upplement to the Liverpool Daily Post, Saturday, January 11, 1969

OUT OF THIS WORLD

DAILY POST SPACE SUPPLEMENT
DAY SIX

Splashdown!

Mission completed

Minutes after splashdown, on Friday, December 27, 1968. Floating in the Pacific, while a recovery crew prepare to help the astronauts to safety . . . the Apollo 8 space capsule after its safe return from Man's first voyage round the Moon.

THE NEXT STAGE — MAN ON THE MOON

The missing link

Before any American astronauts can land on the moon, there is one link in the chain yet to be tested . . . the bug. This is more formally known as LEM or lunar excursion module, which has not been tried out with men aboard.

The lunar module is the vehicle which will lower two of the men on to the moon then, at the end of their exploration, return them to a rendezous with the parent spacecraft which in the meantime will have been orbiting the moon.

The first manned trials with the bug will be carried out by Apollo 9, to be launched on February 28. This will simulate as nearly as possible in earth orbit the manoeuvres which will have to be made during a moon landing. The Apollo 9 programme is described below.

If Apollo 9 is successful, some 2½ months later Apollo 10 will go off on a lunar trajectory identical to that of Apollo 8 except that this time they will have in the compartment below them an operational lunar module.

The Apollo 10 crew will be Air Force Colonel Thomas Stafford and Naval Commanders John Young and Eugene Cernan who all took part in various stages of the Gemini programme.

While in lunar orbit, Stafford and Cernan will climb through into the lunar module and will descend in it to within 50,000 feet of the moon surface. They will not land. They will then return to orbit rendezvous with the parent spacecraft and return to earth.

Except for the actual touchdown, therefore, the landing procedure will have been carried out and, if all goes well, the all-clear will have been given for a moon landing this summer.

The reliance on the efficiency of Apollo's various engines will of course apply as much to Apollo 10 and 11 as to Apollo 8, but in the actual lunar landing there will be additional hazards. If the engine in the lunar module should fail in descent, the bug would fall on to the moon, its speed unchecked by air resistance such as that on the earth.

Similarly, if the ascent engine cuts out during the return to orbit, the bug will crash back and if the engine fails to start at all, the astronauts will be left stranded on the moon with only a few hours of oxygen. (Apollo 11 crew—page 8).

Apollo 9

From Ian McDonald in Washington

The Apollo 9 spacecraft has been moved out to the launching pad at Cape Kennedy in readiness for the first manned test of the lunar landing craft on February 28.

At the manned spacecraft centre in Houston, Texas, the three Apollo 9 astronauts—Colonel James McDivitt, Colonel David Scott and Russell Schweickart — received a briefing on the flight around the moon from the Apollo 8 astronauts, Colonel Frank Borman, Captain James Lovell and Lieutenant-Colonel William Anders.

During their 10-day mission the Apollo 9 astronauts will give the lunar module its first thorough workout in space. They will enter the module, test its engines and go through the motions of a simulated moon landing, while remaining in earth orbit.

A Space Agency official in Washington explained the day-by-day sequence of events during the Apollo 9 mission, which is regarded as an essential prelude to an actual lunar landing.

After the launching on February 28, the astronauts will put Apollo 9 into low orbit ranging from 109 to 112 nautical miles above the earth. They will separate the spacecraft from the third stage of the Saturn 5 rocket, which will have carried them into orbit, extract the lunar module from the housing in the third stage, turn the spacecraft around and dock it with the lunar module. The third stage of the launch rocket will then be jettisoned.

After this manoeuvre the spacecraft and lunar module will be put into a higher orbit ranging up to 131 miles above the earth.

On the second day, the Apollo's service propulsion system will be ignited three times to put it into a correct orbit and favourable lighting conditions for tests with the lunar module on the following day.

Colonel McDivitt and Mr. Schweickhart will go into the lunar module on the third day and check the power system and fire its descent propulsion system, which would land it on the moon during an actual lunar mission, for a period of six minutes.

The fourth day they will again go back to the lunar module. One crewman will attempt extra-vehicular activity in space outside the spacecraft for two hours, and will then practise an emergency escape from the lunar module to the Apollo command module.

On the fifth day, two of the astronauts will return to the lunar module, separate it from the command module and perform a rendezvous in space.

After this they will divide the ascent from the descent stages of the lunar module, as they would on leaving the moon, and dock with the command module. The ascent stage of the lunar module would then be jettisoned in space.

The next day the astronauts are to put the Apollo spacecraft, consisting of the command and service modules, into a new orbit ranging from 210 to 93 nautical miles.

The final three days of the mission will be spent in navigation sightings, tests of living conditions in space and scientific experiments, before coming out of orbit and landing in the Atlantic 1,000 miles off Cape Kennedy after a total of nine days and 22 hours in space.

When the big moment arrives . . .

By WILLIAM E. HOWARD

(One of the leading science writers and editors in the United States)

The spacecraft is ready for the moon landing. Two of the astronauts don their lunar spacesuits and climb through the double hatch into the bug.

There is time for a complete check of the bug's communications, environment and control systems. The pilot and co-pilot methodically run down a check list just as they would if they were flying an airplane.

Then they cast off, igniting the bug's 4,760-kilogram-thrust engine. The engine burns for about 30 seconds and puts the craft into an egg-shaped orbit that brings it to within about 16 kilometres of the surface. The bug is now reversed again and its engine is presented to the direction of flight.

The full power of the engine is turned on and the bug, which has been travelling at 5,760 kilometres per hour, slows down and descends toward the surface. Engine power is then decreased slightly so the bug hovers at an altitude of approximately 150 metres.

As they look about through the craft's windows for the landing site, the astronauts can feel the moon's full gravitational pull—one-sixth of what they feel on earth.

They can, if necessary, move their craft horizontally up 300 metres. The final descent begins very slowly and touchdown is made at about 11 kilometres per hour.

Now they are on the moon.

