

USGS Open-File Report 2005-1190
Figures



Figure 1-Oblique aerial photograph looking northwest of Meteor Crater, Arizona; photo by David J. Roddy, USGS, Branch of Astrogeology.

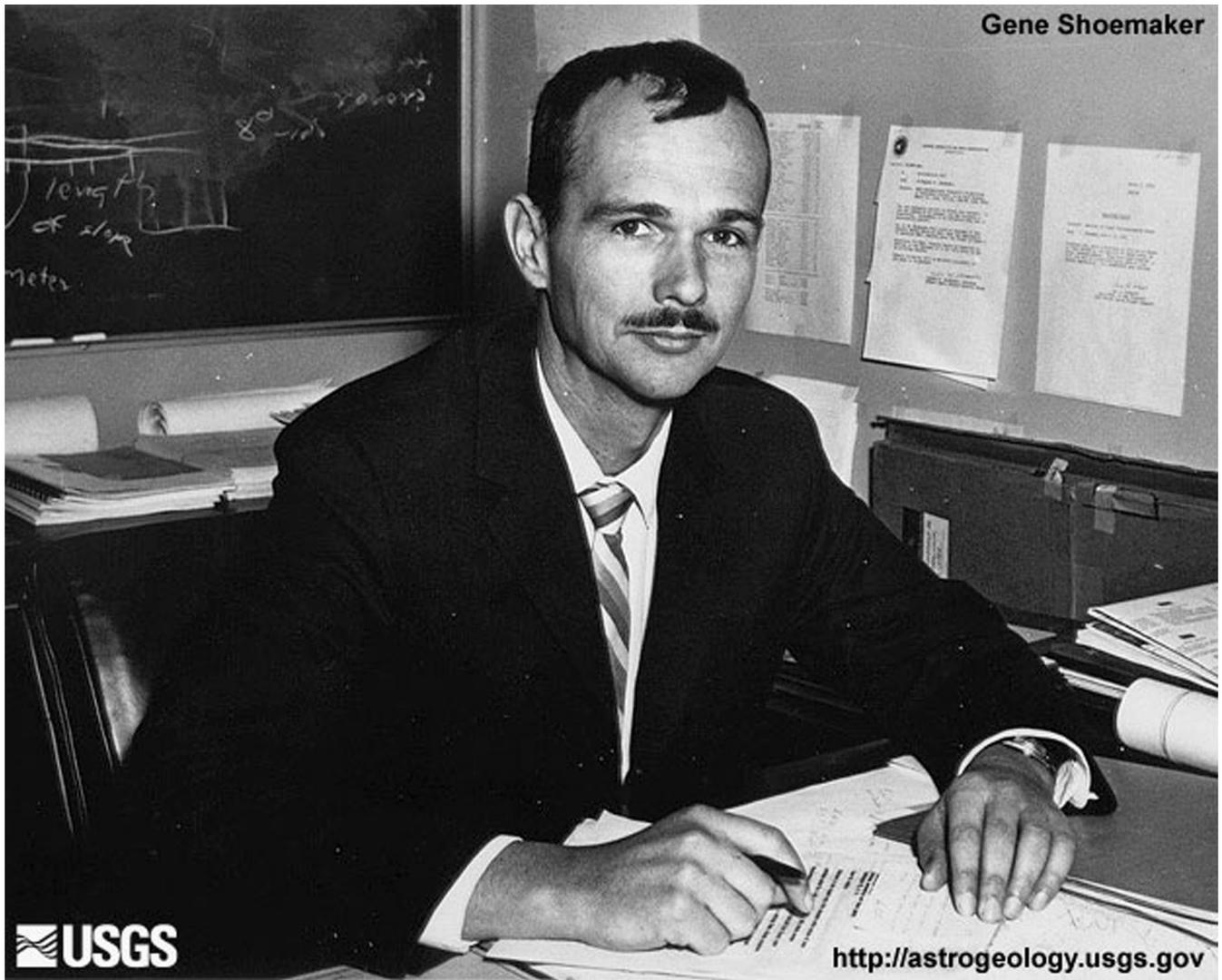


Figure 2-1963 photograph of Eugene M. Shoemaker; NASA



Figure 3-(a) Hopi Buttes Volcanic Field near Dilkon, Arizona; view toward the west. Pines and junipers for scale;
Photo credit: Louis J. Maher, Dept. of Geology and Geophysics, University of Wisconsin, Madison

