The Flight Project Pyrotechnics Subsection
Document Collection, 1971-1985
4.2 cubic feet
JPL 108

History

The collection documents the pyrotechnics subsection of various flight projects that were managed by the Jet Propulsion Laboratory (JPL). Projects Viking, Voyager and Galileo comprise the bulk of the collection. Pyrotechnics are small controlled chemical explosive devices that may function as switches or drivers for change. The device itself is often referred to as a squib.

Project Viking was composed of two spacecraft, Viking 1 and Viking 2, each consisting of an orbiter and a lander. Viking 1 and 2 were the first successful soft landings on the planet Mars. The primary mission objectives were to obtain high resolution images of the Martian surface, characterize the structure and composition of the atmosphere and surface, and search for evidence of life. The two Vikings were launched in August and September 1975. The Viking 1 Lander touched down at Chryse Planitia on July 20, 1976. The Viking 2 Lander touched down at Utopia Planitia on September 3, 1976. The Viking Orbiters and Landers continued sending back data until 1982. The Viking 1 Orbiter was powered down on August 17, 1980, while the Viking 1 Lander was shut down on November 13, 1982. The Viking 2 Orbiter and Lander ended communication earlier. While a number of NASA contractors were involved in the Viking Project, JPL built the orbiters, conducted mission communications, and assumed responsibility for the management of the mission.

Project Voyager was a dual spacecraft long-range mission that conducted a "Grand Tour" of the Outer Planets. The project, originally called "Mariner Jupiter/Saturn 1977" (MJS77) was approved by NASA and Congress in June 1972. MJS77 was renamed Voyager in 1977, slightly before the first launch date. The two Voyager spacecraft were launched in August and September 1977. Voyager 1 made its closest encounter with Jupiter on March 5, 1979; Voyager 2 reached Jupiter on July 9, 1979. Voyager 1 reached Saturn on November 13, 1980. Voyager 2 reached Saturn on August 26, 1981. Voyager 2 then headed towards Uranus and Neptune, while Voyager 1 traveled north of the Ecliptic after its Saturn encounter. Voyager 2 encountered Uranus on January 24, 1986, and Neptune on August 25, 1989. Both Voyager spacecraft continue to send back scientific telemetry, twenty-two years after leaving Earth, and will continue doing so until the power runs out in both spacecraft, around 2017.

In 1610, Italian astronomer Galileo Galilei (1564-1642) was first to observe Jupiter through a telescope. Galileo also soon discovered the four largest moons of Jupiter. Project Galileo, a Jupiter orbiter and atmospheric probe, the next logical step in the exploration of Jupiter after Voyager, was initiated in November 1977. The Project was originally called Jupiter Orbiter Probe (JOP), but quickly christened Project Galileo. Following several postponements involving the Space Shuttle, the launch of Galileo, originally scheduled for April 1982, was rescheduled for May 1986. The explosion of the Shuttle Challenger in January 1986 further postponed the launching of Galileo. Galileo was ultimately launched by the Shuttle Atlantis during the STS –34 mission in October 1989.

Due to the multiple postponements, Galileo missed the launch window for a direct flight to Jupiter. Galileo was forced to fly a trajectory involving gravity-assisted flybys of Venus once and Earth twice, before arriving at Jupiter on December 7, 1995. The Galileo Probe entered the atmosphere of Jupiter, sending back data for an hour before burning up. The Galileo Orbiter continues orbiting Jupiter, exploring its moons and sending back data.

Galileo had three overall scientific objectives: conduct comprehensive investigations of Jupiter's atmosphere, its satellites, and its magnetosphere. Measurements of the atmosphere were accomplished by its atmospheric-entry Probe.

Provenance

The collection was compiled by Ronald L. Smith of JPL Section 342, Electric Power Systems Section. It was transferred to the JPL Archives in April 1990.

Collection Arrangement and Description

The collection is arranged chronologically into four series. There is one file of Mariner 10 documents (in Box 1), which has been given its own series. The other series are Viking Documents (in Boxes 1-2), Voyager Documents (in Boxes 3-9), and Galileo Documents (in Boxes 10-14). The collection documents the pyrotechnics subsection of the four flight projects. The collection consists of reports, interoffice memoranda, test specifications, summary test reports, test orders, parts analysis reports, and electrical drawings.

