MARINER IV

28 NOV 1964 - 21 DEC 1967

MARS ENCOUNTER - 15 JULY 1965

60TH ANNIVERSARY

“Man’s first close-up look at Mars has revealed the scientifically startling fact that at least part of its surface is covered with large craters.

This is a profound fact which leads to far-reaching fundamental inferences concerning the evolutionary history of Mars and further enhances the uniqueness of Earth within the solar system.”

Mariner Mars ’64 Bulletin, Ed. 52 - 4th August 1965

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29 NOV 1964 – 21 DEC 1967

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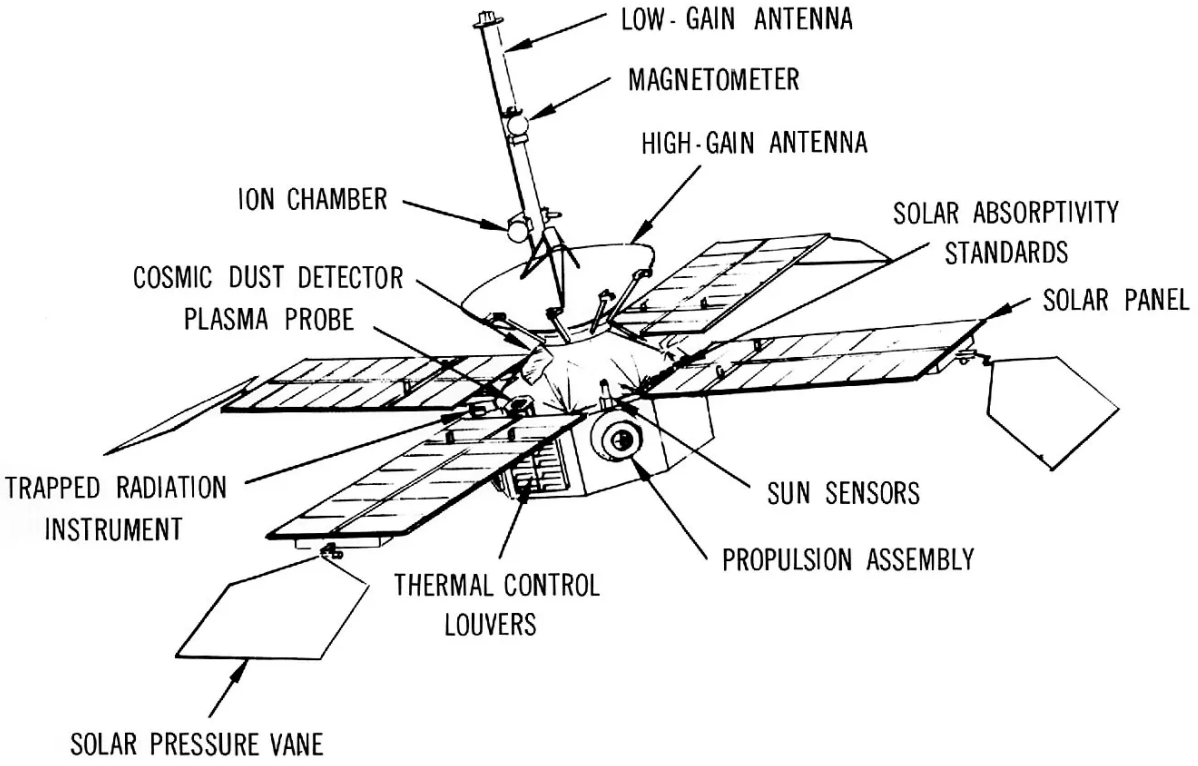
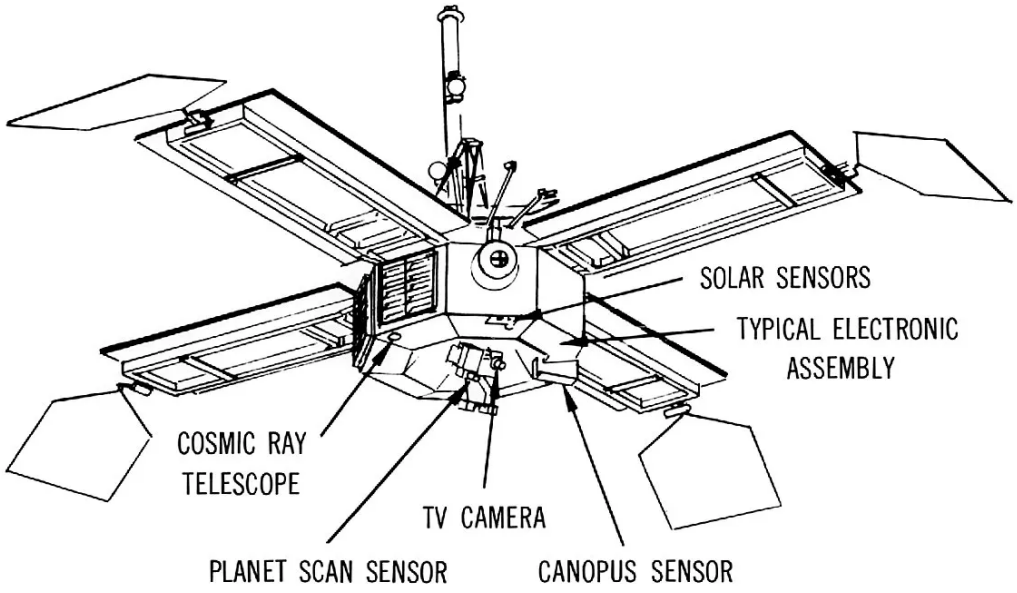
extracted from content on the
Honeysuckle Creek Tracking Station
website developed by Colin Mackellar.

MARINER/MARS SPACECRAFT





Mission Fact Box

Spacecraft:	Mariner C-3 (IV)
Mission type:	Mars flyby
Operator:	NASA / JPL
COSPAR ID:	1964-077A
SATCAT no.:	942
Mission duration:	3 years, 23 days
Manufacturer:	Jet Propulsion Lab.
Launch mass:	260.68 kilograms
Power:	310 watts

Start of Mission

Launch date:	14:22:01 (UTC) 28 November 1964
Rocket:	Atlas LV-3 Agena-D
Launch site:	Cape Canaveral LC-12

End of Mission

Last contact:	21 December 1967

Orbital Parameters

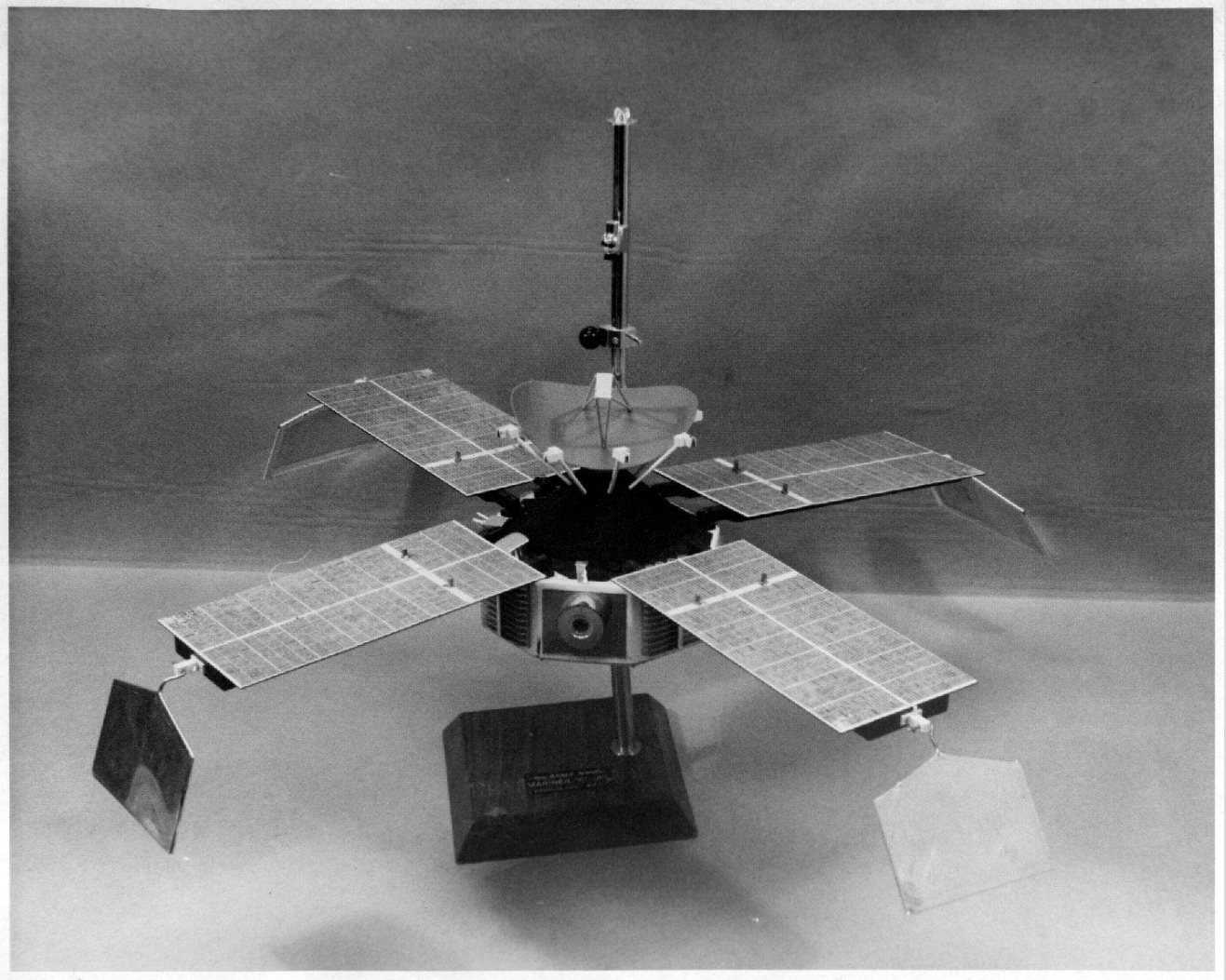
Reference system:	Heliocentric
Semi-major axis:	199,591,220 kilometres
Eccentricity:	0.17322
Perihelion altitude:	166,052,670 kilometres
Aphelion altitude:	234,867,290 kilometres
Inclination:	2.544 degrees
Period:	567.11 days
Epoch:	21:00:57 (UTC) 14 July 1965

Flyby of Mars

Closest approach:	01:00:57 (UTC) 15 July 1965
Distance:	9,846 kilometres
Incidental flyby:	Asteroid D/1895 Q1 Swift
Closest approach:	15 September 1967
Distance:	20,000,000 kilometres

Instruments

Cosmic dust detector
Cosmic ray telescope
Geiger counter/ionization chamber
Helium magnetometer
Solar plasma probe
Trapped radiation detector
TV camera



A model, at Tidbinbilla, of the Mariner IV spacecraft.
Photo preserved by Les Whaley. Scan by Colin Mackellar.

BACKGROUND
Mariner IV

Mariner 4 was the fourth in a series of spacecraft used for planetary exploration in a flyby mode and represented the first successful flyby of the planet Mars, returning the first pictures of the Martian surface. These represented the first images of another planet ever returned from deep space.

Mariner 4 was designed to conduct closeup scientific observations of Mars and to transmit these observations to Earth.

Other mission objectives were to perform field and particle measurements in interplanetary space in the vicinity of Mars and to provide experience in and knowledge of the engineering capabilities for interplanetary flights of long duration.

Spacecraft and Subsystems

The Mariner 4 spacecraft consisted of an octagonal magnesium frame, 127 cm across a diagonal and 45.7 cm high. Four solar panels were attached to the top of the frame with an end-to-end span of 688 cm, including solar pressure vanes which extended from the ends.

A 116.8 cm diameter high gain parabolic antenna was mounted at the top of the frame as well. An omnidirectional low gain antenna was mounted on a 223.5 cm tall mast next to the high gain antenna. The overall height of the spacecraft was 289 cm.

At the bottom centre of the spacecraft the television camera was mounted on a scan platform. The octagonal frame housed the electronic equipment, cabling, midcourse propulsion system, and attitude control gas supplies and regulators. Most of the science

experiments were mounted on the outside of the frame. Science instruments, in addition to the TV camera, were a magnetometer, dust detector, cosmic ray telescope, trapped radiation detector, solar plasma probe, and ionization chamber/Geiger counter.

Power was supplied by 28,224 solar cells contained in the four 176 x 90 cm solar panels, which could provide 310 W at Mars. A rechargeable 1200 W-hr silver-zinc battery was also used for manoeuvres and backup. Monopropellant hydrazine was used for propulsion, via a 4-jet vane vector control 222-N motor installed on one of the sides of the octagonal structure. Attitude control was provided by 12 cold nitrogen gas jets mounted on the ends of the solar panels and three gyros. Solar pressure vanes, each with an area of 0.65 square meters, were attached to the tips of the solar panels. Positional information was provided by four Sun sensors, and an Earth, a Mars, and a Canopus sensor.

Telecommunications equipment consisted of a dual, S-band 7-W triode cavity amp/10-W TWTA transmitter and a single receiver which could send and receive data via the low- and high-gain antennas at 8 1/3 or 33 1/3 bps.

Data could also be stored on a tape recorder with a capacity of 5.24 million bits for later transmission.

All operations were controlled by a command subsystem which could process any of 29 direct command words or 3 quantitative word commands for midcourse manoeuvres.

The central computer and sequencer operated stored time-sequence commands using a 38.4 kHz synchronization frequency as a time reference.

Temperature control was achieved through the use of adjustable louvers mounted on six of the electronics assemblies, multilayer insulating blankets, polished aluminium shields, and surface treatments.

Mission Profile

After launch the protective shroud covering Mariner 4 was jettisoned and the Agena D/Mariner 4 combination separated from the Atlas D booster at 14:27:23 UT on 28 November 1964. The Agena D first burn from 14:28:14 to 14:30:38 put the spacecraft into an Earth parking orbit and the second burn from 15:02:53 to 15:04:28 injected the craft into a Mars transfer orbit.

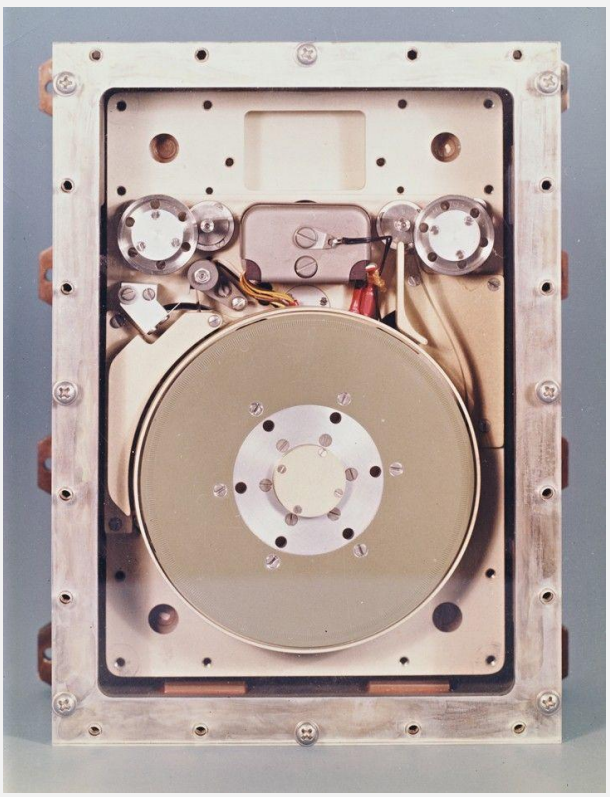
Mariner 4 separated from the Agena D at 15:07:09 and began cruise mode operations. The solar panels deployed, and the scan platform was unlatched at 15:15:00 and Sun acquisition occurred 16 minutes later.

After 7.5 months of flight involving one midcourse manoeuvre on 5 December 1964, the spacecraft flew by Mars on July 14 and 15, 1965.

Planetary science mode was turned on at 15:41:49 UT on 14 July. The camera sequence started at 00:18:36 UT on July 15 (7:18:49 p.m. EST on July 14) and 21 pictures plus 21 lines of a 22nd picture were taken.

The images covered a discontinuous swath of Mars starting near 40 N, 170 E, down to about 35 S, 200 E, and then across to the terminator at 50 S, 255 E, representing about 1% of the planet's surface.

The closest approach was 9,846 km from the Martian surface at 01:00:57 UT 15 July 1965 (8:00:57 p.m. EST 14 July). At the time of closest approach, the spacecraft was 216 million km from Earth moving at a speed of approximately 7 km/sec relative to Mars (1.7 km/sec relative to Earth).



Tape recorder

The images taken during the flyby were stored in the onboard tape recorder. At 02:19:11 UT Mariner 4 passed behind Mars as seen from Earth and the radio signal ceased. The signal was reacquired at 03:13:04 UT when the spacecraft reappeared. Cruise mode was then re-established.

Transmission of the taped images to Earth began about 8.5 hours after signal reacquisition and continued until 3 August. All images were transmitted twice to insure no data were missing or corrupt.

The spacecraft performed all programmed activities successfully and returned useful data from launch until 22:05:07 UT on 1 October 1965, when the distance from Earth (309.2 million km) and the antenna orientation temporarily halted signal acquisition.

Intermittent telemetry contact was re-established on 3 May 1966 showing that the spacecraft and instruments were functioning. Full data acquisition resumed in late 1967. The cosmic dust detector registered 17 hits in a 15 minute span on 15 September, part of an apparent micrometeoroid shower which temporarily changed the spacecraft attitude and probably slightly damaged the thermal shield.

"It could be as long as 24 hours before you could do anything about it and another12-14 hours to find out if you had overcome the problem."
John Heath - Tidbinbilla

The spacecraft systems were reactivated in October 1967 for attitude control tests in support of the Mariner 5 mission.

On 7 December the gas supply in the attitude control system was exhausted, and on December 10 and 11 a total of 83 micrometeoroid hits were recorded which caused perturbation of the attitude and degradation of the signal strength.

On 21 December 1967 communications with Mariner 4 were terminated.

Mariner 4 during a life test in the clean room at the Jet Propulsion Laboratory. Image: NASA/JPL/Caltechaw

Results

The total amount of data returned by the mission was 5.2 million bits.

All experiments operated successfully with the exception of the ionization chamber/Geiger counter which failed in February 1965 and the plasma probe, which had its performance degraded by a resistor failure on 6 Dec. 1964.

The images returned showed a Moon-like cratered terrain (which later missions showed was not typical for Mars, but only for the more ancient region imaged by Mariner 4).

