The X-15 Rocket Plane
Flying the First Wings Into Space

Flight Log

by Michelle Evans
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1. Introduction

This Flight Log for the X-15 research aircraft is a supplement to the book “The X-15 Rocket Plane: Flying the First Wings Into Space,” published by the University of Nebraska Press as part of the “Outward Odyssey, People’s History of Spaceflight” series. This flight log contains a program summary; basic information about the X-15; a log of all captive flights, aborted flights, and research flights; a timeline which includes important milestone dates such as vehicle rollouts and other significant events; and a glossary of terms.

A. FLIGHT LOG FORMAT

Three X-15s were built. They were designated by their tail numbers: 56-6670, 56-6671, and 56-6672.

Flight Numbers

First Digit signifies the aircraft. 1 is 66670, 2 is 66671, and 3 is 66672.
Second Digit signifies A for Abort, C for Captive, or a numeral that signifies the number of actual releases.
Third Digit signifies the number of times that the X-15 was taken aloft, whether released or not.

Examples:
1. Flight 2-53-97 was the 97th time aircraft 2 (66671) was taken aloft but only the 53rd time it was actually released from the B-52.
2. Flight 3-A-46 was the 46th time aircraft 3 (66672) was carried aloft, but the flight was aborted for weather or technical reasons after the B-52 took off, but before the X-15 was released.
3. Flight 1-C-1 was a scheduled Captive flight for aircraft 1 (66670). The X-15 was carried aloft for a technical checkout and returned to Edwards AFB, still attached to the right wing pylon of the B-52.

Column 1

Flight/Pilot: The flight number as given in the above examples, followed by the pilot who flew the mission. The number in parentheses after the pilot's name signifies their current X-15 flight number.

Launch and Landing includes the exact time and area of those events for the X-15.
NOTE: All times for X-15 and B-52 are given in 24-hour format. Example: 15:21 is 3:21 p.m.

Duration is from the moment of X-15 launch until it came to a complete stop after landing.

Column 2

Engine Run and Duration are in seconds.

Altitude is in feet above mean sea level (MSL).

Distance is in statute miles. (to convert to nautical miles, multiply by 0.87)

Column 3

B-52/Pilots: Tail number of the carrier aircraft: NB-52A 52-003 (003) and NB-52B 52-008 (008). Pilots are listed as Pilot & Copilot.

Duration is given in hours and minutes for total B-52 flight time from take off to landing.

Chase Pilots: Chase refers to aircraft that flew alongside the B-52/X-15 during flight for observation and photography. These aircraft included F-100, F-104, F-5D, F-4H, and T-38. Due to the extreme speed of the X-15, separate chase aircraft were assigned to the launch from the B-52 and to landing at Edwards AFB, or remote lakebeds during emergency situations.
B. RESEARCH

This X-15 Flight Log has taken years of research to compile. There is no single definitive source available where all data found in this log can be located, so many different sources have had to be identified and researched. When more than one source has any given piece of data, there is often a contradiction. A judgement must often be made as to the validity of the conflicting data. The criteria used in this judgement must be how close these data are to the actual events, how was the data obtained, and how was it recorded.

There are two primary sources for X-15 flight data: the National Aeronautics and Space Administration (NASA) and the United States Air Force (USAF). NASA documents pertaining to the X-15 are primarily found at the Armstrong Flight Research Center, while USAF documents are found at the Air Force Flight Test Center History Office. Both of these are located at Edwards Air Force Base in California. Edwards AFB is where all the X-15 flights originated between 1959 and 1968.

NASA and USAF documents do not always agree on flight specifics. Since NASA was the lead organization for the X-15 program and was responsible for disseminating all data gained from that research, their records must be given priority when it comes to the X-15 itself. The B-52 carrier aircraft was on loan from the USAF and, with a few exceptions, was flown by USAF pilots. For this reason, USAF records are considered the primary source of information concerning the B-52.

Information surfaced after the first printing of this flight log that raised questions about some of the data contained herein. A new set of records appeared that contradicted many numbers from this log, primarily with concern to the X-15 launch and landing times and the B-52 takeoff and landing times. The records in question have never been made available to researchers for validation, but further work was undertaken to see if these new data could be independently verified through other sources and thus a decision made to be included in this and future revisions of the flight log.

For the X-15 data: A set of graphs was located which were created at the time of each X-15 flight using the raw data recorded by instruments on board the X-15. This information was entered into a computer plotter and the results then output to these graphs. Prior to viewing these graphs, I was told that they are considered the most accurate information on X-15 flights available. After looking at over 300 graphs that covered 144 out of the 199 X-15 flights (graphs from all flights are not available), my conclusion was that some of the original flight records were in error. Those errors have been corrected in this flight log. However, the data that surfaced to instigate this new research was also found to be in error even more often than the original data. With that basis I have stayed with the official Armstrong Flight Research Center records except where directly contradicted by the flight data graphs.

For the B-52 data: In order to verify the B-52 takeoff and landing times I turned to the pilot who flew most of the B-52 sorties during the X-15 program, Fitz Fulton. He kindly went back through his pilot flight hour logs and was able to verify that the original numbers I had obtained through the USAF were very accurate. No independent confirmation of the contradictory data has been found, so the original numbers from the historical record have been retained.

In conclusion: There are many contradictory sets of research numbers connected to the X-15 program. I believe that my research has uncovered the most accurate and verifiable data to date and these data have been incorporated into this flight log. If new records come to light and can be properly scrutinized and verified, then this flight log will be updated accordingly.
2. X-15 Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>56' 1.5&quot; With nose boom and XLR-11 rocket engine</td>
</tr>
<tr>
<td></td>
<td>55' 2.5&quot; With nose boom and XLR-99 rocket engine</td>
</tr>
<tr>
<td></td>
<td>50' 1&quot; With Q-Ball nose and XLR-11 rocket engine</td>
</tr>
<tr>
<td></td>
<td>49' 2&quot; With Q-Ball nose and XLR-99 rocket engine</td>
</tr>
<tr>
<td>Span</td>
<td>22' 4&quot; Standard aircraft</td>
</tr>
<tr>
<td></td>
<td>23' 8&quot; With wing tip pods</td>
</tr>
<tr>
<td>Height</td>
<td>13' 1&quot; Standard aircraft</td>
</tr>
<tr>
<td></td>
<td>11' 6&quot; Without lower ventral fin and with landing gear extended</td>
</tr>
<tr>
<td>Launch Weight</td>
<td>33,500 lbs Standard aircraft</td>
</tr>
<tr>
<td>Burn Out Weight</td>
<td>14,500 lbs Standard aircraft</td>
</tr>
<tr>
<td>Landing Weight</td>
<td>13,800 lbs Standard aircraft</td>
</tr>
</tbody>
</table>
### X-15A-2 Dimensions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>51’ 11”</td>
<td>Modified 66671 aircraft</td>
</tr>
<tr>
<td><strong>Span</strong></td>
<td>22’ 4”</td>
<td>Standard aircraft</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>13’ 1”</td>
<td>Modified 66671 without lower ventral fin and with landing gear extended</td>
</tr>
<tr>
<td><strong>Launch Weight</strong></td>
<td>35,250 lbs</td>
<td>Modified 66671 without external fuel tanks</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>51,600 lbs</td>
<td>Modified 66671 with external fuel tanks</td>
</tr>
<tr>
<td><strong>Burn Out Weight</strong></td>
<td>16,200 lbs</td>
<td>Modified 66671 without external fuel tanks</td>
</tr>
<tr>
<td><strong>Landing Weight</strong></td>
<td>15,500 lbs</td>
<td>Modified 66671 without external fuel tanks - tanks jettisoned</td>
</tr>
</tbody>
</table>

External Fuel Tanks for the modified 66671 aircraft were 22’ long and 37.75” in diameter.

The **Liquid Oxygen** tank weighed 7,919 lbs full and the **Anhydrous Ammonia** tank weighed 6,074 lbs full.
3. X-15 Flight Test Program

A. THE HIGH RANGE

The High Range consisted of a 400-mile-long flight corridor starting at Wendover, Utah, and stretching southwest to Edwards Air Force Base California’s Mojave Desert. Along the corridor were two tracking stations located at Ely and Beatty, Nevada. Along this track were numerous dry lake beds that were used as launch reference points, as well as emergency landing sites if the X-15 did not have enough energy to glide back to the primary landing site of Rogers Dry Lake at Edwards AFB.

B. POWER FOR THE X-15

The X-15 was to be powered by the XLR99-RM-1 (later YLR-99) rocket engine. This single-chamber rocket built by Reaction Motors, Inc., provided 60,000 pounds of thrust and was able to be throttled from 30% to 100% of rated thrust. Development problems caused delays in the delivery of the LR-99, so an interim rocket engine, the XLR11-RM-13, was installed for the beginning of the flight test program. The LR-11 was a 4-chamber rocket and was the same type used for nearly all the rocket-powered X-planes up to that time. (An LR-11 was the rocket engine that powered the X-1 when it broke the sound barrier in 1947.) To provide enough thrust for the X-15, two LR-11 rockets were mounted one on top of the other, giving a total of eight chambers and nearly 16,000 pounds of thrust. Once the LR-99 finally made it through research and development, it was installed in the X-15 where it proved to be reliable, with more than enough power to push the X-15 to its design limits and beyond.

C. X-15 PROGRAM SUMMARY

On 15 October 1958, the first of three X-15s, was unveiled to the public at the North American Aviation plant in Los Angeles, California. It was black, stubby-winged, and wedge-tailed. It was the next logical step in a long line of research aircraft which had methodically pushed back the edge of the unknown. At the time of its roll-out, the altitude record was just slightly above 100,000 feet. The speed record had touched Mach 3, but had destroyed the aircraft and killed the pilot. The X-15 had been designed to stretch this envelope significantly to Mach 6 and 250,000 feet.

One unusual aspect of the experimental rocket planes in general, and the X-15 in particular, was the method of launch. To conserve fuel, it was decided to carry these craft up to altitude in the bomb bay of a “mother” airplane, where they would then be launched. The X-15 was too large even for this, so the carry point was moved from the bomb bay to a pylon slung under the wing of a specially-modified Boeing B-52 bomber. Nested securely between the B-52 fuselage and the first set of jet engines on the right wing, the X-15 rode to above 40,000 feet, where it was dropped from its shackles. Immediately after drop the pilot lit the rocket engine and the X-15 sprinted away on its mission, quickly outpacing even the fastest after-burning chase aircraft.

After launch, the pilot pulled back on the stick and headed up toward space. At burnout, the craft plunged onward and upward on a ballistic arc, often to well above the original design limit of 250,000 feet. At this altitude, conventional control surfaces such as flaps and rudders were completely useless, so the pilot had to rely on the small rocket nozzles of the Ballistic Control System (later known as the Reaction Control System) in the nose and wing-tips to keep the X-15 in the proper attitude for re-entry.

While above the atmosphere and in zero-g, many experiments could be carried out that would have been impossible under the blanket of air. For the last half of the program’s nine year lifetime, the X-15 served as an experiment carrier instead of solely as the aerospace research vehicle for which it had been designed. A wide diversity of experiments were carried, including ultraviolet stellar photography, horizon sensing and star tracking, Apollo-Saturn insulation tests, and micrometeorite collection, among many others.

Twelve men flew the X-15, from Scott Crossfield, who had been the first man to fly twice the speed of sound in the Douglas D-558, Phase 2, Skyrocket; to Neil Armstrong, who was the first man to take a “small step” onto the lunar surface on 20 July 1969. The only US Navy pilot to fly in the program, Forrest Petersen, later went on to further his career by becoming the commanding officer of the aircraft carrier U.S.S. Enterprise. Joe Engle earned his astronaut wings on the X-15 before commanding a different
Enterprise, the first Space Shuttle, which he flew on several atmospheric test flights released from the back of a 747 Shuttle Carrier Aircraft in 1977. He finally flew into space again on the Space Shuttle Columbia in November 1981, and also on Discovery in August 1985. Joe Walker, one of America’s best test pilots, lost his life in the tragic crash of the North American Aviation XB-70A Valkyrie when his Lockheed F-104 Starfighter collided with the huge triplesonic bomber in 1966. His X-15 altitude record of 354,200 feet (67.1 miles) in August 1963 was finally exceeded in October 2004 by Brian Binnie in a flight by SpaceShipOne. A speed record of Mach 6.70 (4,520 mph) was set by Pete Knight, who later became the mayor of Palmdale, California and went on to serve in the California State Assembly.

All test programs of this nature have problems and accidents. Some are minor bumps in the flight envelope, while others may lead to the loss of a valuable aircraft and an irreplaceable pilot. With the right team in place and the proper set of circumstances, an accident that seemed catastrophic may be turned into a true asset. This was certainly the case in the X-15 program. On 9 November 1962, John McKay had an in-flight emergency when the rocket engine would not give the required thrust. This demanded an immediate landing on a hard-packed dry lakebed 200 miles away from his intended goal of Edwards AFB. A chain of malfunctions caught up with him on landing and the aircraft crashed. McKay suffered several compressed vertebrae from the weight of the X-15 literally lying on his neck, since he jettisoned the cockpit canopy as the aircraft rolled over. However, he was able to resume research flying only five months later. Unlike the pilot, the aircraft seemed a total loss. Undaunted by the accident, a proposal was made to rebuild and modify the aircraft to make it capable of research at even higher speed than when the X-15 had first been designed. This resulted in the aircraft into the advanced X-15A-2. With the addition of two external fuel tanks and an ablative coating to protect the Inconel-X skin of the aircraft, the speed range of up to Mach 8 was theoretically possible, but never achieved. This configuration was used when Pete Knight flew Mach 6.70 on 3 October, 1967. After the flight, the insulation was found to need such extensive refurbishment that it would have taken longer to accomplish than the original installation. This, coupled with several other factors, grounded the X-15A-2 for good.

Just three flights later, on 15 November 1967, the program suffered its only loss of life when Michael Adams was killed during the reentry of X-15 no. 3. On this flight, his first that would have qualified him for astronaut wings, Adams became disoriented at high altitude and misread an instrument that could be set to register different functions. When aligning the X-15 for reentry, the aircraft ended up pointed the wrong direction, which sent the craft into a deadly spin, where it broke apart and crashed onto the desert floor.

This left X-15 no. 1 as the sole flying hypersonic aircraft. It continued performing flight experiments for another year before the whole program was finally brought to a close in December 1968 after 199 flights. The 200th flight was attempted but never succeeded due to technical problems in the air and, on the very last attempt, a freak snowstorm at Edwards shut down all flight operations.

Several years later, North American Aviation changed its name to North American Rockwell, and finally Rockwell International. They entered the competition for the design and construction of the world’s first reusable Earth-orbiting space vehicle. They already had extensive experience with a vehicle that routinely flew into, and back from, space: the X-15. The old concepts were dusted off, especially those concerning the advanced X-15A-2 with its jettisonable external fuel tanks. They scaled everything up until they had their winning Space Shuttle design.

Without the basic research supplied by the X-15, the Space Shuttle would have taken longer to get into orbit, and the cost could have been considerably higher. If not for the sidetracking into expendable launch vehicles to play catch-up with the Soviet Union (which forced an overshadowing of the X-15 and the cancellation of its orbital follow-on, the X-20 Dyna-Soar) we probably would have had a shuttle-type vehicle a lot sooner.

For more details on the X-15 and the men who flew this magnificent vehicle, along with the stories of many on the ground who made it all possible, please be sure to read

“The X-15 Rocket Plane: Flying the First Wings Into Space.”
D. AIRCRAFT DISPOSITION

X-15: 66670 — Original aircraft is at the National Air and Space Museum in Washington, D.C.
66671 — Original aircraft is at the National Museum of the US Air Force, Dayton, OH.
66672 — Original aircraft crashed on 15 November 1967 near Johannesburg, CA.
Mockups — Full-scale mockup of X-15 no. 2 is located at Pima Air & Space Museum in Tucson, AZ. Mockups of X-15 no. 3 are at the Armstrong Flight Research Center at Edwards AFB, and at Evergreen Aviation & Space Museum in McMinnville, OR. There is currently no mockup of 66670.

B-52: 003 — Original aircraft is at the Pima Air & Space Museum in Tucson, AZ.
008 — Original aircraft is at the North Gate of Edwards AFB, CA.

E. FLIGHT DESIGNATION MARKINGS

Each time the X-15 was taken aloft, the B-52 mothership that carried it had a small stencil painted on the right forward fuselage to designate the status of the flight. These stencils can still be seen on B-52 No. 003 on display at the Pima Air & Space Museum in Tucson, AZ. The original stencils on B-52 no. 008 have been removed and replaced with a general stencil to make room for stencils for later programs.

F. GENERAL INFORMATION

All X-15 pilots experienced their first flight in X-15 no. 1.
All X-15 aircraft were launched for the first time from B-52 no. 003.
The highest number of launches in a single month was seven in August 1966.
The highest number of aborted launches in a single month was five in July 1965.
The highest number of scheduled captive flights was two in November 1964 and in February 1965.
Walker, White, and Engle never had to make an X-15 emergency landing.
McKay had the highest number of emergency landings with three.
The most emergency landings in a single year was four in 1966.
Nearly one-third of all flights were launched on a Thursday.
4. Program Summary

A. AIRCRAFT FLIGHT SUMMARY  (Number in parentheses refers to X-15A-2 and is included in 66671)

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Launch</th>
<th>Abort</th>
<th>Captive</th>
<th>Airborne</th>
<th>Launch %</th>
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<tr>
<td>66670</td>
<td>081</td>
<td>059</td>
<td>002</td>
<td>142</td>
<td>57.0</td>
</tr>
<tr>
<td>66671</td>
<td>053</td>
<td>035</td>
<td>009</td>
<td>097</td>
<td>54.6</td>
</tr>
<tr>
<td>(66671A)</td>
<td>(022)</td>
<td>(015)</td>
<td>(008)</td>
<td>(045)</td>
<td>(48.9)</td>
</tr>
<tr>
<td>66672</td>
<td>065</td>
<td>031</td>
<td>001</td>
<td>097</td>
<td>67.0</td>
</tr>
<tr>
<td>Total</td>
<td>199</td>
<td>125</td>
<td>012</td>
<td>336</td>
<td>59.2</td>
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B. ORGANIZATION FLIGHT SUMMARY

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<tr>
<th>Organization</th>
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<th>Launch %</th>
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</thead>
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<tr>
<td>NAA</td>
<td>014</td>
<td>014</td>
<td>002</td>
<td>030</td>
<td>46.7</td>
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<tr>
<td>USN</td>
<td>005</td>
<td>002</td>
<td>000</td>
<td>007</td>
<td>71.4</td>
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<tr>
<td>USAF</td>
<td>089</td>
<td>052</td>
<td>006</td>
<td>147</td>
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<td>NASA</td>
<td>091</td>
<td>057</td>
<td>004</td>
<td>152</td>
<td>59.9</td>
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</table>

C. PILOT FLIGHT SUMMARY  (Number in parentheses refers to the flight sequence 001 through 199)

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Org.</th>
<th>Flights</th>
<th>First Flight</th>
<th>Last Flight</th>
<th>High Mach</th>
<th>High Altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Scott Crossfield</td>
<td>NAA</td>
<td>14</td>
<td>8 Jun. 59 (001)</td>
<td>6 Dec. 60 (030)</td>
<td>2.97 (026)</td>
<td>88,116 (006)</td>
</tr>
<tr>
<td>Joseph A. Walker</td>
<td>NASA</td>
<td>25</td>
<td>25 Mar. 60 (009)</td>
<td>22 Aug. 63 (091)</td>
<td>5.92 (059)</td>
<td>354,200 (091)</td>
</tr>
<tr>
<td>Robert M. White</td>
<td>USAF</td>
<td>16</td>
<td>13 Apr. 60 (012)</td>
<td>14 Dec. 62 (075)</td>
<td>6.04 (045)</td>
<td>314,750 (062)</td>
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<tr>
<td>Forrest S. Petersen</td>
<td>USN</td>
<td>05</td>
<td>23 Sep. 60 (022)</td>
<td>10 Jan. 62 (047)</td>
<td>5.30 (041)</td>
<td>101,800 (041)</td>
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<tr>
<td>John B. McKay</td>
<td>NASA</td>
<td>29</td>
<td>28 Oct. 60 (024)</td>
<td>8 Sep. 66 (071)</td>
<td>5.65 (115)</td>
<td>295,600 (150)</td>
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<tr>
<td>Robert A. Rushworth</td>
<td>USAF</td>
<td>34</td>
<td>4 Nov. 60 (025)</td>
<td>1 Jul. 66 (159)</td>
<td>6.06 (097)</td>
<td>285,000 (087)</td>
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<tr>
<td>Neil A. Armstrong</td>
<td>NASA</td>
<td>07</td>
<td>30 Nov. 60 (029)</td>
<td>26 Jul. 62 (064)</td>
<td>5.74 (064)</td>
<td>207,500 (051)</td>
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<tr>
<td>Joe H. Engle</td>
<td>USAF</td>
<td>16</td>
<td>7 Oct. 63 (092)</td>
<td>14 Oct. 65 (153)</td>
<td>5.71 (126)</td>
<td>280,600 (138)</td>
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<tr>
<td>Milton O. Thompson</td>
<td>NASA</td>
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<td>29 Oct. 63 (093)</td>
<td>25 Aug. 65 (144)</td>
<td>5.48 (125)</td>
<td>214,100 (144)</td>
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<tr>
<td>William J. Knight</td>
<td>USAF</td>
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<td>30 Sep. 65 (151)</td>
<td>13 Sep. 68 (198)</td>
<td>6.70 (188)</td>
<td>280,500 (190)</td>
</tr>
<tr>
<td>William H. Dana</td>
<td>NASA</td>
<td>16</td>
<td>4 Nov. 65 (156)</td>
<td>24 Oct. 68 (199)</td>
<td>5.53 (189)</td>
<td>306,900 (174)</td>
</tr>
<tr>
<td>Michael J. Adams</td>
<td>USAF</td>
<td>07</td>
<td>6 Oct. 66 (173)</td>
<td>15 Nov. 67 (191)</td>
<td>5.59 (177)</td>
<td>266,000 (191)</td>
</tr>
</tbody>
</table>

