

WIRELESS SET NO. 42 – THE WWII LARKSPUR SET

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In my opinion, WS42 is the finest wireless set to have come out of WWII¹. You haven't heard of it? Well, neither had I, until Louis Meulstee mentioned it in passing, in an article on the Larkspur sets [1].

A mysterious history

The requirement for a very flexible wireless set, that could stand the rigours of both arctic cold and jungle humidity surfaced formally in 1943, and a prototype WS42 was available for testing in April 1944. Various development and production delays meant that it was not introduced to replace WS22 in 1945, as originally planned. At the same time WS62 was in development to counter this shortfall in WS42 supplies [3].

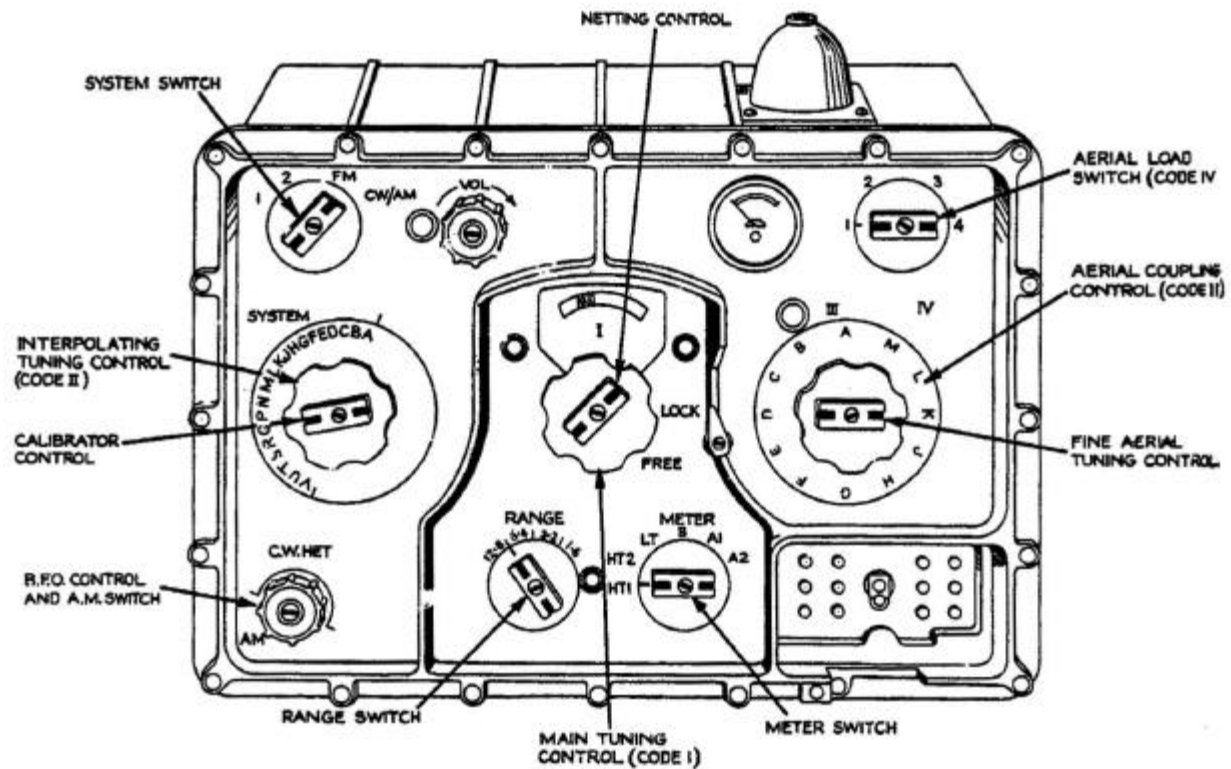
Beyond those few simple facts, the WS42 is something of a mystery. On the one hand, it encompasses remarkable innovation, good performance (according to the trial reports) and it is known that 1,000 models were produced.