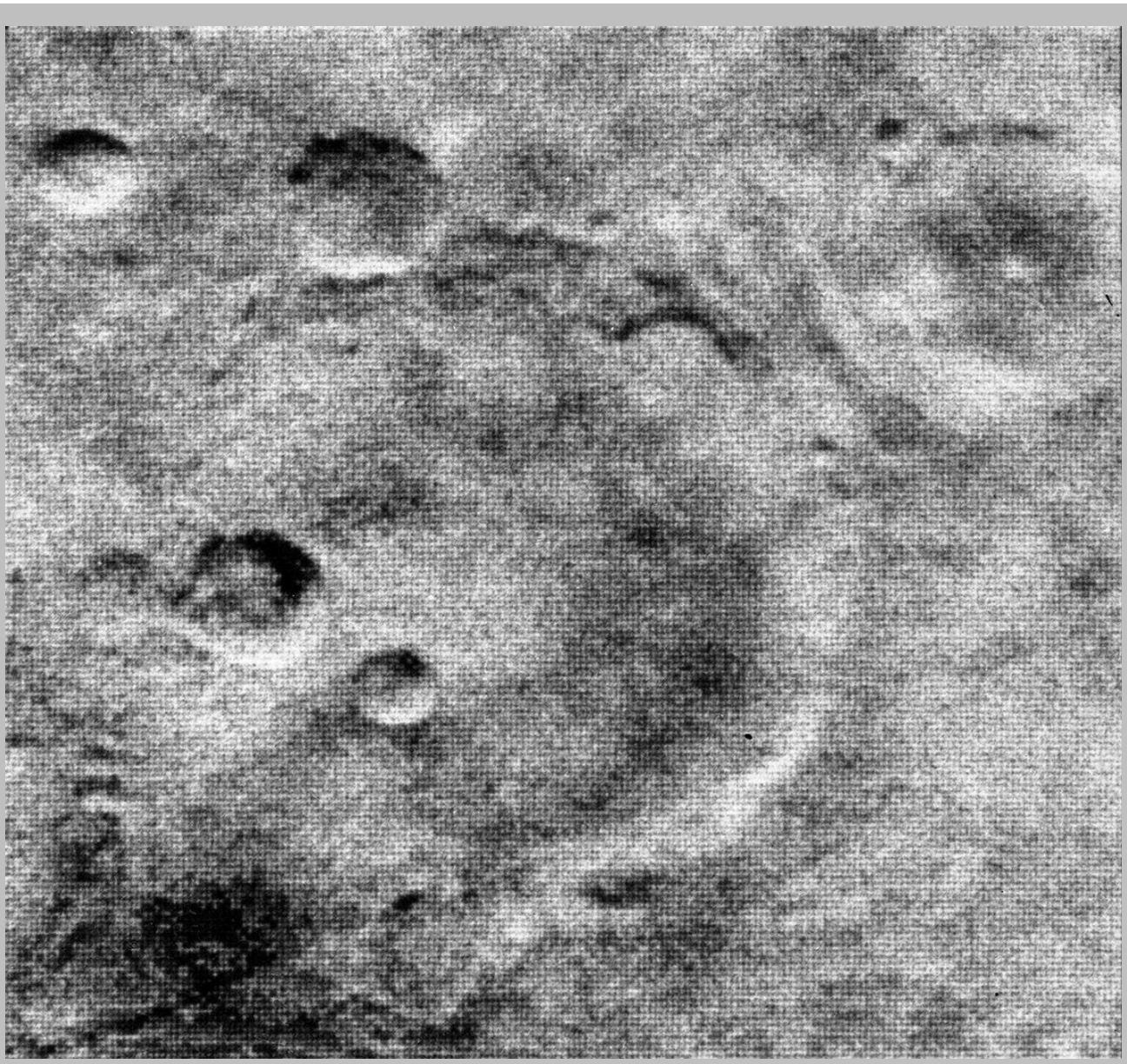
A surface atmospheric pressure of 4.1 to 7.0 mb and daytime temperatures of -100° C were estimated, and no magnetic field was detected, leading to the conclusion that the solar wind may have direct interaction with the Martian atmosphere, and that the atmosphere and surface are fully exposed to solar and cosmic radiation.

The total cost of the Mariner 4 mission is estimated at US$83.2 million in 1965.

In today's dollars (2025) that equates to approx. US$851 million.

Total research, development, launch and support costs Mariners 1 – 10 was approximately US$554 million.

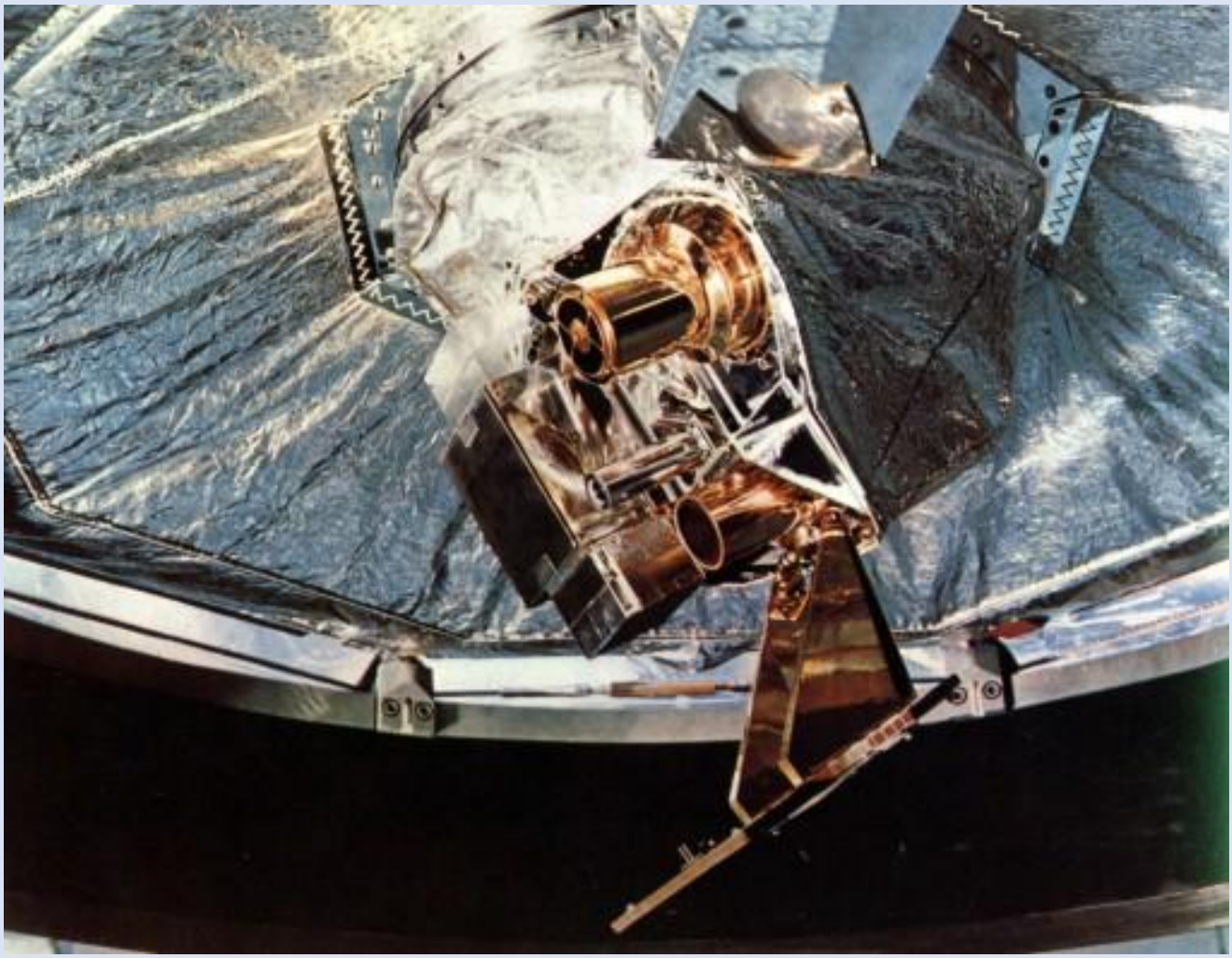
An equivalent program in 2025 would cost approx. US$5.6 billion.



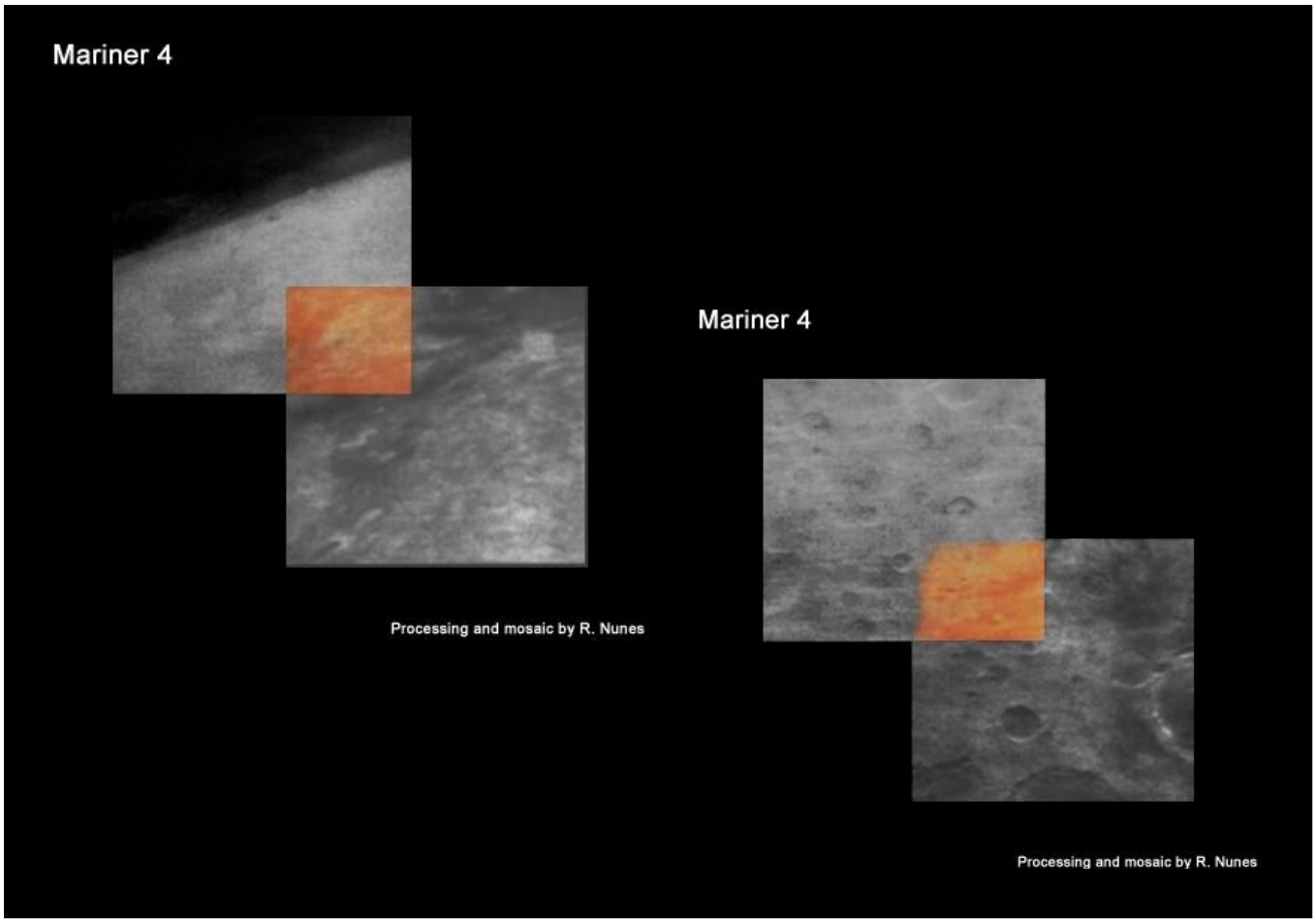
The first Mariner 4 images showed a highly cratered surface. Image: NASA/JPL/Caltech

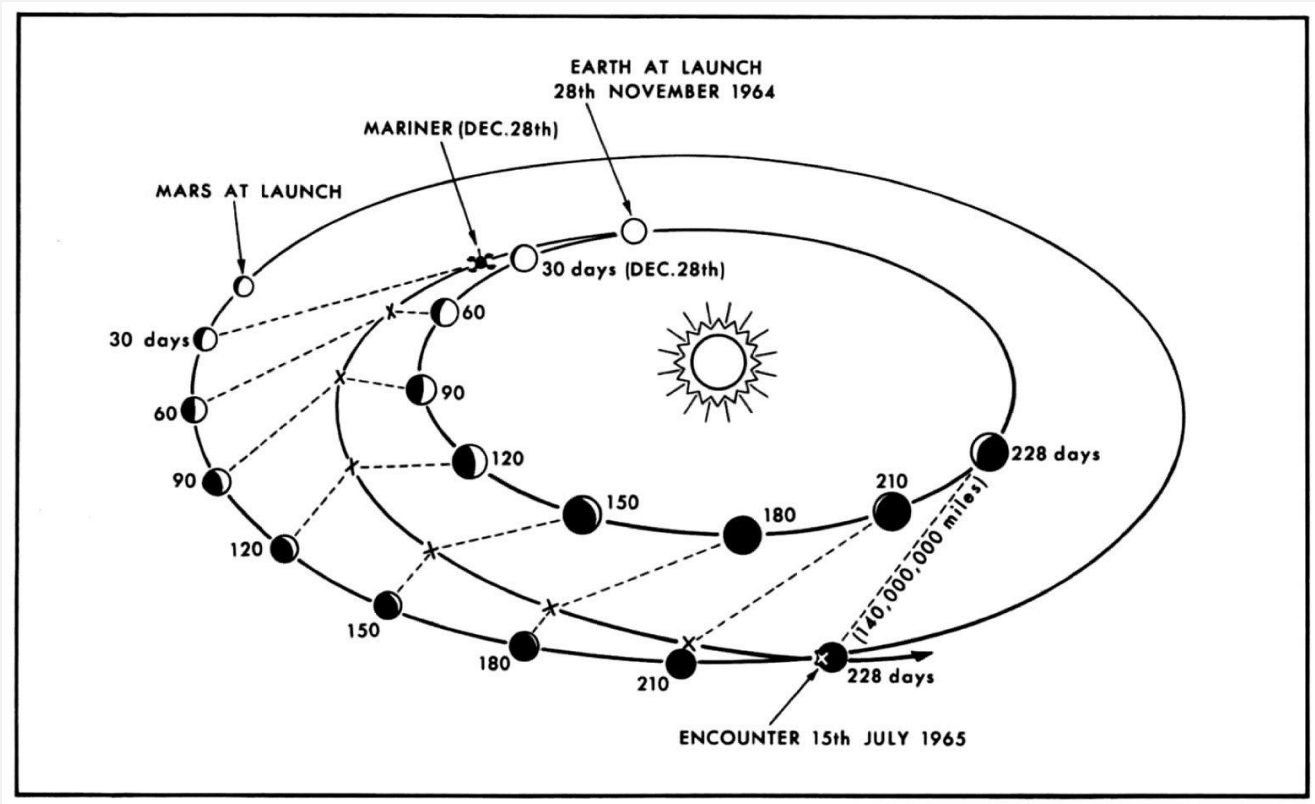
Mariner IV is readied for launch in 1964.

NASA photo. Scan: Jan Delgado.



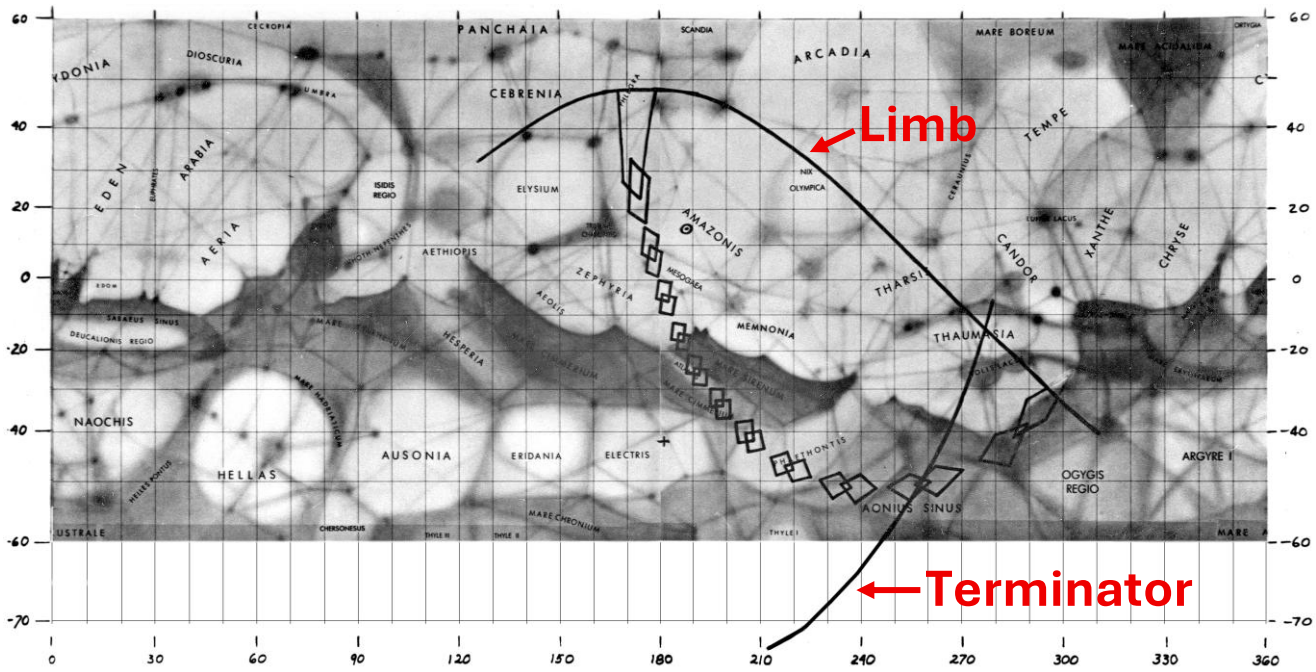
Mariner 4 Camera





Mariner IV's trajectory from the Earth to Mars.

From page 9 of the DSIF-42 opening booklet - preserved and scanned by Harold Frodsham.



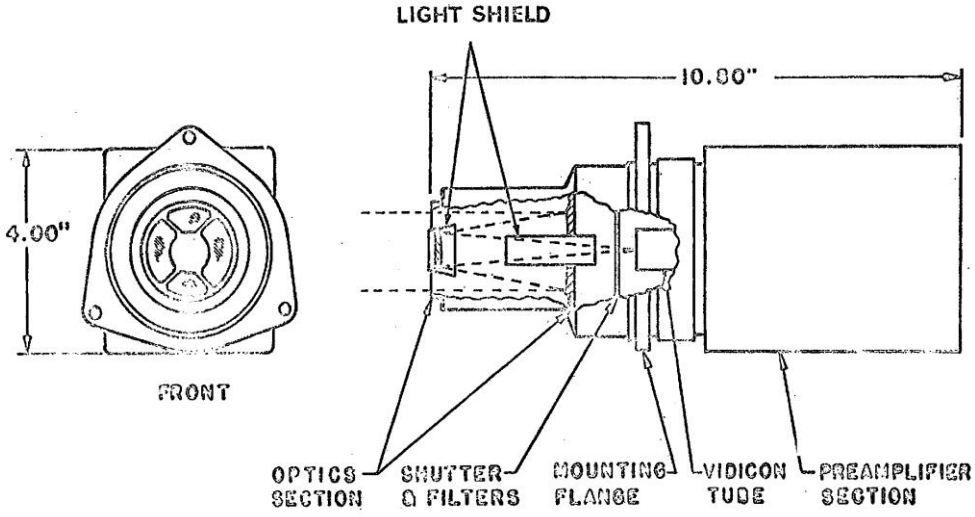
This pre-encounter map of the Martian surface shows how little was known about Mars,

On this map, the areas imaged by Mariner IV (starting at the top) have been superimposed.

The top curved line indicates the limb of Mars as seen from the spacecraft. The lower curved line indicates the terminator at the time of encounter.

The small black trapezpoids indicate the areas to be imaged by Mariner IV's camera.