D. SPEED AND ALTITUDE SUMMARY

<table>
<thead>
<tr>
<th>Mach Number</th>
<th>0-.99</th>
<th>1-1.99</th>
<th>2-2.99</th>
<th>3-3.99</th>
<th>4-4.99</th>
<th>5-5.99</th>
<th>6-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>002</td>
<td>014</td>
<td>020</td>
<td>008</td>
<td>045</td>
<td>106</td>
<td>004</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Altitude (thousands of feet)</th>
<th>0-99.999</th>
<th>100-199.999</th>
<th>200-249.999</th>
<th>250-299.999</th>
<th>300-349.999</th>
<th>350-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>097</td>
<td>060</td>
<td>023</td>
<td>015</td>
<td>003</td>
<td>001</td>
</tr>
</tbody>
</table>

E. B-52 FLIGHT SUMMARY  (Number in parentheses refers to X-15A-2 and is included in 66671)

<table>
<thead>
<tr>
<th>NB-52A Tail Number 52-003</th>
<th>NB-52B Tail Number 52-008</th>
</tr>
</thead>
<tbody>
<tr>
<td>66670</td>
<td>66670</td>
</tr>
<tr>
<td>66671</td>
<td>66671</td>
</tr>
<tr>
<td>(66671A)</td>
<td>(66671A)</td>
</tr>
<tr>
<td>66672</td>
<td>66672</td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
</tr>
</tbody>
</table>
F. AIRCRAFT RECORDS
(* signifies record for X-15 program)

(** Mach number varies with altitude/air density so a higher Mach may be a lower mph)

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Status</th>
<th>Flight</th>
<th>Date</th>
<th>Pilot</th>
<th>Org.</th>
<th>Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>66670</td>
<td>Fastest</td>
<td>097</td>
<td>5 Dec. 63</td>
<td>Rushworth</td>
<td>USAF</td>
<td>Mach 6.06</td>
</tr>
<tr>
<td></td>
<td>Highest</td>
<td>197</td>
<td>21 Aug. 68</td>
<td>Dana</td>
<td>NASA</td>
<td>267,500 feet</td>
</tr>
<tr>
<td></td>
<td>Farthest*</td>
<td>198</td>
<td>13 Sep. 68</td>
<td>Knight</td>
<td>USAF</td>
<td>299.8 nautical miles</td>
</tr>
<tr>
<td></td>
<td>Longest</td>
<td>199</td>
<td>24 Oct. 68</td>
<td>Dana</td>
<td>NASA</td>
<td>688.3 seconds</td>
</tr>
<tr>
<td>66671</td>
<td>Fastest*</td>
<td>188</td>
<td>3 Oct. 67</td>
<td>Knight</td>
<td>USAF</td>
<td>Mach 6.70</td>
</tr>
<tr>
<td></td>
<td>Highest</td>
<td>164</td>
<td>3 Aug. 66</td>
<td>Knight</td>
<td>USAF</td>
<td>249,000 feet</td>
</tr>
<tr>
<td></td>
<td>Farthest</td>
<td>141</td>
<td>3 Aug. 65</td>
<td>Rushworth</td>
<td>USAF</td>
<td>249.2 nautical miles</td>
</tr>
<tr>
<td></td>
<td>Longest</td>
<td>037</td>
<td>25 May 61</td>
<td>Walker</td>
<td>NASA</td>
<td>728.1 seconds</td>
</tr>
<tr>
<td>66672</td>
<td>Fastest</td>
<td>076</td>
<td>20 Dec. 62</td>
<td>Walker</td>
<td>NASA</td>
<td>Mach 5.73/3793 mph**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>126</td>
<td>2 Feb. 65</td>
<td>Engle</td>
<td>USAF</td>
<td>Mach 5.71/3886 mph**</td>
</tr>
<tr>
<td></td>
<td>Highest*</td>
<td>091</td>
<td>22 Aug 63</td>
<td>Walker</td>
<td>NASA</td>
<td>354,200 feet</td>
</tr>
<tr>
<td></td>
<td>Farthest*</td>
<td>189</td>
<td>4 Oct. 67</td>
<td>Dana</td>
<td>NASA</td>
<td>299.8 nautical miles</td>
</tr>
<tr>
<td></td>
<td>Longest*</td>
<td>051</td>
<td>20 Apr. 62</td>
<td>Armstrong</td>
<td>NASA</td>
<td>748.7 seconds</td>
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</tbody>
</table>

G. ASTRONAUT QUALIFICATION FLIGHTS
(above 50 miles or 264,000 feet)

<table>
<thead>
<tr>
<th>Flight</th>
<th>Date</th>
<th>Pilot</th>
<th>Org.</th>
<th>Mach</th>
<th>Altitude</th>
<th>Pilot</th>
<th>Flights</th>
</tr>
</thead>
<tbody>
<tr>
<td>062</td>
<td>17 Jul. 62</td>
<td>White</td>
<td>USAF</td>
<td>5.45</td>
<td>314,750</td>
<td>Walker</td>
<td>3</td>
</tr>
<tr>
<td>077</td>
<td>17 Jan. 63</td>
<td>Walker</td>
<td>NASA</td>
<td>5.47</td>
<td>271,700</td>
<td>White</td>
<td>1</td>
</tr>
<tr>
<td>087</td>
<td>27 Jun. 63</td>
<td>Rushworth</td>
<td>USAF</td>
<td>4.89</td>
<td>285,000</td>
<td>McKay</td>
<td>1</td>
</tr>
<tr>
<td>090</td>
<td>19 Jul. 63</td>
<td>Walker</td>
<td>NASA</td>
<td>5.50</td>
<td>347,800</td>
<td>Rushworth</td>
<td>1</td>
</tr>
<tr>
<td>091</td>
<td>22 Aug. 63</td>
<td>Walker</td>
<td>NASA</td>
<td>5.58</td>
<td>354,200</td>
<td>Engle</td>
<td>3</td>
</tr>
<tr>
<td>138</td>
<td>29 Jun. 65</td>
<td>Engle</td>
<td>USAF</td>
<td>4.94</td>
<td>280,600</td>
<td>Knight</td>
<td>1</td>
</tr>
<tr>
<td>143</td>
<td>10 Aug. 65</td>
<td>Engle</td>
<td>USAF</td>
<td>5.20</td>
<td>271,000</td>
<td>Dana</td>
<td>2</td>
</tr>
<tr>
<td>150</td>
<td>28 Sep. 65</td>
<td>McKay</td>
<td>NASA</td>
<td>5.33</td>
<td>295,600</td>
<td>Adams</td>
<td>1</td>
</tr>
<tr>
<td>153</td>
<td>14 Oct. 65</td>
<td>Engle</td>
<td>USAF</td>
<td>5.08</td>
<td>266,500</td>
<td>Organization</td>
<td>USAF</td>
</tr>
<tr>
<td>174</td>
<td>1 Nov. 66</td>
<td>Dana</td>
<td>NASA</td>
<td>5.46</td>
<td>306,900</td>
<td>NASA</td>
<td>6</td>
</tr>
<tr>
<td>190</td>
<td>17 Oct. 67</td>
<td>Knight</td>
<td>USAF</td>
<td>5.53</td>
<td>280,500</td>
<td>Tail Numbers</td>
<td>1</td>
</tr>
<tr>
<td>191</td>
<td>15 Nov. 67</td>
<td>Adams</td>
<td>USAF</td>
<td>5.20</td>
<td>266,000</td>
<td>66670</td>
<td>2</td>
</tr>
<tr>
<td>197</td>
<td>21 Aug. 68</td>
<td>Dana</td>
<td>NASA</td>
<td>5.01</td>
<td>267,500</td>
<td>66672</td>
<td>11</td>
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Total Astronaut Qualification Flights: 13

H. IN-FLIGHT EMERGENCIES

<table>
<thead>
<tr>
<th>Flight</th>
<th>Date</th>
<th>Pilot</th>
<th>Org.</th>
<th>Lake</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>004</td>
<td>5 Nov. 59</td>
<td>Crossfield</td>
<td>NAA</td>
<td>Rosamond</td>
<td>Engine fire and explosion</td>
</tr>
<tr>
<td>047</td>
<td>10 Jan. 62</td>
<td>Petersen</td>
<td>USN</td>
<td>Mud</td>
<td>Engine failed to start</td>
</tr>
<tr>
<td>051</td>
<td>20 Apr. 62</td>
<td>Armstrong</td>
<td>NASA</td>
<td>Rogers</td>
<td>Overshot altitude and landing</td>
</tr>
<tr>
<td>074</td>
<td>9 Nov. 62</td>
<td>McKay</td>
<td>NASA</td>
<td>Mud</td>
<td>Engine would only go to 30% thrust</td>
</tr>
<tr>
<td>108</td>
<td>21 May 64</td>
<td>Thompson</td>
<td>NASA</td>
<td>Cuddeback</td>
<td>Engine shutdown at 41 seconds</td>
</tr>
<tr>
<td>157</td>
<td>6 May 66</td>
<td>McKay</td>
<td>NASA</td>
<td>Delamar</td>
<td>Engine shutdown at 35 seconds</td>
</tr>
<tr>
<td>159</td>
<td>1 Jul. 66</td>
<td>Rushworth</td>
<td>USAF</td>
<td>Mud</td>
<td>No external fuel tank flow indication</td>
</tr>
<tr>
<td>171</td>
<td>8 Sep. 66</td>
<td>McKay</td>
<td>NASA</td>
<td>Smith Ranch</td>
<td>Low fuel line pressure</td>
</tr>
<tr>
<td>173</td>
<td>6 Oct. 66</td>
<td>Adams</td>
<td>USAF</td>
<td>Cuddeback</td>
<td>Fuel tank bulkhead ruptured</td>
</tr>
<tr>
<td>178</td>
<td>26 Apr. 67</td>
<td>Dana</td>
<td>NASA</td>
<td>Silver</td>
<td>Low fuel line pressure</td>
</tr>
<tr>
<td>184</td>
<td>29 Jun. 67</td>
<td>Knight</td>
<td>USAF</td>
<td>Mud</td>
<td>Electrical failure</td>
</tr>
<tr>
<td>191</td>
<td>15 Nov. 67</td>
<td>Adams</td>
<td>USAF</td>
<td>Randsburg</td>
<td>Fatal crash due to spin</td>
</tr>
</tbody>
</table>

I. LAUNCH LAKE DATA
(Number of flights launched from each dry lake area)

<table>
<thead>
<tr>
<th>Lake</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuddeback</td>
<td>01</td>
</tr>
<tr>
<td>Railroad</td>
<td>02</td>
</tr>
<tr>
<td>Delamar</td>
<td>62</td>
</tr>
<tr>
<td>Rogers [local]</td>
<td>26</td>
</tr>
<tr>
<td>Hidden Hills</td>
<td>50</td>
</tr>
<tr>
<td>Silver</td>
<td>14</td>
</tr>
<tr>
<td>Mud</td>
<td>34</td>
</tr>
<tr>
<td>Smith Ranch</td>
<td>10</td>
</tr>
</tbody>
</table>
J. **B-52 PILOT DATA** (in alphabetical order)

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Flights</th>
<th>Co-Pilot</th>
<th>Flights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sq. Ldr. Harry M. Archer</td>
<td>02</td>
<td>Col. Harry Andonian</td>
<td>07</td>
</tr>
<tr>
<td>Cap./Maj. Charles C. Bock, Jr.</td>
<td>15</td>
<td>Maj. Russell P. Bement</td>
<td>19</td>
</tr>
<tr>
<td>Maj. Jerry D. Bowline</td>
<td>01</td>
<td>Cap./Maj. Charles C. Bock, Jr.</td>
<td>11</td>
</tr>
<tr>
<td>Maj. Frank E. Cole</td>
<td>01</td>
<td>Maj. Jerry D. Bowline</td>
<td>11</td>
</tr>
<tr>
<td>Maj. Charles J. Doryland</td>
<td>11</td>
<td>Cap. John K. Campbell</td>
<td>01</td>
</tr>
<tr>
<td>Maj./Lt. Col. Fitzhugh “Fitz” L. Fulton, Jr.</td>
<td>69</td>
<td>Maj. Frank E. Cole</td>
<td>06</td>
</tr>
<tr>
<td>Col. Gay E. Jones</td>
<td>03</td>
<td>Col. Joseph P. Cotton</td>
<td>12</td>
</tr>
<tr>
<td>Cap. Charles F. G. Kuyk, Jr.</td>
<td>03</td>
<td>Sq. Ldr. David Cretney</td>
<td>01</td>
</tr>
<tr>
<td>Maj./Lt. Col. William G. Reschke, Jr.</td>
<td>03</td>
<td>Cap. Albert H. Crews, Jr.</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maj. Charles J. Doryland</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maj./Lt. Col. Fitzhugh “Fitz” L. Fulton, Jr.</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col. Gay E. Jones</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cap. Charles F. G. Kuyk, Jr.</td>
<td>05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maj./Col. Kenneth K. Lewis, Jr.</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sq. Ldr. John Miller</td>
<td>04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cap. Robert L. Mosley</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maj./Lt. Col. William G. Reschke, Jr.</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cap. Floyd B. Stroup</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lt. Col. Emil T. “Ted” Sturmthal</td>
<td>05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Col. Guy M. Townsend</td>
<td>03</td>
</tr>
</tbody>
</table>

NOTE: All B-52 pilots and co-pilots were USAF with four exceptions: Fitz Fulton retired from the USAF and was then hired by NASA. He continued to fly the B-52 on X-15 missions after becoming a NASA pilot. Squadron Leaders Harry Archer, David Cretney, and John Miller were Royal Air Force pilots.

K. **CHASE PILOT DATA** (in alphabetical order)

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Org.</th>
<th>F-100</th>
<th>F-104</th>
<th>T-38</th>
<th>F-5D</th>
<th>F-4H</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maj. Michael J. Adams</td>
<td>USAF</td>
<td>01</td>
<td>08</td>
<td>04</td>
<td>00</td>
<td>00</td>
<td>13</td>
</tr>
<tr>
<td>Neil A. Armstrong</td>
<td>NASA</td>
<td>00</td>
<td>06</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>06</td>
</tr>
<tr>
<td>Robert “Bob” Baker</td>
<td>NAA</td>
<td>02</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>02</td>
</tr>
<tr>
<td>Maj. Michael Collins</td>
<td>USAF</td>
<td>00</td>
<td>07</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>07</td>
</tr>
<tr>
<td>Cap. Albert H. Crews, Jr.</td>
<td>USAF</td>
<td>01</td>
<td>05</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>06</td>
</tr>
<tr>
<td>A. Scott Crossfield</td>
<td>NAA</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
</tr>
<tr>
<td>Cap. Lawrence C. Curtis, Jr.</td>
<td>USAF</td>
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<td>02</td>
<td>10</td>
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<td>00</td>
<td>12</td>
</tr>
<tr>
<td>Maj./Lt. Col. Fred J. Cuthill</td>
<td>USAF</td>
<td>00</td>
<td>03</td>
<td>09</td>
<td>00</td>
<td>00</td>
<td>12</td>
</tr>
<tr>
<td>William H. Dana</td>
<td>NASA</td>
<td>00</td>
<td>45</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>45</td>
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<tr>
<td>Maj. Walter F. Daniel</td>
<td>USAF</td>
<td>15</td>
<td>18</td>
<td>04</td>
<td>00</td>
<td>00</td>
<td>37</td>
</tr>
<tr>
<td>Cap./Maj. Thomas J. Davey, Jr.</td>
<td>USAF</td>
<td>00</td>
<td>03</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>03</td>
</tr>
<tr>
<td>Einar Enevoldson</td>
<td>NASA</td>
<td>00</td>
<td>01</td>
<td>00</td>
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<td>00</td>
<td>01</td>
</tr>
<tr>
<td>Cap. Joe H. Engle</td>
<td>USAF</td>
<td>00</td>
<td>24</td>
<td>04</td>
<td>00</td>
<td>00</td>
<td>28</td>
</tr>
<tr>
<td>Cap./Maj. Mervin L. Evenson</td>
<td>USAF</td>
<td>00</td>
<td>13</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>13</td>
</tr>
<tr>
<td>Fitzhugh “Fitz” L. Fulton, Jr.</td>
<td>NASA</td>
<td>00</td>
<td>03</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>03</td>
</tr>
<tr>
<td>Cap./Maj. Jerald R. Gentry</td>
<td>USAF</td>
<td>00</td>
<td>26</td>
<td>05</td>
<td>00</td>
<td>00</td>
<td>31</td>
</tr>
<tr>
<td>Maj. Henry C. Gordon</td>
<td>USAF</td>
<td>01</td>
<td>09</td>
<td>06</td>
<td>00</td>
<td>00</td>
<td>16</td>
</tr>
<tr>
<td>Frederick W. Haise, Jr.</td>
<td>NASA</td>
<td>00</td>
<td>07</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>07</td>
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<tr>
<td>Cap. Peter C. Hoag</td>
<td>USAF</td>
<td>00</td>
<td>06</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>06</td>
</tr>
<tr>
<td>Cap. Robert C. Hover</td>
<td>USAF</td>
<td>00</td>
<td>02</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>02</td>
</tr>
<tr>
<td>Hugh M. Jackson</td>
<td>NASA</td>
<td>00</td>
<td>06</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>06</td>
</tr>
<tr>
<td>Cap./Maj. William J. “Pete” Knight</td>
<td>USAF</td>
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**Summary (by aircraft)**

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**Summary (by organization)**

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**Summary (pilots)**

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**Total Chase Sorties** 741 **Total Chase Pilots** 48

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L. **LAUNCH PANEL OPERATORS** (in alphabetical order)

All Launch Panel Operators were NASA personnel. They were crew members on the B-52 that oversaw the launch of the X-15. Their station was located on the interior right side of the B-52 with a blister window so the LPO could physically observe the X-15 prior to launch if required.

William “Bill” Berkowitz
Stanley P. Butchart
Allen F. Dustin
John W. “Jack” Moise
Bruce A. Peterson
John “Jack” Russell
5. **X-15 Program Patches**

During my early interviews I asked each person if there was a patch created for the X-15. No one recalled seeing one. This led to my design of the X-15 program patch (B). Later, two other patches surfaced. One is from pilot Joe Engle (A), which is a prototype that never went into production. Ralph Richardson, who worked on the X-15 pressure suits, had a patch that he got during the program, and still had one on a flight jacket (C).

A. **X-15 PILOT PATCH PROTOTYPE** (right)

The exact origin and designer of this patch is unknown. The black X-15 silhouette is on top of a silver triangle which was made from the same material as the outer layer of the pressure suit. The border of the patch is red.

B. **X-15 PROGRAM PATCH** (left)

This was designed by the author prior to the discovery of other program patches. The black X-15 is shown breaking through hypersonic shockwaves into a dark blue sky with three stars to represent the three primary participants in the X-15 research program: NASA, the US Air Force, and the US Navy. The shock waves alternate silver and red going inward, with the interior exhaust cone being orange and the exterior wedges being yellow. The border of the patch is gold.

C. **ALTERNATE X-15 PROGRAM PATCH** (right)

As with patch A, the origin of this patch is unknown. The black X-15 is rocketing above the blue and green Earth in a medium blue sky with a yellow Sun and five white stars. The border of the patch is red.
6. X-15 Flight Log

Flight/Pilot: 1-C-1/Crossfield  Date: Tue. 10 Mar. 1959
Remarks: Scheduled captive flight. SAS, B-52 power supply, and generator failures. Windshield frosted.

Flight/Pilot: 1-A-2/Crossfield  Date: Wed. 1 Apr. 1959

Flight/Pilot: 1-A-3/Crossfield  Date: Fri. 10 Apr. 1959
Remarks: Both APUs shut down. Upper panel of vertical stabilizer cracked. B-52 no. 003 right front gear failed to retract, but mission was allowed to proceed.

