

## **Productions Modifications, Field Changes, and Optional Modifications for the R-390A**

This is a consolidation of modifications from the Production Modifications as listed in the Y2K Manual, various Navy Field Changes, Hollow State News, and various other sources.

### RF Deck

Production Mod 2: Pin 7, V201, connected to ground instead of pin 2.

Production Mod 2: C275 changed from 5000 pF to 3300 pF. C275 is between S208 rear, pin 7 and ground. Note: The consensus of opinion is that C275 should be 0.033 uF. This value was consistently used in manufacturing contracts during the 1960's.

Production Mod 3: Series network of C256, 0.1 uF, and R235, 47 ohms, inserted between terminal 1 of HR202 and ground.

Production Mod 4: C257, 47pF, added in parallel with C227. C227 is located between V201, pin 2 and ground.

Field Change 7: R210 changed from 56K to 220K. R210 is connected to pin 6 of V207. Finger stock added to shield RF chassis if available. Documented in Navsea 0967-LP-063-2120. (I do not add this one)

### PTO

Field Change 7: R702 changed from 56K to 220K. R702 is connected to pin 6 of V701. Documented in Navsea 0967-LP-063-2120. (I do not add this one)

### AF Deck

Production Mod 1: C612, 68 pF, added in parallel with R601. R601 is 680K connected to pin 2 of V601.

WA4HHG (Chuck Rippel) Easy Audio Mod: Replace C601, C604, and C605 with a 0.022 uF 400V orange drop capacitor, and replace R614 with a 560 ohm 2 watt resistor. Documented here and in HSN issue 46, page 6 (adding the C601 capacitor in the HSN version). Note that some prefer even larger values, up to 0.047 uF. Replacement capacitors which are too thick can be mounted either off the edge or under the circuit board.

Kleronomos Real Audio Mod: This is a major (non-reversible) mod that is documented in Electric Radio issue 42. It converts the AF deck to deliver 5 watts of push-pull audio into an 8-ohm speaker.

### IF Deck

Production Mod 2: C507 and C517 changed from selected value to 51 pF. C508 through C510 and C513 through C515 changed from selected values to 82pF. Trimmer capacitors C564 through C571 added. See schematic and a modified IF deck for details and correct layout.

Production Mod 2: R504 changed from 1000 to 560 ohms. R504 is connected to pin 7 of V501 SSB Mod: (optional, highly recommended) Uses two 1N4148 diodes and one 47pF ceramic disk (or silver mica) capacitor.

-one diode in parallel with R547, cathode as follows  
-----|<-----pin 2 V506A

-one diode in parallel with R546, cathode as follows  
----->|-----pin 1 V509A

-one 47 pF cap in parallel with C535

Mods very similar to this one are described by Lankford and Cornelius in issues of Hollow State News.

3TF7 Substitution Mod: (optional, recommended) Add jumpers on RT510 between pin 7 and pin 5, and between pin 2 and pin 4. This allows you to later substitute a 12BH7A tube in place of your 3TF7 if (when) it ever fails. (HSN issue 10, pages 1&2 or HSN reprints, page 1)

### Chassis

Inrush Current Limiter: (optional, highly recommended) Keystone CL80 (or CL90 if you never run the ovens) added between 120 VAC fuse and line filter. This mod limits AC voltage to the radio over a brief few seconds. It also reduces the incoming AC voltage by a couple of volts. Documented on Jan Skirrow's website at <http://www.skirrow.org/Boatanchors/> and in HSN issue 48, page 3.

B+ Fuses: (these can be added if not present) Fuse F102 is located in the B+ line between pin 5 of plug P111 and pin 5 of plug P119. Fuse F103 is located in the B+ line leading from pin 2 of plug P119. Chassis wiring has to be unlaced, rerouted, and relaced to complete this installation. See the wiring schematic in the Y2K Manual on pages 6-83 and 6-84 to determine which changes are necessary.

