AWA Newsletter

#50

February 2010

A Member of the SARL

Antique Wireless Association of Southern Africa

Inside this issue:

AWA Committee:

* President—Don ZS5DR
* Technical Advisor—Rad ZS6RAD
* Net Controller—Willem ZS6ALL
* Secretary/PRO—Andy ZS6ADY

Reflections:

I never cease to be amazed by the way that the wheel of life turns. A month ago I was bragging about how I had joined the ranks of the unemployed, and this month I have to retract that statement as I am back in the ranks of the employed due to some rather strange occurrences.

Be that as it may, the most pleasing thing of all is the fact that I am able to retain all my valve radio's, my shack and the position where my tower now proudly stands. So much in life is unpredictable and my thanks go to all those who encouraged me to hang in there, as things would get better.

Unfortunately, my beloved FT902 station of 10 years did not survive the challenge and I was maybe in a bit of panic stations as I advertised it as a swop for an Icom 706. Well I got what I asked for, not that I am unhappy with what I have gained, but it was a good setup which was used for the 80/40 relay on Saturdays.

A Collins KWM—2A has taken it's place and stands quite proud in the area vacated by the 902, and after a bit of teething trouble and connection problems, now is patched in to the Collins 75S-3 receiver to carry on with relaying from 80m to 40m.

I wonder how many times we have sold off or swopped out rigs that were important or had some sentimental value in a moment of panic or thoughtlessness, and when it's all over one looks back to actually wonder why you took the decision to do it. I know of a few times that I have made similar decisions, not necessarily in a state of panic, but have certainly regretted having made them. My Hallicrafters HT 37 and SX100 come to mind.

But then one always justifies the decision with the thought of, "it was necessary to make changes in my shack and give me a bit more room", or " the rigs were getting a bit old and I needed to get with the technology of today".

No matter how we try to justify it, I am sure there are always rigs that will be looked back on with longing and regret for having moved them out of the shack.

Best 73

De Andy ZS6ADY

Announcing the 2010 Amplitude Modulation Transmitter Rally

Contest and Operating Event On the HF Amateur Bands (160 meters to 10 meters)

Saturday, February 6, 2010 6:00 AM E.S.T.to 2:00AM E.S.T. the following day.
The purpose of this event is to encourage the use of Amplitude Modulation on the Amateur Radio Bands, and to highlight various types of AM equipment in use today. This event is open to any and all radio amateurs who are running full carrier amplitude modulation (standard AM), and any type of equipment may be used.

Commonly used AM Frequencies: 160 Meters: 1880-1885, 1930, 1945, 1975-1995. 80 Meters: 3730-3740, 3870-3885. 40 Meters: 7160, 7280-7295. 20 Meters: 14286. 10 Meters: 29000-29200.

These commonly used frequencies can be good starting points. As activity grows, expand to other frequencies to prevent congestion and excessively large round tables. As always, PLEASE be considerate of existing QSOs and Nets, and ensure that the frequency is clear before calling "CQ, the A.M. Transmitter Rally".

(*Continued Page 4*)

CW Net:

Not too long and the AWA CW activity day will be a thing of the past and we will be looking forward to the next one. But right now, it's time to concentrate on the upcoming event on the 6th and 7th of February.

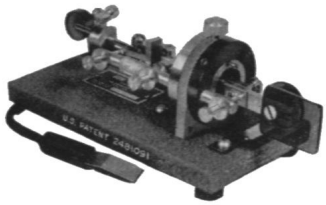
The activity day is run from midday on the 6th to midday on the 7th to give the opportunity to work all 3 bands, 20, 40 and 80 meters, and the way the bands have been over the past few weeks, I am sure we can look forward to some good conditions.

The bands may be a bit noisy from all the thunder storms, but they certainly are not as difficult to work as they were a few months ago.

Last year we had almost 30 entrants and hopefully this year we will attract a few more and really make it something worthwhile. Pierre ZS6BB certainly showed us the way to go was QRP, because, although he worked less stations than some of the entrants, he scored double the points with the contacts he made by working 5w or less. I am sure there will be a few more QRP stations this year.

Because the event is over 24 hours, it seems too, there is less rush to do things and there are many ragchews taking place and not just an exchange of numbers.