Flight/Pilot: 1-A-4/Crossfield  Date: Thu. 21 May 1959

Flight/Pilot: 1-1-5/A. Scott Crossfield  B-52/Pilots: 003/Bock & Allavie
Date: Mon. 8 Jun. 1959  Engine Run: 0.0  Takeoff: 08:00
Launch: 08:38:40.0 - Rosamond  Duration: 296.6  Landing: 09:10
Landing: 08:43:36.6 - Rogers  Altitude: 37,550  Duration: 1:10
Mach/mph: 0.79/522  Distance: 23.9  Chase: White/Wood/Roberts
Mission: 001—Scheduled glide flight to check aircraft systems. Only glide flight ever scheduled for the X-15. First free flight of program. Pitch damper failed prior to launch. PIO near landing due to inoperative pitch damper. Shortest flight of program.

Flight/Pilot: 2-C-1/Crossfield  Date: Fri. 24 Jul. 1959

Flight/Pilot: 2-A-2/Crossfield  Date: Fri. 4 Sep. 1959
Remarks: LOX tank pressure fluctuated due to vent leakage.

Flight/Pilot: 2-1-3/A. Scott Crossfield  B-52/Pilots: 003/Bock & Allavie
Date: Thu. 17 Sep. 1959  Engine Run: 224.3  Takeoff: 07:31
Launch: 08:08:48.0 - Rosamond  Duration: 551.0  Landing: 09:01
Landing: 08:17:59.0 - Rogers  Altitude: 52,341  Duration: 1:30
Mach/mph: 2.11/1393  Distance: 88.4  Chase: White/Walker/White

Flight/Pilot: 2-A-4/Crossfield  Date: Sat. 10 Oct. 1959


Flight/Pilot: 2-2-6/A. Scott Crossfield  B-52/Pilots: 003/Allavie & Bock
Date: Sat. 17 Oct. 1959  Engine Run: 254.5  Takeoff: 09:25
Launch: 10:13:07.0 - Rosamond  Duration: 577.7  Landing: 10:55
Landing: 10:22:44.7 - Rogers  Altitude: 61,781  Duration: 1:30
Mach/mph: 2.15/1419  Distance: 92.4  Chase: White/Walker/White
Mission: 003—Roll damper failed at launch but was reengaged. Nose gear door failed on landing. Minor fire in hydrogen peroxide compartment, engine compartment, and lower ventral at landing.
### Flight/Pilot: 2-A-7/Crossfield  
**Date:** Thu. 22 Oct. 1959  
**Remarks:** Pilot’s oxygen system failed. Windshield frosted over.

### Flight/Pilot: 2-A-8/Crossfield  
**Date:** Sat. 31 Oct. 1959  
**Remarks:** Weather abort.

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<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Duration</th>
<th>Landing</th>
<th>Altitude</th>
<th>Duration</th>
<th>Mach/mph</th>
<th>Distance</th>
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<td>2-3-9/A. Scott Crossfield (4)</td>
<td>Thu. 5 Nov. 1959</td>
<td>13.9</td>
<td>09:00</td>
<td>09:39:28.0 - Rosamond</td>
<td>328.0</td>
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<td>2-4-11/A. Scott Crossfield (6)</td>
<td>Thu. 11 Feb. 1960</td>
<td>251.2</td>
<td>09:07</td>
<td>10:15:25.0 - Rosamond</td>
<td>615.5</td>
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<td>2-5-12/A. Scott Crossfield (7)</td>
<td>Thu. 17 Mar. 1960</td>
<td>309.4</td>
<td>08:54</td>
<td>09:41:32.0 - Rosamond</td>
<td>635.9</td>
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<td>Fri. 18 Mar. 1960</td>
<td>233.5</td>
<td>07:54</td>
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<td>52,640</td>
<td>1:00</td>
<td>2.15/1419</td>
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**Mission:** 004 — Roll damper dropped out at launch. Engine fire and explosion in bottom LR-11. Structural failure at instrument bay, just forward of LOX tank, and nose gear failed on landing due to design flaw and excessive propellant weight. First in-flight emergency after launch. First landing at location other than Rogers. Shortest flight for X-15 no. 2. Aircraft returned to NAA for modifications of fuselage and nose gear.

**Mission:** 005 — Telemetry problems caused late takeoff. First powered flight and first past Mach 2 for X-15 no. 1. First use of B-52 no. 008 for an X-15 launch.

**Mission:** 006 — Farthest flight and highest altitude attained by Crossfield in program. First use of B-52 no.008 for X-15 no. 2. First flight of this aircraft following structural failure on landing and subsequent rebuild (004). Nose gear bottomed out on landing.

**Mission:** 007 — Upper LR-11 engine shut down prematurely, but was able to be re-ignited.

**Mission:** 008 — Maneuverability investigation with dampers on and off. Did a 360-degree roll and a 6-g turn.

**Flight/Pilot:** 2-A-14/Crossfield  
**Date:** Fri. 18 Mar. 1960  
**Remarks:** Fuel leaked and windshield delaminated. Aborted one minute to launch.
### Flight/Pilot: 1-3-8/Joseph A. Walker (1)

- **Date:** Fri. 25 Mar. 1960
- **Launch:** 15:43:23.0 - Rosamond
- **Landing:** 15:52:31.0 - Rogers
- **Mach/mph:** 2.00/1320

### Flight/Pilot: 2-7-15/A. Scott Crossfield (9)

- **Date:** Tue. 29 Mar. 1960
- **Launch:** 09:59:28.0 - Rosamond
- **Landing:** 10:08:38.5 - Rogers
- **Mach/mph:** 1.96/1293
- **Mission:** 010 — Cold soak flight to simulate environmental conditions for a flight launched from Wendover, UT.

### Flight/Pilot: 2-8-16/A. Scott Crossfield (10)

- **Date:** Thu. 31 Mar. 1960
- **Launch:** 08:42:05.0 - Rosamond
- **Landing:** 08:51:01.5 - Rogers
- **Mach/mph:** 2.03/1340
- **Mission:** 011 — Nominal flight to check SAS gains and perform aircraft maneuverability checkout.

### Flight/Pilot: 1-4-9/Robert M. White (1)

- **Date:** Wed. 13 Apr. 1960
- **Launch:** 09:15:11.0 - Rosamond
- **Landing:** 09:24:03.7 - Rogers
- **Mach/mph:** 1.90/1254

### Flight/Pilot: 1-5-10/Joseph A. Walker (2)

- **Date:** Tue. 19 Apr. 1960
- **Launch:** 08:51:44.0 - Rosamond
- **Landing:** 09:01:42.6 - Rogers
- **Mach/mph:** 2.56/1689
- **Mission:** 013 — Hydraulic hose failed. No gear data taken. Performance build-up flight. One B-52 engine required shut down prior to X-15 launch. Walker discovered the rudder could be used after touchdown to steer on the lakebed.

### Flight/Pilot: 2-A-17/Crossfield

- **Date:** Thu. 5 May 1960
- **Remarks:** APU-1 shut down. Hydrogen peroxide failed to jettison.

### Flight/Pilot: 1-6-11/Robert M. White (2)

- **Date:** Fri. 6 May 1960
- **Launch:** 09:53:19.0 - Rosamond
- **Landing:** 10:02:42.2 - Rogers
- **Mach/mph:** 2.20/1452
- **Mission:** 014 — Roll damper failed at launch, but was reset. Normal ventral jettison system failed. Ventral jettisoned by back-up system when gear was released. First flight for White past Mach 2 in program.

### Flight/Pilot: 1-7-12/Joseph A. Walker (3)

- **Date:** Thu. 12 May 1960
- **Launch:** 08:47:37.0 - Silver
- **Landing:** 08:57:47.3 - Rogers
- **Mach/mph:** 3.19/2111
- **Mission:** 015 — Stable platform inoperative. Three engine chambers intentionally shut down and the remaining five chambers shut down on their own at the same time. First flight launched away from local area. First flight in program above 2,000 mph and above Mach 3. First flight of any manned aircraft past Mach 3 without pilot loss. First flight for Walker above Mach 3.
Flight/Pilot: 1-8-13/Robert M. White (3)  
B-52/Pilots: 003/Allavie & Bock  
Date: Thu. 19 May 1960  
Engine Run: 274.7  
Takeoff: 08:05  
Launch: 08:46:47.0 - Silver  
Duration: 684.6  
Landing: 09:20  
Altitude: 108,997  
Duration: 1:15  
Mach/mph: 2.31/1590  
Distance: 138.8  
Chase: Knight/Rushworth/McKay  
Mission: 016—Altitude build-up flight. First flight for White and the X-15 above 100,000 feet.

Flight/Pilot: 2-9-18/A. Scott Crossfield (11)  
B-52/Pilots: 008/Bock & Allavie  
Date: Thu. 26 May 1960  
Engine Run: 243.4  
Takeoff: 08:07  
Launch: 09:08:36.0 - Rosamond  
Duration: 554.4  
Landing: 09:30  
Altitude: 51,282  
Duration: 1:23  
Mach/mph: 2.20/1452  
Distance: 94.4  
Chase: White/White/Petersen  

Flight/Pilot: 1-A-14/Walker  
Date: Fri. 27 May 1960  
Remarks: Telemetry and power supply failure.

Flight/Pilot: 1-A-15/Walker  
Date: Fri. 3 Jun. 1960  
Remarks: Lost hydraulic pressure to APU.

Flight/Pilot: 1-A-16/Walker  
Date: Wed. 8 Jun. 1960  
Remarks: Nitrogen gas leaked. Insufficient propulsion system source pressure. Same day as LR-99 ground test explosion in No. 3.

Flight/Pilot: 1-9-17/Joseph A. Walker (4)  
B-52/Pilots: 003/Allavie & Fulton  
Date: Thu. 4 Aug. 1960  
Engine Run: 264.2  
Takeoff: 08:14  
Launch: 08:59:13.0 - Silver  
Duration: 622.6  
Landing: 09:40  
Altitude: 78,112  
Duration: 1:26  
Mach/mph: 3.31/2196  
Distance: 135.5  
Chase: White/Rushworth/Petersen/Knight  

Flight/Pilot: 1-A-18/White  
Date: Thu. 11 Aug. 1960  

Flight/Pilot: 1-10-19/Robert M. White (4)  
B-52/Pilots: 003/Fulton & Allavie  
Date: Fri. 12 Aug. 1960  
Engine Run: 256.2  
Takeoff: 08:00  
Launch: 08:48:43.0 - Silver  
Duration: 699.1  
Landing: 09:15  
Altitude: 136,500  
Duration: 1:15  
Mach/mph: 2.52/1772  
Distance: 137.1  
Chase: Rushworth/Petersen/Looney  

Flight/Pilot: 1-A-20/Walker  
Date: Fri. 18 Aug. 1960  
Remarks: APU-1 failed to start. Scheduled high temperature test.

Flight/Pilot: 1-11-21/Joseph A. Walker (5)  
B-52/Pilots: 003/Allavie & Cole  
Date: Fri. 19 Aug. 1960  
Engine Run: 251.6  
Takeoff: 07:50  
Launch: 08:34:22.0 - Silver  
Duration: 582.4  
Landing: 09:20  
Altitude: 75,982  
Duration: 1:30  
Mach/mph: 3.13/1986  
Distance: 129.0  
Chase: White/Rushworth/Petersen/Looney  
Mission: 020—Aerodynamic heat build-up. Held Mach 3 for thirteen seconds. Achieved aircraft skin temperatures of nearly 500 degrees F.

Flight/Pilot: 1-A-22/White  
Date: Fri. 2 Sep. 1960  
Flight/Pilot: 1-12-23/Robert M. White (5)  B-52/Pilots: 008/Kuyk & Allavie
Date: Sat. 10 Sep. 1960  Engine Run: 264.3  Takeoff: 11:05
Launch: 11:45:10.0 - Silver  Duration: 600.0  Landing: 12:25
Mach/mph: 3.23/2182  Distance: 138.1  Chase: Looney/Armstrong/Rushworth/Knight
Mission: 021—Aircraft stability and control evaluated. First flight past Mach 3 for White. APU malfunction.

Flight/Pilot: 1-13-25/Forrest S. Petersen (1)  B-52/Pilots: 008/Allavie & Fulton
Date: Fri. 23 Sep. 1960  Engine Run: 146.6  Takeoff: 09:10
Launch: 09:52:06.0 - Rosamond  Duration: 429.6  Landing: 10:20
Landing: 09:59:15.6 - Rogers  Altitude: 53,043  Duration: 1:10
Mach/mph: 1.68/1108  Distance: 62.4  Chase: Looney/Walker/Rushworth
Mission: 022—First flight for US Navy and Petersen in program. Premature shutdown of all chambers of both LR-11 engines. Two unsuccessful restart attempts.

Flight/Pilot: 1-14-27/Forrest S. Petersen (2)  B-52/Pilots: 008/Fulton & Cole
Date: Thu. 20 Oct. 1960  Engine Run: 285.4  Takeoff: 09:00
Launch: 09:30:27.0 - Rosamond  Duration: 566.1  Landing: 10:00
Landing: 09:39:53.1 - Rogers  Altitude: 53,800  Duration: 1:00
Mach/mph: 1.94/1280  Distance: 99.6  Chase: White/Rushworth/Armstrong
Mission: 023—Stability and control evaluation. B-52 to X-15 umbilical pulled out during taxi which prevented hard-wired communications between aircraft. All communications accomplished via radio.

Flight/Pilot: 1-16-29/Robert A. Rushworth (1)  B-52/Pilots: 008/Fulton & Cole
Date: Fri. 4 Nov. 1960  Engine Run: 267.5  Takeoff: 09:05
Launch: 09:43:56.0 - Rosamond  Duration: 545.3  Landing: 10:20
Landing: 09:53:01.3 - Rogers  Altitude: 50,700  Duration: 1:15
Mach/mph: 2.02/1333  Distance: 96.8  Chase: Looney/White/Petersen
Mission: 025—First flight for Rushworth in program. First time two flights attempted on same day with different X-15 aircraft, but flight 2-A-20 did not launch (see above).

Flight/Pilot: 1-15-28/John B. McKay (1)  B-52/Pilots: 008/Fulton & Cole
Date: Tue. 28 Oct. 1960  Engine Run: 271.0  Takeoff: 08:55
Launch: 09:43:56.0 - Rosamond  Duration: 545.3  Landing: 10:20
Landing: 09:53:01.3 - Rogers  Altitude: 50,700  Duration: 1:15
Mach/mph: 2.02/1333  Distance: 96.8  Chase: Looney/White/Petersen
Mission: 024—First flight for McKay in program. Ventral parachute did not open.

Flight/Pilot: 2-10-21/A. Scott Crossfield (12)  B-52/Pilots: 003/Allavie & Kuyk
Date: Fri. 4 Nov. 1960  Engine Run: 271.0  Takeoff: 12:10
Launch: 12:43:33.0 - Rosamond  Duration: 526.3  Landing: 13:15
Landing: 12:52:19.3 - Rogers  Altitude: 48,900  Duration: 1:05
Mach/mph: 1.95/1287  Distance: 101.2  Chase: Looney/White/Armstrong
Mission: 025—First flight for Rushworth in program. First time two flights attempted on same day with different X-15 aircraft, but flight 2-A-20 did not launch (see above).

