

**CENTER SERIES
COMMUNICATIONS DOCUMENTS**

This collection is a loose assembly of documents related to space based communications systems, particularly the Apollo S-Band. They were received in no particular order and were, therefore, arranged by major subject area including Apollo communications, Apollo television systems, and communications systems for future programs. The subseries consists largely of technical reports, although there are some subject notebooks and contract files included. The documents are dated from 1963 through 1972 (bulk 1965-1970). See also the Paul Vavra papers. ADDENDUM (Boxes 5-11) - This addendum to the Communications Documents subseries contains related materials concerning the development of communication systems for the Apollo Program. They range in date from 1957 to 1980, with the majority coming from 1969 to 1972. The documents concentrate on test summaries and status reviews of various Apollo communications systems, especially TV reception, ALSEP transmission, and various radio frequency tests. The provenance of this collection is Jack W. Seyl, who was head of the Systems Test and Control section of the Telemetry and Communication Systems Division in the early 1970's. He became head of the Systems Technique section of the same division in the mid-1970's, Deputy Chief of the Systems Development Division under the Mission Support Directorate in the mid-1980's, and is currently Chief of the Space Station Grounds Systems under the Mission Operations Directorate. He joined NASA in 1965 in the Information Systems Division of the Engineering Directorate (many of the documents in the earlier Communications subseries can be linked to this division, since the name of William Teasdale is stamped on a number of the documents). The collection was well-organized when it arrived, and needed only slight rearrangement to order chronologically. Some subject areas emerged, and these have been placed at the end of the collection. Various acronyms appear frequently, and are listed below: Apollo Communications Systems (ACS) Apollo Lunar Surface Experiments Package (ALSEP) Communications and Tracking Systems Ground Test (CATSGT) Electronic Systems Test Program (ESTP) Lunar Communications Relay Unit (LCRU) Manned Space Flight Network (MSFN) Particles and Fields Subsatellite (PFSS) See also the original subseries and the Paul Vavra papers for related materials.

Inventory

SubHeading:	Box Number: 01	
	P65-35, Hughes Aircraft, Spacecraft Antenna Systems, Interim Engineering Report, (Phase 1 - Final Report), NAS5-3545	October 1963-January 1965
	Dispersed Array Notebook (including graphs, notes, drawings, and equations)	1964, n.d.
	Bellcomm, Inc., TM-65-2021-3, Design Philosophy of Modulation Indices for Apollo Unified S-Band Modes with Ranging	March 11, 1965
	NASA-TN-D-2208, Unified S-Band Telecommunications Techniques for Apollo, Volume 1: Functional Description	March 1965
	Bellcomm, Inc., Design Philosophy for the Frequency Modulated Modes of the Apollo Unified S-Band Communications System	April 5, 1965
	JPL Spec. KNR-1086-DSN, Design Specification MSFN Ground Equipment Unified S-Band RF Receiver/Exciter Subsystem	July 16, 1965
	Bellcomm, Inc., TM-2021-65-6, Optimization of Modulation Indices in Phase Modulated Frequency Multiplexed Communications Systems	August 3, 1965
	Bellcomm, Inc., TM-66-2021-1, Definition and Measurement of the Unified S-Band Transponder Ranging Channel	March 1, 1966
	NASA TN-D-3397, Unified S-Band Telecommunication Techniques for Apollo, Volume II: Mathematical Models and Analyses	April 1966
	Bellcomm, Inc., TM-66-2021-14, A Method for Performing a Bit Error Rate	December 29, 1966