So we encourage you all to get out your keys, paddles or whatever takes your fancy, get in a bit of practice, and come along and support the event. It doesn't take much to get back In to the swing of things and work at about 12—15 wpm again. Gee you can even work slower that that if you want to. The idea is to keep the bands alive



Dowkey

in the allotted frequencies, to make sure we don't lose that portion of the band to some commercial activity.

CW is fun, and a great way to communicate. Just in case you've forgotten.

De ZS0AWA/CW …-.-

SSB activity:

It came upon us suddenly, but the call went out and there certainly were a few who came to the rescue. I am talking of course about the SARL 80m Club Championship.

It's a contest where points a re gathered, not for the individual, but for the club you represent. Because the AWA is registered as a club with the SARL, we thought it may be good for us to be represented in the official channels of the SARL and so the only way to communicate this was via email. So if you weren't notified about it, pleas don't feel we ignored you, it was probably because you don't have email or we don't have your email address. The decision was made at short notice so this seemed like the best way to get as many entrants as we could.

There are still a few other legs to this contest, so now we are aware of it we will try keep you informed about it ahead of time.

The next one is the digital portion which is on the 26th May also from 19:30 to 20:30 SAST.

Then there is a CW portion in July and starting over again SSB, Digital and CW.

So we'll try to keep you all updated about this and lets see if we can get the AWA up on the top listing of clubs. After all, we do carry one of the largest club memberships in the country.

Otherwise, the SSB net on Saturdays continues to be a good meeting place for our membership and the bands are slowly improving on 40m to assist us.

Hallicrafters SX42 Rx

AM:

The AM saga continues, with the summer storms certainly taking their toll on the transmitting AM signals. Although the bands are quite good with signals running mostly around S9, the noise is very often more than that.

But you will always find a few mad hatters out there thinking they can overcome the QRN and still trying their best to get something out on the airwaves.

Saturday morning transmissions still remain the best times to be working AM and the S9 signals with very little noise on the band are greatly appreciated by most of those calling in. Usually around 6 to 7 stations call in on Saturday and with us now taking calls at the end of the AM session on SSB, it does give those without the ability to transmit AM the chance to listen in to the net and then report in afterwards.

As we draw towards the end of summer, the storms will start to disappear, the bands will improve and we will be able to work the various divisions without too much difficulty. Something of course to look forward to.

Don, our new President, has suggested a competition to encourage AM amongst the AWA members, and we have decided to put up a working receiver as a first prize for the listener who calls in the most times on the AM net. We will keep a list of all those reporting in.

Yaesu FR50B Rx

An Experimental Valve Linear Amplifier.

By Rod, ZLIRK.

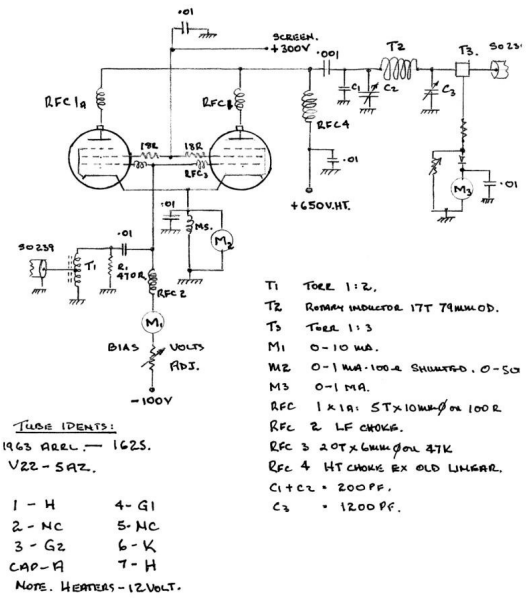
I participate in the local AM networks, being a great believer in AM as the original and practical way of getting going (not as simple as CW of course). I brought with me from South Africa a Gonset AM transmitter which has approximately 15 to 20 watts output. During the winter months when local propagation is very poor and noise is high, (ground wave and DX only) I found that the weaker stations were just not copyable (me too).
I therefore resolved to build or acquire a more powerful TX. This had to use valves to fit into the period 1939 to 1960.
The next task was to source material, components and a source of power. Source of power wasn't too difficult because after a bit of thought it became apparent that I could "borrow" power from my FT200; this having at its accessory socket, HT of 635 volts, 300, 150, and —l00 volts for grid bias. I think that this was originally provided for a Yaesu companion linear amplifier (although I have never seen one).

