

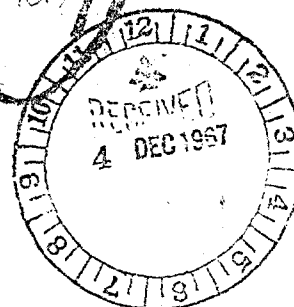
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J. P. Rich



AIR DROP TEST PLAN

REPORT F677

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GEMINI B EJECTION SEAT FUNCTIONAL TEST

AIR DROP TEST PLAN

REPORT F677

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SUBMITTED UNDER F04695-67-C-0023

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1. INTRODUCTION

1.1 PURPOSE. The objective of these tests is to demonstrate that the personnel recovery and survival equipment system conforms with McDonnell Astronautics Drawing 58A820000 under conditions simulating those existing after seat-man separation following emergency ejection. ()

1.2 GENERAL. A series of air-drop tests were performed during the NASA Gemini development program to verify sequence operation and system integrity. Because of a number of design changes of various components in the Gemini B system, a demonstration is required.

Eight tests of the Gemini B system, assembled in accordance with the applicable list presented in Section 3, will be conducted by McDonnell in conjunction with USAF 6511th Test Group, Naval Air Facility (NAF), El Centro, California. During the test operations, the leader of the McDonnell contingent will be designated as the Test Conductor (TC) and will be the proper initial channel of communication between McDonnell and 6511th Test Group.

1.3 TEST REQUIREMENTS. Eight successful tests are required as follows:

- a. One drop 90-percentile dummy
- b. One drop 10-percentile dummy
- c. Six jumps by a qualified test jumper in a pressure suit and jumper harness.

Both dummy drops and live jumps will be launched at 7,500 feet pressure altitude from a C-130 aircraft at 110 KIAS. System performance in the dummy drops must be approved by the Air Force before commencing the live jumps.

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2. DESCRIPTION OF TEST ARTICLES

2.1 COMPONENT ARRANGEMENT. The Gemini B recovery system for this test consists of a recovery parachute and survival kit mounted on a backboard, a seat pan, oxygen hoses, and an electrical harness with disconnects. The backboard is attached to the personnel harness through the harness restraint straps and a lap belt. The seat pan is attached by the lap belt, and by the oxygen hoses and electrical harness through a disconnect. The survival kit will contain a production life raft. For purposes of these tests, the live jumpers will be provided with a chest-pack reserve parachute of 28-foot diameter with automatic deployment mechanisms. The backboard and seat pan will be recovered by a 12-foot-diameter parachute mounted in a canister on the backboard and deployed by a lanyard when the backboard and seat pan are jettisoned.

2.2 NORMAL OPERATION. In the normal sequence of operations, the personnel parachute drogue mortar is armed by pulling the lanyard as the test subject is launched from the aircraft. The subject will then free fall until the drogue mortar fires (approximately 2.3 seconds), deploying the pilot chute which then extracts the personnel parachute. Also at drogue-mortar fire, a five-second pyrotechnic delay cartridge is actuated, after which a mild detonating fuse (MDF) system severs the harness restraint straps, releases the lap belt, and disconnects the oxygen hoses and electrical harness from the seat pan. The backboard and seat pan are thus disconnected from the personnel harness and fall away. As the backboard and seat pan fall away, a mooring lanyard attached to the parachute harness is extended, extracting the life raft and rucksack containing the radio beacon.

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2.3 EMERGENCY OPERATION

2.3.1 RESERVE PARACHUTE. The reserve parachute automatic deployment sequence will be set to actuate at 3,000 feet plus 5 seconds. If all events have occurred normally as described in Section 2.2, the jumper will deactivate the reserve chute automatic deployment mechanism as soon as possible after verification of a good main chute, and prior to reaching 3000 feet altitude. The minimum altitude for automatic deployment of the main personnel chute is 4,500 feet. If the chute has not deployed, the jumper will pull the drogue mortar manual lanyard. If the main chute still fails to open, the reserve chute will open automatically between 3,000 and 2,000 feet. The jumper can then jettison the backboard and seat pan per Section 2.3.2 following.

2.3.2 EMERGENCY JETTISON OF BACKBOARD AND SEAT PAN. If the personnel chute fails to open and the reserve chute is deployed, the jumper will:

- a. Aerify helmet
- b. Disconnect oxygen hoses and electrical harness at pressure-suit fittings
- c. Release lap belt
- d. Release Gemini personnel chute's koch fittings

The backboard and seat pan will fall away.

If the personnel chute opens but the backboard and seat pan fail to jettison at or above 4,300 feet altitude, the jumper will:

- a. Aerify helmet
- b. Verify full deployment of personnel chute
- c. Deactivate reserve parachute deployment mechanism
- d. Immediately after "touch down" release lap belt and canopy releases, and disconnect oxygen hoses and electrical harness.

