

SHUTTLE SERIES
DWIGHT SUITER DOCUMENTS LIGHTNING/THUNDERSTORM RESEARCH FOR SPACE SHUTTLE
LAUNCH CRITERIA

This subseries consists of collected materials on the effects of lightning on electronic and electrical systems, how lightning affects aircraft, and thus protective measures needed and launch criteria developed concerning the space shuttle. The concern towards thunderstorms in general and lightning in particular was generated by the frequency of both in the vicinity of Kennedy Space Center, and by the numerous lightning strikes near and on Apollo rockets and their launch facilities in the late 1960's and early 1970's. The provenance of this material is Dwight Suiter, who was employed at JSC from 1964-1991 and was a member of the Lightning Committee that investigated the aforementioned phenomena and whose goal was to develop the necessary precautions and procedures for similar occurrences with the space shuttle. Mr. Suiter worked in a number of capacities in the Apollo Spacecraft Program Office, Program Operations Office, Shuttle Office, and Orbiter and GFE Projects Office. The materials received were arranged haphazardly, and while some subject areas were noticed, it was decided that some order needed to be imposed. Various Apollo documents were grouped together at the beginning of the collection, followed by important shuttle papers generated by the Lightning Committee, all arranged chronologically from 1963-1984. Subject areas that were obvious or became obvious during processing were placed next in the collection. They are: 1) Lightning Detection and Ranging (LDAR) papers, 2) Lightning Susceptibility Analysis Summaries, 3) Solid Rocket Booster (SRB) papers, 4) OMS Pod materials, and 5) materials related to Kennedy Space Center (KSC). Each subject area has been arranged chronologically. Various personal papers by Mr. Suiter that did not fit into any particular subject area were placed next, arranged in chronological order. Finally, a large number of articles, papers, and documents related to lightning and its effects were interspersed throughout and are arranged chronologically at the end of the collection.

Inventory

SubHeading:	Box Number: 01	
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Early Lightning Protection documents	1963-1966
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Apollo 12 Lightning Incident (Design Data Sheets)	December 19, 1969
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	MSC 01540 Analysis of Apollo 12 Lightning Incident	January 1970
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Apollo 15 lightning report	September 14, 1971
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Apollo documents on lightning (meetings, reports, memos, etc.)	1971
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Lightning Flash History and various Lightning Activity Reports	1972-1973
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	MSC 04112, Supplement 8 Apollo 14 Mission Report, Supplement 8 Summary of Apollo Experiments on Launch Phase Electrical Phenomena	July 1972
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	MSC 07684 Apollo 16 Mission Anomaly Report No. 9- Lunar Roving Vehicle Electrical System Meter Anomalies	January 1973
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	JSC 07948 Apollo 17 Mission-Lunar Roving Vehicle/Traverse Gravimeter Experiment Motion Sensitivity Test	April 1973
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Investigation of Lightning Protection Shielding for Ground Cabling Interfacing CSM 117	August 2, 1973
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Various Skylab Lightning Reports	1973
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Electric Fields at the Ground and Aloft at KSC during June 1975 Evaluated in Respect to Lightning Danger to the Apollo-Soyuz Rocket	July 1975

LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Test Report on ASTP Lightning Instrumentation Verification Tests	August 21, 1975
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Effect of Lightning Damaged X-ducers on ASTP Launch	n/d
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	JSC 07636 Rev. A Space Shuttle Program Lightning Protection Criteria Document and comments	1973-1975
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Update of JSC-07636 Space Shuttle Lightning Protection Document	n/d
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Space Shuttle-Lightning Protection Criteria Document and Lightning Status	March-June 1974
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Memo-Information Pertaining to Lightning	April-May 1982
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Lightning Orbiter Status (with written comments)	January 25, 1983
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Lightning Orbiter Status (with comments)	February 8, 1983
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Orbiter Lightning Damage Analysis	February 1983
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Orbiter Lightning Capabilities	March 15, 1983
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Space Shuttle Lightning Protection Capabilities	June 13, 1984
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	Space Shuttle Lightning Upset Analysis	n/d
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	STS Lightning Launch Criteria	n/d
SubHeading:	Box Number: 01 *	
LIGHTNING COMMITTEE DOCUMENTATION (APOLLO THROUGH SPACE SHUTTLE)	MSC 01540 Analysis of Apollo 12 Lightning Incident * This 88 page document has been scanned	February 1970
SubHeading:	Box Number: 02	
LIGHTNING DETECTION AND RANGING SYSTEM (LDAR)	LDAR - A Lightning Detection and Ranging System	December 1974
LIGHTNING DETECTION AND RANGING SYSTEM (LDAR)	Lightning Detection and Ranging (LDAR)presentation	December 1975
LIGHTNING DETECTION AND RANGING SYSTEM (LDAR)	The Performance of a Real-Time Time-of-Arrival Lightning Location System (LDAR)	December 1976
LIGHTNING DETECTION AND RANGING SYSTEM (LDAR)	S-Band Radar Calibration Test of the Lightning Detection and Ranging System (LDAR)	June 1, 1978
LIGHTNING DETECTION AND RANGING SYSTEM (LDAR)	LDAR Observations of a Developing Thunderstorm Correlated With Field Mill Ground Strike Location, and Weather Radar Data Including the First Report of the Design and Capabilities of a New, Time-of-Arrival Ground-Strike Location System (GSLS)	September 20, 1978
LIGHTNING DETECTION AND RANGING SYSTEM (LDAR)	LDAR - Lightning Detection and Ranging (presentation)	n/d
LIGHTNING SUSCEPTIBILITY ANALYSES (LSA's)	Lightning Susceptibility Analyses (LSA's) on various shuttle systems	1977-1981
LIGHTNING SUSCEPTIBILITY ANALYSES (LSA's)	Lightning Susceptibility Analyses (LSA's) on various shuttle systems	1977-1981

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SubHeading:	Box Number: 03	
SOLID ROCKET BOOSTER (SRB) PAPERS	SRB Lightning Analysis Summary	June 1978
SOLID ROCKET BOOSTER (SRB) PAPERS	Final Supplement to: Support of Lightning Analysis and Testing on the Solid Rocket Booster (SRB) Vehicle	September 1979
SOLID ROCKET BOOSTER (SRB) PAPERS	Calculations on various systems	1980
SOLID ROCKET BOOSTER (SRB) PAPERS	Orbiter/R.H. SRB Interface Shuttle Lightning Analysis Summary	March 20, 1981
SOLID ROCKET BOOSTER (SRB) PAPERS	Orbiter/L.H. SRB Interface Shuttle Lightning Analysis Summary	March 20, 1981
OMS POD MATERIALS	OMS Pod Transducer Data	1975
OMS POD MATERIALS	OMS Pod material (schematics, reports, etc.)	1975-1976
OMS POD MATERIALS	OMS Pod-Direct Effects Test Plan Graphite Epoxy	March 1, 1976
OMS POD MATERIALS	OMS Pod material (schematics, notes, meetings, etc.)	1976-1978
OMS POD MATERIALS	OMS Shielding - E & D Testing	April 6, 1977
OMS POD MATERIALS	OMS Pod - Lightning Protection (reports, studies, etc.)	1977-1978
OMS POD MATERIALS	OMS/RCS Pod - Lightning Strike/Restrike	n/d
KENNEDY SPACE CENTER (KSC) MATERIALS	John F. Kennedy Space Center, NASA Bonding and Grounding, Standard for	May 31, 1968
KENNEDY SPACE CENTER (KSC) MATERIALS	Frequency and Duration of Thunderstorms at Cape Kennedy, Part 1	June 1968
KENNEDY SPACE CENTER (KSC) MATERIALS139	Runway Crosswinds and Headwind Reversals at Cape Kennedy, Florida	October 1972
SubHeading:	Box Number: 04	
KENNEDY SPACE CENTER (KSC) MATERIALS	KSC Lightning Monitoring and Instrumentation	1972-1973
KENNEDY SPACE CENTER (KSC) MATERIALS	KSC Lightning Instrumentation (various reports, charts)	1973-1975
KENNEDY SPACE CENTER (KSC) MATERIALS	John F. Kennedy Space Center, NASA Lightning Instrumentation Systems at KSC, Specification for	March 25, 1974
KENNEDY SPACE CENTER (KSC) MATERIALS	Coordinated Study of the Electrical Properties of Thunderstorms	September 1975
KENNEDY SPACE CENTER (KSC) MATERIALS	Thunderstorm Study Research-KSC (correspondence, research, etc.)	1975-1976
KENNEDY SPACE CENTER (KSC) MATERIALS	Electrostatic Field Changes Produced by Florida Lightning	January 1976
KENNEDY SPACE CENTER (KSC) MATERIALS	Measurement of Electric Fields from Aircraft at Cape Kennedy	January 1976
KENNEDY SPACE CENTER (KSC) MATERIALS	Geometric Model Studies of KSC Launch Facilities	July 31, 1976
KENNEDY SPACE CENTER (KSC) MATERIALS	KSC Lightning Waveform Data	1976(?)
KENNEDY SPACE CENTER (KSC) MATERIALS	Thunderstorm Statistics at KSC	1976
KENNEDY SPACE CENTER (KSC) MATERIALS	LC-39 Pad Lightning Current Paths (Report: Analysis of Lightning Phenomena at KSC for Shuttle)	1976-1979
KENNEDY SPACE CENTER (KSC) MATERIALS	Thunderstorm II-1976 An International Thunderstorm Research Program at KSC	March 1977
KENNEDY SPACE CENTER (KSC) MATERIALS	Analysis of Lightning Phenomena at KSC for the Space Shuttle	December 1978
VARIOUS PERSONAL PAPERS	High Voltage Design Criteria	August 31, 1972

