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1/8/18, was page 41.

Engineering Couplers and Other ERA Products



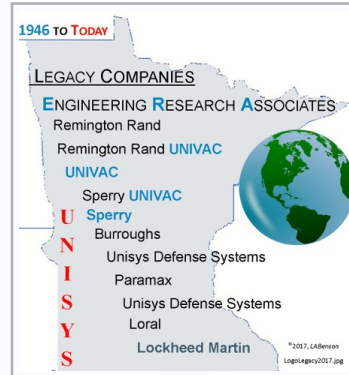
1. Introduction

ERA also built some Ground Support Equipment (GSE) for airlines.

This Legacy chapter discusses the early ERA non-computer products, the most successful of which was the Antenna Coupler series. Unfortunately; Harry, Marc, and Warren who wrote about these ERA products have passed away.

2. Antenna Couplers

The Automatic Antenna Coupler production provided cash flow to keep the plants open in the '50s and early '60s. Couplers were needed for long range over the ocean communications. As illustrated on below right for the KC-135, tail tops or wing tip installations were common. Three 'HAM' radio operators contacted us in 2008, inquiring about surplus store couplers to use with their home systems. Marc Shoquist's [oral interview](#) provides more personal insight into this product as does Warren Becker's [mini-biography](#). [lab]



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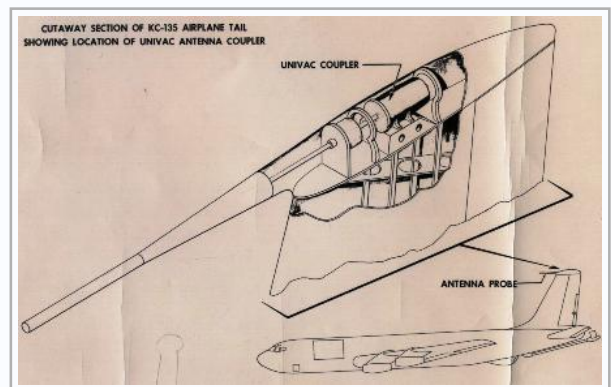
2.1 The Antenna Coupler Program

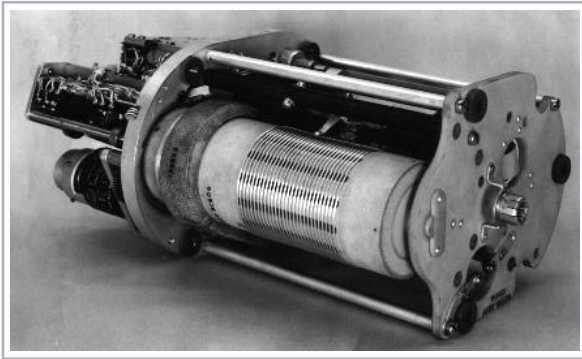
Contributed by Marc Shoquist, Project Engineer on Antenna Coupler Development - 1951 U of MN graduate, Electrical Engineering. Joined ERA in 1953 [34 years with ERA/Sperry]

ERA took on many study contracts from the government during its early years and one of the most successful was the Antenna Coupler program which resulted in the production of over 12,000 units for military and commercial aircraft communication systems during the 1953 – 1970 period, after which the program was transferred to Sperry Marine Systems. It was the largest production program ERA had in the mid 1950's and during the 1953 – 1956 period represented over 25% of the sales and most of the profits for the division. During the 1953 – 70 period, there were three generations of antenna couplers developed; the initial model which used vacuum tubes, an all solid-state unit for the Boeing Jet aircraft developed in 1955, and finally a high tuning speed unit for the General Dynamics B-58 Hustler Bomber developed in 1958.

The coupler consisted of a variable vacuum capacitor and inductor coil, each driven by servo motors which were tuned to automatically match the antenna impedance to the coaxial transmission cable. The tuning elements were controlled by a discriminator which sensed the resistance and phase at the termination of the coaxial cable to the antenna. The coupler tuned wire, probe and tail cap antennas in the High Frequency (HF) 2-30 MHz range. The Boeing 707 used a probe antenna mounted on top of the tail fin so the coupler was exposed to the outside environment where temperatures were frequently below – 65 degrees F. Moreover, the coupler after being in a cold soak at this temperature had to start up an complete the tuning within 10 seconds, a no easy task. In addition, the probe antenna impedance was so miss-matched at low frequencies that the coupling voltage to the antenna was over 20,000 volts. The early units were pressurized with dry nitrogen and sealed with a soldered seal. Later a Teflon coated O-ring seal was developed which was able to hold a vacuum over a long period, thereby simplifying maintenance of the unit.

