



Smithsonian Institution Archives

Multiple-Mirror Telescope  
Videohistory Collection, 1989

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Washington, D.C.  
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## Collection Overview

<b>Repository:</b>	Smithsonian Institution Archives, Washington, D.C., <a href="mailto:osiaref@si.edu">osiaref@si.edu</a>
<b>Title:</b>	Multiple-Mirror Telescope Videohistory Collection
<b>Identifier:</b>	Record Unit 9542
<b>Date:</b>	1989
<b>Extent:</b>	7 videotapes (Reference copies). 25 digital .wmv files and .rm files (Reference copies).
<b>Creator::</b>	
<b>Language:</b>	English

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## Administrative Information

### Preferred Citation

Smithsonian Institution Archives, Record Unit 9542, Multiple-Mirror Telescope Videohistory Collection

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## Historical Note

Since 1979, completely new and radical designs for astronomical telescopes have emerged. The Multiple Mirror Telescope (MMT) was the prototype, both technically and institutionally, for the next generation of large telescopes. The MMT was the world's first large-scale multiple mirror telescope, which used the combined light of six 72-inch reflecting telescopes in a single altitude-azimuth mount. Computers controlled all pointing and tracking of the MMT's individual telescopes. The MMT was located at the Smithsonian's Fred Lawrence Whipple Observatory on Mt. Hopkins, Arizona. Development of this site was begun by the Smithsonian Astrophysical Observatory (SAO) in the late 1960s as the Mt. Hopkins Observatory, renamed the Whipple Observatory in 1981. The MMT was jointly developed and run by SAO and the University of Arizona (UA). This arrangement was the first of several university and observatory consortia that have attempted larger multiple mirror and segmented mirror designs.

Session participants included astronomers, engineers and opticians who worked on virtually every facet of MMT design and development in the 1970s and 1980s. Nathaniel Carleton received an A.B. and Ph.D. in physics from Harvard University, the latter in 1956; he taught physics until 1962 when he was appointed a physicist at the Smithsonian Astrophysical Observatory. He was primarily interested in physics of the Earth's upper atmosphere but became interested in astronomy and the study of other planets. He was involved with the development of the MMT from the beginning.

Frederic H. Chaffee was educated as a physicist at Dartmouth College and received a Ph.D in astronomy from the University of Arizona in 1968. Shortly thereafter he joined the stellar atmospheres group at the Smithsonian Astrophysical Observatory, and, under Smithsonian auspices, returned to Arizona to help establish the first optical telescope on Mt. Hopkins. He became the first resident astronomer at the Mt.

Hopkins Observatory and then resident director of the observatory during the 1970s, when the MMT was built. He became director of the MMT Observatory in July 1984.

Craig Foltz received an A.B. in physics from Dartmouth College in 1974 and a Ph.D. in astronomy from Ohio State University in 1979. He held postdoctoral, research associate, and teaching positions until he was appointed staff astronomer and project scientist for the MMT in 1984.

Carol Heller received a B.S. in biology from the University of Arizona and shortly thereafter became a night assistant at the 9-inch telescope on Mt. Hopkins. She began work with the MMT four years later and was one of the few control room operators of large-scale telescopes in the world.

Keith Hege did not appear on screen, but was interviewed during the observing session by speakerphone. Hege, associate astronomer at the Steward Observatory, University of Arizona, obtained a Ph.D. in nuclear physics at the Rensselaer Polytechnic Institute in 1965. Hege taught at Virginia Polytechnic Institute and Hollins College before joining Steward Observatory in 1975. In 1978 he coordinated Steward Observatory's speckle interferometry program, which was applied to the MMT for cophased interferometric imaging.

Thomas Hoffman received a B.S. degree from the University of Rochester and M.S. and Professional M.E. degrees from the Massachusetts Institute of Technology in 1954. He served over fourteen years as chief engineer and head of the Engineering Department of the SAO in Cambridge, Massachusetts, and was program engineer for the MMT. He left the Smithsonian in 1979.

Aden Meinel, one of the key players in developing the MMT, received his B.S. and Ph.D. in astronomy from the University of California, Berkeley. He held numerous appointments, including director of Kitt Peak National Observatory, Steward Observatory, and the Optical Sciences Center (University of Arizona). He was also professor at the Optical Sciences Center until 1985, when he became senior scientist at the Jet Propulsion Laboratory in Pasadena, California.

Michael Reed was educated at Yale University and Stanford University, and received a Ph.D. in mathematics in 1969. He taught at Princeton University from 1968 through 1974, when he received an appointment at Duke University. He worked on the various aspects of the MMT, including selection of the alt-azimuth mount during the 1970s.

Robert Shannon received a B.S. in optics and M.S. in physics from the University of Rochester. He worked with the Itek Corporation as director of the Advanced Technology Labs before becoming professor and director of the Optical Sciences Center at the University of Arizona in 1969.