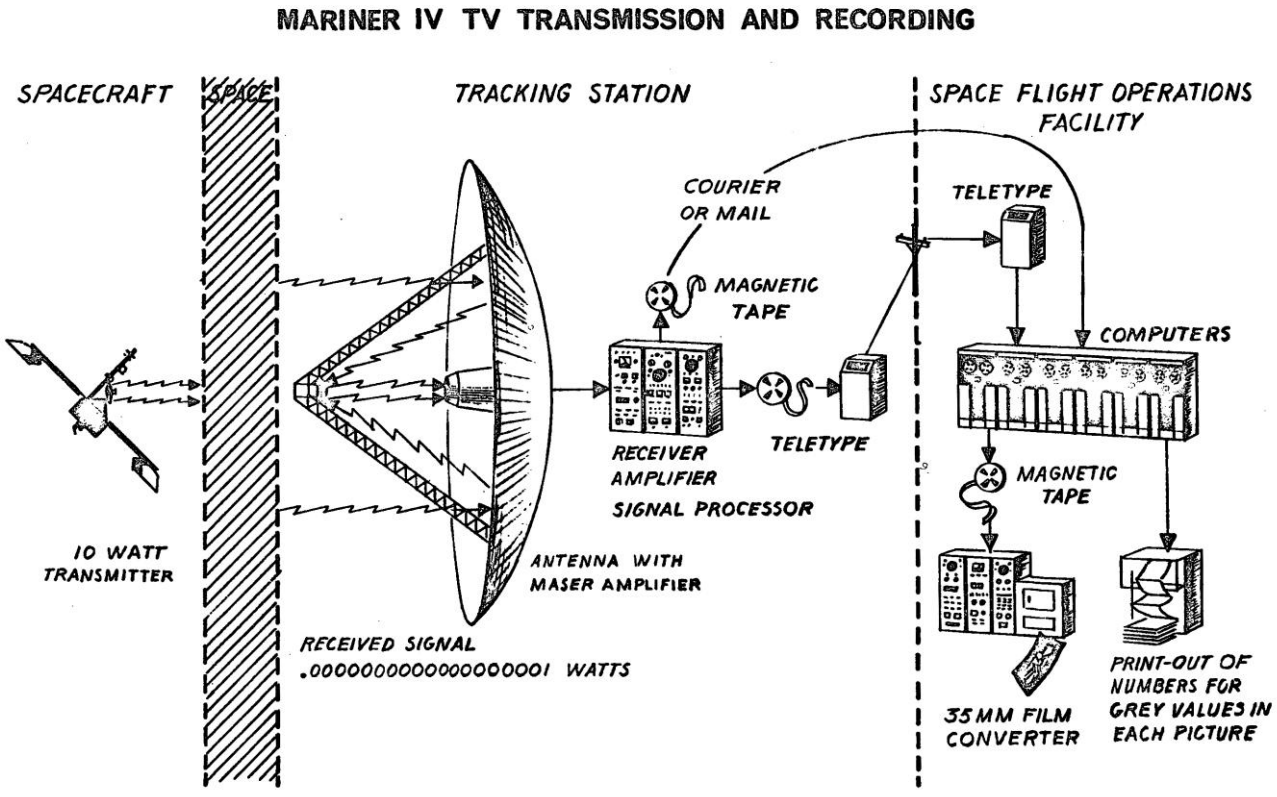
Preserved by Les Whaley. Scanned by Colin Mackellar (red text and arrow added).



MARINER IV
VIDICON CAMERA

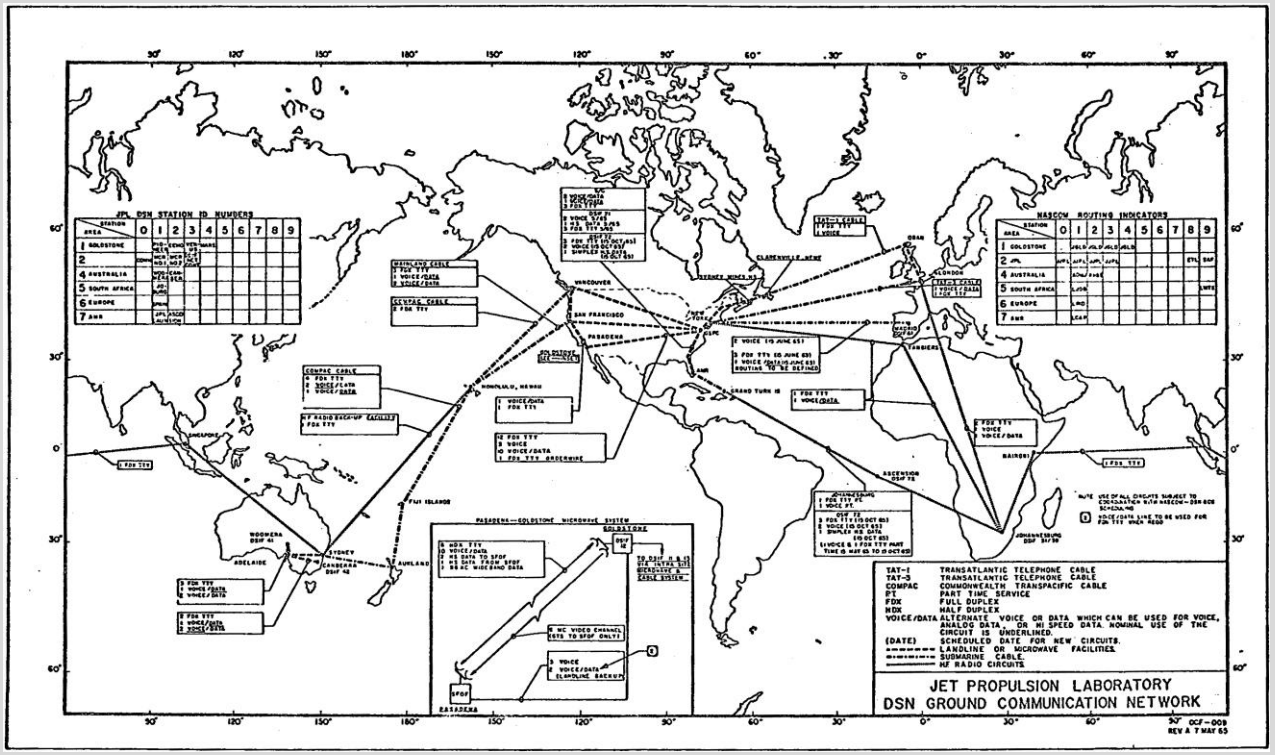
Diagram of the Mariner IV Vidicon TV Camera.

Preserved by Les Whaley. Scan: Colin Mackellar.



How the pictures from Mars be received and sent to JPL.

Preserved by Les Whaley. Scan: Colin Mackellar.



The JPL DSN Ground Communications Network for Mariner IV, as at May 1965.
Preserved by Les Whaley. Scan: Colin Mackellar.

A tense moment during Tidbinbilla's first official track of Mariner IV, January 1965.

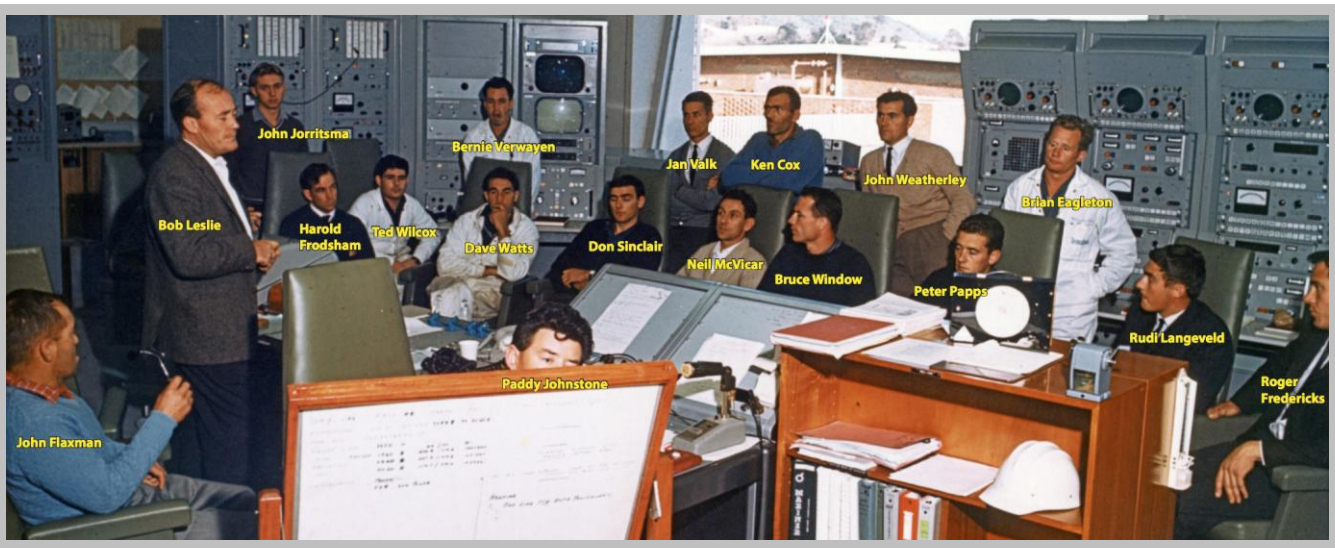
Left to right: **Les Whaley** – Analog console – left edge of photo, wearing glasses; **Bob Cudmore** – Instrumentation Section Leader – hand on chin; **Jack Rothwell** – Antenna Engineer – seated, holding sheet of paper; **Peter Papps** – Magnetic recording – seated in background; **John Heath** – Microwave Engineer – standing; **Bob Leslie** – Station Director – seated at Ops Console; **Neil McVicar** – Receiver Technician – standing; **Paddy Johnstone** – Ops Controller – seated at Ops Console; **Dave Watts** – Antenna Technician – seated in foreground; **Mel Glenn** – JPL Rep – seated at Console. Note the Closed Circuit TV Camera , near Peter Papps.

With thanks to John Heath for the photo and description.

Station Director Bob Leslie addresses the team after their first operational track of Mariner 4.

This and the photos below of the briefing were
probably taken by Station Photographer Henry Holthouse.

Photo preserved by Mike Dinn, scan Colin Mackellar.



DSIF-42 Station Director Bob Leslie addresses the team after their first operational track of Mariner 4, which was *enroute* to Mars. circa March 1965.

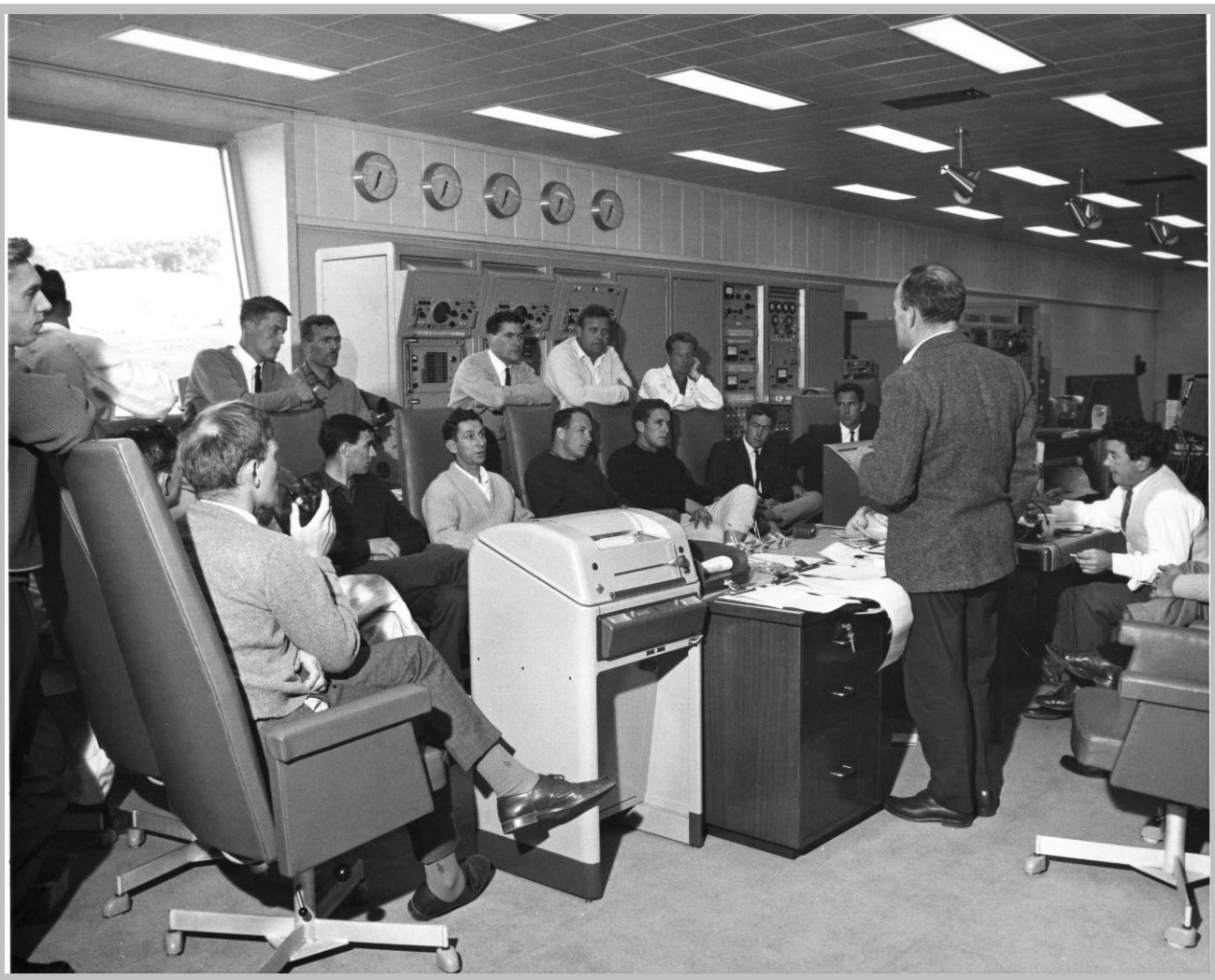
Photo preserved by Mike Dinn. Names with thanks to Mike Dinn, Bruce Window and Rudi Langeveld. Scan and key by Colin Mackellar.

Another view of the same meeting.

Scan courtesy of Glen Nagle, CDSCC.

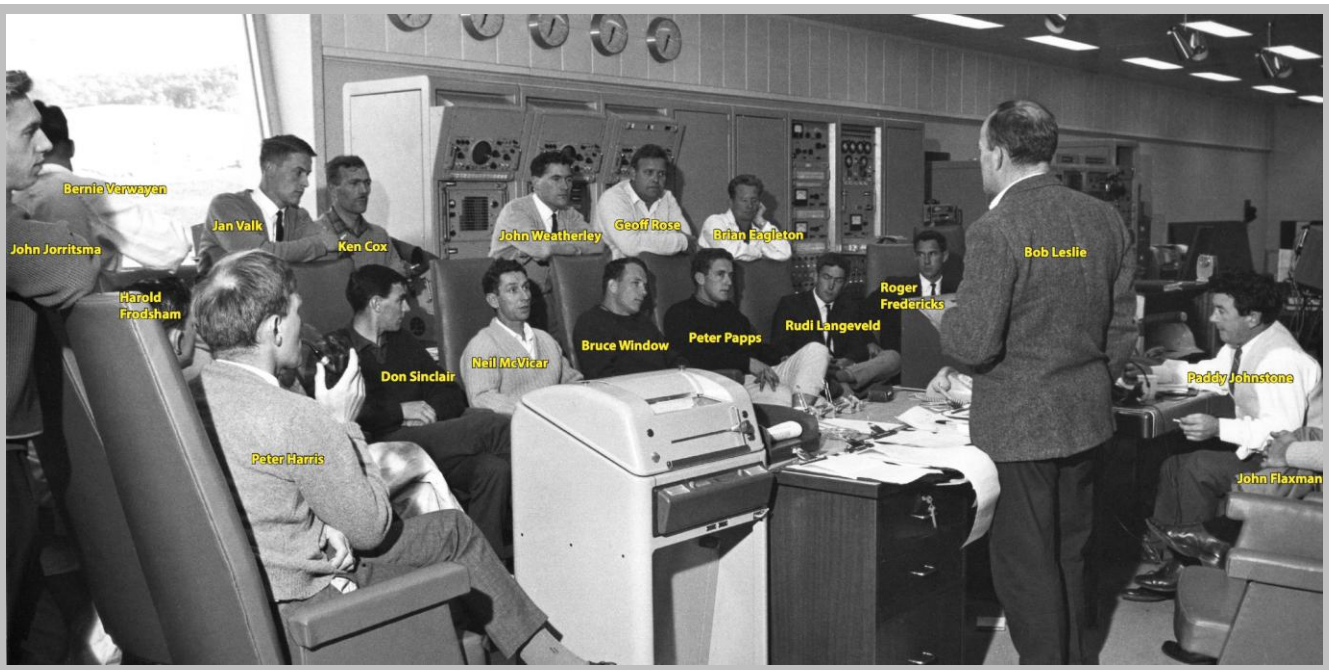
This photo was taken at the same meeting – in this one Brian Harris (with pipe) is visible third from left, and Geoff Rose is standing at far right.

Photo preserved and scanned by Keith Brockelsby.



The same meeting from a different angle.

Photo preserved and scanned by Bruce Window.

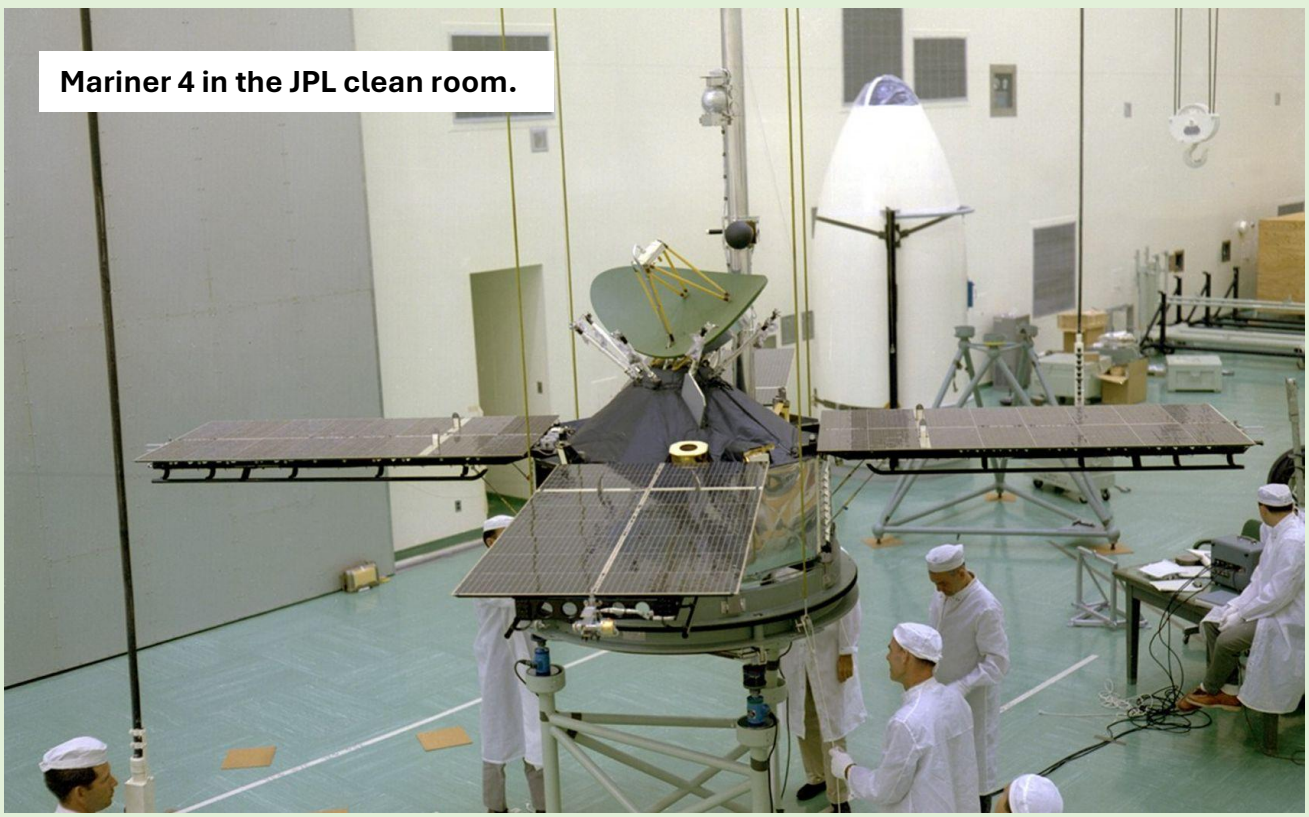


DSIF-42 Station Director Bob Leslie addresses the team after their first operational track of Mariner 4, which was *enroute* to Mars. circa March 1965.

