aTSS

NEWS NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

TELS. WO 2-4155
WO 3-6925

June 17, 1965

NOTE TO EDITORS:

A press briefing on the Mariner IV mission to Mars will be held in the auditorium of the Jet Propulsion Laboratory, Pasadena, Calif., at 9:30 a.m. PDT, June 22, 1965.

The briefing will be made available to news media representatives in the National Aeronautics and Space Administration's auditorium, Federal Office Building No. 6, 400 Maryland Avenue, S.W., Washington, D.C., at 12:30 p.m. EDT, by a telephone line from JPL.

The briefing will be to review events of Mariner's interplanetary flight and to discuss operation of the spacecraft and its scientific experiments during the encounter with Mars July 14.

Participants will include:

Dr. William H. Pickering
Director of JPL

Glenn A. Reiff
NASA Mariner Program Manager

Dan Schneiderman
JPL, Project Manager

Richard K. Sloan
Mariner Project Scientist, JPL

Dr. R. B. Leighton
California Institute of Technology
Television Scientific Investigator

Dr. A. J. Kliore
JPL, Occultation Scientific Experimentor

Dr. Nichola A. Renzetti
Deep Space Network System Manager

After a brief statement of each of the participants, there will be a question and answer session with facilities available for news media representatives in Washington to question the participants in Pasadena.

NEWS NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

TELS. WO 2-4155
WO 3-6925

FOR RELEASE: SUNDAY
June 20, 1965

RELEASE NO: 65-198

FAINT RADIO SIGNALS PROVIDE FIRM LOCK ON MARINER MISSION

[After 204 days of the longest space exploration mission in history, the National Aeronautics and Space Administration Mariner IV's electronic signals to Earth today are arriving with a strength of slightly less than one-billionth-of-one billionth of a watt.]

NASA engineers calculate the power of the received radio signals from the Mars-bound Mariner, now 113 million miles away, at about .0000000000000000001 watt (18 zeros are correct).

When beamed toward Earth from the Mariner antenna, the signal strength is 10 watts.

Targets of Mariner's continuous radio reports from interplanetary space are the 85-foot diameter antennas of the NASA Jet Propulsion Laboratory Deep Space Network. Three DSN stations are located around the globe about 120 degrees apart.

 6/16/65

Super-sensitive receivers, coupled with the big DSN antennas, are able to home in on the Mariner signal, as faint as it is, and amplify it for telemetry processing, recording and relay, via a ground communications system, to JPL's mission control center in Pasadena, Calif.

The three DSN stations, working together, keep a 24-hour-a-day watch on Mariner IV and stand ready to transmit commands to the spacecraft should they be required. Each station receives scientific and engineering information from Mariner's signals for about nine hours every day.

Counting the two to three hours it takes to prepare a station for a Mariner pass, about nine hours of tracking and monitoring, and another hour or so to close down, each DSN station has been devoting some 13 to 14 hours daily to the Mariner mission. Engineers and technicians work in four shifts.

As the Earth rotates on its axis, the DSN big dish antennas move slowly from west to east, finally losing contact with Mariner IV near the horizon at each site.

While the antenna at Goldstone, Calif., is moving out of earshot, the station at Tidbinbilla, near Canberra, Australia, is picking up Mariner's signal. From Tidbinbilla, tracking and monitoring is handed over to the station at Johannesburg, South Africa, and then back again to Goldstone.

- more -

The JPL Space Flight Operations Facility (SFOF) has been operating on a 24-hour basis from the time that Mariner IV was launched, Nov. 28, 1964. Since that day, four American astronauts have orbited the Earth, two Ranger spacecraft have photographed the Moon and 10 NASA satellites have been put in orbit.

Mariner will fly another four weeks before passing within 6,000 miles of Mars July 14 for close-up measurements and it has many weeks to go beyond Mars for transmission of television pictures and other scientific data back to Earth.

JPL scientists and engineers have almost immediate access at the SFOF to Mariner's constant flow of messages -- about 100,000 each day -- that include interplanetary measurements made by scientific instruments aboard and other data indicating performance of the spacecraft itself. It is at the SFOF that data is analyzed and decisions are made to send commands to Mariner.

Latest event, monitored in near real-time, was a command issued by Mariner's on-board Central Computer and Sequencer to the Canopus star tracker June 14.

It is necessary to keep this star sensor pointed at Canopus so that the spacecraft will be properly aligned and stabilized in attitude.

The June 14 command to the star sensor was made to compensate for the changing relationship between the spacecraft, the Sun and Canopus. The command electronically altered the "look angle" of the sensor so that Canopus will remain in view throughout the encounter sequence next month and beyond.