VARIOUS PERSONAL PAPERS	Lightning Effects Induced Through Space Vehicle Exterior Cabling	October-November 1972
SubHeading:	Box Number: 05	
VARIOUS PERSONAL PAPERS	Various reports on Contract NAS10-7871 by Frank A. Fischer	1972
VARIOUS PERSONAL PAPERS	Lightning Induced Voltage Instrumentation	1974-1976
VARIOUS PERSONAL PAPERS	Delete 60 Hz Power Cable Shielding Requirements from JSC 07636	1975-1976
VARIOUS PERSONAL PAPERS	Change to JSC 07636, Rev. A	March 17, 1976
VARIOUS PERSONAL PAPERS	Visit to NOAA, Boulder, CO (various articles, reports, charts, 1 photograph)	April 6-7, 1976
VARIOUS PERSONAL PAPERS	Special Power Lightning Transient Protection for the Orbiter	October 1976
VARIOUS PERSONAL PAPERS	Schematic drawings	1976
VARIOUS PERSONAL PAPERS	ET GH2 UMB System Physical Design Criteria	May 27, 1977
VARIOUS PERSONAL PAPERS	Shuttle Lightning Analysis Summaries	1977-1978
VARIOUS PERSONAL PAPERS	Environmental Requirements and Test Criteria for the Orbiter Vehicle	March 15, 1978
VARIOUS PERSONAL PAPERS	Shuttle Lightning Analysis Summary	1979-1980
VARIOUS PERSONAL PAPERS	ET/Orbiter Interface Lightning Analysis	1980
VARIOUS PERSONAL PAPERS	Working Group Meeting Shuttle Lightning Committee	September 22-23, 1981
VARIOUS PERSONAL PAPERS	Distribution of Change forms for JSC 07636	1981-1982
SubHeading:	Box Number: 06	
VARIOUS PERSONAL PAPERS	STS-4 Launch Criteria papers	1981-1982
VARIOUS PERSONAL PAPERS	Shuttle-related documentation on lightning (schematics, notes, reports)	1982-1984
VARIOUS PERSONAL PAPERS	Various Orbiter/Lightning documents	1983
VARIOUS PERSONAL PAPERS	Launch Pad Protection (overhead presentation)	n/d
VARIOUS PERSONAL PAPERS	ET Cable Inductance	n/d
VARIOUS PERSONAL PAPERS	Miscellaneous material	n/d
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Articles concerning lightning and associated phenomena and effects	1960's-1970's
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Lightning Protection for Supersonic Transports	1969
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	NASA TN D-6901 Atmospheric Electricity Criteria Guidelines for Use in Aerospace Vehicle Development	September 1972
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	NASA TN D-6930 Optimum Runway Orientation Relative to Crosswinds	September 1972
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	A Technology Plan for Electromagnetic Characteristics of Advanced Composites	July 1976
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Advanced Composites: Electromagnetic Properties, Vulnerabilities, and Protective Measures	May 1977
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Effects of Coronas on Electric Fields Beneath Thunderstorms (letter from author included)	February-March 1978
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Proceedings: Second Annual Workshop on Meteorological and Environmental Inputs to Aviation Systems	March 28-30, 1978
SubHeading:	Box Number: 07	
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Atmospheric Electricity Hazards Protection (AEHP) of Advanced	April 28, 1978