Flight/Pilot: 2-10-21/A. Scott Crossfield (12)  B-52/Pilots: 003/Allavie & Kuyk
Date: Tue. 15 Nov. 1960  Engine Run: 137.3  Takeoff: 08:58
Launch: 09:59:00.0 - Rosamond  Duration: 508.4  Landing: 10:28
Landing: 10:07:28.4 - Rogers  Altitude: 81,200  Duration: 1:30
Mach/mph: 2.97/1960  Distance: 93.7  Chase: White/Walker/White
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Landing</th>
<th>Altitude</th>
<th>Duration</th>
<th>Mach/mph</th>
<th>Distance</th>
<th>Chase</th>
<th>Mission</th>
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<tbody>
<tr>
<td>1-17-30/Rushworth</td>
<td>Thu. 17 Nov. 1960</td>
<td>261.9</td>
<td>12:10</td>
<td>12:43:07.0 - Palmdale</td>
<td>13:10</td>
<td>54,750</td>
<td>1:00</td>
<td>1.90/1254</td>
<td>97.8</td>
<td>Looney/Walker/Knight</td>
<td>027 — Lower LR-11 shut down prematurely. Restart accomplished successfully. APU-2 start was sluggish. Launch occurred over Palmdale, not over a lakebed as was normal practice. This is one of only two flights in the program where this type of launch occurred (031).</td>
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<tr>
<td>2-12-33/A. Armstrong</td>
<td>Tue. 6 Dec. 1960</td>
<td>128.9</td>
<td>14:45</td>
<td>15:29:30.0 - Rosamond</td>
<td>16:00</td>
<td>53,374</td>
<td>1:15</td>
<td>2.85/1881</td>
<td>85.2</td>
<td>Daniel/Petersen/White</td>
<td>030 — Crossfield’s final flight. LR-99 shut down on first restart attempt. Two restarts attempted. North American Aviation contractor flight testing phase of X-15 program completed.</td>
</tr>
<tr>
<td>1-21-36/White</td>
<td>Tue. 7 Feb. 1961</td>
<td>276.1</td>
<td>12:10</td>
<td>12:56:10.0 - Silver</td>
<td>13:30</td>
<td>78,150</td>
<td>1:20</td>
<td>3.50/2275</td>
<td>139.3</td>
<td>Daniel/Knight/Petersen/Rushworth</td>
<td>033 — Last flight and highest speed with LR-11. X-15 no. 1 returned to NAA for installation of LR-99 engine on 8 February. X-15 no. 2 formally delivered to NASA on the same date.</td>
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<tr>
<td>Flight/Pilot: 2-13-26/Robert M. White (7)</td>
<td>Date: Tue. 7 Mar. 1961</td>
<td>B-52/Pilots: 008/Kuyk &amp; Cole</td>
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<tr>
<td>Engine Run: 127.0</td>
<td>Takeoff: 09:50</td>
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<tr>
<td>Launch: 10:28:33.0 - Silver</td>
<td>Duration: 514.1</td>
<td>Landing: 10:55</td>
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<tr>
<td>Landing: 10:37:07.1 - Rogers</td>
<td>Altitude: 77,450</td>
<td>Duration: 1:05</td>
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<tr>
<td>Mach/mph: 4.43/2905</td>
<td>Distance: 150.5</td>
<td>Chase: Rushworth/Walker/Petersen/Looney</td>
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<tr>
<td>Mission: 034—First flight for US Air Force and White with LR-99. First flight for any aircraft above Mach 4. First flight for White in X-15 no. 2. Permanent buckles found on fuselage skin. First flight of Q-ball on X-15 no. 2. First and only time that an F-4H was used as a chase aircraft (Petersen).</td>
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<tr>
<td>Flight/Pilot: 2-A-27/Walker</td>
<td>Date: Tue. 21 Mar. 1961</td>
<td>Pilot:</td>
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<td>Remarks: Lost electrical power from B-52. Drag chute from B-52 lost on landing. Wheels locked, blowing a tire. First time an A/P 22S-2 pressure suit was worn by an X-15 pilot.</td>
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<tr>
<td>Flight/Pilot: 2-14-28/Joseph A. Walker (6)</td>
<td>Date: Thu. 30 Mar. 1961</td>
<td>B-52/Pilots: 008/Kuyk &amp; Fulton</td>
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<tr>
<td>Engine Run: 81.9</td>
<td>Takeoff: 09:20</td>
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<tr>
<td>Launch: 10:05:00.0 - Hidden Hills</td>
<td>Duration: 616.5</td>
<td>Landing: 10:25</td>
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<tr>
<td>Landing: 10:15:16.5 - Rogers</td>
<td>Altitude: 169,600</td>
<td>Duration: 1:05</td>
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<tr>
<td>Mach/mph: 3.95/2760</td>
<td>Distance: 180.5</td>
<td>Chase: White/Knight/Petersen/Rushworth</td>
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<tr>
<td>Mission: 035—First flight for NASA and Walker with LR-99. Highest altitude to date. Walker weightless for two minutes. First flight for Walker above 100,000 feet and in X-15 no. 2. Required LR-99 restart. First use of the T-38 chase aircraft in the X-15 program (Knight).</td>
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<tr>
<td>Engine Run: 71.6</td>
<td>Takeoff: 09:10</td>
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<tr>
<td>Launch: 10:05:17.0 - Hidden Hills</td>
<td>Duration: 603.4</td>
<td>Landing: 10:40</td>
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<tr>
<td>Landing: 10:15:20.4 - Rogers</td>
<td>Altitude: 105,000</td>
<td>Duration: 1:30</td>
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<tr>
<td>Mach/mph: 4.62/3074</td>
<td>Distance: 169.3</td>
<td>Chase: Looney/Walker/Rogers/Wood</td>
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<tr>
<td>Mission: 036—First flight over 3,000 mph. White dropped 8,000 feet before engine start. Required LR-99 restart. Cabin pressure fell to 46,000 feet. Pitch damper dropped out at engine shutdown.</td>
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<tr>
<td>Flight/Pilot: 2-A-30/Walker</td>
<td>Date: Fri. 19 May 1961</td>
<td>Pilot:</td>
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<tr>
<td>Flight/Pilot: 2-16-31/Robert M. White (9)</td>
<td>Date: Fri. 23 Jun. 1961</td>
<td>B-52/Pilots: 003/Allavie &amp; Fulton</td>
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<tr>
<td>Engine Run: 78.7</td>
<td>Takeoff: 13:09</td>
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<tr>
<td>Launch: 14:00:05.0 - Mud</td>
<td>Duration: 605.7</td>
<td>Landing: 14:45</td>
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<tr>
<td>Landing: 14:10:10.7 - Rogers</td>
<td>Altitude: 107,700</td>
<td>Duration: 1:36</td>
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<tr>
<td>Mach/mph: 5.27/3603</td>
<td>Distance: 230.3</td>
<td>Chase: Looney/Daniel/Crews/Walker</td>
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<td>Mission: 038—First flight of any aircraft past Mach 5. Heat effects noted on wings. Cabin pressure fell to 56,000 feet which inflated the pilot's pressure suit.</td>
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<tr>
<td>Flight/Pilot</td>
<td>Date</td>
<td>Engine Run</td>
<td>Takeoff</td>
<td>Launch Time</td>
<td>Duration</td>
<td>Landing Time</td>
<td>Altitude</td>
<td>Distance</td>
<td>Chase</td>
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<td>1-22-37/Forrest S. Petersen (3)</td>
<td>Thu. 10 Aug. 1961</td>
<td>117.7</td>
<td>09:42</td>
<td>10:27:05.0 - Silver</td>
<td>564.4</td>
<td>10:52</td>
<td>78,200</td>
<td>122.8</td>
<td>White/Rushworth/Walker</td>
<td>039 — Longest flight for Petersen and his first flight past Mach 4. First flight for X-15 no. 1 with LR-99 and first past Mach 4. Lost cabin pressure and suit overinflated. At launch Petersen grabbed speed brake handle instead of engine throttle.</td>
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<tr>
<td>2-19-35/Forrest S. Petersen (4)</td>
<td>Thu. 28 Sep. 1961</td>
<td>87.1</td>
<td>09:00</td>
<td>09:50:25.0 - Hidden Hills</td>
<td>521.6</td>
<td>10:30</td>
<td>78,000</td>
<td>158.5</td>
<td>Daniel/McKay/Rogers</td>
<td>041—Petersen’s farthest flight. Achieved 1,000 degree F. First flight by Petersen past Mach 5. Highest altitude attained by Petersen. First flight for Petersen in X-15 no. 2. Only pilot to attain highest speed and altitude on same flight.</td>
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<tr>
<td>1-23-39/Robert A. Rushworth (3)</td>
<td>Thu. 17 Oct. 1961</td>
<td>84.6</td>
<td>11:00</td>
<td>10:57:33.0 - Mud</td>
<td>611.7</td>
<td>12:30</td>
<td>108,600</td>
<td>201.1</td>
<td>White/McKay/Daniel/Knight</td>
<td>043—First flight of a manned aircraft above 200,000 feet. Studied BCS system and reentry characteristics. White had two minutes of 0-g and maximum of 4-g on reentry. Outer panel of left windshield shattered during reentry at approximately 70,000 feet.</td>
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<tr>
<td>1-A-41/White</td>
<td>Fri. 27 Oct. 1961</td>
<td>84.6</td>
<td>11:00</td>
<td>10:57:33.0 - Mud</td>
<td>611.7</td>
<td>12:30</td>
<td>108,600</td>
<td>201.1</td>
<td>White/McKay/Daniel/Knight</td>
<td>043—First flight of a manned aircraft above 200,000 feet. Studied BCS system and reentry characteristics. White had two minutes of 0-g and maximum of 4-g on reentry. Outer panel of left windshield shattered during reentry at approximately 70,000 feet.</td>
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<td>Flight/Pilot</td>
<td>Date</td>
<td>Remarks</td>
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<td>2-21-37/Robert M. White (11)</td>
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<td>B-52/Pilots:</td>
<td>008/Allavie &amp; Archer</td>
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<td>Date:</td>
<td>Thu. 9 Nov. 1961</td>
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<tr>
<td>Launch:</td>
<td>09:57:17.0 - Mud</td>
<td>Duration: 571.2 Landing: 10:30</td>
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<tr>
<td>Landing:</td>
<td>10:06:48.2 - Rogers</td>
<td>Altitude: 101,600 Duration: 1:30</td>
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<tr>
<td>Mach/mph:</td>
<td>6.04/4093</td>
<td>Distance: 211.7 Chase: Rushworth/Walker/Gordon/Daniel</td>
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<td>Mission:</td>
<td>045—First flight of a manned aircraft above Mach 6 and 4,000 mph. Highest Mach attained by White in program. Outer panel of right windshield shattered at Mach 2.7.</td>
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<tbody>
<tr>
<td>Date: Wed. 20 Dec. 1961</td>
<td>Engine Run: 106.3</td>
<td>Takeoff: 14:05</td>
</tr>
<tr>
<td>Launch: 14:45:50.0 - Silver</td>
<td>Duration: 625.4</td>
<td>Landing: 15:10</td>
</tr>
<tr>
<td>Landing: 14:56:15.4 - Rogers</td>
<td>Altitude: 81,000</td>
<td>Duration: 1:05</td>
</tr>
<tr>
<td>Mach/mph: 3.76/2502</td>
<td>Distance: 150.9</td>
<td>Chase: Daniel/Petersen/Rushworth</td>
</tr>
<tr>
<td>Mission: 046—First flight for X-15 no. 3. First flight for Armstrong with LR-99 and his first flight past Mach 3. All three axes on the MH-96 system disengaged at launch but reengaged after engine light. Yaw limit cycle at fixed gain during boost phase.</td>
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<tr>
<td>Date: Wed. 17 Jan. 1962</td>
<td>Engine Run: 97.4</td>
<td>Takeoff: 11:05</td>
</tr>
<tr>
<td>Launch: 12:00:34.0 - Mud</td>
<td>Duration: 627.7</td>
<td>Landing: 12:34</td>
</tr>
<tr>
<td>Landing: 12:11:01.7 - Rogers</td>
<td>Altitude: 133,500</td>
<td>Duration: 1:29</td>
</tr>
<tr>
<td>Mach/mph: 5.51/3765</td>
<td>Distance: 223.5</td>
<td>Chase: Gordon/Petersen/McDivitt/Rushworth</td>
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<tr>
<td>Mission: 048—First flight for Armstrong past Mach 5 and above 100,000 feet. First flight for X-15 no. 3 past Mach 5. More than two months elapsed before next flight attempt due to poor weather conditions.</td>
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<td>Date: Thu. 5 Apr. 1962</td>
<td>Engine Run: 79.2</td>
<td>Takeoff: 09:23</td>
</tr>
<tr>
<td>Launch: 10:04:25.0 - Hidden Hills</td>
<td>Duration: 677.0</td>
<td>Landing: 10:27</td>
</tr>
<tr>
<td>Landing: 10:15:42.0 - Rogers</td>
<td>Altitude: 180,000</td>
<td>Duration: 1:04</td>
</tr>
<tr>
<td>Mach/mph: 4.12/2850</td>
<td>Distance: 181.7</td>
<td>Chase: Daniel/McKay/Rushworth</td>
</tr>
<tr>
<td>Mission: 049—Engine would not ignite on the first attempt. Second attempt successful. Q-Ball system tested at low and high dynamic pressures.</td>
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<tr>
<td>Flight/Pilot</td>
<td>Date</td>
<td>Engine Run</td>
</tr>
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<tr>
<td>1-A-45/Walker</td>
<td>Wed. 18 Apr. 1962</td>
<td>84.3</td>
</tr>
<tr>
<td>2-A-38/White</td>
<td>Wed. 25 Apr. 1962</td>
<td>82.4</td>
</tr>
<tr>
<td>2-A-39/White</td>
<td>Thu. 26 Apr. 1962</td>
<td>81.6</td>
</tr>
<tr>
<td>1-A-47/Walker</td>
<td>Fri. 27 Apr. 1962</td>
<td>97.9</td>
</tr>
<tr>
<td>2-A-41/White</td>
<td>Fri. 25 May 1962</td>
<td>75.3</td>
</tr>
<tr>
<td>2-A-42/White</td>
<td>Tue. 29 May 1962</td>
<td>75.3</td>
</tr>
</tbody>
</table>
Flight/Pilot: 2-23-43/Robert M. White (12)  
B-52/Pilots: 008/Fulton & Bement

Date: Fri. 1 Jun. 1962  
Engine Run: 86.0  
Takeoff: 09:59

Launch: 10:51:15.0 - Delamar  
Duration: 601.9  
Landing: 11:28

Landing: 11:01:16.9 - Rogers  
Altitude: 132,600  
Duration: 1:29

Mach/mph: 5.42/3675  
Distance: 224.5  
Chase: Daniel/Dana/Rogers/Collins

Mission: 055—First launch from Delamar Dry Lake. Engine vibration noted at 30 percent thrust. 100th time an X-15 was taken aloft, but only 55th time a successful launch occurred.

Flight/Pilot: 1-29-50/Joseph A. Walker (12)  
B-52/Pilots: 003/Allavie & Bement

Date: Thu. 7 Jun. 1962  
Engine Run: 81.5  
Takeoff: 09:45

Launch: 10:29:20.0 - Hidden Hills  
Duration: 504.2  
Landing: 10:53

Landing: 10:37:44.2 - Rogers  
Altitude: 103,600  
Duration: 1:08

Mach/mph: 5.39/3672  
Distance: 224.5  
Chase: Daniel/McKay/White

Mission: 056—Studied air flow over surfaces. Engine vibration noted during boost. Near 90 degree right turn was made over Daggett, California, to test maneuverability of spacecraft returning from orbit.

Flight/Pilot: 3-5-9/Robert M. White (13)  
B-52/Pilots: 008/Allavie & Fulton

Date: Tue. 12 Jun. 1962  
Engine Run: 81.9  
Takeoff: 10:56

Launch: 12:04:00.0 - Delamar  
Duration: 575.4  
Landing: 12:40

Landing: 12:13:35.4 - Rogers  
Altitude: 184,600  
Duration: 1:44

Mach/mph: 5.02/3517  
Distance: 249.0  
Chase: McDivitt/McKay/Collins/Gordon

Mission: 057—First flight for White in X-15 no. 3. Scheduled flight for pilot checkout and to evaluate BCS system.

Flight/Pilot: 3-6-10/Robert M. White (14)  
B-52/Pilots: 008/Allavie & Lewis

Date: Thu. 21 Jun. 1962  
Engine Run: 82.3  
Takeoff: 10:56

Launch: 12:04:00.0 - Delamar  
Duration: 575.4  
Landing: 12:40

Landing: 12:13:35.4 - Rogers  
Altitude: 184,600  
Duration: 1:44

Mach/mph: 5.02/3517  
Distance: 249.0  
Chase: Daniel/McKay/White

Mission: 058—Contractual demonstration of the MH-96 system. APU-1 shutdown during captive portion of flight, but was successfully restarted prior to launch.

Flight/Pilot: 1-30-51/Joseph A. Walker (13)  
B-52/Pilots: 003/Allavie & Townsend

Date: Wed. 27 Jun. 1962  
Engine Run: 88.6  
Takeoff: 12:13

Launch: 13:08:10.0 - Mud  
Duration: 572.4  
Landing: 13:38

Landing: 13:17:42.4 - Rogers  
Altitude: 123,700  
Duration: 1:25

Mach/mph: 5.92/4104  
Distance: 223.2  
Chase: Rushworth/McKay/Knight/Daniel

Mission: 059—Unofficial world absolute speed record to date. Highest speed attained by Walker in program. Ventral parachute lost during flight and pitch damper went inoperative during a pull-up maneuver.

Flight/Pilot: 2-24-44/John B. McKay (3)  
B-52/Pilots: 008/Allavie & Archer

Date: Tue. 10 Jul. 1962  
Engine Run: 112.4  
Takeoff: 09:57

Launch: 10:41:47.0 - Hidden Hills  
Duration: 533.4  
Landing: 11:05

Landing: 10:50:40.4 - Rogers  
Altitude: 83,200  
Duration: 1:08

Mach/mph: 4.95/3280  
Distance: 167.0  
Chase: Rushworth/Armstrong/Daniel


Flight/Pilot: 3-A-11/White  
Date: Tue. 10 Jul. 1962
Remarks: Could not retract left aft landing gear on B-52 no. 003.

Flight/Pilot: 3-A-12/White  
Date: Wed. 11 Jul. 1962
Remarks: APU-1 pressure regulator ruptured causing hydrogen peroxide jettison.

Flight/Pilot: 3-A-13/White  
Date: Mon. 16 Jul. 1962
Remarks: Umbilical connecting X-15 to B-52 pylon came loose because the lanyard was too short.
Flight/Pilot: 1-31-52/Joseph A. Walker (14)  
B-52/Pilots: 008/Allavie & Archer  
Date: Mon. 16 Jul. 1962  
Engine Run: 83.9  
Takeoff: 13:23  
Launch: 14:09:25.0 - Mud  
Duration: 577.8  
Landing: 14:19:02.8 - Rogers  
Altitude: 107,200  
Duration: 1:17  
Mach/mph: 5.37/3674  
Distance: 227.8  
Chase: Daniel/Dana/Engle/Rushworth  
Mission: 061—Second time two launches attempted on the same day. First flight with new X-15 instrument panel arrangement where the aircraft and simulator were to be set up in an identical configuration. Checkout of SAS. Ventral parachute failed. Last use of the F-100 chase plane for X-15 no. 1 (Daniel). Canopy was difficult to open after landing due to a latch pin that was the wrong size.

Flight/Pilot: 3-7-14/Robert M. White (15)  
B-52/Pilots: 003/Allavie & Archer  
Date: Tue. 17 Jul. 1962  
Engine Run: 82.0  
Takeoff: 08:46  
Launch: 09:31:10.0 - Delamar  
Duration: 620.7  
Landing: 09:41:30.7 - Rogers  
Altitude: 314,750  
Duration: 1:17  
Mach/mph: 5.45/3832  
Distance: 268.3  
Chase: McDivitt/McKay/Dana/Thompson  
Mission: 062—Rain forced change from Smith Ranch to Delamar. Set FAI World Absolute Altitude Record. First manned aircraft flight above 300,000 feet. Farthest flight and highest altitude for White. First flight in X-15 program above 50 miles. First pilot to achieve astronaut rating in a non-ballistic vehicle. Last use of the F-100 chase aircraft for X-15 no. 3 (McDivitt).

Flight/Pilot: 2-25-45/John B. McKay (4)  
B-52/Pilots: 008/Fulton & Bement  
Date: Thu. 19 Jul. 1962  
Engine Run: 106.2  
Takeoff: 09:11  
Launch: 09:53:45.0 - Hidden Hills  
Duration: 503.8  
Landing: 10:02:08.8 - Rogers  
Altitude: 85,250  
Duration: 1:09  
Mach/mph: 5.18/3474  
Distance: 161.2  
Chase: Rogers/Dana/Rushworth  
Mission: 063—Evaluated heating rates at low angle of attack and high Mach number. First flight for McKay past Mach 5. Ventral parachute failed. Last use of the F-100 chase aircraft during program (Rogers).

B-52/Pilots: 003/Fulton & Bement  
Date: Thu. 26 Jul. 1962  
Engine Run: 82.8  
Takeoff: 10:34  
Launch: 11:22:30.0 - Mud  
Duration: 621.4  
Landing: 11:32:51.4 - Rogers  
Altitude: 98,900  
Duration: 1:23  
Mach/mph: 5.74/3989  
Distance: 214.8  
Chase: Rushworth/Collins/Daniel/White  

Flight/Pilot: 3-A-15/Walker  
Date: Wed. 1 Aug. 1962  
Remarks: Fuel tank pressurization failed. Flight scheduled to investigate yawing noticed by White on flight 062.

Flight/Pilot: 3-8-16/Joseph A. Walker (15)  
B-52/Pilots: 003/Fulton & Bement  
Date: Thu. 2 Aug. 1962  
Engine Run: 80.0  
Takeoff: 09:05  
Launch: 10:02:08.8 - Rogers  
Duration: 554.0  
Landing: 10:31  
Altitude: 144,500  
Duration: 1:26  
Mach/mph: 5.07/3483  
Distance: 214.8  
Chase: Rushworth/Collins/Daniel/White  
Mission: 065—First flight by Walker in X-15 no. 3. Evaluated modification to fixed gain of MH-96 system in relation to yaw problem noted previously. System checked out okay. First use of the T-38 chase aircraft with X-15 no. 3 (Daniel).

Flight/Pilot: 2-26-46/Robert A. Rushworth (6)  
B-52/Pilots: 008/Fulton & Sturmthal  
Date: Wed. 8 Aug. 1962  
Engine Run: 95.8  
Takeoff: 09:15  
Launch: 10:08:35.0 - Hidden Hills  
Duration: 462.8  
Landing: 10:33  
Altitude: 90,877  
Duration: 1:16  
Mach/mph: 4.40/2943  
Distance: 214.8  
Chase: McDivitt/McKay/Engle/Collins  
Mission: 066—Evaluated aerodynamic heating at moderate velocity and low altitude.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-A-17/Walker</td>
<td>Fri. 10 Aug. 1962</td>
<td>Broken wire on BCS controls. Scheduled to test new re-entry technique.</td>
</tr>
</tbody>
</table>

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<tr>
<th>Flight/Pilot</th>
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<th>Remarks</th>
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<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>2-A-49/McKay</td>
<td>Thu. 27 Sep. 1962</td>
<td>McKay accidentally tripped ejection seat handles and could not re-stow them. Scheduled to evaluate stability without lower ventral.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-29-50/John B. McKay (5)</td>
<td>Fri. 28 Sep. 1962</td>
<td>All subsequent X-15 flights are flown with no lower ventral until flight 155, where it was reinstalled for testing on the X-15 no. 2 using external fuel tanks. Longest LR-99 burn time to date.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-10-19/Robert A. Rushworth (9)</td>
<td>Thu. 4 Oct. 1962</td>
<td>APU-1 shut down five minutes after launch.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-30-51/John B. McKay (6)</td>
<td>Tue. 9 Oct. 1962</td>
<td>First flight in program for McKay above 100,000 feet. Second stage engine igniter exploded, causing 79 second restriction on burn time for several missions until correction was found.</td>
</tr>
</tbody>
</table>
Flight/Pilot: 3-11-20/Robert A. Rushworth (10)  
B-52/Pilots: 008/Bement & Cross
Date: Tue. 23 Oct. 1962  
Engine Run: 78.0  
Takeoff: 10:31
Launch: 11:30:40.0 - Mud  
Duration: 586.3  
Landing: 12:28
Landing: 134,500  
Duration: 1:57

Flight/Pilot: 2-31-52/John B. McKay (7)  
B-52/Pilots: 008/Bement & Lewis
Date: Fri. 9 Nov. 1962  
Engine Run: 70.5  
Takeoff: 09:29
Launch: 10:23:07.0 - Mud  
Duration: 391.0  
Landing: 11:45
Landing: 10:29:38.0 - Mud  
Duration: 2:16
Mission: 074—Engine only produced 30 percent thrust due to a failed governor valve, causing fuel starvation. Higher than normal landing speed caused by inability to extend flaps put excessive loads on landing gear, causing left skid to fail at touchdown. Left wing and stabilizer dug in, causing the aircraft to roll over. McKay jettisoned the canopy prior to rollover. Aircraft required extensive refurbishment which included lengthened landing gear, extended fuselage, and external fuel tanks to extend range and speed. After rebuild this aircraft will be designated X-15A-2. McKay suffered crushed vertebrae but was later able to return to flight status. McKay's shortest flight.

Flight/Pilot: 3-A-21/White  
Date: Thu. 13 Dec. 1962  

Flight/Pilot: 3-12-22/Robert M. White (16)  
B-52/Pilots: 008/Bement & Cross
Date: Fri. 14 Dec. 1962  
Engine Run: 77.7  
Takeoff: 09:47
Launch: 10:44:07.0 - Mud  
Duration: 577.1  
Landing: 12:00
Landing: 141,400  
Duration: 2:13
Mission: 075—Final flight for White in program. Flown at 22 degree angle-of-attack. Ultraviolet photometer experiment flown but did not function during the flight.

Flight/Pilot: 3-13-23/Joseph A. Walker (17)  
B-52/Pilots: 008/Bement & Fulton
Date: Thu. 20 Dec. 1962  
Engine Run: 81.0  
Takeoff: 10:30
Launch: 11:25:04.0 - Mud  
Duration: 534.3  
Landing: 11:55
Landing: 160,400  
Duration: 1:25
Mission: 076—Investigated control system limits at high dynamic pressure.

Flight/Pilot: 3-14-24/Joseph A. Walker (18)  
B-52/Pilots: 008/Bement & Archer
Date: Thu. 17 Jan. 1963  
Engine Run: 81.2  
Takeoff: 10:07
Launch: 10:59:16.0 - Delamar  
Duration: 583.9  
Landing: 12:08
Landing: 271,700  
Duration: 2:01
Mission: 077—First astronaut qualification flight for Walker. Infrared experiment flown. APU-1 failed four minutes after launch. Hydraulic pressure loss caused shutdown of the Q-ball system and rudder servo about two minutes prior to landing. Altitude buildup with ventral removed.