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MODEL Gemini B**3. TEST EQUIPMENT LIST****3.1 TEST OPERATIONS**

Item	Part Number	Quantity/Test		Furnished by
		Spec. 1	Spec. 2	
Backboard assy.	58A820052	1L	1R	MAC
Seat pan assy.	58A820053	1L	1R	MAC
Jetelox disconnect	58A820054	1L	1R	MAC
Backboard contour assy.	58A820055	1	1	MAC
Survival kit container	58A820056	1L	1R	MAC
Lap belt assy.	58A820073	1L	1R	MAC
Harness reel	52-82701	1	1	MAC
Personnel parachute	52-82151	1L	1R	MAC
Pelvic block	58A820063	1	1	MAC
Suit hose assy. (inlet)	52-83704	1L	1R	MAC
Suit hose assy. (outlet)	52-83704	1L	1R	MAC
Personnel elec. leads assy.	58A721207	1L	1R	MAC
Disconnect assy. (composite)	58A820074	1L	1R	MAC
Personnel drogue mortar	58A720275	1L	1R	MAC
Personnel drogue mortar cartridge	52-52724	1	1	MAC
Personnel drogue mortar manual detonator	52-52724	1	1	MAC
Personnel drogue mortar detonator	52-72724	1	1	MAC
Explosive interconnect (MDF rigid)	52-52724	1L	1R	MAC
Explosive interconnect (MDF rigid)	52-52724	1L	1R	MAC
Explosive interconnect (MDF flexible)	52-52724	1	1	MAC
Restraint strap cutter	58A720203	1	1	MAC
MDF manifold block	58A720309	1	1	MAC
Jetelox pin	58A720414	1	1	MAC
Jetelox explosive inter- connect	52-52724	1	1	MAC
Equipment recovery chute	52-05359	1	1	MAC
Personnel harness		As required		GFE
Pressure suit		As required		GFE
Life raft		1	1	GFE

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3.2 EQUIPMENT FOR DUMMY DROP

Item	Quantity	Furnished by
90 percentile dummy with suit and helmet	1	GFE
90 percentile personnel harness	1	GFE
10 percentile dummy with suit and helmet	1	GFE
10 percentile personnel harness	1	GFE

3.3 Auxiliary Test Equipment

Item	Part Number	Quantity	Furnished by
Equipment installation fixture	52-05333	2	MAC
Test jumper seat assy	Northrop-Ventura PDS-26446	1	-
Portable coolers		4	MAC
Safety shot bags for drogue mortar slug		4	MAC
Reserve chest pack parachutes (28-foot dia. with auto deploy mechanism)		As required	AF 6511th
Vacuum pump and vacuum chamber for packing survival kit		1	MAC
Beam balance scale to weigh life raft inflation bottles		1	AF 6511th
Compressed CO ₂ for life raft bottles			AF 6511th
Liquid oxygen for pressure suit cooling			AF 6511th

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4. INSTRUMENTATION

4.1 PHOTOGRAPHIC RECORDS

4.1.1 ASKANIA AND CONTRAVES CINETHEODOLITE CAMERAS, from which the following items are to be computed:

- a. Aircraft's velocity and altitude versus time from five seconds prior to launch through launch
- b. Space position versus time (X, Y, Z, coordinates)
- c. Subject's descent rate (fps)
- d. Subject's X, Y, Z coordinate velocities (fps)
- e. Tangential acceleration versus time (ft/sec²)
- f. Subject's rate of rotation (rpm) from launch to full parachute deployment
- g. Altitude versus horizontal distance from launch
- h. Event times - launch
 - Drogue mortar fire
 - Personnel main parachute canopy full open
 - Backboard and seat pan jettison
 - Full deployment of survival kit equipment
 - Touchdown of test subject

4.1.2 MOTION PICTURE DOCUMENTATION (COLOR).

- a. Two 16mm cameras operating at 200 fr/sec.
- b. One 35mm "big eye" camera operating at 100 fr/sec.
- c. One 70mm Hulcher camera operating at 20 fr/sec.
- d. One hand-held camera in C-130 aircraft operating at 200 fr/sec.

4.1.3 STILL PICTURE DOCUMENTATION. Black and white still pictures during pre-test preparation and post-test inspection as required.

4.2 METEOROLOGICAL DATA. Rawinsonde balloon measurements shall be made within 15 minutes of test time of the following:

- a. Wind direction relative to true north and test subject's flight direction
- b. Wind velocity
- c. Ambient temperature at launch altitude and ground level.
- d. Ambient pressure (millibars) at launch altitude and ground level.

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5. DATA SUBMITTAL

5.1 TABULATIONS. Data listed in Sections 4.1.1 and 4.2 shall be tabulated on standard numerical data tabulation sheets. Three copies shall be delivered to the contractor (McDonnell).

5.2 PLOTS. The following data shall be plotted, and event times listed in 4.1.1 (b) shall be superimposed:

- a. Test subject descent rate versus time
- b. Test subject altitude versus time
- c. Test subject rate of rotation versus time
- d. Resultant velocity versus time
- e. Tangential acceleration versus time
- f. Altitude versus horizontal distance from launch

Three reproducible copies of each plot shall be delivered to the contractor.