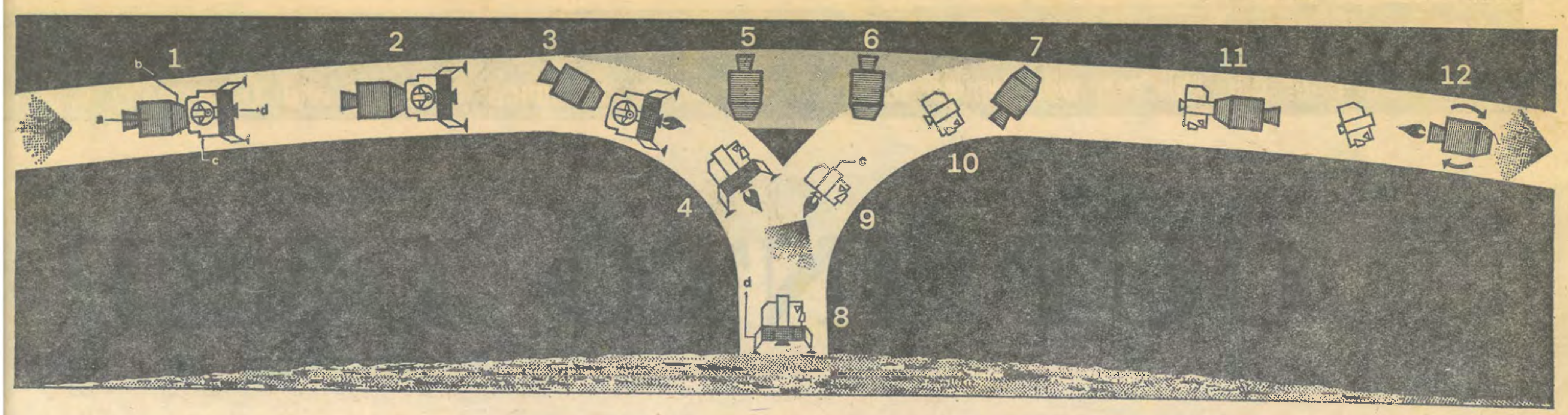
All during this manoeuvre, which takes just a few minutes, the command module or mothership is orbiting overhead. In the event they should encounter previously unidentified treacherous terrain below as the bug is touching down, terrain that makes it seem unwise to land, the astronauts could immediately move to another spot or accelerate the bug's engine and get back to rendezvous with the mothership.

In the first exhilarating moments after settling down on this airless planet, the astronauts will be pre-occupied with one thought: Is the landing craft ready for the return to the command module?

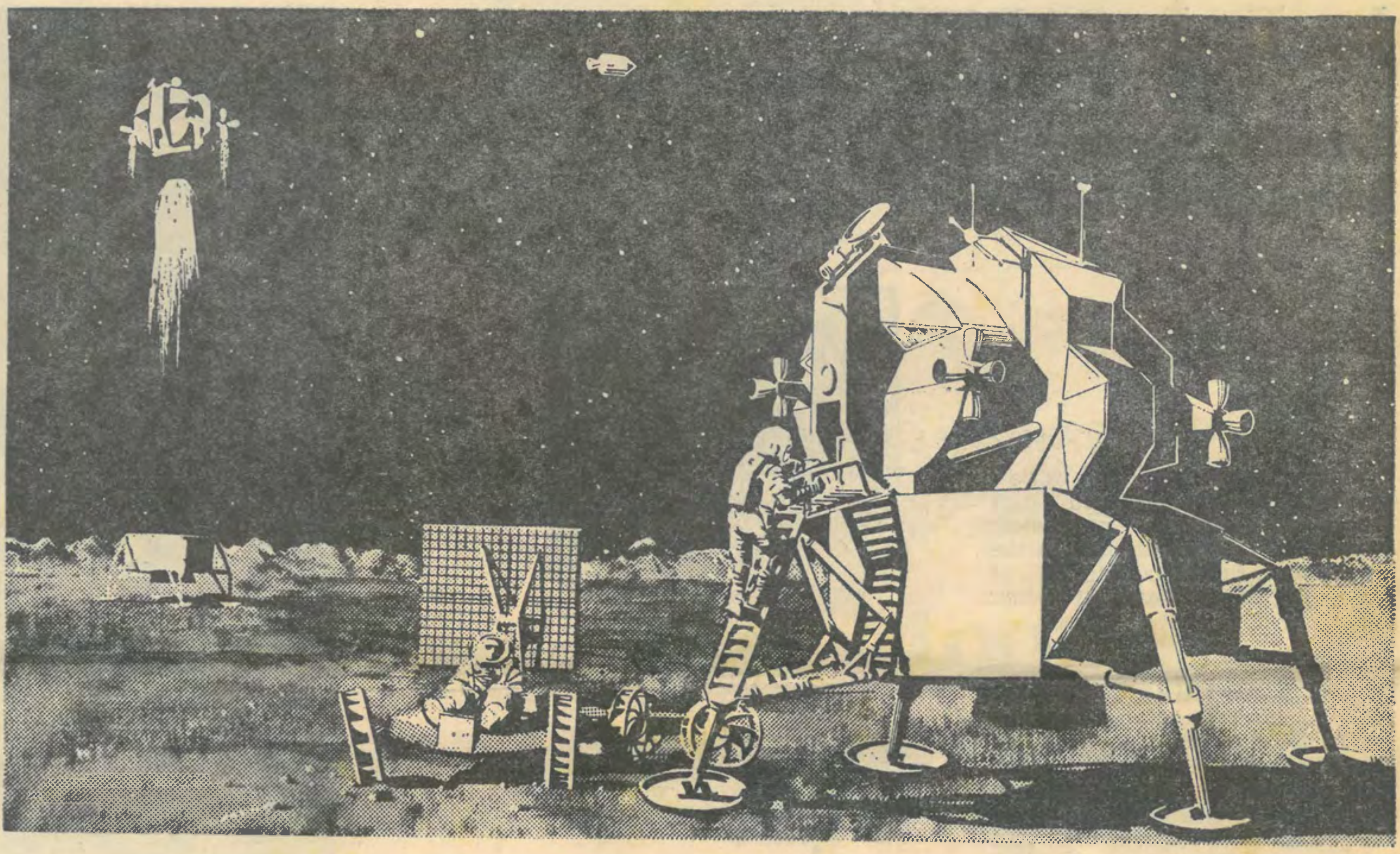
Only after they have assured themselves that everything is still in perfect working condition and no repairs are needed, will they set about exploring. Radiation from solar flares presents a constant danger and an around-the-clock surveillance will be maintained on earth by astronomers to relay a warning of impending danger.

Before the first man sets a foot gingerly on the moon from the bug tests will be made by the astronauts to determine the amount of nearby radiation and whether meteoroids are showering the area.

If it looks safe, the men will venture forth, wearing oxygen-supplying biopacks and carrying cameras and geological gear. One of the first things they will try to do naturally, is answer that age-old



HOW MAN WILL LAND ON THE MOON



Briefly, what will happen is this. One astronaut will continue to orbit the moon, just as the Apollo 8 did. Meanwhile the other two astronauts in a "lunar module" will detach themselves from the main spacecraft and after going into orbit will descend to the moon using a small rocket motor. Finally, using an even smaller motor, they will take off from the moon and rejoin their orbiting colleague before returning to earth in the main spacecraft. In the diagram (which for simplicity omits the lunar orbit of the module) 1 is the spacecraft in lunar orbit, made up of (a) the service module (b) the command module (c & d) the two-part lunar excursion module. 2 The lunar excursion module separates from the main spacecraft and 3 fires its motor to begin its lunar descent. 4 The motor slows the module until it is hovering a few feet from the moon's surface, when the pilot cuts the engines and it drops on to its four pads. Meanwhile, 5, 6 & 7, the command module continues its orbits of the moon as the men below, 8 use radar and optical equipment to keep track of it. They have a computer on board to calculate the precise moment for take-off to rejoin it. 9 At take-off, the descent stage (d) is left behind and acts as a launch platform for the ascent stage (c) which has its own small rocket motor. 10 The lunar excursion module enters orbit and then is manoeuvred by its small thruster jets to rendezvous with the main spacecraft. 11 Once the module is "docked," the two astronauts join their colleague in the relative safety of the main spacecraft. 12 The lunar excursion module is abandoned and the return to earth is just like Apollo 8.

