

TABLE 1

GEOLOGIC FIELD-TRAINING OF NASA ASTRONAUTS BETWEEN JANUARY 1963 AND NOVEMBER 1972

The following is a year-by-year listing of the astronaut geologic field training trips planned and led by personnel from the U.S. Geological Survey's Branches of Astrogeology and Surface Planetary Exploration, in collaboration with the Geology Group at the Manned Spacecraft Center, Houston, Texas at the request of NASA between January 1963 and November 1972. Regional geologic experts from the U.S. Geological Survey and other governmental organizations and universities also played vital roles in these exercises. [The early training (between 1963 and 1967) involved a rather large contingent of astronauts from NASA groups 1, 2, and 3. For another listing of the astronaut geologic training trips and exercises, including all attending and the general purposed of the exercise, the reader is referred to the following website containing a contribution by William Phinney (Phinney, book submitted to NASA/JSC; also <http://www.hq.nasa.gov/office/pao/History/alsj/ap-geotrips.pdf>.)]

1963

16-18 January 1963: Meteor Crater and San Francisco Volcanic Field near Flagstaff, Arizona (9 astronauts). Among the nine astronaut trainees in Flagstaff for that initial astronaut geologic training exercise was Neil Armstrong--who would become the first man to step foot on the Moon during the historic Apollo 11 mission in July 1969! The other astronauts present included Frank Borman (Apollo 8), Charles "Pete" Conrad (Apollo 12), James Lovell (Apollo 8 and the near-tragic Apollo 13), James McDivitt, Elliot See (killed later in a plane crash), Thomas Stafford (Apollo 10), Edward White (later killed in the tragic Apollo 1 fire at Cape Canaveral), and John Young (Apollo 16).

1964

4-7 and 11-14 March 1964: Grand Canyon, Arizona (15 astronauts). Scott Carpenter and Alan Shepard of the Mercury astronauts, Neil Armstrong and Elliot See of the second group, and the entire third group of 14 astronauts, participated in the first section. The remaining astronauts—Wally Schirra, Deke Slayton, Gus Grissom and Gordon Cooper, of the Mercury group; and Ed White, Frank Borman, Jim McDivitt, Jim Lovell, Pete Conrad, John Young, and Tom Stafford, of the second group--all participated in the second section.

2-3 and 15-16 April, 1964: Marathon Basin and Big Bend Park areas, Texas (16 astronauts). NASA Astronauts attending the field trip to Big Bend on 2-3 April included: Buzz Aldrin, Bill Anders, Charlie Bassett, Allan Bean, Frank Borman, Gene Cernan, Walter Chaffee, Mike Collins, Walt Cunningham, Gordon Cooper, Don Eisle, Ted Freeman, Dick Gordon, Rusty Schweikart, Dave Scott, Allan Shepard, C.C. Williams, and John Young. Astronauts participating in the 15-16 April 1964 fieldtrip to Big Bend included: Scott Carpenter, Wally Schirra, Neil Armstrong, Gordon Conrad, Jim Lovell, Jim McDivitt, Elliot See, Tom Stafford, and Ed White.

30 April to 3 May 1964 and 20-23 May, 1964

Kitt Peak Observatory, Arizona and flyover of San Francisco Volcanic Field, Flagstaff, Arizona
(all 29 NASA astronauts attended the two sessions)

3-6 June, 1964

Philmont Boy Scout Ranch near Cimarron, New Mexico (20 astronauts)

[Astronauts participating in the training included Buzz Aldrin, Bill Anders, Neil Armstrong, Charles Bassett, Gene Cernan, Roger Chaffee, Mike Collins, Pete Conrad, Gordon Cooper, Walt Cunningham, Don Eisele, Ted Freeman, Dick Gordon, Jim Lovell, Allan Bean, Rusty Schweikart, Dave Scott, Elliot See, Edward White, and C.C. Williams; focus of exercise was on geologic mapping and geophysical instruments traverses]

7-9 and 15-17 October, 1964

Newbury Crater, Bend Oregon (12 astronauts)

