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ATTACHMENT 1

(OPERATIONS DIRECTIVE)

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OPERATIONS DIRECTIVE THE MARTIN COMPANY	~~CONFIDENTIAL~~	PAGE	ACCOUNT NO.	SUPL. NO.
	2-27-59	1 of 1	3001	348

MODEL	WS 107A-2	CONTRACT NO.(s)	
PRIORITY		AF04(645)-56	ESTIMATE NO.
TITLE	Repair of Stand D-1 and Disposition of "B" Battleship Components		AUTHORIZED BY M. Pitkin R. G. Swope

DESCRIPTION

1. A board of investigation shall be formed to investigate the fire on Stand D-1 that occurred on 26 February 1959.

2. The board shall consist of representatives from Plans and Programs, Engineering, Q.C., and the AFPR office. A report summarizing findings will be published by 3 March 1959.

3. Systems Test Department shall be responsible for control of the Stand area designated for storage of missile components. No missile parts will be removed from the controlled area for other use or disposition without authorization of a subsequent Operations Directive.

4. Quality Control shall be responsible for determining the repairs required to reactivate Stand D-1 and initiating necessary action. Any repairs to facilities items shall be coordinated through Plant Engineering.

5. Quality Control shall be responsible for determining the parts of "B" Battleship that can be:

   a. Utilized in programs either as spares or to relieve production shortages.

   b. Be repaired to serve as items as specified by item 5.a above.

   All other parts shall be designated as scrap.

6. The applicable charge numbers to be used for the effort specified above for those who normally charge direct to the Contract shall be as follows:

   3001-783-1XX - Engineering

   3001-783-3XX - Manufacturing

   3001-783-4XX - Systems Test

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ATTACHMENT 2

(COMMITTEE COMPOSITION)

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COMPOSITION OF INVESTIGATING COMMITTEE

MARTIN/DENVER

M. Pitkin - Chairman
C.T. Donnenworth - Preparation
C. Harrison
J. Worrel
J. Wilson
R. Weber
W. Jones
W. Parker
J. Keeley
C. Howell
R. Sheffer
A. Hulse
R. Gass
G. Heap

AEROJET FIELD OFFICE - DENVER

J. Dougherty
M. Hepburn
J. Feeley
F. Morey
L. Wilson (Sacramento)
B. Hall

SPACE TECHNOLOGY LABORATORY

R. Schedvin
A. Hodgson
I. Hansen

U.S. AIRFORCE PLANT REPRESENTATIVE

B. Whitney

U.S. AIRFORCE, BMD

Major R. Ostrem

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ATTACHMENT 3

(EXPERIENCE AND STATEMENTS OF D-1 OPERATING KEY PERSONNEL)

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ATTACHMENT 3

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MARTIN TEST PERSONNEL ASSOCIATED WITH TEST STAND

D-1 OPERATIONS AT THE TIME OF THE FAILURE

The preparations and countdown procedures were performed on first shift by the normal D-1 Test Stand Test Crew. Key members of the crew involved in this operation were:

Mr. C. Harrison

Mr. V. Mehling

Mr. R. Sheffer

Mr. P. Bennett

Mr. G. Pappas

Mr. A. Bernardi

Mr. H. Green

Mr. J. Lewis

Experience backgrounds of the personnel listed above are included in this attachment along with position descriptions for these particular crew functions and statements of observations made at the time of the emergency.

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Position Description: Test Conductor

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The Test Conductor has the overall responsibility for the conduct of all test operations in the checkout and test firing at the specified test stand. To this end he will direct the activities of fifty or more engineers and technicians. He works at both the blockhouse and stand areas in the testing complex. During checkout and countdown operations at the test complex he normally works in the blockhouse control room; but may, on occasion be required at the test stand. After the area clear signal he will be in the blockhouse control room and will monitor and direct the final countdown activities from there. Following a test, he directs the post-firing operation until the missile and/or the stand is in a safe condition. He will also direct the personnel involved in obtaining quick look data.