In the early 1950's RCA won an Air Force contract for the development of the new ARC-21 Airborne HF Communication System which included an antenna coupler. During its development, RCA experienced problems in developing the antenna coupler and the Air Force gave ERA a study contract



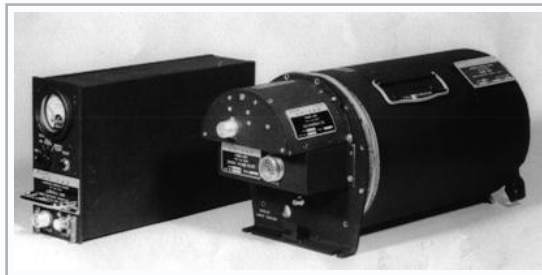


as a fall back. The ERA coupler proved to be superior to the RCA unit thus ERA became the sole source production supplier of the coupler for the system. Initially, it was sold directly to Boeing who sold it as "contractor supplied equipment" in aircraft

delivered to the Air Force. Over 7000 units were sold to the Air Force during the 1953-70 period and were used on about 10 different aircraft. The Coupler assembly line is shown at the right.

I joined the company in 1953 at the time the first generation coupler was entering production. The coupler engineering staff at that time was small and headed by Fran Biltz under the Communications Group directed by Carl Swanson. Other staff engineers included Leon Sabine, Robert Einfeldt, Bruce Sifford, Manny Block, Howard Peterson, and two technicians, Morris "Pappy" Pappenfuss and Oscar Haymen. Carl Hiat, a development engineer had transferred to manufacturing to assist in the transition of the Coupler into production. Fred Hargesheimer headed marketing and Don Blattie did the contracting. Al Meuller led Customer service, which included the training of the supervisors and technicians of the foreign airlines' maintenance shops. {Editor's note: Al was the first VIP Club President in 1980.}

My initial coupler assignment was conducting the Qualification Test of the coupler and writing the report. Later I was the field test engineer for system tests of the Arc 21 communication tests on the B-47 aircraft at McDill Air Force base. This was followed by my supervision of a coupler field modification program at Smoky Hill Air Force base in Kansas. I returned in 1955 to head a development group and became the project engineer for the 2nd generation coupler which was developed for the Boeing 707 aircraft.



The control unit [rectangular box] was mounted adjacent to the radio set.

In 1955, Boeing developed the 707 Commercial jet aircraft and based on the performance of the ERA Coupler awarded ERA the contract to develop the coupler without a competition. This launched the development of the 2nd generation all solid-state coupler, which was the first of its type in industry. The Boeing 707 initiated Boeing's return to the commercial aircraft business, which they continue to lead as the world's largest supplier. The 707 was sold to over 40 airlines worldwide and there was an ERA coupler on every one of them. This was the model 3250 shown at the left. The tube-like unit was mounted either in the vertical stabilizer or at the end of a wing. The

One of the highlights of the military business was supplying the couplers for the Presidents' Air Force One planes. There were six couplers including spares on every aircraft and their installation received special treatment by our engineers and field service staff. Robert Brown, who led our field service group made the initial installation in 1956 at Boeing before they were delivered. The system was upgraded in 1965 and Ernie Griffith, a lead engineer on the coupler project, did the installations at Andrews Air Force Base near Washington DC where the fleet of Presidential aircraft and helicopters are based. I went along to chat with the Boeing representatives and just touring this specially equipped aircraft was worth the trip.

I was project engineer for the 3rd generation coupler for the Air Force B-58 Hustler Bomber. By the time the B-58 Coupler contract was won in 1958, the engineering staff which then included drafting had grown to 70 people and engineers which were added for the 707 project development included John Moe, Charles Class, Allen Anderson, Mick Alsop, Al Sorenson, Paul Richardson, Howard Chen, and Bob Rife. By this time, the



division had become recognized as a specialist in the development of this product to the extent that when Hughes won the contract for the development of the new ARC-68 HF Communication system, they selected us as the coupler supplier, rather than develop it themselves.