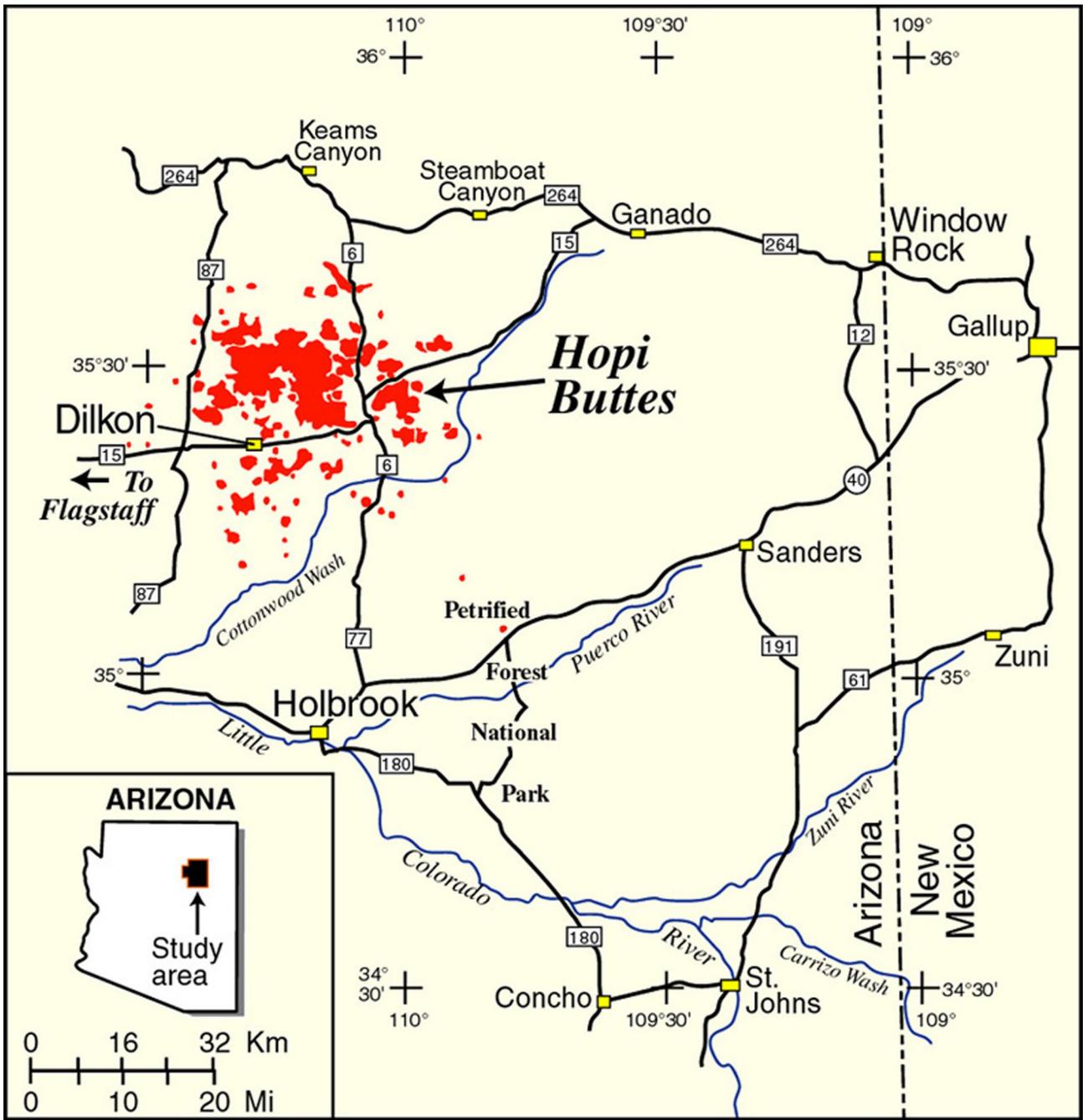


Figure 3-(b) Map showing Hopi Buttes and the surrounding area; data source: <http://esp.cr.usgs.gov/hopibuttes/>



Figure 4-(a) Telescopic photograph of Copernicus Crater (~1 b.y. old; 93-km diameter) on the lunar frontside



Figure 4-(b) Pat Bridges working on original airbrush, shaded-relief map of Copernicus at the Air Force Aeronautical Chart and Information Center (ACIC) in St. Louis, Missouri, in 1959; photo courtesy of Pat Bridges.



Figure 5-The historic Monte Vista Hotel located at 100 N. San Francisco Street in downtown Flagstaff, Arizona.



Figure 6-Gene Shoemaker with Ed Chao (USGS, Washington, D.C.) in 1960 following their discovery of a new high-temperature/high-pressure phase of quartz, Coesite, (see Levy, 2000, p. 82).

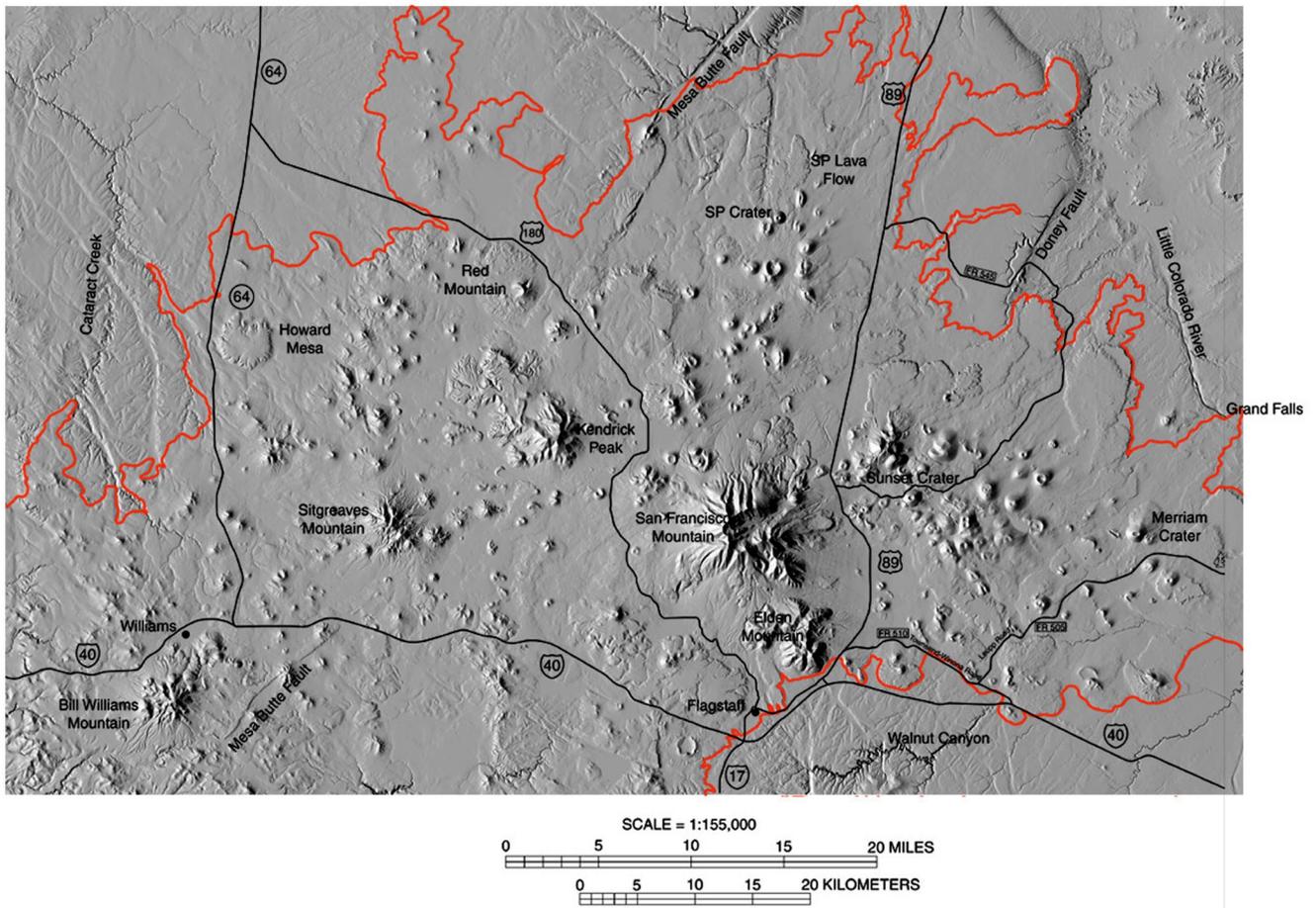


Figure 7-(a) shaded relief map/poster of the San Francisco Volcanic Field in Northern Arizona (San Francisco Volcanic Field, 2001, Grand Canyon Association Publication in conjunction with the staff at the U.S. Geological Survey, Flagstaff Field Center, Flagstaff, Arizona)

