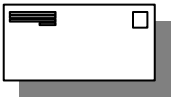
RNARS

NEWSLETTER

ROYAL NAVAL AMATEUR RADIO SOCIETY

SPRING 2018



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The RNARS is grateful to Phil Taylor MØVSE and his brother Wayne G6NGV of **Shine Systems** for hosting our web site free of charge: **www.rnars.org.uk**

Front Cover: Ian 2E0IHH firing up his steam engine to charge some batteries.

Contents:

CHAIRMAN'S CHAT

David Firth
2E0GLL@mail.com

The shack at home has suffered from the gales along with the fence on one side of my postage stamp of a garden. While others battled with snow and ice, the south has had torrential rain. My aerials took a buffeting, but on the whole there was no ingress of rain when the front wall of the shack slipped off its bearers! All fixed, but at least I can say that it was prudent to remove my rigs to the house under the watchful gaze of 'she who must be obeyed' - sigh. Likewise at the HQ shack; a little damage that is manifested by a marked drop in aerial performance hence the call for assistance from our local members on the 11th of February. Hopefully, by then the inclement weather will have subsided.

A huge thank you to Mick Puttick (G3LIK) who took on the task of scoring for the INC-2017 contest. Not an easy job by all accounts. Well done Mick, and sadly I note that Mick is standing down this year! Ladies and gentlemen we will be looking for volunteer to take on this important task.

Our Membership Secretary Marc Litchman is back in hospital again, and we hope that he will emerge in a much better condition when he leaves -Marc, we wish you well.

During the forthcoming months we hope to put some flesh on the bones of a few ideas to get out and about more by holding one or two events of our own, by having short talks, presentations -even videos about various radio topics in the shack, and hopefully, by reaffirming old links to other groups in the area who have similar interests.

The adage that you can never teach an old dog new tricks sometimes doesn't apply - particularly to old sea dogs such as Doug Hotchkiss. There I was quietly showing off our new rig having connected my laptop to it, ready to decode some data-mode or other, when he says "Oi, you know that's not working properly, don't you?" I let him take over the mouse and keyboard and watched fascinated as his fingers danced over the keys. "There you are," he said, and like a master chef presented me with a colourful screen full of decoded JT8 signals from all over the world. Crafty old Hotch!

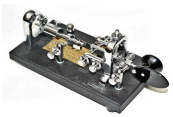
We have to accept that the world of our market sector interest is changing. If what I read in the media is true, late last year saw a dip in sales in some areas of radio equipment manufacturing, while a few hopeful releases of high tech rigs were well received, despite a few releases of the same old designs stuffed into new boxes. There

is some buoyancy in the mood of one or two industry observers, so it is just a question of wait and see when it comes to 2018 in the amateur radio scheme of things. It nice to see that in spite of the apparent decline of Morse code signalling it is still a key design feature (that's nice - get it?) in modern transceivers. Until next time, I wish you all well.

David

RNARS CW Activity Results November 2017

PSN	CALL	GROUP	QSO'S	BONUS	POINTS	TOTAL POINTS
1.	PA0VLA	RN944	25	2	176	352
2.	GB4RN	RN4	27	2	117	234
3.	OE6XMF	CA100	5	4	50	200
4.	DL1GQE	MF620	10	2	91	182
5.	G3RFH	RN173	11	3	60	180
6.	DK7FX	CA149	4	2	31	62
7.	G3ZNR	ROA213	2	2	20	40
8.	PA0JED	MA352	1	1	10	10
9.	MM0CJF	RN4593	1	0	1	1



Comment.
Afraid everyone had great problems through the LZ contest the same weekend.
I found calling CQ on the bands a complete waste of time.
Due to the lack of interest that was the final one that I will organise.
Many thanks to all who have participated in the past. Your efforts have been much appreciated.
I will send out Certificates to all who took part.
73
Mick G3LIK

A Radio Operator on Her Majesty's Yacht "Britannia"

Doug Turk G3PQC

I came home from the Far East Station having served for two and a half years in HMS Morecambe Bay during the Korean War and joined the Royal Yacht in December 1954. There were 12 Radio Operators on board, three operators per four-hour watch, one operator on the Broadcast Bay, one on HF ship/shore wireless telegraphy, and one senior operator in charge. The radio equipment on board consisted of Marconi Transmitters, Murphy Receivers B40 /4L, and Marconi direction finding receivers with Bellini-Tosi direction finding antenna.

The wireless telegraphy broadcast from the shore stations around the world i.e. Admiralty, Ceylon, Singapore, Hong Kong etc., normally ran at about 25wpm which the broadcast operator would read and take on a typewriter. Most of the traffic was in code except for weather reports etc., and was five letter code which was decoded on a deciphering machine, the first two groups enabled the machine to be set up and if one letter was misread we could not decode the message, so we had to ask the ship shore station to repeat the first two groups - questions would be asked! (The fact that we were all taught touch typing comes in very handy for my computer). Looking back at my service on the Yacht, I well remember the State visits by Her Majesty and Prince Phillip to such places as Stockholm, Copenhagen, Oslo etc., when about 5 miles from port hundreds and hundreds of small craft would come out to follow us in all waving and cheering with Her Majesty and Phillip waving in return. Britannia was in commission for over 40 years and is now in Edinburgh as a museum. We have a reunion every two years and naturally our numbers are decreasing since 1954 but we will keep going for as long as we can.

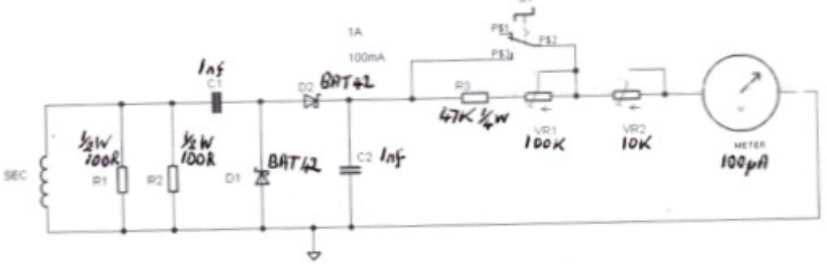
Callsign: GQXC
Displacement: 5000 Tons
Speed: 22 knots
Crew: 175
Launched: 1953

Doug RNARS 0145

RF CURRENT METER

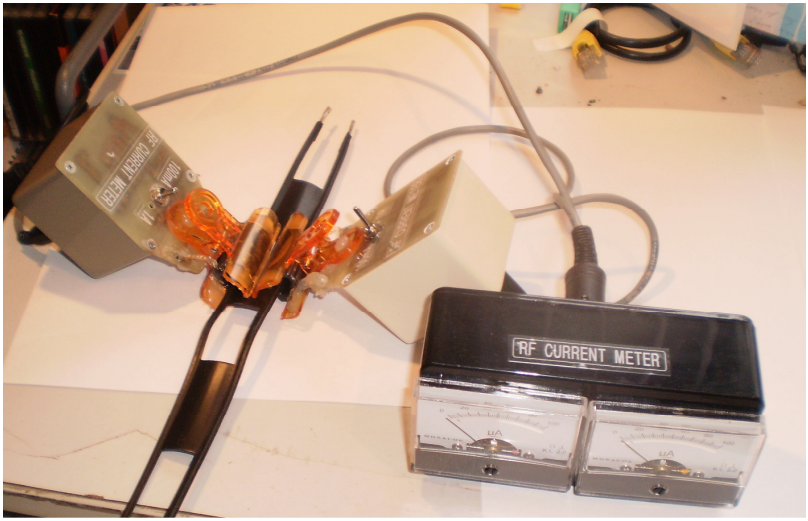
Ken Randall G3RFH

As mentioned in my previous article on balanced ATUs (RNARS Winter 2017), there is a need to measure the RF current in each leg of the balanced feeder. There are various designs for building these: one I used for a long time had to be connected in series with the feeder which meant adding an 18inch length of 450ohm ladder line in series with the feeder, but this arrangement upset the tuning of the balanced ATU.
By accident I came across a design by G4HUP who offered a kit of parts for building it. Unfortunately, his website indicated that G4HUP had become SK and therefore no kits were available. The Instruction Manual was still on the website and a study of it showed it to be a simple design using a split ferrite ring (as used to suppress RF etc, on cables) to clamp around the leg of the feeder, thus not upsetting the tuning of the ATU.
I thought that if I had 2 of these I could monitor the RF current in each leg of the feeder at the same time and connect the output of the RF detectors via flexible cable to twin meters, thus reducing the weight on the feeder and also allowing the meters to be placed in a convenient position.
Also still on the website was the schematic diagram and PCB layout. So it was out with the etch resist pen, copper clad board and ferric chloride (etchant) and soon 2 copies of the PCB were made to accommodate the components of the RF detectors.



The plastic jacket surrounding the split ferrites does not lend itself to a lot of flexing as is experienced in clamping to the feeder legs, it soon becoming split altogether. So a pair of large plastic bulldog clips were used, the ferrites being hot glued to the curved portion of the clips (after the winding had been put on one half of the ferrites) and in turn hot glued to the PCB of the RF detector head.

The 2 panel meters were mounted side by side in a plastic box and connected by about 2feet of cable to the RF detector boxes.



This setup produced exactly the same results as my previous RF current meters but was more convenient to connect to each leg of the feeder.

Ken RNARS RNARS 0175

BOOKS CORNER

The Deadly Trade, Iain Ballantyne
The Complete History of Submarine Warfare from Archimedes to the Present'

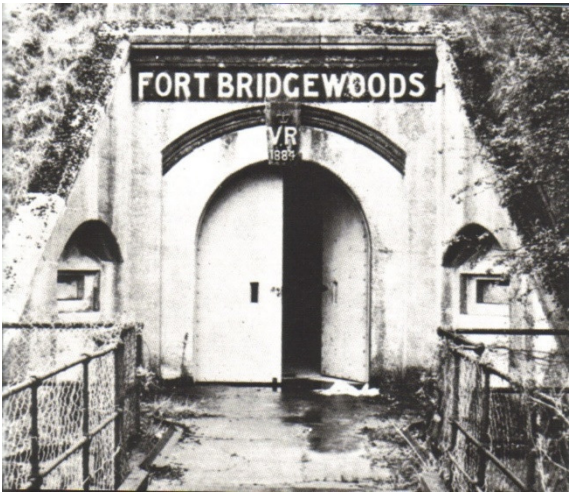
Blind Man's Bluff, Sherry Sontag & Christopher Drew.
The Untold Story of Cold War Submarine Espionage

Instruments of Darkness: The History of Electronic Warfare, 1939–1945, Alfred Price
The rapid evolution of radio and radar systems for military use during the Second World War, and devices to counter them, led to a technological battle that neither the Axis nor the Allied powers could afford to lose. The result was a continual series of thrusts, parries and counter-thrusts, as first one side then the other sought to wrest the initiative in the struggle to control the ether.

Joe G3ZDF

OLD FORTS & SIGINT

Stephen G Small G4HJE



Hollywood has in recent years brought to the public attention the names of Bletchley Park, Enigma, Beaumanor and Alan Turing. They even managed to produce a good, but wholly fictional, yarn about the American Navy recovering vital Enigma materials from a U Boat.

But who has heard of Lt Lionel Beale. Royal Signals. MBE, Lt Cdr. Marshal Ellingworth DSM OBE RN Rtd, Gordon Welchman. Leslie Harrison Lambert and Fort Bridgewoods? Very few I suspect as their names have been shrouded in secrecy.