Included in the collection are examples of Field Test Kits (FTKs), whose specifications define design and performance testing of MJS77 support equipment. FTKs were used for the checkout of the pyrotechnic subsystem prior to systems test and flight preparation of the subsystem. FTKs were also used to monitor the status of the Pyro Switching Unit (PSU) and to measure the resistance of the electroexplosive devices or squib simulators.

The Mariner Jupiter/Saturn 1977 Pyrotechnic Subsystem Prelaunch Evaluation describes operations required to prepare the MJS77 spacecraft pyrotechnic subsystem for launch and to electrically verify the integrity of the subsystem before launch. The document also defines steps required for the disconnection of the pyrotechnic subsystem for spacecraft disassembly or emergency turnaround operations.

The objective of the MJS77 Pyrotechnic Subsystem Integration and Test is to describe the operations required to verify functional and operational compatibility of the MJS77 pyrotechnic subsystem flight electronics with all interfacing subsystems, and to verify proper operation of the pyrotechnic subsystem and support equipment.

The purpose of Circuit Data Sheets (CDS) are to establish mutually compatible interface circuitry between subsystems, and to define the electrical characteristics of system cabling, diagnose anomalous results obtained during the spacecraft test program, and to evaluate system effects relating to proposed changes in the interface design.

The Type Approval and Flight Acceptance Test Requirements and Preacceptance Test Limits (Assembly Level) MJS 77, specifies the MJS77 flight equipment assembly level Type Approval and Flight Acceptance environmental test requirements. The specification controls the environmental test requirements for assemblies and provides a basis for the generation of detail assembly environmental test procedure.

Test Requirement and Procedure Documents describe the Pyrotechnic Switching Unit (PSU). The PSU provides energy storage and switching capability for energizing squibs and similar devices on the spacecraft and also provides power to certain pressure transducers in the propulsion subsystem. The documents cover various aspects of the PSU.

In the Project Galileo series, a number of folders document the interface between the Galileo Orbiter and Probe. Included in these files are specifications, interdepartmental correspondence, diagrams, reports, test analyses, meeting agendas and minutes, and engineering revisions.

The Galileo Telemetry and Command Dictionaries contain the information necessary for flight operation's monitoring and interpretation of spacecraft telemetry measurements. The Command Dictionary describes commands that may be sent to the Galileo Orbiter. The dictionary covers the purpose of the command, its effect on the spacecraft, its relationship to other commands, and telemetry indications for verifying the command.

Conservation/Preservation

Standard preparations of documents for long term storage were completed.

Separation Statement

One document of the original accession, the "Air Force Eastern Test Range Safety Manual, Volume 1," dated September 1, 1972, was removed from the collection and placed in the JPL History Files Collection.

Finding Aids

No other finding aids exist for the collection.

FILE FOLDER LIST

Box 1 of 14 - Mariner Venus Mercury 1973 (Mariner 10) Documents

Fld. 1 MVM 73 Pyrotechnic Switching Assembly, 1972-80

Project Viking Documents

Fld. 2 Damage from Static Electricity Discharge, 1970-74
Fld. 3 Final Report, Pyro Electronics Analysis, Vol. 1, March 20, 1973 (Folder 1 of 2)
Fld. 4 (Folder 2 of 2)
Fld. 5 Final Report, Pryo Electronics Analysis, Vol. II, March 20, 1973
Fld. 6 Pyrotechnic Switching Unit, 1973 [Binder] (Folder 1 of 2)
Fld. 7 (Folder 2 of 2)

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Fld. 8 Pyrotechnic Switching Unit, 1973 [Binder] (Folder 1 of 3)
Fld. 9 (Folder 2 of 3)
Fld. 10 (Folder 3 of 3)
Fld. 11 Pyro Switching Unit, 1973-80

Box 3 of 14 - Voyager Documents

Fld. 12 MJS77 Pyrotechnic Switching Unit (PSU) Caps Resistors and ICS, 1971-75 [Binder]
Fld. 13 MJS PSU Squib Fire Switch/ Design & Test Data, 1974 [Binder] (Folder 1 of 2)
Fld. 14 (Folder 2 of 2)
Fld. 15 MJS 77 Design Info/Requirements, 1974 [Binder] (Folder 1 of 2)
Fld. 16 (Folder 2 of 2)
Fld. 17 MJS 77 Pyrotechnic Subsystem, Viewgraph Drafts, 1974-76