Ground-fault protection capability: (optional) Insulate the line filter from the chassis using insulating sheet, insulated feed-throughs, two soldering lugs, and 0.01 uF 1000 VDC poly capacitor. For details see HSN issue 43, pages 7 & 8. (I do not add this mod to mine)

### Power Supply

Solid State: (optional, only if 26Z5W tubes not available) Cover tube socket with labels regarding solid state mod. Use 3A, 1KV rectifier

diodes. One diode between pins 1 and 3 of socket XV801, connecting the cathode lead to pin 3. Another diode is installed across the same pins on XV802. This change is documented INCORRECTLY in Navships 0967-063-2110, where it describes using pins 1 and 4.

Many suggest adding a 220 ohm dropping resistor to lower the B+ voltage to 240 VDC. (Also see HSN reprints, page 5) Some versions add the dropping resistor to the Power Supply Chassis with the 220 ohm 10 watt resistor between T801-6 and ground (<http://www.qsl.net/wb4tur/milt/index2.htm> website and in HSN issue 48, pages 5 & 6). Some add the 220 ohm resistor to the AF deck (Navy EIB 895 and HSN issue 2, page 5 or HSN reprints, page 5). I prefer to add it to the power supply deck so that I can freely swap power supplies between tube and solid state type and the mod travels with it.

3-prong Power Cord: (optional, recommended if not already installed) Change any two-prong power cords to 3-prong. Insert ground lug from green wire underneath one of the AC terminal cover screws.

#### Other

Tube shields: Tube shields are needed on V201, V206, V505, and V701 (HSN issue 5, page 3 or HSN reprints, page 3). Others are often removed if shiny, but should be kept in place if black (inside and outside). IERC shields are the most highly regarded, with WPM coming in second.

#### Potential Low-Noise Tube Substitutions:

I don't do the following unless I run out of tubes. I tried all of these in my Collins R-390A for several months, but could not really tell any difference. AGC action may have been a bit worse, and sensitivity measurements didn't really change. Resting noise level did decrease with no signal injected, but it was compensated by less gain when signals were applied. Net result: no measurable change in sensitivity. If I had an abundance of the following tubes that would allow me to "tweak" the performance a bit, I might have had better results. Regardless, here are some easy substitutions for you to try.

6BZ6 instead of 6DC6 in V201 and 6AH6 instead of 5749/6BA6W in V508 (National Radio Club reprint R-57)

6JH6 instead of 5749/6BA6W in V501, V502, and V503 (Electric Radio issue 26, pages 22+)

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Date: Mon, 4 Aug 2014 22:41:51 -0700  
From: Perry Sandeen via R-390 <r-390@mailman.qth.net>

Subject: [R-390] \*A\* Improvements

Wow! The list has sure come alive. So here are some on topic ideas.

I have some thoughts on \*A\* improvements that might be attempted by the technically gifted and equipped. Some I'd like to try to do some of them when we move to CA finally gets settled down.

1. The 17 MHz crystal oscillator gets pulled by the AGC applied to the mixer tube. How about a cure? A FET isolation circuit?

2.? The level of the PTO shifts over the 1 MHz range which affects the radio sensitivity. How about a TTL chip biased so there is a constant level square wave for the mixer? Might have to be padded for the right injection level. (And suitable coupling capacitors of course.)

3. The crystal deck might be able to be locked to a PLL circuit for accurate injection frequencies. Also feeding a TTL chip to acquire a constant RF output value?

4.? Bill K.(SK) developed a SSB converter using the LM 1496 DBM chip for an article published in ER magazine for the SP 600. Adapting it to an \*A\* might be simpler to implement than the Capt. Lee 6BE6 PTO mod. And speaking of the LM 1496 perhaps it might be adapted to replace some of the 6C4 mixers.

After all, there are no \*sacred\* circuits in the \*A\*, just some that are now possible to implement with SS devices just like what has been done on the PS when SS diodes became 4 cents apiece. Now 26Z5's cost an arm and a leg with the price continuing to rise over the years.

I have some more ideas if someone wants to contact me off list with a new email. That will save me grief with the Yahoo system.

