



Centaur rocket with an added solid fuel third stage is being used. This is the fastest yet achieved by spacecraft and will allow Pioneers-F and G to leave the solar system and head out into interstellar space.

The total weight of the 11 scientific instruments is 61.5 pounds and none draws more than 4.2 watts. Pioneer-F and G will spend more than six months in the asteroid belt or region of minor planets lying between Mars and Jupiter and should transmit much interesting and valuable information about the giant planet Jupiter and some of Jupiter's 12 moons and the asteroids. The spacecraft will pass within 100,000 miles of Jupiter's surface and fly past, examining the planet for about a fortnight. It will take about two years for Pioneers-F and G (or Pioneers-10 and 11) to reach Jupiter.

We know a fair amount about Jupiter's external appearance and of his gaseous atmosphere but there is still tremendous mystery about the Great Red Spot in his atmosphere, the tremendous radio noise storms and the question whether the planet has any surface at all and why it sends out more energy than it receives from the sun. The Pioneers should throw light on these matters.

### FIRST LUNAR ASTRONOMY OBSERVATORY

Apollo-16 will set up and operate on the moon, a telescope-camera system to obtain ultraviolet and radiation data on Earth's upper atmosphere, auroras, the solar corona and interplanetary, interstellar and intergalactic hydrogen, the solar wind, nebulae, galactic clusters, the lunar "atmosphere" and, possibly, lunar volcanic gases.

The observation programme allows for extensive observations to be made by the tripod-mounted telescope camera (to be deployed in the shadow of the Lunar Module) of the M31 Galaxy in Andromed, the Magellanic Clouds and the Coma cluster of galaxies. Astronauts Young and Duke will re-align the camera several times during each lunar surface exploration period by means of elevation and azimuth of the various objects of interest and activate the automatic exposure sequencer.

Before entering the Lunar Module for the last time, the astronauts will remove the exposed film for return to Earth; the telescope itself will remain on the moon. The experiment is expected to add to understanding of Earth's magnetic field, measure the density of interstellar and interplanetary hydrogen and provide evidence of intergalactic hydrogen and provide information on the feasibility of remote-controlled, unmanned, lunar surface astronomical observatories.

### PROJECT MOONGLOW AND APOLLO-16

TLP's (transient lunar phenomena) are of 3 types usually.

- 1) very short lasting brilliant white flashes.
- 2) obscuration of lunar detail covering several square kilometres, last a few minutes to several hours, perhaps due to dust or gas cloud, normally colourless.
- 3) red or occasionally blue glows lasting several minutes to, more rarely, several hours, covering several square kilometres. This is the type of TLP on which attention has been concentrated.

Type 3 TLP's can be easily detected by using contrasting colour filters, e.g. red/green, or blue/yellow respectively for red and blue type 3 TLP's.

The S-IVB 3rd stage of Apollo-16's Saturn-5 rocket, should hit the moon at about half an hour after Apollo-16 enters lunar orbit with a force of 11 tons of T.N.T. Once it is finished with, the LM should be crashed onto the moon also.

It is hoped that members of the Society will attempt to observe the impact of the S-IVB on the moon in case it causes TLP's. Observations should be made not only of the impact sites but also of any known nearby TLP areas from a few minutes before the impact until up to a few hours after the S-IVB impact and one hour after the LM impact. The 10 inch Orwell Park telescope should be employed for this on the respective nights. Useful data follows.

<u>Event</u>	<u>Time (G.M.T. or U.T.)</u>	<u>Impact Site</u>	<u>Impact Co-ordinates Lat &amp; Long</u>	<u>Nearby TLP sites</u>
S-IVB impact	21h	these have not been announced		Theophilus, Alphoncus

The moon is in first quarter phase at the time of S-IVB impact on Thursday April 20th, setting at midnight. The moon will be due south at sunset and half full

### Russian Moonprobe

Luna-20 was launched on Tuesday 14th February 1972. It reached the moon five days later on Saturday 19th February 1972 and went into selenocentric orbit, altitude 65 miles above the moon, period 118 minutes. On Monday 21st February it fired its rocket again for a few minutes. It then descended in free fall to an altitude of 2,500 feet before firing its rocket again to soften Luna-20's landing upon the moon, which occurred at 19 hr.19 min. G.M.T. The point of landing was about 80 miles north of Luna-16's landing site in the Sea of Fertility (Mare Foecunditas) and very close to Luna-18.