On the other hand, examples of the set are now surprisingly rare, and the set was abandoned following its field trials in 1946.

Some basic information on the WS42

WS42 consists of four main components: (i) the set itself, (ii) a pedal generator, (iii) an accessory case, which includes the Rx vibratory psu, 2.4V NiCad battery, headsets, etc, and (iv) a vehicle PSU, which includes rotary transformers to replace the pedal generator, and a remote control system.

These items could be configured as a manpack set, using components (i), (ii) and (iii), or as a vehicle set, using components (i), (iii) and (iv). The front panel of the set is pictured below.



Wireless Set 42, front view

¹ This is a bold statement, and I am thinking here only of sets of British origin (having not looked in detail at those from US, Germany, etc), and limiting the comparison to sets of a similar type, i.e. manpack and/or vehicle sets. You can form your own assessment by comparing the WS42 with such "equivalent" sets as WS19, WS22, and WS62. Contrary opinions gladly received for future publication (with supporting argument of course!).

Concerning the rarity of the WS42, I have managed to discover the whereabouts of four examples², three of which are in two museums³ (one being Royal Signals, Blandford). I believe the 4th example is in the hands of a Dutch collector, but beyond that I have found no more. The 1,000 originals seem to have largely vanished! This is in contrast to the WS36, for instance, of which 1,600 were made, and while that set is not common, examples do turn up fairly regularly.

The rarity of the set probably has a simple explanation – my guess is that most of the 1,000 production models were shipped to various parts of the world for the field trials, and never returned following the abandonment of the set. They were probably all scrapped locally – but this remains to be confirmed⁴.

Why was it abandoned?

This – for me – is the heart of the mystery. While its performance in humid, jungle conditions was reportedly good, the WS42 was abandoned following the trials, and the 'temporary replacement', the WS62, took over its role, remaining in use up to the early 1960s.

Here is the contemporary, official explanation regarding the demise of the WS42. This is a quote from a report by Brigadier J B Hickman of the Ministry of Supply, written in 1946, who assessed various WWII wireless sets [1]:

Paragraph title: *Low Power Mobile Sets used during The War.*

(This section of the report mostly deals with the use of WS 9 & 11 in the early part of the war and the introduction of WS19 in 1941).

"In the author's opinion, the **WS62** represented a high water mark of achievement of the low-power equipment and had the honour of being used in the conquest of Germany. An ambitious attempt to design the ideal tropical set of this type was begun in the middle of the war. This set was the **WS42** and the intention was to produce a special equipment for use in

² I am thinking here of the production models: I also know of one WS42X – the prototype model – in the hands of a UK collector.

³ Louis Meulstee tells me he donated his example to Blandford Royal Sigs museum (it may or may not still be there, I don't know), and Chris Clotworthy reports two more in a Canadian museum.

⁴ One can always hope that someday, some long-lost MOD warehouse will come to light containing a large number of WS42!

the tropical jungle with an almost infinite resistance to tropical storage conditions and use in the jungles of New Guinea and Burma.

It was so designed that all component parts of the equipment were within hermetically-sealed cases, and the general design was based upon full use of miniaturised components. The power output was 10 Watts on FM and CW and 5 Watts on AM using a vertical 14-ft rod aerial. The frequency band was 1.6 - 12 Mc/s. The set was designed and a number of models were made.

Although tropical performance of this equipment was good, the final weight of the equipment was excessive. Completion of an ambitious programme for its production was not attained in time for an attack on Burma, and none of these equipments saw service in battle. Despite the fact that this set did not become part of the general equipment of the Army, much experience was gained in the development of field sets using miniature components. This experience has been incorporated in the design of WS 88 and will serve again in the design of sets now envisaged."

So, we are told that the sole reason for abandoning the WS42 was 'excessive weight'. This claim will be explored further, but let us first consider some of the innovative features in the set.