Ray Weymann received a Ph.D. in astronomy from Princeton in 1959 and was a Research Fellow at the California Institute of Technology from 1959 through 1961. He taught at the University of Arizona in 1961, became an astronomer at the Steward Observatory, University of Arizona in 1970, and was appointed director of Mt. Wilson Observatory in Los Angeles in 1986.

Joseph T. [J.T.] Williams designed, built, and operated astronomical instrumentation at Smithsonian Astrophysical Observatory sites worldwide for more than thirty years. He studied electrical engineering and served in the U.S. Navy submarine service before joining the Smithsonian at the Haleakala Observatory (Maui, Hawaii) in 1959. After holding several positions with SAO, Williams became manager for site planning and construction of the MMT from 1975 through 1979 and became assistant director for MMT operations and development, in collaboration with the University of Arizona, in 1980. In the 1990 he served on the committee to convert the MMT to a single mirror 6.5-meter telescope.

Fred L. Whipple was educated at University of California, Los Angeles, and received a Ph.D. in astronomy from the University of California, Berkeley, in 1931. He joined the staff of the Harvard College Observatory in 1931 and became a teacher there in 1932. He ultimately became the Phillips Professor of Astronomy, 1970. Whipple was also appointed director of Smithsonian Astrophysical Observatory in 1955 and shortly

thereafter moved its headquarters to Cambridge, Massachusetts. During his tenure as director, Whipple selected and developed Mt. Hopkins as an observatory site. The observatory, initially known as the Mt. Hopkins Observatory, was dedicated the Fred Lawrence Whipple Observatory in 1981. He worked closely with the University of Arizona and the U.S. Air Force in developing the MMT. He retired in 1977 and subsequently held the position Emeritus Phillips Professor of Astronomy at Harvard.

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## Introduction

The Smithsonian Videohistory Program, funded by the Alfred P. Sloan Foundation from 1986 until 1992, used video in historical research. Additional collections have been added since the grant project ended. Videohistory uses the video camera as a historical research tool to record moving visual information. Video works best in historical research when recording people at work in environments, explaining artifacts, demonstrating process, or in group discussion. The experimental program recorded projects that reflected the Institution's concern with the conduct of contemporary science and technology.

Smithsonian historians participated in the program to document visual aspects of their on-going historical research. Projects covered topics in the physical and biological sciences as well as in technological design and manufacture. To capture site, process, and interaction most effectively, projects were taped in offices, factories, quarries, laboratories, observatories, and museums. Resulting footage was duplicated, transcribed, and deposited in the Smithsonian Institution Archives for scholarship, education, and exhibition. The collection is open to qualified researchers.

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## Descriptive Entry

David H. DeVorkin, curator at the Smithsonian's National Air and Space Museum (NASM), recorded six sessions with twelve participants to document this multi-institutional scientific program. He was particularly interested in design and construction of the MMT; in its operation (with basic structural and optical design elements); in how astronomers use the telescope; and in the phenomenon of "consortia." DeVorkin also visually documented the operation of the MMT, including a nighttime observing session, various artifacts and equipment, and the interaction of former colleagues during group discussions. Interviews took place on May 8, 10 and 11, 1989, at the observatory, in a studio in Tucson, Arizona, and at Flandrau Planetarium of the University of Arizona.

This collection consists of six interview sessions, totalling approximately 11:20 hours of recordings and 257 pages of transcript.

Please note that Session 6 is comprised of dual sets of tape from two cameras positioned at different angles.

Additional Information: See Record Unit 262, Records of the Mt. Hopkins Department, SAO, 1966-1967, and Record Unit 9520, Fred Lawrence Whipple Interviews, 1976, Smithsonian Institution Archives. Also, consult records of the director and assistant director, SAO, for additional documentation on the MMT.

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## Names and Subject Terms

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

Subjects:

Astronomy  
Astrophysicists  
Astrophysics  
Interviews  
Observatories  
Oral history  
Science -- History  
Technology -- History

Types of Materials:

Transcripts  
Videotapes

Names:

Carleton, Nathaniel  
Chaffee, Frederic H., 1941-  
DeVorkin, David H., 1944- , interviewer  
Foltz, Craig Billig  
Fred Lawrence Whipple Observatory  
Hoffman, Thomas E.  
Meinel, Aden B.  
Mt. Hopkins Observatory  
Multiple Mirror Telescope Observatory  
Reed, Michael  
Shannon, Robert Rennie, 1932-  
Smithsonian Astrophysical Observatory  
University of Arizona  
Weymann, R. J. (Ray J.)  
Whipple, Fred L. (Fred Lawrence), 1906-2004  
Williams, Joseph T.

