink chops. He reached a couple of the fingers of his right hand through the port to grasp the hand of Benson. Then he rubbed his face and eyes and yawned. When the Plexiglas lid had been fully removed from the container, he once again shook hands with Benson, burped, and folded his arms across his chest while the veterinarian checked his heart rate with a stethoscope. Benson then reached down to test the animal's diapers. "They're damp," he said with a smile.

Following the brief checkup, Benson happily announced, "On the basis of this preliminary examination I'd say he looks very good. It is very encouraging." [10]

Ham was carried to the ship's battle dressing station and placed on a white table, where he was carefully unstrapped from his couch. Once again Benson checked the chimpanzee's heart rate, as well as his temperature, respiration, and lung conditions, and looked for any evidence of broken bones. Unsurprisingly, Ham did display some signs of fatigue, a little wobbling and trembling of his legs when standing, and he had somehow sustained a slight abrasion to the bridge of his nose.

Apart from the facial abrasion everything was fine, and Ham's reflexes were also found to be normal. Benson then produced a shiny red apple, at which Ham became excited, jumping and reaching out in anticipation. Benson cut the apple and fed it to him in slices as a post-flight treat, which he eagerly devoured. The flight had clearly

Pilot John Hellriegel gently lowers the MR-2 capsule onto a platform. (Photo: U.S. Navy)

Opening the hatch on Ham's capsule. (Photo: NASA)

not affected Ham's appetite. While he ate, Ham stood with his arm around the major, and later consumed half an orange along with a small wedge of lettuce.

Later, with Benson sleeping in an adjoining stateroom, Ham spent the night in the commodore's quarters as the ship steamed across a moonlit ocean for Grand Bahama Island. It was not exactly a trip of luxury, because he was in a cage on the floor of the bathroom, lashed to the toilet and the safety rail that was designed to prevent one from slipping after a shower aboard a rolling, pitching ship. But these were merely safety precautions aimed at protecting precious government research property [11].

UNWANTED FAME

The next day, Ham was loaded back onto the helicopter and transported to a forward medical facility at Grand Bahama Island for further medical checks. Once these were done, he was flown back to Cape Canaveral aboard a U.S Air Force C-131 transport aircraft, touching down at Patrick AFB at 1:11 p.m., where hordes of reporters and photographers were eagerly waiting alongside Hangar S for a glimpse of America's latest space hero.

Ham's container after extraction from the spacecraft. (Photo: NASA)

Ham was quick to indicate his displeasure at this rowdy intrusion into his living space. He became agitated, bared his teeth, and screeched at the melee of strangers. His handlers finally took the fretting animal back into the familiar surroundings of his van to calm him down. Upon being taken out again a short while later, he threw another tantrum as the news crews surged in close, some popping flashbulbs in his face. The handlers tried hard to get the reluctant chimp to pose next to a Mercury training capsule, but he didn't want to go anywhere near the darned thing. America's astrochimp was definitely not impressed by his newfound fame [12].

Several days later, on 3 February, Ham was returned to Holloman AFB in New Mexico. Here, over the next two years, he was kept under scrutiny while performing tasks to determine whether he had suffered any residual effects from his journey into space.

Ham is given a preliminary examination by veterinarian Dr. Richard Benson. (Photo: NASA)