On the surface of the Moon . . . Above on the right is how the lunar expedition module will look after landing. On the left is how it will take off—leaving its unwanted descent stage behind—to rendezvous with the parent spacecraft orbiting overhead. The vehicle for lunar exploration, powered by a panel of solar cells, will not be used on the first Moon descent, but is a possible later development.

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question: What is the moon made of?

This may not be easy at first glance. But a trained eye may be able to tell fairly certainly whether the great craters pocking the surface were caused by meteor hits, by volcanic eruptions, or both—something which has bothered astronomers for years.

They will be making a selenogical survey, the counterpart of a geological survey. This includes:

Sampling as many different types of rock, dust and other material as can be found.

Mapping and photographing all of the terrain that they can see, as well as noting where the surface samples are taken.

Implanting seismic, radiation counting and magnetic field recording devices which will continue to radio back data after the astronauts leave.

The astronauts will also use a portable television camera to send pictures of the moon to the earth for worldwide reception.

They plan to bring back to earth for laboratory analysis a variety of moon surface materials in a special airtight container. This is a major objective of Project Apollo.

The astronauts will also record the precise locations and surface characteristics surrounding the specimens they select. From these data, scientists expect to learn a great deal about the origin of the moon, the things that have taken place since its formation, and even about the earth and the solar system.

In their moon roamings the astronauts must be extremely careful, always mindful of soft pockets and hidden caverns and crevices. Nor do they want to risk gashing their life-protecting space-suits.

Of particular interest will be whether they find any indications of water. Many scientists theorise that it is possible that water does exist as glacial ice beneath the surface of the moon and, perhaps, as a liquid a good number of metres down.

Water would be important to establish a future permanent moon base. Broken down into its hydrogen and oxygen components it could even be used to refuel spaceships for journeys to the planets.

In all probability the astronauts will come upon several scientific surprises—possibily even traces of some form of long extinct life dating from the time when the moon may have had an atmosphere, if such were the case.

This is something that only actual exploration can reveal.

After several hours' sleep, the lunar visitors end their brief stay and begin the most hazardous phase of the mission getting home. The bug is launched from the landing stage, which remains on the moon.

'Just as our present-day world no longer questions the value of electricity, aircraft or communications satellites, so the world of our children will depend for their well-being on space activities and their many side effects'

OUT INTO DEEP SPACE

by L. J. CARTER

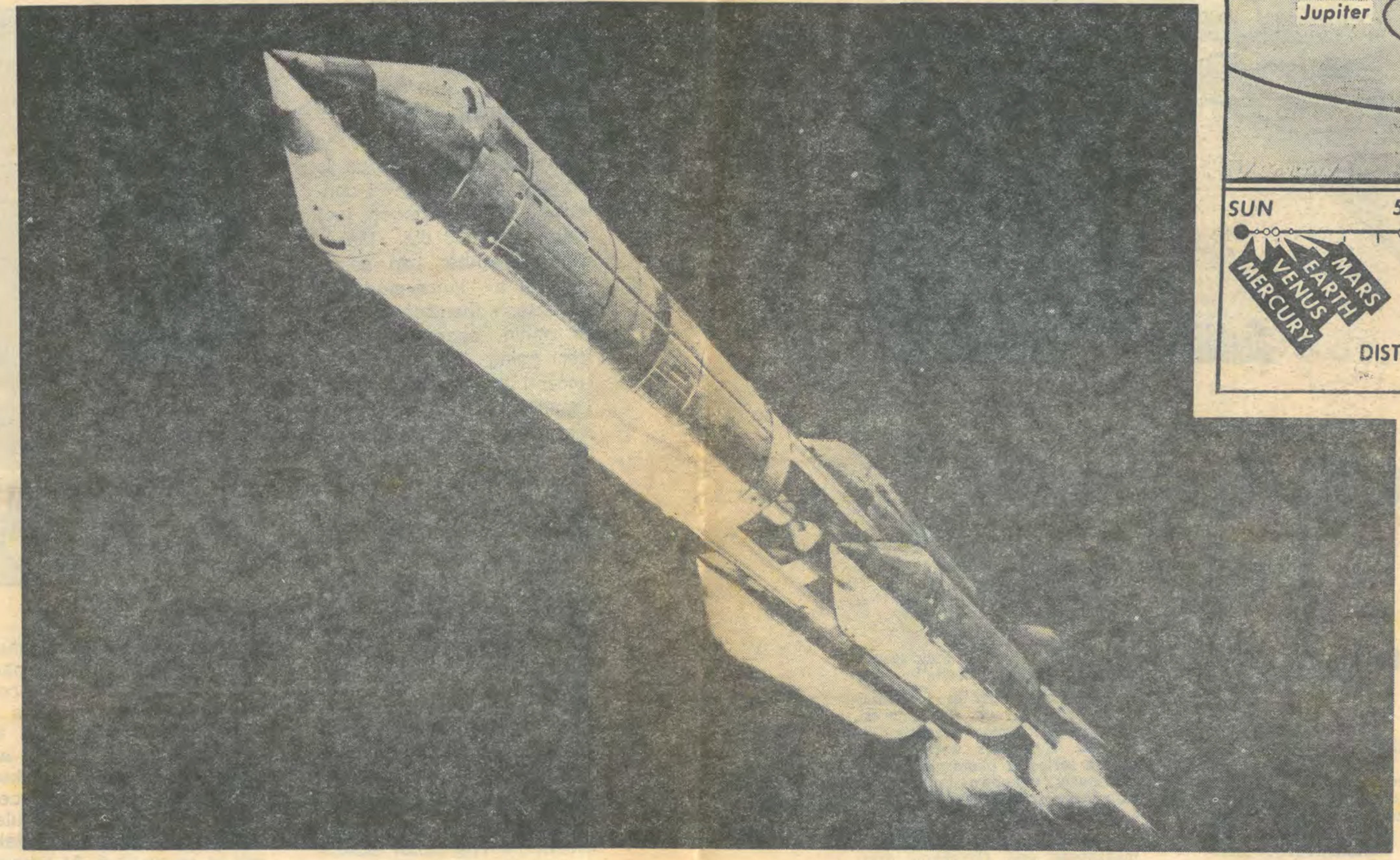
Executive Secretary, British Interplanetary Society

What the future holds

Huge stations in space

A 'switch on' weather service

Lessons at home by world TV



An artist's impression of a nuclear-powered spaceship which might take man to Mars

Thirty years ago the world's leading scientists regarded space travel as bunkum, completely impossible, or possible only in the very remote future, perhaps tens of hundreds of millions of years hence.