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## Container Listing

### Interviews

Interviews

#### **Session 1: May 8, 1989**

Interviews

At the MMT Observatory, Mt. Hopkins, Arizona, featured Carleton, Chaffee, Foltz, Heller, Hege, and Williams discussing the technical design and engineering features of the MMT, c. 1970-1989, including: site selection; mechanical engineering of structure; elements of building's box design and rotation capability; use of standard steel members; alt-azimuth drives and bearing supports; operation of spectrograph; optical components and support structure; mounting of each mirror; optical focal plane; operation of control room; telescope and instrument set up and procedures; observing procedures, calibration, and alignment; data gathering. Visual documentation included: exterior views of mountain tops considered during site selection; tours of major function rooms, including the telescope chamber, spectrograph instrument lab, basement, and yoke and control rooms; placement of liquid nitrogen in red channel spectrograph; tour of support structure of MMT (Star of David design); tour of mirror placement; demonstration of how building rotates; demonstration of data collection and analysis with computers; demonstration of astronomers and control room operator at work.

Interviews

Transcript, 1-75 pages, of videotape recording, 3 hours.

Interviews

Recording of Interview: Total Recording Time: 3 hours

Note:

- Original Masters: 9 Beta videotapes
- Preservation Masters: 9 Motion jpeg 2000 and 9 mpeg digital files
- Dubbing Masters: 3 U-Matic videotapes
- Reference Copies: 2 VHS videotapes, 9 Windows Media Video and 9 Real Media digital files

Interviews

#### **Session 2: May 10, 1989**

Interviews

In the studio of Channel 18, Tucson, Arizona, featured Carleton, Hoffman, and Whipple discussing the origins of the MMT, c. 1960-1989, including: history and background of MMT; concern in early 1960s of photon collection at minimal cost; informal meetings with engineers, opticians, astronomers; influence of radio astronomy; development of segmented mirror designs; proposal from the University of Arizona; specifications and cost requirements; receipt of 72-inch mirrors from United States Air Force; working on a multi-institutional project; optical systems and mounts; conservatism of scientific community concerning project and funding; peer review. Visual documentation included: photograph of segmented mirror design; group interaction.

- Interviews Transcript, 1-30 pages, of videotape recording, 1 hour.
- Interviews Recording of Interview: Total Recording Time: 1 hour  
Note:
- Original Masters: 1 1-inch reels
  - Preservation Masters: 1 Motion jpeg 2000 and 1 mpeg digital files
  - Dubbing Masters: 1 U-Matic videotape
  - Reference Copies: 1 VHS videotape, 1 Windows Media Video and 1 Real Media digital files
- Interviews **Session 3: May 10, 1989**
- Interviews In the studio of Channel 18, Tucson, Arizona, featured Carleton, Hoffman, Reed, and Williams about how major design decisions were made, c. 1970-1989, including: operation of the alt-azimuth mount; ball-bearing support structure; operation of rectangular rotating building; acceptance of design by astronomical community; design of optical support structure; work with Optical Sciences Center, University of Arizona (OSC); technical and economic aspects of mirrors; selection of Mt. Hopkins over Mt. Lemmon; construction. Visual documentation included: copy of written proposal and photograph; group interaction.
- Interviews Transcript, 1-28 pages, of videotape recording, 1 hour.
- Interviews Recording of Interview: Total Recording Time: 1 hour  
Note:
- Original Masters: 1 1-inch reels
  - Preservation Masters: 1 Motion jpeg 2000 and 1 mpeg digital files
  - Dubbing Masters: 1 U-Matic videotape
  - Reference Copies: 1 VHS videotape, 1 Windows Media Video and 1 Real Media digital files
- Interviews **Session 4: May 10, 1989**
- Interviews In the studio of Channel 18, Tucson, Arizona, featured Carleton, Chaffee, Hoffman, Reed, Shannon, and Williams discussing cooperation during construction and operations and use of MMT, c. 1970-1989, including: how astronomers and engineers worked together, shared knowledge, responsibilities, and interests; budgeting and general costs; general management and operation; the MMT as both an engineering prototype and a working scientific instrument; "user-friendliness" of the MMT for insiders and visiting astronomers; effectiveness of the multi-institutional consortium; effectiveness of MMT in operation and data collection; lessons learned from the MMT experience. Visual documentation included: group interaction.
- Interviews Transcript, 1-34 pages, of videotape recording, 2 hours.



documentation included: tour of mirror on display in planetarium's exhibit hall; sketch of multiple mirror design; model of original design; group interaction.

Interviews

Transcript, 1-56 pages, of videotape recording, 2 hours.

Interviews

Recording of Interview: Total Recording Time: 2 hours

Note:

- Original Masters: Camera A: 6 Beta videotapes
- Camera B: 4 Beta videotapes
- Preservation Masters: 10 Motion jpeg 2000 and 10 mpeg digital files
- Dubbing Masters: Camera A: 2 U-Matic videotapes
- Camera B: 2 U-Matic videotapes
- Reference Copies: Camera A: 1 VHS videotape
- Camera B: 1 VHS videotape, 10 Windows Media Video and 10 Real Media digital files