The Johannesburg station was tracking Mariner when the "update" occurred right on time at 11:40 a.m. EDT. It was about 10 minutes later that Mariner's keepers in Pasadena, learned that the command was issued and was acted upon properly. Because of the communications distance on that day, Mariner's radio signal needed nearly 10 minutes to reach the big antenna in Johannesburg.

As Mariner IV gets closer to Mars and into the critical encounter sequence, activity will heighten at SFOF and at the tracking stations. During the week prior to Mariner's July 14 planet fly-by, the three stations now tracking Mariner will follow it from horizon to horizon, increasing the viewing time up to about 12 hours a day for each station and hence expanding the overlapping coverage. Three additional stations of the DSN are expected to be "on line"--at Woomera, Australia; Madrid, Spain; and a second station at Goldstone.

Before any one of the tracking stations can "lock on" to Mariner's signal, technicians must know where to point the antenna when their turn comes around.

This information is supplied by the radio signal itself. As tracking is receiving at one of the stations and is relayed to SFOF it reveals to trajectory experts Mariner's exact location in space and its velocities relative to the Sun, Earth and Mars.

With the aid of computers of the SFOF data processing center, pass predictions are made and transmitted to the station waiting to lock up the signal. These predictions tell the station personnel where to expect Mariner to appear in the sky as it clears the horizon and at what radio frequency to tune the receiver.

Accurate tracking of Mariner IV is based on the Doppler shift of its radio signal, or the apparent change in frequency of the signal as the spacecraft moves farther away from Earth. Two-way Doppler used by the DSN in tracking lunar and planetary spacecraft, utilizes a signal transmitted from the station to the spacecraft receiver-transmitter where it is converted to a new frequency in an exact ratio with the ground frequency and then retransmitted to Earth. Since the frequency of the signal sent from the ground can be determined with great precision, the resulting Doppler information and velocity calculations are very accurate.

-more-

Transmitter power at each of the DSN stations is 10,000 watts. The transmitter is used both for two-way Doppler tracking and for sending commands to Mariner IV. The spacecraft has received and acted upon 42 commands from Earth since launch. Others may be transmitted during the encounter phase of the mission.

The two-way Doppler technique is the key to one of Mariner IV's planetary investigations--the occultation experiment. About an hour after the point of closest approach the spacecraft will pass behind Mars as viewed from Earth. The Doppler effect upon the radio signal as it penetrates the Martian atmosphere may permit scientists to determine the density and scale heighth of the atmosphere.

The Mariner IV camera system is expected to take and record as many as 21 black-and-white still pictures of the planet's surface for later playback to Earth beginning about 10 hours after the fly-by.

Because of the data rate possible at the Earth-Mars distance--8 1/3 bits per second--it will take more than eight hours to transmit each picture which contains about 250,000 bits of information. Plans to play back each picture twice will require nearly three weeks for completion.

-more-

Since the picture data will be received in binary form--ones and zeroes which form values representing light intensity from white to black--it is possible to receive part of a picture at Johannesburg or Madrid and another part at Goldstone, losing nothing in the transfer. The time-coded digital information can be matched at JPL where it will be converted into a photograph of the surface of Mars. The conversion process, involving computer programs and specialized equipment, may take several days.

On April 29, 1965, Mariner IV established a new space communication distance record of 66 million miles. The mark will more than double at encounter.

Mariner project officials do not anticipate a break in the communications from Mariner to Earth for several months after it encounters Mars. It is probable that Mariner IV will continue broadcasting for a long time as it orbits the Sun but out of range of the Earth.

Mariner IV position reports for the period June 17 through June 23 follow (all time Eastern Daylight):