Flight/Pilot: 1-33-54/Robert A. Rushworth (11)  
B-52/Pilots: 008/Bement & Archer
Date: Thu. 11 Apr. 1963  
Engine Run: 120.5  
Takeoff: 09:21
Launch: 10:02:47.1 - Hidden Hills  
Duration: 536.7  
Landing: 10:40
Landing: 74,400  
Duration: 1:19
Mission: 078—Checkout of APU repair which consisted of pressurizing the APU compartment. Optical degradation experiment (KC-1 camera) mounted under fuselage to study photographic degradation caused by shock waves and hypersonic air flow. SAS roll disengaged at launch but was reset.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>B-52/Pilots</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Duration</th>
<th>Landing</th>
<th>Duration</th>
<th>Mach/mph</th>
<th>Distance</th>
<th>Chase</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-34-55/John B. McKay (8)</td>
<td>008/Bement &amp; Fulton</td>
<td>Thu. 25 Apr. 1963</td>
<td>86.3</td>
<td>13:14</td>
<td>14:03:38.3 - Delamar</td>
<td>632.3</td>
<td>14:45</td>
<td>1:31</td>
<td>5.32/3654</td>
<td>234.0</td>
<td>White/Thompson/Wood/Knight</td>
<td>080—First launch from Delamar for X-15 no. 1. KC-1 camera tested. Winds at 30 mph with 50 percent cloud cover hindered flight. McKay’s first flight following rollover accident on flight 074. SAS roll disengaged at launch. Alternate SAS engaged.</td>
</tr>
<tr>
<td>3-16-26/Joseph A. Walker (20)</td>
<td>008/Bement &amp; Archer</td>
<td>Thu. 2 May 1963</td>
<td>79.2</td>
<td>09:08</td>
<td>09:59:54.0 - Mud</td>
<td>557.2</td>
<td>10:40</td>
<td>1:32</td>
<td>4.73/3488</td>
<td>216.3</td>
<td>White/Dana/Rogers/Knight</td>
<td>081—Check-out of APU at high altitude after modifications to pressurize the housing. Infrared and ultraviolet experiments conducted. Nose gear door was replaced and main gear (rear skid) oleos changed following the incident on flight 079.</td>
</tr>
<tr>
<td>3-18-29/Joseph A. Walker (21)</td>
<td>008/Bement &amp; Fulton</td>
<td>Wed. 29 May 1963</td>
<td>84.3</td>
<td>09:53</td>
<td>10:43:22.0 - Delamar</td>
<td>702.5</td>
<td>11:22</td>
<td>1:29</td>
<td>5.52/3858</td>
<td>232.9</td>
<td>White/Dana/Knight/Rogers</td>
<td>084—Evaluated heat transfer rates. Inner panel on left windshield shattered approximately at engine burn out. The loss of the windshield was attributed to the bolts holding it in place being too long.</td>
</tr>
<tr>
<td>Flight/Pilot</td>
<td>3-19-30/Robert A. Rushworth (13)</td>
<td>B-52/Pilots: 008/Bement &amp; Archer</td>
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<tr>
<td>Date</td>
<td>Tue. 18 Jun. 1963</td>
<td><strong>Engine Run</strong>: 79.3</td>
<td><strong>Takeoff</strong>: 09:42</td>
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<tr>
<td>Launch</td>
<td>10:34:21.0 - Delamar</td>
<td><strong>Duration</strong>: 580.3</td>
<td><strong>Landing</strong>: 11:40</td>
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<tr>
<td>Landing</td>
<td>10:44:01.3 - Rogers</td>
<td><strong>Altitude</strong>: 223,700</td>
<td><strong>Duration</strong>: 1:58</td>
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<td></td>
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<tr>
<td>Mach/mph</td>
<td>4.97/3539</td>
<td><strong>Distance</strong>: 235.0</td>
<td><strong>Chase</strong>: Gordon/Dana/Ward/Rogers</td>
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<tr>
<td>Mission</td>
<td><strong>085</strong>—First flight by Rushworth above 200,000 feet. Altitude build-up flight. Ultraviolet experiment.</td>
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<thead>
<tr>
<th>Flight/Pilot</th>
<th>1-36-57/Joseph A. Walker (22)</th>
<th>B-52/Pilots: 003/Bement &amp; Archer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Tue. 25 Jun. 1963</td>
<td><strong>Engine Run</strong>: 92.8</td>
</tr>
<tr>
<td>Launch</td>
<td>09:53:50.0 - Delamar</td>
<td><strong>Duration</strong>: 599.3</td>
</tr>
<tr>
<td>Landing</td>
<td>10:03:49.3 - Rogers</td>
<td><strong>Altitude</strong>: 111,800</td>
</tr>
<tr>
<td>Mach/mph</td>
<td>5.51/3911</td>
<td><strong>Distance</strong>: 248.4</td>
</tr>
<tr>
<td>Mission</td>
<td><strong>086</strong>—Evaluated heat build-up. Traversing probe and optical degradation experiments. Left forward fuselage faring cracked at buckle noted on flight <strong>083</strong>.</td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Flight/Pilot</th>
<th>3-20-31/Robert A. Rushworth (14)</th>
<th>B-52/Pilots: 008/Bement &amp; Archer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Thu. 27 Jun. 1963</td>
<td><strong>Engine Run</strong>: 80.1</td>
</tr>
<tr>
<td>Launch</td>
<td>09:56:03.0 - Delamar</td>
<td><strong>Duration</strong>: 628.0</td>
</tr>
<tr>
<td>Landing</td>
<td>10:06:31.0 - Rogers</td>
<td><strong>Altitude</strong>: 285,000</td>
</tr>
<tr>
<td>Mach/mph</td>
<td>4.89/3425</td>
<td><strong>Distance</strong>: 236.6</td>
</tr>
<tr>
<td>Mission</td>
<td><strong>087</strong>—Highest altitude attained by Rushworth in program. First flight by Rushworth above 50 miles altitude. Becomes third X-15 pilot to achieve astronaut qualification.</td>
<td></td>
</tr>
</tbody>
</table>

| Flight/Pilot | 1-A-58/Walker | Date | Wed. 3 Jul. 1963 | Remarks: X-15 could not be received on the radio. |

<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>3-37-59/Joseph A. Walker (23)</th>
<th>B-52/Pilots: 008/Archer &amp; Bement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Tue. 9 Jul. 1963</td>
<td><strong>Engine Run</strong>: 83.6</td>
</tr>
<tr>
<td>Launch</td>
<td>12:12:12.0 - Delamar</td>
<td><strong>Duration</strong>: 537.7</td>
</tr>
<tr>
<td>Landing</td>
<td>12:21:09.7 - Rogers</td>
<td><strong>Altitude</strong>: 226,400</td>
</tr>
<tr>
<td>Mach/mph</td>
<td>5.07/3631</td>
<td><strong>Distance</strong>: 240.8</td>
</tr>
<tr>
<td>Mission</td>
<td><strong>088</strong>—Evaluated optical degradation. A cork sheet ablation material was tested on the lower right speed brake. Traversing probe became inoperative after engine burnout because of an overloaded fuse.</td>
<td></td>
</tr>
</tbody>
</table>

| Flight/Pilot | 1-A-60/Rushworth | Date | Wed. 17 Jul. 1963 | Remarks: Pilot's oxygen quick disconnect from B-52 uncoupled during takeoff. The flight was aborted and had to quickly return to Edwards since Rushworth had a limited internal oxygen supply. |

<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>1-38-61/Robert A. Rushworth (15)</th>
<th>B-52/Pilots: 003/Fulton &amp; Bock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Thu. 18 Jul. 1963</td>
<td><strong>Engine Run</strong>: 85.2</td>
</tr>
<tr>
<td>Launch</td>
<td>10:07:20.0 - Mud</td>
<td><strong>Duration</strong>: 563.9</td>
</tr>
<tr>
<td>Landing</td>
<td>10:16:43.9 - Rogers</td>
<td><strong>Altitude</strong>: 104,800</td>
</tr>
<tr>
<td>Mach/mph</td>
<td>5.63/3925</td>
<td><strong>Distance</strong>: 214.8</td>
</tr>
<tr>
<td>Mission</td>
<td><strong>089</strong>—Ablative test articles installed on both lower speed brakes, the left upper speed brake, and the leading edge of the lower fixed ventral. Flight was performed without automatic systems. Engine was shut down manually, and a malfunction was found in the second stage igniter.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>3-21-32/Joseph A. Walker (24)</th>
<th>B-52/Pilots: 008/Fulton &amp; Bement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Fri. 19 Jul. 1963</td>
<td><strong>Engine Run</strong>: 84.6</td>
</tr>
<tr>
<td>Launch</td>
<td>10:20:05.0 - Smith Ranch</td>
<td><strong>Duration</strong>: 684.1</td>
</tr>
<tr>
<td>Landing</td>
<td>10:31:29.1 - Rogers</td>
<td><strong>Altitude</strong>: 347,800</td>
</tr>
<tr>
<td>Mach/mph</td>
<td>5.50/3710</td>
<td><strong>Distance</strong>: 288.5</td>
</tr>
<tr>
<td>Mission</td>
<td><strong>090</strong>—First flight in program by Walker above 300,000 feet. First launch from Smith Ranch Dry Lake. Towed balloon experiment tested, which was developed for the Mercury-Atlas 9 mission that flew on 15 May 1963. The experiment failed on both X-15 and Mercury.</td>
<td></td>
</tr>
</tbody>
</table>
Flight/Pilot: 3-A-33/Walker  Date: Tue. 6 Aug. 1963
Remarks: Weather cancellation and an overheated computer.

Flight/Pilot: 3-A-34/Walker  Date: Tue. 13 Aug. 1963
Remarks: APU-1 would not run after start. Stayed operational about four seconds, then shut down.

Flight/Pilot: 3-A-35/Walker  Date: Thu. 15 Aug. 1963
Remarks: Weather canceled the flight. After abort, APU-1 had the same start-up problems as encountered in previous aborted flight. APU controller was adversely affected by low temperatures.

Flight/Pilot: 3-22-36/Joseph A. Walker (25)  B-52/Pilots: 003/Bement & Lewis
Date: Thu. 22 Aug. 1963  Engine Run: 85.8  Takeoff: 09:09
Launch: 10:05:57.0 - Smith Ranch  Duration: 668.6  Landing: 10:56
Landing: 10:17:05.6 - Rogers  Altitude: 354,200  Duration: 1:47
Mach/mph: 5.58/3794  Distance: 293.4  Chase: Wood/Dana/Gordon/Rogers


Date: Mon. 7 Oct. 1963  Engine Run: 118.9  Takeoff: 11:22
Launch: 12:22:56.0 - Hidden Hills  Duration: 457.8  Landing: 13:00
Landing: 12:30:33.8 - Rogers  Altitude: 77,800  Duration: 1:38
Mach/mph: 4.21/2834  Distance: 138.5  Chase: Sorlie/Thompson/Rogers
Mission: 092 — First and shortest flight by Engle in program. First flight with KS-25 (Phase 2 optical degradation instrument). Ablative tested on speed brakes. Abort originally called for bad angle-of-attack indicator. Indicator started working and the flight went ahead, but the indicator became inoperative immediately after launch. An unauthorized 360-degree roll performed by Engle during glide back to Edwards.

Flight/Pilot: 3-A-37/Rushworth  Date: Mon. 14 Oct. 1963
Remarks: Upper vertical leading edge modified to razor edge. Inertial system platform malfunctioned.

Flight/Pilot: 3-A-38/Rushworth  Date: Fri. 25 Oct. 1963
Remarks: Inertial system platform malfunctioned. A flight attempt the day before was canceled prior to takeoff when a cracked right windshield was found on the B-52.

Flight/Pilot: 1-40-64/Milton O. Thompson (1)  B-52/Pilots: 008/Fulton & Jones
Date: Tue. 29 Oct. 1963  Engine Run: 126.1  Takeoff: 11:59
Launch: 12:42:34.0 - Hidden Hills  Duration: 523.0  Landing: 13:09
Landing: 12:51:17.0 - Rogers  Altitude: 74,400  Duration: 1:10
Mach/mph: 4.10/2925  Distance: 144.2  Chase: Sorlie/Walker/Rushworth
Mission: 093 — First flight for Thompson and first past Mach 4. Previous ablative test material was removed and replaced with a new Emerson Electric ablative material which was tested on the lower right speed brake. Optical degradation tests performed.

Flight/Pilot: 3-23-39/Robert A. Rushworth (16)  B-52/Pilots: 008/Bement & Jones
Date: Thu. 7 Nov. 1963  Engine Run: 107.2  Takeoff: 09:24
Launch: 10:11:14.0 - Hidden Hills  Duration: 531.7  Landing: 10:41
Landing: 10:20:05.7 - Rogers  Altitude: 82,300  Duration: 1:17
Mach/mph: 4.40/2925  Distance: 145.8  Chase: Gordon/Thompson/Sorlie
Mission: 094 — First flight with razor sharp leading edge on upper vertical stabilizer. Evaluated heat transfer and damper-off stability. Main gear spread too much on landing creating a turn to the left. Discovered the main gear oleo was not serviced properly prior to the flight.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Duration</th>
<th>Landing</th>
<th>Altitude</th>
<th>Duration</th>
<th>Chase</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-41-65/Engle</td>
<td>Thu. 14 Nov. 1963</td>
<td>84.6</td>
<td>10:36</td>
<td>466.5</td>
<td>11:55</td>
<td>90,800</td>
<td>1:19</td>
<td>Rogers</td>
<td>095 — Optical degradation experiment. All ablative test materials removed from aircraft.</td>
</tr>
<tr>
<td>3-24-41/Thompson</td>
<td>Tue. 19 Nov. 1963</td>
<td>89.0</td>
<td>11:34</td>
<td>424.3</td>
<td>12:25</td>
<td>89,800</td>
<td>1:28</td>
<td>Dana</td>
<td>096 — Takeoff was delayed when an O-ring on X-15 pilot's seat was damaged when entering the cockpit. Pilot input caused left roll at launch. Inertial system failed at launch.</td>
</tr>
<tr>
<td>3-25-42/Thompson</td>
<td>Thu. 16 Jan. 1964</td>
<td>76.6</td>
<td>11:15</td>
<td>530.7</td>
<td>12:44</td>
<td>139,900</td>
<td>1:29</td>
<td>Engle</td>
<td>098 — First flight past Mach 5 and above 100,000 feet for Engle in program. Evaluated high angle-of-attack stability without SAS. Inertial platform malfunctioned at peak altitude.</td>
</tr>
<tr>
<td>1-44-70/Rushworth</td>
<td>Tue. 28 Jan. 1964</td>
<td>84.2</td>
<td>11:14</td>
<td>497.0</td>
<td>10:30</td>
<td>71,000</td>
<td>1:10</td>
<td>Dana</td>
<td>099 — Heat transfer experiment with upper vertical razor leading edge. Evaluated stability and damper-off controllability. Speed brakes difficult to open during period of highest heat. Skids coated with cermet.</td>
</tr>
</tbody>
</table>
| 1-44-70/Engle | Tue. 8 Jun. 1969 | 77.2 | 11:14 | 625.5 | 12:55 | 107,400 | 1:39 | Engle | 100 — 100th launch of the X-15 since the first flight on 8 Jun. 59. Edwards commander, General Branch, aboard B-52 as co-pilot. Evaluated stability and control using the upper speed brakes only in preparation for redesigned lower ventral to be used in scramjet program. SAS roll failed repeatedly.
Flight/Pilot: 3-26-43/Milton O. Thompson (4)  B-52/Pilots: 003/Fulton & Jones
Date: Wed. 19 Feb. 1964  Engine Run: 83.3  Takeoff: 09:16
Landing: 10:04:27.1 - Rogers  Altitude: 78,600  Duration: 1:39
Mach/mph: 5.29/3519  Distance: 151.0  Chase: Fulton & Jones
Mission: 101—First flight past Mach 5 for Thompson in program. Razor edge experiment and boundary layer noise experiment. Premature engine burnout due to a LOX line not being covered.

Flight/Pilot: 3-27-44/John B. McKay (10)  B-52/Pilots: 003/Bement & Lewis
Date: Fri. 13 Mar. 1964  Engine Run: 105.2  Takeoff: 09:01
Launch: 09:46:27.0 - Hidden Hills  Duration: 449.0  Landing: 10:13
Landing: 10:04:27.0 - Rogers  Altitude: 76,000  Duration: 1:12
Mach/mph: 5.11/3392  Distance: 151.5  Chase: Bement & Lewis
Mission: 102—First flight for McKay in X-15 no. 3. Experiments with heat transfer, skin friction, and boundary layer noise. An on-board data recorder failed due to a switch being in the wrong position.

Flight/Pilot: 3-A-71/Rushworth  Date: Tue. 17 Mar. 1964
Remarks: Computer malfunctioned.

Flight/Pilot: 1-45-72/Robert A. Rushworth (19)  B-52/Pilots: 003/Bement & Lewis
Date: Fri. 27 Mar. 1964  Engine Run: 85.0  Takeoff: 09:16
Launch: 10:10:18.0 - Delamar  Duration: 592.4  Landing: 10:30
Landing: 10:02:27.0 - Delamar  Altitude: 101,500  Duration: 2:14
Mach/mph: 5.63/3827  Distance: 228.7  Chase: Gordon/Peterson/Adams/Engle
Mission: 103—Induced-turbulence experiment tested.

Flight/Pilot: 3-A-45/McKay  Date: Tue. 31 Mar. 1964
Remarks: Inertial guidance system failure.

Date: Wed. 8 Apr. 1964  Engine Run: 79.9  Takeoff: 09:10
Launch: 10:02:27.0 - Delamar  Duration: 585.7  Landing: 10:38
Landing: 10:12:12.7 - Rogers  Altitude: 175,000  Duration: 1:28
Mach/mph: 5.01/3468  Distance: 227.2  Chase: Gordon/Thompson/Crews/Rogers
Mission: 104—Phase II optical degradation experiment tested. A small fire occurred in APU-2 due to overheating. A peroxide leak was suspected as the cause but never located in post-flight ground testing.

Flight/Pilot: 1-47-74/Robert A. Rushworth (20)  B-52/Pilots: 003/Fulton & Bock
Date: Wed. 29 Apr. 1964  Engine Run: 82.3  Takeoff: 09:09
Launch: 10:00:27.0 - Delamar  Duration: 574.6  Landing: 10:40
Landing: 10:10:16.8 - Rogers  Altitude: 101,600  Duration: 1:31
Mach/mph: 5.72/3906  Distance: 233.7  Chase: Gordon/Thompson/Crews/Rogers
Mission: 105—Phase II optical degradation experiment. Inner pane of right windshield shattered. Pilot reported smoke in cockpit. Flight attempt on previous day was canceled for weather before B-52 takeoff.

Flight/Pilot: 3-A-46/McKay  Date: Mon. 11 May 1964
Remarks: LOX tank regulator over pressurized.