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Position Description: Propulsion Group Engineer CONFIDENTIAL

The Propulsion Group Engineer is a member of the checkout and test team. He is responsible for the direction of all work on the following systems: missile engines, start system, airborne propellant loading system and airborne pressurization system control.

In the performance of his duties during checkout and troubleshooting the missile propulsion, propellant and pressurization systems he supervises the work of the Propellant and Pressurization System Engineer, the Propulsion Technicians and Lead Propulsion Engineer assigned to the test stand.

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Position Description: Propellant Loading Controller Console Operator

The Propellant Console Operator works in the blockhouse as a member of the checkout and test team. During test operations he works under the supervision of the Test Conductor and at other times under the general supervision of the Facilities Group Engineer. He supervises the lox and fuel storage and transfer technicians.

In the performance of his duties he follows propellant loading procedures during countdown and test, being directed by the Facilities Engineer and/or Test Conductor at the test stand.

Using PLC readouts during countdown or test he analyzes malfunctions and/or correct operation of lox and fuel loading systems, reporting directly to the Facilities Engineer and/or Test Conductor. He has control and readout indications of test stand nitrogen and helium systems during countdown and test.

Position Description: Pressurization and Propellant System Console Operator

The P & P Console Operator works in the blockhouse as a member of the checkout and test team. He works under the supervision of the Test Conductor during test operations. At other times he works as a member of the propulsion and pressurization checkout team under the supervision of the Lead Propulsion Engineer.

Using P & P console readouts during countdown or test he analyzes malfunctions and/or correct operation of airborne lox and fuel systems, reporting directly to the Lead Propulsion Engineer and/or Test Conductor. He has control and readout indications of airborne high pressure gas systems.

NAME: Sappenfield

WORK: Stand Supervisor, C. A. Harrison

PRE-TITAN EDUCATION:

Sept. 1950 - June 1954	University of Virginia, BSME
Sept. 1954 - June 1955	
Oct. 1951 - Mar. 1952	Guided Missile School, White Sands P. G.

PRE-TITAN EXPERIENCE:

Sept. 1950 - July 1955	Guided missiles and artillery officer, U. S. Marine Corps, (last rank Captain)

TITAN EDUCATION:

June 1955 - Sept. 1955	Inertial guidance course, American Bosh Arma Corp.
May 1958	Titan Familiarization, Martin Co.
June 1958	Electrical Facilities, Martin Co.

TITAN EXPERIENCE:

June 1955 - Dec. 1955	Electro-mechanical designer, American Bosh Arma Corp. Worked on design of 107A stable element, gimbal system and components. Left because of intolerable labor situation.
Dec. 1955 - Apr. 1958	Engine designer. Aerojet-General Corporation. Served as project representative on materials review board and engineer in charge of XLR-87 build-up. Progressed to assistant head of engine design for XLR-87. Was initial ACF field representative to M-D and continued on as project representative after office was established.
Apr. 1958 - Present	Test conductor; D-1; night supervisor, trained initial two Martin-Cocoa crews for four firings on stand. Since Sept. have been stand supervisor. Was test conductor on previous sequenced runs (Lot F runs 7 & 8).

SYSTEM: ALL

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TITLE: Group II Engineer, V. Mehling

TEST POSITION: Test Conductor

PRE-TITAN EDUCATION AND EXPERIENCE:

Graduated High School 1938, one year of electrical engineering at Johns Hopkins University 1940. Worked in test equipment design at Bendix Radio until 1945. From 1945 to 1947 held position of electrical engineer with Martin-Baltimore on facility and airborne design.

Employed by Republic Aircraft Co. of Farmingdale, L. Y. as an electrical engineer from 1947 to 1954. During this time the work involved development design and testing of various control circuits. These circuits included fire control, camera control, flight controls and engine controls (fit engines). In 1954 returned to Martin-Baltimore and worked on the electrical design for the RB-68D and the Bullpup Missile.