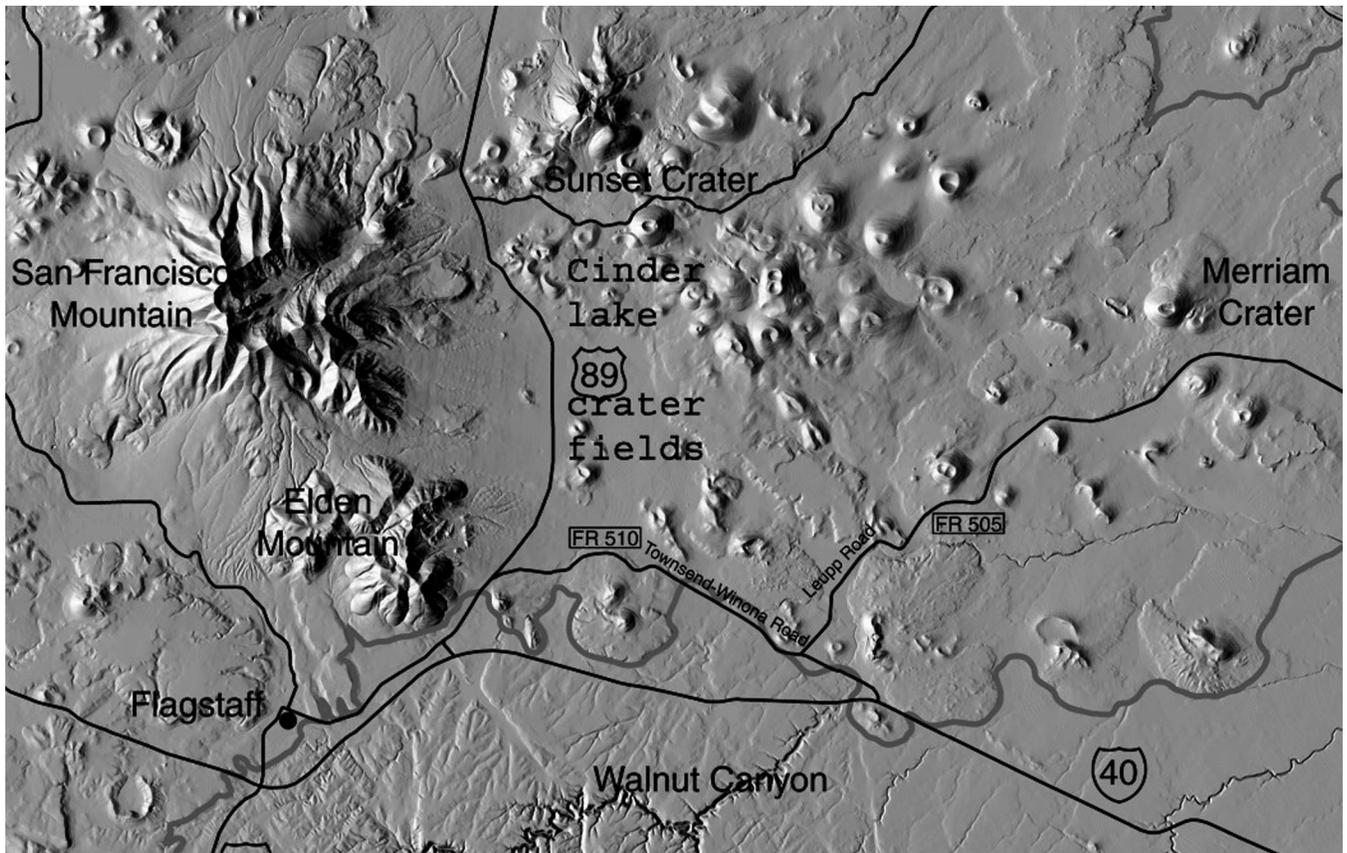


Figure 7-(b) enlarged portion of (a) showing the details of the area just north and east of Flagstaff where many of the geologic training field-training exercises (described in this work) were carried out for NASA's Astronauts.



Figure 8-Aerial view (August 1968) of downtown Flagstaff, Arizona, showing the location of the old Arizona Bank building (dark roof); presently, Bank of America) on Birch Street; USGS photo packet P656.

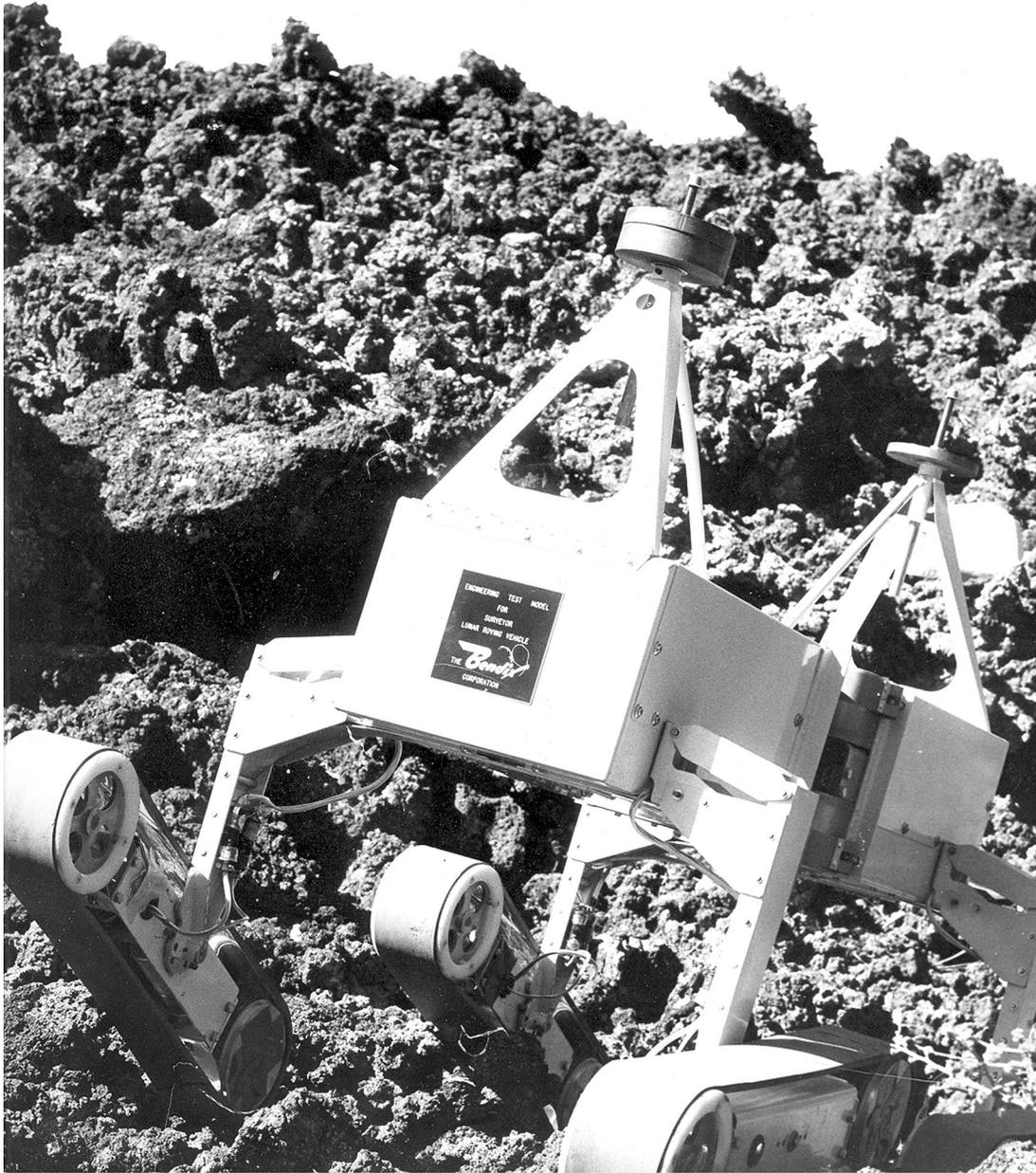


Figure 9- May 1964 photograph of the design prototype of the Surveyor Lunar Roving Vehicle (SLRV) built by the Bendix Aerospace Corporation. The Bendix SLRV is shown here being tested on the rugged (aa) Bonita lava flow adjacent to Sunset Crater just northeast of Flagstaff. Also tested at that time (in a one-on-one competition with the Bendix vehicle) was a wire-wheeled version of the SLRV built by General Motors. The SLRV was eventually dropped from the Surveyor Program after disappointing field tests of both vehicles in the Flagstaff area by the USGS.