As a suitable chassis was not available, I decided to use a breadboard, bits of suitable planking being readily available.
Eventually this proved to be quite impractical and after a further search a small chassis, which I had made many moons ago for a receiver, which I never got around to building was unearthed. Components such as capacitors (for blocking and decoupling at high voltage) were plentiful in my junk boxes and at a club junk sale wide spaced plate tuning condensers were obtained. What was difficult to find were high wattage non-inductive resistors.
Valves were no problem as I found that I had brought no fewer than eight 1625s, four 807s even a few 813 and one 814. So 1625s were the obvious choice. I managed to source two 7 pin bases for them from Geoff ZL1AKY. Note that the 1625s are basically 12 volt 7 pin versions of the 807 which has 5 pins. Both have an internally connected suppressor grid. I also uncovered a large variable rotary inductor ex MOD WWII, 17 turns of 3 mm dia. wire which, being adjustable and with l00 pf forming a parallel resonant circuit and using my original grid dip oscillator resonated
at the 80 m frequency of 3850 kHz.

Then followed a very frustrating interruption of several months due to an attack of arthritis during which I was unable to use my hands and walked with great difficulty.

Design and construction

From a design point of view it should be possible by using two 807/1625's in parallel, running in class B and at the voltages mentioned I should be able to get, with a drive level of 6 or so watts some 60 watts out. Bearing in mind my original 15 watts the ratio of 15 to 60 is a gain of 6 dB or 1 S point. But I had noted that stations running 60/70 watts were perceptibly stronger than the 10/15 W chaps on the net. (My 32 V I only ran 70 watts RMS carrier, and that was perceptibly stronger than the FT200, 25 watts AM.)..(6 Watts drive to 60 Watts is 10 dB's) or (6 watts getting a report of S9 should on increasing to 60 watts get a report of S9 + 10dB. Wishful thinking!)



From the circuit diagram note how the two tubes are arranged in parallel. You will realise that the driver transmitter has an output at approx 50 ohms and the input to the grids of the 1625's is a very high impedance. Evert gave me the advice on how to drive the amplifier. By using a torroidal transformer, in this case an auto torroidal transformer I was able to load the 50 ohm output (of the TX) and which at 6 watts is about 20 volts RF and double the voltage to about 40 volts RF. Note the DC blocking capacitor C, otherwise the bias volts would be shunted

to ground via the autotransformer, (a single winding tapped halfway) it would also have put a negative voltage on the output circuit of the driver. These voltages were measured with a high impedance probe of a dual trace scope. Note that the anode current is measured at the cathode. This current will include the screen grid currents and allowance must be made for this. This arrangement prevents HT on the front panel.

Normal practice was followed with the rest of the assembly. Interestingly I was somewhat reluctant to switch on and wait for the smoke or BLUE FLASHOVER in the tubes so I decided to pre-tune the Pi Coupler. I used the ICOM 740 to provide 70 watts of CW carrier which I coupled into the plate end of the coil. ZILCH, nothing, nought. Only a very high swr on the IC740 and no power into the Pi circuit. I went to bed in perplexed disgust that my idea had failed so completely. After a disturbed nights rest and following a chat with Rad ZS6RAD the penny dropped. The Pi coupler is basically an impedance matching device, matching the HIGH impedance of the PA ANODES to the 50 ohms of the
resonant dipole. Followed a bit of guesswork and some frenzied winding, a torroidal transformer with an impedance ratio of 60 to 1 (3000 ohms to 50 ohms) produced the desired results and the coupler behaved beautifully and was tuneable over a large range and with many combinations of LC. The output power meter worked although I had to change the torroid as it got too hot. With a bit of juggling I got that right as well, all this without ever firing the unit up! And I was ready for the BIG test. With great trepidation I switched on the drive and HT and blow me down, it, after a slight adjustment, WORKED!! I felt an elation that I haven't had since building my first regenerative receiver. Input
+1- 6 watts and OUTPUT a staggering 63 watts through a Bird wattmeter and into 50 ohms dummy load. And all this from a heap of junk.!!!