Photo preserved by Mike Dinn. Names with thanks to Mike Dinn, Bruce Window and Rudi Langeveld. Scan and key by Colin Mackellar.

And one more.

Photo preserved by Jacqui Galbraith. Scanned by Colin Mackellar.

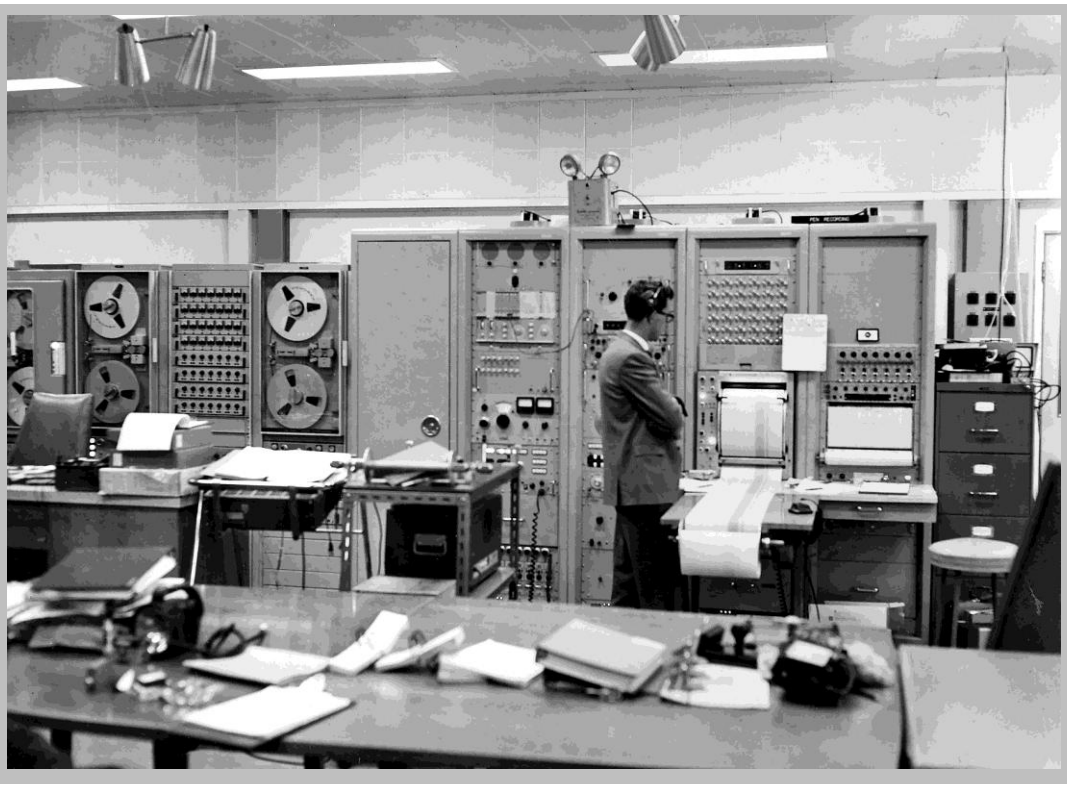


Mariner 4 in the JPL clean room.

DSS42 ops - taken during Tidbinbilla's first track of Mariner 4 *enroute* to Mars in March 1965.

Tony Saville is second from right in this photo. Jack Rothwell, standing at left. Bob Leslie and Paddy Johnstone seated, Tony Saville and Bob Cudmore at right. In the distance, Les Whaley is visible above Bob Leslie. He is speaking with Keith Aldworth. John Weatherly is in the background standing in profile.

With thanks to Keith Aldworth for his help with the names.
Photo from Clive Jones via John Heath. Scan: Colin Mackellar.



Les Whaley at the Analog Instrumentation System's chart recorder.

Scan by Les Whaley.

Mariner IV Preparations

Bruce Window remembers:

> "I recall that Bob Leslie got a CCTV installed so that the journalists (who were corralled in the Briefing Room to watch the Occultation) could see what was going on during the Mars flyby of Mariner IV.
>
> Later, after the pass was concluded, the journalists and photographers were allowed into the OPS Room and were able to interview us. That is when my photo was taken at the Receiver, and my bio was obtained for publication the next day (Friday 16 July 1965) by the Sydney Morning Herald along with Bob all the other staff."

Mariner IV Mars Pre-encounter

There was considerable excitement about the coming Mars encounter.

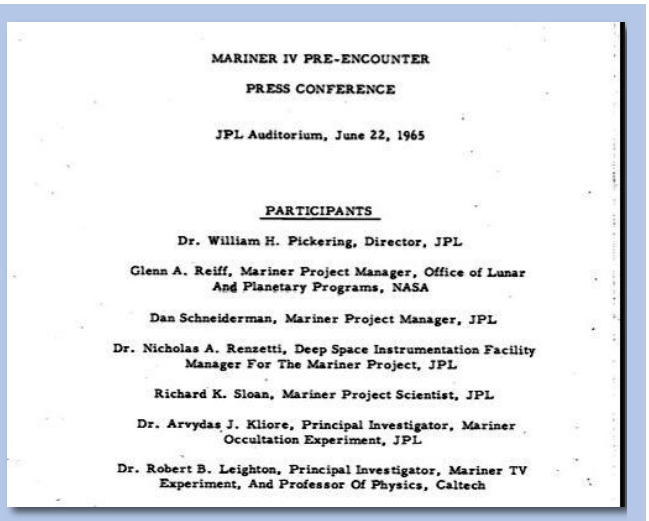
Three weeks before Mariner reached Mars, a Press Conference was held at the Jet Propulsion Lab in Pasadena, outlining the sequence of events.

It included discussion of the roles of the various Deep Space Network stations.

Mariner IV Mars encounter

Mariner IV encountered Mars on Thursday, 15 July 1965, and sent back the first close-up pictures ever seen of the Red Planet.

The telemetry was received at Goldstone, Tidbinbilla, Island Lagoon and Johannesburg.



MARINER IV PRE-ENCOUNTER

PRESS CONFERENCE

JPL Auditorium, June 22, 1965

PARTICIPANTS

Dr. William H. Pickering, Director, JPL

Glenn A. Reiff, Mariner Project Manager, Office of Lunar And Planetary Programs, NASA

Dan Schneiderman, Mariner Project Manager, JPL

Dr. Nicholas A. Renzetti, Deep Space Instrumentation Facility Manager For The Mariner Project, JPL

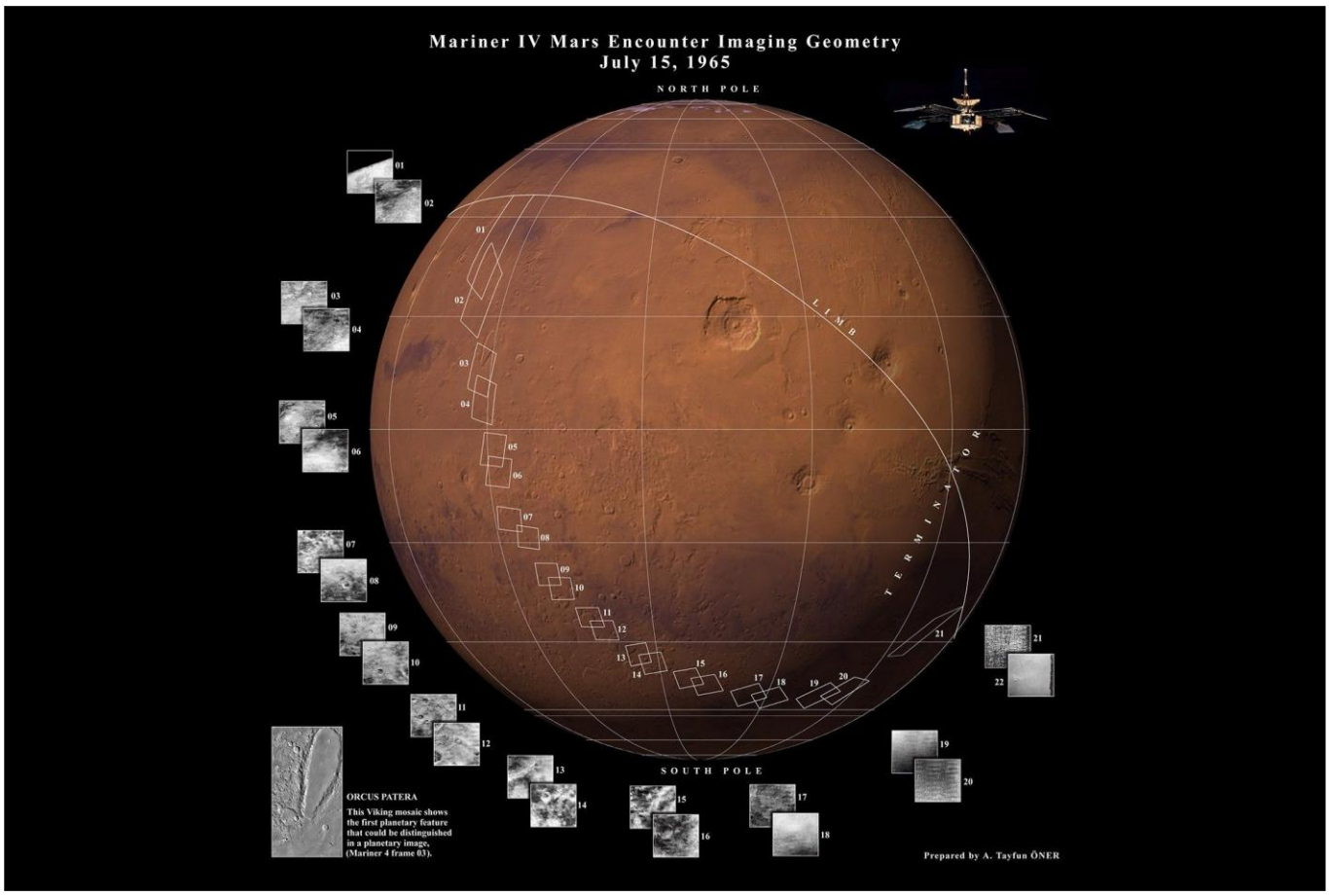
Richard K. Sloan, Mariner Project Scientist, JPL

Dr. Arvydas J. Kliore, Principal Investigator, Mariner Occultation Experiment, JPL

Dr. Robert B. Leighton, Principal Investigator, Mariner TV Experiment, And Professor Of Physics, Caltech

The above linked document is a fascinating summary of what was expected.

Les Whaley preserved this transcript of the Pre-Encounter Press Conference on 22 June 1965. Link - 5.1MB PDF file.



DSIF 42 STATION NOTICE NO. 32 — MARINER ENCOUNTER PHASE

On 15 July, when for the first time a spacecraft passes the planet Mars, Station 42 will be tracking and recording invaluable data.

To safeguard against the possibility of loss of data due to radio/electrical interference, the following precautions are to be taken during the specified times:

Thursday, 15 July from 11 a.m. to 2.00 p.m. (local) (ie during actual encounter)

1) All vehicles on site will be immobilised, with ignition switched off, and vehicle keys checked on the transport boards.

2) All vehicles approaching the site will be stopped at the "STOP" sign on the site side of Paddy's River bridge, and will remain there until authorised to proceed. Authorisation will be given only by the tracking director on duty, via the guard stationed at the "STOP" sign.

3) All electrical equipment, except the actual operational equipment used in tracking the spacecraft, will be switched off. This includes all forms of electrically driven hand tools, solder guns, welding plant, etc. Unfortunately, this also includes hot plates, coffee pots, etc., which means that a hot meal will not be available at mid-day.

4) All laboratory equipment to be switched off.

5) All Surveyor equipment to be switched off.

6) All Pioneer equipment to be switched off

7) FR 800 to be switched off

8) All radios and TV sets to be turned off

Tracking Periods 15, 16 and 17 July (approx 11 a.m. to 11 p.m.)
(ie when the first TV pictures will be received)

1) Vehicles, other than Station cars, will be stopped at the "STOP" sign (as for para 2 above) until authorised to proceed.

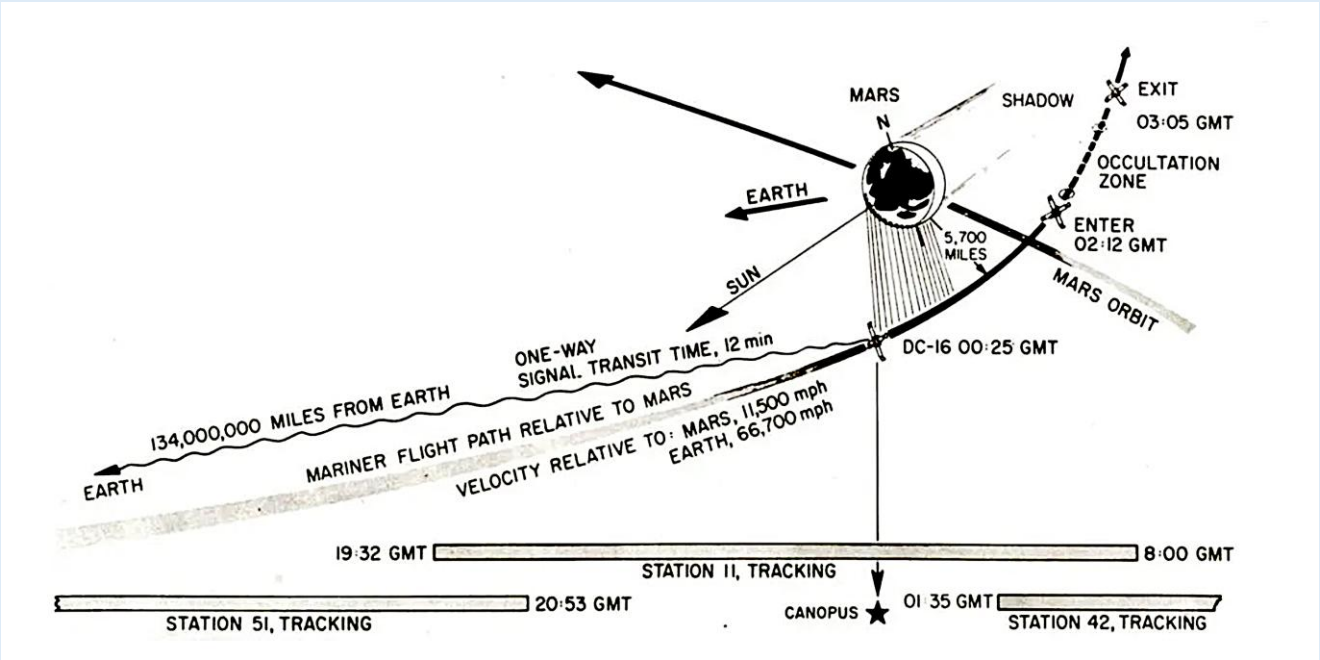
2) For this critical three day period (and for the remainder of the TV picture transmission up to 4 August) all personnel are asked to operate electrical appliances only if strictly necessary and, if major items such as welding plant need to be used, the tracking director's permission must be obtained. During this period, no Pioneer or Surveyor S-Band equipment is to be operated without permission from the tracking director.

R. A. LESLIE
Station Director

Distribution:
Notice Boards (4)
Section Leaders (10 each)
Engineers
SOC (3)
Ops. Room

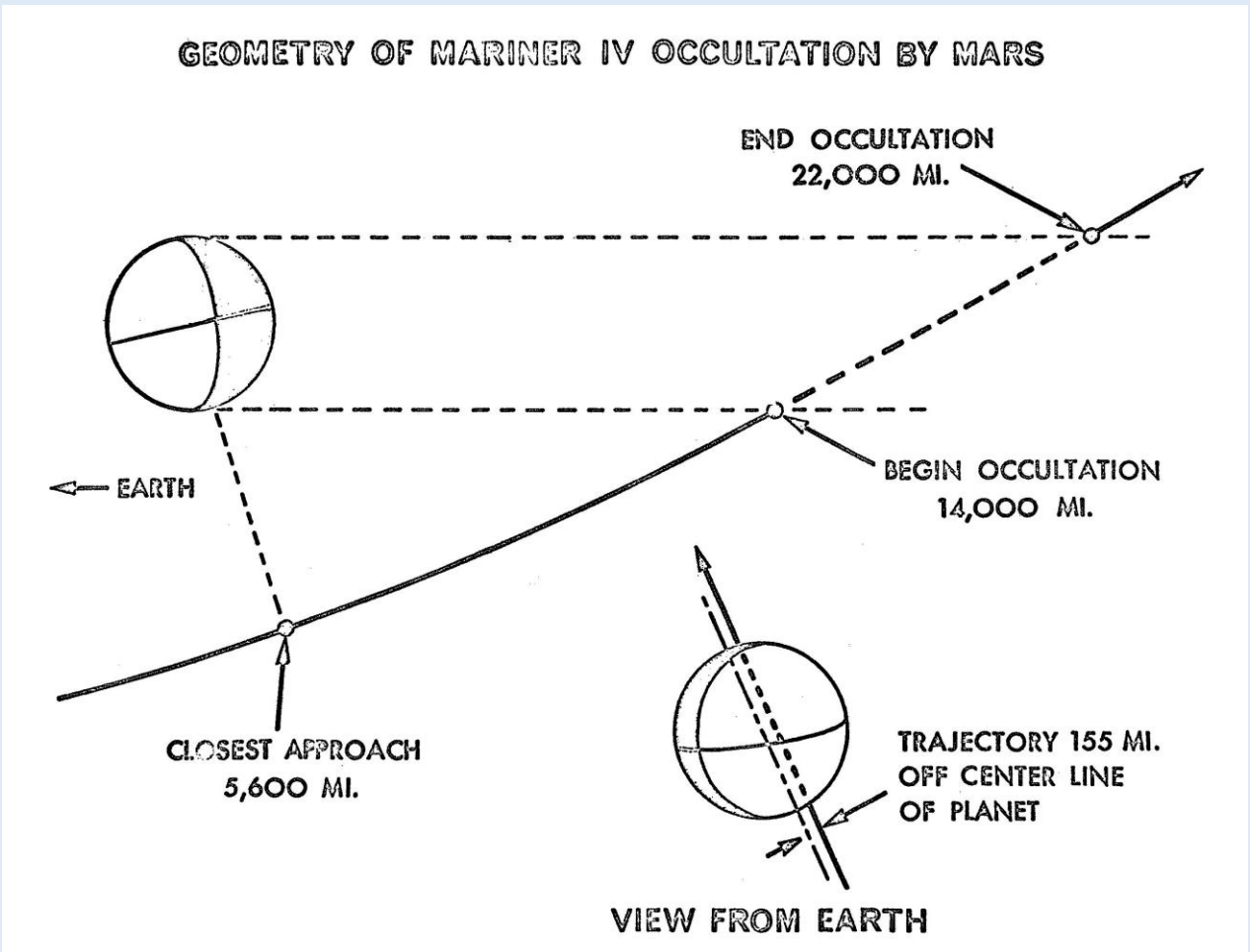
Station Director Bob Leslie was taking no chances for the Mariner IV encounter with Mars.

All possible sources of radio interference were to be turned off. There would be no hot meal in the canteen on Thursday 15th July 1965. Preserved and scanned by Gary Peach.