[Astronauts attending these two trips to Newbury included: (on 7-9 October) Eugene Cernan, Roger Chaffee, Michael Collins, Rusty Schweikart, and Dave Scott; and (on 15-17 October) Buzz Aldrin, Neil Armstrong, Charles Bassett, Allan Bean, Walt Cunningham, Elliott See, and C.C. Williams]

23-25 October 1964 and 13-14 November, 1964

Valles Caldera, New Mexico (16 astronauts)

[Astronauts attending the three separate trips to Valles Caldera include (on 23-25 October- Buzz Aldrin, Bill Anders, Allan Bean, Roger Chaffee, Michael Collins, Ted Freeman, and C.C. Williams; (on 29-31 October 1964) Neil Armstrong, Charles Bassett, Eugene Cernan, Walt Cunningham, Dick Gordon, Dave Scott, and Elliot See. Astronauts attending on 13-14 November were Walt Eisele, and Rusty Schweikart.]

1965

12-14 January 1965: Hawaii (Big Island) (several astronaut groups). Attending this first astronaut trip to Hawaii were astronauts Buzz Aldrin, William Anders, Neil Armstrong, Charles Basset, Alan Bean, Roger Chaffee, Michael Collins, Charles Conrad, Walt Cunningham, Don Eisele, Dick Gordon, Rusty Schweikart, Dave Scott, Elliot See, and CC. Williams, Jr.

17-18 and 24-25 February 1965: Nevada Test Site, Nevada. Geologic study of nuclear crater (14 Astronauts). Astronauts participating in the three trips to the NTS included: (on 17-18 February- Buzz Aldrin, Neil Armstrong, Charles Bassett, Allan Bean, Eugene Cernan, and Michael Collins; (on 24-25 February- Walt Cunningham, Donald Eisele, Dick Gordon, Rusty Schweikart, and Dave Scott; (on 3-4 March- Roger Chaffee, and Elliott See.

[Author's Note: Scott Carpenter and Allen Shepard of the Mercury astronauts, Neil Armstrong and Elliot See of the second group, and the entire third group of 14 astronauts, participated in

the first section. The remaining astronauts—Wally Schirra, Deke Slayton, Gus Grissom and Gordon Cooper, of the Mercury group; and Ed White, Frank Borman, Jim McDivitt, Jim Lovell, Pete Conrad, John Young, and Tom Stafford, of the second group--all participated in the second section]

22-23 April 1965: Meteor Crater, Arizona (near Flagstaff) (11 Astronauts). Astronauts attending the 22-23 April 1965 training trip to Meteor Crater included William Anders, Charles Bassett, Eugene Cernan, Roger Chaffee, Michael Collins, Walt Cunningham, Donald Eisele, Dick Gordon, Rusty Schweikart, Dave Scott, and C.C. Williams.

29 June through 2 July, 1965: Katmai, Alaska (9 astronauts). Astronauts attending this trip to Katmai included; Buzz Aldrin, William Anders, Charles Bassett, Eugene Cernan, Roger Chaffee, Walt Cunningham, Rusty Schweikart, Dave Scott, and C.C. Williams.

12-16 July 1965: Iceland (10 astronauts). Astronauts attending this trip to Iceland included William Anders, Charles Bassett, Eugene Cernan, Roger Chaffee, Walt Cunningham, Don Eisele, Rusty Schweikart, Dave Scott, and C.C. Williams.

1-3 and 8-10 September 1965: Medicine Lake, California (6 astronauts). Astronauts attending the 1-2 September trip to Medicine Lake included William Anders, Allan Bean and Rusty Schweikart. The 8-10 September trip included Charles Bassett, Walt Cunningham, and C.C. Williams.

14 through 21 September 1965: Zuni Salt Lake, New Mexico (4 astronauts). Astronauts participating in this exercise were William Anders, Allan Bean, Walt Cunningham, and Rusty Schweikart.

8-10 November 1965: Pinacate Volcanic Field, Northern Mexico (4 astronauts). [Astronauts attending this first Pinacate trip included William Anders, Walt Cunningham, Rusty Schweikart, and C.C. Williams.

