PROJECT MERCURY:
TECHNICAL INFORMATION SUMMARY
OF
MERCURY-ATLAS MISSION NO. 5/9
(Capsule No. 9)

(NASA-TM-X-51302) PROJECT MERCURY:
TECHNICAL INFORMATION SUMMARY
OF
MERCURY-ATLAS MISSION 5/9 (CAPSULE NO. 9)
(NASA) 14 p

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Space Task Group
Langley Air Force Base, Virginia

Available to NASA Offices and NASA Centers Only.
TEST OBJECTIVES AND SYSTEMS PRIORITIES

Test objectives for MA-5/9.- The MA-5/9 mission will be the fifth flight of a specification Mercury capsule to be powered by an Atlas booster. The capsule will have a medium-sized primate aboard for this mission. The capsule, after insertion, will complete three orbits before reentering the earth's atmosphere and landing in a predesignated area approximately 689 nautical miles southeast of Cape Canaveral, Florida.

First-order test objectives.-

Capsule -

(1) Demonstrate the performance of the Environmental Control System by utilizing a primate during the three-orbit mission.

(2) Demonstrate satisfactory performance of the capsule systems throughout a Mercury orbital mission.

(3) Determine by detailed measurements the heating rate and the thermal effects throughout the Mercury capsule for all phases of an orbital mission.

(4) Exercise the satellite clock.

Booster - Determine the ability of the Atlas booster to release the Mercury capsule at the prescribed orbital insertion conditions.

Network - Demonstrate satisfactory performance of the Mercury Network in supporting an orbital mission.

Flight control - Demonstrate the ability of the Flight Controllers to satisfactorily monitor and control an orbital mission.

Recovery - Demonstrate the adequacy of the recovery plans for an orbital mission. Particular emphasis is required for the capsule occupant.

Second-order test objectives.-

Booster -

(1) Evaluate the performance of the Abort Sensing and Implementation System.
(2) Determine the magnitude of the sustainer/vernier residual thrust after cutoff.

(3) Obtain data on the repeatability of the performance of all Atlas missile and ground systems.

Network - Evaluate Mercury Network countdown and operational procedures.

Third-order test objectives -

Booster - Evaluate the Atlas booster with regard to engine start and potential causes for combustion instability.
## TABLE I. - NORMAL FLIGHT PLAN AND MAJOR TRAJECTORY PARAMETERS

<table>
<thead>
<tr>
<th>Event</th>
<th>Time (hr:min:sec)</th>
<th>Altitude (ft)</th>
<th>Aerodynamic velocity (ft/sec)</th>
<th>Surface range from launch (n.m.)</th>
<th>Dynamic pressure (1b/ft²)</th>
<th>Latitude (deg:min:sec)</th>
<th>Longitude (deg:min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lift-off</td>
<td>00:00:00</td>
<td>112</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Maximum dynamic pressure (exit)</td>
<td>00:01:00</td>
<td>33,880</td>
<td>1,504</td>
<td>*2 E.</td>
<td>872</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Booster engine cutoff</td>
<td>00:02:11</td>
<td>207,358</td>
<td>9,155</td>
<td>45 E.</td>
<td>20</td>
<td>26°43'11&quot; N.</td>
<td>79°43'38&quot; W.</td>
</tr>
<tr>
<td>Booster engine separation</td>
<td>00:02:14</td>
<td>218,195</td>
<td>9,228</td>
<td>49 E.</td>
<td>13</td>
<td>26°44'18&quot; N.</td>
<td>79°39'36&quot; W.</td>
</tr>
<tr>
<td>Tower jettison</td>
<td>00:02:34</td>
<td>293,581</td>
<td>9,894</td>
<td>78 E.</td>
<td>—</td>
<td>26°52'39&quot; N.</td>
<td>79°08'33&quot; W.</td>
</tr>
<tr>
<td>Sustainer engine cutoff</td>
<td>00:05:04</td>
<td>528,497</td>
<td>24,379</td>
<td>436 E.</td>
<td>—</td>
<td>30°25'41&quot; N.</td>
<td>72°31'25&quot; W.</td>
</tr>
<tr>
<td>Capsule separation</td>
<td>00:05:05</td>
<td>528,513</td>
<td>24,379</td>
<td>440 E.</td>
<td>—</td>
<td>30°26'34&quot; N.</td>
<td>72°27'00&quot; W.</td>
</tr>
<tr>
<td>Maximum altitude</td>
<td>00:50:06</td>
<td>810,710</td>
<td>24,049</td>
<td>10,669 E.</td>
<td>—</td>
<td>31°07'18&quot; S.</td>
<td>99°53'58&quot; E.</td>
</tr>
<tr>
<td>Retrorocket firing initiated</td>
<td>04:32:26</td>
<td>528,854</td>
<td>24,397</td>
<td>2,544 W.</td>
<td>—</td>
<td>32°04'08&quot; N.</td>
<td>125°40'21&quot; W.</td>
</tr>
<tr>
<td>Retrograde package jettisoned</td>
<td>04:35:26</td>
<td>518,163</td>
<td>24,055</td>
<td>2,311 W.</td>
<td>—</td>
<td>32°27'16&quot; N.</td>
<td>125°07'46&quot; W.</td>
</tr>
<tr>
<td>Reentry begins</td>
<td>04:42:49</td>
<td>286,379</td>
<td>24,300</td>
<td>159 W.</td>
<td>3</td>
<td>27°13'23&quot; N.</td>
<td>83°10'07&quot; W.</td>
</tr>
<tr>
<td>Maximum heating</td>
<td>04:45:19</td>
<td>192,092</td>
<td>20,446</td>
<td>482 E.</td>
<td>168</td>
<td>23°37'03&quot; N.</td>
<td>73°26'42&quot; W.</td>
</tr>
<tr>
<td>Maximum dynamic pressure and</td>
<td>04:46:23</td>
<td>127,299</td>
<td>9,744</td>
<td>646 E.</td>
<td>441</td>
<td>22°25'49&quot; N.</td>
<td>70°42'48&quot; W.</td>
</tr>
<tr>
<td>longitudinal acceleration</td>
<td>04:46:25</td>
<td>125,049</td>
<td>9,261</td>
<td>649 E.</td>
<td>440</td>
<td>22°24'28&quot; N.</td>
<td>70°39'48&quot; W.</td>
</tr>
<tr>
<td>Drogue chute deployed</td>
<td>04:48:49</td>
<td>21,000</td>
<td>395</td>
<td>689 E.</td>
<td>95</td>
<td>22°06'38&quot; N.</td>
<td>70°00'33&quot; W.</td>
</tr>
<tr>
<td>Main chute deployed</td>
<td>04:49:26</td>
<td>10,000</td>
<td>267</td>
<td>689 E.</td>
<td>61</td>
<td>22°06'38&quot; N.</td>
<td>70°00'33&quot; W.</td>
</tr>
<tr>
<td>Impact</td>
<td>04:54:15</td>
<td>—</td>
<td>30</td>
<td>689 E.</td>
<td>1</td>
<td>22°06'38&quot; N.</td>
<td>70°00'33&quot; W.</td>
</tr>
</tbody>
</table>

