Abstract

Two historic technical news items from 1970 covering the Australian Post Office’s involvement in the Apollo 13 emergency and a non-theoretical review of laser developments.

Introduction

These two short historical papers were published as technical news items in the *Telecommunication Journal of Australia* in June 1970.

The first paper details the Australian Post Office’s (APO’s) involvement in the Apollo 13 emergency in April 1970. Most readers who witnessed Neil Armstrong’s historic moon walk in July 1969, on the Apollo 11 mission, would be aware of the emergency situation that befell the later Apollo 13 mission, due to an explosion in the service module.

The astronauts were able to return to Earth safely, but their rescue required an enormous effort and ingenuity by the National Aeronautics and Space Administration (NASA) and its contractors, as well as assistance from many American allies, including the APO.

The paper describes how the APO quickly deployed an AWA microwave link from the Parkes high gain radio telescope (made famous in the 2000 film *The Dish*) to the NASA tracking station at Honeysuckle Creek, because the astronauts no longer had access to powerful transmitters in the service module and Parkes could...
receive their weaker signals.

The APO was also asked via the American Embassy to protect from interference the communications frequencies used by the astronauts in their emergency descent. This necessitated checking the operating frequencies of all microwave systems near the flight path and either changing operating frequencies or re-routing traffic and temporarily disabling the systems.

The Apollo 13 rescue was successful and was later immortalised in the 1995 film *Apollo 13* [6] starring Tom Hanks. Recently, in December 2018, the Special Broadcasting Service (SBS) in Australia broadcast a documentary entitled *Mission Control: The Unsung Heroes of Apollo* [7], which featured details of many of NASA’s achievements, including the moon walks and the Apollo 13 rescue.

The second paper provides a non-theoretical review of a decade of developments in laser technology. It was written by A. Tucker (*Tucker, 1970* [8]) who was the Science Correspondent of *The Guardian* newspaper in London. It was supplied for publication in the *Telecommunication Journal of Australia* by the Information Service of the British High Commission.

It covers the unique properties of the laser, the short wavelengths, potential deployment in space, use for measurements where great precision is required, use for medical procedures and the possibility of transmission in glass fibres, which was yet to be perfected. It ends with the profound statement: *one thing is certain, lasers are still in their infancy and we are only just beginning to exploit their enormous potential for human good*.

References


The Historic Papers
TECHNICAL NEWS ITEM

AUSTRALIAN POST OFFICE INvolvement IN THE APOLLO 13 EMERGENCY

As a result of experience with the earlier missions in the Apollo programme the arrangements used during the earlier stages of the Apollo 13 flight to interconnect the various N.A.S.A. installations in Australia by A.P.O. nets worked very well and could be set up and operated in what had come to be regarded as standard arrangements for Apollo missions.

However, the emergency situation which resulted from the explosion in the service module of the spacecraft led to requests being made to the Post Office by the N.A.S.A. authorities and by the U.S. Embassy for special facilities and actions which were successfully fulfilled in spite of the limited time available and the insufficiency of office and field work involved.

The first request was made shortly after the explosion when it became necessary to set up special arrangements to keep down communications from the command module and to work instead from the low power radio equipment in the lunar module. To maintain satisfactory communication and telemetry operations between the lunar vehicle and earth while Australian earth stations were in use it was vital that the higher aerial gain and superior receiver facilities at the Parkes radio telescope be pressed into service.

These facilities had been used on earlier missions, but with improvements in facilities in the spacecraft were not required under normal circumstances during the Apollo 13 flight. The temporary interconnections which had been used during earlier flights had therefore been dismantled.

In the emergency situation which developed on Tuesday April 14th the Post Office undertook to re-establish a broadband connection between the Parkes radio telescope and the N.A.S.A. station at Honeyguide Creek which involved installing a microwave system between the Parkes station and the nearest Departmental microwave station at Coonambra and then also installing a microwave system between the N.A.S.A. station at Honeyguide Creek and the Williamsdale radio relay station. Existing radio bearers between Coonambra and Sydney, Sydney and Canberra, Canberra and Williamdale also required to be interconnected to complete the circuit from Parkes to Honeyguide Creek.

Equipment for the connection was found to be available from A.W.A. and teams of Departmental and A.W.A. staff worked overnight to complete and commission the installations by Wednesday morning.