Since then I have had heaps of headaches in trying to make the whole kaboodle single switch operated. I wanted to have the original combination of Trio 9R59D RX and Gonset GSB100 TX as a stand alone unit with the linear switched in when needed. I wanted a three position switch with indicator LEDs and relays to do the job. Not as easy as one would imagine, anyway I will eventually get there. If anyone has any queries or requires further explanation I can be contacted by e-mail at rodzs5rk@xtra.co.nz (Note that this is a New Zealand address)
.
To those adventurers who would like to give something similar a try, well why not give it a try. I would like sometime to try to use an 829b or 06/40 dual tetrode in place of the two 1625s.

Acknowledgements: Technical Advice by Evert ZS6AQW, Geoff ZL1AKY, Ian ZL1PZ, The ARRL Handbooks and many others too numerous to mention individually. Encouragement by Ron ZL1BYW and other members of SPAM. I am a member of SA AWA as well as SPAM.

(AM Contest Continued)

Points are to be awarded as follows:

a) 1 point for each station worked a specific band. If you work the same station on more than one band, you get 1 point for each band.
b) 1 point for each state, country or Canadian Province worked.

Note: Both you and the station with whom you are QSO ing must be using AM.

Logging: The following information must be included in your log for each contact to be counted:
Time (local), Frequency, Call Sign, First Name, Their Location (state is OK), Their Equipment Log Format: Each item should appear in a separate column, one line per contact.

Template logs are here: www.classeradio.com/amtrlog.xls (excel) www.classeradio.com/amtrlog.csv (csv)

Please let us know about anything unusual or unique you hear and / or any nominations for stations in "unusual" categories or with unusual or unique characteristics.

A description of your station equipment, power and any other interesting features should also be included as part of your submission along with your mailing and email addresses. Pictures (in electronic form if available) are also encouraged!

Whenever possible, please use electronic submission of logs using Excel or CSV (comma separated values) (preferred) formats. Email logs to: amtr@radioassociates.com. If you do not own, or cannot use a computer, paper logs may be mailed to: (*continued page 10*)

Edward George Bowen

(Continued from Issue 49)

.The radiotelescope at Parkes

In the first decade following the end of the war Radio physics established an enviable reputation in the new science of radio-astronomy. It was a time of exciting discoveries and innovative ideas, a time when a new observing system could be quickly tried out. The outstanding Australian successes in this period were recognised when URSI elected to hold its 10th General Assembly in Sydney in August 1952, the first meeting of an international scientific union ever held outside Europe or the USA. But by then the era of improvised equipment was drawing to a close and the era of big science was soon to begin.

Radio astronomy now needed aerial systems with much higher resolution and able to collect more of the extremely weak signals arriving at the Earth. One approach was to develop a very large parabolic-reflector aerial and as early as 1948 Bowen had been convinced that this was the best solution. Bernard Lovell at Manchester University in 1952 was the first to set off down this path. Bowen was very conscious that the British government had funded the project at a cost far beyond the resources of Radio physics. Nevertheless he persisted and tried to find more economical designs, but none were quite satisfactory.

During visits to the USA, where he had made many influential contacts during the war, Dr Vannevar Bush (President, Carnegie Corporation) and Dr Alfred Loomis (Trustee, Carnegie Corporation and Rockefeller Foundation) revealed that it might be possible for Bowen to build a large radio telescope in Australia with financial help from the USA. In April 1954 the Trustees of the Carnegie Corporation of New York announced a grant of $250,000 to Australia for this purpose. This generosity was returned by Bowen, in part, over the next year by his help in establishing US radio astronomy: in January 1955, he arranged for John Bolton and Gordon Stanley to be seconded to the California Institute of Technology, a move that marked the beginning of the science in California.

Bowen organised a Technical Advisory Committee (TAC) in 1955 to advise on and specify the proposed design study for the Australian telescope. The committee included two structural experts, H.A. Wills of the Aeronautical Research Laboratories, Melbourne, and J.W. Roderick, head of the Civil Engineering School of the University of Sydney.

A highly significant development occurred in mid-year when Bowen had discussions with Barnes Wallis (later Sir Barnes Wallis FRS), the famous airship and aircraft designer at Vickers Armstrong, Weybridge. Wallis revealed some innovative ideas including a *'master equatorial'* for controlling the movements in equatorial co-ordinates of the mounting, a concept that was to become a key feature of the Parkes Telescope. The outcome was that Freeman Fox and Partners (FF&P), London, the designers of the Sydney Harbour Bridge, were selected for the studies with advice from Barnes Wallis. Harry Minnett, from the Telescope Planning Committee, was appointed as CSIRO liaison officer and radio consultant to FF&P.