While the initial coupler business was with the Air Force and Boeing, in 1967 the company was successful in displacing Collins Radio as the supplier of the Coupler on the Lockheed P-3C Patrol aircraft for the Navy. Winning this contract was a milestone in extending the airborne coupler business to other services. In 1984, I visited Sperry Marine systems 15 years after the the Coupler Business had been transferred to them.

Supplying couplers for the P-3C was the major source of their revenue for their coupler

military business. The P-3 coupler is shown here at the right. [Marc Shoquist]

The antenna coupler is very much a part of the military history of ERA/Univac/LM. I think that the first one was designed for the KC-130 "flying filling station", the prototype of the Boeing 707. The USAF let Boeing build three 707s on government tooling and then made Boeing build their own tooling for the commercial plane. This gave Boeing several years to test fly those planes. In the early 1930's Boeing had built a few prototype B-17s. The depression stopped the production. A Dr. Reynolds invented modern flight testing and spent years working on those prototypes. That is why the B-17 was such a good plane. Dr. Reynolds designed the B-29 at the start of WW II. The first prototype killed him. His niece worked for Remington Rand Univac about 1958. I met her because her parents lived across the street from my parents in Tegucigalpa, Honduras. It's a small world. At one time Margaret might have been the most knowledgeable person in the plant on transistor physics as a result of her programming in that area. [Harry Wise]



The photo at the right was taken in the 1950s at the then ERA plant 3, located on University Avenue between the Cleveland and Raymond intersections.

2.2 Business Aspects by Shoquist

I had mentioned that the Coupler was one of the primary production programs that ERA/RRU had during the 1950's and was very profitable. Over 12,000 couplers were manufactured during the 1953 to 1970 period when the program was transferred and continued at Sperry Marine in Charlottesville, Va. Fiscal year 1957 [April 1, 56 - March 31, 1957] was one of its most profitable years, and I can recall Art E. Johnson from the controllers department calling the Coupler Engineering managers together to review the results. He distributed the following financial data which I have kept all these years. He opened his remarks saying that the St. Paul Division had total sales of about \$ 40M that year with the Coupler contribution as follows:

1. Coupler Sales as percentage of total sales 38%
2. Coupler Profit as percentage of total profit 88%
3. Coupler Return on Sales 40%
4. Division Return on total Sales 3.5%
5. Coupler Return on Investment 163%
6. Division Return on Investment 13%
7. Coupler Return per Professional Employee \$162,000

This was the year that the new plant was opened on West 7th Street, and Wm. Norris would say it wouldn't have been built but for the coupler profits. Only the western quarter of the plant was air conditioned for the two stories. It is no wonder that the Coupler Engineering staff occupied the south/west quarter of the air conditioned section on the first floor. The number of people in this section was over 70, including assigned draftsmen. At that time we were developing the 2nd generation couplers, which were all solid state and were for the Boeing 707 jet aircraft and its military derivative, the KC-135 cargo and tanker aircraft. We had also just won the coupler development from Hughes Aircraft for the new 1 KW HF Communications System for the GD B-58 Bomber [Hustler]. I can remember over 70 people attending the annual Coupler Christmas party that year [1956]. Somewhere I have the attendance list. {Side note: Webmaster Lowell Benson began his technology career in the Antenna Coupler department in July, 1960 as a drawing control clerk - doing paper work for engineering change orders. In the spring of 1961, management moved the antenna coupler engineering department to plant 5 in the midway area. }

A Production summary is shown in this table.

Series	Time Frame	Customer	Aircraft	Quantity
3000	1953 - 1959	Boeing and General Dynamics	Bombers & VC-137 President's aircraft	7000
3250	1958 -1970	Boeing	707/KC-135	3500*
3300	1958 - 1962	General Dynamics	B-58 Hustler**	180
1809	1968 - 1984	Lockheed	P-3C	several 100***
4000	1963 -?	Air Force	Minuteman mobile installation	?

*Additional 3250 series units built at Sperry Marine after 1970.