27-29 December 1965: Zuni Salt Lake, New Mexico (3 astronauts-makeup trip). Astronauts participating included Charles Bassett, Eugene Cernan and Roger Chaffee.

1966

2-3 June 1966: Grand Canyon, Arizona (4th and 5th groups of astronauts; 16 astronauts total). Astronauts participating in this trip included Vance Brand, John Bull, Jerry Carr, Charles Duke, Joe Engle, Fred Haise, James Irwin, Don Lind, Jack Lousma, Ken Mattingly, Ed Mitchell, Bill Pogue, Stewart Roosa, Jack Swigert, Paul Weitz, and Al Worden.

23-24 June 1966: West Texas (21 astronauts). Astronauts participating in this trip include Vance Brand, John Bull, Charles Duke, Joe Engle, Ron Evans, Ed Givens, Fred Haise, James Irwin, Joe Kerwin, Don Lind, Jack Lousma, Ken Mattingly, Bruce McCandless, Curtis Michel, Ed Mitchell, Bill Pogue, Stewart Roosa, Harrison Schmitt, Jack Swigert, Paul Weitz, and Al Worden.

27-29 July 1966: Bend, Oregon (4th and 5th groups of astronauts; 21astronauts total). Astronauts participating in this trip included Vance Brand, John Bull, Jerry Carr, Charles Duke, Joe Engle, Ron Evans, Owen Garriott, Ed Givens, Fred Haise, Jim Irwin, Joe Kerwin, Don Lind, Jack Lousma, Ken Mattingly, Bruce McCandless, Ed Mitchell, Bill Pogue, Stuart Roosa, Jack Swigert, Paul Weitz, and Al Worden.

21-25 August 1966: Katmai, Alaska (4th and 5th groups of astronauts; 24 astronauts total). Astronauts participating in this exercise were Vance Brand, John Bull, Jerry Carr, Charles Duke, Joe Engle, Ron Evans, Owen Garriott, Ed Gibson, Ed Givens, Fred Haise, Jim Irwin, Joe Kerwin, Don Lind, Jack Lousma, Ken Mattingly, Bruce McCandless, Curtis Michel, Ed Mitchell, Bill Pogue, Stewart Roosa, Jack Schmitt, Jack Sweigert, Paul Weitz and Al Worden.

25 September 1966: Valles Caldera, New Mexico. (4th and 5th groups of astronauts; 24 astronauts total). Astronauts attending this field exercise were Vance Brand, John Bull, Jerry Carr, Charles Duke, Joe Engle, Ron Evans, Owen Garriott, Ed Gibson, Ed Givens, Fred Haise, Jim Irwin, Joe Kerwin, Don Lind, Stuart Lousma, Ken Mattingly, Bruce McCandless, Curtis Michel, Ed Mitchell, Bill Pogue, Stuart Roosa, Jack Schmitt, Jack Sweigert, Paul Weitz, and Al Worden.

7-10 November, 1966: French Butte, Hopi Buttes, Arizona (just east of Flagstaff, Arizona). Three astronauts participated, including Harrison “Jack” Schmitt, Joe Engle, and Paul Weitz.

29 November through 2 December 1966: Pinacate Volcanic Field, Northern Mexico (4th and 5th groups of astronauts; 18 astronauts total). Astronauts attending this trip include Vance Brand, John Bull, Jerry Carr, Charles Duke, Ron Evans, Ed Gibson, Fred Haise, Jim Irwin, Don Lind, Jack Lousma, Ken Mattingly, Curtis Michel, Ed Mitchell, Bill Pogue, Harrison Schmitt, Jack Sweigert, Paul Weitz and Al Worden.

1967

12-19 February 1967: Hawaii (Big Island), HI. (4th and 5th groups of astronauts; 15 astronauts total). Astronauts participating in this Hawaii trip included John Bull, Jerry Carr, Charles Duke, Joe Engle, Bill Pogue, Owen Garriott, Ed Gibson, Fred Haise, Jim Irwin, Jack Lousma, Ken Mattingly, Bruce McCandless, Curtis Michel, Ed Mitchell, and Al Worden.