Bowen was forced to turn to a number of US funding organisations in the hope of supplementing the available funds. These overtures were successful for in December 1955 the Rockefeller Foundation contributed $250,000, with an important condition that the Australian government should match this sum as well as the amounts previously received. When approached by Sir Ian Clunies Ross, Chairman of CSIRO, the Prime Minister, Robert Menzies, agreed to this proposal and also to pay for the running costs of the complete installation.

In London the senior partner of FF&P was Ralph Freeman but the telescope project was directed by Gilbert Roberts, a brilliant if somewhat idiosyncratic engineer. Later both men were knighted and Roberts was also elected to the Royal Society. Roberts' first assistant in charge of the telescope team was Michael Jeffery, an outstanding structural engineer.

The three basic questions that Bowen had posed for the consultants were: compensated or rigid reflector structure; altazimuth or equatorial mounting; telescope cost as a function of reflector size for both mountings. As Wallis had remarked, the design of a giant radio telescope to the precision required was a venture into the unknown. It was not expected that Bowen's questions would be easily settled.

The structural aspects of the study proceeded satisfactorily. A small, very rigid central hub supporting the reflector structure was adopted to encourage symmetrical deflection patterns. For a rigid steel reflector, these were found to be so promising that the investigation of complicated servo-compensated aluminium structures was ultimately abandoned as unnecessary. Roberts and Wallis intuitively preferred an alt-azimuth mounting because of its structural simplicity compared with an equatorial, and a compact and extremely rigid design was evolved. However, a thorough study of the feasibility and cost of the Wallis master equatorial concept and the alt-azimuth servo drive system would clearly be crucial to the mounting decision. Unfortunately it proved very difficult initially to interest competent firms in this task.

In October 1956, however, Grubb Parsons Ltd. agreed to develop and cost a master equatorial system. They also suggested an important innovation for sensing the error between the pointing directions of the master unit and the slave reflector axis. This idea was based on proven auto-guidance technology and was a significant advance on the untried mechanical and hydraulic system in the Wallis proposal. By that time also Minnett had proposed a servo system that avoided the stability problems arising from structural resonances, and had shown that it could accurately track astronomical sources under dynamic wind loads. These ideas were adopted by Metropolitan Vickers, who had agreed to develop and cost the drive system. FF&P were confident by early 1957 that an altazimuth mounting was the best solution.

The design study report was completed by November and Bowen asked the TAC to critically review its recommendations. After discussions with Minnett and Roberts in Sydney, the Committee agreed that the feasibility of the telescope had been established and that the design was an excellent one. From the cost-size data, a diameter of 210 ft. (64 m) was chosen early in 1958 to match the available funds. Bowen's foresight in setting up and carefully organising the design study was a major factor in this result and avoided many pitfalls.

Following completion of the detailed design, Bowen insisted on international tenders. MAN (Maschinenfabrik Augsberg Nurnberg AG) in West Germany was successful, with Metropolitan Vickers as contractor for the servo drive systems. The offer by Askania Werke of West Berlin was accepted as sub-contractor for the master equatorial control system. The MAN contract was finalised in July 1959. By his vigorous participation in the tendering process and contract negotiations, Bowen achieved a significant improvement in earlier estimates of the completion date and cost. Some additional funding was still needed, however, and he approached the Rockefeller Foundation again. Early in December it generously approved a further $130,000 which was matched by the Australian government.

MAN proceeded with great vigour. The construction of the base tower at Parkes started in September 1959 and a trial assembly in Germany of the mounting and servo drives took place in May 1960. On-site construction of the telescope commenced in September 1960, with Jeffery as resident engineer for FF&P. That it was completed closely to schedule was a tribute not only to MAN and to FF&P's careful design work and supervision, but also to Bowen's energetic efforts throughout the project.