A design breakthrough

What is so special about the design of the WS42? Here are some features that have struck me from a fairly cursory reading of the documents. These appear to be well ahead of any other British design, and as far as I know, are also in advance of any other contemporary design from the Allies⁵:

- ❖ a manpack set with 10W RF output!
- ❖ switch selected 10Kc/s channels, like the much later synthesised sets provide, but achieved by clever mechanics: this makes the set very easy to use by those lacking in wireless operator's training;
- ❖ hermetic sealing of the case, providing reliable performance in jungle conditions with the relative humidity regularly at or near 100%;

⁵ It may well be that the Axis powers had equivalent or better sets in service during WWII. I have not studied the question. Even if they had, these designs and the concepts behind them would not have been readily available to the designers of the WS42.

- ❖ silent netting, by use of a built-in crystal calibrator;
- ❖ a sophisticated modulation amplifier with AMC, to maintain an even modulation depth;
- ❖ a clever arrangement of the functional items into the various boxes, which keeps the

number of them to a minimum (so there are fewer bits to lose), and yet provides enough flexibility for either manpack or vehicle-based use;

- ❖ a vastly improved DC input to RF output power conversion efficiency, compared to WS19, WS22 or WS62., which means the power output to weight ratio is also better.

Comparison with WS62

The WS62 was brought in to fill the hole created first by the lateness of the WS42, and then by its total abandonment, so a comparison between the sets should be interesting. The table below gives such a side-by-side comparison of the two sets, on a number of performance and specification features.

Feature or characteristic	WS42	WS62
Operational roles	Manpack, vehicular	Manpack, animal pack, vehicular
Operable on the march?	Rx – yes, Tx – no	Rx – yes, Tx - yes
Number of loads for manpack station	3	2 or 3
Weight: minimum manpack station ⁶	77 lbs	64 lbs
equivalent manpack stations ⁷	77 lbs	104 lbs
Frequency range	1.6 – 12.8 Mc/s in 3 ranges	1.6 – 10.0 Mc/s in 2 ranges
Tuning arrangement	10 Kc/s switched channels – requiring no skill to adjust.	Continuous tuning, with flick mechanism – requiring skill to adjust.
Modulation types	AM-V, FM-V, CW	AM-V, CW
Power output:	5 watts 10 watts 10 watts	0.5 – 0.8 watts - 0.8 – 1.1 watts
Vehicle battery current:	1.65 amps 9.5 amps	3 amps 5 amps
Battery input to RF output power conversion efficiency:	8.8 %	1.8 %
Silent netting:	Yes	No – unless Xtal Cal carried
Crystal calibrator built-in:	Yes	No
Remote control facilities	Built into vehicle supply unit.	Separate remote control units supplied (e.g. Type L)

I rather fear that the well-loved WS62 looks like the poor cousin in this match! Interestingly, the main criticism I have heard of the WS62 from those who used it seriously in an Army role, was that its RF power output was too low to give reliable links over the typical ranges required. The 10dB greater power of the WS42 would have been an enormous benefit – the range increase would be substantial, depending of course on the local geography.

Let’s consider the weight issue. What is plain is that the WS62 can be either lighter – or very much heavier, depending on how much kit you are prepared to leave at home! This flexibility does mean that the WS62 becomes a 2-man load at a push. The price of doing this is that you only have the operating time of one battery. Once that is flat, you are dead – or at least the radio is – and there is no means of recharging at all. When you compare similar configurations,

⁶ This is the minimum of kit offering an operational radio station: in the case of the WS62, the pedal generator and Xtal calibrator are excluded. The WS42 remains in standard configuration, i.e. no artificial attempt has been made to lighten the set!

⁷ In this case, the WS62 has the pedal generator, the Xtal calibrator and a 2nd headset/mic added to the minimum configuration.

however, the WS62 looks very overweight, and of course performance is very much poorer!

Does the “too heavy” claim make sense? If not – what then?