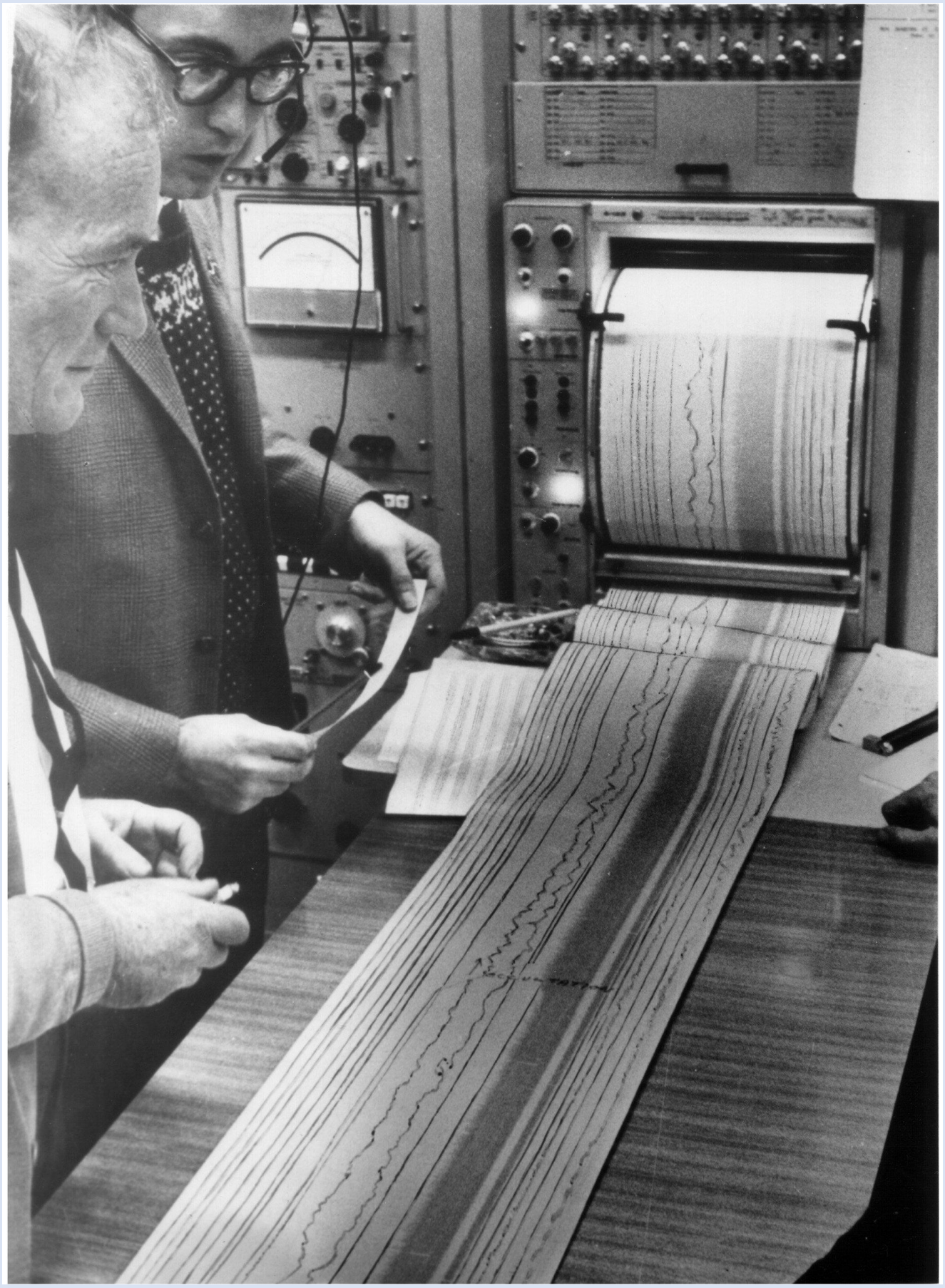
This image, adapted from a slide shown at the Pre-encounter Press Conference at JPL, shows which stations will be tracking during the encounter. DSIF-11 (Goldstone) and DSIF-42 (Tidbinbilla) will both see the radio occultation and re-emergence.

Preserved by Les Whaley. Modified by Colin Mackellar.



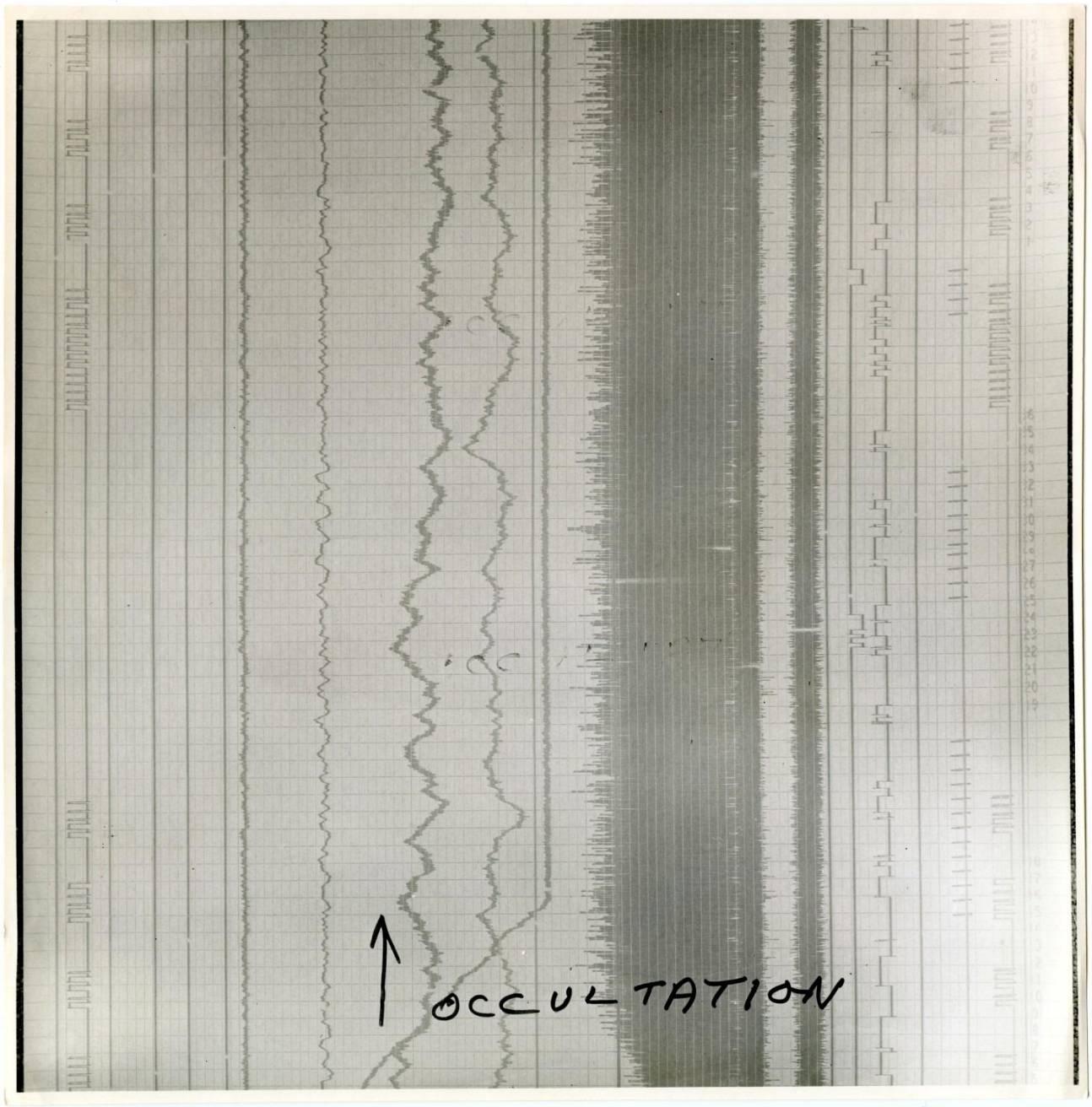
This JPL diagram shows the expected occultation geometry.

Preserved by Les Whaley. Scan: Colin Mackellar.



Station Director Bob Leslie (left) and Les Whaley
examine the output from the chart recorder
showing the Mariner IV radio occultation as it went behind Mars.

Scan by Mike Dinn.



OCCULTATION! Detail from the chart recorder.

Les Whaley preserved photographs of the charts. Scans by Colin Mackellar.

Bruce Window explains:

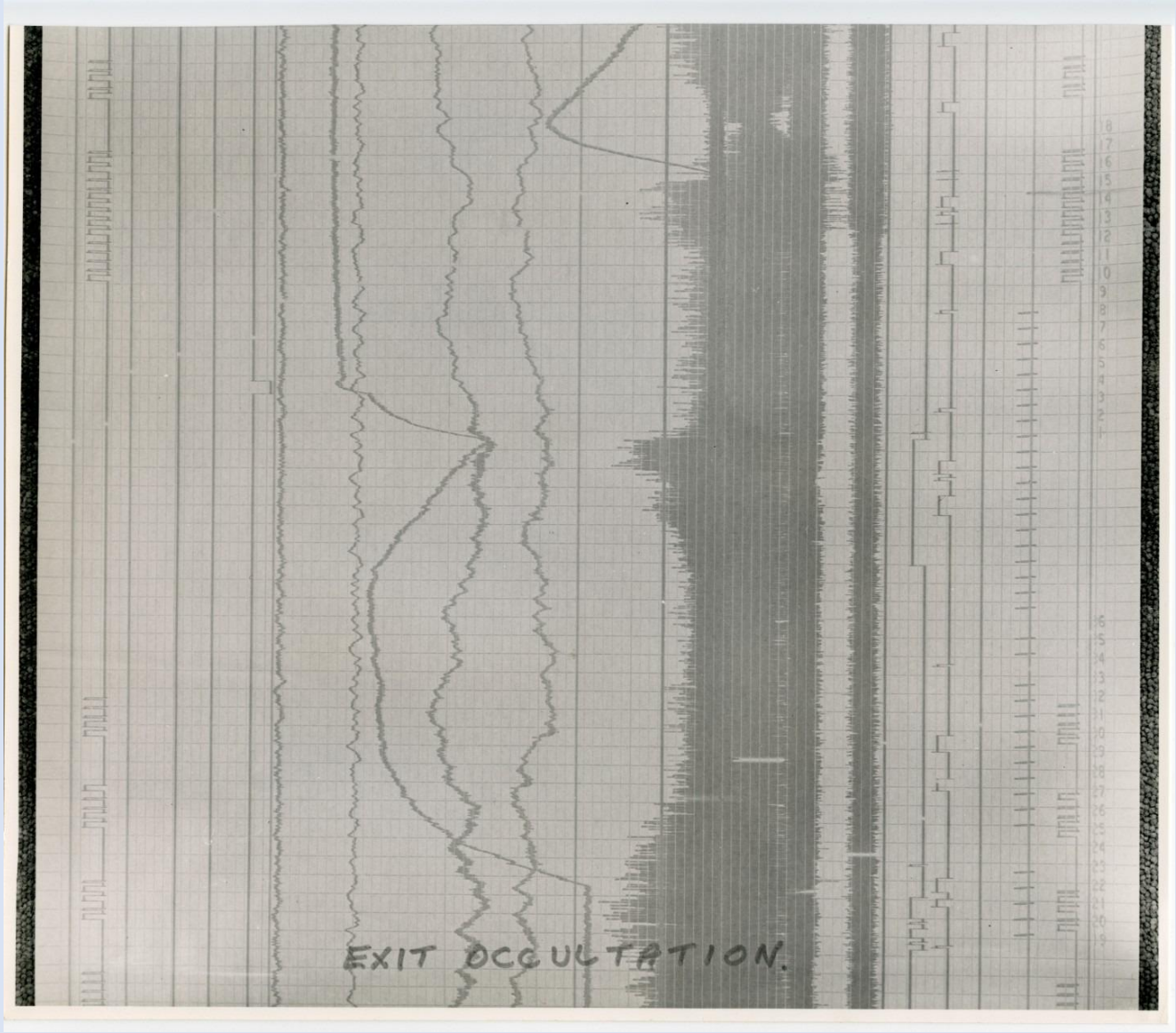
OCCULTATION!

"This is a record from DSS42 Analog Instrumentation System's large chart recorder (CLC 5-123 Oscillograph) which was visible in near-real-time.

It shows, amongst other things, Receiver-1 AGC voltage which represents the received signal level of the spacecraft.

At the time of occultation, this signal dropped from a steady figure (say -160dBm) to receiver threshold, (say -170dBm). The diagonal line on the chart is Receiver-1 ACG voltage.

The first "O" of the word 'occultation' cuts this trace of ACG voltage. The magnitude of the signal increases towards the left of the chart. Thus, when Receiver-1 lost lock because the spacecraft was obscured by the planet Mars, the chart shows the AGC going to the right."



EXIT OCCULTATION!

EXIT OCCULTATION!

"This is a continuation of the same CLC Oscillograph record, and shows amongst other things, Receiver-1 AGC voltage when Receiver 1 became locked onto the one-way downlink signal after the spacecraft emerged from behind Mars.

Receiver-1 AGC is the trace that intersects the letter "L" from the word "occultation" and shows that when it locked onto the spacecraft initially, it was a false lock on a sideband of the carrier.

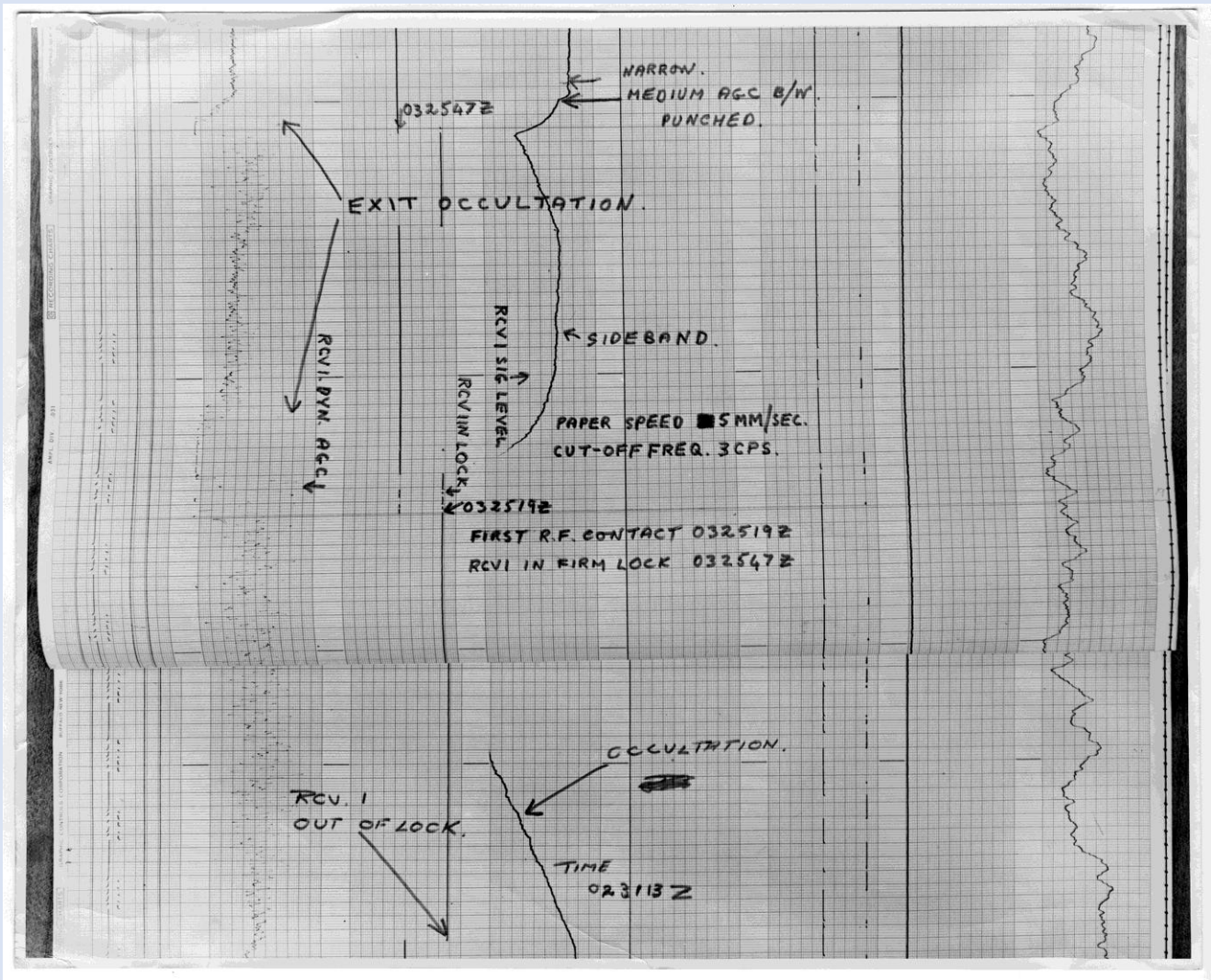
The trace shows that false lock was intentionally broken, and then a true, downlink lock on the signal was achieved. The strength of the signal increases towards the left of the chart."

THERMAL CHART RECORDER

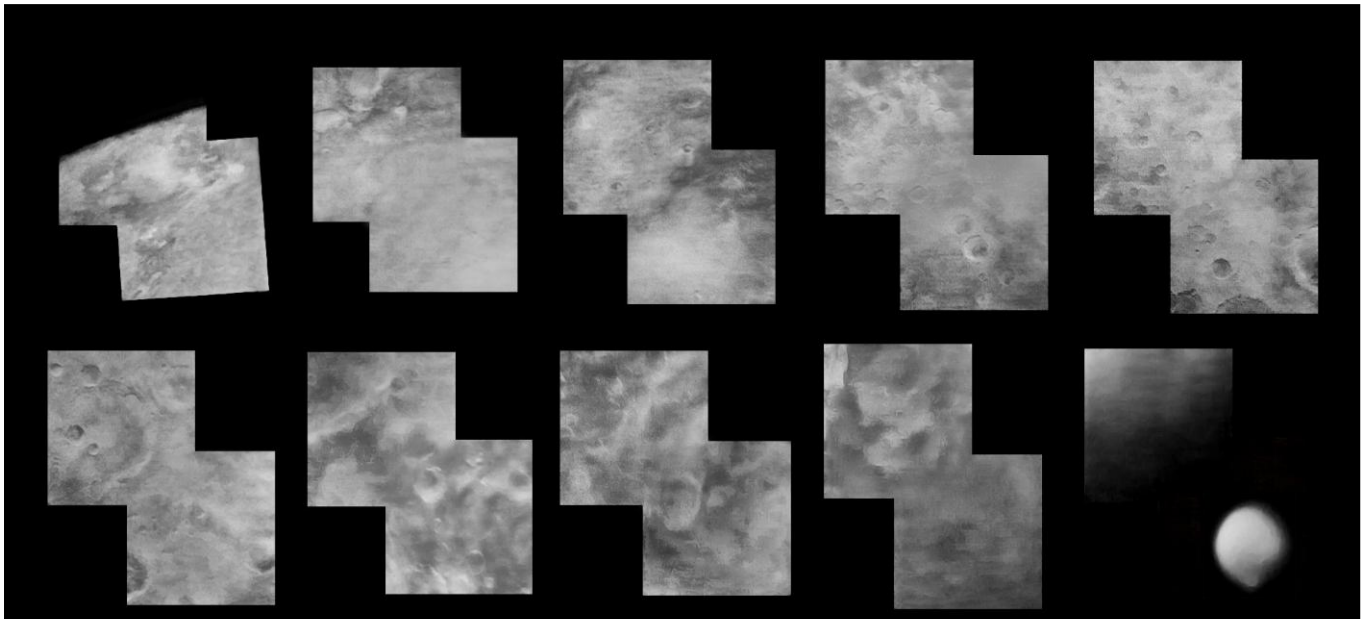
"This is a record from a Sanborn 8 channel thermal chart recorder which was a backup to the AIS CLC Oscillograph. It is of Mariner IV occultation. It was generally run in parallel with the CLC for special events because it was instantly visible.

The configuration of this recorder was more under station control than the CLC which was dictated by the Mission documentation."