Figure 10-Branch of Astrogeology's 30-inch telescope on Anderson Mesa (south of Flagstaff, Arizona); (a) telescope under construction; key presentation of housing building on 29 January 1964; USGS photo P879B, F1200

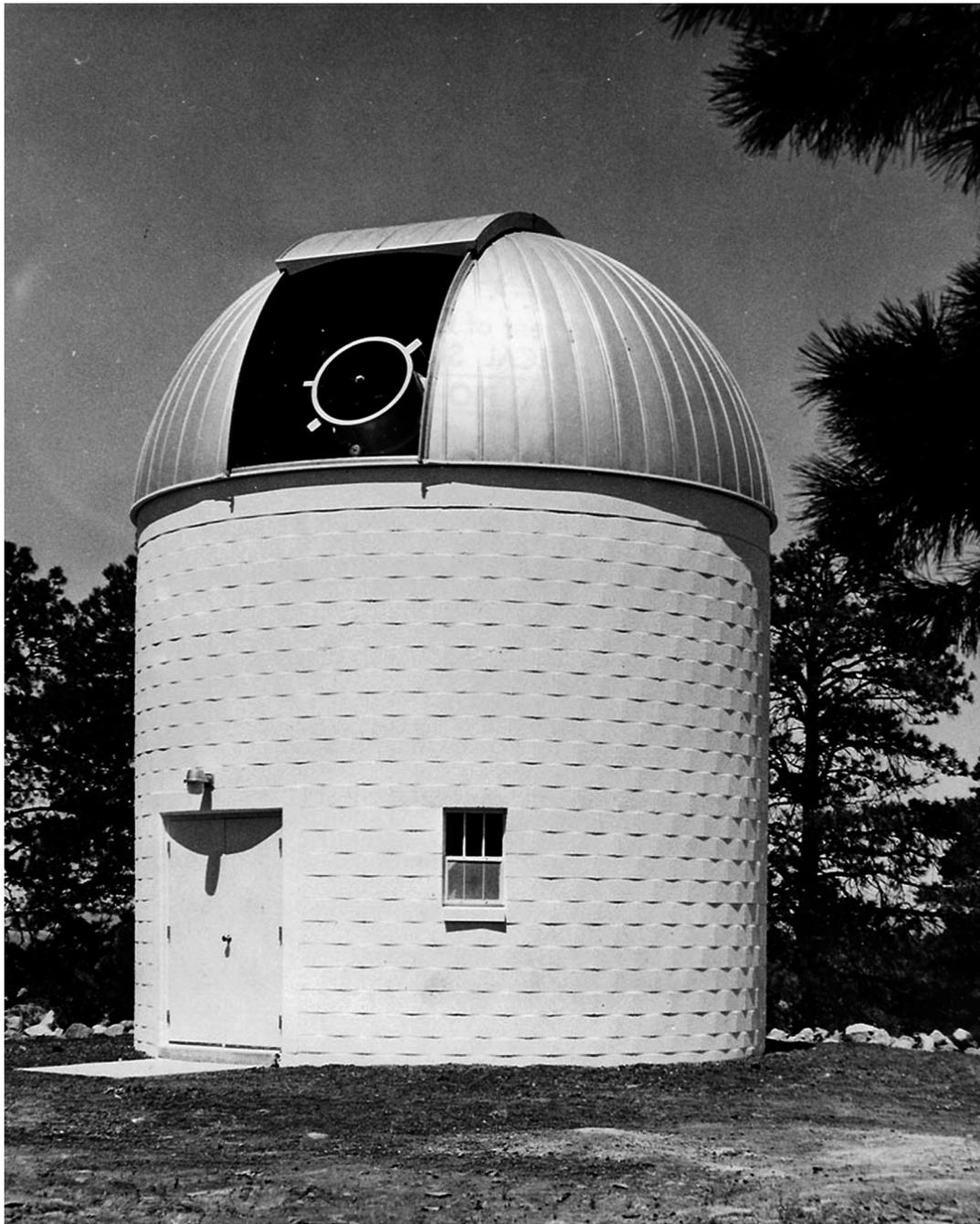


Figure 10-(b) completed telescope building, summer 1964; USGS P879B, F 1219

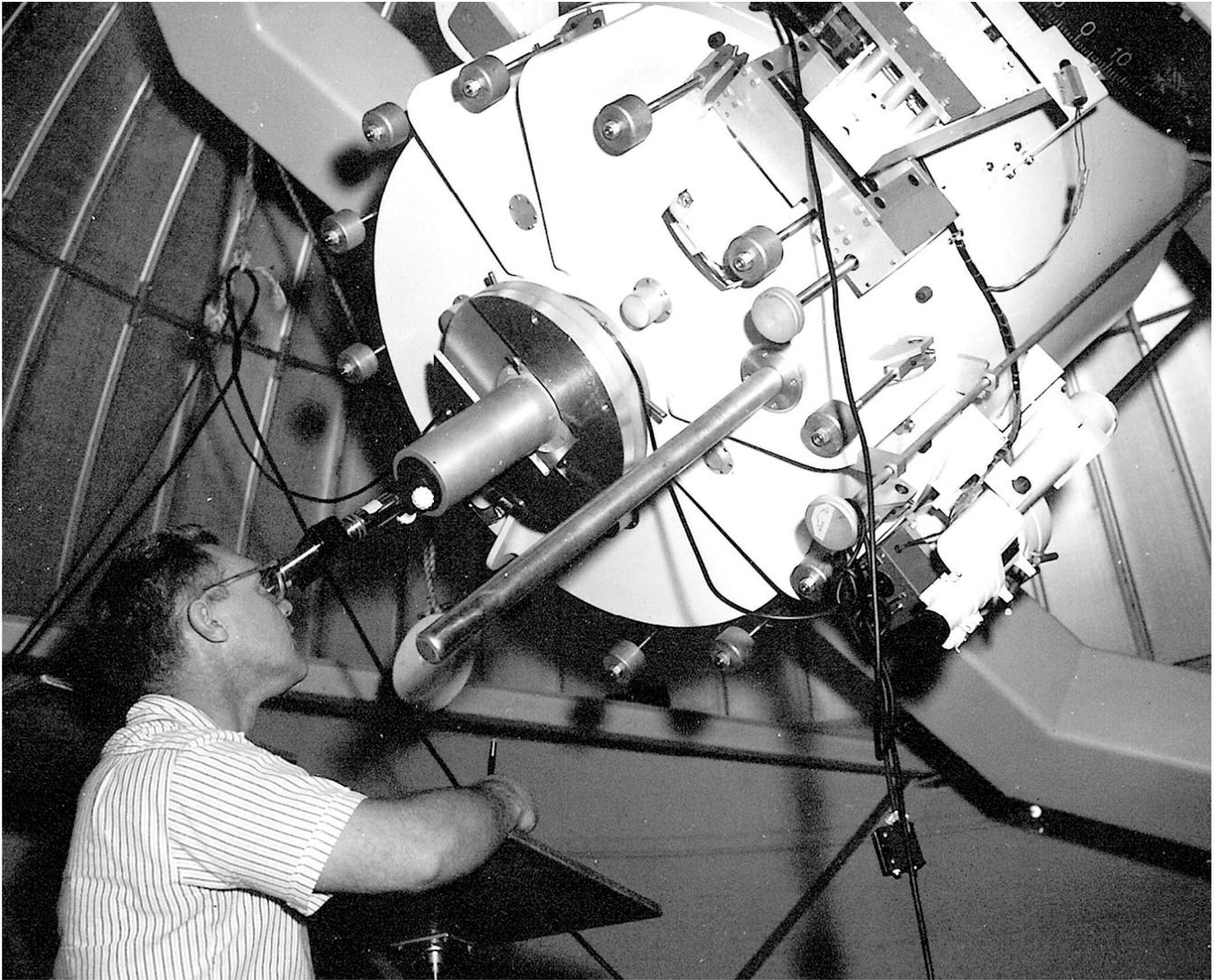


Figure 10-(c) geologist Elliot Morris at eyepiece of newly completed telescope, USGS photo P879B, F1221.