*East of launch site
## TABLE II. - NOMINAL WEIGHTS FOR THE MA-5/9 CAPSULE

<table>
<thead>
<tr>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,195 pounds</td>
<td>Gross weight at lift-off (includes adapter and escape tower)</td>
</tr>
<tr>
<td>2,924 pounds</td>
<td>Capsule weight after separation from Atlas</td>
</tr>
<tr>
<td>2,635 pounds</td>
<td>Capsule weight at start of reentry</td>
</tr>
<tr>
<td>2,347 pounds</td>
<td>Capsule flotation weight</td>
</tr>
</tbody>
</table>
Figure 1.-
Mercury-Atlas launch vehicle configuration.
LENGTH OF OVERALL CAPSULE CONFIGURATION
24.5 FEET

FIGURE 2.- CAPSULE CONFIGURATION
Figure 3.- General interior arrangement of capsule.

NOTE: ASTRONAUT IS SHOWN TO INDICATE SCALE AND RELATIVE LOCATIONS OF EQUIPMENT. FOR UNMANNED MISSIONS AND ASTRONAUTS' SPACE IS OCCUPIED BY SPECIAL INSTRUMENTATION, AND CREW SIMULATOR OR CHIMPANzee COUCH.
1. Fire booster, sustainer, and vernier engines.
2. Booster engine cuts off and separates upon GE guidance command.
3. Twenty seconds after booster engine separation (staging) fire tower ring separation bolts.
4. At tower ring separation, escape and tower jettison rockets fire to jettison tower. Landing system is armed.
5. Atlas is steered by ground guidance.
7. After longitudinal acceleration drops to 0.20g, fire posigrade rockets.
8. After 5 seconds of damping capsule rotates 180° and assumes orbit and retroattitude of -34°.
9. Retrorockets fire by satellite clock backed up by ground command.
10. Sixty seconds after retrofit, retrorocket package is jettisoned and capsule assumes reentry attitude.
11. At 0.05g damper mode and roll rate initiated.
12. Drogue parachute is deployed after reentry to stabilize capsule.
13. At 10,000 feet, drogue chute and antenna fairing are jettisoned and main chute is deployed.
14. At impact, main chute is disconnected, and pilot chute, balsa block, and dye marker are ejected.

Figure 4.- General Sequence of Events Planned for this mission.
UPON RECEIPT OF ABORT SIGNAL...

1. SHUT OFF BOOSTER, FIRE CAPSULE ADAPTER BOLTS.
2. IGNITE ESCAPE ROCKET.
3. SENSE CAPSULE ADAPTER SEPARATION.
   JETTISON RETROPACKAGE, AND
   JETTISON RETROROCKET UMBILICALS.
   a. MAXIMUM ALTITUDE SENSOR RUNS OUT,
   b. FIRE TOWER SEPARATION BOLTS.
4. SENSE TOWER RING SEPARATION,
   JETTISON TOWER AND COMMAND RATE DAMPING.
5. RATE DAMPING STOPS AT CHUTE DEPLOYMENT.

   * AUTOMATIC ENGINE CUT OFF FEATURE OF ASIS IS
   ENABLED AT $T_0 + 30$ SEC.

FIGURE 5.—GENERAL SEQUENCE OF EVENTS THAT WOULD OCCUR IF FLIGHT SHOULD BE ABORTED
BEFORE CAPSULE ESCAPE TOWER IS JETTISONED.
Figure 6. - Earth track of Mercury-Atlas 3-orbit trajectory showing locations of significant events and deployment of recovery forces.
ABORT SYSTEM

ASIS

BLOCK HOUSE
   CAPS UMBILICAL
   ATLAS UMBILICAL
   NASA R.F. LINK

NASA CONTROL CENTER
   R.F. LINK

RANGE SAFETY OFFICER
   R.F. LINK (ENGINE CUT-OFF)

TIME, SECONDS

CAPSULE UMBILICAL EJECTION
   (2° MOTION)
   (8° MOTION)
   10 SEC
   T+0 175

CAP SEp
   T+131.4 (BECO)
   T+305.2 (SECO)

FIGURE 7—ABORT CAPABILITY/AUTHORITY OF MERCURY-ATLAS.
Figure 8.—BLOCK DIAGRAM OF A-BORT SENSING AND IMPLEMENTATION SYSTEM.