MARS '64

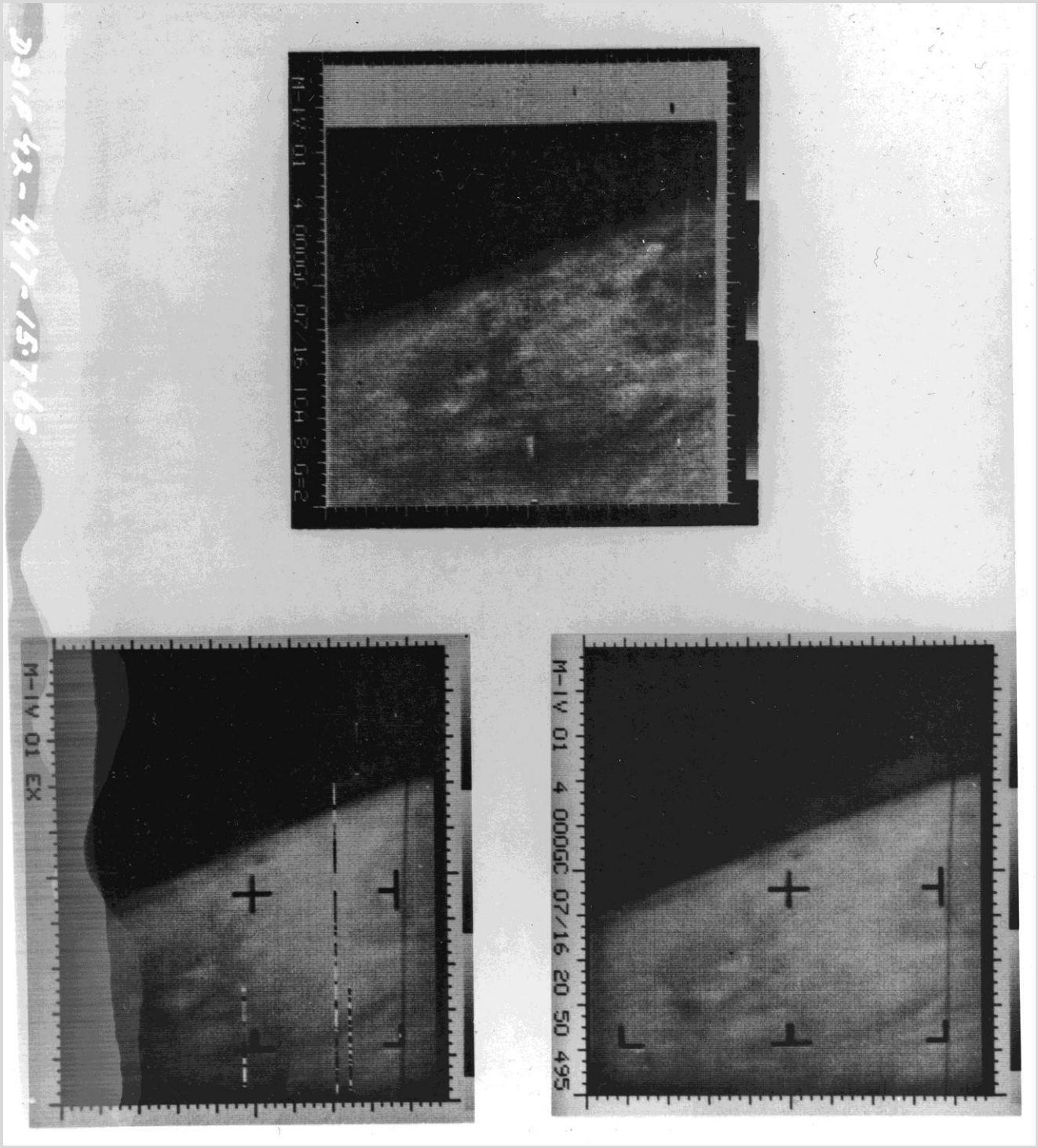


THERMAL CHART RECORDER



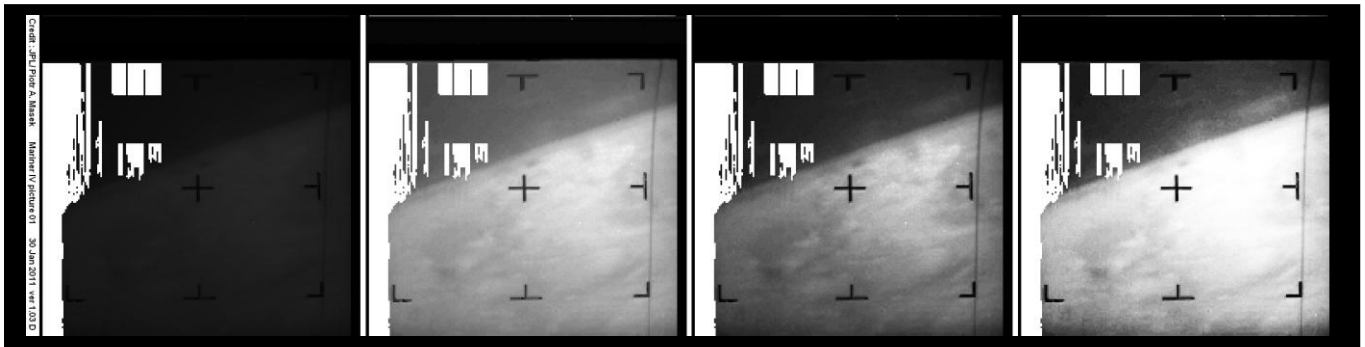
A compilation of Mariner 4 images. The image in the lower right hand corner (which includes Phobos) and shows the correct hemisphere, is from a later Mariner mission.

From the Bruce Murray Space Image Library. Images: NASA / JPL Processed by Ted Stryk

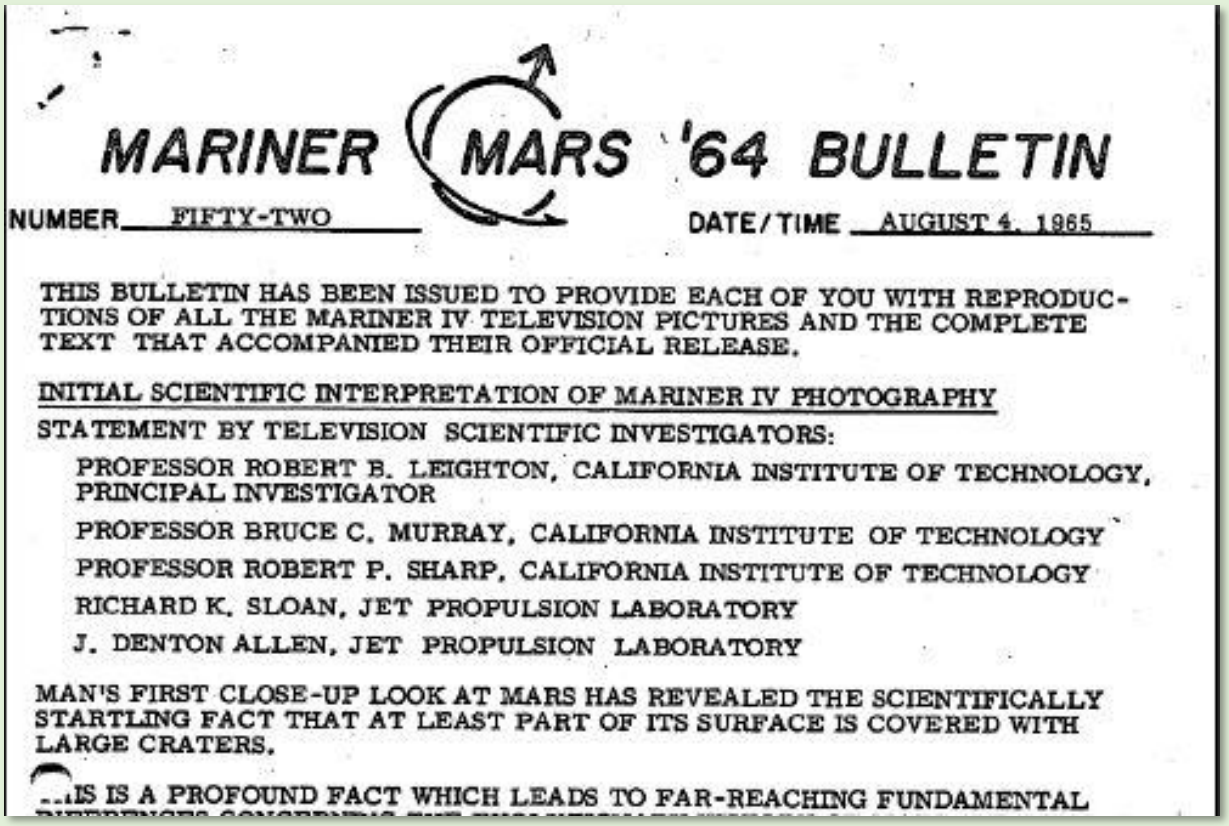


Three different versions of image 01, with various enhancements in an attempt to bring out details.

Preserved by Les Whaley. Scanned by Colin Mackellar.



Mariner 4 – Image #1 – processed in different filters.



MARINER MARS '64 BULLETIN

NUMBER FIFTY-TWO DATE/TIME AUGUST 4, 1965

THIS BULLETIN HAS BEEN ISSUED TO PROVIDE EACH OF YOU WITH REPRODUCTIONS OF ALL THE MARINER IV TELEVISION PICTURES AND THE COMPLETE TEXT THAT ACCOMPANIED THEIR OFFICIAL RELEASE.

INITIAL SCIENTIFIC INTERPRETATION OF MARINER IV PHOTOGRAPHY

STATEMENT BY TELEVISION SCIENTIFIC INVESTIGATORS:

PROFESSOR ROBERT B. LEIGHTON, CALIFORNIA INSTITUTE OF TECHNOLOGY, PRINCIPAL INVESTIGATOR

PROFESSOR BRUCE C. MURRAY, CALIFORNIA INSTITUTE OF TECHNOLOGY

PROFESSOR ROBERT P. SHARP, CALIFORNIA INSTITUTE OF TECHNOLOGY

RICHARD K. SLOAN, JET PROPULSION LABORATORY

J. DENTON ALLEN, JET PROPULSION LABORATORY

MAN'S FIRST CLOSE-UP LOOK AT MARS HAS REVEALED THE SCIENTIFICALLY STARTLING FACT THAT AT LEAST PART OF ITS SURFACE IS COVERED WITH LARGE CRATERS.

...IS IS A PROFOUND FACT WHICH LEADS TO FAR-REACHING FUNDAMENTAL

This scan is of a copy of the original release, hence the poor quality of the images.

Preserved by Les Whaley. Scanned by Colin Mackellar.

The JPL Mariner Bulletin

The JPL-produced Mariner bulletin was sent to the DSN stations along with copies of the images.

Dated 4th August 1965, the Mariner Mars '64 Bulletin #52 accompanied sets of images for members of the DSN team. Click the image above or here for a 700kb PDF file.

Here's the main text of the bulletin:

> This bulletin has been issued to provide each of you with reproductions of all the Mariner IV television pictures and the complete text that accompanied their official release.
>
> **Initial scientific interpretation of Mariner IV photography** statement by television scientific investigators:
>
> Professor Robert B. Leighton. California Institute of Technology, Principal Investigator
>
> Professor Bruce C. Murray, California Institute of Technology
>
> Professor Robert P. Sharp, California Institute of Technology
>
> Richard K. Sloan, Jet Propulsion Laboratory
>
> J. Denton Allen, Jet Propulsion Laboratory
>
> Man's first close-up look at Mars has revealed the scientifically startling fact that at least part of its surface is covered with large craters.
>
> This is a profound fact which leads to far-reaching fundamental inferences concerning the evolutionary history of Mars and further enhances the uniqueness of Earth within the solar system.
>
> Frame number 11 of the Mariner sequence must surely rank as one of the most remarkable scientific photographs of this age.
>
> The existence of Martian craters is demonstrated beyond question: Their meaning and significance is, of course, a matter of interpretation. The seventy craters clearly distinguishable on Mariner photos nos. 5 through 15, range in diameter from 3 to 75 miles. It seems likely that smaller craters exist, and there also may be still larger ones than those photographed, since the Mariner

photographs, in total, sampled only about one percent of the Martian surface.

The observed craters have rims rising a few hundred feet above the surrounding surface and depth of a few thousand feet below the rims. Crater walls so far measured seem to slope at angles up to about 10°.

The number of large craters per unit area of the Martian surface is closely comparable to the densely cratered upland areas of the Moon.

If the Mariner sample is representative of the Martian surface, the total number of craters of the sizes so far observed is more than 10,000 compared to a mere handful on Earth.

In appearance, the Martian craters closely resemble impact craters on Earth, both artificial and natural, and the craters of the Moon. Craters of widely different degree of preservation and, presumably age, are distinguishable.

A few elongated diffuse markings are present on the Mariner photos but at this early stage of analysis no conclusions can be offered concerning them. On frame no. 13, one such feature looks like a part of the edge of a very large crater and, perhaps significantly, lies near the border of a Martian dark area.

In southern sub-polar latitudes, where the season is late mid-winter some craters appear to be rimmed with frost, particularly in frame 14.

Some mention must be made of features looked for but not seen on Mariner photos. Although the flight line crossed several "Canals," sketched from time to time on maps of Mars, no trace of these features was discernible. It should be remembered in this respect that the visibility of many Martian surface features. Including the “Canals,” is variable with time.

No Earth-like features, such as mountain chains, great valleys. Ocean basins or continental masses were recognized.

Clouds were not identified, and the flight path did not cross either polar cap.

The following are some of the fundamental inferences to be drawn from the photos:

1. In terms of its evolutionary history, Mars is more Moon-like than Earth-like. Nonetheless, because it has an atmosphere, Mars may shed much light on early phases of earth's history.

2. Reasoning by analogy with the Moon, much of the heavily cratered surface of Mars must be very ancient - perhaps two to five billion years old.

3. The remarkable state of preservation of such an ancient surface leads us to the inference that no atmosphere significantly denser than the present very thin one has characterized the planet since that surface was born. Similarly, it is difficult to believe that free water in quantities sufficient to form streams or to fill oceans could have existed anywhere on Mars since that time the presence of such amounts of water (and consequent atmosphere) would have caused severe erosion over the entire surface.

4. The principal topographic features of Mars photographs by Mariner have not been produced by stress and deformation originating within the planet, in distinction to the case of the Earth. Earth is internally dynamic giving rise to mountains, continents and other features, while evidently Mars has long been inactive. The lack of internal activity is also consistent with the absence of a significant magnetic field on Mars as was determined by the Mariner magnetometer experiment.

5. As we had anticipated, Mariner photos neither demonstrate nor preclude the possible existence of life on Mars. The search for a fossil record does appear less promising if Martian oceans never existed. On the other hand, if the Martian surface is truly in its primitive form, that surface may prove to be the best -- perhaps the only -- place in the solar system still preserving clues to original organic development, traces of which have long since disappeared from Earth.

The Mariner photos will profoundly affect scientific views about the origin and evolution of planetary bodies in the planetary solar system.

Mariner IV images returned

The following images are an incomplete set of the images provided to Tidbinbilla.

All images were preserved by Les Whaley and scanned by Colin Mackellar.

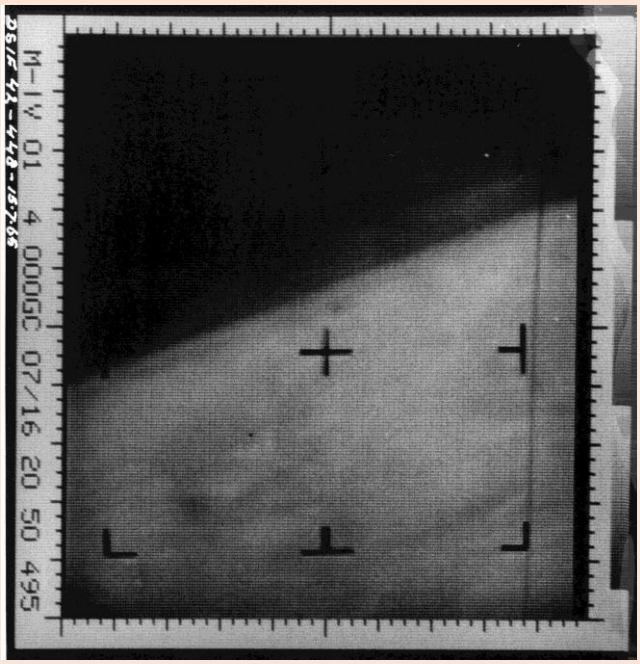


Image 01. The first ever close up image of Mars. Note the haze layer. Orange filter.

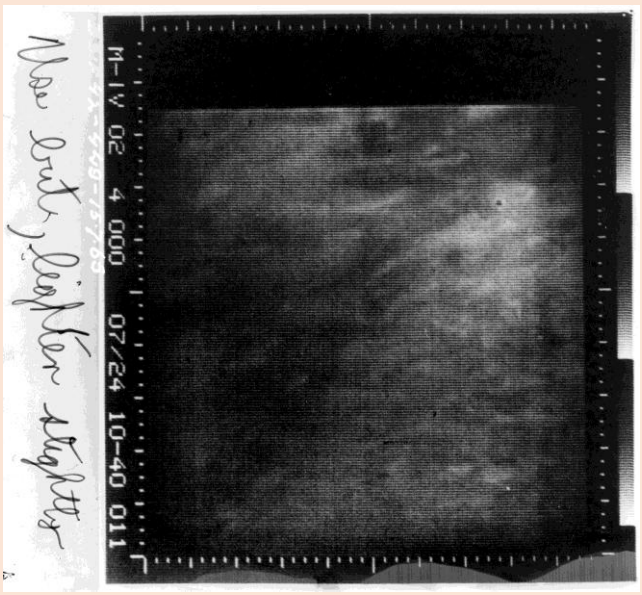


Image 02. Orange filter.

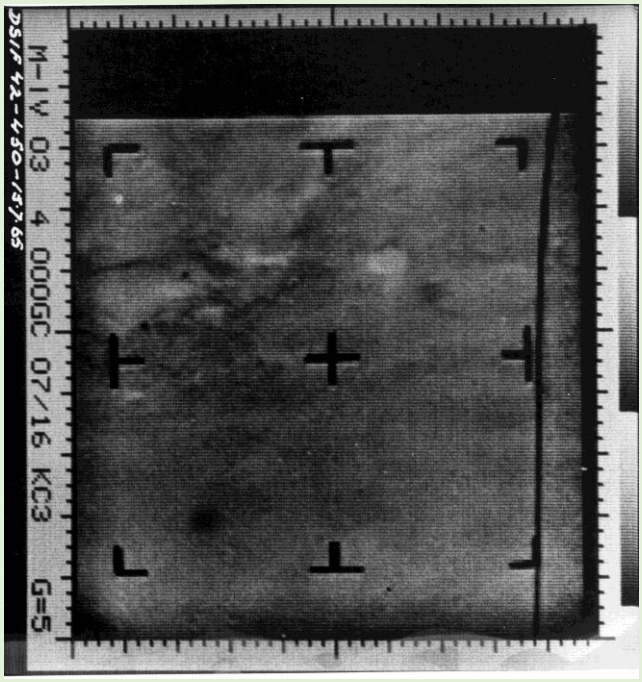


Image 03. Green filter.

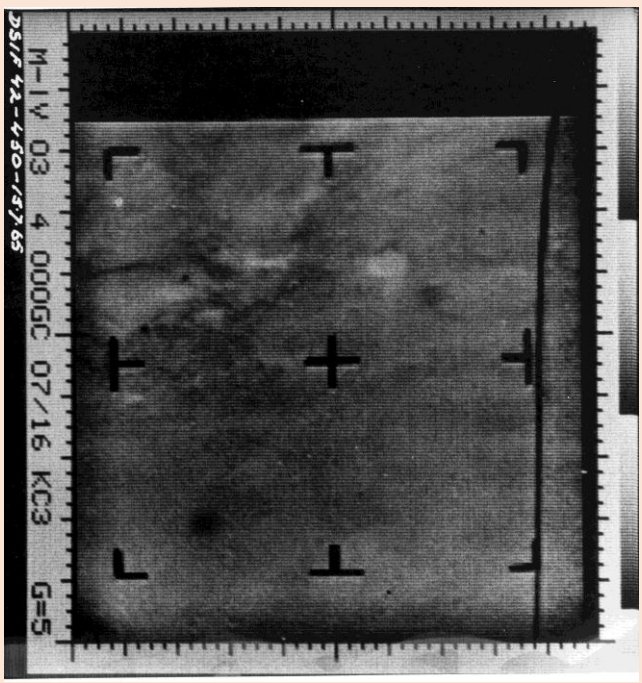


Image 04. Orange filter.