The vital work of Bletchley Park and the 'Y' Service was so secret that Winston Churchill demanded that his 'geese that laid the golden eggs and did not cackle' would never reveal the work that they had carried out.

It was not until the mid 1970s that books started to appear that alluded to the breaking of the German code system and the impact it had on the outcome of World War 2. It was perhaps surprising that the authors were not prosecuted under the terms of the Official Secrets Act, and one has to wonder why that should have been. More recent analysis suggests that The Government Communications Head Quarters (GCHQ) took the pragmatic view that the release of the Ultra Secret, and historians focus upon it, kept them away from a more important secret, that of the SIGINT organisation that had gathered the material that had underpinned the work at Bletchley Park. In truth, post 1945 the 'Y' organization had just shifted targets, from the Nazi Beast to the Russian Bear and more latterly the Warsaw Pact.

Without SIGINT the breaking of Enigma would not have been possible. Very early on it was realised by the Code Breakers that their work was very much like a very old recipe for rabbit stew, before making stew you had to catch your rabbits!

So, one asks, what has SIGINT to do with Old Forts, as alluded to in the title of this monograph? Well that all comes together at 0900 hrs on 21st March 1926 when one reserve officer and five operators (Experimental Wireless Assistants) opened the first military wireless interception station in a redundant Victorian Fort overlooking the

River Medway whose original intent was to protect the Dockyard at Chatham from landward assault.

Fort Bridgewoods was one of five forts built during the Victorian era to bolster the defence of the Dockyard and anchorage at Chatham. At the time of inception, we had only recently beaten the French at Trafalgar and Waterloo and the continental threat remained very real. Under the direction of Lord Palmerston a committee was set up to consider the defence of strategic sites, however, despite a promptly completed survey and recommendations the report was shelved due to lack of political will and over stretched national finances post the Napoleonic War.

The original plan was revisited several years later as part of a review of the protection of London in view of ever changing political circumstances across Europe. In the mid 1860's it was agreed that a number of Forts would be built, including five protecting the landward approaches to Chatham Dockyard. Again the Treasury held up the work due to cost. By the 1880's work had finally started but the Treasury insisted upon the use of convict labour to keep the costs to a minimum.

Chatham Dockyard was already being expanded to accommodate a fleet that was moving from wooden walls to those made from steel. To achieve this a public works prison had been built at Chatham and housed predominantly Irish prisoners who supported the republican cause. The building of the forts was delayed whilst a further public works prison was built on high ground close to the village of Borstal just outside of Rochester.

The name Borstal may well be familiar as it was that given to a training system for young criminals. This was one of those early Edwardian social experiments to reduce the levels of youth crime in London and, having a redundant prison to hand, the Prison Commission gave over the old public works prison to the reformers and the name of the village was to become forever tied with the training of young offenders. It is perhaps interesting to digress here and note that at the same time as this experiment was underway another great social experiment to reduce youth crime in London was being conceived by a retired Army General, his name Baden Powell and his concept the Scout Movement.

By the time the forts had been completed the political landscape of Europe had changed dramatically. The French were now allies and the growing villains were Germany and Russia. The forts were in fact redundant before even being brought into commission and indeed none of the guns were ever mounted on site.

In 1907 The Corps of Royal Engineers carried out mining operations at Fort Bridgewoods and demonstrated how such fortifications could be undermined with explosives laid at the end of tunnel shafts. Operations in Flanders several years on were to benefit from the lessons learnt from the exercises of the summer of 1907.

During the First World War the fort was used to house troops as they waited to embark for the Western Front. At the end of the war the forts moved into care and maintenance and slowly nature started to recover her place.

However, a new beginning for Fort Bridgewoods was born from developments in wireless technology during World War One. Wireless had been embraced, although at times reluctantly, by both the Admiralty and Army. Certainly the Admiralty had become well aware that fleet communications by flags at the height of battle, particularly when fogged by the belching smoke from warship funnels, was at times precarious. Wireless was of course the answer, however, many more traditional senior officers were yet to be convinced.

Advances in valve and receiver technology carried out by Maurice Wright and Captain Round of the Marconi Company at their laboratory at Chelmsford realised the reception of German Naval signals emanating from the fleet at their home port. This led to three radio amateurs. Hippersley (HLX – G2CW), Clarke (THX) and Lambert (G2ST) being commissioned into the RNVR and setting up an wireless interception station close to the Coast Guard station at Hunstanton. It was soon realised that the Admiralty had a direct line into the communications of the German fleet. The development of aperiodic direction finding by Wright (father of Peter Wright who wrote the infamous Spy Catcher) permitted the location and potential movement of German naval ships to be plotted and consequently gave early notice of the German fleet being at sea prior to the Battle of Jutland.

The Army had also made advances in wireless interception and the breaking of the various simple field codes that were used between the front and rear headquarters. Direction finding stations were also established to help pinpoint key radio installations.

All of this learning was drawn together with the forming of the Government Code and Cipher School (GC&CS) in the early 1920's under Commander Dennistorn. One of the key figures to appear on the establishment list of GC&CS was Leslie Harrison Lambert, late of Hunstanton, who was recorded as being the radio expert. Lambert was a shadowy figure who at one time had been a magician and indeed had been vice president of the Magic Circle. His shadowy lifestyle also included his being better known in the 1930's as A.J. Alan who broadcast mystery stories for the BBC. Lambert

was also a key member of the 'Y' Committee which brought him into regular contact with the fledgling wireless interception station at Fort Bridgewoods.

The Fort Bridgewoods station had humble beginnings, indeed the original receiver provided was of French design and of little use other than to pick up commercial broadcast stations. Fortunately the commanding officer, Lt Beal, had after his leaving the Army at the end of WW1 joined the Marconi Company as an engineer and had developed and demonstrated the first duplex radio telephone equipment in 1924. Beale was the son of a very eminent doctor and indeed his grandfather and great grandfather had also been eminent doctors. Beale had been expected to follow the family tradition and go into medicine but instead he had developed an interest in the wonders of radio. In 1912 his father was granted an amateur radio licence for his son, being under the age of 21 Beale was not allowed to hold it in his own right. He had gone off to university just prior to the outbreak of war and had volunteered for a commission. His knowledge of radio technique eventually saw his transfer to the Royal Engineers Wireless Corp the forerunner of the Royal Signals.

It is not clear how Beale came to gain command of Fort Bridgewoods, however, his being a former Army officer and being employed by the Marconi Company may hold the answer. Reading the early chapters of Spy Catcher one cannot help but realise that there was a very close association between the secret service and the Marconi Company. The common thread of Freemasonry is also alluded to. Beale was more than qualified in all respects.

The five operators; Sid Wort, Les Hadler, Jim Sparkes, Fred Hawkes and William 'Pop' Blundell, employed as EWA's at Fort Bridgewoods were all former Army men, most having served as intercept operators at Sarafand.

1926 was of course a time of great unrest in the United Kingdom and social order soon broke down with the onset of General Strike. The Fort Bridgewoods team were quickly recalled to barracks in London in order to provide essential government communications with other major cities.

Post the strike they returned to their duties and slowly developed new radio equipment and explored predominantly diplomatic traffic between the major powers that the Foreign Office had particular interest in.

Despite the value of the work that they were doing the station was always the poor relation in the family and as the reductions under the Geddes Act took hold they were fighting for their very existence. What did not help was the fact that the Cryptographers at GC&CS were really disinterested in their product mainly because it

arrived in various hands as written script. The products from the interception of cable traffic was far more to their taste as it came neatly typed.

Fort Bridgewoods under Beale's leadership made some very serious developments despite the financial hardships. They developed receivers that could cope with high speed Morse transmissions and also a series of line filters that permitted three reception strands to be transmitted at he same time along one GPO line. Beale was in 1932 rewarded with an MBE.

Beale was not to see the ultimate fruit of his hard labour as he died suddenly on the morning of 3rd September 1934 at the age of 39. The post mortem revealed that he had been a ticking time bomb as he had a congenital brain aneurysm. He had survived the rough and tumble of public school rugby, the horrors of life in the trenches to die in his own bed.

He was buried with full honours at Fort Pitt Military Cemetery Rochester with his operators acting as bearers. His wife kept a list of those who attended the funeral and at the very top is Leslie Harrison Lambert Esq. from the Foreign Office. Also present was Captain McGregor of the War Office, actually the Head of MI1B. Other mourners included prominent people from his two lodges and a wealth of family members.

The loss of their commanding officer took a great toll on the staff of Fort Bridgewoods and for a while they drifted in a world with an uncertain future. Christmas 1934 was bleak but the New Year saw an arrival that was to be the turning point in the fortunes of the intercept station.

Lt Cdr. Marshall John William Ellingworth DSM RN had retired from the Royal Navy in the December of 1934. He had joined the service at HMS Ganges on 18 May 1906 having completed his education at Oakham, a minor public school. Ellingworth had joined the recently formed communications branch and was to rise quickly to Chief Petty Officer by the outbreak of World War One. In 1915 he was awarded the Distinguished Service Medal for gallantry in action, something he was always reluctant to talk about but would always bear the scars of.

Ellingworth was singled out for a commission and was one of the very first new breed signal communications officer specialists. From commissioning he was appointed to a trials team that was developing ASDIC equipment. Thereafter he had command of the

High Powered Wireless Telegraphy Station at Horsea Island and subsequently the communications centre in Malta.

Ellingworth was a true professional communicator and brought with him the organised can do attitude of the senior service. He was also noted for some of the other traits often associated with naval officers of the time and was often described as difficult to work for. That said, his leadership qualities were second to none and he ensured that the job was done in a structured and professional manner. His no nonsense approach also ensured that he got his way and that meant that his station was well prepared and equipped by the time that the second round of the conflict with Germany opened in the summer of 1939.

From 1935 it was clear to all but the government of the day that Germany was on a collision course with its European neighbours. Many, like Ellingworth, were aware that the surrender of Germany in 1918 had only signalled a half time break and that it would not be long before the second half would be played out.

Ellingworth took to organising the station for a war footing and carried out a whole series of exercises to train and test his operators to the highest levels of readiness. As well as the original group of EWA's he was allowed to recruit, something that had been denied Beale. Ellingworth ensured that he selected highly competent operators; many being recently retired RN operators. They were highly competent in the reception of Morse code under difficult conditions and well knew the difficulties attached to maintaining HF radio communications under the changing conditions during day and night watches.

The tasking of the station remained essentially a watch on diplomatic traffic being passed over high speed commercial links across the world. The number of sets was increased to accommodate the increase of traffic. This increase in workload was as a result of careful observation of identification of new networks. The Russian's came under close observation as the Comintern took to setting up clandestine networks to serve those who were attempting to spy and undermine the western powers. Japan came under observation as their empire moved to expand their influence upon the world stage.

The structural make up of the fort was not wasted by Ellingworth and the underground casemates and tunnels were soon transformed into secure set rooms with some as deep as ninety feet underground. This preparation was to be appreciated by the operators as the South East of England came under heavy attack by the German Air Force during the Blitz.

Quality radio receivers for

interception work remained a serious issue. One of the taskings post-1936 was to design a bespoke receiver for interception work. It came into service in the early part of the war as the DST 100 and was described by operators as being a pig to handle. Ellingworth would describe it as a good receiver in the hands of a competent operator. The commencement of Lend Lease overcame the shortage of quality receivers with the arrival of first the HRO and sometime later the true Rolls Royce – the AR88.