On 31 October 1961 the Governor General, Lord de Lisle, was invited by the CSIRO Chairman, Dr F W G White, to perform the opening ceremony; Bowen followed with a speech of thanks. The occasion was a grand affair in spite of the unusually high wind. The ceremony was attended by a large assembly of Radiophysics staff, Chiefs of CSIRO Divisions, academics, industrialists and local people.
Bowen was delighted with the performance of the new instrument. In 1963 he wrote *'It is clear from the figures that the telescope is one of superlative performance and provides both surface and pointing accuracy which is approximately double that called for in the original specifications'*. The Parkes Telescope also proved timely for the US space programme. Bowen received a NASA grant for Minnett to participate in studies at the Jet Propulsion Laboratory in California for the design of a 210 ft. instrument for communicating with very distant space probes. Many of the Parkes features, including the drive and control concepts, were adopted.

John Bolton, the first Director of Parkes, initiated an intensive survey to detect radio sources and eventually listed many thousands, including many quasars. Detailed studies of hydrogen line emissions at 21cm wavelength helped to reveal for the first time the spiral structure of our galaxy. The versatility of the instrument made possible a variety of other investigations including: ionised interstellar hydrogen, supernova remnants, polarisation and magnetic fields, the discovery of new pulsars, the study of the Magellanic Clouds and remote galaxies. During the first twenty-five years of operation, over 1,000 research papers were published.

The telescope played a vital role in NASA's Apollo moon landing programme and through it the world's television audiences saw Man's first steps on the Moon. For the European Space Agency's Giotto mission to Halley's Comet, Parkes was the prime receiving centre. The telescope was linked to the NASA station at Tidbinbilla to boost the signal during the successful flight of Voyager II past Jupiter, Uranus and finally Neptune, then the most distant planet of the solar system.

Over more than a quarter century, the achievements of the Parkes Telescope have more than justified the very great efforts necessary to bring it into being. Now the major element in the Australia Telescope National Facility, it is destined to continue its scientific contributions well into the next century. There could be no more enduring monument to the vision, tenacity and energy of 'Taffy' Bowen.

The Anglo-Australian telescope

In the first decades after the War, there was much discussion about the need for a large optical telescope in the southern hemisphere. The matter was taken up formally by the Royal Society of London and the Australian Academy of Science on a joint basis towards the end of 1963. Their discussions were lengthy, and at the end of June 1965 submissions for the construction of a 160-inch (3.8m) Anglo-Australian telescope were presented to both governments. A long delay then ensued.

In the months that followed, the Australian government was non-committal on the Anglo-Australian proposal despite British

pressure. A firm commitment had been delivered by W.L. Francis, the Secretary of the Science Research Council, that Britain would fund half the cost of designing and building a 3,8 m telescope.

The Australian Academy of Science asked L.G.H. Huxley and Bowen to seek an interview with the responsible Minister, Senator Gorton. Once a few matters had been clarified, they found the Minister was very much in favour of the Anglo-Australian proposal. In May he announced the agreement of the two governments to build a 3,8m optical telescope on Siding Spring Mountain near Coonabarabran, New South Wales, the site of an Australian National University observatory.

The two governments set up a Joint Policy Committee (JPC), pending the legal creation of a Board, to direct the design, construction and operation of the new telescope. Bowen with Professor O.J. Eggen and Mr K.A. Jones represented Australia and Sir Richard Woolley, Professor Hermann Bondi and Mr J.F. Hosie represented the United Kingdom. Shortly after the first meeting, Bondi accepted another post and was replaced by Professor F. Hoyle.

At the first JPC meeting in August 1967 in Canberra, it was decided to follow broadly the design of the 150-inch polar axis telescope then being planned for the Kitt Peak National Observatory (KPNO) in Arizona. Many of the new post-war technologies had been applied to radio telescopes and the time was ripe for changing some traditional optical telescope practices. R.O. Redman of the University of Cambridge and S.C.B. Gascoigne of Mount Stromlo Observatory had been appointed as permanent astronomical advisers to the project, as a link with potential users and with special responsibilities for the optics.

Redman and Gascoigne recommended that the prime focal length adopted by KPNO should be increased to f/3.3 and that a simplification should be made to the arrangements at the prime focus cage. The primary mirror blank, to be cast in a new material with a zero coefficient of temperature expansion, was ordered at once from the US supplier to take advantage of the discount offered by adding to the KPNO order. The nucleus of the Project Office was established by appointing Hermann Wehner (Mount Stromlo Observatory) and John Pope (Greenwich Observatory) with particular responsibilities for instrumentation design.
After the first meeting of the JPC, Bowen set out to implement a number of his proposals which had been agreed. He organised the secondment as Project Manager of M.H. Jeffery, chief assistant to Sir Gilbert Roberts at Freeman Fox and Partners, London, during the design of the Parkes Telescope and resident engineer during its construction. H.C. Minnett from Bowen's Radiophysics Division, together with a British counterpart, R.L. Ford of the Royal Radar Establishment, were appointed as consultants on drive and control. Bowen also recruited D. Cunliffe from the CSIRO Division of Mechanical Engineering as the Executive Officer of the Project Office.