16-17 March 1967: Makeup trip to the Pinacate Volcanic Field Northern Mexico (4 astronauts). Astronauts who participated in this exercise were Joe Engle, Owen Garriott, Joe Kerwin, and Bruce McCandless.

20-24 March 1967: Makeup trip to Hawaii (Big Island) (7 astronauts). Astronauts participating in this Hawaii trip included John Bull, Jerry Carr, Charles Duke, Joe Engle, Bill Pogue, Owen Garriott, Ed Gibson, Fred Haise, Jim Irwin, Jack Lousma, Ken Mattingly, Bruce McCandless, Curtis Michel, Ed Mitchell, and Al Worden.

16-19 May 1967: Zuni Salt Lake, New Mexico; Hopi Buttes, Meteor Crater, Arizona (21 astronauts). Astronauts participating included Vance Brand, Jerry Carr, Charles Duke, Ron Evans, Owen Garriott, Fred Haise, Jim Irwin, Joe Kerwin, Don Lind, Jack Lousma, Ken Mattingly, Bruce McCandless, Curtis Michel, Ed Mitchell, Stewart Roosa, Jack Swigert, Paul Weitz, and Al Worden]

31 May-2 June 1967: Makeup trip to Zuni Salt Lake, New Mexico (4 astronauts). Astronauts participating in this makeup trip to Zuni Salt Lake included John Bull, Joe Engle, Ed Givens, and Bill Pogue.

2-8 July 1967: Iceland, (4th and 5th groups of astronauts; 18 astronauts total). Astronauts attending this exercise included Bill Anders, Neil Armstrong, Vance Brand, Jerry Carr, Charles Duke, Joe Engle, Ron Evans, Owen Garriott, Ed Gibson, Fred Haise, Don Lind, Jack Lousma, Ken Mattingly, Curtis Michel, Ed Mitchell, Bill Pogue, Harrison Schmitt, Jack Swigert, and Al Worden.

1968

13-14 February 1968: Big Bend, Oregon, Apollo 8 and Apollo 9 crew trip (6 astronauts). Participating astronauts included Frank Borman, E.E. Aldrin, J.A. Lovell, N.A. Armstrong, Michael Collins, and W.A. Anders.

1969

Started Geologic Field Training Of Assigned Apollo 11-14 Prime and Backup Astronaut Crews

Apollo 11 Crew Training

24 February 1969: Sierra Blanca, Texas (Armstrong, Aldrin, Lovell, Haise)

Apollo 12 Crew Training

Various days from 1 through-14 March 1969: Quitman Mountains (Conrad, Bean)

8-9 April 1969: Kilbourne Hole, New Mexico (Conrad, Bean, Gibson)

1-2 May 1969: Big Bend, Texas (Conrad, Bean, Gibson)

10 July 1969: Meteor Crater, Arizona (Bean)

9-11 August 1969: Hawaii (Big Island) (Conrad, Gibson, Bean, Scott, Irwin, Schmitt)

10 October 1969: Sunset Crater, Arizona (Conrad, Bean, Scott, Irwin, Gibson)

Apollo 13 Crew Training

Late September 1969: Orocopia Mountains, California (Lovell, Haise, Young, Duke, Schmitt)

24 Sept-1 October 1969: Mono Craters, California (Lovell, Haise, Young, Duke)

24 October 1969: Meteor Crater, Arizona (Lovell, Haise, Young, Duke)

11 November 1969: Kilbourne Hole, New Mexico (Lovell, Haise, Young, Duke)

17-20 December 1969: Hawaii, Big Island) (Lovell, Haise, Young, Duke)

Apollo 14 Crew Training

14 August 1969: Flagstaff, Arizona (Shepard, Mitchell, Engle)

22-23 August 1969: Craters of the Moon, Idaho (Shepard, Mitchell, Cernan, Engle)

1970

Geologic Field Training Of Assigned Apollo 13-16 Prime and Backup Astronaut Crews

Apollo 13 Crew Training

15-16 March 1970: SIM to MSC from the USGS' Black Canyon Crater Field, Verde Valley, Arizona (Lovell, Haise, Young, Duke)