TITAN EDUCATION:

Joined the Titan project December 1, 1955. Attended the original meetings to define work assignments for the various engineering efforts. Helped to prepare the initial program plan. Attended the interchange meetings with all associated contractors to establish and coordinate the Martin and associated contractors interfaces. Group engineer in charge of all airborne electrical control circuit design. Handled the coordination between the airborne electrical design group and the GSE electrical group. Also coordinated the airborne electrical design with the propulsion design group. Served as project engineer and project director for the activation Test Stand D-1 and the completion and installation of the original Lot A battleship tanks. Reviewed all Aerojet manuals and documents for compatibility with the Martin test program. Also handled the conversion and activation of Stand D-1 for the Lot B program.

TITAN EXPERIENCE:

Joined Systems Test as an Assistant Test Conductor in June 1957. Ran the daily status meetings for the Lot A battleship tanks. Made several trips to Aerojet-Sacramento for familiarization and coordination of Martin and Aerojet interfaces. Directed the final phase of activation of Stand D-1. Served as assistant test conductor throughout the Lot A program. Served as a test conductor for the Lot B program up to the present time.

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SYSTEM: Supervisory, Assistant Test Conductor Stage I

TITLE: Assistant Test Conductor and Window Observer, Phillip E. Bennett

PRE-TITAN EDUCATION & EXPERIENCE:

Graduated from Valley Center Kansas High School in 1948, served in the U. S. Air Force for two years, honorably discharged, 2½ years of education at Municipal University of Wichita.

PRE-TITAN EXPERIENCE:

Police Officer, Wichita, Kansas. Engineer, Boeing Aircraft Co., Wichita, Kansas. At Boeing I was responsible for layout and construction occurring on the flight line. Highest position held, lead engineer.

TITAN EDUCATION:

I have attanded the following Company sponsored education courses:

Safety
Human Relations in Supervision
Titan Familiarization
Cryogenics
Erector Systems
Process Water System
Conference Leadership

TITAN EXPERIENCE:

Lead engineer during Lot B hot battleship testing at Test Stand D-1. Responsible for high pressure gas systems, propellant loading systems, erector operations, CO_2 system and process water system, in addition to test stand maintenance.

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SYSTEM: Supervisory, Assistant Test Conductor

TITLE: Assistant Test Conductor, Stage II, A. A. Hulse

PRE-TITAN EDUCATION:

Scottsbluff High School, Scottsbluff, Nebr. - Grd. 1949
Scottsbluff Jr. College, Scottsbluff, Nebr. - 1950
Colorado University, Boulder, Colo. - 1951 - 1953 (1 3 ME)
Naval Officer Candidate School, Newport, R. I. - 19[illegible]3 (4 mos)
USN Buord Orientation, Washington, D.C. - 1954 (2 weeks)

PRE-TITAN EXPERIENCE:

Boeing Airplane Company, Wichita, Kansas - 1953 (2 mos.)
Design Drafting in B-47 Developmental Group. Left to enter Navy.

U. S. Navy - Sept. 1953 - March 1957
Assigned to U. S. Naval Ordinance Missile Test Facility, White Sands Proving Ground, New Mexico for 3 years. Served as following: Navy representative to flight determination lab (3 mos.), Asst. Viking Project Officer (2 mos.), Enlisted Mens Club Manager (12 mos.), Personnel Officer (2 mos.), Asst. Talos Project Officer (30 mos.), Talos Drone Officer (30 mos.), Talos Recovery Officer (30 mos.)
In Talos Project, coordinated between Army, Navy, Air Force, Bendix, APL/JHU, NMCAMA, for flight firing of Talos Missile. Participated in firings of developmental Talos missile from S/N 16 through S/N 130. Also carried out various administrative duties such as investigation boards, custodian of registered publications, etc.