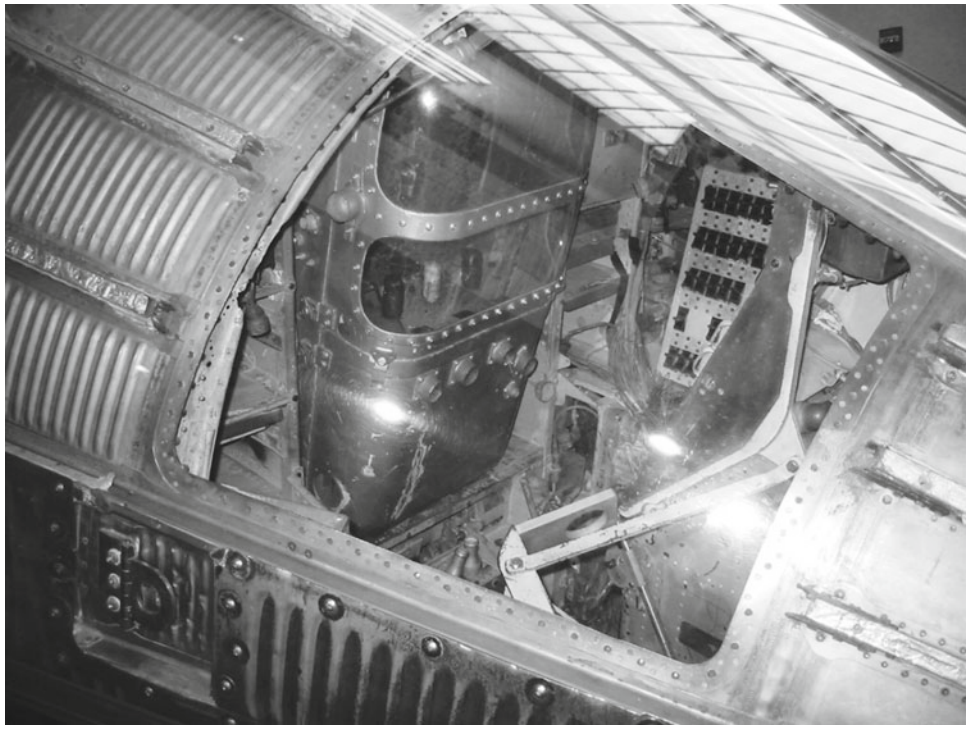
Although he did train for a second mission, Ham never flew into space again. He spent 17 years in "retirement" at the National Zoo in Washington, D.C. In 1980, by now seriously overweight, he was transferred to the North Carolina Zoological Park, where he died as a result of an enlarged heart and liver failure on the afternoon of 17 January 1983, aged 26. His skeleton would be retained for ongoing examination, but his other remains were buried in a place of honor with a carved marker and memorial plaque outside of the International Space Hall of Fame in Alamogordo, New Mexico.

Ham eagerly reaches out to take an apple from Dr. Benson. (Photo: NASA)

Dr. Benson (left) and M/Sgt. Paul Crispen remove Ham's biomedical sensors after his flight into space. (Photo: NASA)

The grave of space pioneer Ham in New Mexico. (Photo: International Space Hall of Fame, New Mexico)

The author stands alongside the MR-2 spacecraft, now on exhibition at the California Science Center, Los Angeles. (Photo: Francis French)



The positioning of the animal container inside the MR-2 spacecraft. (Photo: Francis French)

FINAL CHECKOUT OF THE REDSTONE BOOSTER

Following an extensive evaluation of the MR-2 Redstone's over-acceleration and harmonic vibration problems, it was reported that the reliability factor of the booster was well below the level required for NASA to confidently launch an astronaut into space.

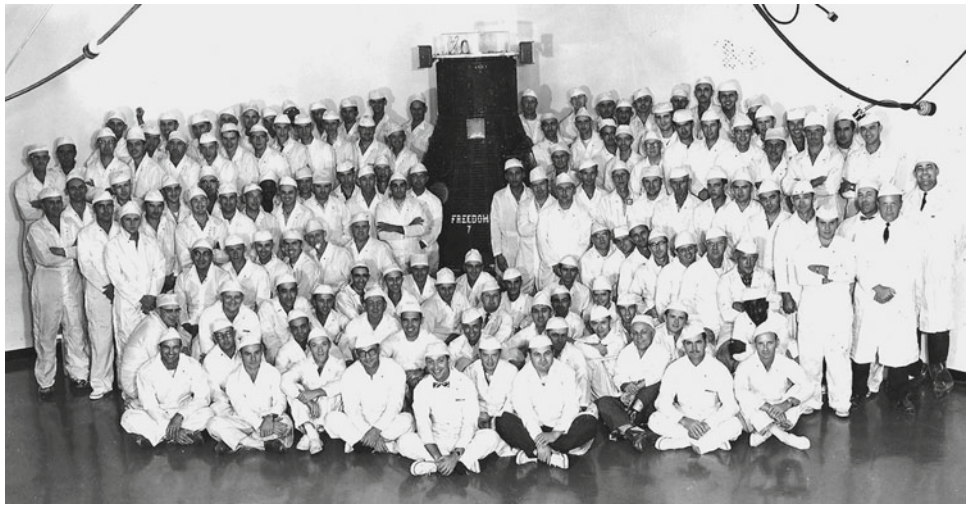
Although the first manned flight with Alan Shepard as the prime pilot had already been scheduled for launch on 24 March 1961, there was a distinct feeling of unease in Washington, D.C. The president's technical advisor on science issues, Jerome B. Wiesner, had recently been appointed to head the Science Advisory Committee and was advocating a far more cautious approach in what he perceived as something of a rush for NASA to launch an astronaut into space. Wiesner bluntly warned Kennedy that a dead astronaut would not do a lot for the young president's administration, and he argued for several more chimpanzee launches to iron out any possible problems prior to committing to a manned flight. The new NASA Administrator, James Webb, and the head of the STG, Robert Gilruth, were brought into the discussion, holding consultations early in February with key Mercury personnel. Owing to some minor technical issues with Ham's flight, and under pressure from the White House to be cautious, Wernher von Braun was advised there should be a delay in the first