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Fld. 18 MJS PSU Parts/Stress Analysis, 1974-75 [Binder] (Folder 1 of 2)
Fld. 19 (Folder 2 of 2)
Fld. 20 PSU Analysis, 1974-75 [Binder] (Folder 1 of 2)
Fld. 21 (Folder 2 of 2)
Fld. 22 PSU Power Supplies Instrumentation, 1974 [Binder]
Fld. 23 MJS 77 Transformer Data, 1975
Fld. 24 MJS 77 Worst Case Analysis, Appendix A, 1975 (Folder 1 of 2)
Fld. 25 (Folder 2 of 2)

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Fld. 26 Environmental Test Specification Summary/ Type Approval- Flight Acceptance- Test Authorization/ Test Order/ Test Results Summary Form, 1975
Fld. 27 Solid Rocket Motor Safe & Arm, June-July 1975
Fld. 28 Electromagnetic Compatibility (EMC) Test, Assembly Level, September 3, 1975
Fld. 29 Pyrotechnics Subsystem, Critical Design Review, October 16, 1975
Fld. 30 MJS 77 Pyro Circuits, 1975-76 (Folder 1 of 2)

Fld. 31 (Folder 2 of 2)
Fld. 32 MJS 77 PSU Analyses, 1975-76 (Folder 1 of 2)
Fld. 33 (Folder 2 of 2)
Fld. 34 Electro Magnetic Circuits and Magnetic Testing Procedure, 1975-76

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Fld. 35 Procedure Change Integrator, 1976 [Binder] (Folder 1 of 2)
Fld. 36 (Folder 2 of 2)
Fld. 37 MJS 77 Wire Harness, 1976
Fld. 38 Type Approval and Flight Acceptance Test Requirements and Preacceptance Test Limits (Assembly Level), MJS 77 Flight Equipment, March 1, 1976
Fld. 39 MJS 77 Pre-Production Model Prototype, Pyro Switching Unit, March-April 1976, June 1980
Fld. 40 MJS 77 Critical Safety Review, April 1, 1976 (Folder 1 of 2)
Fld. 41 (Folder 2 of 2)
Fld. 42 MJS 77 Pyrotechnic Switching Unit, Pyrotechnic Subsystem- Initial Power Turn-On Test Procedure, May 17, 1976
Fld. 43 MJS 77 PSU, Pyrotechnic Subsystem- Performance Test Procedure, May 21, 1976
Fld. 44 MJS 77 PSU, Pyrotechnic Subsystem - Continuity Test Procedure, May 26, 1976

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Fld. 45 MJS 77 PSU, Pyrotechnic Subsystem - Flight Equipment Type Approval and Flight Acceptance Testing - EMC and Magnetics Detail Procedure, June 1, 1976
Fld. 46 MJS 77 PSU, Pyrotechnics Subsystem - Static Acceleration, Vibration, and Thermal Vacuum Performance Test Procedures, June 8, 1976
Fld. 47 MJS 77 PSU, Pyrotechnic Subsystem - Detail Specification, June 17, 1976
Fld. 48 MJS 77 Type Approval (TA) and Flight Acceptance (FA) System Test Requirements, June 15, 1976
Fld. 49 MJS 77 Hardware Review/Certification Data Package Summary - Pyro Switching Unit, July 1976
Fld. 50 Trajectory Correction Attitude Propulsion Unit (TCAPU) Valve Simulator Panel, MJS 77 Propulsion Simulator Test Procedure, July 7, 1976
Fld. 51 MJS 77 System Test Console, Pyrotechnic Subsystem, Test Procedure for Support Equipment, July 29, 1976
Fld. 52 MJS 77 Project Software Requirements Document - Telemetry Math Model Pyrotechnic-A Model Pyro Subsystem, August 1, 1976
Fld. 53 MJS 77 Hardware Review/Certification Data Package Summary - Pyro Switching Unit, October-November 1976
Fld. 54 MJS 77 Hardware Review/Certification Data Package Summary - Pyro Switching Unit, January 1977
Fld. 55 MJS 77 Preliminary Test Model, Pyrotechnic Switching Unit, June 1976-February 1977
Fld. 56 MJS 77 Pyrotechnic Subsystem Integration and Test, (JPL Proc. MJS77 208.00), July 19, 1976

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Fld. 57 MJS 77 PSU S/N 102, September 1976