Figure 11-Astronaut geologic training trip (5-6 and 12-13 March 1964) to Grand Canyon, Arizona; (a) l.-to r., Donald "Deke" Slayton, Jim McDivitt, Dale Jackson (USGS), NASA photo S-64-13809, 12 March 1964



Figure 11-(b) Neil Armstrong on mule, NASA photo S-64-14760 5 March 1964



Figure 11-(c) James Lovell; NASA photo S-64-13799; 12 March 1964

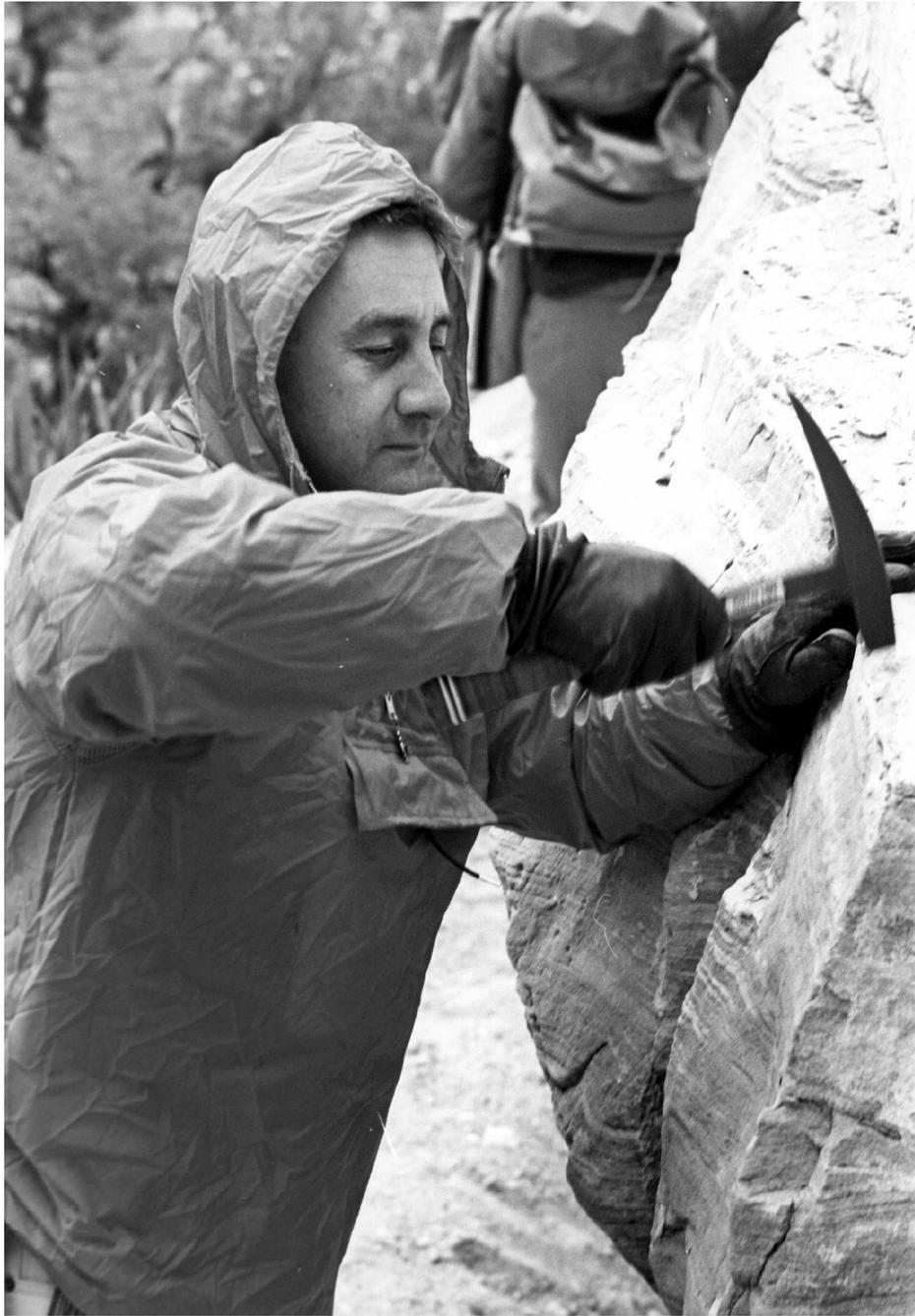


Figure 11-(d) Gus Grissom; NASA photo S-64-1711; 12 March 1964



Figure 11-(e) l. to r., Wally Schirra, Ed White, Al Chidester (USGS, Branch of Astrogeology, Flagstaff, Arizona), Frank Borman, NASA photo S-64-13859, 13 March 1964