TITAN EDUCATION:

Titan Familiarization
Safety
Titan Propulsion
Propulsion - 6 weeks Aerojet 1957
Propulsion - 1 week Aerojet 1958

TITAN EXPERIENCE:

Assigned to Stand D-1 Apr. 1957 to Present.
Propulsion Group - Apr. 1957 - Oct. 1958
Asst. Test Conductor - Oct. 1958 - Dec. 1958
Shift Supervisor - Dec. 1958 - Present
Assisted in activating Stand D-1 to Lot A configuration. Participated in Lot A firings as panel operator, and Propulsion Leadman. Assisted in training D-1, D-2, D-3 and Cocoa personnel on the job. Assisted in converting stand to Lot B configuration. Acted as asst. test conductor and test conductor for Lot B firings.

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SYSTEM: Propulsion

TITLE: Propulsion Group Engineer, Robert M. Sheffer

PRE-TITAN EDUCATION AND EXPERIENCE:

B.S. in M.E. University of Illinois 1952.

Various short term technical schools on aircraft and aircraft engines. (USAF and civilian schools)

12-54 to 2-56 Martin-Baltimore - 14 months - propulsion system testing - (components - jet engines - fuel systems) for TM-61 A, B, & C, RB57D and XP6M-1.

7-52 to 10-54 North American Aviation Inc. - 27 months - jet turboprop and reciprocating engine-powered aircraft flight testing of propulsion systems. Primarily involved in data analysis from flight testing. Also worked intermittently on jet and turboprop engine test stands.

TITAN EDUCATION:

4-57 to 6-57 10 week course at Aerojet-Sacramento on the XLR 87 and XLR 51 engines. Course consisted of 5 weeks class room and 5 weeks on-the-job training on Aerojet test stands.

TITAN EXPERIENCE:

Joined Titan project at Martin-Baltimore 2-56. Worked on preliminary planning of propulsion system test program. Conducted preliminary R & D tests to develop tank baffles and pressurization system. Directed activities of personnel conducting Titan aerodynamic testing in various wind tunnels.

Transferred to Denver 2-57. Have been lead engineer in charge of propulsion on Test Stand D-1 since before 1st Lot A battleship firing.

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SYSTEM: Propulsion

TITLE: Propulsion Lead, Stage II, H. D. Green

PRE-TITAN EDUCATION:

a. Erasmus Hall High School, Brooklyn, N. Y. - Grad. 1949
b. North Carolina State College, Raleigh, N. C. - Grad. 1953
B.S. Mechanical Engineering - Aeronautical Option
c. Special Weapons School - U.S.A.F. - Grad 1954
Missile Guidance Systems

PRE-TITAN EXPERIENCE:

a. Summer months during college -
Consolidated Edison Co., New York, N. Y. - Jr. Draftsman
b. 1954 to 1956 - 1/Lt. - USAF - OIC "Matador" Guidance Team

TITAN EDUCATION:

a. Stress Analysis Course, Martin Co. - Feb. 1957
b. Propulsion Course, Martin Co. - June 1958
c. Propulsion Course, Aerojet General Corp - Aug. 1958

TITAN EXPERIENCE:

a. June 1956 to Sept. 1957 - Stress Analysis Group
Supervisor - L. J. Adams
b. Sept. 1957 to May 1958 - Project Administration
Supervisor - R. Best
c. May 1958 to Present - Propulsion Test Stand D-1
Supervisor - R. M. Sheffer

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SYSTEM: Propulsion

TITLE: Eng. Pressurization & Pneumatics Operator: A. J. Bernardi

PRE-TITAN EDUCATION:

Graduated Oakland Technical High School, 1946
Attended Michigan Stage College, 1943; Preflight & Bombardier Training, 1943; B. A. University of California 1949.

PRE-TITAN EXPERIENCE:

Advertising Agency, 1948-1949, Reporter San Francisco Call Bulletin, 1950-1951; Editor (Science) Associated Press 1951-1953; KOA Television & Radio, Denver, 1953-1955; Construction Contractor, Denver, 1955-1956

TITAN EDUCATION:

Titan Familiarization, Erector Electrical, Propulsion I & II

TITAN EXPERIENCE:

Technical Publications Engineer, Technical Publications 8-7-56 - 10-1-58. Administrative Assistant D-1 Test Stand Supervisor 10-1-58; Panel Familiarization & Operating experience during this period; announcer Lot B battleship firings; assigned Propulsion Group 2-9-59.