This picture has changed in an *incredibly short time*, for we are already about to witness landings on the Moon by both American and Soviet astronauts. With this as an example, one has to be careful in trying to forecast developments over the **next** 30 years, even though 30 years ago there **were** a handful of men who accurately and fully described the space developments we see today.

One of the things which **won't** be important 30 years hence is the charge that space expenditure is unnecessary, pointless, and that space scientists and engineers would be better engaged in doing something else. The time would long since have passed where the overwhelming significance of spaceflight became apparent to everyone. Just as our present-day world no longer questions the value of electricity, aircraft or even, latterly, communications satellites so the world of our children will rely on and depend for their well-being on space activities and their many side-effects.

This is not to say that such questions will no longer be asked. By that time, they will be applied to such "visionary" subjects as planetary engineering, or even interstellar travel, i.e. travel to the stars.

The next 30 years will undoubtedly see the complete transition from present-day small, unmanned, satellites, to large permanent structures built in space to contain crews of up to 100 people. These will include a large proportion of specialists to carry out research to meet a heavily-populated world's requirements for the 21st Century.

Plant studies carried out in weightlessness and in different radiation fields might pave the way to "quick-yield" food supplies, which can then be fed back to multi-storey farms on Earth.

Power generation and transmission will be based on major research projects studying radiation from the Sun and its interaction with the Earth, and aimed to see how more of this radiation could be intercepted and put to terrestrial use. Some completely new discoveries might emerge, e.g. the interaction of the million-mile-an-hour solar wind with the Earth's magnetosphere might show us how to generate fusion power on Earth and meet all man's future energy needs.

Other examples of everyday "work" from these multi manned stations sudying the earth—they will measure such things as rainfall, river levels, ocean currents, marine life, agriculture, insect and pest control, atmospheric and sea pollution, besides studying geology and mineralogy.

The list of such projects is virtually endless. It could be extended to iceberg, volcano, and forest fire monitoring, or a detailed mapping survey of the ocean beds!

By the year 2000 we will be taking the weather much more for granted. It should be possible to "switch on" the Weather Service at any time of day or night to see the weather situation as viewed by satellite, together with an **accurate** forecast for several weeks ahead.

This would be based on millions of measurements from unmanned buoys at sea, free-floating balloons, aircraft in flight, and satellites monitoring radiation from the Sun, all fed into a central computer for analysis.

The super-capacity communication satellites will provide hundreds of millions of telephone and radio links, with "direct dialling" extended to most of the world.

The TV channels which they provide will bring a revolution in education, teaching and business methods. The world's best teachers will be able to reach **every** interested student, irrespective of his location. For example, a distinguished surgeon could demonstrate a new operation before students from all the world's hospitals at the same time.

Such programmes would greatly accelerate the demand for a world language and make it really "One World."

The vast number of requirements from satellites studying the Earth and near-space will cause radical advances in methods of processing and analysing data.

Large information centres will need to be set up to absorb this information, using ultra-high speed computers and techniques which we, at present, only dimly envisage.

Very few decisions will be made, by governments or by industry, without referring to these great banks of world knowledge.

Navigation satellites will direct and control the flight-paths of future supersonic transports, as well as "stacking" them ready for landing.

The really big transports may not be **aircraft** but **spacecraft**, taking the form of large passenger-carrying rockets flying in ballistic paths. Transit times would be between 30-40 min. for 2,000-3,000 mile journeys. The number of persons carried might vary between 200-500.

The average citizen of the year 2000 will know a good deal about the other bodies in our solar system. Semi-permanent bases will have been set up on the Moon. Other expeditions will have landed on Mars and, possibly, the satellites of Jupiter.

Unmanned probe rockets will have examined every other planet in the solar system extending as far out as Pluto, nearly 4,000 million miles from the Sun.

Some of these probes will be circling these other worlds to provide a steady stream of data. Others will have soft-landed to provide automatic stations on the surface.

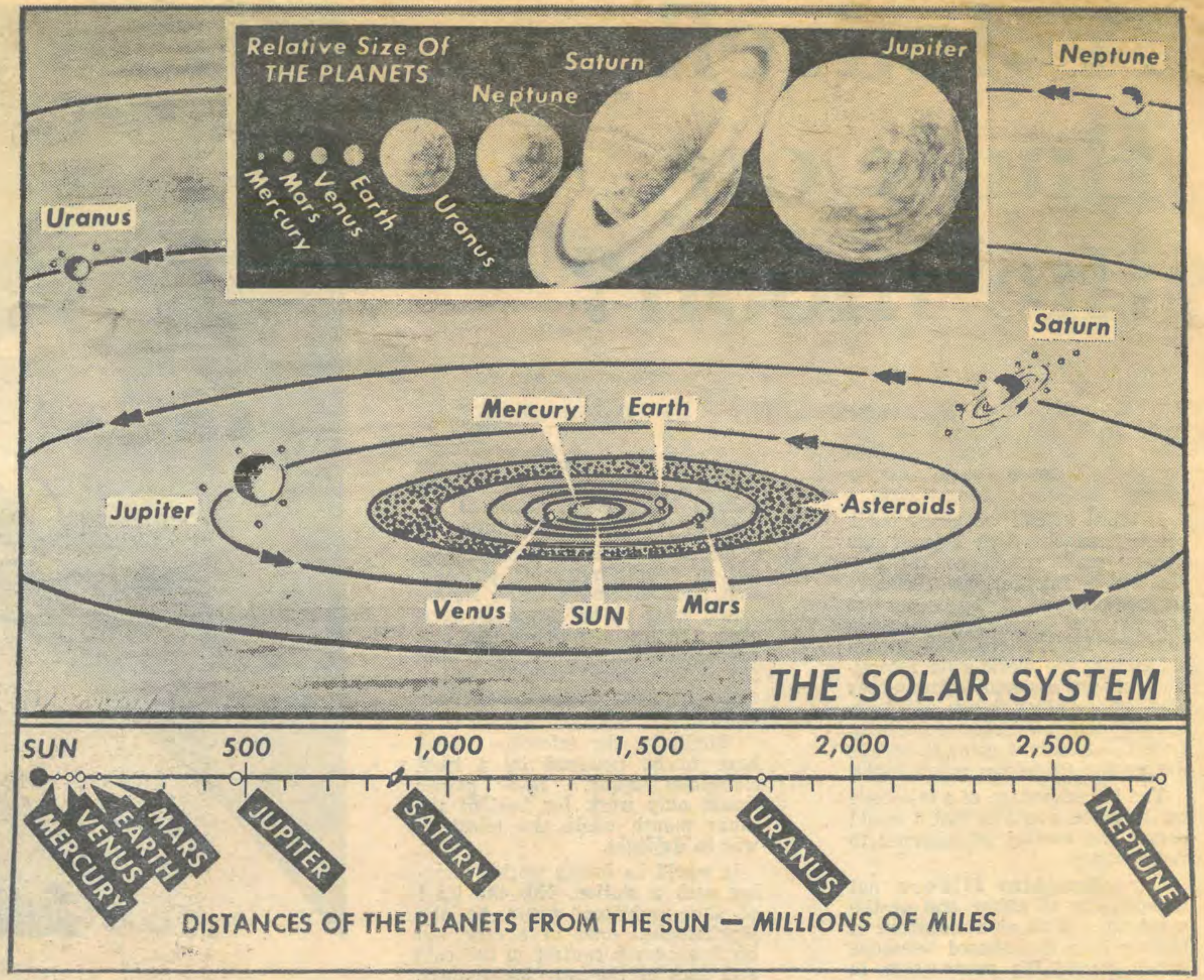
A group of probes using electrical propulsion will be undertaking a complete survey of the asteroid belt.