Figure 11-(f) Gordon Cooper, NASA photo S-64-13818, 13 March 1964

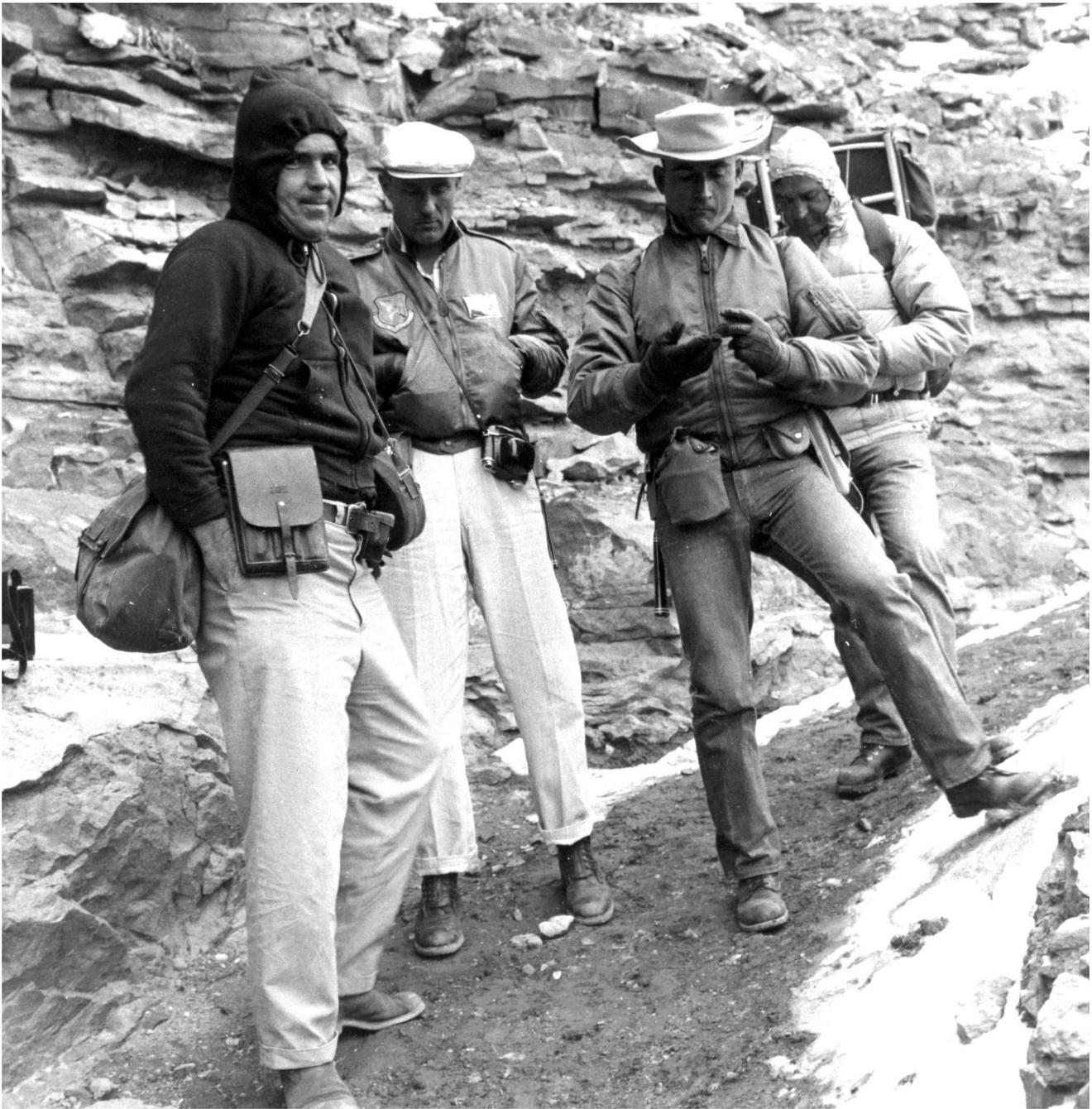


Figure 11-(g) l.-to-r.. Jack McCauley (USGS, Branch of Astrogeology, Flagstaff, Arizona), Tom Stafford, John Young, and Frank Letey, NASA photo S-64-13871, 12 March 1964).



Figure 12-Astrogeology staff at the Museum of Northern Arizona in spring 1964; (l to r) Eugene Phillippi, Elliot Morris, Carl Roach, Dale Jackson, Gene Shoemaker, Don Elston, Judy Rockwell, Ed Chao, Charles “Chuck” Marshall, Taylor, Wayne Lowry, Ray Batson, John “Jack” McCauley, Harold “Hal” Masursky, Frank Cuttitta, and Russell “Russ” Wahmann; USGS photo P879A, F1091.



Figure 13-Surveyor test-camera set up with GM personnel on Bonita Lava flow in 1964; USGS photo, P879B, F651112.



Figure 14-Twenty-nine NASA astronauts visited Flagstaff, Arizona for early geologic training on 30 April-1 June 1964 and 21-22 May 1964. They came up from Tucson after viewing the Moon on the then new McMath Solar Telescope at Kitt Peak Observatory); (a) NASA S-64-23729- astronauts C.C. Williams, Frank Borman, Gene Cernan with trainer Dale Jackson (USGS) at Sunset Crater, NASA photo S-64-23729, 30 April 1964



Figure 14-(b) astronaut Al Shepard with Flagstaff Mayor Rollin Wheeler at Pulliam airport; USGS photo P883b, F7106



Figure 14-(c) astronaut Scott Carpenter with Flagstaff Mayor Rollin Wheeler; USGS photo P883b, F7105.



Figure 15-Astronaut trip on 3-6 June 1964 to Philmont (Boy Scout Ranch), near Cimarron, New Mexico; (a) Joel Watkins (USGS) (right) discusses gravity meter data with Dave Scott (left), Neil Armstrong and Roger Chaffee; NASA photo S-64-23868



Figure 15-(b) (l to r) Marty Kane, Alan Bean, Neil Armstrong, Bill Anders (suspenders), person in hat (unidentified), Roger Chaffee, Joel Watkins (right side); NASA photo



Figure 15-(c) Gordon Cooper (left) with Marty Kane (USGS) with Worden gravity meter; NASA photo