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Date: Tue, 11 Nov 2014 15:55:18 -0500  
From: Steve Hobensack <stevehobensack@hotmail.com>  
Subject: [R-390] OT Battery Leakage

Sorry about the ot post, but there are some smart people here. Has anyone noticed the quality of alkaline cells these days? They are supposed to have a shelf life of ten years, but some brands leak far before the dc voltage drops off. I have had bad luck with job smart (True Value) and Rayovac. The D cells and AA cells leak a corrosive goo that has damaged a Simpson 260, 6v lantern, flashlights, frs ht, and calculators. I would gladly pay a little more for a leak proof brand. What's a good brand?

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Date: Tue, 11 Nov 2014 14:04:36 -0700  
From: Transmaster <22hornet@gmail.com>  
Subject: Re: [R-390] OT Battery Leakage

I have had very good luck with the Duracell ProCell line. I just remembered

to change the batteries in my Simpson 260. The ProCell's, a "D" and 2 AA's after at least 10 years looked brand new.

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Date: Tue, 11 Nov 2014 15:22:21 -0600  
From: Les Locklear <leslocklear@hotmail.com>  
Subject: Re: [R-390] OT Battery Leakage

Stay away from Duracell's imho.  
I've never had any problems with Energizers.

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Date: Tue, 11 Nov 2014 15:22:58 -0600  
From: Cecil <chacuff@cableone.net>  
Subject: Re: [R-390] OT Battery Leakage

I've been using only Everedy Energizers for years since I helped my son do a science fair project and they consistently beat the copper tops in every load test. I've had a few leak but it didn't cause any damage...I've had the Duracells leak too...but the off brands have been worse about it.

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Date: Tue, 11 Nov 2014 15:27:02 -0600  
From: Les Locklear <leslocklear@hotmail.com>  
Subject: Re: [R-390] OT Battery Leakage  
Message-ID: <COL127-DS2100E0521153C2C3941941A4810@phx.gbl>

Duracell and Duracell Procell are entirely different lines.....

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Date: Tue, 11 Nov 2014 13:37:06 -0800  
From: Bill Guyger via R-390 <r-390@mailman.qth.net>  
Subject: [R-390] OT Battery leakage

This may be because the batteries were totally run down, but about 14 years ago one of the guys I worked with dropped a brand new Mini Maglite belonging to one of the other engineers down a 4" conduit coming up into one of the studios at our radio station complex. Needless to say we never let him forget it since you could look down the conduit and see the light shining around the 90 degree bend until the batteries died. I was able to retrieve the flashlight about 2 years ago when we demolished the studios after moving. The Maglite was in immaculate condition, no leakage whatsoever. The batteries were Duracells. I got the two guys back together so the borrower could give the "borrowee" his flashlight back. He put new batteries back in and has a brand new old Mini Maglite.....

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Date: Tue, 11 Nov 2014 17:14:40 -0500  
From: Charles Steinmetz <csteinmetz@yandex.com>  
Subject: Re: [R-390] OT Battery Leakage  
Message-ID: <20141112012425.OPYiG0sH@smtp3h.mail.yandex.net>

I haven't noticed any change -- alkalines have always been prone to leakage. All brands, all types, no exceptions (though some are worse than others). They also outgas something that turns copper alloys brown or black, which is painfully evident if you install them in a confined space like

a waterproof flashlight. It doesn't matter if current is drawn or not (to my observation, it may even be worse if no current is drawn, as in an emergency flashlight).

I've switched to Energizer "Ultimate" and "Advanced" lithium batteries exclusively. I've never had one leak (knock wood), they have higher energy density than alkalines, and they have the added benefit of much lower leakage current so they have a much longer shelf life. I still have some "C" cells frozen, but I think all they make now are AAA, AA, and 9 volt. (I use the "C" cells in adapters to replace "D" cells in things like multimeters. You can get adapters for AA batteries to replace "C" and "D" batteries. Because of the greater energy density, this often works just fine, certainly for low-drain devices such as multimeters and the like.)