Probes will have intercepted comets, injected capsules into the atmospheres of Jupiter and Saturn, and into the fiery furnace of the Sun itself.

Detailed studies of the stars with large orbiting telescopes will open a new window on our Universe. We will "see" with the whole range of the electromagnetic spectrum, and not only through the narrow "visible light" and "radio astronomy" windows.

We may well detect many planets circling other stars and the big talking point, by then, will centre on whether we should beam high-energy signals to see if any response was returned to show the existence of intelligent life.

The assumption that life is widespread throughout the Universe may not be sufficient justification for advertising our existence. Since other life forms will need to be at least as technically-advanced as ourselves, and probably more so, the prospect that such communication might be an advantage, will be tempered by the fact that it could equally be a disaster.



Pluto, 3,675,000,000 miles from the sun, could not be shown on this diagram

The Moon as an industrial site

By Donald Yardley

The moon is an arid, airless, crater-pocked desert one-sixteenth of the size of earth. The moon's day and night each last two earth weeks. At its zenith, the sun is sufficiently hot to boil water, while at night an unprotected human would freeze almost instantly.

With lunar gravity one-sixth that of ours, a 180lb. man on earth would weight only 30lb. on the moon. This low gravity would allow structures on the moon to be larger and make erection easier. But it would present man with a major problem: on the moon he will have to relearn how to walk.

If he attempted the rapid strides he takes on earth, he would slowly rise off, then return to, the ground. About 20 paces a minute would be a good lunar walking pace. He could achieve running pace by springing into the lunar void and descending—bounce by bounce, like a kangaroo.

Although it is intended that the moon should be colonised by early next century, the first astronauts on the moon will take scientific instruments designed to collect data and signal it back to earth after the astronauts return home. Measurements of solar wind, magnetic fields and moonquakes will be included in the experiments.

Scientists will later establish manned bases on the moon for long-term observations and investigation of physical and biological phenomena.

Among the studies would be human reactions to prolonged stays on another world. Changes of behaviour, innate rhythms, growth and development are important aspects to be fully understood if ultimately we are to visit more distant planets within our solar system.

From a scientist's viewpoint, the moon has endless possibilities. Its make-up is believed to be similar to the earth's and colonising the moon could mean supplementing supplies of raw materials now becoming exhausted on earth.

To acquire these, small groups of humans may be transported to the moon to create a liveable, comfortable environment — enclosed so that they can discard spacesuits. These colonists, says one scientist, might develop a lunar chemistry to provide air, food and water. Techniques are already being developed on earth to enable them to do this.

The moon has an immediate use as an industrial site. For example, many industries need vacuums in which to make their products. Even small vacuum facilities on earth are expensive; large ones are almost impossible. The airless void of the moon would be a natural factory in which to carry out these processes.

In ten years of space exploration feats have been achieved that once seemed impossible. Early in the 21st century the moon is expected to be a normal part of our human environment within easy and economical reach of earth. Vistas which once defied our imagination, are becoming more and more real.

A Jodrell Bank on the moon?

By David Coss

By the end of the century there could be a Jodrell Bank on the other side of the moon, says Professor Sir Bernard Lovell, director of the Cheshire tracking station.

If there is, and we probe outer space from the dark side of our nearest space neighbour, the project will be international, probably financed and set up by one of the international space research bodies like the International Astronomical Union, the world-wide association of professional astronomers who, among other things, will have to ratify the new names of Borman, Lovell and Anders, given to craters during the Christmas moon flight.

The big advantage of a telescope on the moon would be that it would escape the earthly interference to radio waves.

Our atmosphere filters out wavelengths at either end of the spectrum. With no atmosphere to blinker it, a moon-based telescope would record the micro-waves in the spectrum below radar waves and also pick up long wave-length radiation which bounces off our ionosphere. This is at present being studied by satellites.

No one expects any shattering new information from such a study but simply extending the field of study might reveal something in the long or short wavelengths to which we have been blind.

The heavy interference that affects the wavelengths that the present Jodrell Bank picks up is of two types.

There is the interference from legitimate radio stations. As broadcasting grows, there are few wave lengths free from voice or music. Jodrell Bank uses internationally-agreed "radio silences" on the bands or tunes into wavelengths when they are not being used.

The second type of interference is that from cars, power lines, electric razors or any of the other domestic appliances all of which affect reception to the giant telescope. On one occasion, a courting couple, buzzing around the nearby lanes on their moped put the equipment out of action for ten minutes.

It is similar to the snowstorm on the television when your neighbour starts up an unsupressed electric drill, except that at the tracking station the interference shows up as peaks on a chart, similar to those recorded by stars.

With the moon between the telescope and all this background buzz, the scientists would get a much clearer picture of space.

