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Apollo Flight Guidance Computer Software Collection [Hamilton]

Elizabeth C. Borja

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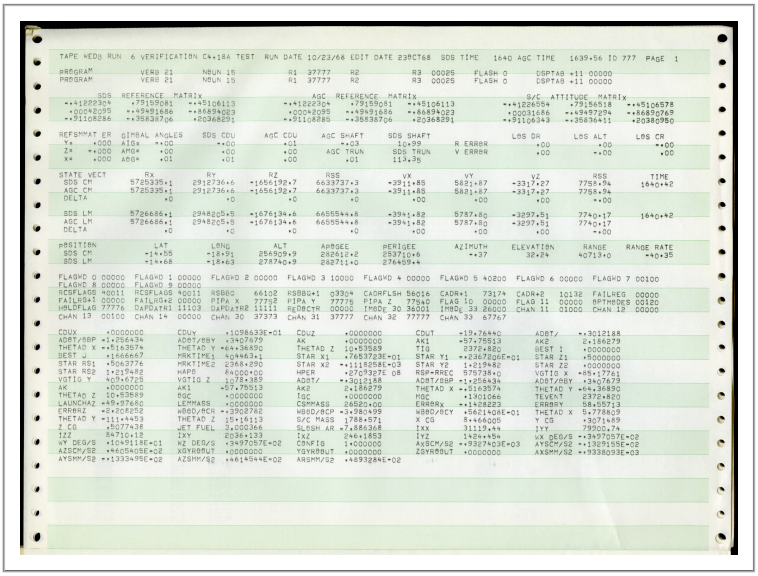

National Air and Space Museum Archives
14390 Air & Space Museum Parkway
Chantilly, VA 20151
Business Number: Phone: 703-572-4045
NASMRefDesk@si.edu
https://airandspace.si.edu/archives

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Collection Overview

Repository:	National Air and Space Museum Archives
Title:	Apollo Flight Guidance Computer Software Collection [Hamilton]
Date:	1965-1986 (bulk 1965-1972)
Identifier:	NASM.1986.0158
Creator:	Hamilton, Margaret Heafield, 1936-
Extent:	1.22 Cubic feet (2 legal document boxes; 1 slim legal document box)
Language:	English .
Summary:	The Apollo Flight Guidance Computer Software Collection [Hamilton] consists of reports, memoranda, and related material documenting the Apollo flight guidance software developed by Margaret Hamilton's team at the Charles Stark Draper Laboratory (CSDL) in the late 1960s and early 1970s. The collection also includes Hamilton's 1986 handwritten notes on selected documents.

Administrative Information

Acquisition Information

Donated by Margaret Hamilton, gift, 1986-1987.

Processing Information

Arranged, described, and encoded by Elizabeth C. Borja, 2017.

Preferred Citation

Apollo Flight Guidance Computer Software Collection [Hamilton], Accession 1986-0158, National Air and Space Museum, Smithsonian Institution.

Restrictions

No restrictions on access.

Conditions Governing Use

Permissions Requests

Biographical Note

Margaret H. Hamilton (b. 1936) was the Director of Software Engineering Division at Charles Stark Draper Laboratory (CSDL), Massachusetts Institute of Technology (MIT) and was responsible for the onboard flight software for NASA's

Apollo and Skylab missions. She became known as the "Rope Mother," an apt description for her role and referred to the unusual way that computer programs were stored on the Apollo guidance computers.

Hamilton received a BA in Mathematics from Earlham College in Richmond, Indiana, and postponed her Ph.D. work when she was offered the opportunity to work on the Apollo project. She has published over 130 papers and reports on her areas of expertise in system design and software development. In 1986, she became the founder and CEO of Hamilton Technologies, Inc. in Cambridge, Massachusetts. On November 22, 2016, President Barack Obama awarded Hamilton the Presidential Medal of Freedom for her contribution that led to Apollo 11's successful landing.

Scope and Contents

This collection consists of reports, memoranda, and related material documenting the Apollo flight guidance software developed by Margaret Hamilton's team at the Charles Stark Draper Laboratory (CSDL) in the late 1960s and early 1970s. Documents include a printout from an Apollo guidance computer software simulation; software program change routing slips; reports from Apollo Guidance, Navigation, and Control (formerly Apollo Guidance and Navigation); a preliminary flight plan for Apollo 7; memoranda for the submission of MIT/IL Software Development Plan, critiquing each new official version of the flight system; guidance system documents using assorted programs, including Sundisk, Skylark, and Luminary; and an oversized Charles Stark Draper Laboratory brochure. When she donated the collection in 1986, Hamilton composed handwritten notes on the history of selected documents, which are included with each document and identified in the finding aid as "[Note from Margaret Hamilton]."

Arrangement

The materials are arranged chronologically.