	Analysis of the ALSEP Telemetry Data Link	
	Bellcomm, Inc., TM-67-2034-2, Communication Performance of the Proposed LM Relay Equipment	January 19, 1967
SubHeading:	Box Number: 02	
	Internal Note No. 67-EB-R-4, Apollo S-Band Telecommunications and Tracking Circuit Margins, Volume 1: Two-way Margins for the Block I CSM	January 1967
	Bellcomm, Inc., TM-67-2034-4, Spectral Analysis of a Communications Relay System Using an Apollo Unified S-Band Transponder	June 30, 1967
	Internal Note No. MSC-EB-R-67-9, The Apollo Pseudo-Random Noise Ranging System	December 1967
	NASA TN-D-4402, Performance of Several Convolutional and Block Codes with Threshold Decoding	March 1968
	MSC-EB-R-68-6, Project Apollo LM S-Band Communications Gross Compatibility Test and Analysis	April 1, 1968
	PHO-TN202, Rev. A, Philco Ford Corporations, Coding for Aerospace Applications, NAS9-1261	May 15, 1968
	MSC-EB-R-68-9, Apollo S-Band Telecommunications and Tracking Circuit Margins, Volume II: Two-Way Margins for Block II CSM	August 1968
SubHeading:	Box Number: 03	
	LM and CSM Performance and Interface Specifications for Manned Spaceflight Network / S-Band Communications Notebook (with notes, tables, change logs, etc.)	1968 - 1969
	Apollo Relay Satellite Notebook (Intelsat)	1968 - 1970
	EB68-2011(U), Effects of Transmitted Noise on Receiver Signal-to-Noise Ratios	January 3, 1969
	NASA-TR-R-384, A Study of FM Threshold Extension Techniques	April 1972
	Apollo Omnidirectional Antenna Design with Reentry Considerations	n.d.
	An Analysis of the Telecommunications Performance of a Lunar Relay Satellite System	n.d.
SubHeading:	Box Number: 04	
APOLLO TELEVISION	RCA, Operation and Maintenance Manual, Apollo Command Module (CSM) Television Camera Subsystem	April 7, 1969
APOLLO TELEVISION	RCA, Familiarization Manual: Apollo Command Module (CSM) Television Camera Subsystem, NAS9-9318	May 5, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EB2-051569-1, Potential Antenna Requirements for an Earth Orbiting Space Base	May 15, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EB2-052769-2, A Double-Sideband Quadrature Subcarrier Modulation Technique for Multi-Channel Voice Transmission	May 27, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EB2-062569-4, Signal Design Considerations for Space Base / Ground Communications Links	June 25, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EB2-062769-5, Signal-to-Noise Ratio and Transmission Bandwidth Requirements of a Digital / Analog	June 27, 1969

	Hybrid Modulation Scheme for Space Base Application	
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EB2-070969-6, A Proposed Laboratory Test Set for Evaluation of Digital Voice Techniques	July 9, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EB2-081369-7, Intelsat IV Support of Two-Way Voice Communications with an Earth Orbiting Space Base	August 13, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EE8-082269-8, Calculating Signal-to-Noise Ratios in Binary PCM	August 22, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EE8-082969-9, A Comparison Between PCM-PSK and FM Modulation Schemes for Space Base Application	August 29, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EE8-092569-10, Signal Design Optimization for Single Channel Voice Transmission	September 25, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EE8-100669-11, Carrier Frequency Optimization for Future Earth Orbiting Space Telecommunications Systems	October 6, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EE8-100769-12, Communications System Parameter Trade-Offs for Single Voice Channel Transmission Using Intelsat IV Relay	October 7, 1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	EE8-090470-13, A Coded Digital Signal Design for Simultaneous Transmission of Voice and PCM	September 4, 1970
APOLLO TELEVISION	Lear Siegler, Inc., Operation and Maintenance Manual, Slowscan Monitor, Model 0762	January 27, 1965
APOLLO TELEVISION	RCA, Apollo Command Module Television Camera Program Plan, NAS9-7438	March 1, 1968
APOLLO TELEVISION	NASA Support Manual, Operational Manual for the Apollo Command Module (CSM) Television Camera, NAS9-7438	July 29, 1968
SubHeading:	Box Number: 04 *	
APOLLO TELEVISION	Philco, Sequential Color Video to Parallel Color Video Converter, Operations Manual, NAS9-13781 *This entire 50 page document has been scanned	February 20, 1975
APOLLO TELEVISION	Apollo TV Slow Scan Converter Operations and Maintenance Manuals *This entire 117 page document has been scanned	1964, 1968, n.d.
APOLLO TELEVISION	Westinghouse Electric, NASA Scan Converter, Conversion of Slow Scan TV to a Standard Broadcast Presentation in Real-Time, Final Report, (NAS9-2998) (related documents attached) *This entire 65 page document has been scanned	May 1966
APOLLO TELEVISION	Lunar Television Camera Development Contract (including Statement of Work), NAS9-3548 *This entire 123 page document has been scanned	July 3, 1967
SubHeading:	Box Number: 05	
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	GFE Command and Service Module - MSFN Signal P&I Specification, Block I	February 22, 1965
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP Report on Special FM Channel Performance and Evaluation Tests	May 18, 1966
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	LEM VHF P&I Specifications	August 1, 1967
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	LM/EVCS Interface Specifications	1968-1969
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Apollo Communications Configuration Handbook	February 24, 1969

SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Building 440 Intercommunication Directory (Revision 1)	February 1970
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP Phase II Apollo Lunar Scientific Data System / MSFN Systems Compatibility and Performance Test Report	November 20, 1970
SubHeading:	Box Number: 05 *	
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Television Broadcasting material (Skylab Television System Improvement Study Report; Apollo, Skylab, and Shuttle TV Configurations; Electrical Performance Standards- Monochrome Television Studio Facilities *This entire 98 page document has been scanned	1957-1976
SubHeading:	Box Number: 06	
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP Apollo Communications System Phase III EVCS-LM-MSFN System Compatibility and Performance Evaluation Test Report	December 1970
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	MSC-02661 Electronic Systems Test Laboratory (ESTL) Calibration Test Procedures - LRV Electro - magnetic Compatibility Tests (Unclassified) Pre- Test Edition	January 15, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP Phase II Apollo Lunar Data Recorder / Reproducer Scientific Data System / MSFN Test Status Review	January 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	PFSS / MSFN Systems Compatibility and Performance Test Summary	February 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Section 13 - Experiments(?) Includes Test Plan for Lunar Surface Experiments Electromagnetic Compatibility Program (MSC-03995)	February-March 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Notes on the Krohn-Hite Variable Filter	March 10, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Summary of LCRU Test Results	March 16, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Flutter analysis of Apollo Block II DSE	March 17, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	MSC-02662 System Test Procedures for LRV Electromagnetic Compatibility Program	March 22, 1971
SubHeading:	Box Number: 07	
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Section 12(?) - Tests on LCRU	March 26-27, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Test Summary - MSFN Television Systems Low Frequency Response and MSFN RER FM and PM IF Frequency Response Tests	April 22, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	LRV ECP Systems Test Data Package Supplement 1	June 25, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP Lunar Communications Relay Unit/MSFN System Compatibility and Performance Test Report	June 25, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Tuneable PSK Demodulator System Compatibility and Performance Test Summary SDS and PFSS / MSFN Ber measurements	June 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Summary of Results - Apollo 15 TV Configuration Optimization Tests	July 7, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ALSEP Transmitter-MSFN Receiver System Compatibility and Channel Performance Summary	July 13, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	LCRU / MSFN RF System Evaluation Summary	August 9, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Investigation of Incidental Amplitude Modulation as Related to Apollo 14	September 3, 1971

	and 15 Lunar Module Steerable Antenna Oscillations	
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP ALSEP Transmitter MSFN USB Compatibility Test Report	September 20, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ACSTTS-LCRU Performance for the Apollo 15 Mission	October 12, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Apollo Communication System Test Technical Summary (ACSTTS) - PFSS Performance	October 19, 1971
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Bit Error Rate Tests on an LED (Light Emitting Diode Data Link)	January 12, 1972
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Trompeter Connector RF Leakage Tests Summary Report	January 19, 1972
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ALSEP / STDN Compatibility and Channel Performance Test Summary	February 1972
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	VHF Transmitter / Receiver / CM System Compatibility and Performance Test Summary	February 1972
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP ALSEP (Array E) STDN USB Compatibility Test Report	March 27, 1972
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Distribution of Voice Intelligibility Supplement to VHF Air-to-Ground Systems Compatibility and Performance Test Summary	May 24, 1972
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP Standard Test Procedure (Documents #EE7-77-601 to #EE7-77-622), some missing	1977-1978
SubHeading:	Box Number: 08	
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	LCRU / MSFN FM System Frequency Response and CM FM / LCRU FM Interference Test Results Summary	n/d
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	Proposal - Pulse Code Modulation (PCM) for the Space Shuttle Orbiter Vehicle	n/d
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	ESTP LCRU / MSFN System Compatibility and Performance Test Report	n/d
SPACE BASE COMMUNICATIONS TECHNICAL MEMORANDA	2 Polaroid photographs (2T Pulse)	n/d
CATSGT MATERIALS	Approved CATSGT Documentation (Interagency Agreement between Air Force / NASA; JSC 09687, Space Shuttle Program NASA Task 501, System Development Plan; JSC 09685, Space Shuttle Program, NASA Task 501, Verification Plan; JSC 09946, Space Shuttle Program Operating Plan for CATSGT)	1975-1977
CATSGT MATERIALS	CATSGT Action Items, Related Correspondence	1976-1980
CATSGT MATERIALS	CATSGT Panel Minutes Meetings #1-12	1977-1980
FM DEMODULATOR MATERIAL	FM Demodulator Test Program FMFB Demodulator and SDDS FM Demodulator	October 1968
FM DEMODULATOR MATERIAL	Motorola FM Demodulator Summaries	1968-1969
SubHeading:	Box Number: 09	
FM DEMODULATOR MATERIAL	MSFN 50 MHz FM Demodulator Preliminary Technical Manual	March 14, 1969
FM DEMODULATOR MATERIAL	Test Procedures and Data Sheets for MSFN 50 MHz FM Demodulator	May 1, 1969
FM DEMODULATOR MATERIAL	Recommended Procedures for MSFN 50 MHz FM Demodulator Alignment and MSFN Receiver Frequency Adjustment with LCRU TV Modes	July 2, 1971
S-BAND MATERIAL	Task 1 - Final Report, Apollo Unified S-Band System Block I Compatibility	September 8, 1965

