Sir Ivanhoe: Central Electronics' Gallant Novice Rig

By Dominic (Nick) Tusa, K5EF
75757 Highway 1082
Covington, LA 70435
985-249-6467 Office
504-400-8873 Mobile

At the mere mention of names like *Ivanhoe* and *Galahad,* one thinks of King Richard, the Crusades, and the Knights of the Round Table. Now, us radio amateurs can relate those same names to Central Electronics, Zenith Radio, Wes Schum, and also to a lesser known, but CE-important electronics design engineer: Robert H. Redfield, W9NPB, SK.

All right, I know what you're thinking: "Nick, have you been sniffing too many solder fumes lately? How can Central Electronics have *anything* to do with *Ivanhoe* or shining *knights*?" As it turns out, plenty.

Picture yourself at Central Electronics in the 1960 era. The age of desk-crushing radios is showing cracks and soon will be drawing to a close. The FCC had, a few years earlier, created a new thing called Citizens Band Radio, and a tidal wave of Baby Boomers was soon to become of Novice ham-radio age. How was CE to capitalize on this new wave of opportunity in a big way? Looking thorough the file cabinets of documents Wes Schum saved all these years, it is clear he had a plan for riding both the Citizen Band and Novice waves.

Several new development projects were started by Central Electronics in 1961. The first, a CB radio, was to be product-branded as *Central Electronics* and marketed by Zenith through its vast distribution and service network. Now, the second was to be a new rig geared to the beginner-novice and also as a stepping stone to CE's advanced SSB gear.

On June 30th, 1961, the plan was in place. Wes wrote a memo to his engineering team headed by Joe Batchelor and Robert (Bob) Redfield with these specs for CE's new Novice-class transmitter:

1. A minimum of 75 watts input;
2. Provisions for an accessory modulator to be mounted inside the main equipment box;
3. 80-6 Meters, with output circuit to match 25-500 ohms;
4. Should drive to full input from currently available VFOs;
5. Grid-blocked keying with wave shaping for minimal key clicks;
6. Meter calibrated in watts input. Illuminate the meter in lieu of a panel light;
7. TVI filtered because of Class C operation;
8. The combined transmitter and modulator retail price should not exceed $89.95 for the kit and $109.95 for the wired unit.

This one memo set into motion one of the most rapid and innovative development efforts in Central's history. Immediately, Bob Redfield went to work. And nearly immediately, Joe Batchelor resigned. Joe was angered that this Novice rig and the CB radio development took away precious resources needed to finish the 2500L linear amplifier and the "Hot-Rod" mid-tier receiver development work …his *projects.* This "Hot-Rod" receiver, as it was code-named, was to fit underneath Central's 100R receiver that was also being developed by the Zenith Military Electronics group.

With Joe's sudden departure, development of the new Novice rig fell to Redfield.

What's unusual about this Novice rig was not so much the technology, but Central's use of an outside and well respected industrial design firm to handle the packaging aspects of the transmitter. *Melvin Boldt and Associates* was established in 1952, but by 1960 they were a product packaging powerhouse in Chicago. Boldt's quality and styling influence is seen in all Zenith radios and television of the 1950s and until Zenith insourced its design efforts in the 1980s. The mock-up photograph of the rig in **figure 1** tells the story…it looks nothing like anything ever produced by Central and is more like the new line of Hi-Fi component devices contemplated by Zenith. Why the shift by Central to "style versus girth"? A quote from an October 1960 Wall Street Journal news article on the use of style to achieve product identity and boost sales says it all: *"Even if an instrument functions well, if it doesn't look pleasing the poor chump who buys it can't help feeling he's been had."* Truer words were never spoken!

Central had intended to construct a total of six working evaluation sets once the project migrated out of the prototype stage. Redfield, along with Herb Saxon, Nick Fishik, and others, went to work on two prototypes that were to look as close as possible to that being designed in parallel by the outside Boldt team. Nick Fishik's association with Wes Schum began in World War II when Wes was employed by the Cover Dual Signal Company. Nick was a machinist/model maker extraordinaire. If you could draw it, Nick could build it..**fast**.