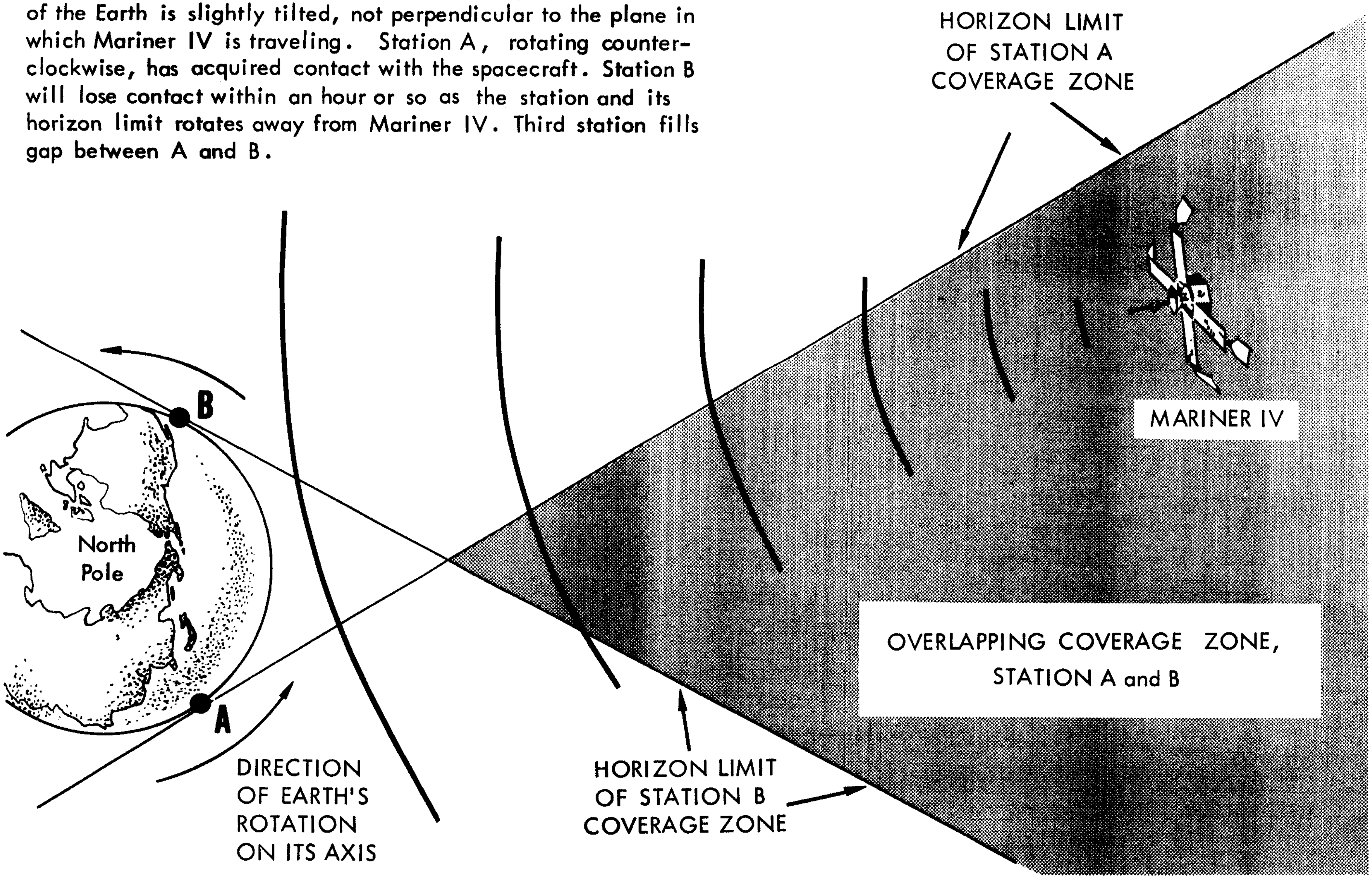
Date	Earth-Mariner Distance (miles)	Mariner-Mars Distance (miles)	Total Distance Traveled (miles)
6/17			
9 am	109,864,940	6,592,523	293,600,000
9 pm	110,318,940	6,469,492	

6/18			
9 am	110,772,820	6,346,590	294,700,000
9 pm	111,226,560	6,224,022	
6/19			
9 am	111,680,170	6,101,572	295,900,000
9 pm	112,133,630	5,979,307	
6/20			
9 am	112,586,940	5,857,220	297,100,000
9 pm	113,040,090	5,735,309	
6/21			
9 am	113,493,070	5,613,567	298,200,000
9 pm	113,945,587	5,491,988	
6/22			
9 am	114,398,490	5,370,571	299,400,000
9 pm	114,850,910	5,249,309	
6/23			
9 am	115,303,120	5,128,199	301,500,000
9 pm	115,755,513	5,007,233	

- end -

COMMUNICATIONS WITH MARINER IV

Simplified sketch illustrates how the three Deep Space Network Stations of NASA (two shown) maintain around-the-clock communications with Mars-bound Mariner IV. Actually, the stations are located somewhat above and below the Equator and the axis of the Earth is slightly tilted, not perpendicular to the plane in which Mariner IV is traveling. Station A, rotating counter-clockwise, has acquired contact with the spacecraft. Station B will lose contact within an hour or so as the station and its horizon limit rotates away from Mariner IV. Third station fills gap between A and B.



VISIBILITY OF DEEP SPACE STATIONS

(Showing areas of overlapping coverage)