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Date: Tue, 11 Nov 2014 17:32:32 -0500  
From: Charles Steinmetz <csteinmetz@yandex.com>  
Subject: Re: [R-390] OT Battery Leakage

>Duracell and Duracell Procell are entirely different lines

Different lines, yes. Different batteries, no. The Procell batteries are just Duracell's second-best batteries ("Duracell Plus") with different graphics and packaged in bulk. Duracell's best batteries ("Ultra Power") offer slightly greater energy density. IMO, they both leak in time.

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Date: Tue, 11 Nov 2014 17:29:09 -0600  
From: Les Locklear <leslocklear@hotmail.com>  
Subject: Re: [R-390] OT Battery Leakage

Then, if they are Duracell's second-best batteries, why did the Procells last longer and never cause leakage problems in our shops multi meters, Maglite's or other devices we used? We spec'd Procell's to our suppliers after experiencing leakage and early failures with Duracell's.

I'm awaiting your prolonged, scientific filled answer, as I'm just a retired controls technician, and have always desired to be enlightened by a multi-paragraphed answer from someone less informed than me on the equipment  
I worked on.....

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Date: Tue, 11 Nov 2014 17:51:28 -0600  
From: Tisha Hayes <tisha.hayes@gmail.com>  
Subject: Re: [R-390] OT Batteries

I too only buy Duracell. Quite often Walgreens will run a special on batteries. I buy a pack of ten or twenty of AA's or AAA batteries. I have some C's and D's too as there are a few pieces of test equipment that uses those. Sooner or later we are going to have a hurricane that runs up into Alabama and the power will be out for a few days. I will at least be able to keep flashlights and a portable radio operating. Another choice would be to go with Ni-MH rechargables and invest in a good charger. Ni-MH

batteries are not ones you throw away.

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Date: Tue, 11 Nov 2014 17:50:56 -0700  
From: Transmaster <22hornet@gmail.com>  
Subject: Re: [R-390] OT Battery Leakage

ProCell's are NOT a second best line. If anything they are better then the Duracell line as they have a higher charge density. They are designed for professional use, that is anybody who uses battery-powered equipment to make a living. They are designed for a heavy current draw. The main reason

why they are cheaper is they are sold in bulk packaging that is easy for a person to get into to get fresh batteries, a bubble pack out in the sticks with a petroleum survey team just doesn't hack it. Please read up on the ProCell line at the Duracell website, and get your facts straight.

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Date: Tue, 11 Nov 2014 18:06:42 -0700  
From: Transmaster <22hornet@gmail.com>  
Subject: Re: [R-390] OT Battery Leakage

Here is a link:

<http://www.medicbatteries.com/duracell-coppertop-alkaline-batteries>

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Date: Tue, 11 Nov 2014 19:07:57 -0600  
From: Cecil <chacuff@cablone.net>  
Subject: Re: [R-390] OT Battery Leakage

Dang...all this over batteries... Can't imagine how we might argue over whether 9mm is of any use for self defense and whether Blonds really do have more fun...bleached or natural... Use the one you like and neutralize the leakage with vinegar...cause they all leak if you leave them unattended long enough...

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Date: Tue, 11 Nov 2014 20:12:01 -0500  
From: Bob Camp <kb8tq@nlk.org>  
Subject: Re: [R-390] OT Battery Leakage

Keep in mind that in this day and age, just about anything can (and is) counterfeited. It's not just the brand you buy, but who you get them from. That wonderful deal from "Bob's Batteries of Bulgaria" on Duracell Pro's is low priced for a reason.... The price delta between no-names and good ones makes batteries a tempting target.

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Date: Tue, 11 Nov 2014 20:13:40 -0500  
From: Charles Steinmetz <csteinmetz@yandex.com>  
Subject: Re: [R-390] OT Battery Leakage

>Then, if they are Duracell's second-best batteries, why did the  
>Procells last longer and never cause leakage problems in our shops  
>multi meters, Maglite's or other devices we used?