On the bare figures given above, the claim that the WS42 was excessively heavy looks entirely spurious. In addition, I find it inconceivable that the design team which came up with the impressive list of innovations already noted, would overlook something so basic as the equipment weight – especially for a manpack set! And of course, in the vehicle role, weight is of little importance.

It is, of course, unwise to be dogmatic on this point, without knowing the exact field requirement that the WS42 was intended to meet. For instance, it is possible that there is an unstated requirement here, namely that the set had to be portable by 2 men, rather than 3 – and plainly the WS42 would fail on these grounds.

It is possible of course, that the weight requirement never reached the design team. My own experience of working in British industry (albeit some decades later) suggests this is plausible. Why? Well, engineering in the UK has been plagued for decades with a failure to give the engineers the status that they deserve, by managers who have been almost universally non-technical.

Customers will be typically handled by the marketing and financial guys, while the engineers will be kept safely far away in some back room. This may of course spare certain home truths reaching customers (since engineers tend to be very down to earth, straightforward people, who “tell it like it is”), but at the same time, the non-technical “buffer” forms a damaging filter for vital information, which often compromises the quality of the design and thus the product.

If you are into conspiracy theories, then you will probably like my final idea that the real truth about the failure of the WS42 was far too embarrassing for some official somewhere, and thus blaming excessive weight was a good cover story, which was easily understood by all and sundry and was unlikely to ever be investigated in detail. Certainly, there was some problem with design and production delays, and this may have caused political embarrassment in certain quarters, leading to a desire to kill off the WS42 at the first opportunity.

Further research required

My information on the WS42 is currently limited to the published documents, but the story they present leaves mystery hanging in the air. Two

ways of clearing the matter up suggest themselves:

- ❖ Obtain one, or preferably two WS42. Restore them to fully working and original condition, and then carry out field trials to determine just what performance is offered. Are the specs met? Do the test results agree with the original trial data? How does it compare with the WS62?
- ❖ Try and contact any of the original design team, procurement team or those involved in the trials, to see what their reminiscences reveal about goings on “behind the scenes”.

Of course, if and when that further research is done, I may need to revise some of my opinions expressed in the above article! I shall be very glad to hear from anyone who can help with either approach, particularly the procurement of one or two WS42, to purchase or to borrow - as long as the owner is happy to see it made operational.

Conclusions

Perhaps the answer to these riddle of the WS42 lies in the unfortunate designation “42”... thanks to Douglas Adams we now all know the true significance of this number! Perhaps the WS42 was intended to be the wireless set equivalent of an answer to the ultimate question – the “answer to life, the universe and everything!”

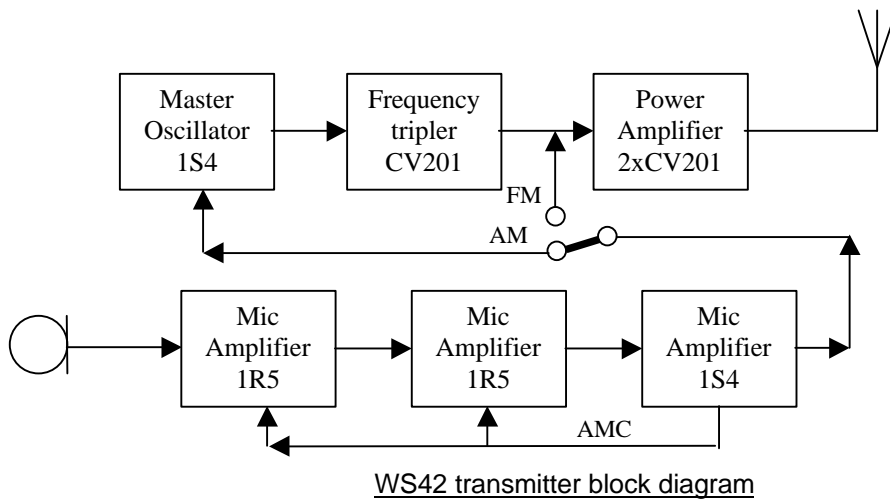
I am only half joking here – the requirement for the set was a tough one – definitely years ahead of its time. The WS42 came pretty close to meeting it, and yet there was some failure – possibly not its weight. There is a quirk of human nature that means that small failures tend to be magnified out of all proportion, while major strengths are overlooked. It may well be that the trials team took for granted the magnificent radio performance, etc, and focused their condemnation on some relatively minor irritant.