Luna-16 had landed on a plain at latitude  $0^{\circ} 41'S$ , longitude  $56^{\circ} 18'E$  in the Sea of Fertility and brought back a sample of moonrock. Luna-18 crashed in a mountainous region at latitude  $03^{\circ} 34'N$ , longitude  $56^{\circ} 30'E$  on the edge of the Sea of Fertility. Luna-20 landed inbetween these two at latitude  $03^{\circ} 32'N$  longitude  $56^{\circ} 33'E$  in a mountain plateau region. Luna-18 was probably meant to retrieve a sample of rock from a lunar mountain to compare with the sample of the lunar plain from Luna-16. Luna-18 however, crashed and Luna-20 is probably a back-up flight to it.

Luna-17 landed in Mare Imbrium (Sea of Rain) on the moon in November 1970 landing Lunokhod-1, the unmanned mobile lunar roving vehicle. Luna-19 is at this moment orbiting the moon and still transmitting T.V. pictures from above the moon and other useful data.

Shortly after landing on the moon on an inaccessible mountain plateau on the edge of the Grange of mountains bordering the North East edge of the Sea of Fertility, Luna-20 started to bore into the moon. The drill was at the end of an arm and was a hollow cylinder, an improved version of Luna-16's drill, so it collected a core sample as it drilled. The rock was said to be the hardest rock yet encountered on the moon and the operators on earth had to switch off the drill at intervals, presumably to allow it to cool down before recommencing the drilling operation. The operation was monitored by Luna-20's T.V. camera.

After finishing the drilling the drill arm moved up and the drill bit with its moonrock sample was put in a hermetically sealed container on the top of the spacecraft. The upper section then blasted off for earth at 10 hr.25 min. G.M.T. on 22nd February with its cargo of lunar soil. The lunar soil was from ejecta blown up from the nearby crater Apollonius C. It is thought to be lunar bedrock 100 million years older than any moonrock yet brought back to earth. The spherical container of moonrock successfully re-entered the atmosphere, landed by parachute and was recovered as planned in Kazakhstan in the USSR on Friday 25th February 1972 amidst blizzard and cloudy conditions. If any member is interested, I (the Editor) have a considerable amount of information from the analyses of the Luna-16, Apollo-11, Apollo-12 and Apollo-14 moon rock samples available for loan.

Apollo-16 Timetable

<u>Event</u>		<u>Date</u> (April)	<u>Time</u> (GMT) hr.min.	<u>Ground</u> <u>Elapsed Time</u> hr.min.
Launch	(TV)	16	17.54	000.00
Earth Orbit Insertion		16	18.06	000.12
Translunar injection		16	20.41	002.35
Lunar Orbit Insertion		19	19.57	074.03
Descent Orbit Insertion		19	23.55	078.01
Separation of LM from CM	(TV)	20		
LM Lunar Orbit Circularisation		20	19.00	097.06
LM Landing		20	20.06	098.12
Stand up EVA		20		
EVA (Moonwalk) 1 start	(TV)	20	23.59	102.05
End EVA-1	(TV)	21	06.59	109.05
Start EVA-2	(TV)	21	21.59	124.05
End EVA-2	(TV)	22	04.59	131.05
Start EVA-3	(TV)	22	21.59	148.05
End EVA-3	(TV)	23	04.59	155.05
LM Launch from moon	(TV)	23	21.04	171.10
LM Lunar Orbit Insertion		23	21.19	171.17
LM/CM Docking	(TV)	23	22.50 approx.	172.50 approx.
LM Jettison & impact on moon		24	-	-
Transearth Injection		25	23.38	221.44
Transearth EVA (spacewalk)	(TV)	26	19.14	241.20
Re-entry		28	21.17	291.23
Splashdown	(TV)	28	21.30	291.36

(TV) means Televised, live television pictures available.