Anecdote has it that HRO stands for 'hell of a rush order' which indeed it was. National, who designed and built them, were told by the American government to start producing them and keep doing so until told otherwise. They just kept on making them and for those who took up amateur radio post war was that indeed a blessing!

The Italian expansion in North Africa and the engagement in the Spanish Civil War was to prove a remarkable training ground for Ellingworth and his operators. The Italians were certain that their low powered battle field communications systems would not radiate over a long distance. How wrong could they have been! Throughout almost every 24 hour period the intercept operators were able to maintain constant watch on the major command networks and learnt an awful lot about the tactical use of radio in battle. Even when the Italian's introduced new radio security measures such as random frequency changing and daily call sign changes they were still able to quickly re-establish interception watch and identify station locations. The identification of operators by their 'fist' and operating errors was a real trait of the expertise of the operators at the Fort and was to play a major part in the radio war with Germany.

As the Italian Army decamped from Spain aboard a conscripted ocean liner, the operators at Fort Bridgewoods were able to retain a full listening watch on their traffic until they finally docked in Naples.

In 1938, despite there being no official tasking from GC&CS, the operators at Fort Bridgewoods had set watch on a number of radio networks that were German in origin. They were distinct in that they contained five letter groups. Fort Bridgewoods was the first British intercept station to take five letter Enigma traffic. Although they did not know it at the time this would soon be their staple diet for the war period and would mark them out as vital to the breaking of Enigma.

In August 1939 Fort Bridgewoods was in all respects ready for war. The previous two years activity intercepting Italian war traffic had allowed them to hone their skills and develop the embryonic systems that we know today as Signals Intelligence. The staff at the station had been expanded to over 100, a far cry from the original five, and this included members of the Intelligence Corps who would go on to identify whole command communications networks by the analysis of transmissions, call signs and frequencies used. One of the intelligence officers was Captain, later Major, H F Jolowicz, a professor of law from Oxford University.

The interception staff were soon into a number of what was known to be German traffic networks albeit that they were encrypted using the Enigma machine and thus no

sense could be made of their content. As the German Army crossed into Belgium, France and Holland the levels of traffic was to rise exponentially and this level of observation was to prove vital to Gordon Welchman at Bletchley Park who was trying to find a way into the machine code. Welchman had demanded 500 intercepts a day so that he could observe the makeup of the message headings. Bridgewoods had initially found this difficult as the Germans were still using secure telephone lines for traffic handling. Once on the move they had to rely on radio. The reality being that once committed to air anyone with a decent receiver can intercept what is sent. The Germans firmly believed that Enigma was, like the name of the machine, impenetrable – how wrong this proved to be.

The secret that Churchill and GCHQ really did not want coming out was not that we had broken Enigma but how we had done it. In reality it was poor crypto security, operator error and the ability to use cribs that allowed Bletchley Park to break its way into Enigma.

The German cipher operators took short cuts and were lazy and accordingly basic errors in an otherwise unbreakable system allowed a way in. That still meant a lot of hard work for the cryptographers but it made it possible for brain power to exploit the back doors that were being provided by poor crypto security.

Ellingworth and Welchman formed a close friendship and came to understand each other's capabilities and needs. Welchman inducted Ellingworth into the work at Bletchley Park and Ellingworth taught Welchman about the wonders and difficulties of HF radio communications. The relationship was vital to the work at hand, indeed special traffic watches were soon to become known as Welchman specials and regular traffic lists were sent directly to him over a secure teleprinter circuit. All the message headers were transmitted ahead of the actual intercept being despatched by motorcycle courier.

The breaking of Enigma has become public knowledge in recent years but the vital part played by Fort Bridgewoods has remained shrouded in secrecy. In late 1940 it was planned to close Fort Bridgewoods and forced a group of Code Breakers to write directly to Winston Churchill stating the vital importance of the work of the station and how critical it was to the breaking of the German code. This rested entirely upon the ability and skill of the operators who provided 100% intercept texts where other stations did not even come close. It was suggested that the breaking of Enigma hung by a thread and that Bridgewoods made the difference between it breaking or not!

The various Enigma Keys came to be known initially by colours, Red, Brown, and Green et al. As a new key was discovered from the intercepts provided by Fort Bridgewoods, Welchman would use a new coloured pencil to chart them. One of the first to be broken was Red and this initial success helped breaks into other keys.

Whilst Fort Bridgewoods was a military station it now transpired that the bulk of the traffic being intercepted originated from the German Air Force. Pragmatically, it was

decided to allow the operators to continue taking this traffic as its primary tasking as it was so vital to the efforts being undertaken at Bletchley Park.

For those who have read Most Secret War by Professor R.V. Jones, it will be appreciated the significance of his work countering the beam stations that were being used by the German Air Force to direct pathfinders onto target ahead of the main bomber streams. Good intelligence work and some early Enigma breaks had provided evidence of this German operation that could easily have brought Great Britain to its knees.

Fort Bridgewoods played a vital role in this intelligence work as by careful observation they had gained a front seat into the radio trials team who were developing the beam bombing system. As their work was secret they had been allocated their own Enigma Key, however, they were foremost engineers rather than radio operators and this provide a real prize for the interceptors. During one particular interception watch it became clear from operator chatter that they could not get the Enigma machines at both ends of the circuit to work. One operator clearly thought he was right so sent 'en clear' the full setting for the machine to the other operator. One can just imagine the glee of the intercept operator as he took this down verbatim and rushed to have it passed to Welchman by priority teleprint message. This was not the only occasion that this particular team managed to compromise the security of the Enigma code by their total incompetence.

Having a ring side seat was to permit Jones to daily predict the transmitter frequencies of the primary beam station, the reserve and the cross beam station and accordingly they were successfully jammed.

Another important period for the station was during the evacuation of allied troops from the beaches at Dunkirk. The intercept operators had broken into a stream of voice traffic which used low level code that was quickly broken at source. This was the communications between ground stations and the dive bombers that were attacking the troops and ships at the beach head. Ellingworth informed his chain of command and asked for the facility and permission to jam. A GPO line was made available directly to the high powered MF/HF station at Rugby where a 10 kilowatt transmitter was put under the control of Fort Bridgewoods. However, being a multi-national force operation it was deemed necessary by the high command that the agreement should be sought of all powers before jamming could commence. After some days delay, where the operators could do no more than swear at the set whilst the indiscriminate bombing of our troops continued, Ellingworth became so annoyed by the delay that he was minded to recall his naval history as taught at Britannia. Recalling Nelson's putting his telescope to his blind eye in order not to see the senior officers signal to withdraw; he took the conscious decision to ignore the high command directive and commenced jamming operations. The direction to dive bomber crews from the ground station was completely obliterated by 10 Kilowatt of inverted speech as Ellingworth personally read from the Bible! This cat and mouse game continued for the remainder of the evacuation with great success. Frequency change after change was achieved

with great speed reflecting the skills of both Fort Bridgewoods operators and the technical staff at Rugby.

In late 1940 an incident was to happen that highlighted the vulnerability of this most vital military asset. It was bombed just as the shift change was taking place. It was not a direct bombing raid, in fact it was subsequently established it had been a random discharge from a retreating bomber crew. A number of personnel were killed as the oil bomb exploded alongside the bridge that crossed the dry moat. A number of the fatalities were ATS teleprinter operators who were burnt to death as they sat in the back of their transport. Sid Wort, second in command, had the sad duty of attending the hospital mortuary the following day to identify the bodies.

In March 1941 station personnel were transported to Chicksands whilst the new station at Beaumanor was being readied for use. Whilst at Chicksands one of the operators Albert Stevens, a former CPO telegraphist, was to take a long intercept whilst on watch. Some days later he was called into Ellingworths's office and expecting the worst had prepared himself for a 'rollocking' of the type only Ellingworth could deliver. Instead he was asked to sit and offered a glass of finest Scotch. Ellingworth reminded him of the long intercept he had taken. It had been DF'd at the time and had provided the position of Bismark. Subsequently the copy taken by Stevens had been the only one to be complete and broken by Bletchley Park. It was the long message to Group North from the Fleet Commander. Ellingworth congratulated Stevens on the part that he had played in sinking the Bismark.

The Fort Bridgewoods operators moved to their new home at Beaumanor in early 1942 and remained civilian EWA's for the duration of the war. They were joined by some 76 school boys recruited by Ellingworth from Kent schools and trained at Fort Bridgewoods. Although designated now as a training establishment, Ellingworth kept one more secret, he still carried out interception work from there allowing him a diversity of interception. What might be missed at Beaumanor would likely be caught at Bridgewoods and vice versa.

The Army could never cope with a Lieutenant Commander in charge of an Army facility so they made him a Lieutenant Colonel. He had the last laugh though, on VE Day, he had a 12 breadth White Ensign flown from the stations flag pole.

For those who have found this interesting and would like to know the full story you might like to consider my book: Fort Bridgewoods – From Victorian Fort to WW2 Y Station' which is available from the RSGB. My working title for this research project and subsequent book was Palmerston's Enigma, reflecting the origins of the fort with the secrets that it preserved. They told me that my title would not sell books!
ISBN: 9781 9101 9309 9

Stephen RNARS 592

THE SIDE SWIPER KEY

John Taylor M0HTE

The 'sideswiper' key, as its name implies, involves keying the contacts either side of a flexible bar. It is distinct from a 'bug' where a stream of dits are supplied on the left or thumb side of the paddle and an 'iambic' key where dits are produced on the left and dahs on the right paddle.

It takes a while to get the hang of using the sideswiper but, once mastered, becomes very addictive and used in preference to the straight key. A good speed can be achieved once the operator gets used to going left and right and not try to send parts of a letter on the same side. Letter S for example would be left – right – left.

Above is a photo of my home-brew sideswiper, also known as a 'cootie' key.

Go into YouTube and put in 'cootie key' and you will see some good operators sending with the sideswiper.

I belong to a sideswiper net which meets on a Sunday evening on 3566Khz. More details may be found on the website http://www.sideswipernet.org/

John RNARS 4957

RNARS Social Media Policies

Copies of the Social Media and Data Protection policies are now available on the T&Cs / Policies page of our website.
They cover a wide range of related topics.
Please send any comments to Joe G3ZDF.

ICOM IC-7300 SCOPE SET UP

David Firth 2E0GLL

If like me you don't like being stuck with the manufacturer's settings it's worth tinkering with the controls when you have a spare half hour. While the preset waterfall display is more than adequate I wanted to see whether or not I could reprogram it to give me the presentation of a single green line modulated by the received signal input across whatever band had been selected. If you have a 7300 then the following steps will produce the required display with a continuous green line without any background signal peak persistence. **Remember to write down the original settings as you go down the list –just in case you want to revert to the original settings**.