5.3 DOCUMENTARY MOTION PICTURES. Motion picture film reproductions shall be delivered to the contractor as follows:

- a. Two quick-look work prints as soon as possible after test
- b. One final print
- c. One color master

5.4 STILL PICTURES. Three copies of each still picture, printed on 8 1/2 x 11 paper shall be delivered to the contractor.

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6. TEST PROCEDURE

6.1 INSPECTION TEAM. An inspection team shall be formed to verify the acceptability of the assembled test specimens. This team shall be composed of the following:

- a. McDonnell design engineer
- b. McDonnell test engineer
- c. McDonnell inspector
- d. McDonnell pyrotechnic technician
- e. AF 6511th test engineer
- f. AF 6511th inspector
- g. AF 6511th test jumper (for live jumps)

6.2 PRE-TEST PREPARATION. The test specimen shall be assembled using the 52-05333 installation fixture, in accordance with the applicable assembly preparation list. For live jumps, portable liquid oxygen coolers and adaptors will be utilized to ventilate the pressure suit. The radio beacons shall not be capable of emitting signals because of emergency radio interference.

6.3 TEST OPERATION. In the dummy drops, the drogue-mortar lanyard shall be pulled by the jump master as the dummy is launched. In the live jumps, the drogue-mortar lanyard shall be pulled by the jumper after he clears the aircraft.

6.4 POST-TEST PROCEDURE. The inspection team shall be divided into two sections, the first to inspect and recover the test subject, the second to inspect and recover the jettisoned equipment. The first team shall be composed of:

- a. McDonnell test engineer
- b. McDonnell design engineer
- c. AF 6511th test engineer

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This team will carry a portable ventilator to ventilate the live jumper in the pressure suit. The second team shall be composed of:

- a. McDonnell inspector
- b. McDonnell pyrotechnics technician
- c. AF 6511th inspector.

As soon as possible, the live jumper will be brought to the drop-zone control station where the jumper will remove the reserve parachute, harness, and pressure suit, and will be examined by the Navy medical officer. He will then be debriefed using a debriefing questionnaire provided in the test procedure. All drop-test equipment shall be examined for damage or malfunction prior to removal from the drop zone, and any damage or discrepancies shall be noted.

The second section of the inspection team will remain clear of the jettisoned equipment until the pyrotechnics technician has verified the equipment safe for inspection. Damage or discrepancies shall be recorded.

The test hardware shall be impounded after removal from the drop zone until test motion pictures and preliminary data have been viewed.

6.5 TURNAROUND. After release from impound, the test specimen shall be assembled for the next test in accordance with the applicable assembly preparation list, including the following steps:

- a. Backboard and seat pan assemblies shall be repaired as required
- b. The lap belt release shall be cleaned and reassembled
- c. The survival kit and equipment recovery parachute shall be cleaned, repaired as required, and repacked
- d. The personnel-leads disconnect, electrical wire bundle, and suit hose assemblies shall be cleaned, inspected, and re-installed
- e. The parachute, drogue mortar, harness restraint straps, MDF manifold, MDF hard lines, MDF flexible lines, Jetelox pin, and restraint strap cutter shall be replaced with new items.

6.6 PROCEDURE, GENERAL. Paragraph 6 provides an outline of procedures, however, each test will operate with a detailed Test Procedure which will include safety, equipment handling, and a jumper debriefing questionnaire.

Copies will be supplied by McDonnell.

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7. GOVERNMENT FURNISHED FACILITIES AND SERVICES

7.1 DIRECT TEST SUPPORT. The AF 6511th Test Engineer shall perform the following functions:

7.1.1 Schedule the following:

- a. Range time
- b. Aircraft
- c. Jumper
- d. Photo coverage
- e. Rawinsonde balloon observations
- f. Flight surgeon
- g. Recovery of test subjects and equipment
- h. Data processing.

7.1.2 Deliver computed data and motion picture prints to the contractor as specified in Section 5.

7.1.3 Write periodic reports as required by AF procedure.

7.2 FACILITIES AND SERVICES. The AF6511th Test Group shall provide space and facility as follows:

- a. Heated and air conditioned office area of approximately 900 square feet with at least four 110-v, 60-cycle electrical outlets
- b. Heated and air conditioned work and assembly area of approximately 1,600 square feet with at least four 110-v, 60-cycle electrical outlets
- c. Two telephones. Local calls shall be at Facility expense; toll and long distance calls shall be at Contractor's expense.
- d. Six desks and chairs for office area
- e. Two work benches for assembly area
- f. Magazine storage area for pyrotechnic items
- g. Toilet facilities
- h. Cleaning services
- i. Reproduction services (Xerox or equivalent) on a limited basis.

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8. SCHEDULE

An elapsed week schedule will be provided when available.