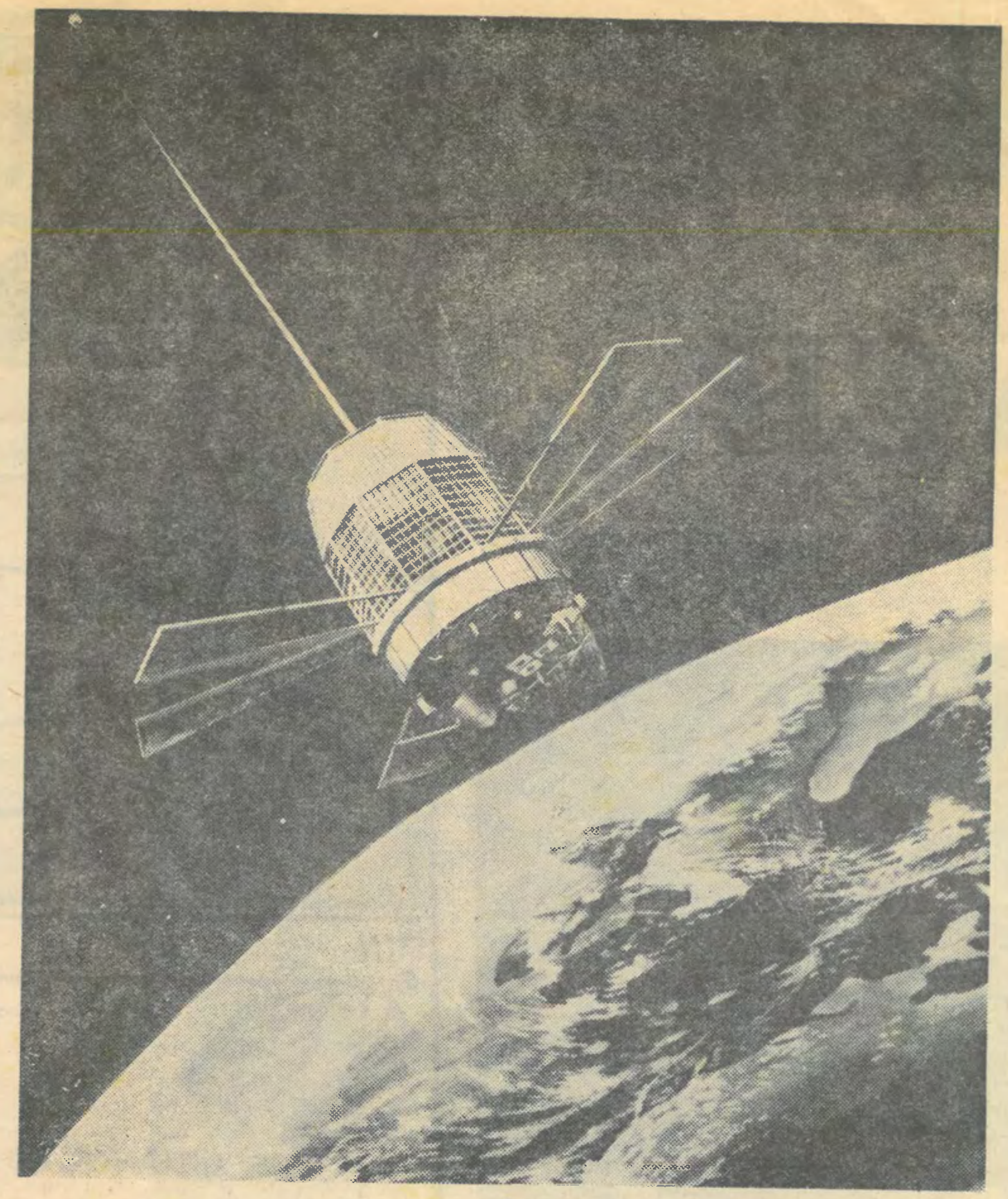
A moon station would have to be ferried through space and erected on the lunar surface. Because there is no weather on the moon and its gravity makes everything a sixth of its earthly weight, a moon telescope could be a much flimsier and probably bigger, structure than the one at Jodrell Bank. It would not be hampered by snow or high winds which put Jodrell Bank out of action at the start of the Apollo 8 venture.

The scheme has not been worked out in detail, but it is probable that once erected a moon station would have to be manually operated. The moon, which would blot out interference would also blot out radio control signals until a chain of relay stations had been built.

Similarly, the telescope would have to be powered by a local electricity supply. Solar panels would only work for half of the lunar month while the telescope was in daylight.

It would be lonely work operating such a station. Not the least of the problems would be the psychological ones of a crew cut off from earth contact in the cold and dark of the long lunar night.

FOR THE RECORD: The colour picture in Supplement No. 2 captioned in some editions as the crew of Apollo 8 was in fact the Apollo 1 crew.



An artist's impression of the proposed Earth Resources Satellite.

How satellites will help us

By David Le Roi

When scientists at Helsinki University were studying photographs of Scandinavia taken by a space satellite circling the earth, they noticed on the prints some particularly bright white areas in the Gulf of Bothnia.

The satellite had transmitted photographs of dangerous floating ice back to earth before it had been detected by the weathermen.

The often-frozen shipping lanes through the Gulf of Bothnia are trade routes vital to the economy of Scandinavian countries, but winter ice can spell disaster for the ships sailing along them.

Now, thanks to the chance discovery on that photograph, the authorities have arranged for photographs taken by American satellites to be triggered into Helsinki directly from the spacecraft.

From these photographs, the Finns can quickly pinpoint the build-up of pack ice moving down the gulf, and send ice-breakers to keep the threatened sea lanes open.

Similar practical demonstrations of the potentialities of space technology have convinced scientists that there is a wealth of information waiting to be collected and reported by an organised monitoring of the earth satellites. So space technologists are planning to launch a new and versatile generation of satellites.

Called an Earth Resources Technology Satellite, the first of these new type of spacecraft is now on the drawing board.

The Nimbus weather-satellites already put into orbit have provided those who are planning the Earth Resources Satellite with some idea of the type of information that the new spacecraft will provide.

Infra-red cameras on the Nimbus satellite have photographed the Gulf Stream, clearly outlining its path across the Atlantic. Simultaneously, radiometers on the spacecraft have measured the variations in heat from the warm current. From this data oceanographers have been able to build up reliable pictures on the location and movement of other major currents. This kind of information is of tremendous value to the fishing and shipping industries.

The fishing industry, which has recently been concerned by reduced catches of certain species of fish, may one day find the new satellite invaluable in locating rich shoals.

Though photographs from a satellite could not actually show the presence of large shoals, the surface temperature of the sea is often a clue to their location.

Consequently, data from a sensitive temperature - recording infra-red or microwave sensor mounted on a satellite may someday become as valuable to the trawler skipper as the echo-sounder is to-day.

Mining and petroleum industries are to-day spending millions of pounds every year compiling detailed topographic and geological charts to help them in their search for minerals, oil and metallic ores.

An example of the potential of satellite surveys for mineral deposits occurred recently in Sweden. Geologists were poring over a series of photographs of a previously unknown fault structure taken from a satellite.

Part of the fault was known to include an area rich in iron, manganese and chromium ores. This led the geologists to recommend extensive ground exploration along the same fault line and resulted in the discovery of additional rich ore deposits.

In fact, the applications of an Earth Resources Satellite seem unlimited. In under - developed countries it could offer the first opportunity for collecting accurate information on planted acreage and crop yield.

Satellite instrumentation would also make it possible to predict with accuracy which ocean areas would have high waves, allowing ships to chart a safer course.

Scientists studying Gemini space photographs discovered an earthquake fault of potential danger. And temperature - measurements transmitted from space by Nimbus II while over the volcanic island of Surtsey, off Iceland, gave geologists the first comprehensive temperature record of the material being belched up from the earth's interior.