1. Press and hold the EXPD/SET button on the screen at the bottom right hand side. A sub-menu appears.
2. To start with ensure you are the top of the menu by pressing the up-arrow on the screen more than once.
3. Now scroll down to VBW and ensure it is set to NARROW.
4. Change/check that AVERAGING is set to 4
5. Change Waveform Type to FILL+LINE
6. Change Waveform Colour (Current) by setting Red to 0, Green to 0 and Blue to 0.
7. Scroll down and set Waveform Colour (Line) to green by setting: R to 56, G to 255, B to 0.
8. Scroll down and change Waterfall Colour (max hold) Red to 0, Green to 0, Blue to 0 to remove the shadow effect behind the line.
9. Scroll down and change Waterfall Display to OFF (had no effect on my rig).
10. Optional: Scroll down and change Waterfall Peak Colour Level to 4 (from8) –I saw no difference.
11. Press the Return button to get back to the waterfall screen, and then adjust the SPAN and or EDGE controls in conjunction with CENT/FIX to finely adjust the screen presentation to your liking. Caveat Emptor.

David RNARS 4994

THE BUILDING OF SS GREAT BRITAIN

Doug Hotchkiss G4BEQ

The man - Isambard Kingdom Brunel

Brunel by the launching chains of the SS Great Eastern

In the Victorian era there was almost a religious feeling about steam, on a par with what we see happening with soccer today. Isambard Kingdom Brunel was considered, by some, the high priest of the cult that was to restore Britain's dominance of the world's merchant fleets.

He was born in 1806 in Portsmouth, the son of Sir Marc Brunel, a brilliant engineer and a royalist Frenchman who had fled his country after the revolution. His mother was English and came from Plymouth. She had met his father whilst learning French in Rouen.

During his 53 years Isambard Brunel built 25 railways in Britain, Ireland, Italy and India, 130 bridges, five of them suspension, eight piers and harbour systems and three ocean going steam vessels.

The Ship

Late in 1835 in a hotel at Blackfriars the Board of Directors of the Great Western Railway Company were at a meeting. In attendance was Brunel who was the Consultant Engineer to the company. The topic under discussion was the track system from Paddington to Bristol: some 120 miles of it. Brunel surprised the assembled company by announcing that this could be extended to New York if a suitable steamship were built capable of reliable regular sailing. It would also mean that passengers could purchase a ticket at Paddington for the through journey.

The Directors took his suggestion seriously and set up a 3-man committee to examine the proposal in greater detail. This shows what energetic, forward thinking people these directors were. In modern parlance this was like someone suggesting at the end of WW2, when military aircraft were being converted to passenger planes, they should design a supersonic aircraft for transatlantic flights. How many of our modern day directors would have taken that suggestion seriously let alone investigate it in depth. The Atlantic trade at that time was dominated by fast American clipper ships of some 500 tons. They were making crossings averaging 36 days out, 20 days return. When

Brunel made the suggestion, no steam vessel had ever crossed the Atlantic. His intention was that the crossing should be cut to 20 days out, 13 days return. Steam vessels were not new but never anything on the scale he was proposing. In 1788 a very young Robbie Burns went for a trip in a steam boat. The vessel consisted of two hulls with a couple of paddle wheels in line behind them. In one hull was the boiler and in the other the engine, it had two vertical open topped Newcomer cylinders of some four inches diameter and an eighteen inch stroke. This engine still exists in the Science Museum.

In 1836 the committee submitted a favourable report and it was agreed to set up the Great Western Steamship Company. Brunel was tasked to design a ship and once more surprised everyone by stating that the ship should be a large vessel of some 1200 tons capable of crossing the Atlantic without running out of coal. Due to the scheming of fellow competitors, the Great Western, as the ship was to be named, was not the first to carry out such a crossing. A small 700 ton vessel called Sirius chartered by the British Transatlantic Steamship Company beat her by a few hours having set out a few days before. This was due to the remarkable seamanship of her Commander, a Naval Lieutenant, and at the expense of burning some of her cargo to achieve it. The Great Western arrived a few hours later but still had 200 tons of coal in her bunkers. It had taken her 15 days and she was to return in 14 days. Although not the first to cross the Atlantic, she was the first to be laid down and equipped for continuous Atlantic crossings. The Sirius was a once only trip. The Great Western had proved that it was possible to provide a reliable fast service and quickly eclipsed the sailing packets both in speed and comfort so that passengers were keen to sail in her.

Two years later due to the commercial success of this venture the company decided to build a sister ship to be known as City of New York. Brunel, flushed with the success of his creation had grander ideas. During the next two years he produced some five versions of his new ship and on each occasion it grew in size.

Because of this increase in size it was felt a better name for this new ship would be Mammoth.

During the later planning stages the first of two very important changes were made. Wooden construction was no longer feasible. Brunel had calculated that the Great Western was as large as one could go using that medium. One of the reasons for this was Brunel's fascination with a vessel called Rainbow. This was a small vessel built of iron that had arrived in Bristol to demonstrate its powers. Brunel sent two of his trusted lieutenants onboard to take passage to Antwerp to evaluate its possibilities. He was impressed with the report they submitted and became convinced that his new vessel must be built of iron

He used 6x2.5 foot sheets of wrought iron plate riveted to 6x3 inch frames which were spaced 20 inches apart. The plates overlapped each other which gave 15% added strength compared to flush fitting plates. This was to set a new standard in all future shipbuilding.

When Brunel put his new ship out to tender no one came forward. There were two reasons for this. None of the shipbuilders had any skills in building such a ship, contemporary thinking deemed it impossible. The other major factor was that none had a slipway big enough or strong enough to take it. Undeterred, Brunel decided to do it himself.....what do they say? ... If you want a job done properly, do it yourself, an old maxim but in this case true. He built the Great Western Dock for the purpose.

The keel was laid in July 1839. The vessel on completion would be some 3675 tons, three times that of the earlier Great Western. Because of this vast size and all the new techniques that would be put into her it was now decided that her name would be the Great Britain. She was the fore runner of the future modern vessels as we now know them being of metal construction, steam powered and screw propulsion. She would become famous not only because of her size but also for the number of features that were to revolutionise and extend the frontiers of ship building. Her bottom was given strength and longitudinal stiffness by a series of 10 deep girders running fore and aft on top of which was more plating - a form of construction that we now know as double bottom. There were five transverse bulkheads, designed to be watertight in the event of collision or grounding. A balanced rudder was also introduced which made steering extremely light compared to the unbalanced rudder currently in use by all other vessels.

Ten months into the building the second major change took place. Brunel took all by surprise by stating that paddle wheel propulsion was not the way forward. It was wasteful of power and inefficient in all but ideal calm conditions. Screw propulsion was the way forward. The reason for this argument was that he had been impressed with another small vessel called Archimedes which had arrived in Bristol to demonstrate a novel method of propulsion using a screw propeller. It was the invention of Francis Pettit Smith, a farmer from Hendon. He hit upon this novel idea after experimenting with model boats on his farm pond. Brunel chartered the vessel for six months to carry out his own trials which convinced him that this was the most efficient method of ship propulsion.

A popular belief that has developed over the years is that the engine that was to drive the paddles was turned 90 degrees and adapted to drive the propeller. Totally untrue, Brunel co-opted a gentleman by the name of Thomas Guppy, a successful engineer

and one of the three man committee that had sanctioned the Great Western. He was tasked with producing an engine that would drive this massive vessel across the Atlantic. He derived much of his inspiration for his engine from a design that Brunel's father had made in 1822. This was called the triangle engine. It was the first "V" engine which drove upwards to an overhead crankshaft. The engine that was to drive the Great Britain had four cylinders working in pairs and inclined upwards and outwards at an angle of 60 degrees, the pistons were 88 inches in diameter and worked with a 72-inch stroke to an overhead crankshaft.

The crankshaft was a wheel of 18 feet in diameter and 38 wide which, by a system of chains toothed on their inner side, turned a smaller 6-foot wheel attached to the propeller shaft below. The engine was rated at 1600 HP and designed to rotate at 18 rpm using steam at 5 psi raised from salt water, heated by coal fired boilers of which there were 24. Another innovation designed by Brunel was to pre-heat the feed water using waste heat from the funnel. Contrary to present day systems here we have an engine that turns more slowly than the propeller.

The massive crankshaft, mounted above the engine, protruded 4 feet above upper deck level and was housed in a large deckhouse. Passengers used to watch it rotate with great fascination through the skylights.

The engine was built in the Great Western's own workshops and a model of it is now in the Science Museum in London.

The size and design of the propeller and prop shaft was toy-like on the Archimedes compared to the one required on this 3600-ton giant. The genius of Brunel once more came through. The centre of the prop shaft was made of thin wall 6x2 foot iron plates and shaped to form a tube some 61 feet long and 30 inches in diameter. At each end were shorter solid shafts rotating in bearings. The propeller, the first large one ever constructed, was six bladed, some 15 feet in diameter and 4 tons in weight. Each blade was made separately and riveted to the centre boss. The art of manufacturing a solid propeller came many years later.

When a scale model of this propeller was compared with a scale model of that used on a modern super tanker at Teddington in 1970, it was found to be within 5% as efficient.

Her certificate of registration described the ship as a “schooner rigged with standing bowsprit, square stern with false galleries and royal arms figurehead". In truth she was a steamship with auxiliary sails, which would only be used if the winds were favourable to save coal. Her sailing arrangements were unique. She had six masts which were nicknamed Monday through to Saturday. The only one made of metal and

stepped to the keel was the mainmast. All the other masts were stepped on swivel bases on the upper deck. The rigging was iron wire, apart from the tackles. This was another Brunel innovation, the forerunner of steel wire rope as we know it today. It was needed to hold the masts rigid. The sail arrangement was designed to save labour and to be handled mainly at deck level. Only 30 men were required to handle the sails. The Times commented that her sailing arrangements "looked like a laundress's yard prepared with props and wires for hanging out clothes". She carried 16,000 square feet of sail, a vast amount but modest compared to what a traditional sailing vessel of a similar size would have to carry. In later life she would be carrying 33,000 square feet due to the changes made in her mast arrangements. Only the main mast was square rigged which did require men to go aloft.

Late in 1844 she moved out of dock to begin the long journey down the River Avon to the open sea. Because the promised action by the Town Council to widen the locks, into and out off the Cumberland Basin, had not been carried out, there would be great difficulty in getting her through. In fact she got stuck and had to be hauled back and the top coping stones of the lock removed. It took Government intervention to force the Council to carry out these modifications.

Whilst being towed down river steam was raised and preliminary trials were carried out in the Bristol Channel. With her engine rotating at 6 rpm she logged four knots. Speed was slowly increased and on reaching Portishead she was logging 11 knots and the engine was rotating at 16 rpm. At this time only 18 of the 24 boilers were in use. The balanced rudder worked perfectly and the Master commented on the fact she was handling like a yacht. All onboard remarked on the total lack of vibration and noise.

Doug RNARS 0626

PORTISHEAD RADIO WEBSITE

The website of Portishead Radio has been revamped. There's plenty of audio and video files, photographs and history of the old place, sadly long demolished.

Website at www.portisheadradio.co.uk

Larry G4HLN says all contributions will be gratefully received.

WHAT DID IT TAKE TO BE A SPARKER[1] IN 1899?

CJC Kidd G3YTQ

Here is the Syllabus proposed by Marconi and forwarded by Captain Jackson; Course of 10 Days' Instruction for Operators of the Wireless Telegraph, with a previous knowledge of the Morse Code, proposed by Mr Marconi.