The Department has received the following comment on its work on this project:

"The Director of manned flight support in expressing his thanks for the Australian support of the Apollo 13 mission has singled out those responsible for bringing up the Parkes antenna and associated data systems in record time. He has also stated that this response was so impressive that special mention of it was made to President Nixon during his visit to Goddard Space Flight Centre".

The second issue resulting from the emergency was raised in a Note from the Embassy of the U.S.A. on Thursday 16th April and which was receiv-

ed at Post Office Headquarters late on Thursday morning.

The U.S. Note advised details of the latest recovery plan and requested the co-operation of the Government of Australia in protection of the communication frequencies to be used by the spacecraft in its emergency descent. The Note included the following request:

"Although no radio interference has been experienced on the above frequencies to date, the Apollo 13 emergency situation is such that the United States is asking all countries to cooperate in avoiding any radio operation which might possibly interfere with reception anywhere on earth of the spacecraft's transmissions."

With less than two days available the Department undertook the work of identifying the services which "might possibly interfere", of assessing the level and effect of the interference and of considering the possible consequences of closing down the interfering services.

By late on Thursday three types of radio services emerged as interference sources:

(a) communication and radiolocation type transmissions of the Defence group;
(b) Radiolocation services ("Shoran") used by geophysical survey parties;
(c) trunk line radio systems operated by the Post Office.

The transmissions under control of the Defence Department were immediately regulated, the Post Office to Canberra to all Services and to the Supply Department prohibiting transmissions on all N.A.S.A. operating channels and on potentially interfering channels until after splashdown. A State by State (including New Guinea) check of the operations of Shoran users was undertaken and the controlling operators and ten field parties using this facility were asked to cease Shoran operations until after the return of the Apollo 13 spacecraft. One operator was located in West Irian which is beyond the range of Australian control but his agreement was nevertheless received to a request to stop transmissions during the emergency.

The greatest area of potential interference arose from the use of frequencies closely adjoining the spacecraft frequencies by the / nek line microwave radio systems of the Post Office and also by microwave radio systems operated by the Post Office and commercial television companies to relay television programmes from television studios to the associated transmitting stations.

As studies continued it became apparent that many of these systems lay close to the track to be taken by the spacecraft on the last stage of its descent, while others were capable of interfering with reception in the special aircraft which were to be deployed along the recovery track to act as radio relay stations.

As the location of the aircraft and likely track of the spacecraft became known a hard core of about 50 microwave links emerged as the most troublesome.

By changing from "working" to "standby" frequencies some of the interference sources could be eliminated while in some cases the radio system could be closed down without serious effect upon trunk telephone traffic.

In the case of television relays, changes to alternative frequencies required the use of temporary systems in view of the short time available and the difficulty of retuning working equipment for operation on another frequency. As all National and most Commercial television stations proposed staying open all night to transmit the satellite television relay from the recovery area it was imperative that no television relays be dislocated. Two particularly difficult situations arose from this orientation of the Apollo 13 mission has singled out those responsible for bringing up the Parkes antenna and associated data systems in record time. He has also stated that this response was so impressive that special mention of it was made to President Nixon during his visit to Goddard Space Flight Centre".

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The microwave radio systems in use between Sydney and the satellite earth station at Moree in northern N.S.W. and between Victoria and Tasmania via Flinders Island were very serious sources of interference. Both these links were critical in distributing the satellite relay which was received at Moree and relayed to all States by the Post Office broadband network.

By closing down the offensive channel on the Moree-Sydney system and operating on the protection bearer, with staff in attendance to remedy any faults that might occur, the satellite transmissions were successfully relayed without risking interference to the spacecrafts' transmissions.

In the case of the Victoria-Tasmania radio system, telephone traffic (which was not high in the early hours of Saturday morning) was re-routed via King Island, the offending bearer was closed down and the remaining bearer was used for the television relay to Tasmania.

The cessation of transmission on all of the frequency assignments which were finally listed as potentially dangerous sources of interference to the critical descent and recovery of the spacecraft was completed by late in the evening of Friday April 17 some hours before the onset of the critical phase of the descent and all services were restored to normal during Saturday morning after the astronauts had "splashed down" safely.
of the height of the lowest cloud layer, but also still fainter detectable measurements of a whole series of upper cloud layers that are invisible from the ground.