Such information could form the basis of an early warning system to forecast volcanic eruptions.

HOUSTON ... a name you will hear again

The name of Houston was heard many times during the Apollo 8 flight. It is a name that will become more and more familiar as America progresses towards a landing on the Moon. For Houston, Texas, is the home of the Manned Spacecraft Centre and the Mission Control Centre which controls the Apollo astronauts during their flights. American journalist Jim Malone here describes Houston's role in the space programme.

Directors John Hodge, an Englishman (left) and Christopher C. Kraft, Jr., at consoles during a flight simulation at the Mission Control Centre, Houston. Hodge is now Director of the M.S.C. Advanced Missions Programme Office.

Many even in the United States are still not clear on Houston's role in the country's manned space flight programme. In fact, some who live in Houston believe to this day that this Clear Lake Area near their city is a launch centre—so foreigners can certainly be excused if they take Houston to be a code name used in the man-to-the-moon programme or if they confuse it with home base of the German rocket men who have made a large part of the programme possible, or if they think it is an area near Cape Kennedy.

So, what is Houston? What is its role in the manned space flight programme? Why are the astonauts continually answering Houston this, and Houston that?

First of all, as many are aware, Houston is the largest city in the Southern United States and by far the largest in population in Texas—being a metropolitan area of some 2,500,000. It is a city of industry and commerce, being the nation's leading centre for oil and petrochemicals. It has the country's third largest port. By any standards in the world, it is a rich city and a young city.

All very nice, but what has this to do with the space programme?

Nothing, really, except that some 30 miles from its central business district—in an area generally known as Clear Lake (which is certainly anything but clear) which is some 30 miles from the Gulf of Mexico is the N.A.S.A. (National Aeronatuics and Space Administration) Manned Spacecraft Centre.

The Manned Spacecraft Centre, or M.S.C. as it has come to be called, is one of 13 N.A.S.A. field centres spread—politically, some say—across the country.

Being at Clear Lake, it is an unincorporated area of Harris County, of which Houston covers a good part and, thus, not in the Houston city limits.

M.S.C. is one of the three N.A.S.A. centres responsible for the United States' manned (as opposed to unmanned and purely research facilities) space programme.

The other two centres in the manned space programme are the Marshall Space Flight Centre at Huntsville, Alabama, and the Kennedy Space Centre, Merritt Island, Florida (which always ends up being called Cape Kennedy, which used to be called Cape Canaveral, which is a general area like Clear Lake. Clear?)

Wernher von Braun is at Huntsville as director of the Marshall centre, some 900 miles from Houston. It is Marshall's responsibility to design, develop and manage the construction of the launch rockets used by N.A.S.A. It is most famous for its Saturn and mounting this country's first satellite that put this country into the space race.

Since no new launch rockets are under development and the production of the Saturn (produced at sites near New Orleans and Seal and Hunnington Beaches, California) has been slowed, Marshall engineers and scientists are being given a larger and larger part in the programmes to follow Apollo lunar exploration and long earth orbital flights.

The Kennedy centre is directed by another naturalised American, Kurt Debus, close associate of von Braun.

K.S.C., as it is called operates from a brand new facility called the Merritt Island Launch Area (M.I.L.A.).

Until M.I.L.A. was in operation—Apollo 8 was its first manned launch—N.A.S.A. launches were made at the Air Force's facility at Cape Kennedy. It is K.S.C.'s business to check out and launch rockets, which it does very well indeed considering that the Saturn V that launched Apollo 8 was .65 miliseconds off leaving its launch pad.

So Marshall manages the production and testing of rockets and Kennedy launches them on to Houston, or, more properly, M.S.C.

M.S.C. has three responsibilities, two of which have made it and Houston known around the literate world. These are:

The design and management of the production and testing of manned spacecraft so far, the Mercury, the Gemini and the Apollo.

The planning and directing of the flights of these spacecraft.

The selection, training and naming of the crews that will man these spacecraft.

The last of these responsibilities means that M.S.C.—and Houston—is the home of the country's 52 pilot and scientist astronauts.

But its fame is more probably due to the fact that the flights are directed from the M.S.C. Mission Control Centre, which has become known as M.C.C.-Houston—thus the reason for the control centre's calls to Apollo 8, "Apollo 8, Apollo 8, Houston," and Lovell's beautiful, memorable, "Hey, there, Houston, how you doing."

It will be no different this summer when some American first puts his foot to the rugged surface of the moon—possibly, even Borman or Lovell—and says, "Houston, we are here." And around the world all men will know again of Houston, because not only of the word, but because it is from Houston—relayed from M.S.C. to public broadcasters—that the word is sent to all the world.

The world will get its announcement of man's furtherest travels on this new sea of space from the M.C.C.—a three storey, windowless, drab structure that is uninspiring until the periods when it is doing what it was built to do—direct flights to the moon and, someday, beyond.

Its bottom floor houses one of the world's largest computer complexes. Room after room of them are necessary if manned space flight is to be. They receive, send and process information from astronauts and spacecraft as near instantaneously as is possible. They do this at the direction of men and for men. The men who manage them while a flight is going on are at their side like keepers of mighty animals who need constant attention. The men they work for or either one or two floors above and maybe on both.

The two floors above the computer complex are almost identical. These are the Mission Operations Control Rooms. It is in one of these that the action is while a flight is going on. These rooms provide tiers of consoles with buttons and switches and TV monitors where specialists of every type—from doctors to public information men—can see in microseconds what particular information about the astronauts or the spacecraft concerns them most.

In front of each of these amphitheatre-like rooms are a giant centre screen and two side screens. The centre screen generally shows a map indicating the flight of the spacecraft. while the side screens show specific information about the flight and clocks that time its course from lift-off to splashdown.

While one of the control rooms is being used to direct a flight, the second can, and often is, used to simulate the next flight.

Simulations of flights is one of the most important jobs of the entire control centre and often it goes on around the clock for days. The astronauts, in mock craft here or at the Cape, take part in these simulations and many credit the simulations, done over and over and over again, with the success of many missions.

Before it was announced, in September, 1961, that M.S.C. would be located in the Houston area, the Clear Lake area was a sleepy, little populated area. It was composed mostly of ranch land, scrubby and flat with some swamps, and some nearby fishing villages. The population of the whole area may have been 10,000 then.

It is now a "new city" in every sense of the word of some 50,000 whose average income is nearly 10,000 dollars (4,170) annually.

APOLLO 11 CREW

THE THREE MEN FOR THE MOON

Neil Armstrong

Edwin Aldrin

Michael Collins

By Russell Forgham

One of these men could well be the first man to set foot on the moon.