Astronomy Notes for March and April

The moon is at last quarter on March 8th rising at midnight. New moon is on March 15th and First Quarter is on March 22nd when the moon sets in the west at midnight. Full moon will be on March 29th when the moon will be due south at midnight and Last Quarter will be on April 6th.

As the moon moves against the background of stars it occasionally passes in front of a star, blotting it out. This is known as an Occultation.

On March 19th the moon passes in front of the Pleiades cluster of stars. This will be well worth watching with or without a telescope or binoculars. The first star will be blotted out at about 19 hrs 20 minutes G.M.T.. Thirteen Pleiade stars will be occulted between 19 hrs 20 min G.M.T. and 21hrs 50 min. Stars will be disappearing and reappearing every seven minutes and so it will be well worth sitting outside watching throughout this period.

There will be a Graze occultation of ZC1191/212B Gemini on March 23rd at 23 hrs 05 min U.T. (approx). The moon will be at altitude 44.5° above the horizon and azimuth 260° (West-South-West).

Tarz: 1.6 The sun will be 36.3° Below the horizon. The Position Angle of the axis of the moon will be 21.5 P.A. of north cusp will be 13.1

The occultation will be best seen from Orford, Woodbridge, Wickham Market, and Eye and points inbetween. The star will flicker on and off several times. Accurate timings of this to within 1/2 second will be useful. Stopwatches should be set off the 6th pulse of the Greenwich time signal on the radio or from the telephone speaking clock.





Three planets will be in the constellation of Taurus this month; Venus, Mars and Saturn. They will be closest together on and around March 24th and will provide interesting contrast of colour and lightness. Venus sets at 22 hrs G.M.T. at the start of the month and at 23 hrs G.M.T. at the end of March, being visible in the southwest well above the horizon shortly after

HEAD STARS OCCULTED

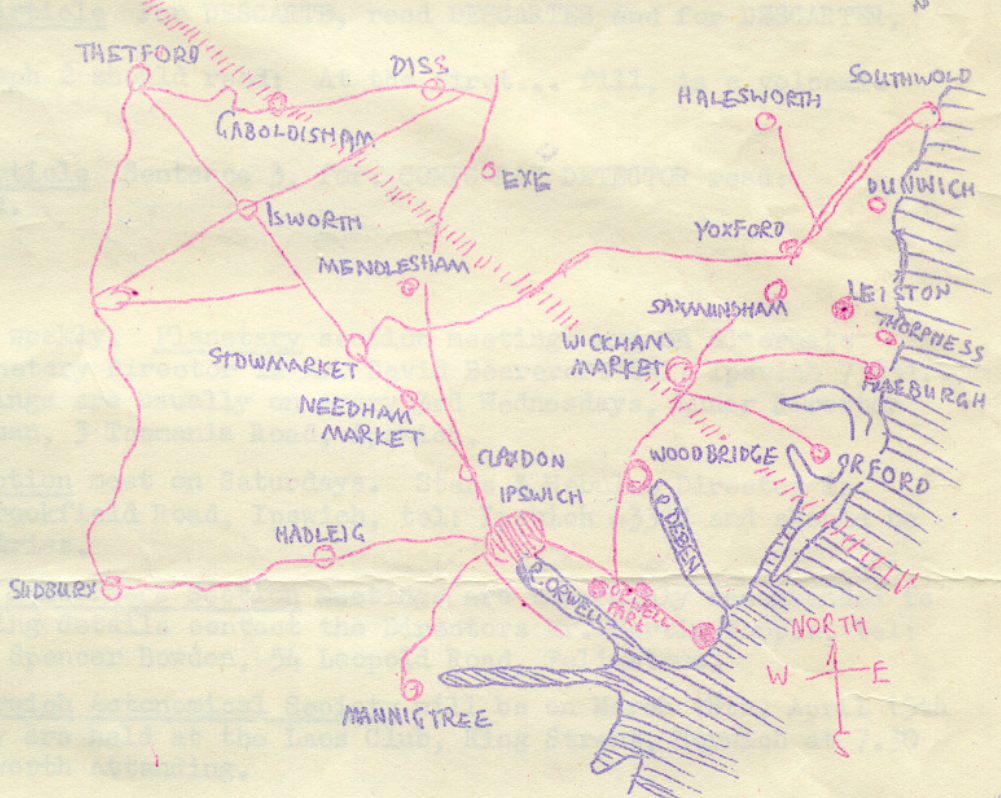
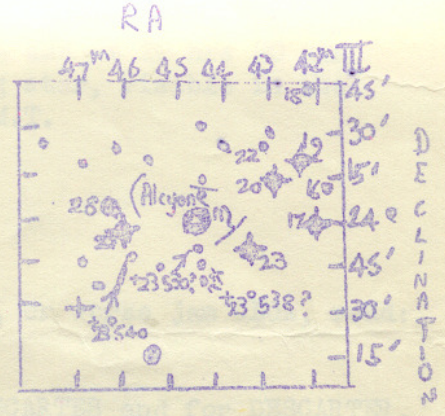
MARCH 19<sup>th</sup> ARE (IN ORDER OF OCCULTATION)