Flight/Pilot: 3-28-47/John B. McKay (11)  B-52/Pilots: 003/Bement & Jones
Date: Tue. 12 May 1964  Engine Run: 108.6  Takeoff: 09:07
Launch: 09:51:46.0 - Hidden Hills  Duration: 491.3  Landing: 10:40
Landing: 09:59:57.3 - Rogers  Altitude: 72,800  Duration: 1:33
Mach/mph: 4.66/3084  Distance: 155.6  Chase: Sorlie/Peterson/Engle
Mission: 106—No velocity, altitude, or rate-of-climb information was available to the pilot because of an inertial guidance computer failure. Pitch and roll channels of SAS tripped off and could not be reengaged. Speed brakes only opened to 30 percent during high heat.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Duration</th>
<th>Landing</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-48-75/Joe H. Engle (5)</td>
<td>Tue. 19 May 1964</td>
<td>78.7</td>
<td>09:35</td>
<td>10:26:28.0 - Delamar</td>
<td>541.2</td>
<td>11:05</td>
<td>107—Phase II optical degradation experiment. Altitude buildup flight. This aircraft was used as a static display during Armed Forces Day celebrations at Edwards.</td>
</tr>
<tr>
<td>3-29-48/Milton O. Thompson (5)</td>
<td>Thu. 21 May 1964</td>
<td>42.9</td>
<td>08:58</td>
<td>09:39:34.0 - Silver</td>
<td>476.5</td>
<td>10:40</td>
<td>108—Thompson's shortest flight. Engine shut down at 41 seconds and would not re-light in two attempts. Emergency landing with no damage. Defective fuel line switch caused engine shutdown.</td>
</tr>
<tr>
<td>2-32-55/Robert A. Rushworth (21)</td>
<td>Tue. 30 Jun. 1964</td>
<td>78.2</td>
<td>08:59</td>
<td>09:34:47.0 - Hidden Hills</td>
<td>534.7</td>
<td>09:58</td>
<td>109—First flight of aircraft no. 2 since 9 Nov. 62 rollover accident at Mud Dry Lake, which led to rebuild and upgrade to X-15A-2 configuration. First flight past Mach 4 for A-2. Right roll out of trim. Right horizontal stabilizer warped. This stabilizer was exchanged with the stabilizer on X-15 no. 3.</td>
</tr>
<tr>
<td>1-49-77/John B. McKay (12)</td>
<td>Wed. 8 Jul. 1964</td>
<td>83.4</td>
<td>08:59</td>
<td>09:49:40.0 - Delamar</td>
<td>686.7</td>
<td>10:27</td>
<td>110—Stable platform power supply failed at launch so alternate profile was flown. Flight scheduled for 182,000 feet. McKay replaced Thompson, who was original pilot slated for this flight.</td>
</tr>
<tr>
<td>3-30-50/Joe H. Engle (6)</td>
<td>Wed. 8 Jul. 1964</td>
<td>78.9</td>
<td>11:59</td>
<td>13:02:28.0 - Delamar</td>
<td>596.4</td>
<td>13:45</td>
<td>111—First flight for Engle in X-15 no. 3. Flights suspended three weeks for rework required on ejection seat booms. Ablative test articles were installed on lower ventral and speed brakes. Aircraft used as static display on 2 and 3 Jun.</td>
</tr>
<tr>
<td>Flight/Pilot</td>
<td>Date</td>
<td>B-52/Pilots</td>
<td>Remarks</td>
<td></td>
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<tr>
<td>3-33-54/John B. McKay (13)</td>
<td>Wed. 26 Aug. 1964</td>
<td>003/Fulton &amp; Bement</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3-34-55/Milton O. Thompson (7)</td>
<td>Thu. 3 Sep. 1964</td>
<td>003/Bement &amp; Jones</td>
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<td></td>
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<tr>
<td>3-35-57/Joe H. Engle (8)</td>
<td>Mon. 28 Sep. 1964</td>
<td>003/Fulton &amp; Lewis</td>
<td></td>
<td></td>
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<tr>
<td>2-34-57/Robert A. Rushworth (22)</td>
<td>Tue. 29 Sep. 1964</td>
<td>008/Fulton &amp; Townsend</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3-35-57/Joe H. Engle (8)</td>
<td>Mon. 28 Sep. 1964</td>
<td>003/Fulton &amp; Lewis</td>
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<td></td>
</tr>
<tr>
<td>2-34-57/Robert A. Rushworth (23)</td>
<td>Tue. 29 Sep. 1964</td>
<td>008/Fulton &amp; Townsend</td>
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</table>

**Mission 112—** Evaluated heat transfer rates, measured airflow, and tested ablative samples.

**Mission 113—** Experienced high vibrations with speed brakes at high aerodynamic pressures.

**Mission 114—** First flight of A-2 past Mach 5. Nose gear extended after peak Mach at about Mach 4.2. Chase aircraft reported tires appeared badly burned, but Rushworth stayed with aircraft. Tires failed 300 feet after touchdown and remainder of the 5,630 foot rollout was on the rims.

**Mission 115—** Highest Mach number attained by McKay in program. Heat transfer, skin friction, and boundary layer experiments.


**Mission 117—** Ablative sample tested. Warped right stabilizer found on X-15A-2 on flight 109 and was put on X-15 no. 3. Smoke in cockpit after burnout. Inertial velocity malfunction.

**Mission 118—** Stability and control flight. First use of B-52 no. 008 in eight months and first with A-2. Nose gear scoop door came open at about Mach 4.5. Checkout of star tracker system.
Flight/Pilot: 1-A-78/McKay  Date: Fri. 2 Oct. 1964
Remarks: First flight of X-15 no. 1 since wing tip pods were modified to perform high altitude research. SAS problems.

Flight/Pilot: 1-50-79/John B. McKay (14)  B-52/Pilots: 008/Fulton & Cotton
Date: Thu. 15 Oct. 1964  Engine Run: 72.9  Takeoff: 12:31
Launch: 13:15:40.0 - Hidden Hills  Duration: 520.9  Landing: 13:50
Mach/mph: 4.56/3048  Distance: 153.5  Chase: Rogers/Peterson/Knight50
Mission: 119—Flight fifty for X-15 no. 1. First flight with 200-pound wing tip pods installed. Micrometeorite experiment opened while going transonic at High-Key point. Evaluated inertial guidance system that was to have been used in X-20 Dyna-Soar program and was later incorporated into X-15.

Flight/Pilot: 3-C-58/Thompson  Date: Thu. 29 Oct. 1964
Remarks: Scheduled captive flight to verify nose gear modifications. Flight was flown late in the day and did not return until just before sunset at 4:53 p.m.

Flight/Pilot: 2-C-59/McKay  Date: Fri. 6 Nov. 1964
Remarks: Scheduled captive flight to check landing gear modification.

Flight/Pilot: 1-A-80/Engle  Date: Fri. 4 Dec. 1964

Flight/Pilot: 3-37-60/Milton O. Thompson (9)  B-52/Pilots: 008/Fulton & Lewis
Date: Wed. 9 Dec. 1964  Engine Run: 101.4  Takeoff: 09:56
Launch: 10:36:17.0 - Delamar  Duration: 514.8  Landing: 12:42
Landing: 10:42:42.7 - Rogers  Altitude: 87,200  Duration: 1:12
Mach/mph: 4.66/3089  Distance: 142.1  Chase: Sorlie/McKay/Parsons/Rogers
Mission: 121—First launch for McKay in X-15A-2. Same aircraft that rolled over on McKay when crash landing on flight 074, 9 Nov. 62. Evaluated stability and control. Star tracker experiment. Landing gear checkout after cable pull was modified by shortening from 13.75 inches to 11 inches.
Flight/Pilot: 3-38-61/Robert A. Rushworth (24)  
B-52/Pilots: 003/Fulton & Bock  
Date: Tue. 22 Dec. 1964  
Engine Run: 88.0  
Runway: 003  
Takeoff: 09:54  
Launch: 10:44:52.0 - Hidden Hills  
Duration: 469.9  
Landing: 11:08  
Altitude: 86,200  
Mach/mph: 5.55/3593  
Mission: 124—Rushworth experienced continual roll oscillations after launch. He stated that nothing on the flight appeared normal. Originally scheduled to land on runway 23 but was unavailable. Changing runways forced a high crosswind landing that nearly overloaded the landing struts. Ablative samples tested.

Flight/Pilot: 3-39-62/Milton O. Thompson (10)  
B-52/Pilots: 003/Bement & Fulton  
Date: Wed. 13 Jan. 1965  
Engine Run: 98.5  
Takeoff: 10:03  
Launch: 10:51:06.7 - Hidden Hills  
Duration: 407.6  
Landing: 11:15  
Altitude: 99,400  
Mach/mph: 5.48/3712  
Distance: 147.7  
Chase: Smith/Dana/Rushworth  
Mission: 125—Highest Mach number attained by Thompson in program. Gathered data on heat transfer, boundary layer noise, and skin friction. Roll damper malfunctioned during pull-up/roll maneuver.

Flight/Pilot: 1-A-82/McKay  
Date: Tue. 26 Jan. 1965  
Remarks: Inertial system malfunctioned.

Flight/Pilot: 3-40-63/Joe H. Engle (10)  
B-52/Pilots: 008/Fulton & Bement  
Date: Tue. 2 Feb. 1965  
Engine Run: 81.4  
Takeoff: 12:00  
Launch: 12:50:14.6 - Delamar  
Duration: 598.3  
Landing: 13:15  
Altitude: 98,200  
Mach/mph: 5.71/3885  
Distance: 230.6  
Chase: Sorlie/Peterson/Stroface/Rushworth  

Flight/Pilot: 2-C-61/Rushworth  
Date: Mon. 15 Feb. 1965  
Remarks: Scheduled captive flight to check out modifications to main landing gear. Supposed to photograph gear deployment but failed to get it, so a second flight was scheduled later that same day.

Flight/Pilot: 2-C-62/Rushworth  
Date: Mon. 15 Feb. 1965  
Remarks: Scheduled captive flight to check out modifications to main landing gear. Photography successful on second attempt that day.

Flight/Pilot: 1-52-85/John B. McKay (16)  
B-52/Pilots: 008/Fulton & Bock  
Date: Fri. 26 Feb. 1965  
Engine Run: 83.2  
Takeoff: 10:57  
Launch: 11:45:55.0 - Delamar  
Duration: 566.0  
Landing: 12:16  
Altitude: 153,600  
Mach/mph: 5.40/3750  
Distance: 236.9  
Chase: Knight/Peterson/Stroface/Engle  
Flight/Pilot: 1-53-86/Robert A. Rushworth (26)  B-52/Pilots: 008/Fulton & Bock
Date: Fri. 26 Mar. 1965  Engine Run: 79.6  Takeoff: 10:16
Launch: 11:01:59.2 - Delamar  Duration: 664.3  Landing: 11:44
Landing: 11:13:05.5 - Rogers  Altitude: 101,900  Duration: 1:28
Mach/mph: 5.17/3580  Distance: 230.8  Chase: Engle/Dana/Gentry/Knight
Mission: 129—Infrared scanner photography experiment and inertial guidance system checked out.

Flight/Pilot: 3-41-64/Joe H. Engle (11)  B-52/Pilots: 008/Fulton & Cotton
Date: Fri. 23 Apr. 1965  Engine Run: 91.4  Takeoff: 09:04
Launch: 09:44:16.7 - Hidden Hills  Duration: 462.1  Landing: 12:45
Landing: 09:51:58.8 - Rogers  Altitude: 79,700  Duration: 1:09
Mach/mph: 4.80/3273  Distance: 148.7  Chase: Rushworth/McKay/Knight
Mission: 130—Heat transfer and boundary layer noise experiments. Evaluated ablative test samples.

Flight/Pilot: 2-37-64/John B. McKay (17)  B-52/Pilots: 008/Bock & Townsend
Date: Wed. 28 Apr. 1965  Engine Run: 78.9  Takeoff: 11:28
Launch: 12:26:20.9 - Hidden Hills  Duration: 472.5  Landing: 12:45
Landing: 12:34:13.4 - Rogers  Altitude: 92,600  Duration: 1:17
Mach/mph: 4.80/3273  Distance: 154.1  Chase: Sorlie/Thompson/Engle

Flight/Pilot: 1-A-87/Thompson  Date: Tue. 11 May 1965

Flight/Pilot: 2-A-65/McKay  Date: Thu. 13 May 1965
Remarks: Cabin could not be pressurized.

Flight/Pilot: 2-38-66/John B. McKay (18)  B-52/Pilots: 008/Fulton & Jones
Date: Tue. 18 May 1965  Engine Run: 78.9  Takeoff: 09:06
Launch: 09:56:38.0 - Mud  Duration: 582.0  Landing: 10:35
Landing: 10:06:20.0 - Rogers  Altitude: 102,100  Duration: 1:29
Mach/mph: 5.17/3541  Distance: 215.9  Chase: Sorlie/Mallick/Gentry/Engle

Flight/Pilot: 1-54-88/Milton O. Thompson (11)  B-52/Pilots: 008/Fulton & Jones
Date: Tue. 25 May 1965  Engine Run: 81.1  Takeoff: 09:22
Launch: 10:12:07.5 - Mud  Duration: 542.5  Landing: 10:35
Mach/mph: 4.87/3418  Distance: 211.9  Chase: Rushworth/Peterson/Stroface/Knight
Mission: 133—First flight by Thompson above 100,000 feet in program. MIT scanner experiment. Originally scheduled for launch at Delamar, but weather conditions deteriorated and forced a change to Mud.

Flight/Pilot: 3-42-65/Joe H. Engle (12)  B-52/Pilots: 008/Fulton & Jones
Date: Fri. 28 May 1965  Engine Run: 82.5  Takeoff: 08:56
Launch: 09:43:51.0 - Delamar  Duration: 575.4  Landing: 10:24
Landing: 09:53:26.4 - Rogers  Altitude: 209,600  Duration: 1:28
Mach/mph: 5.17/3754  Distance: 243.4  Chase: Sorlie/Haise/Parsons/Knight
Mission: 134—First flight by Engle above 200,000 feet in program. Langley's Horizon Scanner mounted above engine exhaust on upper ventral. Northrop Space Lab Radiometer, boundary layer noise experiments.

Flight/Pilot: 2-A-67/McKay  Date: Fri. 4 Jun. 1965
Remarks: Cabin pressure regulator failure. Scheduled star tracker checkout.

Flight/Pilot: 2-A-68/McKay  Date: Tue. 8 Jun. 1965
Remarks: Helium source pressure lost.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Duration</th>
<th>Landing</th>
<th>Altitude</th>
<th>Duration</th>
<th>Mach/mph</th>
<th>Distance</th>
<th>Chase</th>
<th>Mission</th>
</tr>
</thead>
</table>
| 1-55-89/Milton O. Thompson (12) | Thu. 17 Jun. 1965 | 85.3 | 08:58 | 09:44:39.9 - Delamar | 587.7 | 10:15 | 155,900 | 1:17 | 5.64/3938 | 245.0 | Rushworth/Peterson/Gentry/Knight | 137—Evaluated star tracker and landing gear. Originally scheduled for Mud launch but had to be changed to Delamar due to thunderstorms.
| 2-A-71/McKay | Fri. 2 Jul. 1965 | 79.2 | 08:29 | 09:16:55.8 - Delamar | 573.4 | 09:50 | 212,600 | 1:21 | 5.19/3659 | 245.5 | Knight/Dana/Whelan/Gentry | 139—First flight for McKay above 200,000 feet in program. RAS failed to operate. Evaluated landing dynamics. Star Tracker experiment worked but no data was taken due to excessive roll and yaw.
| 3-A-68/Rushworth | Tue. 13 Jul. 1965 | 79.2 | 09:08 | 09:59:28.8 - Delamar | 634.5 | 10:38 | 105,400 | 1:30 | 5.40/3670 | 236.4 | Knight/Dana/Whelan/Gentry | 140—Boundary layer noise experiment. Experiments in tail cone removed prior to flight. APU-1 helium fill valve was knocked off by pilot during cockpit entry. Valve was replaced and flight went ahead.

Flight/Pilot: 3-45-69/Robert A. Rushworth (27) | B-52/Pilots: 008/Jones & Andonian
Date: Wed. 20 Jul. 1965 | Engine Run: 79.2 | Takeoff: 09:08 | Launch: 09:59:28.8 - Delamar | Duration: 634.5 | Landing: 10:38 | Altitude: 105,400 | Duration: 1:30 | Chase: Knight/Dana/Whelan/Gentry | Mission: 140—Boundary layer noise experiment. Experiments in tail cone removed prior to flight. APU-1 helium fill valve was knocked off by pilot during cockpit entry. Valve was replaced and flight went ahead.
Flight/Pilot: 1-A-90/Thompson  Date: Fri. 23 Jul. 1965
Remarks: Pressure suit face plate leaked, causing a pipe organ sound to the pilot. Infrared experiment.

Flight/Pilot: 1-A-91/Thompson  Date: Tue. 27 Jul. 1965

Remarks: Q-ball nose beta mechanism was wired in reverse causing the system to malfunction.

Flight/Pilot: 2-41-73/Robert A. Rushworth  B-52/Pilots: 008/Bock & Andonian
Date: Tue. 3 Aug. 1965  Engine Run: 82.4  Takeoff: 11:51
Launch: 12:40:05.7 - Delamar  Duration: 572.0  Landing: 13:05
Landing: 208,700  Duration: 1:14
Machine/mph: 5.16/3602  Distance: 249.2  Chase: Sorlie/Dana/Whelan/Stroface

Flight/Pilot: 1-56-93/Milton O. Thompson  B-52/Pilots: 008/Fulton & Andonian
Date: Fri. 6 Aug. 1965  Engine Run: 83.0  Takeoff: 08:51
Launch: 09:41:46.7 - Delamar  Duration: 613.0  Landing: 10:36
Landing: 103,200  Duration: 1:45
Machine/mph: 5.15/3534  Distance: 235.6  Chase: Rushworth/Haise/Livingston/Engle
Mission: 142—Stability and control tests. SAS wiring was completely replaced prior to flight. Q-ball system replaced because unit was required on A-2, and another unit was unavailable. Space Lab Infrared Scanner experiment. Engine cockpit timer failed to operate after launch.

Flight/Pilot: 3-46-70/Joe H. Engle  B-52/Pilots: 003/Jones & Andonian
Date: Tue. 10 Aug. 1965  Engine Run: 82.1  Takeoff: 10:28
Launch: 11:24:21.7 - Delamar  Duration: 591.8  Landing: 11:51
Landing: 271,000  Duration: 1:23
Machine/mph: 5.20/3550  Distance: 246.9  Chase: Sorlie/Dana/Gentry/Stroface

Flight/Pilot: 1-A-94/Thompson  Date: Fri. 20 Aug. 1965
Remarks: Cabin pressure regulator failure.

Flight/Pilot: 1-A-95/Thompson  Date: Tue. 24 Aug. 1965
Remarks: Inertial system abort.

Flight/Pilot: 1-57-96/Milton O. Thompson  B-52/Pilots: 003/Fulton & Cotton
Date: Wed. 25 Aug. 1965  Engine Run: 84.5  Takeoff: 09:05
Launch: 09:54:46.8 - Delamar  Duration: 531.5  Landing: 10:38
Landing: 214,100  Duration: 1:33
Machine/mph: 5.11/3604  Distance: 237.1  Chase: Rushworth/McKay/Merrett/Parsons
Mission: 144—First flight by Thompson above 200,000 feet in program, as well as highest altitude and farthest flight. Thompson's final flight in the X-15 program. Horizon scanner experiment. Poor pitch control during landing due to position of center of gravity.

Flight/Pilot: 3-47-71/Robert A. Rushworth  B-52/Pilots: 008/Cotton & Bock
Date: Thu. 26 Aug. 1965  Engine Run: 78.6  Takeoff: 09:01
Launch: 09:52:12.1 - Delamar  Duration: 627.6  Landing: 10:30
Landing: 239,600  Duration: 1:29
Machine/mph: 4.79/3372  Distance: 230.0  Chase: Sorlie/Haise/Livingston/Parsons
Mission: 145—Boundary layer noise and radiometer experiments. Flight slipped due to wet lakebeds, then slipped again due to conflict with flight 144.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>B-52/Pilots</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Duration</th>
<th>Landing</th>
<th>Duration</th>
<th>Mach/mph</th>
<th>Distance</th>
<th>Chase</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-42-74/John B. McKay</td>
<td>008/Bock &amp; Jones</td>
<td>Thu. 2 Sep. 1965</td>
<td>84.0</td>
<td>08:52</td>
<td>09:40:05.6 - Delamar</td>
<td>549.8</td>
<td>10:15</td>
<td>1:23</td>
<td>5.16/3570</td>
<td>242.4</td>
<td>Rushworth/Peterson/Stroface/Knight</td>
</tr>
<tr>
<td>1-58-97/Robert A. Rushworth</td>
<td>008/Bock &amp; Fulton</td>
<td>Thu. 9 Sep. 1965</td>
<td>82.1</td>
<td>09:10</td>
<td>10:07:00.9 - Rogers</td>
<td>670.2</td>
<td>10:40</td>
<td>1:30</td>
<td>5.25/3534</td>
<td>239.2</td>
<td>Wood/Peterson/Livingston/Parsons</td>
</tr>
<tr>
<td>3-48-72/John B. McKay</td>
<td>008/Bock &amp; Jones</td>
<td>Tue. 14 Sep. 1965</td>
<td>80.9</td>
<td>09:12</td>
<td>10:11:04.1 - Rogers</td>
<td>598.1</td>
<td>10:39</td>
<td>1:27</td>
<td>5.03/3515</td>
<td>239.2</td>
<td>Rushworth/Haise/Evenson/Knight</td>
</tr>
<tr>
<td>1-59-98/Robert A. Rushworth</td>
<td>003/Bock &amp; Jones</td>
<td>Tue. 22 Sep. 1965</td>
<td>82.0</td>
<td>09:17</td>
<td>10:07:37.6 - Delamar</td>
<td>653.9</td>
<td>11:38</td>
<td>1:38</td>
<td>5.33/3732</td>
<td>290.5</td>
<td>Sorlie/Dana/Adams/Engle</td>
</tr>
<tr>
<td>3-49-73/John B. McKay</td>
<td>003/Bock &amp; Andonian</td>
<td>Tue. 28 Sep. 1965</td>
<td>80.8</td>
<td>09:24</td>
<td>10:15:20.9 - Delamar</td>
<td>716.6</td>
<td>10:42</td>
<td>1:18</td>
<td>5.33/3732</td>
<td>290.5</td>
<td>Rushworth/Peterson/Haise/Engle</td>
</tr>
<tr>
<td>1-60-99/William J. Knight</td>
<td>003/Bock &amp; Fulton</td>
<td>Thu. 30 Sep. 1965</td>
<td>127.4</td>
<td>08:55</td>
<td>09:43:55.3 - Hidden Hills</td>
<td>502.6</td>
<td>10:10</td>
<td>1:15</td>
<td>4.06/2718</td>
<td>143.7</td>
<td>Sorlie/Peterson/Engle</td>
</tr>
<tr>
<td>1-A-100/Engle</td>
<td></td>
<td>Fri. 8 Oct. 1965</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>BCS leak. 100th time X-15 no. 1 carried aloft. Only X-15 to achieve 100 times aloft.</td>
</tr>
<tr>
<td>3-50-74/William J. Knight</td>
<td>008/Jones &amp; Fulton</td>
<td>Tue. 12 Oct. 1965</td>
<td>86.2</td>
<td>09:02</td>
<td>09:43:13.2 - Hidden Hills</td>
<td>427.8</td>
<td>10:22</td>
<td>1:20</td>
<td>4.62/3108</td>
<td>140.7</td>
<td>Sorlie/Haise/Engle</td>
</tr>
<tr>
<td>152—First flight for Knight in X-15 no. 3. Launch number 50 for aircraft no. 3. Shortest flight by Knight. APU-2 shutdown after launch and was reset ninety seconds after burnout.</td>
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</tr>
</tbody>
</table>
Date: Thu. 14 Oct. 1965  
Launch: 12:46:32.6 - Delamar  
Landing: 12:55:1.0 - Rogers  
Mach/mph: 5.08/3554  
Mission: 153—Final flight in program for Engle. MIT Horizon Photometer experiment and Pace transducer tests. Data timer failure. Yaw damper tripped out twice and was reset successfully.