By late August, prototype #1 was constructed and code-named *Ivanhoe.* In fact, *Ivanhoe* - as a potential name for the product - was embraced by Boldt and is clearly seen as such in their engineering drawing submittals. *Ivanhoe* was to QSO where mere Novices only dreamed to travel!

Component parts selection and costing was developed for *Ivanhoe* over the summer of 1961, while Bob and his crew steadily

Figure 1: This is the new Novice rig's publicity photo and it shows how attractive the transmitter would have been.

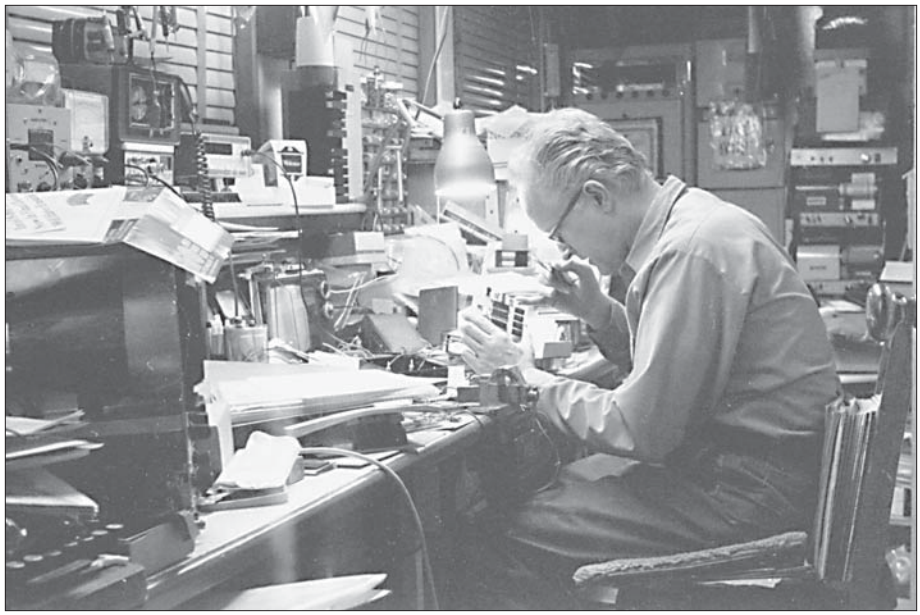

Figure 2: Robert Redfield works in his lab at Skokie, Il, during 1976.

worked to resolve circuit design nits. Prototype #1 did not contain the AM modulator as that was being designed in a separate, but parallel path, with the aim to be eventually integrated within the prototype. Wes didn't get everything he wanted right away with *Ivanhoe*, but prototype #1 was clearly heading down the right path.

Bob's prototype #1 was designed for the Novice-class operator having near-zero experience in radio, but could be useful to the beginning General-class operator, too. It had both screen-modulated AM and CW, covering the 80-10 meter bands. Its maximum power input was 90 watts, using a single 6146 final amplifier. The set allowed for four crystals and a VFO input. A two-stage meter was provided to measure both final grid and plate current. And, unlike the wide matching range specified by Wes, the rig's output pi network was principally designed to a 50-ohm target and an optional antenna tuner would be available for balanced and unbalanced antennas. Never one to leave a stone unturned, so to speak, Wes had even secured price quotes to have CE-branded quartz crystals made available to the new Novice ham, which were to be stocked by ham dealers throughout the land.

The plan was to have *Ivanhoe* fully completed and ready to be marketed by March 30th, 1962, and by late December 1961 that goal was clearly within easy reach. But then the unthinkable: Zenith deactivated Central on January 1st, 1962, and exited the ham radio market forever! With that deactivation, all of the CE products and new ideas where shelved. The Belmont Avenue plant shuttered. All gone…But was it all gone?

After CE's deactivation, Wes retreated to his basement to resume designing hearing equipment for the J. L. Warren Company and manufacturing his own Schum line of high voltage test equipment used by AT&T, Bell Labs, Teletype Corporation, and others.