1. How to connect coils in series or parallel, and to understand the possibility and danger of short circuits. A knowledge of the connexions (sic) of transmitting apparatus, battery, key, induction coil and earth.
2. Adjustments of spark, adjustments of contact breaker and how to remedy small defects in the insulation coli.
3. A knowledge of the connexions of the receiver, cells, relay, tapper, tube, jigger, chokes, shunts and earth.
4. How to align and test relay.
5. To mount and test a tube, how to adjust tapper and how to adjust the inker and change paper.
6. How to mount and insulate aerial wire, and knowledge of how to fit it to a ship, how to test insulation of aerial wire, and earth tests.
7. Practical signaling

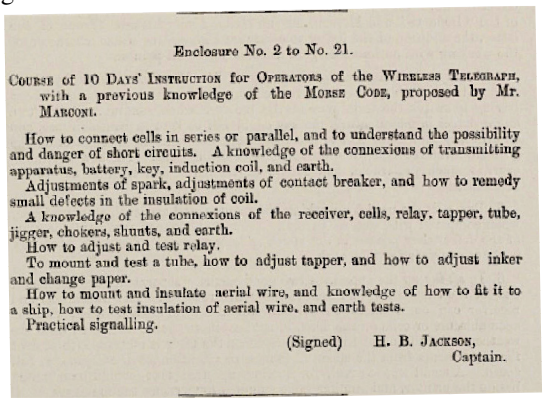
(signed) H. B. Jackson
Captain

DECODE

The tube mentioned above is the Coherer. A Jigger is a type of transformer used in the Ae circuit. The tapper is to clear the coherer after a dit or dah has been received. The inker is used to record, on paper the Morse signal for reading by the operator- think of a ticker tape machine operated by clockwork

Clive RNARS 0690

And here's the original:



Enclosure No. 2 to No. 21.

COURSE of 10 DAYS' INSTRUCTION for OPERATORS of the WIRELESS TELEGRAPH, with a previous knowledge of the MORSE CODE, proposed by Mr. MARCONI.

How to connect cells in series or parallel, and to understand the possibility and danger of short circuits. A knowledge of the connexions of transmitting apparatus, battery, key, induction coil, and earth.

Adjustments of spark, adjustments of contact breaker, and how to remedy small defects in the insulation of coil.

A knowledge of the connexions of the receiver, cells, relay, tapper, tube, jigger, chokers, shunts, and earth.

How to adjust and test relay.

To mount and test a tube, how to adjust tapper, and how to adjust inker and change paper.

How to mount and insulate aerial wire, and knowledge of how to fit it to a ship, how to test insulation of aerial wire, and earth tests.

Practical signalling.

(Signed) H. B. JACKSON,
Captain.

[1] Naval slang for a radio operator

ME AND MY SHACK

This is the shack of Uly HB9ASX RNARS 1033 but as he says "*I am a very much silent/passive member of the RNARS – my HAM activities are at a very low scale. More time goes into sailing* 😊 *the Baltic and the Norwegian coast; however, I am QRV on our yacht as HB9ASX/mm. The rig is carefully stowed away (picture) to a location suggested by the 'admiral' (my spouse). The equipment is mainly used in weather report reception and email transmission (WINLINK) , despite it being much faster over the phone and internet… The second hand FT100 feeds into an antenna tuner at the base of the back stay and a decent copper mesh in the aft cabin serves as a capacitor to ground, hence no additional hole through the hull*."

CONNECTING SHOREHAM HARBOUR - PAST AND PRESENT

Howard Felstead M0HJF

In the 1800's mindful of possible invasion from the sea, forts and lookouts signalled to the Admiralty in London, during daylight hours. A chain of signal semaphore stations, running along and over the South Downs from Portsmouth and Dover was built. This allowed messages to reach London in 7½ minutes rather than 4½ hours by horseback. Coastguards reporting smuggling and shipwrecks also communicated along the south coast using line of sight signalling stations, with lights and flags from the hill tops and churches etc.

By the time Shoreham Fort had been built in 1857 visual communications were being replaced by land line telegraph in conjunction with the building of railways. Messages sent in Morse code could be received in seconds throughout the British Isles and beyond.

In the early 1900 the use of radio was rapidly developing with the installation of receivers and transmitters both on land and ships. There was no regulation and the damped spark gap technology meant unreliable communications, with regular interference between professional and amateur stations alike.

On a cold night in the Atlantic in 1912 RMS Titanic sank and after that all changed. It became mandatory for radio watch hours, distress frequencies, priority for distress and safety traffic and radio silence periods all to be standardised. Even after a hundred plus years, distress alerting can still rely on a human listening to a receiver.

The understanding of propagation and technologies in radio developed way beyond what was known by pioneers such as Hertz and Marconi. In the Titanic era low frequencies such as 820KHZ were being transmitted while now technology allows higher frequencies. At present Shoreham Harbour Radio operates on VHF 156.700 MHZ, Channel 14.

All year, volunteers of the National Coastwatch[2], in the adapted WW2 gun aiming light tower, on the east side of the Fort, are on duty. Over the last 5 years Worthing and District Amateur Radio Club have run a special event Radio Station, call sign GB1SCW at the lookout.

Howard RNARS 5023

[2] The National Coastwatch Institution (NCI) is an entirely voluntary organisation keeping a visual watch along UK shores. Each station assists in the protection and preservation of life at sea and around the UK coastline. Currently 50 NCI stations are operational and manned by over 2000 volunteers keeping watch around the British Isles from Rossall Point in the North West, through Wales, to Wearside in the North East.

Cadet Challenge - Comms Task

Simon Langlois GD4ODX

The Cadet Challenge is held in Jersey every year, putting cadets through their paces with a range of tasks including First Aid, Map & Compass, Fieldcraft, Inspection, Timed March and of course, Communications. Competing for the trophy are 10 or more teams of 8 cadets from Sea Cadets, Marine Cadets, Army Cadets, Air Training Corps and CCF (Navy, Army and Air Force) and needless to say, there's a very high

level of rivalry!

It's an all day event run each November, regardless of the weather, with a team of more than 20 CFAVs (Cadet Force Adult Volunteers) and visiting VIPs including Jersey's Lieutenant Governor, currently Air Chief Marshal Sir Stephen Dalton, GCB, ADC to keep the cadets on their toes! The local Jersey Evening Post gave it a full page of coverage which always helps with publicity.

Teaching Comms (CIS) to the Sea and Marine cadets for the last 25 years is an ex-MN R/O, Simon (GJ4ODX / RN2825). He was pleased to announce that, despite coming 3rd overall in the Cadet Challenge, the Marine Cadet team took first place in the Comms task! They had to prove their proficiency in voice procedure, phonetic alphabet and accuracy of sending and receiving battlefield style messages over the radio. BZ! Let's hope that these early experiences with radio encourage them to progress to Amateur Radio in the future.

Simon, CIS Instructor T.S. Jersey MFQ15,
RNARS 2825

MEMBERSHIP CHANGES

A very warm welcome to our new members and up-dates

New Members		
Rev Hein Bartram	VE5TEN	5039
Dave Pennell	NP2MR	5040
DSTL Radio Club (Fort Halstead)	G3BRK	5041
Will Jones (Will is the first member to join under the new Under-25 rule.)	M6WRJ	5042
Michael Moore	SWL	5043
Alan Rachett	SWL	5044
Re-joiners		
Derek Andrews	G4EZZ/F4VQE	2228
Changes		
Resigned		
Silent Keys		
Stan Spencer	G3ZIN	0930
David Waugh	GI3OBO	0150
Mickey Warr	ZS1WA	0092

COLIN WHALE VK4CU SK

Here, for those of us who knew him personally:
Colin VK4CU RNARS 1561 became a silent key at 1455 on Saturday 9th December 2017 in the Northwest Private Hospital at Everton Park in Queensland after a two and a half year battle with Prostate Cancer. He passed away peacefully with Anne, his wife, at his side.
Colin leaves just Anne. The funeral was held on Monday 18th December. Colin was a life member of the Society.
He will be readily remembered by those who knew him when he was Maritime Mobile for all those years in the Far East as a First Radio Officer on board various Bulk Carriers between Brisbane and the main ports in the Areas from Japan down to New Zealand (CW ONLY).
He was also one of the stalwart helpers within the Maritime Museum in South Brisbane where he was mainly responsible for the operations and upkeep on board H.M.A.S. DIAMANTINA and the sea-going tug "Forceful" which belonged to the Museum.

Wally Walker
G4DIU RNARS 0391

THE LOADED VOLTAGE DIVIDER & ITS CHARACTERISTIC CURVES

Jürgen H. Timcke HB9ANE

Reading the title perhaps the one or other reader will ask himself: why to write an article about such a simple circuit like a voltage divider?

I will explain it.

During the reading of one of my books about various interesting circuits I found some information regarding the electrical behaviour of the loaded voltage divider compared with the unloaded one.

Refer to circuit B showing the addition of R3 in parallel to R2 now loading the original circuit A with the consequences of doing this given below:..:

1. The total resistance R *falls*.
2. The total current J1 *rises*.
3. The component voltage U1 at R1 *rises*.
4. The component voltage U2 at R2 (and R3) *falls*.

To this see figure 1

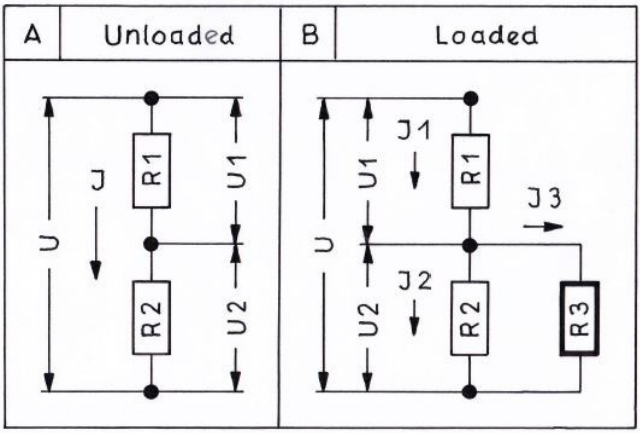


Figure 1
Circuit of the unloaded and loaded voltage divider and the designation of the voltages, currents and resistors (as used in this treatise). Thick bordered: the load resistor R3

In the book was additionally presented a not very meaningful diagram and because of that I did not present it here.

Well, these 4 statements are only words concerning the „up“ and „down“ of the mentioned values.

However, no further information was given regarding e.g. the characteristic curves of them, based on calculations for different values of R3 combined with different values of U, R1 and R2 of unloaded voltage dividers.

Because of that I was curious and decided to make a study about this to find answers to arising questions. The result led to this article.

To simplify the text of this treatise I used for the two different voltage dividers the following abbreviations:

< Unloaded voltage divider = ULVD

< Loaded voltage divider = LVD

Questions arising

Influence of different voltages U (cases A-B-C-D), at R1 and R2 = constant, on the characteristic curves of J, U1 and U2 of the LVD (Treated in part 1).

Influence of the exchanged resistors R1 and R2 (case E) on the characteristic curves of R, J1, U1 and U2 of the LVD (Treated in part 2).

Influence of equal values of the resistors R1 and R2 (case F) on the characteristic curves of R, J1, U1 and U2 of the LVD (Treated in part 3).

Influence of the resistors R2 = 0,5xR1 (case G) on the characteristic curves of R, J1, U1 and U2 of the LVD (Treated in part 4).

ULVDs as basis for the study

Seven ULVDs with different given values of U, R1 and R2 for the cases A to G, see Figure 2, were the basis to treat the mentioned 4 parts. Note that the sum of R1+R2 = 300 [kΩ] is constant.