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SYSTEM: Propellant & High Pressure Gas

TITLE: Propellant Loading Console Operator, George T. Pappas

PRE-TITAN EDUCATION:

B. A. Degree Mech. Eng., 1958, Chicago, Ill.

PRE-TITAN EXPERIENCE:

Sgt. U. S. Army, July 1952-1954

TITAN EDUCATION:

Have studied Martin manuals, proceedures and drawings on propellant loading and handling, high pressure gas system, lox and fuel transfer system. Have not attended any Martin schools.

TITAN EXPERIENCE:

Have observed and have operated Propellant Loading Console on majority of Lot B firings.

SYSTEM: Facilities

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TITLE: "ater Panel Operator, J. Lewis

PRE-TITAN EDUCATION:

High School - 1937
Air Force Tech School - WWII

PRE-TITAN EXPERIENCE:

Various jobs with CAA, Arman & Co. and USAF

TITAN EDUCATION:

Titan Familiarization
Process Water System
Stand Facilities and Electrical Course

TITAN EXPERIENCE:

Activation of Stands D-1 and D-2, Complex 15. Water panel operator, Lot A and B. Maintain and operate high pressure gas system, process water and propellant loading facilities.

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TEST POSITION: Stand Supervisor

NAME: C. Harrison

STATEMENT:

During the firing I had positioned myself in front of the test conductors table to observe the firing and take action as required. At the command for CO_2 immediately after $91FS_1$ I observed abnormal fire on the stand through the observation window and commanded for firex and shutdown and then, delaying ten seconds, commanded for prevalves closing. During the insuing three hours, I directed the test stand operation for best water usage and securing operations.

TEST POSITION: Test Conductor

NAME: V. Mehling

STATEMENT:

I was watching N_{T1} when $GGFS_1$ was called out. Glanced at NTAP and then at TV. The APDA appeared to be off and running and the shutdown of Stage I appeared to be normal. Looked back at NTAP just as $91FS_1$ was called out. At that time I heard three loud reports, looked at the TV screens and as quickly as possible called for engine deluge, then firex. The command to shutdown had already been called out. Shortly thereafter I gave the command simultaneously with propulsion lead to close lox and fuel prevalves. The panel lights indicated the closures were accomplished. Additional water commands were then given and retracted as required to continue the fire fighting operation.

TEST POSITION: Assistant Test Conductor and Window Observer

NAME: P. Bennett

STATEMENT:

At $87FS_1$ the shutdown appeared normal. $GGFS_1$ appeared normal and sequencing continued. $91FS_1$ no visible external explosions. To the best of my observance and knowledge the 91 engine ran approximately 1 second or more before I observed a series of abnormal flashes indicating explosions in the vicinity above the Stage II engine compartment. At this point as window observer I called the water panel for engine deluge, CO_2 thrust chamber spray, missile wash down, and vernier protect. During the interval I observed balls of fire rolling out the vernier duct. Proceeded to advise Test Conductor of condition of stand and direct the process water system to contain the fire.

TEST POSITION: Propulsion Group Engineer

NAME: R. Sheffer

STATEMENT:

Position during firing was in front of the Bristol recorders to observe engine parameters. Up to $87FS_1$ all countdown activities were normal with single exception of malfunction of P & P Stage II tank pressure measurement which was repaired.

XLR 87 firing was normal with exception of a T_{ti} measurement which indicated a malfunctioning thermocouple. P_{c6} on both chambers decayed and a TCPS shutdown occurred.

The APDA and GG start on Stage II appeared normal. When $91FS_1$ occurred the chamber firing was audibly different from previous XLR 91 firings in that a honking noise occurred. All XLR 91 paramters immediately fell off indicating that the engine shut down. Quickly thereafter all XLR 91 Bristol readings became erratic; swinging full scale deflections intermittently. Since the engine had apparently stopped, the "kill" switch was not activated.