human-tended mission. Instead, an unmanned proving flight of the booster would take place on the date previously allocated to MR-3.

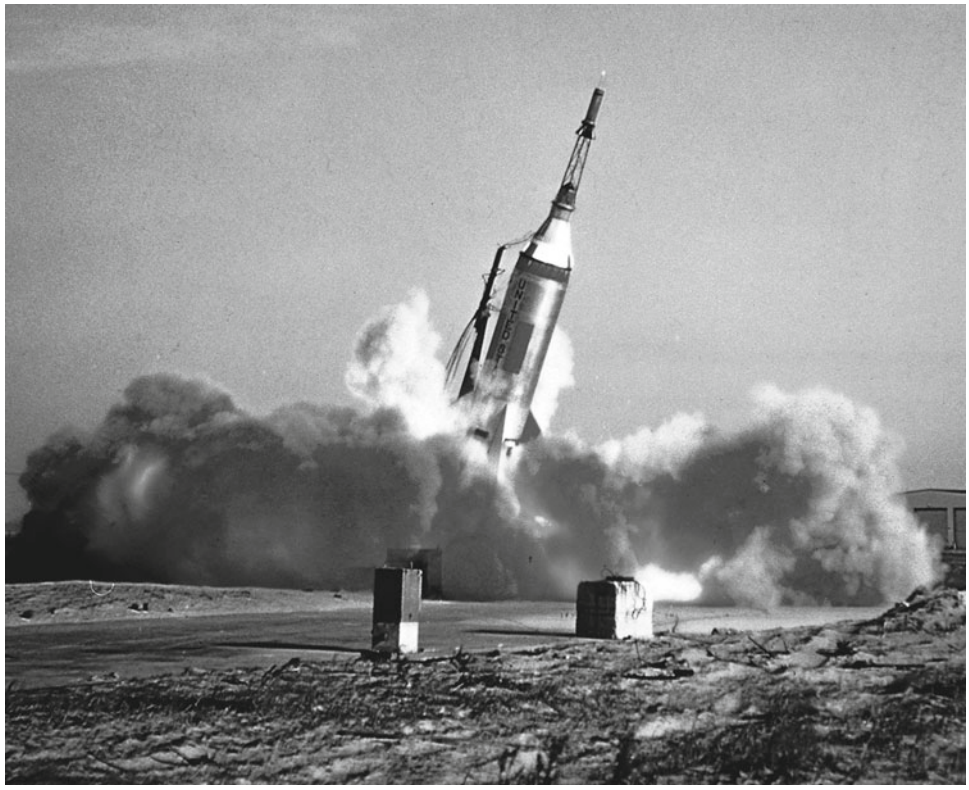
As eager as he was to proceed with the manned flight, von Braun readily agreed with Webb and Gilruth – in fact, he had already been actively pressing for a further test flight, a "booster development launch" as he called it, although he was aware that it would not be possible to completely eliminate all risk. It was agreed that if this test proved successful, the manned MR-3 mission could proceed and the launch date was set for 25 April. It was a delay that arguably cost America the historical prestige of launching the first human being into space.

The new mission became known as the Mercury-Redstone Booster Development (MR-BD) flight. Its primary purpose was to verify the modifications made to prevent a recurrence of the flaws that afflicted the MR-2 flight. To prevent over-acceleration, the thrust regulator and velocity integrator were tweaked, and the vibration induced by aerodynamic stress in the upper part of the booster was remedied by adding four stiffeners to the ballast section and 210 pounds of insulation to the inner skin of the upper, instrument compartment section of the Redstone [13].