	Test Program	
S-BAND MATERIAL	Design Specification - MSFN Ground Equipment Unified S-Band RF Receiver / Exciter Subsystem	July 22, 1966
SubHeading:	Box Number: 10	
S-BAND MATERIAL	ESTP CSM Block I D-Model-MSFN Unified S-Band Communications System Compatibility and Performance - Final Report	December 19, 1966
S-BAND MATERIAL	Uplink and downlink S-band communications combinations for CSM, LM, LCRU, SDS, ALSEP, and PFSS	1966-1970
S-BAND MATERIAL	Block III-C DSIF Ground Equipment S-Band RF Receiver / Exciter Subsystem, Detail Specification for	June 14, 1967
STATUS REVIEWS	LM Gross Tests Status Review	December 15, 1966
STATUS REVIEWS	CSM Block II Gross Tests Status Review	December 15, 1966
STATUS REVIEWS	ALSEP Gross Tests Status Review	January 23, 1967
STATUS REVIEWS	ACS Phase I Quick-Look Tests Status Review	March 22, 1967
STATUS REVIEWS	ESTP Investigation of IPM Effects as Related to LM RF Tracking Systems Operation	May 9, 1967
STATUS REVIEWS	ESTP ALSEP / MSFN Compatibility and Performance Test Status Review	April-May 1968
SubHeading:	Box Number: 11	
TEST SUMMARIES	C1 Mission Test Results Summary	January 22, 1969
TEST SUMMARIES	Phase III LM DUA Test Summary	February 6, 1969
TEST SUMMARIES	Apollo 11 Communication System Summary	May-July 1969
TEST SUMMARIES	Incidental Frequency Modulation (IFM) Effects on Amplitude Modulation (AM) Measurements	July 14, 1969
TEST SUMMARIES	Parkes 210 Antenna System Real Time Evaluation Technical Summary	August-September 1969
TEST SUMMARIES	ESTL / LM Color TV (LM-6) Test Results Summary	August-October 1969
TEST SUMMARIES	ALSEP Command Anomaly Summary	October-November 1969
TEST SUMMARIES	Apollo Lunar Exploration Mission (ALEM) Communications System Performance Tests	November 17, 1969
TEST SUMMARIES	Apollo 12 Color TV Test Summary	November 20, 1969
TEST SUMMARIES	LCRU / LSS TV Preliminary Tests and Results	December 1969
TEST SUMMARIES	Summary of AM Measurements on the 30 KHz and 70 KHz Subcarrier Oscillators	January 20, 1970
TEST SUMMARIES	LCRU Data Channel Design Verification Test Summary	February 19, 1970
TEST SUMMARIES	Interference Effects on the FM Television Channel	April 14, 1970
TEST SUMMARIES	ALSEP VCO Phase Jitter	April 21, 1970
TEST SUMMARIES	Lunar Orbit Subsatellite (LOSS) Quick-look Acquisition Test	May 6, 1970
TEST SUMMARIES	LCRU Television Pre/Deemphasis Tests	May 15, 1970
TEST SUMMARIES	PFSS Technical Summary	May 26, 1970
TEST SUMMARIES	LCRU Television Preemphasis Tests (6 color photographs)	May-July 1970
TEST SUMMARIES	SDS (Prototype Modulation) Test Status Review	August 1970

TEST SUMMARIES	PFSS Command Decoder Tests	September 22, 1970
TEST SUMMARIES	LCRU Engineering Model - RCA Color Camera Tests	September-October 1970
TEST SUMMARIES	LCRU Design Verification Tests Final Report	October 1970
TEST SUMMARIES	MSFN / ALSEP Redundant Command Receiver Test Summary	December 15, 1970
TEST SUMMARIES	LM / CCS Interference Tests (Apollo 13) (10 memos)	1970
TEST SUMMARIES	LCRU FM / PM (Subcarrier) Data Channel Design Verification Test Result Summary	n/d
	Special Investigation of Exciter 60 Hz Modulation	n/d