This measurement of the vertical structure of cloud systems is of importance to the forecasters and the technique has the advantage of also showing—by the degree of absorption of light—the density of the invisible cloud layers.

In a world occasioned worryingly by the potential threat of more sinister clouds, those of chemical or biological droplets being used as weapons, it is comforting to know that this radar technique can spot a spraying aircraft very easily, by day or night.

Further, because of its accuracy, laser rangefinding can be used to detect the tiny movements which precede a slippage in an open caste mine, an earthquake tremor or a geological fault, or the variation in distance of celestial objects like the moon.

Indeed, among the first objects left on the surface of the moon by men will be a laser reflector designed to provide astronomers with the most accurate measurements of the moon’s wobbly orbit they have ever had.

**Power Density**

There is that, like that of employing a laser beam as a guide of straightness when making long tunnels, lean on only some of the laser’s properties. But the most striking property of all is that of power density. A laser beam is capable of vaporising any material on earth.

Small boys are prone to play with a magnifying glass in such a way that the focused rays of sunlight burn holes in wood or plastic. The laser beam can be a million times hotter, a property which sounds, and certainly is, dangerous but which can be turned to a number of extremely valuable uses.

In fine engineering and in modern electronics—particularly in the manufacture of the latest tiny micro-miniaturised components—there is a need for etching, cutting and boring techniques on a scale far too small for conventional tools. Now a laser beam can have a diameter as small as a hundredth of an inch and can easily vaporise hard metals and metals or materials like gold or silicon used extensively in electronics.

It is therefore, not surprising that for special tasks of etching circuit designs, pouncing tiny holes or cutting very refined shapes, the laser has already established itself as a technique of major importance. Its power can be controlled very accurately, as can its guidance, and both can be automatically controlled and ‘programmed’ for use on a production line.

Further, the technique can be used for carrying out welding on a scale much smaller than any known before. But welding and cutting accurately are activities by no means confined to engineering. For reasons that are not yet fully explained the laser beam affects living cells in a curiously clean way. Its damage is very closely confined to its point of impact.

**Can Help Surgery**

This means that it could become a valuable tool in surgery, offering the medical profession refinements of technique that are available in no other way. Already in Britain, International Research and Development at Newcastle upon Tyne, in the north of England with the backing of the National Research Development Corporation and the electronics firm of Elliot-Automation, have developed very small portable laser surgeons’ welding tools which have been used in the treatment of a condition known as ‘detached retina’.

The retina is the sensitive curved region at the back of the eye on which the image falls and is processed by the nervous system. Some diseases, or age alone, can lead parts of this very delicate area to separate from supporting tissue so that sight is either damaged or lost.

Re-attachment can be carried out in several ways but it has been found that the burst of laser light—which does no damage to the clear lens of the eye through which it has to pass—forms a tiny and neat weld at the point at which it strikes the retina. The process is so simple and painless that it has immense promise and is already being used experimentally in several hospitals.

Equally there is promise that the laser will be valuable in excising surface tumours, for it creates an incision that is sealed, thus markedly reducing the likelihood of tumorous material entering the bloodstream and being distributed round the body. Further, since laser light can be ‘piped’, there is a chance that it might eventually be used through flexible glass-fibre bundles for delicate treatments internally.

So, already, there is a very wide range of uses for this curious device which depends on making light buzz up and down inside a tube with reflecting ends and of such a length that the light’s journey-time resonates at the natural molecular frequency of the material through which it is passing.

If that material is continually ‘excited’ by the addition of energy, the added energy will be given off as light each time the internally reflecting bunch of light waves passes by.

**Great Precision Needed**

In this way the energy of the ‘bunch’, whose frequency is that of the material, increases step by step and, if the mirror at one end is momentarily removed, will leave the tube as a burst of laser light.

If one of the end mirrors is only partially reflecting, then a continuous beam of lower energy will be emitted and different materials and tube lengths lead to laser light of different wavelengths. The engineering precision needed to make a laser of high efficiency is very great, but the truth is that if you put mirrors of the right kind on the ends of a neon light tube you would have a laser of sorts.

That it took half a century for the tubular gas-discharge lamp to evolve into something far more powerful and yet only a few years for the more powerful development to find a host of uses, is an indication of the almost erratic development of science and technology.

One thing is certain, lasers are still in their infancy and we are only just beginning to exploit their enormous potential for human good.

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