Name	Magnitude
16 Tauri	5.4
17 "	3.8
23 "	4.2
+23° 523	7.0
+23° 538 (double star)	7.1
Alcyon / Tauri (ETA)	3.0
+23° 540	6.8
1058 Tauri	6.6
27 " (double star)	5.8
28 "	5.2
+23° 561	6.6
+23° 570	6.8

THE PLEIADES  
STARS DOWN TO MAG 7

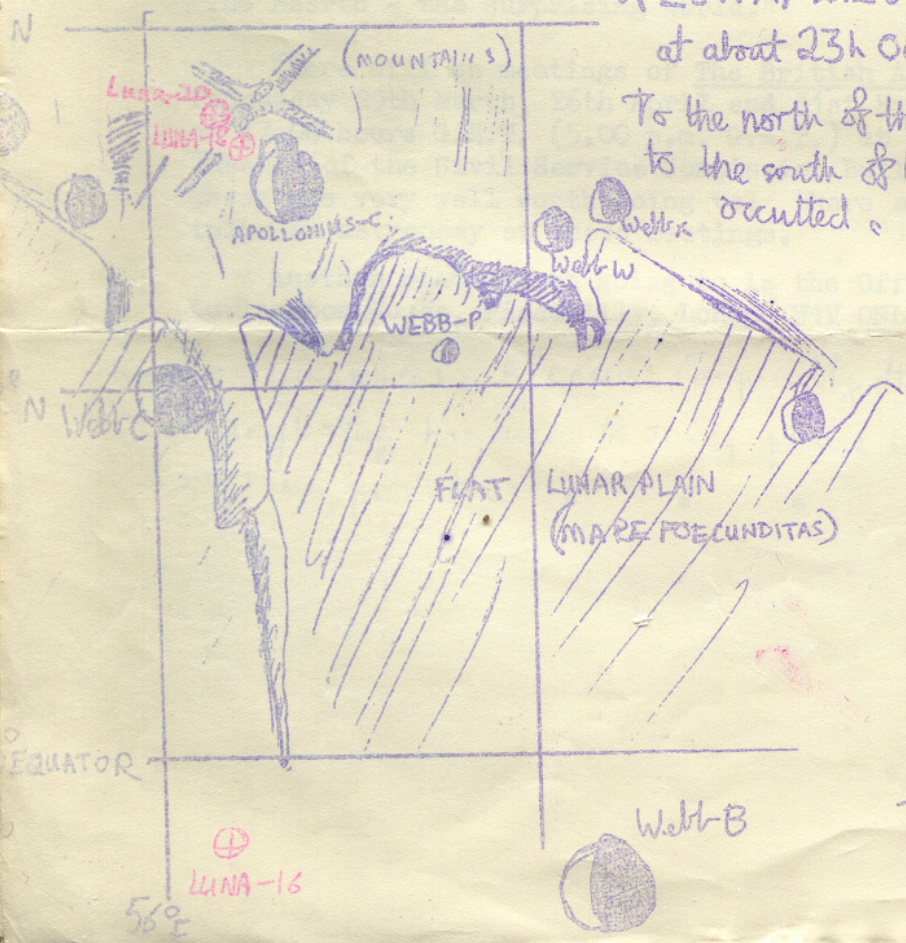
KEY:  
 Mag 3   
 Mag 4   
 Mag 5   
 Mag 6-7 