Apollo 14 Crew Training

14-18 February 1970: Pinacate, Mexico (Shepard, Mitchell, Cernan, Engle)

2-4 April 1970: Hawaii (Big Island) (Shepard, Mitchell, Cernan, Engle)

3-4 June 1970: Kilbourne Hole, New Mexico (Shepard, Mitchell, Cernan, Engle)

18-19 June 1970: Flagstaff, Arizona (Roosa, Evans)

11-13 August 1970: Ries Crater, Germany (Shepard, Mitchell, Cernan, Engle)

11 September 1970: Nevada Test Site (Shepard, Mitchell, Cernan, Engle, Evans)

16 November 1970: Cottonwood, Arizona (Branch of Astrogeology's Black Canyon "Crater Field" in Verde Valley, Arizona) (Shepard, Mitchell)

Apollo 15 Crew Training

6-8, 11-12 May 1970: Chocolate Mountains, California (Scott, Irwin, Gordon, Schmitt)

3 June 1970: Orocopia Mountains, California (Scott, Irwin, Gordon, Schmitt)

4-5 June 1970: Flagstaff, Arizona (Scott, Irwin, Gordon, Schmitt)

15-17 July 1970: Flagstaff, Arizona (Merriam Crater) (Scott, Irwin, Worden, Gordon, Schmitt, Brand)

August 1970: Flagstaff, Arizona Cinder Lake Crater Field (Scott, Irwin, Gordon, Schmitt, Worden, Brand, Allen, Heinze, Parker)

22-23 July 1970: Medicine Hat, Alberta, Canada (Gordon, Brand, Schmitt, Scott, Irwin, Worden)

26-28 August 1970: San Juan Mountains, Colorado (Scott, Irwin, Gordon, Schmitt)

17-18 September 1970: Buell Park, Arizona (Scott, Irwin, Gordon, Schmitt)

7-9 October 1970: Northern Minnesota (Scott, Irwin, Gordon, Schmitt)

2-3 November 1970: Merriam Crater and Cinder Lake Crater Field, Flagstaff, Arizona (first exercise use of Astrogeology's newly completed Grover LRV simulator) (Scott, Irwin, Schmitt, Cernan)

19-20 November 1970: San Gabriel Mountains, California (Scott, Irwin, Gordon, Schmitt)

5-12 December 1970: Hawaii (Big island) (Scott, Irwin, Gordon, Parker, Schmitt, Allen)

Apollo 16 Crew Training

8-10 July 1970: San Juan Mountains, New Mexico (Young, Duke, Haise, Pogue, Carr)

23 July 1970: Medicine Hat, Albert, Canada (Young, Duke, Haise, Pogue, Carr)

1-2 September 1970: Colorado Plateau (Young, Duke, Haise, Pogue, Carr)

12-14 October 1970: Northern Minnesota (Young, Duke)

12-13 November 1970: Nevada test Site, Nevada (Young, Duke)

23-24 November 1970: San Gabriel Mountains, California (Young, Duke)

1971

Geologic Field Training Of Assigned Apollo 15-17 Prime and Backup Astronaut Crews

Apollo 15 Crew

18 January 1971: Kilbourne Hole, New Mexico (Scott, Irwin, Gordon, Schmitt)

10-12 February 1971: Ubehebe Craters, California (Scott, Irwin, Gordon, Schmitt)

11-12 March 1971: Rio Grande Canyon, Taos New Mexico (Scott, Irwin, Gordon, Schmitt)

29-30 April 1971: Coso Hills, California (Scott, Irwin, Worden, Gordon, Schmitt, Brand)

20-21 May 1971: Nevada Test Site, Nevada (Scott, Irwin, Gordon, and Schmitt)

25 June 1971: Coconino Point area north of Flagstaff, Arizona (Scott, Irwin, Gordon, Schmitt)

Apollo 16 Crew

18-20 January 1971: Kilbourne Hole, New Mexico (Young, Duke, Haise)

25-26 February 1971: Flagstaff, Arizona (Young, Duke, Haise)

29-30 March 1971: Merriam Crater, Flagstaff, Arizona) (Young, Duke, Haise)