Names and Subject Terms

This collection is indexed in the online catalog of the Smithsonian Institution under the following terms:

Subjects:

Charles Stark Draper Laboratory
Project Apollo (U.S.)
Space vehicles -- Guidance systems

Names:

Hamilton, Margaret Heafield, 1936-

Container Listing

Box 1, Folder 1	Sokkappa, Balraj G. "On Optimal Steering to Achieve 'Required Velocity.'" Report R-491, April 1965
Box 1, Folder 2	"Guidance System Operations Plan for Manned CM Earth Orbital Mission Using Program Sundisk. Section 6: Control Data." Report R-547 Rev. 1 [Note from Margaret Hamilton], December 1967
Box 1, Folder 3	"Guidance System Operations Plan for Manned CM Earth Orbital Mission Using Program Sundisk. Section 5: Guidance Equations" Report R-547 Rev. 2, March 1968
Box 1, Folder 4	"Guidance System Operations Plan for Manned LM Earth Orbital and Lunar Missions Using Program Luminary. Section 4: PGNCS Operational Modes." Report R-567 [Note from Margaret Hamilton] [1 of 3], March 1968
Box 1, Folder 5	"Guidance System Operations Plan for Manned LM Earth Orbital and Lunar Missions Using Program Luminary. Section 4: PGNCS Operational Modes." Report R-567 [2 of 3], March 1968
Box 1, Folder 6	"Guidance System Operations Plan for Manned LM Earth Orbital and Lunar Missions Using Program Luminary. Section 4: PGNCS Operational Modes." Report R-567 [3 of 3], March 1968
Box 1, Folder 7	NASA, Preliminary Flight Plan Apollo 7, AS 205/101, May 31, 1968
Box 1, Folder 8	Hamilton, M. MIT/IL. COLOSSUS Revision Memos. [Note from Margaret Hamilton], May 1968 - July 1968
Box 2, Folder 1	Instrumentation Laboratory, MIT, Apollo Project Memorandum #2038, Submission of MIT/IL Software Development Plan, December 20, 1968
Box 2, Folder 2	Battin, Richard H. and Gerald M. Levine. "Application of Kalman Filtering Techniques to the Apollo Program." Report E-2401, April 1969
Box 2, Folder 3	Schmidt, George T. and Larry D. Brock. "General Questions on Kalman Filtering in Navigation Systems." Report E-2406., April 1969
Box 2, Folder 4	Memo, To: FS55/Head, Apollo Guidance Program Section, From: FS55/Head, Program Support Group, Subject: Apollo Mission G Post-flight Summary - AGC support (console 37, Flight Dynamics SSR), September 19, 1969
Box 2, Folder 5	MIT/Charles Stark Draper Laboratory. Stubbs, G., A. Penchuk, and R. Schlundt. "A Digital Autopilot for Thrust Vector Control of Apollo CSM and CSM/LM Vehicles." Report R-670, November 1969

Box 2, Folder 6	Apollo Guidance Program Symbolic Listing Information for Block 2, Revision 2 [1 of 3], November 20, 1969
Box 2, Folder 7	Apollo Guidance Program Symbolic Listing Information for Block 2, Revision 2 [2 of 3], November 20, 1969
Box 2, Folder 8	Apollo Guidance Program Symbolic Listing Information for Block 2, Revision 2 [3 of 3], November 20, 1969
Box 2, Folder 9	MIT/Draper Laboratory Program Change Routing Slips [Note from Margaret Hamilton], February to July 1969
Box 2, Folder 10	AC Electronics, Apollo 13 Guidance and Navigation Summary, circa 1970
Box 2, Folder 11	[Note from Margaret Hamilton, placed in AC Electronics, Apollo 13 book], circa 1986
Box 3, Folder 1	Delco Electronics. Apollo Command Module. Primary Guidance, Navigation and Control System. Student Study Guide. CM Digital Autopilot., June 2, 1969; revised April 15, 1971
Box 3, Folder 2	[Note from Margaret Hamilton, placed in Delco Electronics. Apollo Command Module. Primary Guidance, Navigation and Control System. Student Study Guide.], circa 1986
Box 3, Folder 3	Hamilton, Margaret. Charles Stark Draper Laboratory. Software Shuttle Memo #29. Management of APOLLO Programming and its Application to the Shuttle. [Note from Margaret Hamilton], May 20, 1971
Box 3, Folder 4	"Guidance System Operations Plan Manned CM Earth Orbital Missions Using Program Skylark 1. Section 2: Data Links." Report R-693 [Pre-Release Copy], December 1971
Box 3, Folder 5	Hamilton, Margaret. Charles Stark Draper Laboratory. Shuttle Management Note #14. First Draft of a Report on the Analysis of Apollo System Problems During Flight., October 23, 1972
Box 4, Item 1	NASM-9A16037: The Charles Stark Draper Laboratory [promotional material], circa 1971
Box 4, Item 2	NASM-9A12593: Apollo Guidance Computer Software Simulation - [computer printout] (command module test run simulation in a powered flight program demonstrating parameter during an error detection and recovery process. Bailout during burn.) [Note from Margaret Hamilton], October 23, 1968
	NASM-9A12593-45506-A: Apollo Guidance Computer Software Simulation, Printout, Page 45506-A, October 23, 1968 Image(s): Apollo Guidance Computer Software Simulation, Printout, Page 45506-A [NASM-9A12593-45506-A]

Image(s)

Notes: Page (45506-A) from an example of a command module test run simulation in a powered flight program demonstrating parameters during an error detection and recovery process. Run date: 10/23/1968.