I was told they were the same by a Duracell engineer. She had QC reports that showed the same data attributed to both. I wouldn't put too much stock in anybody's anecdotal reports of battery life (including mine), since usage is a huge uncontrolled variable -- how much were the flashlights used, how much were the multimeters used on the ohms ranges, and how much were they left forgotten on the ohms ranges for prolonged periods? Also are you sure you were comparing the Procells specifically to the "Duracell Plus" batteries I mentioned, or could it possibly have been to one of the many other Duracell battery product lines?

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Date: Tue, 11 Nov 2014 19:42:14 -0600  
From: Les Locklear <leslocklear@hotmail.com>  
Subject: Re: [R-390] OT Battery Leakage

Well, they were Procell's. I worked on a DOD installation and they were procured through our supply group for our squadron after we experienced multiple failures with Duracell's.

I worked on Industrial Chillers, Boilers and various other controlled systems on Keesler AFB. I personally used a Fluke 27/FM, TS-352's and many other Mil-Spec designated model numbers. Flashlights were all Maglites, AA's, and multi cell D's. The "Original Coppertop Duracell's leaked regularly, the Procell's didn't, PERIOD. They were used five days a week for many years. I personally had 3 D Cell Maglite's leak to the point they had to be drilled out, cleaned wire brushed and salvaged. Never had that happen with Procell's. At home I use Energizer's exclusively for no other reason than they have never leaked on me and Procell's are hard to find in a store.

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Date: Tue, 11 Nov 2014 19:44:08 -0600  
From: Les Locklear <leslocklear@hotmail.com>  
Subject: Re: [R-390] OT Battery Leakage

To add, I've never seen a Duracell Plus battery.

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Date: Tue, 11 Nov 2014 20:44:33 -0500  
From: Charles Steinmetz <csteinmetz@yandex.com>  
Subject: Re: [R-390] OT Battery Leakage

>Here is a link: [stating that Procells are different.....]

The batteries compared on that page are Procells and Duracell's standard "copper top" batteries. I said I had been told by a reliable source that the Procells are the same as a different Duracell consumer product, "Duracell Plus." (I really don't care if they are or not, since I don't use alkaline batteries anymore.)

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Date: Wed, 12 Nov 2014 02:20:46 +0000 (UTC)  
From: Norman Ryan via R-390 <r-390@mailman.qth.net>  
Subject: Re: [R-390] OT Battery Leakage



I haven't used alkaline batteries since forever (so it seems).? Depending on the application, I'll use either lithium or rechargeable NiMH batteries where AAs are called for. Never experienced leakage with either of the two. Hoping this unscientific finding helps.

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Date: Tue, 11 Nov 2014 21:39:22 -0500  
From: Robert Newberry <N1XBM@amsat.org>  
Subject: Re: [R-390] OT Battery Leakage

<snip> I use Procell batteries. A guy that I work with wife works at a hospital.  
I guess employees can buy them CHEAP! . He just resells them to me to cover the cost to them. They seem like good batteries. I'm not an engineer either.

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Date: Tue, 11 Nov 2014 21:52:28 -0500  
From: <Jbrannig@verizon.net>  
Subject: Re: [R-390] OT Battery Leakage

How many AA's does it take to power an R-390?  
After A/c conversion.....

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Date: Tue, 11 Nov 2014 21:04:24 -0600  
From: kc9ieq via R-390 <r-390@mailman.qth.net>  
Subject: Re: [R-390] OT Battery Leakage

"Leak PROOF" would equal forgetting about any type of wet cell battery. Go lithium if it's a low current device that will likely have the battery installed for years. It's worth the extra money, for the greatly extended shelf life alone.

FWIW I've had worse luck with Duracell and Procell alkaline batteries leaking, than I have with Energizer. Energizer has a "pro" line as well, but I haven't really used any to speak of.

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Date: Wed, 12 Nov 2014 07:31:51 -0600  
From: Tisha Hayes <tisha.hayes@gmail.com>  
Subject: Re: [R-390] OT; Battery Leakage

Quote: "They are supposed to have a shelf life of ten years, but some brands leak far before the dc voltage drops off."

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That might be the kicker. When they give a battery a life expectancy it is usually for a battery in its original package, fully charged and stored in some place at 20 C. As batteries dry carbon and alkaline batteries discharge they eat away at the case. The case is the anode and the ions from the case corrode away and migrate to the cathode in the center of the battery.