They are Neil A. Armstrong, Edward E. Aldrin and Michael Collins, who have just been named by the National Aeronautics and Space Administration (N.A.S.A.) as the crew for the United States' Apollo 11 man-on-the-moon attempt next summer. All are 38.

Armstrong, born in Wapokeneta, Ohio, on August 5, 1930, is a civilian employee of N.A.S.A. and will be the flight commander. The first civilian ever to be sent on a space mission, he was on the almost disastrous Gemini 8 Earth-orbit flight in March, 1966, but by skilful handling of the craft's directional jets he prevented it from spinning wildly into an orbit from which it would never have come back. (The story was told on Page 6 of Supplement number 4).

He was formerly a test pilot, and flew the X15 rocket aircraft at over 200,000 feet and at almost 4,000 miles an hour.

During the Korean war he flew combat missions, and was a naval pilot before that from 1949 to 1952. In 1955 he graduated from Purdue University with a degree in aeronautical engineering.

Armstrong was one of nine astronauts selected by N.A.S.A. in September, 1962, and as well as being command pilot for Gemini 8, he was reserve command pilot for Gemini 5 and 11.

He received the 1962 Institute of Aeronautical Sciences Octave Chanute award and the N.A.S.A. Exceptional Service award for his work in manned space flight.

He and his wife Janet have two children: Eric, aged 11, and Mark, aged six.

With Armstrong in the lunar module which will land on the moon will be module pilot Aldrin, an Air Force Colonel nicknamed "Buzz."

Born in Montclair, New Jersey, on January 20, 1930, like Armstrong he flew combat missions in the Korean war. He graduated from the United States Military Academy in 1951 with a B.Sc degree.

Aldrin completed work for his Doctor of Science degree in astronautics at Massachusetts Institute of Technology in 1963, and was assigned to the Gemini target office of the Air Force space systems division at Los Angeles, and later to the Manned Spacecraft Centre at Houston.

He was one of fourteen astronauts selected in October, 1963, and was reserve pilot for Gemini 9 and pilot for Gemini 12, the last of the two-man Gemini missions in November, 1966, making space history when he left the craft for a record space walk.

He and his wife Joan have three children: James, aged 13, Janice, aged 12, and Andrew, aged 10.

The third member of the crew, Air Force Colonel Collins, the command pilot, will orbit in the main Apollo ship seventy miles above the moon's surface.

Collins, like Aldrin the father of three children (Kathleen, aged eight, Ann, aged seven, and Michael, aged five), was pilot of Gemini 10 in July, 1966, after being reserve pilot for Gemini 7.

He was born in Rome and graduated from the United States Military Academy in 1952 with a B.Sc. degree.

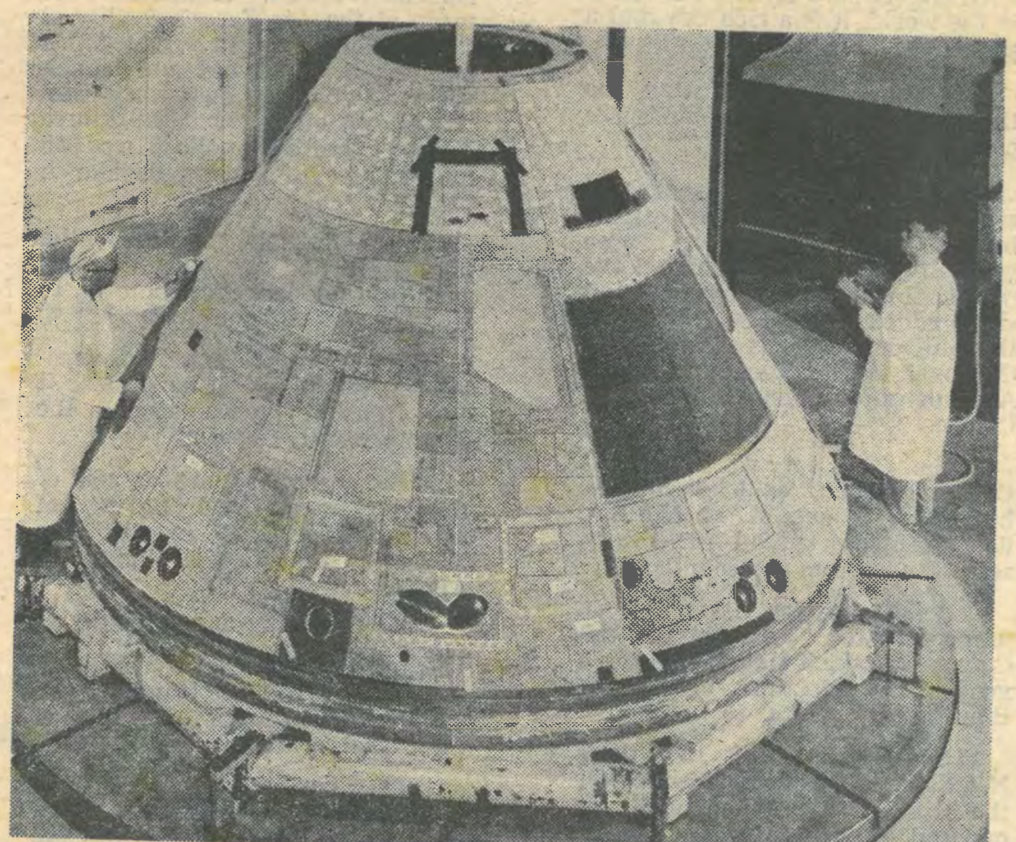
After graduation, he served as an experimental test pilot at Edwards Air Force base, California.

He was another of the fourteen astronauts selected in October, 1963, and has received the N.A.S.A. Exceptional Service medal for his accomplishments on the Gemini 10 mission, when he proved man's ability to perform extra-vehicular tasks relative to a target vehicle. He performed three separate periods of activity outside the spacecraft on this flight.

He was originally scheduled for Apollo 8, last month's round-the-moon trip, but a spinal operation meant he had to withdraw, to be replaced by James Lovell.

Lovell, himself, and fellow Apollo 8 crewman William Anders, have been named as members of the standby crew who will take over if Armstrong, Aldrin or Collins drop out. Third member is Fred Haise.

Frank Borman, the Apollo 8 flight commander, has been appointed Deputy Director of Flight Operations at the Manned Space Centre in Houston.



Right:
The heat shield is contoured on to an Apollo spacecraft. Already another Apollo —Apollo 9—is ready for its flight next month. The plastic-like ablative material used is designed to withstand temperatures in excess of 5,000 degrees C.

SUPPLEMENTS edited by Walter Huntley.

Sources: U.S. National Aeronautics & Space Administration, Novosti Press Agency, Moscow; United Press International, Newsweek, Associated Press, Universal Pictorial Press, Camera Press, Press Association, Transworld Features, War Office, Fox Photos, Keystone Press, Central Press Photos, Topix, Provincial Press Features, U.S. Information Service, Planet News.