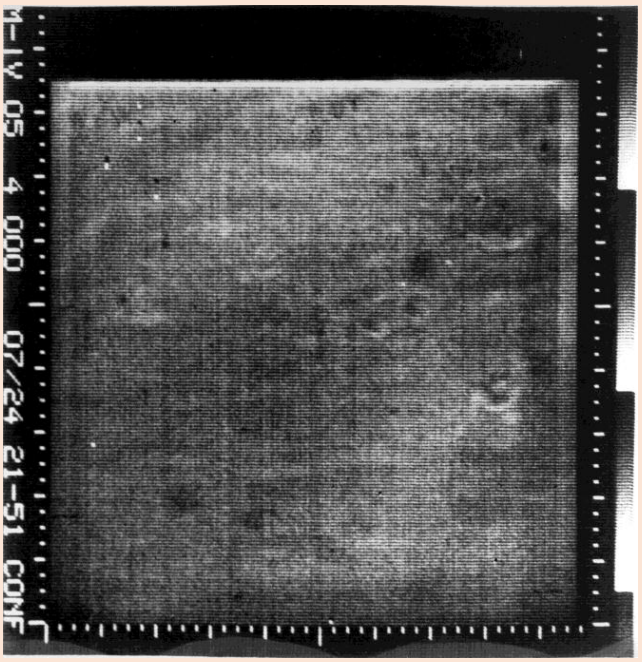


Image 05. Orange filter.

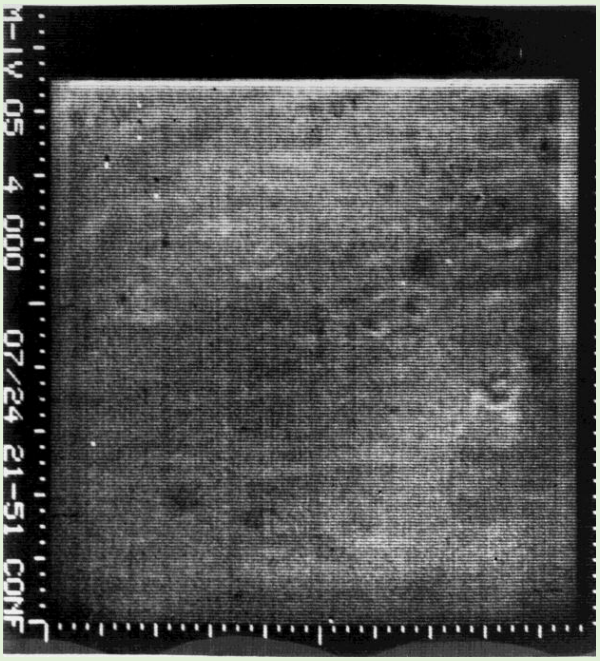


Image 07. Green filter.

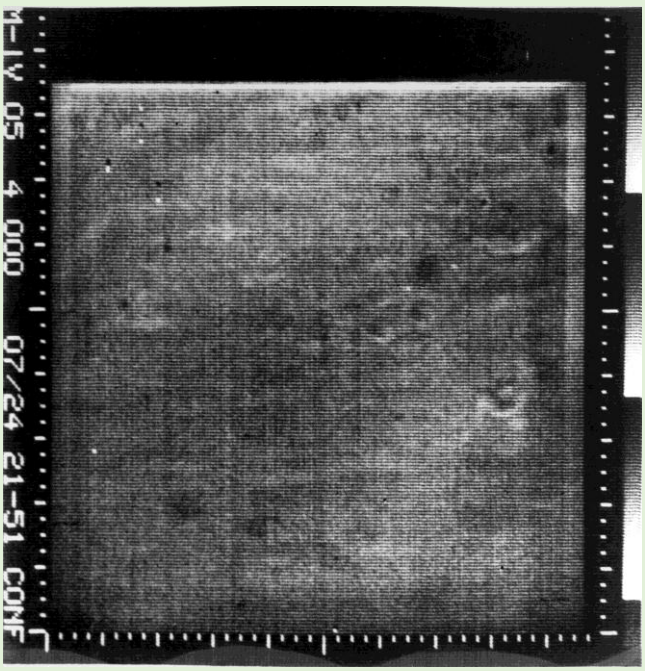


Image 06. Green filter.

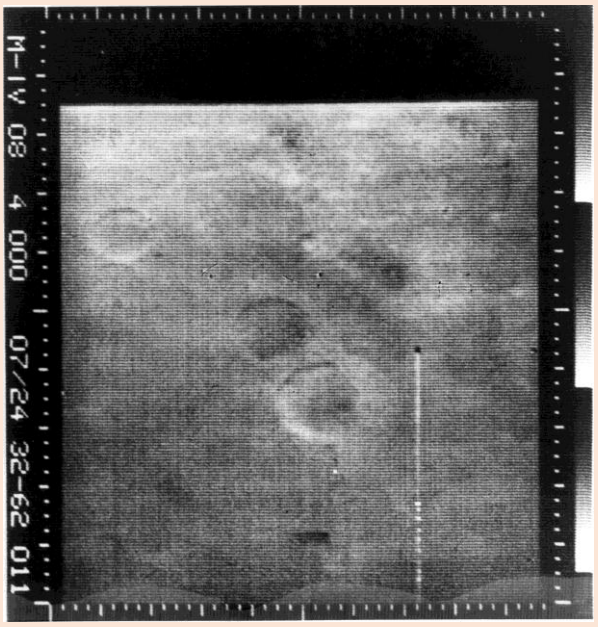


Image 08. Orange filter.

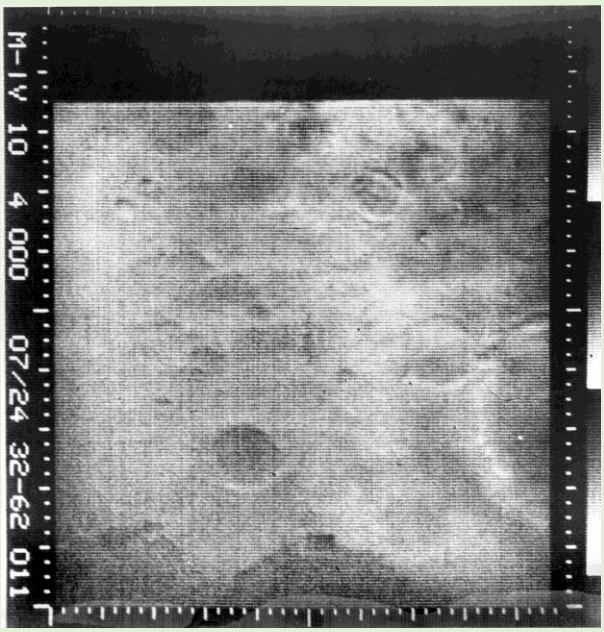


Image 10. Green filter.

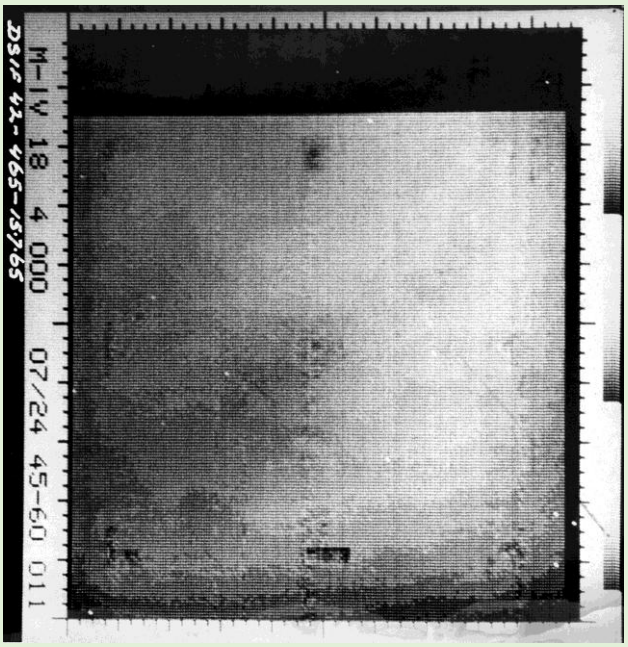
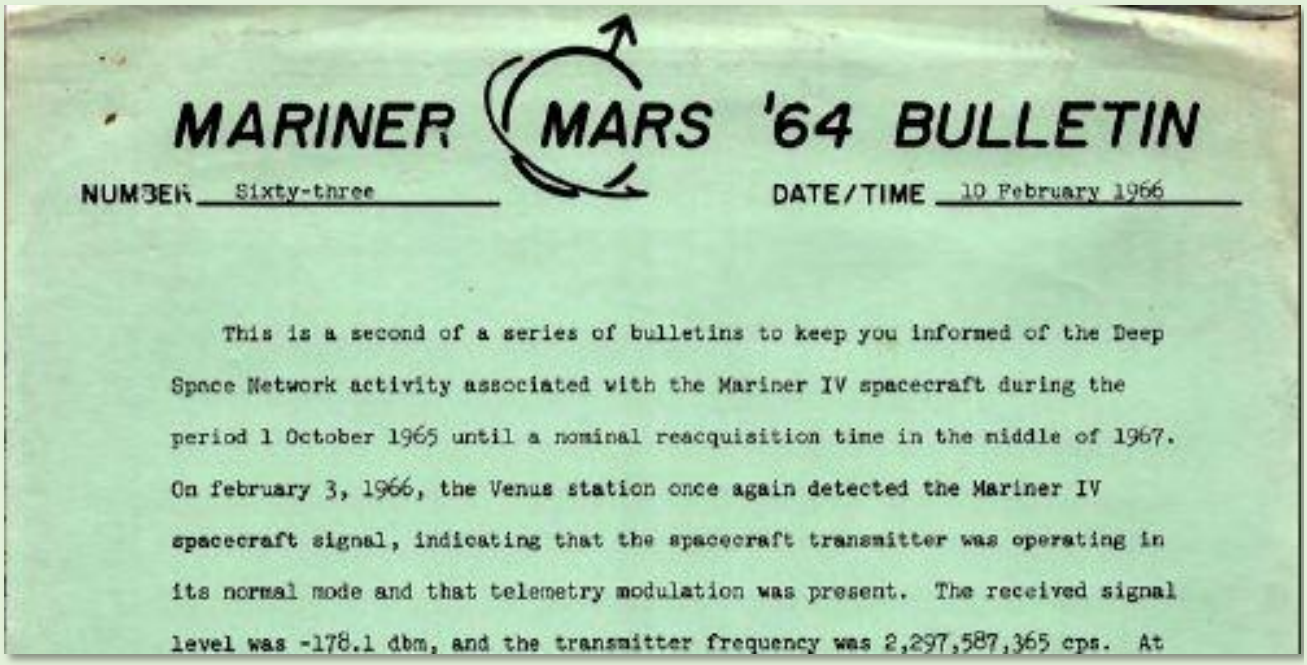


Image 18. Green filter.



MARINER MARS '64 BULLETIN

NUMBER Sixty-three DATE/TIME 10 February 1966

This is a second of a series of bulletins to keep you informed of the Deep Space Network activity associated with the Mariner IV spacecraft during the period 1 October 1965 until a nominal reacquisition time in the middle of 1967. On february 3, 1966, the Venus station once again detected the Mariner IV spacecraft signal, indicating that the spacecraft transmitter was operating in its normal mode and that telemetry modulation was present. The received signal level was -178.1 dbm, and the transmitter frequency was 2,297,587,365 cps. At

This bulletin is dated 10th February 1966. Click the image or here for a 400kb PDF file.

Preserved by Les Whaley. Scanned by Colin Mackellar.

Bruce Window at the Tidbinbilla receivers at the time of encounter.

Audio

Hear Bruce Window's account
Part 1 - 7 min 16 sec

Audio

Hear Bruce Window's account
Part 2 – starting at 10 min mark

Mariner IV Stories at Tidbinbilla

Bruce Window remembers:

"I was a Receiver Operator on shift until the day of the spacecraft arriving in the vicinity of Mars. That was a pretty exciting time that had been built up. with the expectation that we would be perfect, and we didn't want any hitches.

In fact, I've got a letter which I wrote to my mother, which is dated Monday the 19th of July 1965…

Also, I guess you heard about the Mariner on the news. On the day of encounter, they had all the press out at the station and had closed circuit TV to show them what was going on.

It was a muck-up right from the start – with people in a panic everywhere, and this made things ever more difficult than they really were.

To start with, there were incorrect predictions, and so it took me 8 minutes to find the signal after it had come over the horizon. Not that anything was lost, because the station at Goldstone was tracking at that time.

Then, later, when the thing went behind Mars, the Operations chief here had a long discussion with the mission directors to try and get some better predictions for when it came out from behind Mars.

Also, during this time, we all had lunch, as best we could. I didn't trust time going to a barbecue, so I took sandwiches.

Anyway, about thirty seconds before the signal was due to arrive back on Earth, they gave us a new set of predictions, and then there was a scramble to set up the new figures.

As I was tuning the receiver, I heard the signal, and we were the first station to make contact after the encounter.

Later on in the afternoon, the operations manager asked the two of us operating the

DSS-42 Operations during the first track of Mariner IV, January 1965.
John Heath is at the far right of the photo.

Preserved by Les Whaley, 2025 re-scan by Colin Mackellar.

receivers to go and have an interview with the press. Anything you read in the papers need not necessarily have been said. It certainly is a marvellous achievement the Yanks have done."

John Heath writes:

My recollections of that exciting time back in the mid-1960s are dominated not so much by the anxious events that culminated in the Mariner IV flyby of Mars but of the events just prior to our first track of that spacecraft that occurred a few months earlier (which was incidentally, also our first track of any spacecraft and consequently quite a harrowing time for the station staff).

It was particularly harrowing for me as there were two troublesome systems that were critical to the success of the operation, and they were both RF systems.

The first was the transmitter system that was required to send commands that were essential to the operation of the spacecraft. This system was experiencing irregular 'drop outs' – i.e. it switched itself off for some reason associated with the coolant flow. At the time the responsibility for the transmitter rested with my boss Allan Lum.

The other problem system was the maser, which was my responsibility. The maser was a recent incredible breakthrough in low noise microwave amplifiers that lowered the threshold of microwave receivers by about 8 db. This enabled much higher data rates or similar data rates over much greater distances to be achieved. The maser achieved this remarkable performance by operating at liquid helium temperatures of approximately 4.5 Degrees K, and the problem was achieving and maintaining this very low temperature. This was something of a hit or miss exercise as it required 12 to 14 hours to cool the maser down to liquid helium temperature and nearly as long for it to warm back up to room temperature so if, for any reason, the cool down to liquid helium temperature was interrupted, it could be as long as 24 hours before you could do anything about it and another 12 to 14 hours to find out if you had overcome the problem.

As you can appreciate, having two critical systems performing so unreliably was not conducive to a high level of confidence going into our first track, and this lead to some fractious exchanges between Allan and the Station Director Bob Leslie and between Bob and myself.

As things eventuated, the transmitter only dropped out once at a non-critical time, and through the efforts of my two staff Geoff Rose and Mal Lee and myself, the maser performed well. In addition, it led to my boss resigning and me inheriting the transmitter.

Distant happy memories!

Friday, July 16, 1965

FORECASTS for today: CITY: Fine. Cool. Westerly winds. Expected temp. ranges: 43 to 60 degrees Liverpool: 33 to 60 degrees. N.S.W.: Light showers and cold W winds southern inland. Fine, cool in north and along coast.

The Sydney Morning Herald

SUN: Today, rises 6.58, sets 5.4. MOON: Rises 7.15 p.m., sets 8.43 a.m. TIDES (Fort Denison): High, 10.10 a.m. (4ft 1in.), 10.11 p.m. (5ft 6in.). Low, 4.18 a.m. (1ft), 3.45 p.m. (1ft 6in).

No. 39,805 JONES STREET, BROADWAY, BOX 506, G.P.O., SYDNEY. Telephone 2 0944 Registered at the General Post Office, Sydney, for transmission by post as a newspaper. One Hundred And Thirty-fifth Year of Publication 30 PAGES PRICE 6d.

MARINER IV IN MARS PUZZLE

After its 7½ months' journey into space, Mariner IV discovered yesterday that Mars is probably very different than predicted.

For the first time in its 350 million miles' trip, the satellite behaved unpredictably, slowing down as it passed by the planet.

Mystery of lost minutes as craft goes behind planet

By NOEL LINDBLOM our SCIENCE CORRESPONDENT

CANBERRA, Thursday. — We cannot know yet whether Mariner's 21 photographs will be successfully transmitted.

But whatever they show, there is certainly something odd about the Martian atmosphere.

Whether a heavier atmosphere or a greater pull of gravity slowed it, the spacecraft took 7 minutes 12.4 seconds longer than expected to sink below the Martian horizon.

Mariner IV was more than 8 minutes late appearing from behind the Red Planet.

Since it was launched from Cape Kennedy in November Mariner IV had run to a split second schedule.

Today it followed its flight path so closely that a U.S. National Aeronautics and Space Administration official at Tidbinbilla, 26 miles from here, described it as comparable to rolling a bowling ball from Canberra to Melbourne and scoring a complete strike.

At 12.24 p.m., according to this precision schedule, Tidbinbilla should have lost the Mariner signal as it passed behind Mars for 52 minutes 32 seconds.

Instead, something caused the windmill shaped craft to slow down dramatically from its 11,500 m.p.h.

Just outside the operations room, excited station officials put forward reasons for the slowing up.

The seconds ticked by . . . 12.26 p.m. to 12.27 p.m. Still Mariner hung over the surface of Mars, seeing it as one scientist said "as plainly as you would see a 12in diameter ball held at arm's length."

Finally at 12.31 and 12.4 seconds, Mariner did pass from track. It was 7 minutes 12.4 seconds slower than the timetable allowed for it.

All that Australian space scientists could say tonight was that they had "a lot of wriggly lines" which they believe will yield the answers.

After 11 hours of recording at the 85m Tidbinbilla deep space tracking station, that was all that could be said.

Except that it was a colossal success story from the time at 11.44 this morning when the 85ft dish-meter antennae "locked on" to Mariner IV.

Metallic voice

A 27-year-old former Queensland State police cadet with the likely name of Bruce Window, was operating Receiver One in the big operations room at Tidbinbilla when the spacecraft rose above the southern horizon.

Nine minutes earlier the metallic voice direct from mission headquarters in Pasadena announced: "It's go—go—go status for the fifth time" . . . .

Australia's "back up" station at Woomera chimed in with: "All go here."

Then a red-green flashing light on Bruce Window's receiver stayed at green.

Mariner IV, nearly 134 million miles away and connected to earth by only the thread of its one-tenth of a billionth watt signal, was being tracked.

Started to receive

At 12.12 p.m. precisely the 575lb satellite moved under the belly of Mars.

At 12.19 p.m. Bruce Window, a radio and electronics technician who likes nothing better than to play with hi-fi sets, began to receive the first signals ever transmitted back to earth across the atmosphere of another planet in the solar system.

For another 12 minutes Mariner IV continued to send back its information-packed messages for transmission to California.

The voice from Pasadena told Tidbinbilla, No. 42 station of the American space agency deep tracking network: "You're dead on the money."

Tidbinbilla will continue to trace Mariner IV's progress for another 22 days. Theoretically, it could receive the spacecraft's signals until it is 175m miles from earth.