If you leave a battery installed in an electronic device like a Fluke meter there is going to be a few microamps of drain on the battery. This is in addition to any self-discharge that the battery already has going on.

If the battery is open-circuit and stored in its package the only leakage is self-discharge, so that gradual migration of ions through the electrolyte is what determines that 10 year life rating.

Putting any sort of load on the battery drains more off of the battery than the self-discharge. That ten year life may now only be six months or a year when that battery is installed in some device.

Remember that most power switches on devices this day actually do not disconnect the battery. The power sense circuit is always juiced up.

It used to be that you could get an idea of where a battery is on its life-curve by looking at the open circuit voltage. That is not necessarily true any more. They have messed with formulations so a battery can have a very flat performance curve until it just stops working, completely depleted.

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Date: Wed, 12 Nov 2014 09:56:48 -0800  
From: Bill Guyger via R-390 <r-390@mailman.qth.net>  
Subject: Re: [R-390] OT Battery Leakage

Don't know about AA's and the 390A's, but back in the day I took a swing through live show production. We had 5 wireless mics in the show and after a couple of battery failures, the producer went off the deep end and required us to change batteries every show. There were 5 shows a day, and each transmitter was a 50 - 100 mw. analog radio, so how much drain was there really.....

We bought a crate of standard 9V. batteries and did as told. That left us with stacks of barely used batteries which we as bored techies began plugging end to end which is possible due to the male and female terminals. Ever seen a 900 V. battery? :-)

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Date: Sat, 15 Nov 2014 15:22:02 +0000 (UTC)  
From: Johnsay Johnsay via R-390 <r-390@mailman.qth.net>  
Subject: [R-390] Batteries

In my line of work I purchased pallet quantities of alkaline batteries for use in scientific oceanographic equipment. These instruments (current meters, thermistor strings and acoustic mooring releases) were typically deployed for one and occasionally two years in difficult environmental conditions. Batteries were frequently in storage for a year or two before use due to the purchase requisition process. All batteries were load tested before installation. My preference based on a variety of operational characteristics were first to last: Panasonic Industrial, Energizer, Duracell, and Rayovac. Rayovac was well down the list with quite a few more problems with leakage.

We did a trial with primary lithium batteries but these tended to have more problems with leakage. When this happened, due to their chemistries they would totally destroy the instruments. Tadiran was particularly bad actor in this respect. John,

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Date: Sat, 15 Nov 2014 11:35:25 -0600  
From: Raymond Cote <bluegrassdakine@hotmail.com>  
Subject: Re: [R-390] Batteries

Ditto the battery references. I also worked in oceanography and purchased my batteries by the pallet loads. I had no trouble with leaks or bad cells. On our case, we tested many cells in 1978 or 1980 time frame and concluded with voltage and current tests that the copper top Duracell was top with energizer a close second. The others listed did not come close. We soldered multiple batteries together to fit in a round pressure case to get the right voltage/current specs we needed. An instrument would be expected to last on the ocean floor up to a year. Our timed releases were also powered with Duracell batteries to fire an explosive bolt.

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Date: Sat, 15 Nov 2014 14:35:23 -0500  
From: <Jbrannig@verizon.net>  
Subject: Re: [R-390] Batteries

My residential sample is no where near what you fellows have experienced,  
But I've found Duracell leakage in AA, C, and D sizes including a completely trashed 3 X D cell Maglite. AA's and C's in seldom used VOM's have been a problem. I just replaced leaky AA's in a set-back thermostat. My rememberer is frequently faulty, I don't seem to recall this level of leakage in "yonder days"

Jim PS: Duracell replaced the Maglite

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Date: Sat, 15 Nov 2014 22:58:56 -0500  
From: <Jbrannig@verizon.net>  
Subject: Re: [R-390] Batteries

A quick check of Costco Duracell AA's does not say "Made in China".....  
If the Chinese figure out how to cut threads or maintain a modicum of quality control we are screwed!!!!

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