Each of the 7 cases was combined by calculation with 15 different values of R3:

R3 [kΩ] = 3-6-9-12-15-30-60-90-120-150-**300**-600-900-1200-1500

Result: 7 cases x 15 values of R3 = 105 combinations.

For each of the 15 R3-values 10 calculations were necessary to get the numerical values for the later to calculate dimensionless values for the diagrams with the characteristic curves.

Result: 105 combinations x 10 calculations = 1050 calculations.

To the calculation of the total resistance R has to be noted: for the ULVDs the value of R is just the sum of R1+R2, but for the LVDs one has at first to calculate the parallel resistance of R2 and R3 and hence it follows: R = R1 + [R2xR3 / (R2+R3)].

The calculations of J, J1, J2, J3, U1 and U2 are all based on the well-known Ohm´s Law and do not need any additionally explanation.

Presentation of the characteristic curves

The wide range of the calculated dimensional numerical values of R [kΩ], J1 [mA], U1 [V] and U2 [V] as well as the wide range of the load resistors R3 (3 [kΩ] to 1500 [kΩ]), presented in diagrams with linear X- and Y-axis, led to not acceptable solutions.

Because of that I decided:

< to convert all required dimensional numerical values into dimensionless ones (a further 420 calculations!)

< to use for the X-axis a logarithmic and for the Y-axis a linear scale division.

The dimensionless values of R, J1, U1 and U2 at the Y-axis are quotients, e.g.: R_{loaded} / $R_{unloaded}$

The dimensionless values of the X-axis are the quotients of R3 / (R1+R2). As to see in figure 2 the sum of R1+R2 is constant for all 7 cases and for that reason for R3 = 300 [kΩ] the dimensionless value is R3 / (R1+R2) = 1 [-] (bordered) and the appertaining points/values in the characteristic curves are marked, additionally to the little circles of the calculated values, with a „great“ circle.

Unloaded voltage divider

Line	Part	Case	Given			Calculated						
			U	R1	R2	R	J	U1	U2	U1+U2	U1/U2	R1/R2
			V	kΩ			mA	V			—	
1	1	A	150	270	30	300	0,5	135	15	150	9	
2		B	100				0,333	89,991	9,999	99,990		
3		C	200				0,666	180,009	20,001	200,010		
4		D	1500				5	1350	150	1500		
5	2	E	150	30	270	0,5		15	135	150	0,111	
6	3	F		150				75			1	
7	4	G		200	100			100	50		2	

Figure 2
Given and calculated values of the unloaded voltage divider

Check of the dimensionless values

Regarding the presentation of the diagrams for this article I checked the dimensionless values for them in such way, to draw for each part (1, 2, 3, 4) draft-diagrams for R, J1, U1 and U2, altogether 12 (J1 and U1 in one diagram, because, dependent on the part, the dimensionless values of J1 are admittedly different, but equal like those of U1 (that means I could „save“ 4 draft-diagrams!).

Because these draft-diagrams are, each for itself alone, not very meaningful for the reader, I have not included them in the article and therefore searched for better and, first of all, more meaningful diagrams to show comparatively the effects of the different influence quantities on the dimensionless values on the one hand as well as on the tendencies of the characteristic curves on the other hand.

Final results

Summarizing present the figures 3, 4 and 5 the final results of my study. These diagrams, respectively the tendencies of the characteristic curves, confirm the mentioned 4 statements regarding the behaviour of R, J1, U1 and U2 of LVDs compared with ULVDs.

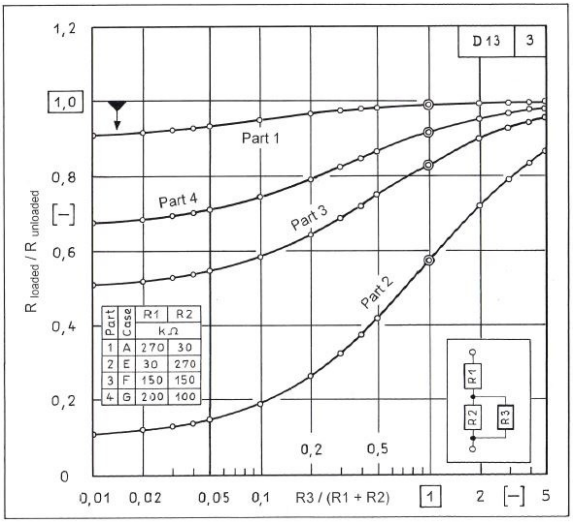


Figure 3
Comparison of the curves of the dimensionless values of the total resistance R for different value-combinations of the resistors R1 and R2, dependent on R3 / (R1+R2): confirmation of statement 1!

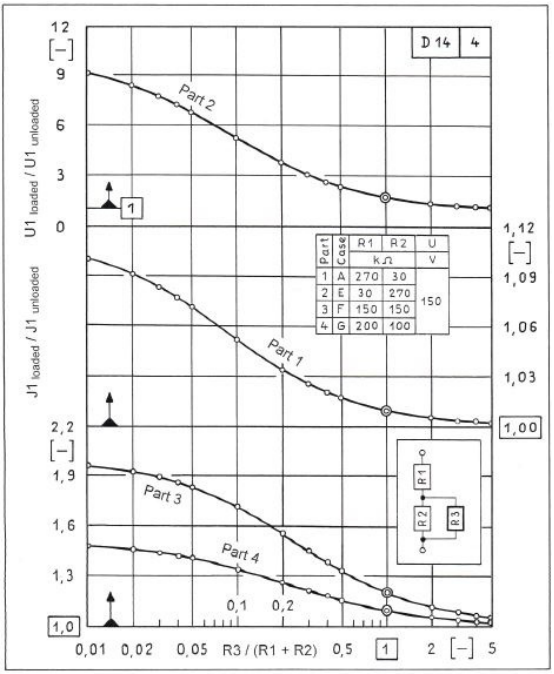


Figure 4
Comparison of the curves of the dimensionless values of the total current J1 and the component voltage U1 for different value-combinations of the resistors R1 and R2 at U = const, dependent on R3 / (R1+R2): confirmation of statement 2 and 3!

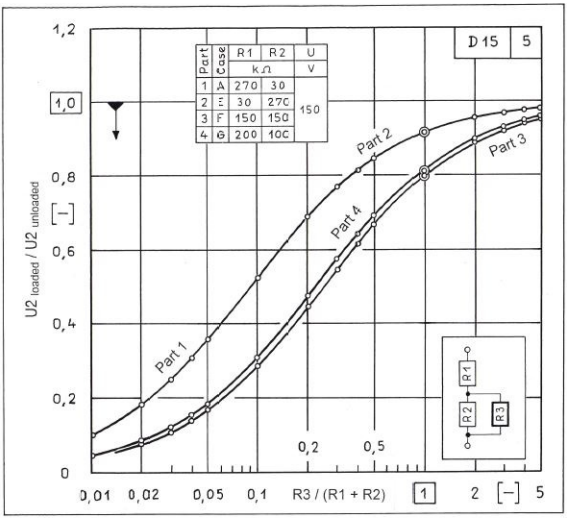


Figure 5
Comparison of the curves of the dimensionless values of the component voltage U2 for different value-combinations of the resistors R1 and R2 at U = const, dependent on R3 / (R1+R2): confirmation of statement 4!

The 3 diagrams with their captions are self-explanatory and for that reason further comments are not required.
Request: In not one of the technical specialist books of my library I could find diagrams like these. In the case that the one or other reader has already seen such kind of diagrams I would very much appreciate to get an information.

Example of a loaded voltage divider

A classic example of a loaded voltage divider in practice is the connection of a voltmeter to measure the anode voltage of a tube, see figure 6

The input resistance of the voltmeter acts in this case as load resistor R3 (see figure 1). The measuring instrument can be either a multimeter or a vacuum tube voltmeter (VTVM).

Assumed the existing anode voltage is U_a = 280 [V]. The external resistance R_a acts then as R1 and the internal resistance R_i of the tube as R2.

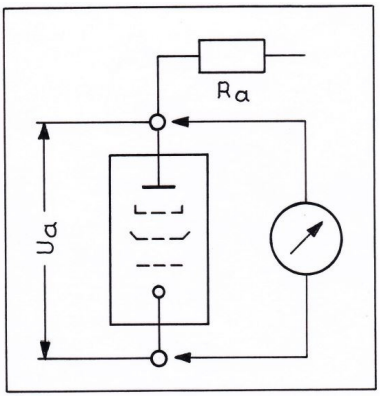


Figure 6
Classic example of a loaded voltage divider: measurement of the anode voltage U_a

How influences the input resistance of the measuring instrument the measured anode voltage U2, compared with the existing one?

Multimeter with input resistance R_i = 250 [kΩ], measured: U2 = 183,9 [V] = 65,7 [%] of the existing anode voltage.

VTVM with input resistance R_i = 11 [MΩ] = 11000 [kΩ], measured: U2 = 276,7 [V] = 98,8 [%] of the existing anode voltage.

Both measured values U2 confirm on the one hand the statement „4“ and show on the other hand very clearly in which way the input resistance of the measuring instrument influences the measuring result.

Quotation to this from [4] of the bibliography:

„When working with valves, a modern voltmeter or universal meter is of little or no use. So, a VTVM is the solution.“

Jürgen RNARS 3493

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[2] Grundlagen der Elektrotechnik
-Zum Einstieg in die Elektronik-
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[3] Werner W. Diefenbach
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Franckh´sche Verlagshandlung Stuttgart
[4] Bengt Grahn SM0YZI
Valves Revisited
Published by the Radio Society of Great Britain

Drawings, table and diagrams: Author
Layout: Rolf Rüttimann

MALE OR FEMALE?

A teacher of Spanish was explaining to her class that in Spanish, unlike English, nouns are designated as either masculine or feminine.
House for instance, is feminine: ‘la casa’. Pencil is masculine: ‘el lápiz’. A student asked; ‘What gender is a ‘computer’?’ Instead of giving the answer, the teacher split the class into two groups, male and female, and asked them to decide for themselves whether computer should be a masculine or a feminine noun. Each group was asked to give four reasons for its recommendation.

The male group decided that ‘computer’ should be of the feminine gender; ‘la computadora’, because:

- No one but their creator understands their internal logic.
- The native language they use to communicate with other computers is incomprehensible to everyone else.
- Even the smallest mistakes are stored in long term memory for possible later retrieval.

- As soon as you make a commitment to one, you find yourself spending half your pay on accessories for it.

The female group, however, concluded that computers should be masculine; 'el computador', because:

- In order to do anything with them, you have to turn them on.
- They have a lot of data but still can't think for themselves.
- They are supposed to help you solve problems, but half the time they are the problem.
- As soon as you commit to one, you realise that if you had waited a little longer, you could have had a better model.

CAAn You Connect Your Laptop?