Flight/Pilot: 3-51-75/ John B. McKay (24)  
Date: Wed. 27 Oct. 1965  
Launch: 10:49:10.3 - Delamar  
Landing: 11:01:04.0 - Rogers  
Mach/mph: 5.06/3519  
Mission: 154—Boundary layer noise, infrared scanner, and horizontal stabilizer loads experiments.

Flight/Pilot: 1-A-102/Dana  
Date: Tue. 2 Nov. 1965  
Remarks: Cabin pressure regulator malfunctioned and lost telemetry. First attempted launch for Dana.

Flight/Pilot: 2-43-75/Robert A. Rushworth (32)  
Date: Wed. 3 Nov. 1965  
Launch: 09:09:10.7 - Cuddeback  
Landing: 09:14:12.3 - Rogers  
Mach/mph: 2.31/1500  
Mission: 155—First time A-2 is configured with external tanks for flight (tanks were empty). Tanks separated properly. Ammonia tank landed intact, but LOX tank was destroyed on impact when parachute failed. Only external tank not recovered intact. Lower ventral installed for flight but lost when parachute failed to deploy. First use of lower ventral since flight 070. First and only flight that launched from Cuddeback.

Flight/Pilot: 1-62-103/ William H. Dana (1)  
Date: Thu. 4 Nov. 1965  
Launch: 09:11:31.0 - Hidden Hills  
Landing: 09:20:16.1 - Rogers  
Mach/mph: 4.22/2765  
Mission: 156—First flight for Dana in program and first past Mach 4. Engine took three attempts and nearly 25 seconds before ignition. Weather problems put the next attempted flight off for more than five months. The next successful launch did not occur for six months and two days.

Flight/Pilot: 2-A-76/Rushworth  
Date: Wed. 13 Apr. 1966  
Remarks: Inertial system failed prior to launch.

Flight/Pilot: 2-A-77/Rushworth  
Date: Wed. 20 Apr. 1966  
Remarks: Yaw channel of SAS failed to engage after APU start.

Flight/Pilot: 2-A-78/Rushworth  
Date: Thu. 5 May 1966  
Remarks: Yaw channel of SAS failed to engage after APU start.

Flight/Pilot: 1-63-104/John B. McKay (25)  
Date: Fri. 6 May 1966  
Launch: 13:30:12.8 - Delamar  
Landing: 13:36:15.5 - Delamar  
Mach/mph: 2.21/1434  
Mission: 157—Premature engine shutdown at 35 seconds. Ruptured turbo pump case. Window shade test flown over left window. Canopy damaged after ejection on landing. Aircraft went off lakebed before coming to a stop, but there was no damage to the airframe except for the canopy.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Duration</th>
<th>Landing</th>
<th>Altitude</th>
<th>Distance</th>
<th>Mach/mph</th>
<th>Chase</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-44-79/Robert A. Rushworth (33)</td>
<td>Wed. 18 May 1966</td>
<td>81.9</td>
<td>09:33</td>
<td>10:24:00.3 - Mud</td>
<td>536.8</td>
<td>11:00</td>
<td>99,000</td>
<td>211.7</td>
<td>5.43/3689</td>
<td>Fulton &amp; Doryland</td>
<td></td>
</tr>
<tr>
<td>2-45-81/Robert A. Rushworth (34)</td>
<td>Fri. 1 Jul. 1966</td>
<td>33.2</td>
<td>10:12</td>
<td>11:02:36.1 - Mud</td>
<td>268.6</td>
<td>11:55</td>
<td>44,800</td>
<td>35.2</td>
<td>1.70/1061</td>
<td>Rogers</td>
<td></td>
</tr>
<tr>
<td>2-45-81/Robert A. Rushworth (34)</td>
<td>Fri. 1 Jul. 1966</td>
<td>33.2</td>
<td>10:12</td>
<td>11:02:36.1 - Mud</td>
<td>268.6</td>
<td>11:55</td>
<td>44,800</td>
<td>35.2</td>
<td>1.70/1061</td>
<td>Rogers</td>
<td></td>
</tr>
</tbody>
</table>

**Mission:** 158—Ablative test on nose gear door, horizontal stabilizer, and lower fixed ventral. Fuel leak through jettison tube caused premature burnout of the engine, although planned Mach number was reached.

**Flight/Pilot:** 1-A-105/McKay | Date: Thu. 2 Jun. 1966 | Remarks: Inertial system malfunctioned. Six days after this flight, on 8 June, former X-15 pilot Joseph A. Walker was killed in a mid-air collision between his F-104A and XB-70A no. 2.

**Flight/Pilot:** 1-A-106/McKay | Date: Fri. 10 Jun. 1966 | Remarks: Inertial system malfunctioned.

**Flight/Pilot:** 3-A-76/Dana | Date: Mon. 20 Jun. 1966 | Remarks: Inertial system malfunctioned.

**Flight/Pilot:** 3-A-77/Dana | Date: Wed. 13 Jul. 1966 | Remarks: Inertial system malfunctioned.

**Flight/Pilot:** 2-C-80/Rushworth | Date: Mon. 27 Jun. 1966 | Remarks: Scheduled captive flight to check out the fully-loaded external fuel tanks.

**Flight/Pilot:** 2-45-81/Robert A. Rushworth (34) | Date: Fri. 1 Jul. 1966 | Engine Run: 33.2 | Takeoff: 10:12 | Launch: 11:02:36.1 - Mud | Duration: 268.6 | Landing: 11:55 | Altitude: 44,800 | Distance: 35.2 | Mach/mph: 1.70/1061 | Chase: Knight/Peterson/Curtis/Sorlie |

**Mission:** 159—First flight with full external fuel tanks. Telemetry indicated no fuel flow from external tanks after launch. Bad indicator was at fault. Tanks separated under worst conditions (half full) but there were no problems and the tanks were recovered intact. The tank parachutes failed to separate on touchdown, dragging the tanks across the ground. Shortest and last flight for Rushworth in program. On return of the X-15 from Mud lake on 6 July the wingtip was clipped by a camper truck as the truck passed the convoy on the highway. Truck owner attempted to sue for damages but was unsuccessful.

**Flight/Pilot:** 1-64-107/William J. Knight (3) | Date: Tue. 12 Jul. 1966 | Engine Run: 83.2 | Takeoff: 10:44 | Launch: 11:32:15.7 - Mud | Duration: 516.0 | Landing: 12:25 | Altitude: 130,000 | Distance: 209.8 | Mach/mph: 5.34/3652 | Chase: Curtis/Dana/Hoag/Gentry |

**Mission:** 160—First flight for Knight past Mach 5 and above 100,000 feet. Landing was shorter than normal. Nose strut was bent on landing.

**Flight/Pilot:** 3-A-77/Dana | Date: Wed. 13 Jul. 1966 | Remarks: Inertial system malfunctioned.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Duration</th>
<th>Landing</th>
<th>Altitude</th>
<th>Mach/mph</th>
<th>Distance</th>
<th>Chase</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-46-83/William J. Knight (4)</td>
<td>Thu. 21 Jul. 1966</td>
<td>81.3</td>
<td>11:09</td>
<td>12:02:03.1 - Delamar</td>
<td>531.0</td>
<td>12:30</td>
<td>192,300</td>
<td>5.12/3568</td>
<td>231.9</td>
<td>Curtis/Manke/Sorlie/Gentry/Peterson</td>
<td>162—First flight for Knight in X-15A-2. Right roll was out of trim. Star tracker experiment.</td>
</tr>
<tr>
<td>1-65-108/John B. McKay (26)</td>
<td>Thu. 28 Jul. 1966</td>
<td>85.4</td>
<td>09:08</td>
<td>10:01:12.1 - Delamar</td>
<td>583.0</td>
<td>11:05</td>
<td>241,800</td>
<td>5.19/3702</td>
<td>253.4</td>
<td>Curtis/Peterson/Sorlie/Gentry</td>
<td>163—Computer malfunctioned due to electrical transients on alternator-2. Precise launch schedule was maintained to simulate WTR missile tracking with experiment on later flights.</td>
</tr>
<tr>
<td>2-47-84/William J. Knight (5)</td>
<td>Wed. 3 Aug. 1966</td>
<td>81.8</td>
<td>07:54</td>
<td>08:45:26.3 - Delamar</td>
<td>545.5</td>
<td>09:24</td>
<td>249,000</td>
<td>5.03/3440</td>
<td>231.1</td>
<td>Curtis/Manke/Parsons/Sorlie</td>
<td>164—First flight for Knight above 200,000 feet in program. Inertial altitude incorrect throughout flight. Star tracker experiment. Engine thrust misalignment.</td>
</tr>
<tr>
<td>3-53-79/William H. Dana (3)</td>
<td>Thu. 4 Aug. 1966</td>
<td>78.9</td>
<td>09:06</td>
<td>09:06:43.7 - Mud</td>
<td>508.0</td>
<td>10:45</td>
<td>132,700</td>
<td>5.34/3693</td>
<td>212.4</td>
<td>Curtis/Manke/Parsons/Gentry</td>
<td>165—First flight for Dana above 100,000 feet and Mach 5. Boundary layer noise experiment. Tail loads data. Bug eye camera installed to monitor third skid on lower ventral.</td>
</tr>
<tr>
<td>1-A-109/McKay</td>
<td>Tue. 9 Aug. 1966</td>
<td>81.8</td>
<td>07:54</td>
<td>09:06:43.7 - Mud</td>
<td>508.0</td>
<td>10:45</td>
<td>249,000</td>
<td>5.34/3693</td>
<td>212.4</td>
<td>Curtis/Manke/Parsons/Gentry</td>
<td></td>
</tr>
<tr>
<td>1-A-110/McKay</td>
<td>Wed. 10 Aug. 1966</td>
<td>78.9</td>
<td>09:06</td>
<td>09:06:43.7 - Mud</td>
<td>508.0</td>
<td>10:45</td>
<td>249,000</td>
<td>5.34/3693</td>
<td>212.4</td>
<td>Curtis/Manke/Parsons/Gentry</td>
<td></td>
</tr>
<tr>
<td>1-66-111/John B. McKay (27)</td>
<td>Thu. 11 Aug. 1966</td>
<td>84.8</td>
<td>08:53</td>
<td>09:44:13.1 - Delamar</td>
<td>562.2</td>
<td>10:19</td>
<td>251,000</td>
<td>5.21/3607</td>
<td>239.5</td>
<td>Sorlie/Manke/Evenson/Gentry</td>
<td>166—Highest dynamic pressure (2,050 psf) attained in program. Electrical power transients caused intermittent SAS. High crosswind caused the aircraft to swing sharply to the left on landing.</td>
</tr>
<tr>
<td>3-54-80/William H. Dana (4)</td>
<td>Fri. 19 Aug. 1966</td>
<td>75.8</td>
<td>09:03</td>
<td>10:04:35.7 - Delamar</td>
<td>573.1</td>
<td>10:45</td>
<td>178,000</td>
<td>5.20/3607</td>
<td>241.6</td>
<td>Sorlie/Mallick/Smith/Adams</td>
<td>168—Altitude buildup flight for pilot. Boundary layer noise experiment.</td>
</tr>
</tbody>
</table>
Mission: 169—Telemetry lost five minutes after launch. After this flight the wing tip pods were removed from X-15 no. 1 until late in the program, after the loss of X-15 no. 3 on flight 191. Cockpit system displays degraded during reentry at 80,000 feet through landing due to a computer program malfunction.

Mission: 170—First flight with the Maurer camera system. Ventral parachute deployed prior to jettison and ventral was severely damaged after jettison and subsequent impact.

Mission: 171—First flight launched from Smith Ranch Dry Lake for X-15 no. 1. Last flight for McKay in program. Engine shut down prematurely at 45 seconds. Fuel tank regulator malfunctioned, causing an indication of low fuel line pressure. Nose wheel tire punctured by nail on lakebed runway.

Mission: 172—First flight for Dana above 200,000 feet in program. X-15 no. 1 tip pods installed on X-15 no. 3. Third skid did not deploy on landing. Energy management system computer was too cold to turn on. Engine thrust misalignment caused nose right yaw during boost.

<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>3-56-83/Dana</td>
<td>Tue. 1 Nov. 1966</td>
<td>First flight for Dana above 300,000 feet. Dana becomes sixth X-15 pilot</td>
</tr>
<tr>
<td>2-50-89/Knight</td>
<td>Fri. 18 Nov. 1966</td>
<td>Hadley transformer malfunctioned.</td>
</tr>
<tr>
<td>3-57-86/Adams</td>
<td>Wed. 22 Mar. 1967</td>
<td>Radio malfunctioned at launch and contact was not regained until Cuddeback.</td>
</tr>
<tr>
<td>1-70-119/Adams</td>
<td>Wed. 22 Mar. 1967</td>
<td>Highest Mach attained by Adams, and first past Mach 5 and above 100,000 feet.</td>
</tr>
</tbody>
</table>

**Flight/Pilot: 3-A-84/Dana**  
**Date:** Fri. 18 Nov. 1966  
**Mission:** 174—First flight for Dana above 300,000 feet. Dana becomes sixth X-15 pilot to achieve astronaut qualification. Highest altitude attained by Dana. Checklist knocked loose at peak altitude. Micrometeorite experiment did not cycle. Last time an X-15 would fly above 300,000 feet.

**Flight/Pilot: 3-A-85/Adams**  
**Date:** Wed. 23 Nov. 1966  
**Mission:** 176—Radio malfunctioned at launch and contact was not regained until Cuddeback.

**Flight/Pilot: 1-A-117/Adams**  
**Date:** Wed. 15 Mar. 1967  
**Remarks:** Scheduled captive flight for thermocouple environmental checkout. Weather problems canceled all X-15 flights for nearly three months.

**Flight/Pilot: 1-A-118/Adams**  
**Date:** Tue. 21 Mar. 1967  
**Remarks:** Weather abort. Radio malfunction.

**Flight/Pilot: 1-A-120/Adams**  
**Date:** Thu. 20 Apr. 1967  
**Remarks:** Weather abort. Inertial system over-cooled and the liquid nitrogen line had to be replaced with a smaller line. Flight rescheduled for after higher priority X-15 no. 3 flight.
<table>
<thead>
<tr>
<th>Flight/Pilot</th>
<th>Date</th>
<th>Engine Run</th>
<th>Takeoff</th>
<th>Launch</th>
<th>Duration</th>
<th>Landing</th>
<th>Distance</th>
<th>Chase</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-71-121/Michael J. Adams (4)</td>
<td>Fri. 28 Apr. 1967</td>
<td>82.0</td>
<td>08:30</td>
<td>09:23:32.6 - Delamar</td>
<td>556.8</td>
<td>10:30</td>
<td>5.44/3720</td>
<td>235.3</td>
<td>179—Pitch attitude malfunctioned and inertial velocity was erratic. WTR and MIT experiments checked out. WTR experiment did not deploy because minimum altitude of 170,000 feet not reached. Circuit breakers were found open on WTR experiment after flight and power diodes were burned.</td>
</tr>
<tr>
<td>2-51-92/William J. Knight (9)</td>
<td>Mon. 8 May 1967</td>
<td>76.9</td>
<td>11:45</td>
<td>12:27:38.8 - Hidden Hills</td>
<td>506.8</td>
<td>12:55</td>
<td>4.75/3193</td>
<td>166.9</td>
<td>180—Dummy scramjet mounted on modified lower ventral. Scramjet chute came off but was repairable. Final flight before full ablative installed on A-2. Eyelid tested on left window. When eyelid opened the aircraft pitched up, rolled right, and yawed right. Window fogged over after eyelid opened.</td>
</tr>
<tr>
<td>3-59-89/William H. Dana (8)</td>
<td>Wed. 17 May 1967</td>
<td>96.1</td>
<td>09:55</td>
<td>10:45:48.0 - Silver</td>
<td>415.6</td>
<td>11:22</td>
<td>4.80/3177</td>
<td>124.5</td>
<td>181—Attempted lifting body approach during glide, but did not use all the way to landing.</td>
</tr>
<tr>
<td>1-72-125/Michael J. Adams (5)</td>
<td>Thu. 15 Jun. 1967</td>
<td>81.4</td>
<td>10:10</td>
<td>11:09:28.3 - Delamar</td>
<td>551.0</td>
<td>12:00</td>
<td>5.14/3606</td>
<td>236.9</td>
<td>182—First flight for Adams above 200,000 feet, and his longest flight. Stick kicker inoperative. WTR frequency converter circuit breaker blew out at shutdown causing video recorder malfunction.</td>
</tr>
</tbody>
</table>
Flight/Pilot: 3-60-90/William H. Dana (9)  
B-52/Pilots: 008/Cotton & Sturmthal  
Date: Thu. 22 Jun. 1967  
Engine Run: 93.2  
Takeoff: 13:57  
Launch: 14:57:17.2 - Hidden Hills  
Duration: 426.3  
Landing: 15:38  
Landing: 15:04:23.5 - Hidden Hills  
Mach/mph: 5.34/3611  
Distance: 139.7  
Chase: Knight/Manke/Krier/Gentry  

Flight/Pilot: 1-73-126/William J. Knight (10)  
B-52/Pilots: 008/Reschke & Sturmthal  
Date: Thu. 29 Jun. 1967  
Engine Run: 67.6  
Takeoff: 10:22  
Launch: 11:27:51.2 - Smith Ranch  
Duration: 607.0  
Landing: 12:00  
Landing: 11:37:58.2 - Rogers  
Mach/mph: 4.23/2870  
Distance: 169.9  
Chase: Cuthill/Dana/Jackson/Evenson/Hoag  
Mission: 184—Complete electrical system failure while climbing through 107,000 feet. One APU was restarted to allow emergency landing at Mud lake with no damage. Last emergency landing of an X-15. Headrest ejected into canopy after landing. Timing should have placed landing at Grapevine.

Flight/Pilot: 3-61-91/William H. Dana (10)  
B-52/Pilots: 008/Cotton & Fulton  
Date: Thu. 20 Jul. 1967  
Engine Run: 92.1  
Takeoff: 09:19  
Launch: 10:11:00.8 - Hidden Hills  
Duration: 456.5  
Landing: 10:42  
Landing: 10:18:37.3 - Hidden Hills  
Mach/mph: 5.44/3693  
Distance: 144.7  
Chase: Adams/Krier/Davey  
Mission: 185—Boost guidance computer did not operate properly throughout flight. An incorrect memory bit was found in the computer after landing, but a power recycle cleared the problem.

Flight/Pilot: 2-C-93/Knight  
Date: Mon. 7 Aug. 1967  
Remarks: Scheduled captive flight checked effects of cold-soak with full ablative coating, dummy scramjet, and external tanks in place. External tanks removed after captive flight.

Flight/Pilot: 2-A-94/Knight  
Date: Fri. 11 Aug. 1967  
Remarks: Pilot's suit vent heater failed just before launch, causing excess chilling of windshield defrost lines, which, in turn, caused liquid nitrogen from B-52 pylon to be sprayed on X-15.

Flight/Pilot: 2-A-95/Knight  
Date: Tue. 16 Aug. 1967  
Remarks: APU-2 helium source pressure loss.

Flight/Pilot: 2-52-96/William J. Knight (11)  
B-52/Pilots: 008/Cotton & Reschke  
Date: Mon. 21 Aug. 1967  
Engine Run: 82.2  
Takeoff: 10:01  
Launch: 10:59:16.0 - Hidden Hills  
Duration: 460.0  
Landing: 11:27 (approximate)  
Landing: 11:06:56.0 - Rogers  
Mach/mph: 4.94/3368  
Distance: 157.0  
Chase: Cuthill/Evenson/Manke/Adams  
Mission: 186—First flight with full ablative coating. Dummy scramjet shape installed. Ejected too close to ground but was refurbishable. Forward quarter of right window smeared with ablative after heating.