As a result of Bowen's initiatives, Jeffery was able to attend the next JPC meeting in London in March 1968. Minnett and Ford, after investigations in the UK and USA at the end of 1967, had produced a drive and control report for the JPC recommending that the setting accuracy target should be 10 arcsec; that the telescope should be controlled by a computer system operating through servo drives; and that a modern auto-guidance device should be developed to relieve the astronomer of this chore. Bowen later proposed that Maston Beard should be seconded from Radiophysics for a major role in this work. He also supported a proposal by Minnett and Jeffery that traditional worm drives should be replaced by high-precision spur gearing with symmetrical anti-backlash drives as in radio telescope technology.

When Jeffrey died suddenly from a heart attack early in September 1969, Bowen's reaction was typically swift. Within days he had arranged for Minnett to be seconded to Canberra as Acting Project Manager and had obtained the agreement of Freeman Fox to make a study of a serious problem in the design of the declination bearings. The engineer selected was Colin R. Blackwell who had worked on the design studies for the Parkes Telescope.

At the August 1970 meeting of the JPC in London, Blackwell was able to recommend a satisfactory solution to the bearing problem. By then Freeman Fox's role had been expanded by Bowen and the Board to include responsibility for the supervision of the complete mounting contract on behalf of the Project Office. The AAT inter-government agreement specified that tenders had to be called on an international basis and Bowen was insistent on the observance of this proviso. In October 1970 the contracts for both the mounting and the drive and control system were awarded to a Japanese company that offered specially favourable terms designed to win the work.

In February 1971, following the passage of the necessary legislation through the Australian Parliament, the JPC was dissolved and its members were appointed to the AAT Board, with Bowen as Chairman and Hoyle as Deputy. The management and operation of the telescope now became a critical and divisive issue. It was not settled until April 1972 when Bowen supported the British stand for a Scientific Director responsible only to the Board. Within a year Bowen was appointed to the post of Science Counsellor at the Australian Embassy in Washington, D.C., and he therefore had to resign as Chairman of the Board. Hoyle took his place and Paul Wild was appointed as a new Australian representative.

Bowen had successfully guided the project through the complex years when the design of the telescope was evolving and had overcome other problems of great difficulty to arrive at last at a highly satisfactory result. In the words of Hoyle: *'there is no doubt that a large share of it (the credit) must go to Taffy Bowen. Without him the telescope would have been*

only a shadow of what it was eventually to become'.

The telescope was officially inaugurated on 16 October 1974 in the presence of H.R.H. Prince Charles. When operations commenced in 1975, the telescope was accepted as a technological *tour de force.* In the words of Gascoigne: 'The mounting and the optics were clearly of the highest standard, but what created the real impression was the computer control system, which was comprehensive, versatile and efficient to a degree beyond anything previously contemplated'.

Sport

Bowen had an enduring love of cricket, which he began playing while he was a youth in Wales. After playing for the South Wales League at Gormorton, he continued at King's College, London, and later at Felixstowe arid Martlesham. He continued his passion for cricket when he joined the Radiophysics Laboratory in Sydney.

He was also a keen sailor having started in England, but his main opportunity was in Sydney, where he became devoted to VJ's and Moths. He later bought a Yachting World boat that he raced in the Middle Harbour Yacht Club. About 1968 he was elected Rear Commodore of the Club. Later, as Science Counsellor in Washington, he lived at West River on Chesapeake Bay. There he sailed a 32 ft yacht named 'Sosie' about the Bay and with some success in local races.