Mike M0CAA & Sue M0BOZ

Published originally in the Journal of the Horndean & District Amateur Radio Club

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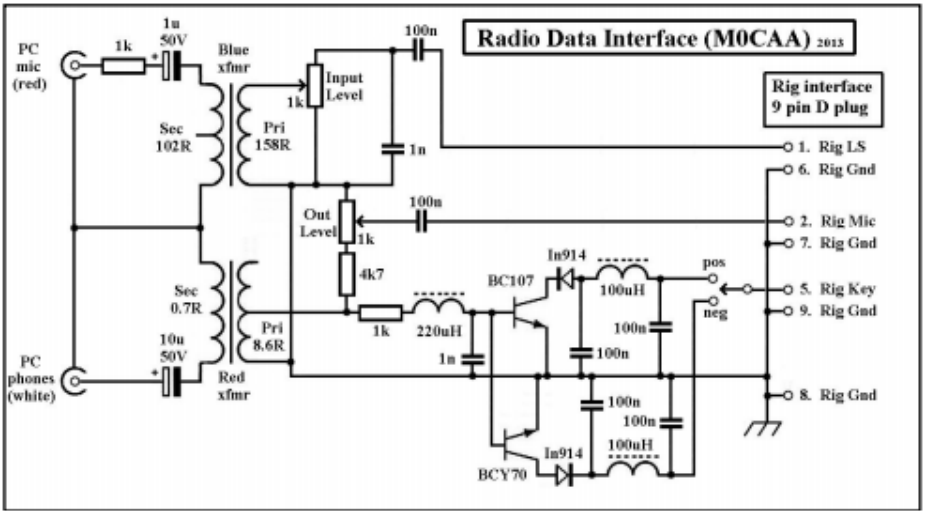
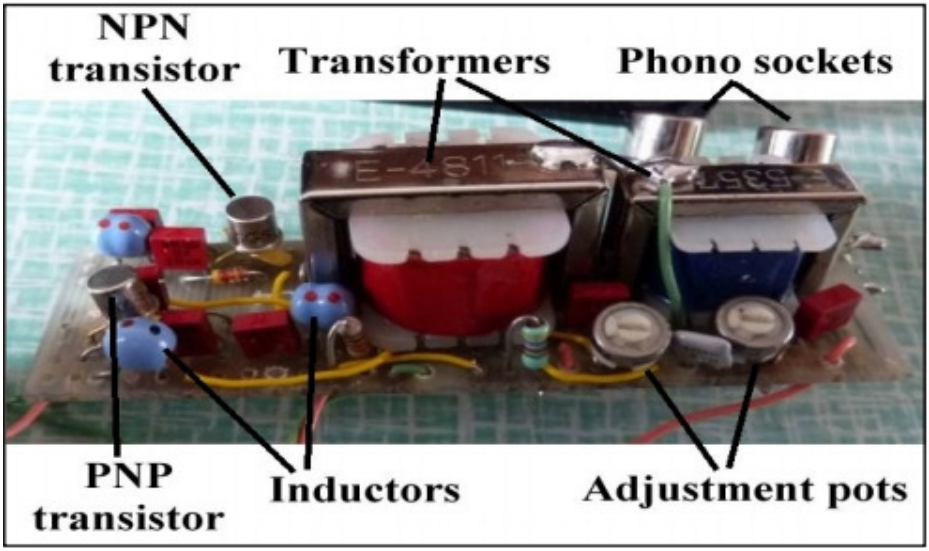
From time to time I have dabbled in data modes (slow scan TV, Digipan, etc) and needed to connect the radio to the computer. Direct connection is possible at low transmit powers (QRP) but an isolating connection is better and fairly essential above 5 watts, when the PC becomes part of the antenna, not good!

In the past I have home-brewed interfaces for the rig and computer in use at the time using small audio transformers from the junk box. Trouble is you change the rig and need to do it all again, then you keep finding mysterious leads and can't remember what they were for! Previously rig control (PTT) was done using the control lines on the 'Comms' (RS232) port but modern PCs don't have them anymore as they use USB. I purchased a cheap USB to 'Com' port adaptor from EBay but found it didn't have the control lines implemented. It appears these are designed for updating car GPS units and use X-on/X-off control.

Things came to a head when I was doing some low power CW on the shortwave bands. You have to send a lot of CQ calls on QRP before anyone answers, so some assistance from a laptop would be good. One thing all the radio software programs I use have in common is they all have a manual mode where the coded signal comes out the audio port when TX is activated. So why not use that to activate the transmission? Armed with hot tea and soldering iron, it was time to raid the junk box.

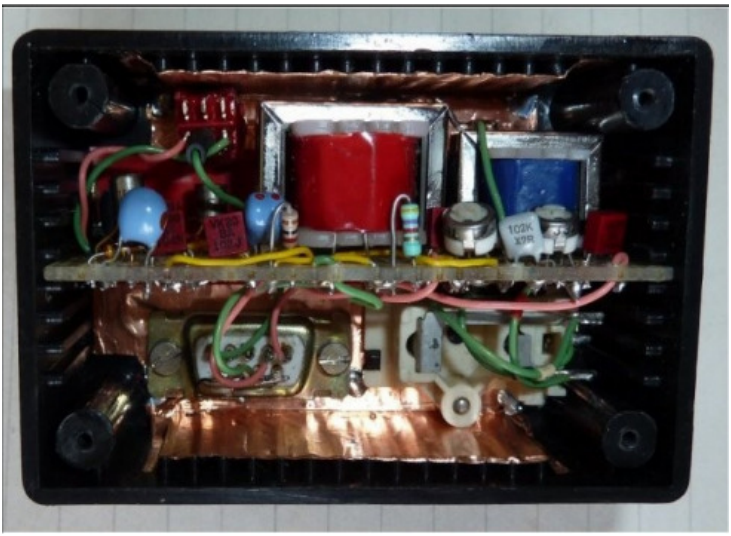


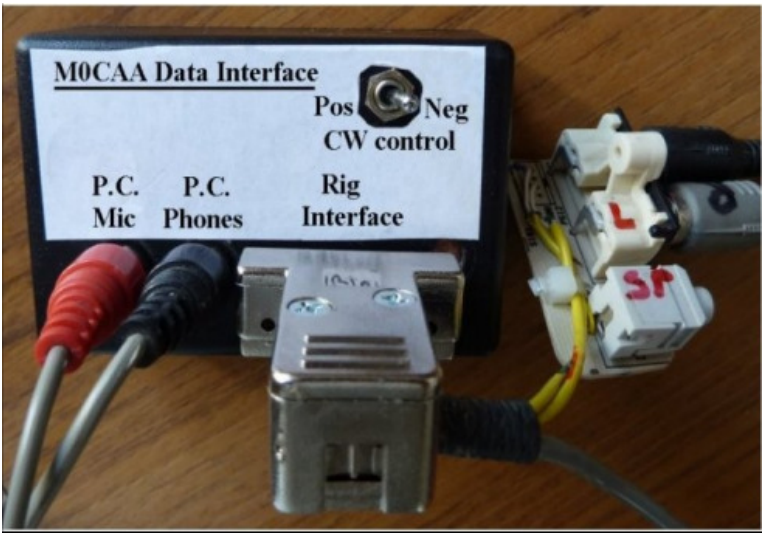
AUDIO ISOLATION I removed 2 audio transformers from an old transistor radio and added preset potentiometers to allow adjustment of the signal levels. The capacitors in series with the inputs and outputs provide DC isolation.



RIG CONTROL I then built what is basically a VOX switch to operate the rig's PTT / KEY input as soon as data is sent. This is basically a simple transistor amplifier. When the audio signal goes above 0.7 volts, the transistor will turn on, making its collector pull the voltage on the PTT switch to ground. There is a danger that some RF from the transmitter will get into the input and also be amplified, keeping the circuit switched

on. A low pass filter at the input (using an inductor removed from a scrap video recorder) helps stop this. A diode is placed in series with the output to stop reverse voltages damaging the transistor. Another low pass filter at the output provides yet more RF isolation. The output from this circuit will not be a permanent low as it is only 'on' during the positive half cycle of the audio signal. This doesn't actually matter as all rigs have smoothing (switch bounce suppression) on the PTT and KEY inputs. Adding further smoothing is inadvisable as we don't want any significant delay between the audio signal and the transmission starting.





PAST PROOFING!

Most modern rigs have a positive voltage on the PTT and KEY inputs and for this an NPN transistor will pull this to ground. However older rigs like my Yaesu FT101B use a negative voltage and for this it is necessary to use a PNP transistor. I have both circuits and a switch to select 'old timer' mode.

GOOD HEAVENS - IT'S IN A BOX.

The junk box provided a small plastic box (metal might be better) which was lined with copper tape to screen the circuit. A scrap video recorder provided a plastic block with 2 phono connectors for the audio connection to the laptop. This is ideal as the earthy end must be isolated from the rig ground. A 9-pin D connector was used for the rig connections. This allows leads to be made for different rigs using screened cables. The circuit was made up on a strip of prototyping board cut to fit into the box. Point-to-point wiring was kept as short as possible and the transformer frames taken to ground. The adjustment pots were placed at the top for access.

ANY GOOD?

There is a slight delay between the audio starting and the rig going into transmit. For data modes the rig is switched to PTT mode and connection made to the PTT switch connections. This worked well as there is usually a leader before the data starts so you miss nothing. On CW the rig was switched to VOX mode and connection made to the KEY input. The slight delay causes a shortening of the first element of the first letter. Not a problem in the UK for me with CW at 12 WPM because for 'CQ' you're sending a dash and it's repeated anyway so you don't notice. If you were attempting a QSO with a French station at higher speeds you would be sending a dot and you might need a couple of 'R's before you start to prevent losing the first element. Above 50 watts I had to disconnect the laptop from the mains and add some ferrite rings to the connection leads, to stop the RF causing it to jam on transmit. It also worked well using my Android tablet but I had to make a breakout lead to connect to the headset jack on the tablet.

CONCLUSION

I hope this give you some ideas as to what can be done with scrap components and maybe sparks some homebrew projects.

Happy bodging - Mike & Sue (M0CAA & M0BOZ)

Affiliated Clubs: As well as hearing from members, perhaps some of our affiliated clubs might share their news? Do you have any rallies or DXExpeditions planned; don't keep it a secret, send in your news and pictures.

SEA STORY – CONTINUED © ERIC BRAY

Tuesday morning was much the same, but without the drunken LRO; Morse tapes and radar tapes. In the afternoon, we scrubbed and polished - - .

Wednesday was the same, with one exception. After about ten seconds of frantic scribbling, Slinger remarked, -"Hey! This is a different tape, that's not fair!"

Our marks slumped dramatically.

Thursday came and went, and then it was Friday. Morse, radar, scrub and polish. At four, we were told that on Monday we would be expected to start work for real, and our duty watches would apply. As 1st Starboard was the duty watch over the weekend, if any of us were 2nd Starboard, or either of the Port watches, we could apply for 'Cinderella' leave. The answer to our inevitable question was "Back on board before midnight!" That meant that Slinger and Bagsy could go. I was duty watch. It fell to me to clean our 'part of ship' over the weekend. Because of all the hoses, cables, and debris in the passageway outside the EWO, I could only pretend. I picked up the worst of the portable rubbish, and disposed of it. It also fell to me to scrub out our part of the mess-deck, ready for Evening Rounds.

Pete, who was also 1st Starboard, nominally supervised, then 'stood' rounds, reporting that 4P2 mess was ready for your inspection, Sir!" to the Midshipman who had been lumbered with the task. (Officers have their pecking order, too!).

"Very well!" The middy poked his head round the door. "Many in tonight?"

"Three, Sir."

"Carry on."

"Sir."

"Where's next, PO?"

"This way." The grizzled PO Stoker wasn't about to call a teenager Sir!