"The vicinity of something"

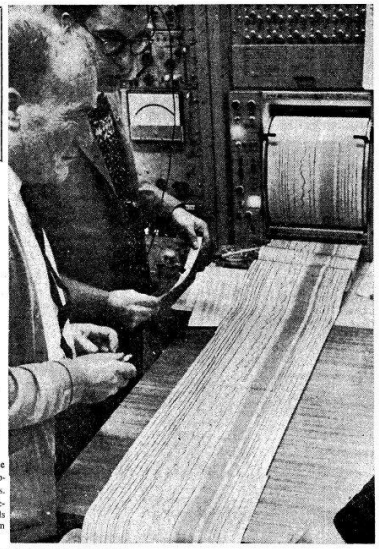
Curious slang terms like this crept into the welter of space-age jargon throughout the long day.

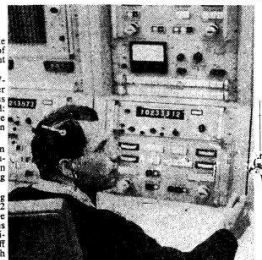
Trying to explain the 7-minute delay in the Mariner fly-past the anonymous American technician said: "At least we know we're hitting something. We're in the vicinity of something."

Mission headquarters in California later congratulated all three Australian stations for their tracking throughout the day.

And it had been a trying day—particularly for the 12 good technicians and true manning the operations room. Even the air-conditioning had to be turned off to avoid interference with the miniscule Mariner signal.

But in the event this day put Tidbinbilla—the name is "Fidgin" for two aboriginal stockmen called Ted and Bill who once lived on the property—on the space map.





"Wiggly lines" that may explain some of the mysteries of Mars — the director of Tidbinbilla tracking station, Mr R. A. Leslie (nearest camera) examines the information sent back by Mariner. The word written accross the wavy lines is "occultation." LEFT: Bruce Window, of Queensland, listening to signals being sent back from the spacecraft.

Booby-trap peril for Australians

From ALAN RAMSEY, A.A.P. special correspondent with the Australians in Vietnam.

BIEN HOA, Thursday. — Vietcong saboteurs are infiltrating into the Australians' outer perimeter at night to plant booby-traps.

A senior officer said this today after two more Australian soldiers had been wounded by a grenade yesterday.

They are:

Private William Keith Blakie, 19, single, of North Lidcombe, shrapnel wounds to right arm.

Private Ronald Leslie Riley, 19, single, of Fairymeadow, shrapnel wounds to right hip, calf and foot.

Both were taken to hospital. Their condition today was said to be satisfactory.

It was the second such incident in three days.

Patrol still out

On Monday a grenade operated by a trip-wire wounded the forward scout of a patrol sweeping the battalion's territory — an area 4,000 yards by 4,500 yards extending from the camp to the Dong Nai River.

The latest casualties occurred as a patrol from D Company went through the area which was thought to be clear after having been swept by patrols more than two weeks ago.

The patrol, which has not yet returned to camp, was led by Second Lieutenant Jim Bourke, 22, of Ayr, Queensland.

It was his platoon which, in the War Zone D operation last week, killed the first Vietcong in an engagement with Australian forces.

Twenty-four hours later Private W. J. Nalder, of Fairfield, Sydney, was shot dead by a Vietcong sniper—the first Australian killed in combat in Vietnam.

The latest casualties take the 32-man platoon's total to four in seven days.

Snipers yesterday morning fired on a convoy of nine Australian troop-carriers near Bien Hoa airbase. Three bullets struck one of the armour-plated carriers.

One bullet hit a few inches from where Lieutenant Bob Hill, of Coolgardie, was manning the carrier's machine gun.

Another hit an ammunition box and a third ricocheted off the carrier's side.

Standing-by for first pictures

PASADENA, Thursday. — Scientists believe Mariner IV recorded up to 20 pictures of Mars yesterday as it hurtled past the planet at a distance of 5,600 miles.

However, they will not know until late today whether the pictures can be relayed 140 million miles back to earth as planned.

Conflicting signals from the spacecraft have aroused fears that the camera's tape recorder did not operate properly.

New Zealand-born director of the Jet Propulsion Laboratory here, Dr W. Pickering, said: "We believe we have 20 pictures on tape."

But scientists will not know until later today how many, if any, can be transmitted to earth.

First of the planned 21 pictures of Mars is due to be relayed back starting late tonight.

Australian report

Dr Pickering said: "Without any pictures at all, Mariner IV is a magnificent scientific achievement."

Earlier, conflicting signals from Mariner left scientists in the dark over the success or failure of the mission.

(An American news service message from Woomera quoted reports that Mariner had failed in the photographic attempt. A Jet Propulsion Laboratory spokesman said there was no way of knowing whether the probe took its pictures until the first photograph was received.)

But scientists have already learned something of value from the signals.

Information in the past few hours had shown Mars apparently only has a small, weak magnetic field—less than one-tenth that of the earth.

The scheduled 25-minute picture-taking period was to have been the highlight of the 200m dollar (£A89m) mission.

But minutes after its camera apparently began working, according to plan, scientists had doubts whether the tape recorder, storing pictures before their relay to earth, was functioning correctly.

Twenty-one pictures were to have been taken.

Signals told conflicting stories. One set indicated the tape recorder was in order, while another suggested it was not.

Each picture will take some eight and a half hours to relay back to earth. The entire 21—assuming that many have been snapped—will take some 10 days to be radioed back to earth.

(A.A.P.-Reuter)

Four hurt in bus incident

Passengers in the top [illegible] broken glass when an overhanging tree branch brushed along the side of a bus at North Sydney yesterday.

Four passengers were cut by the flying glass and taken to the Mater Misericordiae Hospital at North Sydney where they were treated for lacerations to the face, head and hands.

Airport staff see mysterious glowing object

CANBERRA, Thursday.—Six of the staff of Canberra airport's control tower and two T.A.A. pilots saw a mysterious glowing object hovering in the sky for 40 minutes near the airport today.

The R.A.A.F. is investigating the reports of the object.

The control tower staff, all employees of the Department of Civil Aviation, said it was five to 10 miles north-east of the airport about 5,000 feet up.

The men could not define its shape, but said it was a "glowing white spot," similar to the reflection of a light aircraft at a distance.

The R.A.A.F. sent a plane to try to identify the object, but it disappeared before the aircraft could reach it.

The air control officer in the control tower at the time, Mr T. Lindsay, said he first noticed the shining spot about 10.50 a.m. when watching for an aircraft.

Several other people at the airport also said they had seen it, including two T.A.A. Fokker Friendship pilots.

The pilots, who had just taken off from the airfield, were asked if they could see the object.

They replied that they could.

Astronomer fails to find it

Mr T. Miller, an astronomer at Mt. Stromlo Observatory, said he had received many reports of the object but had been unable to find it.

There was no astronomical explanation for the object that had been described.

It was unlikely that it was an illusion or mirage because more than one trained observer had seen it.

The object was also unlikely to have been a meteorological balloon because it would not have remained stationary so long.

Very few astronomical objects were visible in day time.

"Heaven knows — it may have been an object from another planet," he said.

Unidentified flying objects were reported recently over the Atlantic and in the Antarctic.

Electro-magnetic clocks stopped at the airport at Santa Maria Island in the Azores when a white, cylinder-shaped object flew overhead last Friday.

Early this month Argentinean, British and Chilean scientists in the Antarctic said that electro-magnetic instruments "went wild" when mysterious objects flew over.

An artist's impression showing the 7½ months' journey of the Mariner IV spacecraft from its launching until is passed behind Mars and prepared to send back photographs.

INDONESIAN "REPRISALS"

DJAKARTA, Thursday. — The Indonesian Army newspaper said today that Indonesia should be ready to "take reprisals" against Australia.

The newspaper, "Berita Yudha," was commenting on Sir Robert Menzies' references to Indonesia at his Tuesday Press conference, which the Indonesian official news agency Antara interpreted as meaning that "Australia is at war with Indonesia."

"Berita Yudha" said: "This proves the truth of the reported Necolim (neo-colonialism and imperialism) plot to destroy Indonesia and of President Sukarno's statement on Monday that Necolim is trying to encroach on Indonesia from the south and the north.

"Indonesia, as the one being encroached on, should sharpen the sword. We should be more vigilant and ready to take reprisals."

The Commander-in-Chief of the Indonesian Army, Lieutenant-General Ahmed Yani, said last night: "It is up to Sir Robert Menzies' interpretation, but what the Australian's are facing in North Kalimantan (Borneo) are Kalimantan fighters and Indonesian volunteers.

"Indonesia has never sent regular troops to Borneo."

General Yani made the comment in an interview with the Djakarta newspaper "Suluh Indonesia."

He spoke of the "increasing military build-up by Britain in Borneo" and said that "any concentration of strategic weapons around Indonesia can be evaluated as a preparation of an aggression which threatens the integrity of our country."

[At his Press conference, Sir Robert Menzies was asked how he defined the Australian position vis-à-vis Indonesia and Borneo. He replied: "There are operations of war going on along the frontier. There are operations of war because fighting is going on and fighting is an operation of war."]

(A.A.P.-Reuter)

Exciting pace in industry

Exciting development is taking place in Australia's basic industries and resources.

Some of the world's largest deposits of iron ore are being exploited; the world's largest alumina plant is being erected; the world's largest railway project is in progress; the steel and chemical industries are expanding remarkably.

The fascinating story of this phenomenal economical expansion is told in a series of articles in "Australia Unlimited, 1965," a 66-page free supplement to be published with the "Herald" next Monday.

"Australia Unlimited, 1965" is an invaluable record of national progress and an essential aid for schoolchildren. Orders for extra copies should be placed with newsagents now.

LATE NEWS

First signals from Mars

Last night the Tidbinbilla deep space tracking station received a message that the ticking station near Madrid, Spain, had begun receiving the first of Mariner IV's signals transmitting photographs of Mars back to earth.

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Mystery of the "canals"

Mars is named after the ancient Roman god of war.

The planet's existence was known to ancient Chaldean priests as early as 3800 B.C. and the markings or canals on its surface have puzzled astronomers for many centuries.

A little over half the size of the earth, it is the second smallest planet.

Its distance from earth varies from 35 to 63 million miles during its orbit of the sun.

Except for Mercury, Mars is the only planet whose true surface can be seen by astronomers on earth.

Three-quarters of the planet is believed to be barren desert, the remainder being a polar region and seas.

Temperatures on its surface range from 77 degrees Fahrenheit to minus 148 degrees.

Scientists are generally agreed there could be plant life on Mars, but doubt the presence of any form of animal life, due to the cold, arid and oxygenless climate.

Mars is circled by two small moons, Phobos and Deimos, discovered by an American astronomer in 1877.

COLUMN 8

DOOR SLAMS. Today, almost six weeks before it opens, the organisers have had to close bookings for the Commonwealth and Empire Law Conference.

Late yesterday, more than 1,500 lawyers had booked — totalling with their wives, 2,900. Of them, 600 are N.S.W. men and women.

The great legal spectacular will be at Sydney Town Hall on August 25, when 120 Judges in their full robes will march down the aisle.

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HE MADE GOOD. Trustees of the Services Canteens Trust Fund are rubbing their hands over their selection of Brian D. O. Anderson, of Killara, as 1963 scholar for postgraduate study overseas.

Anderson is studying at the Stanford Electronics Laboratories in California, whose Professor R. W. Newcombe has reported:

"Brian has passed the Ph.D. qualifying orals, he being the only one to have scored 100 per cent on these exams since their origin. His progress is something to be proud of."

A trustee says that Anderson's triumph is also "a reminder to the academically bright that this scholarship is available."

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STAND UP, the boy who wrote a bold double-O in front of the figure of hatpeg No. 7 at St. Aloysius' College yesterday!

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AT A PREMIUM. Has anybody got a drop of "pream" to spare? Poor Professor Julius Miller has been warned off dairy products since his heart attack, but is addicted to [illegible]. He came to Australia with two bottles of American substitute cream, "pream," but the tide in the last bottle is running low. And, scientist though he is, he doesn't know how to brew his own.

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HER SLICE. When she was a little girl, Mrs Florence Cowan (now 85, and a great-grandmother) used to swing from the branch of "the tree that grew in North Sydney." It was felled recently to make way for the new expressway's approach to the Bridge.

Her great - grandson has bought her a slice from one of its branches, to be made into a teapot stand about 9 inches across.

Mrs Cowan has spent 82 of her years in Little Arthur Street—in the first North Sydney house to get gas."

granny

On Other Pages

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The Sydney Morning Herald featured news from Tidbinbilla in its front-page story on the encounter. Scan: Mike Dinn.

MR DAVE ARMAN is a tracker at the Tidbinbilla space tracking station, near Canberra. From this command console he has instant voice communications with the United States. An egg-timer sits in front of him to remind him of set time tasks.

THE NIGHT DAVE WATTS FOUND MARS

By OUR SCIENCE CORRESPONDENT: MICHAEL DALEY

"We've got Mars," announced a technician, Mr Dave Watts.

From around the control room at Tidbinbilla space station, near Canberra, technicians converged that night this week, on the television monitor.

It was near 9 pm in day 187 of the American Mariner space craft's journey to Mars. For the first time in the long days and nights of tracking the target was in sight.

"That big blob there," Dave said, pointing to the top right-hand corner of the 17-inch screen. Big? Big enough, considering Mars was 134,000,000 miles away.

PICTURE TAKING

The picture was relayed from the 6in telescope reflector on the station's 85ft diameter radio telescope.

Over the next week Mars will move towards the centre of the target frame on the TV screen.

By next Thursday, when Mariner is scheduled to take pictures as it flies past Mars, it should be dead centre.

At dead centre this night was Mariner, its ungainly windmill-like body invisible to all but Tidbinbilla's radio-eye.

Mariner is sending information back at a rate of 8 1/3 "bits" a second. By the time each signal reaches the listening antenna after 11 minutes the signal strength is a fantistically low one trillionth of a watt.

Mr Dave Arman, track director for the night turned up the volume on the receiver. All that could be heard was a rushing noise, like wind.

Mariner's voice is recorded on magnetic tape, transposed on to teletypes and transmitted to the Goddard Space Flight Centre in Maryland, U.S.A.

A bell rang. It was an egg-timer, more than somewhat incongruous in the maze of electronic equipment.

"With so much to do you need a buzz to remind you of things," said Dave.

The thing this time was that Mariner was now equidistant between Tidbinbilla and the Johannesburg tracking station, and the two stations were tracking in overlap.

Earlier Tidbinbilla had stopped transmitting while Johannesburg focused on Mariner.

Tidbinbilla had come on the air at 11.56 that morning.

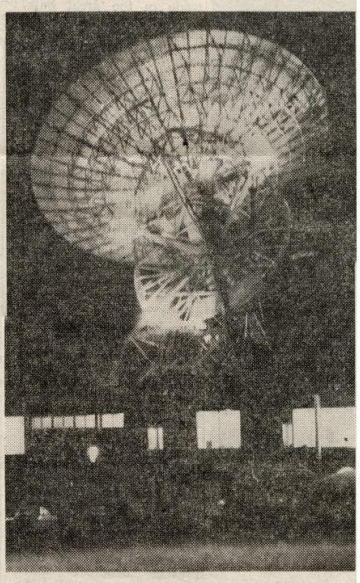
Every day it is supplied with a set of predictions for Mariner's frequency at five-minute intervals.

THE PROBLEMS

Mars kept moving off the top of the TV screen. Apparently, it was due to a fractional change in the deflection of the antenna.

At 10.50 Mariner had gone from the horizon. From Goddard in America came a request for information on any problems.

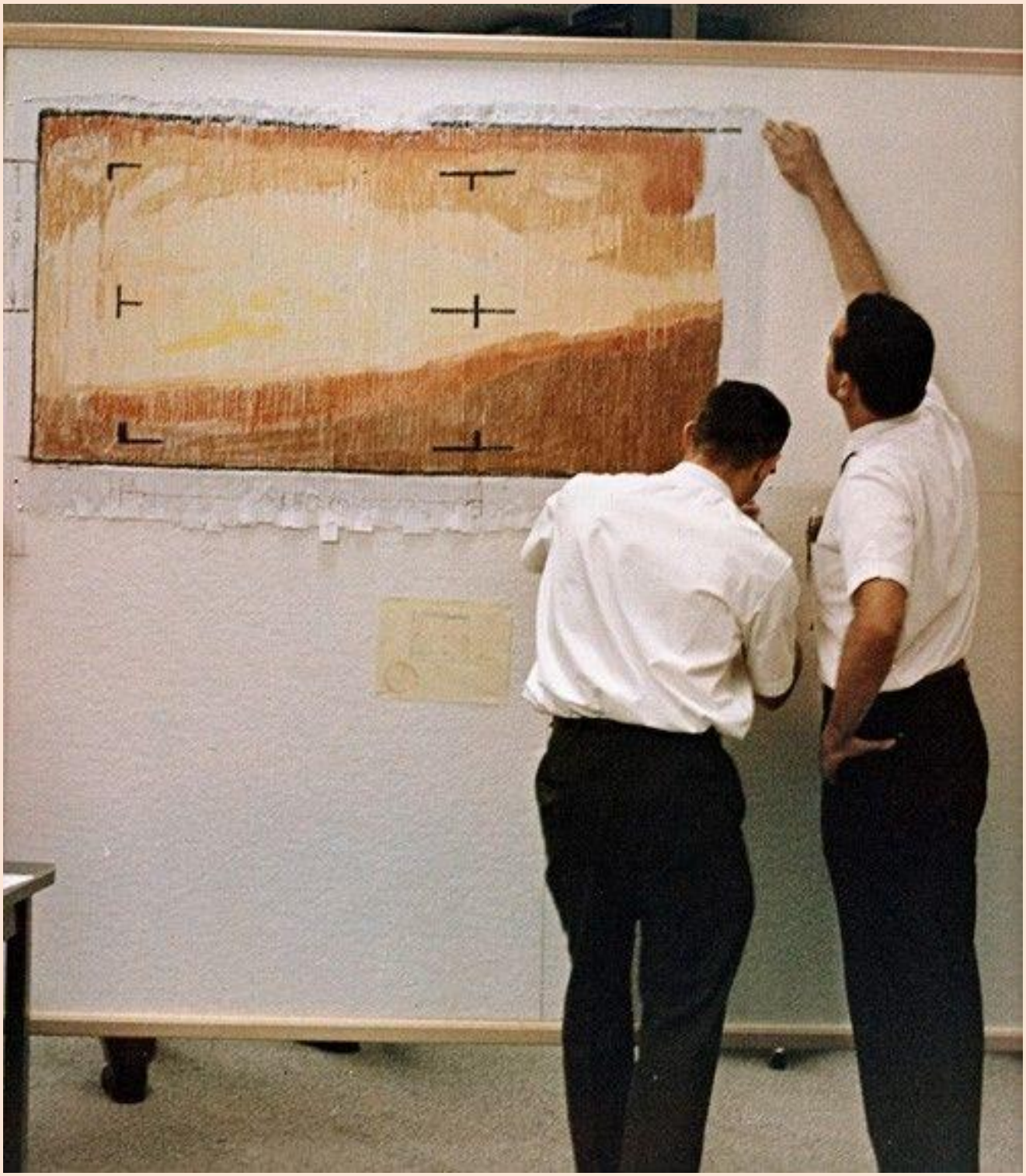
In another hour the midnight shift would come on to begin checking out the equipment for the next session.



FLOOD-LIT AGAINST the night sky, the 85ft diameter radio-telescope at Tidbinbilla tracks the Mars-bound American Mariner-4 space vehicle, 128 million miles away.

Les Whaley saved this newspaper clipping of a story by Australian Science journalist Michael Daley.

Dave Arman at Tidbinbilla is pictured.



A real-time data translator machine converted Mariner 4 digital image data into numbers printed on strips of paper. The team coloured in the strips by hand with pastels, making this both a work of art and the first digital image from space.

Image: NASA/JPL/Caltech

Extracted from www.honeysucklecreek.net
and the Jet Propulsion Laboratory website.
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ABOUT THE AUTHOR

Colin Mackellar is the creator and developer of the space history website: www.honeysucklecreek.net

The Reverend (retired) Colin Adrian Mackellar received the Medal of the Order of Australia in January 2019 for his services to community history.