Flight/Pilot: 3-62-92/Michael J. Adams (6)  
B-52/Pilots: 003/Bowlin & Reschke  
Date: Fri. 22 Sep. 1967  
Engine Run: 71.3  
Takeoff: 12:35  
Duration: 457.0  
Landing: 14:01  
Landing: 13:35:05.0 - Rogers  
Mach/mph: 4.63/3115  
Distance: 147.3  
Chase: Gentry/Jackson/Knight  
Flight/Pilot: 2-53-97/William J. Knight (12)  B-52/Pilots: 008/Cotton & Reschke
Date: Tue. 3 Oct. 1967 Engine Run: 140.7 Takeoff: 13:31
Launch: 14:31:50.9 - Mud Duration: 497.0 Landing: 15:20
Landing: 14:40:07.9 - Rogers Altitude: 102,100 Duration: 1:49
Mach/mph: 6.70/4520 Distance: 213.7 Chase: Cuthill/Twinting/Krier/Adams

Flight/Pilot: 3-63-94/William H. Dana (11)  B-52/Pilots: 003/Cotton & Reschke
Date: Wed. 4 Oct. 1967 Engine Run: 84.7 Takeoff: 09:12
Launch: 10:16:54.0 - Smith Ranch Duration: 646.0 Landing: 11:04
Landing: 10:27:40.0 - Rogers Altitude: 251,100 Duration: 1:52
Mach/mph: 5.53/3897 Distance: 299.8 Chase: Cuthill/Krier/Gentry/Manke
Mission: 189—Highest Mach attained by Dana. Micrometeorite system did not retract.

Flight/Pilot: 3-64-95/William J. Knight (13)  B-52/Pilots: 008/Reschke & Miller
Date: Tue. 17 Oct. 1967 Engine Run: 84.2 Takeoff: 09:41
Launch: 10:27:40.0 - Rogers Duration: 506.0 Landing: 11:50
Landing: 10:34:58.8 - Smith Ranch Altitude: 280,500 Duration: 1:47
Mach/mph: 5.53/3856 Distance: 296.5 Chase: Cuthill/Twinting/Gentry/Adams
Mission: 190—Highest altitude attained by Knight and longest flight. Knight became seventh X-15 pilot to achieve astronaut qualification. Last successful flight of X-15 no. 3. Third skid did not deploy.

Flight/Pilot: 3-A-96/Adams  B-52/Pilots: 008/Reschke & Miller

Flight/Pilot: 3-65-97/Michael J. Adams (7)  B-52/Pilots: 008/Cotton & Stroup
Date: Fri. 1 Mar. 1968 Engine Run: 65.6 Takeoff: 10:34
Launch: 11:35:46.1 - Rogers Duration: 104,500 Landing: 12:15
Landing: 11:28:11.0 - Hidden Hills Altitude: 266,000 Duration: 2:12
Mach/mph: 5.20/3570 Distance: 185.8 Chase: Cuthill/Jackson/Dana/Twinting

Flight/Pilot: 1-C-127/Dana  Date: Tue. 1 Mar. 1968
Remarks: Scheduled captive flight to check modifications after electrical failure on flight 184.

Remarks: Cabin pressurization failure and yaw channel of SAS failed pre-launch check.

Flight/Pilot: 1-A-129/Dana  Date: Tue. 27 Feb. 1968
Remarks: SAS failed pre-launch check. Metal chips found in test box after de-mating.
Flight/Pilot: 1-A-131/Dana
Date: Thu. 28 Mar. 1968
Remarks: Radio malfunctioned.

Date: Wed. 3 Apr. 1968
Remarks: Weather abort.

Flight/Pilot: 1-75-133/William H. Dana (13)  B-52/Pilots: 008/Cotton & Sturmthal
Date: Thu. 4 Apr. 1968  Engine Run: 78.8  Takeoff: 08:29
Launch: 10:02:17.1 - Delamar  Duration: 562.8  Landing: 10:43
Mach/mph: 5.27/3610  Distance: 232.8  Chase: Cuthill/Jackson/Smith/Hoag/Fulton

Flight/Pilot: 1-76-134/William J. Knight (14)  B-52/Pilots: 008/Sturmthal & Reschke
Date: Fri. 26 Apr. 1968  Engine Run: 81.5  Takeoff: 10:49
Launch: 11:51:49.8 - Delamar  Duration: 557.1  Landing: 12:45
Landing: 12:01:06.9 - Rogers  Altitude: 209,600  Duration: 1:56
Mach/mph: 5.05/3545  Distance: 237.2  Chase: Manke/Krier/Livingston/Gentry/Fulton
Mission: 194—WTR and Saturn rocket ablative tests. Wing tip pod camera used.

Flight/Pilot: 1-A-135/Dana
Date: Thu. 23 May 1968
Remarks: Weather abort.

Flight/Pilot: 1-77-136/William H. Dana (14)  B-52/Pilots: 008/Cotton & Reschke
Date: Wed. 12 Jun. 1968  Engine Run: 83.4  Takeoff: 07:19
Launch: 08:31:01.0 - Smith Ranch  Duration: 692.4  Landing: 09:24
Landing: 08:42:33.4 - Rogers  Altitude: 220,100  Duration: 2:05
Mach/mph: 5.15/3563  Distance: 294.4  Chase: Gentry/Manke/Jackson/Hoag/Fulton

Flight/Pilot: 1-A-137/Knight
Date: Mon. 15 Jul. 1968
Remarks: BCS malfunctioned. Originally scheduled for 5 July, but changed to 8 July, then 15 July, due to missile launch schedule slippage at Vandenberg AFB.

Flight/Pilot: 1-78-138/William J. Knight (15)  B-52/Pilots: 003/Sturmthal & Reschke
Date: Tue. 16 Jul. 1968  Engine Run: 80.5  Takeoff: 14:17
Launch: 15:23:06.7 - Railroad  Duration: 582.3  Landing: 16:24
Landing: 15:32:49.0 - Rogers  Altitude: 221,500  Duration: 2:07
Mach/mph: 4.79/3382  Distance: 239.8  Chase: Gentry/Manke/Cuthill/Davey/Krier
Mission: 196—First launch from Railroad Dry Lake. Hydraulic gauge malfunction during boost forced a profile change. WTR experiment not utilized due to alternate profile. Sky brightness experiment in left tip pod. Forward looking tip pod camera installed. Experienced shaking and vibration during reentry from 200,000 feet to 65,000 feet. One year from this date the Apollo 11 flight will launch to the Moon for the first lunar landing with former X-15 pilot Neil Armstrong as Commander.

Flight/Pilot: 1-79-139/William H. Dana (15)  B-52/Pilots: 003/Sturmthal & Fulton
Date: Wed. 21 Aug. 1968  Engine Run: 82.9  Takeoff: 07:52
Launch: 09:04:48.0 - Railroad  Duration: 563.0  Landing: 10:30
Landing: 09:14:11.0 - Rogers  Altitude: 267,500  Duration: 2:38
Mach/mph: 5.01/3443  Distance: 234.1  Chase: Cuthill/Krier/Hoag/Gentry/Shawler
Mission: 197—Last flight of X-15 program to exceed 50 miles. Only scheduled for 250,000 feet altitude. WTR experiment retracted by a timer due to altitude overshoot.

Flight/Pilot: 1-80-140/William J. Knight (16)  B-52/Pilots: 003/Sturmthal & Miller
Date: Fri. 13 Sep. 1968  Engine Run: 84.3  Takeoff: 10:06
Launch: 11:19:23.2 - Smith Ranch  Duration: 655.5  Landing: 12:15
Landing: 11:30:18.7 - Rogers  Altitude: 254,100  Duration: 2:09
Mach/mph: 5.37/3723  Distance: 299.8  Chase: Twinting/Manke/Shawler/Gentry/Krier
Flight/Pilot: 1-81-141/William H. Dana (16)  B-52/Pilots: 003/Sturmthal & Miller
Date: Thu. 24 Oct. 1968  Engine Run: 83.8  Takeoff: 08:56
Launch: 10:02/47.3 - Smith Ranch  Duration: 688.3  Landing: 11:02
Landing: 10:14:15.6 - Rogers  Altitude: 255,000  Duration: 2:06
Mach/mph: 5.38/3716  Distance: 297.4  Chase: Cuthill/Krier/Evenson/Hoag/Manke/Enevoldson
Mission: 199—Originally scheduled for 12 October, but slipped because of Vandenberg missile launch schedule. First time a missile launch and an X-15 launch were properly coordinated to track launch with WTR experiment. WTR experiment extended properly, but lost power. No data taken and experiment doors were closed. BCS system no. 2 never turned on. Sky brightness experiment lost power at engine shutdown due to a shorted wire. Last flight for Dana and last launch accomplished in the X-15 program.

Flight/Pilot: 1-A-142/Knight  Date: Thu. 12 Dec. 1968
Remarks: Inertial system malfunctioned. Last time that the X-15 aircraft taken aloft for attempted launch.

Flight 200
A total of eight attempts were made to launch the 200th flight. The research program was funded through 31 December 1968. All attempts to launch Flight 1-82 met with problems and the flight never occurred. Only once out of the eight attempts, on Thursday, 12 December, did the X-15 even make it off the ground before cancellation. The following sequence of events occurred during the last month of the X-15 program:

25 Nov.  X-15 no. 1 was mated to B-52 no. 008.
27 Nov.  The first flight attempt was made on Wednesday, 27 November 1968, but was canceled after pilot entry and prior to B-52 taxi. The BCS system developed a malfunction causing the right yaw rocket to steam. This was cleared, but a blower overheated causing cancellation. The X-15 was demated from B-52 no. 008 because it was committed for other testing. B-52 no. 003 was then scheduled to take the final X-15 flight, but this had to be postponed until early December because of its commitment to a flight in the lifting body program.
9 Dec.  X-15 no. 1 was mated to B-52 no. 003.
10 Dec.  Flight canceled just prior to servicing due to weather conditions.
11 Dec.  Flight again canceled for weather. An inertial guidance system malfunction was detected and repaired.
12 Dec.  X-15 was taken aloft for launch but canceled due to an inertial system malfunction and weather conditions at Railroad Valley Dry Lake (Flight 1-A-142).
13 Dec.  Flight canceled due to weather conditions. An engine governor flange was found to be leaking. Operational checks found the leak was at an acceptable rate to accomplish the flight. Weather was unacceptable to attempt any flights for the next four days.
17 Dec.  The required C-130 support aircraft was unavailable for X-15 flight operations.
18 Dec.  Flight canceled due to weather conditions.
19 Dec.  Microwave transmissions unavailable so the flight plan was changed to launch from Hidden Hills Dry Lake to obtain data from a newly-installed Autonetics experiment.
20 Dec.  The final attempt occurred on Friday, 20 December 1968. The B-52, which was ready for taxi with Pete Knight in the X-15, never left the ground because of a snowstorm at Edwards AFB. Paul Bikle, the head of NASA at Edward AFB, came on the radio from the control room to tell everyone that “Someone is trying to tell us something. It’s time to wrap up the program.” Later that day, X-15 no. 1 was taken back to the hangar and demated from B-52 no. 003 for the final time. It was prepared for storage and later shipment to the Smithsonian Institute in Washington, D.C. for permanent static display in June 1969.
7. Timeline

This timeline is a summary of major events in the X-15 program and also significant events concerning the pilots who flew the X-15. Included are other major space program and historical events.

1951

- 20 Apr. Scott Crossfield makes his first flight in a rocket plane, the XS-1.
- 27 Aug. Joe Walker makes his first flight in a rocket plane, the XS-1.

1953

- 29 May Edmund Hillary and Tenzing Norgay reach the summit of Mt. Everest.
- 20 Nov. Scott Crossfield makes the first flight by a manned aircraft to Mach 2 in the D-558, Phase 2.

1954

- 17 May Segregation ruled illegal in America.
- 9 Jul. First meeting held to discuss what will eventually become the X-15.
- 5 Oct. NACA unveils resolution for Mach 7 research aircraft.
- 9 Nov. "Memorandum of Understanding" signed between NACA, USAF, and USN for X-15 program.
- 30 Dec. Prospective contractors asked to submit proposals for the X-15 aircraft.

1955

- 4 Feb. Prospective contractors asked to submit proposals for the LR-99 rocket engine.
- 9 May NAA, Douglas, Republic, and Bell submit X-15 aircraft proposals.
- 17 Jul. Disneyland opens in Anaheim, California.
- 5 Aug. Completed evaluation report shows North American Aviation as the winning contractor.
- 8 Aug. Joe Walker jumps from X-1A just before it explodes in the bomb bay of the B-50.
- 30 Sep. North American Aviation informed it has won the X-15 design competition.
- 30 Nov. Reaction Motors design is accepted for X-15 rocket engine.
- 9 Dec. Official contract for three X-15 aircraft is executed.

1956

- 22 Mar. Jack McKay makes emergency drop in D-558, Phase 2, when an engine runs away on B-50.
- 28 May X-15 aircraft have their tail numbers assigned (56-6670, 56-6671, and 56-6672).
- 29 Jun. Interstate highway system approved.
- 7 Sep. XLR99-RM-1 rocket engine contract signed with Reaction Motors.
- 25 Sep. Trans-Atlantic telephone cable carries first telephone call between America and Europe.

1957

- 15 Aug. Neil Armstrong makes his first flight in a rocket plane, the X-1B.
- 4 Oct. Launch of first artificial Earth satellite by the Soviet Union, Sputnik 1.

1958

- 31 Jan. Launch of first artificial Earth satellite by the United States, Explorer 1.
- 3 Aug. USS Nautilus crosses the North Pole under the Arctic ice pack.
- 1 Oct. The NACA becomes the National Aeronautics and Space Administration (NASA).
- 4 Oct. First Trans-Atlantic passenger jet operations begin (BOAC).
- 15 Oct. Rollout ceremonies are held for first X-15 aircraft at NAA plant in Los Angeles, California.
- 17 Oct. X-15 no. 1 arrives at Edwards AFB.
- 10 Dec. First jet airline passenger service in America (National Airlines).

1959

- 22 Feb. First Daytona 500 stock car race.
- 27 Feb. Rollout ceremonies are held for X-15 no. 2 at North American Aviation plant in Los Angeles.
- 2 Apr. NASA selects the original seven astronauts for Project Mercury.
10 Apr. X-15 no. 2 arrives at Edwards AFB.
18 Apr. Completion of initial qualification runs on LR-99 rocket engine by Reaction Motors.
17 Sep. Flight 2-1-3: Scott Crossfield makes the first flight of X-15 no. 2 and first powered flight of the program.

1960
17 Mar. Flight 2-6-13: Scott Crossfield experiences maximum positive g (+6.0g) recorded on X-15 flight.
29 Mar. Flight 2-7-15: Scott Crossfield experiences maximum negative g (-3.0g) recorded on X-15 flight.
1 Apr. First weather satellite orbited, Tiros 1.
1 May U-2 reconnaissance aircraft flown by Francis Gary Powers shot down by Soviet Union.
8 Jun. X-15 no. 3 is severely damaged in LR-99 rocket engine ground firing explosion.
1 Jul. 50-star United States flag introduced.

1961
12 Apr. Vostok 1: Soviet launch of Yuri Gagarin as the first man to orbit the Earth.
5 May Mercury 3: Suborbital launch of Alan Shepard, who becomes the first United States man in space.
25 May President John F. Kennedy commits America to land a man on the Moon before 1970.
25 May 50-star United States flag introduced.
1962
20 Feb. Mercury 6: Launch of John Glenn, who becomes first United States man to orbit the Earth.
20 Apr. Flight 3-4-8: Neil Armstrong makes the longest flight by the X-15 at 748.7 seconds.
17 Jul. Flight 3-7-14: Robert White makes the first X-15 flight above 50 miles altitude.
18 Jul. Collier Trophy presented to Crossfield, Walker, White, and Petersen by President Kennedy.
14 Oct. First of 13 days of the Cuban Missile Crisis.
9 Nov. Flight 2-21-37: Robert White makes the first manned aircraft flight above Mach 6.
21 Nov. World premiere of the motion picture “X-15” in Washington, D. C.
20 Dec. Flight 3-1-2: Neil Armstrong makes the first flight of X-15 no. 3.

1963
13 May Construction begins on the X-15A-2 (refurbished and lengthened X-15 no. 2).
22 Aug. Flight 3-22-36: Joe Walker flies X-15 no. 3 to a record altitude of 354,200 feet (67.1 miles).
22 Nov. President John F. Kennedy is assassinated in Dallas, Texas.

1964
28 Jan. Flight 1-44-70: Robert Rushworth makes the 100th flight of the X-15 program.
7 Feb. The Beatles arrive in America.

1965

1966
8 Jun. Joseph A. Walker is killed in collision between his F-104 and the XB-70A.
12 Jul. Milt Thompson makes the first flight of the M2-F2 lifting body.
8 Sep. “Star Trek” television series premiere.
1 Nov. Flight 3-56-83: Bill Dana makes the last flight of X-15 above an altitude of 300,000 feet.
15 Dec. Walt Disney dies.

1967
27 Jan. Apollo 1 fire takes the lives of astronauts Gus Grissom, Ed White, and Roger Chaffee.
9 Nov. Apollo 4: First launch of the Saturn V space vehicle.
15 Nov. Flight 3-65-97: Michael J. Adams is killed in X-15 no. 3. Only fatality of the X-15 program.
3 Dec. First human heart transplant accomplished by Dr. Christiaan Barnard in South Africa.

1968
4 Apr. Rev. Martin Luther King, Jr. assassinated in Memphis, Tennessee.
11 Oct. Apollo 7: First manned launch of the Apollo program.
24 Oct. Flight 1-81-141: Bill Dana makes the 199th and final flight of the X-15 program.
20 Dec. Pete Knight makes the last attempted flight of the X-15 program.

1969
10 May X-15 no. 1 departs Edwards AFB to Andrews AFB on C-133 (s/n 62003)
10 Jun. X-15 no. 1 arrives at the Smithsonian Institute in Washington, D.C.
15 Aug. Woodstock rock concert takes place over three days in Bethel, New York.

1972
9 Sep. Bill Dana makes the last powered flight of a rocket plane in the X-24B lifting body.

1975

1976
17 Sep. Roll out of the Space Shuttle Enterprise.

1977

1981
12 Apr. STS-1: first launch of the Space Shuttle.
12 Nov. STS-2: Joe Engle enters space for the 4th time as commander of the Columbia.

1983
20 Sep. Decision made to write the book “The X-15 Rocket Plane, Flying the First Wings into Space.”

1985
27 Aug. STS-51I: Joe Engle enters space for the 5th, and final, time as commander of the Discovery.

1990
13 Feb. German re-unification.

1993

2004
7 May X-15 pilot William J. “Pete” Knight dies.

2006
19 Apr. X-15 pilot A. Scott Crossfield dies.

2010
8 Jul. Solar Impulse becomes first solar-powered aircraft to complete a 24 hour flight

2012
5 Aug. Mars Science Laboratory Rover Curiosity lands on Mars

2014
6 May X-15 pilot William H. Dana dies.
8. Glossary

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>APU</td>
<td>Auxiliary Power Unit.</td>
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<tr>
<td>BCS</td>
<td>Ballistic Control System. System of small steam rockets on the nose and wings of the X-15 used to control the attitude and orientation of the aircraft when outside the atmosphere (see also RCS).</td>
</tr>
<tr>
<td>EAFB</td>
<td>Edwards Air Force Base, California.</td>
</tr>
<tr>
<td>FAI</td>
<td>Fédération Aéronautique Internationale. Organization that verifies all aviation records.</td>
</tr>
<tr>
<td>High-Key</td>
<td>Point at which the X-15 starts its final descent to the lakebed for landing.</td>
</tr>
<tr>
<td>LOX</td>
<td>Liquid Oxygen.</td>
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<tr>
<td>LPO</td>
<td>Launch Panel Operator.</td>
</tr>
<tr>
<td>MACH</td>
<td>Speed of Sound.</td>
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<tr>
<td>MH-96</td>
<td>Minneapolis-Honeywell System that combined use of BCS with aerodynamic controls depending on the altitude flown at the time.</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology.</td>
</tr>
<tr>
<td>NAA</td>
<td>North American Aviation.</td>
</tr>
<tr>
<td>NACA</td>
<td>National Advisory Committee for Aeronautics.</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration.</td>
</tr>
<tr>
<td>PIO</td>
<td>Pilot Induced Oscillation.</td>
</tr>
<tr>
<td>Q-Ball</td>
<td>Nortronics Flight Path Control Sensor is installed on the nose of the X-15 to sense the attitude of the X-15 through dynamic air pressure, also known as Q.</td>
</tr>
<tr>
<td>RAS</td>
<td>Reaction Augmentation System.</td>
</tr>
<tr>
<td>RCS</td>
<td>Reaction Control System (see also BCS).</td>
</tr>
<tr>
<td>SAS</td>
<td>Stability Augmentation System.</td>
</tr>
<tr>
<td>USAF</td>
<td>United States Air Force.</td>
</tr>
<tr>
<td>USN</td>
<td>United States Navy.</td>
</tr>
<tr>
<td>WTR</td>
<td>Western Test Range. WTR is located at Vandenberg AFB on the central California coast.</td>
</tr>
<tr>
<td>XLR-11</td>
<td>Interim rocket engine used while XLR-99 engine was still in development.</td>
</tr>
<tr>
<td>XLR-99</td>
<td>Primary rocket engine used in the X-15 program.</td>
</tr>
</tbody>
</table>