26-27 April 1971: USGS Black Canyon Crater Field, Camp Verde, Ariz. (Young, Duke, Haise)

24-25 May 1971: Capulin Mountains, New Mexico (Young, Duke, Haise)

10-11 June 1971: Mono Craters, California (Young, Duke, Haise)

29-30 June 1971: Flagstaff, AZ (Merriam Crater, USGS' Cinder Lake Crater Field) (Young, Duke)

7-9 July 1971 (possibly through 14 July): Sudbury, Ontario, Canada (Young, Duke, Haise)

9-10 September 1971: Rio Grande Canyon, Taos, New Mexico (Young, Duke, Haise, Mitchell)

27 October 1971: Nevada Test Site (Young, Duke, Haise, Mattingly)

17-18 Nov. 1971: Coso Hills, California (Young, Duke, Haise, Mitchell)

7-13 December 1971: Hawaii (Big Island) (Young, Duke, Haise, Mitchell)

**Orbital Geology Training (fly-around and field exercises) for the
Apollo 16 prime and backup CMP pilots during 1971**

5-6 May, 1971: S.F. Volcanic Field, North-Central, Arizona

23-25 June 1971: Craters of the Moon, Butte Crater (rille), Idaho, landslides and mud flows (in Idaho), and Pleistocene lake terraces, Salt Lake, and structure in the Wasatch Mountains (in Utah)

19-21 July, 1971: (a) Pinacate Volcanic Field (Sonora, Mexico) and New Mexico; (b) Descartes landing site geology with Apollo 14 ; (c) Meteor Crater and the Hopi Buttes, Arizona

7-8 September, 1971: Rio Grande Valley, Taos, New Mexico and Valles Caldera, New Mexico

13-15 October, 1971: Northern California, Southern Oregon (Mt., Lassen, Medicine Lake Highlands and Crater Lake Caldera)

27-28 October, 1971: Nevada Test Site, Mercury, Nevada (with entire crew)

Apollo 17 Crew Training

19-22 October 1971: Big Bend, Texas (Cernan, Schmitt)

17-18 Nov. 1971: Flagstaff, Arizona (Evans)

18 November 1971: Coso Hills, California (Cernan, Schmitt)

20-21 Dec. 1971: Kilbourne Hole, New Mexico (Cernan, Schmitt)

1972

**Geologic Field Training Of Assigned Apollo 16 And 17 Prime and
Backup Astronaut Crews**

Apollo 16 Crew Training

17-18 February 1972: McCullough Mountains west of Boulder City, Nevada (Young, Duke, Haise, Mitchell)

Apollo 17 Crew Training

24-25 January 1972: McCullough Mountains west of Boulder City Nevada (Cernan, Schmitt, Evans)

22-25 February 1972: Chocolate Mountains, Mojave Desert, California (Cernan, Schmitt, Scott, Irwin)

- 23-24 February 1972:** Flagstaff, Arizona (Evans)
- 14-15 March 1972:** Sierra Madera (Cernan, Schmitt)
- 16-17 March 1972:** Nevada Test Site (Young, Duke)
- 10-12 April 1972:** San Gabriel Mountains, California (Cernan, Schmitt, Scott)
- 24-25 May 1972:** Sudbury Crater, Ontario, Canada (Cernan, Schmitt, Evans)
- 22-29 June 1972:** Hawaii (Big Island) (Cernan, Schmitt, Evans)
- 24-25 July 1972:** Stillwater, Montana (Cernan, Schmitt, Evans, Young)
- 7-8 August 1972:** Nevada Test Site (Cernan, Schmitt, Young, Duke, Roosa)
- 6-7 September 1972:** Tonopah, Nevada-Lunar Crater (Cernan, Schmitt, Young, Duke)
- 6 October 1972:** Blackhawk Slide (north of the San Bernardino Mountains and the Mojave Desert, California (Cernan, Schmitt, Young, Duke)
- 2-3 November 1972:** Sunset Crater and the Cinder Lake Crater Field near Flagstaff, Arizona (Cernan, Schmitt, Young, Duke)