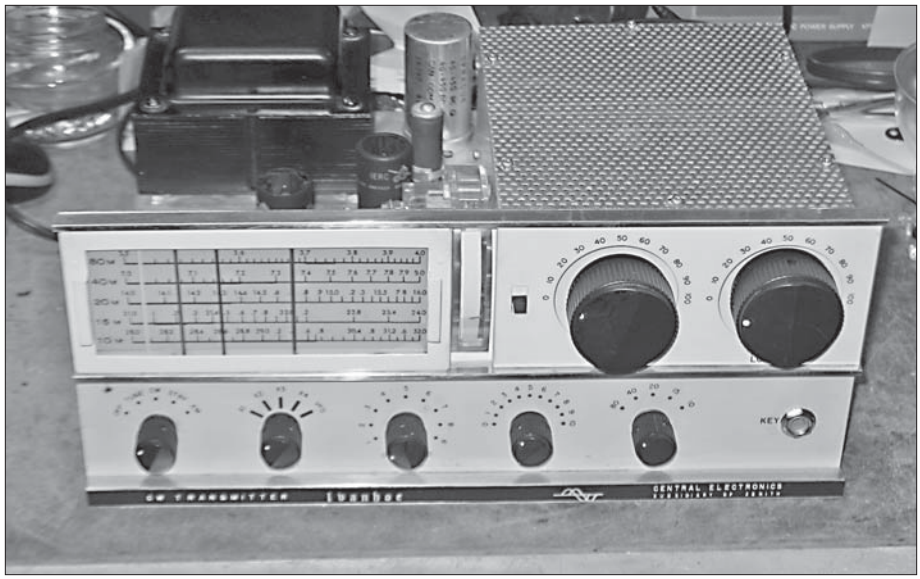

Figure 3: This is the Ivanhoe transmitter, shown during it's restoration at Nick's radio shop.

Bob Redfield remained with Zenith for a short time, but eventually moved on to greener pastures. By 1963 Bob was employed by Standard Kollsman designing TV tuners and, throughout his engineering career, spawned a progression of patented ideas that included:

• A Protective Coating for Motion Picture Films (1948)

• Electronic Teaching Device (1964)

• Audio-Visual Teaching Apparatus (1966)

• UHF Television Tuner (1967)

Okay, but what about *Ivanhoe*? Fret not… *Ivanhoe* and his brother, prototype #2, (Yep, there was a second prototype started in November 1961 and likewise named *Ivanhoe*) was spirited away and lived quietly for the next 53 years at Bob's QTH in Evanston, Illinois.

Incidentally, Melvin Boldt was, for many years, listed as one of America's ten best-dressed businessmen. So, *Ivanhoe's* style was virtually guaranteed to turn heads and generate huge CE sales. If you would like to see *Ivanhoe* up close and operational, circle the July 23rd weekend and plan to attend the W9DYV Boat Anchor Radio Event in Jonesborough, TN.

Circuit Design and Operational Status

In October of 2015, my friend and fellow "boat anchor" restorer Bob Sullivan (WØYVA) received an out-of-the-blue email from Larry Redfield about a novice rig his father had designed during the time he worked at Central Electronics. Bob passed the note onto me and the name immediately jogged a memory: *Robert Redfield* the last Director of Engineering for Central Electronics. I had seen a picture of the planned Novice rig, but did it truly exist? Not only did it exist, but it *actually worked* and Bob Redfield had apparently scooped it up while Central was being deactivated. How did that come to pass?

As it turned out, Redfield's role was the actual engineering development of the

Novice rig prototype, had named it himself and had not only the working prototype, but a second engineering sample that was partially completed. Along with a treasure trove of company documents, Larry asked if we would preserve *Ivanhoe* in his father's name. Needless to say, the agreement was made and within a few months both arrived safely here. Opening those two boxes was like opening a Central Electronics time capsule. The drawings, documentation, parts, and the two radios, themselves, were akin to being transported back to year 1961 and into Bob Redfield's workshop/office.

Ivanhoe's Circuit Details

Now, we talk a bit about its bones. It is an oscillator-multiplier rig that employs a 6CQ8 oscillator-buffer; a 12BY7A as a doubler/tripler-driver and a single 6146 power-amplifier stage. It uses a solid-state voltage doubler HV supply that develops 640 volts for the 6146 plate. The power supply has a 30k-ohm bleeder that is equipped with two taps. One tap is connected to the bottom half of the voltage doubler and is set for 300V that supplies the 6146's screen voltage and also plate voltage for the 6CQ8 pentode buffer and 12BY7A doubler/driver. A second bleeder tap is set for 150V and is the plate supply voltage derived for the 6CQ8 triode oscillator.