The MR-BD test would use an inert, expendable boilerplate Mercury spacecraft, and it was decided to reuse the one that had been retrieved after the Little Joe LJ-1B abort test mission on 21 January of that year. This capsule had been built at NASA's Langley Research Center, ballasted and configured to match the production capsule that was to be used on the first manned flight. However, it was not equipped with a retrorocket package or posigrade rockets because these would not be required. It was



The Manufacturing, Quality Control, and various other classifications of workers at the McDonnell Aircraft Corporation plant in St. Louis, Missouri, gather around the completed *Freedom 7* spacecraft, which would soon carry Alan Shepard into space. (Photo courtesy of Philip Kempland/McDonnell Aircraft Corporation)



Little Joe LJ-1B, launched on 21 January 1960. The boilerplate capsule used on this primate flight was recovered, and would later be used on the MR-BD flight. (Photo: NASA)

to be attached to the Redstone booster in the normal manner, but there would be no separation in flight. The escape rocket system, which was also inert, was a standard Mercury configuration utilizing spent rocket motors that were balanced to the correct weight for the MR-BD flight [14].

The LJ-1B flight had successfully carried Rhesus monkey Miss Sam on an eight-and-a-half minute test of the capsule's escape sequence and landing systems. The boilerplate capsule had splashed down smoothly 12 miles from the Wallops Island launch site on the Atlantic coast, whereupon it was plucked from the sea by a waiting helicopter and returned to the launch site. Forty-five minutes after liftoff, an excited but otherwise healthy Miss Sam was extracted from the capsule.

A SUCCESSFUL TEST FLIGHT

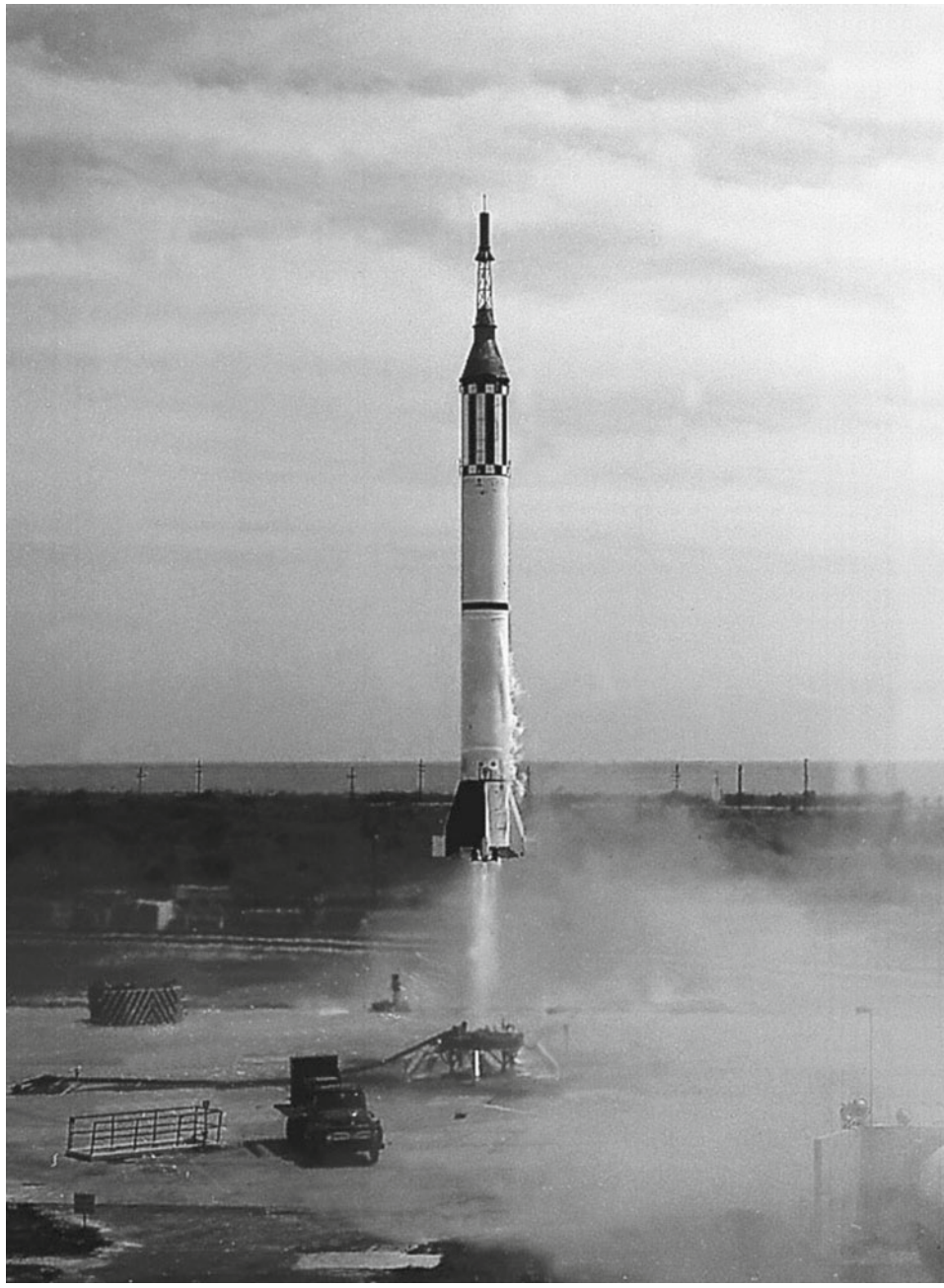
On 24 March 1961 the weather conditions at Cape Canaveral were favorable for a liftoff that day from Launch Complex 5. The launch procedures had been arranged in a four-hour countdown that began at around 8:30 a.m. (EST). Liftoff had originally