Fld. 58 MJS 77 PSU S/N 103, December 1976-January 1977
Fld. 59 Field Test Kits, Pyrotechnic Subsystem, MJS 77 Support Equipment Detail Specification, 1977
Fld. 60 MJS 77 Environmental Test Report- Operations Log, 1977 (Folder 1 of 2)
Fld. 61 (Folder 2 of 2)
Fld. 62 MJS 77 System Test, 1977 [Binder]
Fld. 63 MJS 77 Circuit Data Sheets (CDS), Rev. C, April 22, 1977 (Folder 1 of 2)
Fld. 64 (Folder 2 of 2)

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Fld. 65 MJS 77 Pyrotechnic Subsystem Prelaunch Evaluation, JPL Proc. MJS77 121.00B, June 20, 1977 (Folder 1 of 3)
Fld. 66 (Folder 2 of 3)
Fld. 67 (Folder 3 of 3)

Box. 10 of 14 - Galileo Documents
Fld. 68 Galileo Probe/Orbiter Interface, 1978-1985 (Folder 1 of 9)
Fld. 69 (Folder 2 of 9)
Fld. 70 (Folder 3 of 9)
Fld. 71 (Folder 4 of 9)
Fld. 72 (Folder 5 of 9)
Fld. 73 (Folder 6 of 9)

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Fld. 74 Galileo Probe/Orbiter Interface, 1978-1985 (Folder 7 of 9)
Fld. 75 (Folder 8 of 9)
Fld. 76 (Folder 9 of 9)
Fld. 77 JOP Support Equipment Requirements, Pyrotechnic Subsystem, 1978-1982
Fld. 78 JOP Pyrotechnic Switching Unit Requirement, 1978 [Binder] (Folder 1 of 2)
Fld. 79 (Folder 2 of 2)

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Fld. 80 Galileo Pyrotechnics Baseline, Viewgraph Drafts, February 15, 1978
Fld. 81 Galileo Safety Policy, January-February 1979
Fld. 82 Galileo Support Equipment, 1979-1983 (Folder 1 of 2)
Fld. 83 (Folder 2 of 2)
Fld. 84 Galileo 1985 Launch Baseline, December 1980-March 1981
Fld. 85 Contract Modifications, 1980-1982
Fld. 86 Galileo- Power/Pyro Subsystem (PPS), 1981-1982
Fld. 87 Galileo PPS Schedule Information, August-October 1981
Fld. 88 Engineering Drawings, 1981-1983
Fld. 89 Galileo 1986 Launch Baseline, Interface with Centaur, August-October 1982

Box 13 of 14
Fld. 90 Galileo, Schematic Diagram, Probe Simulator, May 26, 1983
Fld. 91 Galileo Orbiter and Spacecraft Pyrotechnic Subsystem Prelaunch Evaluation, 1984 (Folder 1 of 2)
Fld. 92 (Folder 2 of 2)

Fld. 93 Galileo Orbiter/Spacecraft Pyrotechnic Subsystem Prelaunch Evaluation, JPL Proc. 121, Book 2, 1984 (Folder 1 of 3)
Fld. 94 (Folder 2 of 3)
Fld. 95 (Folder 3 of 3)
Fld. 96 Telemetry and Command Dictionary Inputs, August-October 1984
Fld. 97 Military Specification- Transformers and Inductors, General Specification, June 21, 1968 (copy)
Fld. 98 Quarterly Contractor Financial Management Reports, 1984-85

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Fld. 99 Galileo Orbiter and Spacecraft, Pyrotechnic Subsystem Prelaunch Evaluation 121.01, February 7, 1985 (Folder 1 of 4)
Fld. 100 (Folder 2 of 4)
Fld. 101 (Folder 3 of 4)
Fld. 102 (Folder 4 of 4)
Fld. 103 Galileo Power/Pyro Subsystem Telemetry Measurements, April 24, 1986
Fld. 104 Attitude and Articulation Control Subsystem (AACS) Computer Print-Out, Unknown Mission, September 1983

CATALOG DESCRIPTION
Flight Project Pyrotechnics Subsection Document Collection, 1971-1985.
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Register available in the repository.

Tracings
Galileo Project - History
Jupiter Orbiter with Probe (JOP) - History
Jet Propulsion Laboratory- History
Voyager Project - History
Mariner Jupiter/Saturn 1977 - History
Viking - History
Mariner Venus Mercury 1973 - History
Pyrotechnic Subsystem
Smith, Ronald L.

Accession 90-143.