	Technology Aircraft (Electrical/Electronic Subsystems)	
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Instrumentation and Flight Report	June 1978
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Composite Forward Fuselage System Integration, v. 1	September 1978
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Composite Forward Fuselage System Integration, v. 2	September 1978
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Optical Digital Techniques-Final Report	February 1979
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Properties of Lightning Derived from Time Series Analysis of the VHF Radiation Data	1979
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	AGARD-LS-110 Atmospheric Electricity-Aircraft Interaction	May 1980
SubHeading:	Box Number: 08	
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	AGARD-CP-283 Electromagnetic Effects of (Carbon) Composite Materials upon Avionics Systems	October 1980
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	AGARD-CP-290 Image and Sensor Data Processing for Target Acquisition and Recognition	November 1980
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Assessment of Lightning Simulation Test Techniques	October 1981
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	A Physical Model for Nuclear Lightning	March 5, 1982
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Electrical Breakdown Characteristics in 0.8 to 1.0 Meter Soil Samples	April 19, 1982
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Alternative Labelling Schemes in Electromagnetic Topology	May 1983
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Planarity Criteria in Electromagnetic Topology	July 1983
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Nonlinear Electrical Studies on Buried Conductors	November 1, 1983
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Location of Lightning Electromagnetic Sources by Time of Arrival Compared to Interference from Electromagnetic Fields, Thunder Acoustics, and videotape photographs	October 1983
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	National Atmospheric Electricity Hazards Protection Plan for Aircraft	March 27-28, 1984
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Data on Atmospheric Research Aircraft	April 1984
SubHeading:	Box Number: 09	
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Manufacturing Technology for Improved High Voltage Power Supply Packaging	May 1984
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	NASA TM-86522 The MSFC/J70 Orbital Atmosphere Model and the Data Bases for the MSFC Solar Activity Prediction Technique	November 1985
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Atmospheric Electricity Hazards Protection Part IV-Design Guide for Air Vehicles	February 1987
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Atmospheric Electricity Hazards Protection Part V-Qualifications and Surveillance Test and Analysis Procedures	February 1987
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	Atmospheric Electricity Hazards Protection (AEHP) of Advanced Aircraft	April 2, 1987
VARIOUS LIGHTNING ARTICLES, PAPERS, DOCUMENTS	The Electromagnetic Modeling of Thin Apertures Using the Finite-Difference Time-Domain Technique	June 1987
SubHeading:	Box Number: 10	
VARIOUS LIGHTNING ARTICLES,	NASA TM-4006 Space/COHMEX Data	August 1987

PAPERS, DOCUMENTS

Inventory Document

VARIOUS LIGHTNING ARTICLES,
PAPERS, DOCUMENTS

Shuttle Flight Rule Workshop on Entry
Precipitation and Thunderstorm
Criteria (Rule 4-64D)

October 5-7, 1987

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