It is thus well within the bounds of possibility that the abandonment of the WS42 was a major error, which the British Army had to pay for by being lumbered with the relatively poor performing WS62 for years afterwards. That judgement remains the province of further research – which I hope that I or others will have the opportunity to conduct in the future.

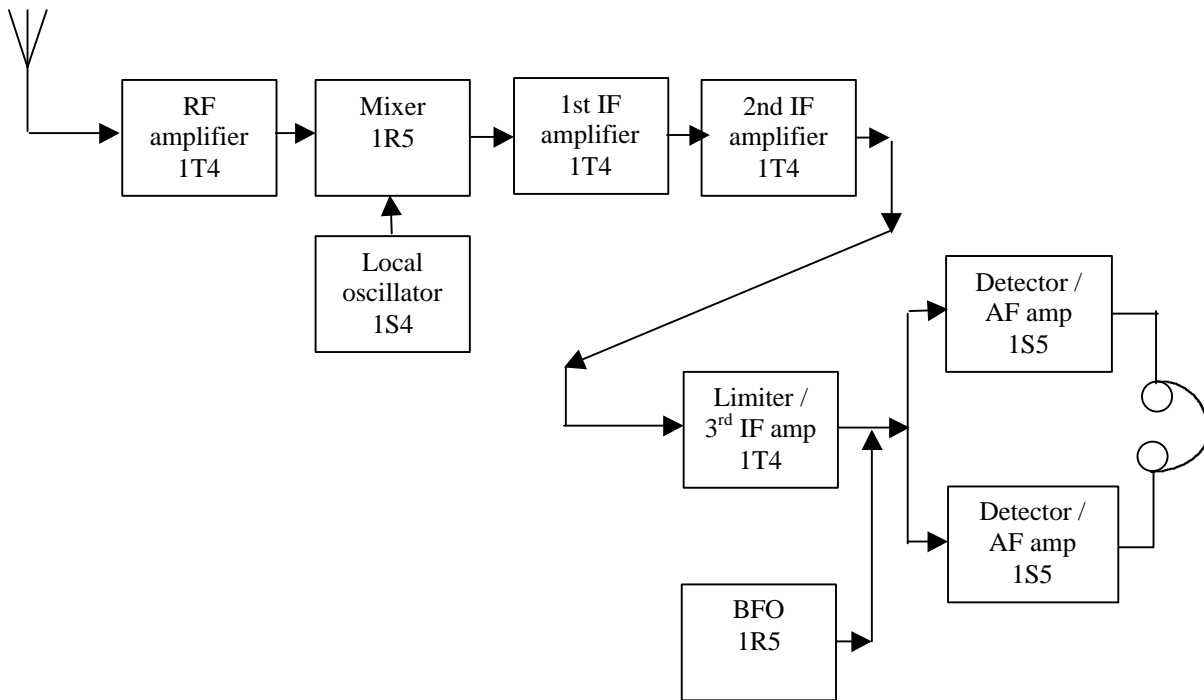
References

- 1 "Larkspur" by Louis Meulstee, published in Radio Bygones magazine.
- 2 Paper by Brigadier J B Hickman, MC MA, Ministry of Supply, entitled "Military Radio Communications", read at the Radiocommunication Convention, 26 March 1947, originally published 9 December 1946.
- 3 "Wireless for the Warrior: Standard Sets of WWII", Vol.2, Louis Meulstee.

Appendix: WS42 block diagrams



WS42 transmitter block diagram



WS42 block diagram on receive

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