On Saturday, when prompted, I followed Pete to the Master's office, where the duty watch was mustered. After being counted and ticked off a list, we were told to report to our 'part of ship', but to listen out for 'pipes' on the p.a. There we, meaning I, scrubbed and polished the EWO.

At thirteen hundred, the duty watch was mustered, counted, and ticked off, then sent to hide.

It happened again at twenty hundred, with a reminder to be 'here' at oh-nine hundred.

Sunday was a repeat, but I just brushed up in the EWO, as nobody had been in.

On Monday, Slinger and Bagsy were duty, along with Henry. I had leave from midday until midnight. Apart from that, the week was no different to the previous one. Morse, radar, scrub, hide. I had 'Cinderella' that weekend.

On the Monday week, the dockies let the water back into the dock, as Hermes' bottom-scrape and re-paint was complete. We were towed back round to Middle Slip, but we saw nothing of it. It is strange how a couple of zillion tons of steel can feel different when it is floating, compared to when it is solidly down on the blocks in a dock.

Tuesday dawned. We were volunteered for 'Store Ship', and sent to report to the PO on the jetty. We spent the forenoon staggering up the forrard brow, carrying crates of cans, sacks of vegetables, slabs of frozen meat, bundles of broom handles, baulks of timber, and anything and everything else that gets used up. From the brow, we went down to four deck, then along to the appropriate store, usually on seven deck or lower, then back, via the aft brow, and round again.

The stores party was granted the afternoon off, properly called a 'make and mend', because its original function was to allow the men to repair or make their clothing. In reality, it was a get your head down time! The duty watch and 'men under punishment' carried on storing ship. There seemed to be more M.U.P than duty watch.

On Wednesday, it was Stationery Stores. Copier paper, copier fluid, teleprinter rolls, logbooks, typewriter ribbons, pens, pencils, etc. It is amazing how heavy a two-foot stack of reams of A4 paper is!

In the afternoon, at about 1500, the duty watch was called. Pete dragged me out of my pit, and we staggered up to the Master's office, where we were designated 'Store Ship party'.

"Oh God, not again!" Pete groaned.

Toilet rolls, fresh bread, eggs, lettuce, carrots, tomatoes, mushrooms, and spuds greeted us, as well as fresh fruit.

On Thursday, it was NAAFI stores. Nutty bars, beer, coke, orange, lemon, soap, toothpaste, razor blades, paperbacks, cotton thread, needles, buttons, all the stuff of the village 'sells-all' shop, which is what the NAAFI really is.

On Friday, we changed to sea-going watch-keeping. We were still one in four, but now the duty part of the watch had to stay in the EWO, because all the electronic gadgets were switched on. Initially, they were in 'stand-by' mode, so that all the hundreds of valves could warm up. Taff the Tiff, and an apprentice, were chasing up and down the ladders between compartments, monitoring his 'baby' as it woke up from its slumbers. Scrubbing the deck was a lost cause with all the booted feet tramping through, so we got away with that!

After lunch, the UA8, UA9, and UAZ were switched 'fully on'. The c.r.t's filled with blue strobes, responding to all the operating radar sets that inhabited the dockyard.

Pete and I had the afternoon watch, so had to sit there, just in case, while Taff did his stuff. The other three sections kept out of the way, in the mess. It also meant that Pete and I had the 'middle' watch, from midnight to four a.m, then the forenoon, from eight to twelve. Then we were off-watch until the 'second dog', or 1800 to 2000, after which we had the 'morning', four to eight a.m, followed by the 'first dog', 1600 to 1800, and the 'first watch', 2000 to 2359. (There is no 2400, the clock 'jumps' from 2359 to 0001, where the two missing minutes go, nobody knows.). So, Saturday afternoon was officially bed-time for the two of us. On Sunday forenoon, we were on duty in the EWO, thus avoiding the daily cleaning duties. Now we were running 24 hour watches, the EWO scrub-out was performed during the 'morning' watch, when there were fewer feet tramping through the place. (*To be continued*)

Eric RNARS 4834

DONGLES TASTER

Joe Kirk G3ZDF

For some years it has been possible to buy cheap USB dongles that are in effect wideband radio signal receivers. Many are based on the RTL2832U chip. They were originally developed as DVB-T TV tuners.
The dongle plugs into a USB port and an aerial connected to the signal input.
When combined with any of the freely available software they can convert your PC, Pi or Mac into a fully fledged tuneable radio receiver.
The early dongles only covered 26 MHz to about 3 GHz so were not very good for HF work. However, an 'upconverter' became available which moved HF signals to where they could be tuned. Later versions and some of the more expensive tuners now incorporate the 'upconverter' to give a frequency range from 100 KHz to 6GHz.

The dongles are not a replacement for a good HF/VHF/UHF receiver but they are useful for experimenting or just for exploring different parts of the frequency spectrum or new modes.
Like all receivers the quality of the signals received will be down primarily to the quality of the aerial used.
A useful source of information about all the dongles and the available software, free or otherwise is https://www.rtl-sdr.com. The most well known free software packages for Windows are SDR#, HDSDR and SDR-Radio. Some are easier to set up than others.
This is not meant to be a definitive guide to dongles but as the headline says, just a taster.

Joe RNARS 0585

QRT – CLOSING DOWN

Thanks to everyone who responded to my canvass for articles and photos for the Newsletter and to Colin for passing on the articles that had already been sent to him, it is much appreciated.
However, please keep those articles and photos rolling in. We need to ensure that we can have every issue full to the brim with relevant, interesting and informative material.
We are still looking for a new Editor. We can offer lots of help and support to anyone taking up the position. If you are interested please drop me a line or give me a call.
I hope this is my last issue as temporary Editor. Doug G4BEQ made an interesting suggestion that we should share the task of Editor among the Committee and that every member should be responsible for producing one issue. In the absence of a volunteer for full-time Editor maybe that is an option we will have to explore at the next Committee meeting.
For the moment though any articles, photos or suggestions should be sent to me at the usual address and I will be happy to pass them onto my successor.

Joe G3ZDF

RAFARS & Royal Signals ARS Nets

RAFARS	Time	Freq	Control
Daily	1100 A	3.71	GØSYF GI4SAM
	1830 A	3.71	G3HWQ MØRGI
Monday	1900 A	3.7	G3PSG GØBIA
Tuesday	0730 A	14.27	G4IYC
	1400 A	7.015	
	1900 A	3.567	
Wednesday	1500 Z	14.29	?
	1530 Z	21.29	
Thursday	1830 Z	14.17	ZC4RAF
Friday	0730 A	14.055	CW Net
Sunday	0900 Z	5.403	?
First Monday of the month	1000 A	3.71	?
RSARS Nets	**Time**	**Freq**	**Control**
Monday - Friday	1000 A	7.17	GW3KJW M3VRB
Monday	1830 A	3.585	GM3KHH (RTTY)
Tuesday	1400 A	7.17	MØOIC
	1600 Z	14.18	G4BXQ
Wednesday	0600 Z	14.143	Various
	1030 Z	3.615	?
	1830 A	3.565	GM3KHH
	2030 A	1.946	2EØBDS
Thursday	1400 A	7.17	GØRGB
	1800 A	3.743	G6NHY
Friday	1830 A	3.583	GM3KHH (PSK31)
	1830 A	3.565	High speed CW
	2000 Z	14.055	CW
Saturday	0600 Z	14.143	SSB
Sunday	1000 A	3.565	G3JRY (Slow speed CW)
	1100 A	7.17	GW4XKE
	1100 A	3.745	GM4FOZ
Joint Service Net	**Time**	**Freq**	**Control**
Sunday	0900 A	5.4035	G3RAF
Tuesday	1900 A	5.4035	G3RAF

RNARS Nets

All frequencies are +/- QRM. DX nets are GMT; UK nets are GMT or BST as appropriate. The list is compiled by Mick Puttick G3LIK mick_g3lik@ntlworld.com – 02392255880 **who must be informed of all changes**.

UK	Time Local	Freq	Net	Control
Daily	2359-0400	145.727	Midnight Nutters	Vacant
Sun	0800	3.667	News 0830	G3LIK
	1030	7.065	Northern Net	GM4VUG
	1100	145.4	Cornish Net	GØGRY
	1100	7.02	CW Net	G4TNI
Mon-Sat	1030	7.065 / 3.743	Bubbly Rats	GØGBI GØOKA GDØSFI MØZAE
Mon	1400	3.575 / 7.02	QRS CW	GØVCV
	1900	7.088 / 3.743	North West-News 2000	GØGBI
Tue	16:00	7.068 / 3743	HQ Shack	GB3RN
	1900	7.028 / 3.528	CW Net	G3RFH
Wed	1400	3.74 / 7.088	White Rose	G4KGT
	1930	3.743	SSB News 2000	GØOAK
	2000	145.4	Stand Easy	Vacant
Thur	1900	3.542	Scottish CW	Vacant
	2000 GMT	1.835	Top Band CW	GØCHV G4KJD
Fri	1600	10.118	CW	SM4AHM
Sat	0800	3.74/7.088	GØDLH Memorial Net	GØVIX
DX	**Time GMT**	**Frequ**	**Net**	**Control**
Sun	0800	7.015/30555	MARAC CW	PA3EBA/PI4MRC
	1430	21.41/28.94	RNARS DX	WA1HMW
	1800	Echolink	Echolink	VE3OZN / K8BBT
	1900	14.33	N American	WA1HMW
Mon	0930	3.615	VK SSB	VK1RAN/VK2RAN
Wed	0118-0618	7.02	VKCW	VK4RAN
	0148-0648	10.118	VK CW	VK4RAN
	0800	3.62	ZL SSB	ZL1BSA
	0930	7.02	VK SSB	VK5RAN
	0945	7.09	VK SSB	VK1RAN/VK2RAN
Thur	1430	21.41	RNARS DX	WA1HMW
Sat	0400	7.09	VK SSB	VK2CCV
	1330	7.02	VK CW	VK2CCV
	1400	7.09	VK SSB	VK2CCV
	1430	21.41	RNARS DX	WA1HMW

RNARS activity frequencies									
FM	145.4								
CW	1.824	3.52	7.02	10.118	14.052	18.087	21.052	24.897	28.052
SSB	1.965	3.66	3.74	7.088	14.294	14.335	18.15	21.36	28.94

RNARS Commodities

Item	Price
Body Warmer, embroidered with the new RNARS logo, your name and callsign. Colour: Black only Sizes: S to XXXL	£30-00 P&P £4-00
Polo shirt, embroidered with new RNARS logo, your name and callsign. Colour: Navy only Sizes: S to XXXL	£16-00 P&P £4-00
Sweatshirt, embroidered with the new RNARS logo, your name and callsign. Colour: Navy only Sizes: S to XXXL	£16.00 P&P £4-00
Fleece jacket, embroidered with new RNARS logo, your name and callsign Colour: Navy only Sizes: S to XXXL	£21-00 P&P £4-00
Gold blazer badge with **new RNARS logo**	£10-00 P&P £2-00
Lapel badge with **new RNARS logo**	£2-00 P&P £1-00
RNARS Log Book	£4-00 P&P £3-00
Cap with RNARS (new) logo	£10.00 P&P £4.00

Size in inches:

Small 36-38 Medium 38-40 Large 40-42
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Please allow fourteen days for delivery and while these prices are correct when going to press, prices do vary and are subject to change.