A second transformer secondary winding provides a -130 volt bias source that is used to block-bias the stages when in standby or key-up and is then differential-sequenced to turn on the oscillator/buffer stages first and then the 6146 PA stage. The RC timing values for the PA and oscillator/buffer stages were set to allow the oscillator to "get up to speed" before the PA was enabled at key down and then, upon key up, to have the PA biased off and then have the oscillator turn off.

The net effect of Redfield's elegant sequenced design is a nice, click free waveform that was achieved without a dedicated keying tube.

The *Ivanhoe* function switch contains a separate snap-switch that applies 120VAC to the transformer primary and, by so doing, filament voltage and blocking bias to all stages. A second wafer is used to select the various modes. A "Tune" position allows for adjustment of the oscillator/doubler stage and also allows for receiver frequency spotting. The "Standby" position applies filament power but disables both the 630V and 300V sources. When in CW position, the PA plate and screen voltage (as well as for the lower stages) is applied.

The function switch also has an AM position. *Ivanhoe* was intended to have either a built-in modulator for the "DeLuxe" version or an add-on modulator module for the standard version. The deluxe *Ivanhoe* would also have a built-in 6C4 stage for full break-in CW and a low-pass TVI filter. Several versions of modulators were considered and, due to simplicity, a screen modulator on the lines of the Heath DX-60 and Hallicrafters HT-40 was considered. These were standard designs that had been replicated by many over the years and were "proven." Yet, remember this was being developed by Central Electronics, so one should expect the unexpected. I was, of course, so rewarded.

A far different modulator was also being considered for *Ivanhoe* and it was a design that was quite unique for an amateur radio transmitter. It was termed: "series-gate modulation" (SGM). SGM combines both control-carrier and screen modulation. It provides for automatic speech clipping, achieves 95% modulation, and actively prevents over-modulation. A complete discussion and mathematical analysis of SGM appeared in the November 1st, 1957,

issue of *Electronics* magazine. If that has peaked your inquisitive nature and you are into AM, find the article as it an excellent piece. [Editor's Note: ER will have more about this unique modulation system in a future issue this year.}

While the *Ivanhoe* schematic includes the normal screen grid modulator circuitry as used by Heath and Hallicrafters, the recovered CE documentation clearly shows that a decision on screen modulation versus SGM had not been made. My plan is to build both for comparison's sake, although from the CE cost information the parts needed for SGM would have been about $3.50 higher.

Now, one would think "what's the big deal about $3.50?" Well, in 1961 dollars it would have been a big deal to *Ivanhoe's* planned selling price target. Some soul searching would have been in order via the "Zenith Bean Counters of the Day" to see if the cost difference was worth the benefit. Had it been Wes Schum's sole decision to make…although he *really* didn't like AM one iota….Ivanhoe would have gone for SGM if only because it represented an advanced state of technology and a better value for the beginner amateur op.

Back to the Ivanhoe prototypes and how they have fared over the past 55 years. Although dusty and smudged, each was in altogether excellent shape. And while each has a cadmium plated chassis, both cleaned up to the point where it is truly hard to sense these radios are so old. Ivanhoe #1 and #2 each look like they were made yesterday, which points to the industrial design foresight of Melvin Boldt and Associates. But, a critical cosmetic part was incomplete and that was the crystal front plate.

Ivanhoe has provisions for as many as four plug-in FT-243 type crystals. These are accessed by removing a front panel crystal cover that contains an 80-10 meter band plan legend. Four movable frequency markers are included that can visually identify the portion of the spectrum covered by those crystals. This is further enhanced by back lighting. And, whenever the rig is placed in the CW mode, a second panel light back-illuminates the plate tune and load controls…pretty snazzy! This translucent crystal cover was not competed by CE and several mechanical frames for the translucent legend plate were under consideration. I have completed this piece for both Ivanhoe prototypes, but to see how I did it you'll have to travel to Jonesborough, TN for the W9DYV Boat Anchor Event this July 23rd weekend.