Based on Norton's Star Atlas



On the above map is the approximate track of Grase Occultation of zc 1191/2128 Gemini on March 19<sup>th</sup> 1972, at about 23h 00 min GMT to 23h 10 min GMT.

To the north of the track there will be no occultation, to the south of the track the star will be fully occulted.



Left: A map of the north east part of the Sea of Fertility on the moon, showing the Luna-16, Luna-18, and Luna-20 landing sites. The shading for the relief is as if it is illuminated from the east. The lunar plain is shaded also. This is based on the Times Atlas of the Moon, map 62.

sunset. Mars sets at around 23 hrs 30 min G.M.T. throughout March. Saturn sets at midnight at the start of the month and at 22 hrs 20 min G.M.T. at the end of March. Jupiter is a morning star, visible in the East before dawn, rising at about 02 hrs a.m. G.M.T.

ERRATA to February 1972 OAS Journal

Page 7 Telescope out of action article For:..., or worse jam CLOA, read: or worse jam OPEN.

Page 1, Apollo-16 Article For DESCARTE, read DESCARTES and for DESCARTER, read DESCARTES.

Sentence 3, paragraph 2 should read: At the first... fill, is a volcanic material .

Page 2 Apollo-16 Article Sentence 3, for: COMIC-RAY DETECTOR read: COSMIC-RAY DETECTOR.

SOCIETY MEETINGS

The OAS meets weekly. Planetary section meetings are on alternate Thursdays, the Planetary Director is Mr. David Bearcroft tel: Ipswich [redacted]. Lunar section meetings are usually on every 3rd Wednesdays, Lunar Director is Mr. R. M. Cheesman, [redacted], Ipswich.

Stars & Nebulae section meet on Saturdays. Stars & Nebulae Director is R. Hazelwood, [redacted], Ipswich, tel: Ipswich [redacted] and should be contacted for enquiries.

Beginner's Tuition & Learners Section meetings are thoroughly recommended to everyone; for meeting details contact the Directors Mr. Martin Topple, tel: Kirton [redacted] and Mr. Spencer Bowden, [redacted], Felixstowe.

Meetings of the Norwich Astronomical Society will be on March 18th, April 15th and May 20th. They are held at the Laos Club, King Street, Norwich at 7.30 p.m. and are well worth attending.

At the April 15th meeting at Norwich, Mr. I. O. Evans (author of "The Earth" in the Hamlyn Colour Paperback series) will give a talk entitled "The Earth - the surprising world."

There will be meetings of The British Astronomical Association on Wednesday 29th March, 26th April and 31st May 1972. These meetings will be at 17.00 hours G.M.T. (5.00 p.m. G.M.T.) at the Scientific Societies Lecture Theatre of the Civil Service Commission Building at 23 Savile Row, London W.1. These are very well worth going to; there are interesting discussions and talks on astronomy at these meetings.

Another place worth going to is the Office and Library of the BAA at Burlington House, Piccadilly, London W1V ONL.

NEEDED URGENTLY: A RONEO (or possibly Ates) DUPLICATOR.

IF anybody has access to one, please let me (Editor) know as soon as possible. \* \* \* \*