Rhesus monkey Miss Sam flew on the LJ-1B abort test flight from Wallops Island. (Photo: NASA)

been scheduled for 1:00 p.m., but this was advanced by half an hour at the request of the Atlantic Missile Range. The countdown would only involve procedures relative to the MR-5 Redstone booster, as the research and development capsule mounted on top was inert. Everything went smoothly, and the loading of the liquid oxygen began two hours prior to the scheduled launch time.

Including the spacecraft and its escape tower, the MR-BD vehicle stood 83.1 feet tall, and would have a total weight of 66,156 pounds at liftoff. Given the elongated fuel tank and enhanced performance of this Redstone variant, the more powerful but toxic Hydyne fuel was replaced by a mix of 75 percent ethyl alcohol and 25 percent water that would be combined, as previously, with liquid oxygen.

At 12:29:58 p.m. the MR-BD rocket lifted off the launch pad and booster cutoff occurred 141.7 seconds later. No thrust difficulties were encountered as the Redstone climbed to an altitude of 115 miles, attaining a maximum velocity of 5,123 miles an hour. After a flight lasting 8 minutes 23 seconds the entire assembly plunged into the Atlantic 311 miles downrange – almost exactly as planned. The area of impact was only 1.7 miles longer than planned, and less than 3 miles to the right of the envisaged



The Mercury-Redstone Booster Development (MR-BD) test that was launched on 24 March 1961. (Photo: NASA)

site. As the structure sank swiftly to the floor of the ocean, a SOFAR (sound fixing and ranging) bomb attached to the interior of the capsule automatically detonated at 3,500 feet. This device had been inserted at the request of the Navy for a checkout of its Broad Ocean Area (BOA) Missile Impact System.

All of the test objectives of the MR-BD mission were achieved, and a preliminary analysis of the flight data showed only slight deviations from the ideal performance. All systems functioned as planned and no problem areas were revealed.

"The engine performed perfectly," Dr. Kurt Debus, NASA's director of launch operations later explained. "It burned its prescribed time and did not cut off too soon, as on the previous launching." Debus announced that if a careful analysis of all the post-flight data demonstrated that the Redstone had functioned smoothly, no further tests would be required and that an astronaut would be able to be launched within six weeks to fly approximately the same 15-minute course as had been traveled that day. "However," he cautioned, "a close look at the tapes might reveal a slight flaw which could necessitate another test Redstone launching." [15]

Other NASA officials warned against an over-optimistic timetable, emphasizing that a manned flight depended on several other factors. Mercury Operations Director Walter Williams, pointed out that, in particular, the capsule had to undergo further helicopter drop and flotation tests before an astronaut could ride it.

RUSSIA RESPONDS

The very next day, 25 March, the Soviet Union overshadowed the Redstone test by launching into orbit and recovering by parachute the *Korabl-Sputnik 5* spacecraft, which not only carried a small dog named Zvezdochka ("Little Star") but also a full-sized space-suited mannequin cosmonaut which had been gleefully nicknamed "Ivan Ivanovich."

Now suitably armed with a launch date for the first American astronaut, whose name had not yet been publicly revealed, the Soviet Union pressed ahead in an effort to completely upstage and diminish America's space plans.

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