Attention was then directed to TV to observe the fire which had occurred. The P & P operator was directed to vent Stage II propellant tanks. Some time later the P & P operator was directed to close Stage II prevalves since it appeared that the fire was being fed by fuel. No further action was taken by the Propulsion Group Engineer except consultations with other test personnel in the interest of controlling the fire.

TEST POSITION: Propellant and Pressurization Console

NAME: A. J. Bernardi

STATEMENT:

During the Stage I phase of the operation, the P & P II instruments indicated stable pressurization of P_gOT, P_gFT, P_gA & P_gMT. Nothing of significance was noted during the period from GGFS1 to FS-1(91). Almost immediately following Stage II ignition, P_gMT fell from 3100 to approximately 2000, wavered, and continued to drop off rapidly. P_gA, P_gOT & P_gFT dropped below ambient. Then all dial indicators began acting erratically. Dial indicators twirled and finally spiked at random positions. All switch indicator lights illuminated. The operator returned to "standby" position for positive panel operation. Propulsion Group leader called for venting of the tanks. The operator placed the switches in the proper position although securing operations had been previously accomplished. The call then was made to close all prevalves. This order was complied with. From this point on the P & P II panel stopped operating and gave reliable information. Power was removed from the panel.

TEST POSITION: Propellant Loading Console

NAME: George T. Pappas

STATEMENT:

At T-1 minute 35 seconds I proceeded to close Stage I He inlet as prescribed by the procedure. I then focused my attention on the P & P checker II console to monitor the He tank pressure and listen for the command to open Stage II He inlet. While observing the He tank pressure on the P & P II console, all pressure gages started to oscillate. I then glanced at the TV monitor and noticed three distinted flash in the engine compartment. There was no action taken on the emergency shutdown. Only the Check Supply-Stand Supply was centered.

TEST POSITION: Water Panel

NAME: J. Lewis

STATEMENT:

At T-2 min., 20 seconds, the Stage I & II deflector plate water was turned on also the vernier duct cooling and umbilical base sprays. At T+2 minutes the CO_2 and thrust chamber spray was turned on Stage II. The test conductor and window observer called for the following: CO_2, engine deluge, thrust chamber spray and missile wash, then firex was turned on. The flame deflector water pressures on Stages I & II were reduced in pressure. The fire was localized and controlled by the use of II stage missile wash, engine deluge, thrust chamber spray and vernier protect.

TEST POSITION: Safety Officer

NAME: J. Rogers

STATEMENT:

From T-10 minutes I was watching the progress of the count on TV when the fire broke out. I called security and had the MAC fire truck removed from the factory and had it replaced with an Air Force Decon. The MAC was directed to standby at security post T-9. The La France was directed to stand by at security post T-6. Security was directed to post an additional road block at GPL gate.

The next two calls were to Stands D-2 and D-2 directing all personnel to clear back from stand area and take cover. My third call was to security to dispatch a Jeep D-3 and pick up maintenance personnel to check the process water tank for Mr. Bob Munden.

My next move was to clear all personnel from the visitors gallery to the D-2 side of the blockhouse.

When the fire was out Mr. Harrison and myself proceeded to the test stand with the fire crew on the MAC truck. The MAC was hooked up to pump from the fire hydrant. The fire crew was directed to cool down the second stage battleship tank and facility structure.

Security was called to supply two additional guards. One guard was placed at the deflector plate level. The other two guards were posted on each side of the second stage battleship tanks. They were directed to allow no personnel into the area except as directed by Mr. Harrison. The fire department was directed to stand by on the stand all night.