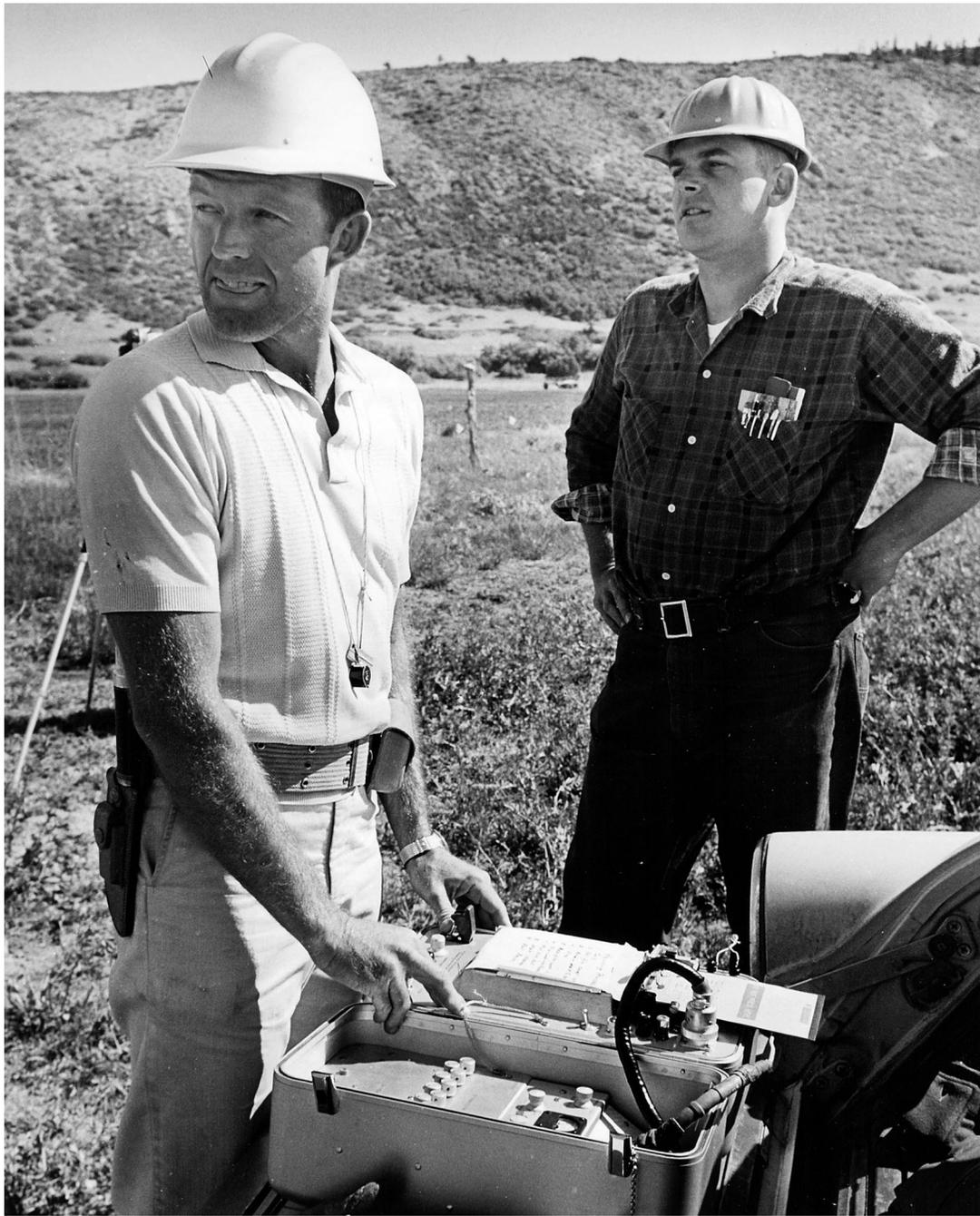


Figure 15-(d) Gordon Cooper (left) operates a GT-2 timer while Joel Watkins (USGS) observes; NASA photo.



Figure 16-The Branch of Astrogeology's very first spacesuit test AS-1 15-20 June 1964 at Sunset Crater National Monument, just northeast of Flagstaff, Arizona off U.S. 89 N.; Photographs below were all taken by Paul Long (Museum of Northern Arizona, Flagstaff, Arizona); (a) Test support van alongside Bonita Lava Flow with staff preparing Branch of Astrogeology suited test subject (either G. Shoemaker, G. Phillippi, or J. Harbour)



Figure 16-(b) Suit engineers handling communication lines for suited subject's arduous climb onto Bonita Lava Flow



Figure 16-(c) suited subject standing on edge of Bonita Lava Flow with early concept of Lunar Staff with sun compass on top



Figure 16-(d) an exhausted Gene Phillippi in Gemini suit resting near the Bonita Lava Flow during test

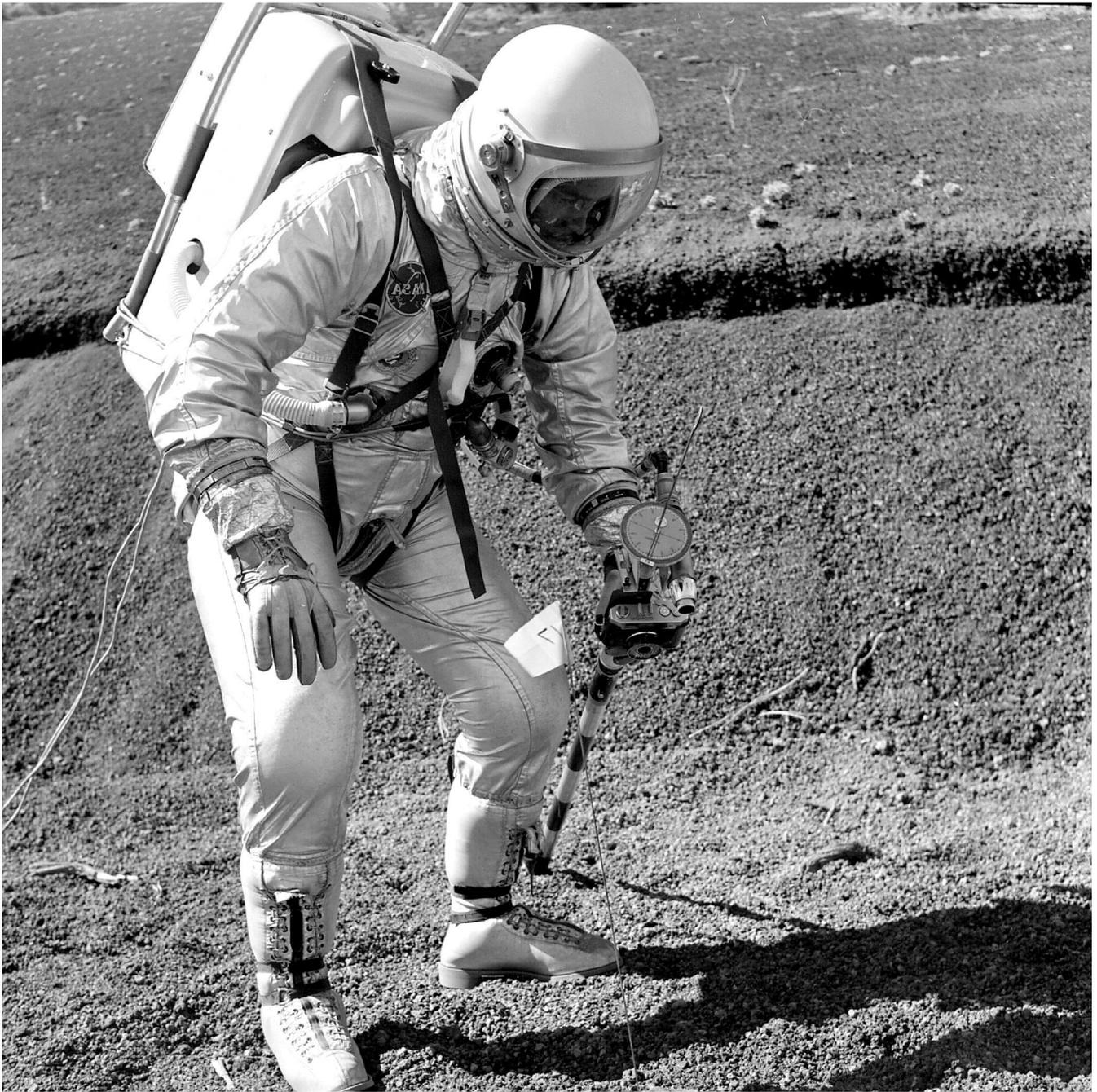


Figure 16-(e) suited subject investigation the base of a cinder cone (Sunset Crater?) holding the Lunar Staff



Figure 16-(f) Hal Stephens (stationed at the USGS' Menlo Park Center at that time), photographer, working with his movie camera with which he was documenting the test