Restoration Details

Restoring Ivanhoe #1 required minimal electronic prowess. Four under-chassis filter caps were changed, a current inrush limiter was installed and the set brought up using a Variac. It keys as designed and its output is an easy 60 watts on 40M. The only other change made was to install a Zener shunt regulator for the oscillator's 150V plate supply. This one change made the rig fully chirp-free for every crystal I tried. Ivanhoe #2, however, was only about 80% electrically complete when Central Electronics was deactivated. Looking at this set, it appears a person was diligently working to build it when Zenith management came into the assembly area just before 1962's New Year's Eve weekend and told everyone to stop work and exit the building. In fact, the last engineering drawing in the Ivanhoe collection is dated: December 29, 1961,...which happened to be Friday, of course.

Galahad

Now, then we have Galahad! Back in 1961, tube vendors were quick to furnish experimental tubes to companies like Zenith. Tung-Sol had an experimental

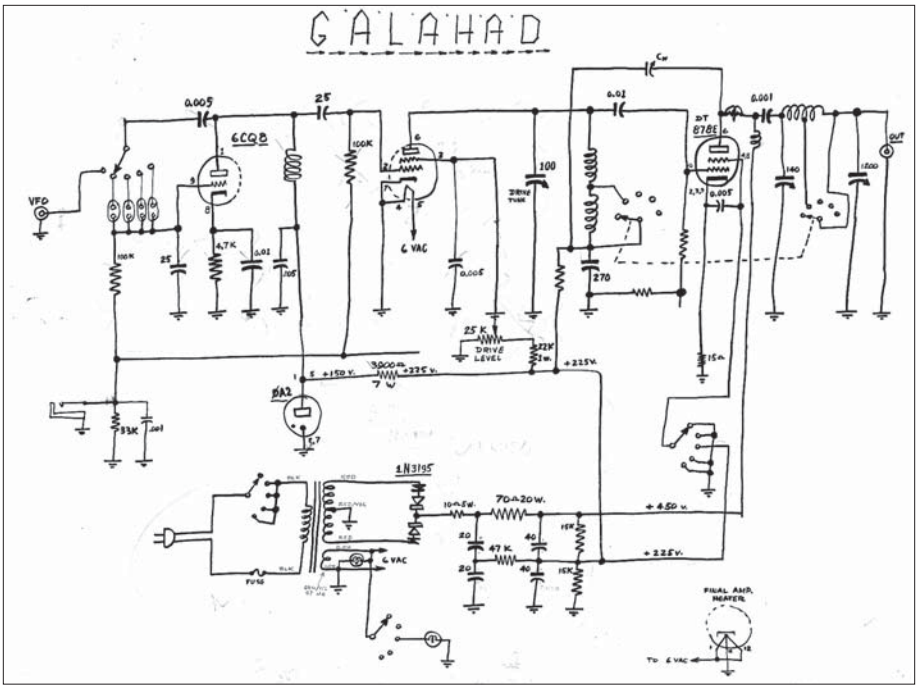

Figure 4: The Surviving Hand Drawn Schematic for the Galahad Transmitter

type that was pitched to Central Electronics as D-T 878E. This was a 12-pin compactron-style tube that was similar to the 6883/6146 family except the plate lead was in the base and the tube was operable with 30 watts plate dissipation up to 175 MHz.

Redfield crafted a proof-of-concept breadboard transmitter using the same Ivanhoe power supply, but eliminated the 12BY7A and installed the DT-878E as the final. This was to be a three-tube CW-only rig termed Galahad. Its tube lineup retained the 6CQ8 triode/pentode but now configured as a triode oscillator and pentode doubler/tripler/driver; the single DT-878E final, and a 0A2 voltage regulator for the 6CQ8 triode oscillator. This rig was targeted as a compact fifty-watter and was to be positioned as Ivanhoe's little brother. I know Galahad's breadboard was constructed since, in the materials sent to me by Larry Redfield, a hand written schematic diagram exists with changed parts values and circuitry mods. It also came bundled with a new in-the-box Tung-Sol DT-878E and tentative spec sheet. Those values and circuitry aspects changed as the design was being worked out by Redfield in hardware form.

Sadly, the Galahad breadboard didn't survive and appears to have been lost somewhere along the line. Yet, surely Ivanhoe and Galahad would have served nobly in the envisioned Central Electronics product line for 1962.

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