Personal

Bowen's Division of Radiophysics was quite unlike others in CSIRO. It had been founded in 1939, in the utmost secrecy, to work on wartime radar for the fighting services. Several scientists spent the war in the fighting services and when demobilised came to Australia and joined in the remarkable post-war researches that Bowen headed. Two such men were John Paul Wild and John Bolton. The former, who succeeded Bowen as Chief of Division, has this interesting analysis of Bowen as his predecessor:

I was one of several young research scientists who joined the CSIR Radiophysics Laboratory in the early post-war years. The Chief, Taffy Bowen, was firmly in command: young, confident, cheerful and breezy, always optimistic and giving the impression that he knew exactly where he was going. He had supervised the transition of the laboratory from its wartime programme of military radar to its new peacetime policy.

By the mid 50's the Laboratory's activities had narrowed down to two large programmes – cloud physics under Taffy's direction and radio astronomy under Joe Pawsey's. Both programmes stood high in international repute.

Taffy then decided to enter the radio astronomy arena himself and set his mind on the construction of a giant radio telescope. Such was our reputation at the time, combined with Taffy's influence and diplomacy in the USA, that half the cost needed to fund this project came from the Carnegie and Rockefeller foundations. The major credit for the existence and success of this instrument must go to him.

The other major work that owes much to Taffy is the Anglo-Australian Telescope (AAT). As Chairman of the AAT Board he steered the 3,8m optical telescope to fruition, again showing his great skill in choosing and supervising the contractors.

The world will remember Taffy firstly as a member of the three-man team that developed radar to help save the day for Britain in 1940 – secondly as the dynamic post-war leader of the Radiophysics Laboratory; and thirdly as the engineer who brought to successful completion two major astronomical instruments of his era.

John Bolton, clearly an admirer, goes further with this sympathetic summary of Bowen's contribution:

There can be no question that Taffy's most important contribution to science was his wartime work in airborne radar and there may be millions of people in the world today who are quite unaware of their debt to him.

His second contribution was the holding together of the wartime Radiophysics Lab and the conversion into one of Australia's most effective research centres. It is perhaps noteworthy that no less than five staff members were elected to the Royal Society before he himself was similarly and belatedly honoured.

Bowen's election to the Royal Society in 1975 was supported by posthumous letters from Sir John Cockcroft FRS and by Sir Harold Hartley FRS. His personal wartime work on radar, his telescope at Parkes for radioastronomy and his contribution to the understanding of cloud seeding were sufficient. He was elected to the Australian Academy of Science in 1957 and was awarded a Fellowship of his University College in Swansea.

Bowen's personality was complex. In the relaxed first interview with Robert Watson-Watt and Jimmy Herd, as he tells it in his book, he was challenged to sing the Welsh national anthem. This brought a response from Bowen that he would do so if they would sing the Scottish anthem. He remained a firm friend and admirer of Watson-Watt from then on. Throughout his life he remained an ardent Welshman and in Australia rejoiced in the name of 'Taffy'. He refused the opportunity of taking

Australian citizenship and thus sacrificed the possibility of Australian honours. In December 1987, he suffered a stroke at his home in Sydney. In spite of dedicated medical attention and the care of his family and friends, his condition gradually deteriorated. He died on 12 August 1991 at the age of 80.

1941	OBE
1947	Medal of Freedom USA – for contributions to the US war effort
1950	Thurlow Award of the American Institute of Navigation – 'for the most outstanding contribution to the science of navigation during 1950'
1951	Royal Commission Award to Inventors in the United Kingdom
1957	Elected Fellow of the Australian Academy of Science
1957	DSc (Honorary) University of Sydney
1962	Vice-President of the Australian Academy of Science
1962	CBE in recognition of contributions to the development of science in Australia
1967-1971	Chairman of Joint Policy Committee of the Anglo-Australian Telescope
1971-1973	Chairman of the Anglo-Australian Telescope Board
1975	Elected Fellow of the Royal Society of London

Fellow and first President, Australian Institute of Navigation

Fellow, Royal Astronomical Society

Foreign Member, American Academy of Arts and Sciences

Foreign Member, US National Academy of Engineering

Honorary Fellow, King's College, London

Honorary Fellow, University College, Swansea

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R. Hanbury Brown, AC, FRS, FAA, (wrote the section entitled 'The war years'), Emeritus Professor of Physics, University of Sydney.
Harry C. Minnett, OBE, FAA, FTS, former Chief of the CSIRO Division of Radiophysics, 1978-1981.
Frederick W.G. White, KBE, FRS, FAA, former Chairman of CSIRO, 1959-1970

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