Figure 16-(g) suited test subject at support van



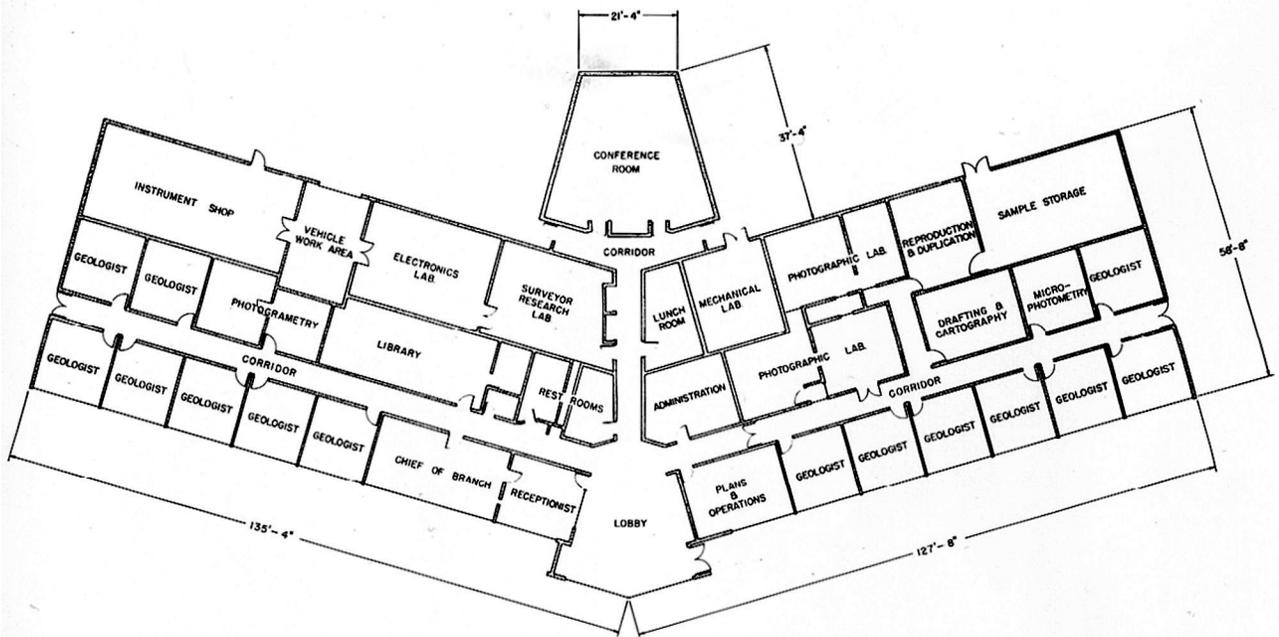
Figure 16-(h) close-up of suited test subject holding Lunar Staff



Figure 16-(i) close-up of suited test subject working with Sun compass on Staff



Figure 16-(j) kneeling suited test subject collecting sample near Bonita Lava Flow; San Francisco Peaks in background.



PROPOSED U.S. GEOLOGICAL SURVEY BUILDING FLOOR PLAN

Figure 17-Proposed U.S. Geological Survey Building Floor plan (Building-One) on McMillan Mesa, Flagstaff, Arizona (1964), USGS photo P879, F1036.



Figure 18-Branch of Astrogeology's military surplus Burroughs Electro-Data computer installed in September 1964 in a specially-modified, and air-conditioned, room built for it at Arizona State College (ASC) (now Northern Arizona University, NAU) in Flagstaff, Arizona; (a) General view showing the large size of the early computer and its control console; USGS photo P789c, F1253

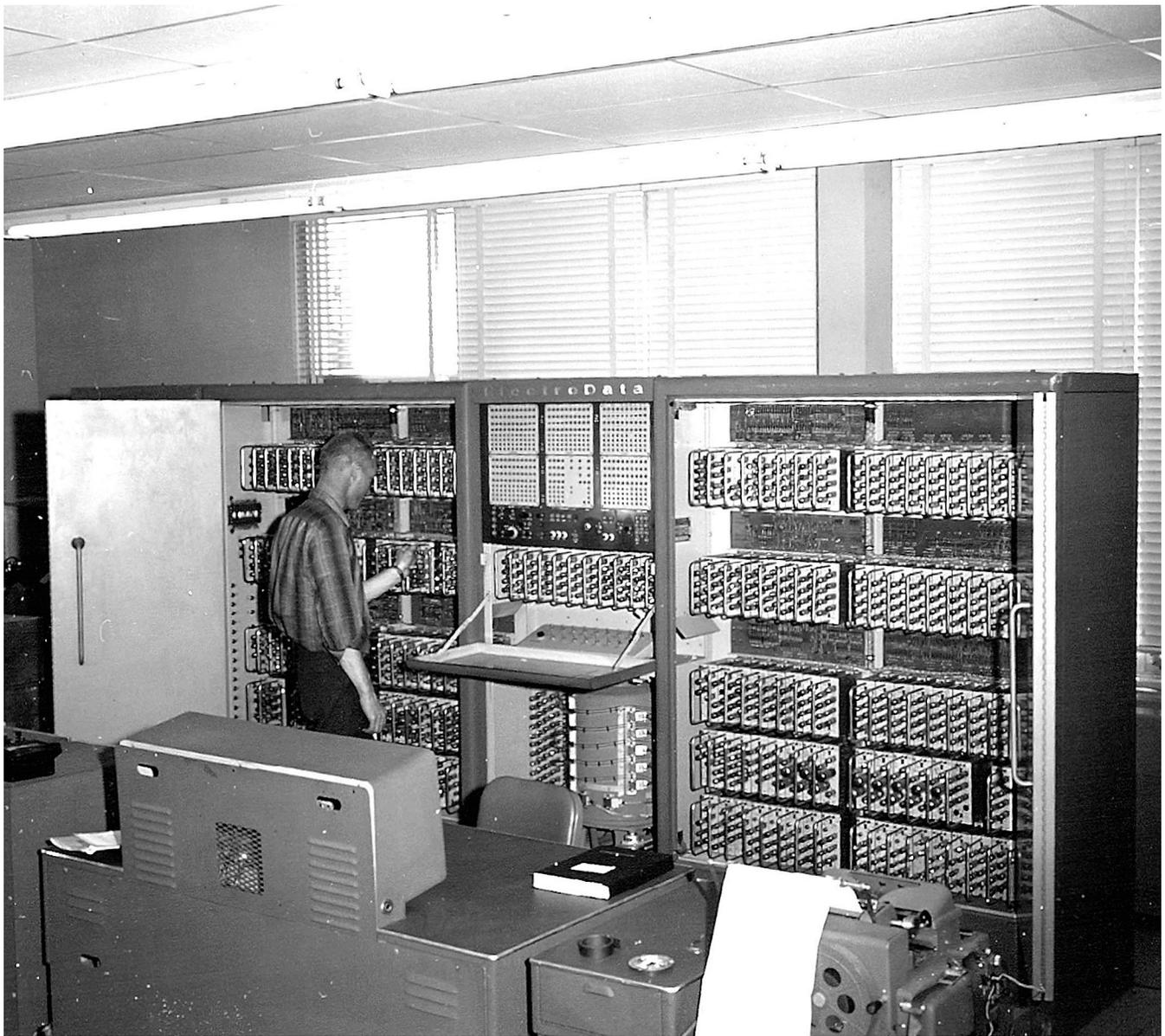


Figure 18-(b)View showing the banks of hundreds of glass vacuum tubes which powered this early mainframe computer that arrived at ASC in September 1964; USGS photo P879c, F1247. The computer never really became fully functional before it was scrapped.



Figure 19-Plywood LM mockup on flatbed truck; being used during Branch of Astrogeology Apollo test 5 (27 September to 1 October 1965) in Hopi Buttes Test Site (80 miles northeast of Flagstaff, USGS photo P46 F9657c; see 1965).