ATTACHMENT 4

(TEST DIRECTIVE)

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COPY

TEST DIRECTIVE
MARTIN-DENVER

Date: 17 February 1959

NUMBER: D-1-1/2-B-BF-17

RUN NO: 10

TEST ARTICLE: Stages I and II of Lot B Battleship

TYPE OF TEST: Full duration Stage I and II sequenced firing (125/8/130/65)

TEST LOCATION: Test Stand D-1, Positions 1 and 2

PLANNED TEST DATE: 20 February 1959

REFERENCE: (a) WDD-M-TP-8 (Rev 2) Lot B battleship test plan

1. Configuration

a) Complete Stage I Lot B battleship test article mounted on Position 1 of Test Stand D-1;

b) Complete Stage II Lot B battleship test article mounted on Position 2 of Test Stand D-1 and electrically connected to Stage I to fire in sequence following Stage I full duration firing.

c) Final GSE.

2. Description

a) The Stage I and II propellant tanks will be filled as defined by ETO BFB-72;

b) The Stage I engines will be fired for approximately 125 sec. using facility pressurization for the initial portion of the run with a transfer to airborne pressurization after 95 sec. of running;

c) The Stage I thrust chambers will be gimballed as defined by ETO BFB-73;

d) Record BLH system measurements of both stages during their propellant loading, thrust buildup, steady state, and thrust decay periods;

e) APDA start ($GGFS_1$) will be initiated by MOC timer at T+120 seconds;

f) Stage I shutdown ($87FS_2$) and start of the staging timer will be initiated either by fuel low level sensor or by signal from Stage I thrust chamber pressure switch (TCPS) activation due to thrust decay as a result of lox exhaustion. The fuel low level sensor will be locked out by MOC timer for the first 120 seconds of running;

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g) Stage II engine start ($91FS_1$) will be initiated by the staging timer at $87FS_2$+3 sec;

h) The Stage II engine will be run for approximately 130 sec. using airborne pressurization for the initial portion of the run with a transfer to facility pressurization when the pressure to the airborne helium primary regulator inlet drops to 450 psig;

i) A Stage II gimballing program will be implemented as defined by ETO BFB-73;

j) Stage II engine shutdown will be initiated by the MOC timer at T+258 seconds;

k) Solo vernier operation will continue for approximately 65 sec. after Stage II engine shutdown until shutdown by a timer signal from the MOC at T+323 seconds;

l) The Stage II lox tank will be vented through the vent valves after vernier shutdown;

m) During the Stage II firing, hydraulics will be supplied from the airborne hydraulic pump powered from the airborne hydraulic battery;

n) Only the hydraulic umbilical disconnects and the lox and fuel fill and drain probes will be disconnected for this run;

o) The Stage II engine will be replaced with a new engine for this run.

3. Test Objectives

a) Primary Objectives

1) Evaluate staging sequencing;

2) Verify Stage II propulsion performance parameters on an engine different from that used on the previous Stage II, Lot B battleship test runs;

3) Evaluate TCPS - lox exhaustion shutdown on Stage I;

b) Secondary Objectives

1) Verify operating characteristics of the airborne Stage II hydraulic subsystem when powered by the airborne battery;

2) Obtain environmental data;

3) Evaluate performance of the Stage II helium heat exchanger;

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4) Evaluate Stage II Air Research primary and secondary helium resulators;

5) Determine Stage I and II thrust misalignment;

6) Evaluate method of vernier thrust determination;

7) Determine helium temperature spikes at input to Stage II primary regulator.

c) Tertiary Objectives

1) Determine transient response and velocity limits of the Stage I flight controls subsystem.

2) Verify frequency response data of the Stage II flight controls subsystem.

4. The following Engineering Test Orders are effective for this run:

BFB-3(Rev 2), BFB-14, BFB-28, BFB-35, BFB-59, BFB-72, BFB-73(Rev 1) BFB-74, BFB-77, BFB-78, BFB-79, BFB-80, BFB-83, BFB-84,

Prepared: E. E. Fulmer /s/
E. E. Fulmer
Battleship Test Integration

Approved: R. G. Summers /s/
R. G. Summers
Test Project Engineer

R. Schedvin /s/
R. Schedvin
STL, DFO

Byron L. Whitney (for) /s/
Major W. Dienst
BMD

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