**Nose probe antenna.

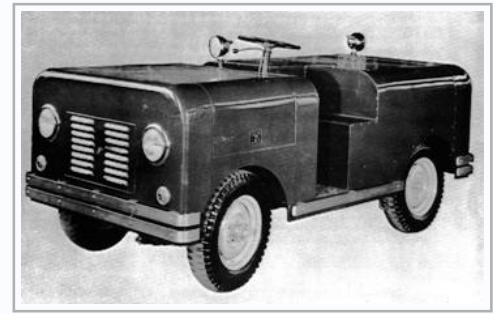
***Mostly at Sperry Marine after 1970



3. Crosley-based Ground Support Equipment

Shown at the right is a Crosley based fueling vehicle which was sold for use at small airports in the late 40's. This was part of the work that Parker brought to the plant because of his previous affiliation with Northwest Airlines. [lab]

I may still have a picture of the ERA Honey Wagon. It was based on a Crosley automobile "strip down": chassis, engine, transmission, running gear, etc., reference <http://www.ggw.org/>. When I first came to Remington Rand Univac in 1956 there were still Crosley parts tucked into corners around the old plant. [Harry Wise]



4.0 Doppler Wind Drift Indicator

{Editor's note: This story by Glen Turner originally appeared in the VIP Club newsletter in April 1990, contributed to the Legacy Project by Ed Nelson. The Newsletter editor at that time was William 'Curt' Nelson.}

This is a story written to clear my conscience. A couple years ago, I told Curt that I would write a piece about one of the projects I was on back in the early 1950s. Now with the completion of this I can face him without feeling guilty. I started at ERA in November 1950 right after 4 years of school on the GI bill of rights. I was hired by Bob Patterson after being interviewed by Ken Bergan and Ken Bush. {Editor's note: Ken Bush's son Tom and grandson Steve both became employees of UNIVAC/UNISYS} I went to work on a project that had nothing to do with computers which was not unusual in the early days of ERA. My introduction to ERA was on a project called "The Doppler Miss Distance Indicator" (Project 2021, if my memory serves me right.) It was of all things, a radar to detect how far a bullet missed a target.

The project was classified Confidential and the project manager, Mr. Bergan impressed on me that I was not to discuss the project outside the hallowed halls of that old glider plant. My wife couldn't understand why I couldn't even confide in her what I was working on. To this day, I get an occasional needle about that secrecy.

I was assigned to design a 20,000 volt power supply for the magnetron for the X-Band radar. Until my clearance came through, I could not even see the radar for which I was designing the power supply. In fact, we drilled a hole in the wall to feed the wires through so the other project people in another room could test their equipment while I ran tests on the power supply. Mr. Bergan must not have been too happy with my cavalier attitude about how I worked around that power supply because he went to the library and got an article on electrocution and made it required reading for me and anyone that worked with me. Some names that come to mind on the project are John 'Art' Engstrom, Lowell Johnson, Wally Moe, Carl Hyatt, Manny Block, 'Ski' Zarembinski, Bob Rhode, Al Mueller, Morris Papenfuss, Bob Einfeldt, Leon Sabine, Alton O. Christenson, John Reedy, John Zavaski, Bob Groschen and many more that will undoubtedly let me know that they worked that program too.

After being on the project for a month; I was introduced to the Monthly Project Report. Being just out of school, I wrote a report that could have been a good start on a thesis on power supplies for air borne radars. It was incorporated in the report and set up for review by a Mr. Coombs. He decided it was too verbose, and I heard him come down the hall asking for that new kid. He told me my part of the report was bigger than all the rest of the report put together and I would have to pare it down. Then they ran into a problem – it had been classified, and I couldn't even see my own report. Mr. Bergan made the corrections.

Testing the radar as it was being built was a challenge. The antennae were set up in the hallway, and we fired Ping-Pong balls down the hall to attempt to simulate bullets. This was fun but not very successful. John Reedy then built a horizontally rotating 'barber pole' with a metallic strip painted on it. This worked well enough to get us to the point where it was ready for testing with real bullets.

Arrangements were made with the Arms Plant in New Brighton for the project to set up the radar antenna and fire 50 cal. Machine gun bullets past it. The data reduction equipment was set up in the gun room. Zarembinski had experience in WWII, so he was our gunner. Numerous trips were made out to the firing range after making engineering changes. [That's engineering talk for we didn't do it right the first time.] We spent so much time at the Arms Plant that the people in charge of the firing range just ignored us and let us do our thing. That turned out to be a mistake on their part. Although the gun was fired in a single shot mode, in time all the sand that absorbed the bullets was blasted away and eventually a hole was made in the back of the cement bunker. The result was that one day a tracer bullet went out of the back of that bunker and set the dry grass on fire. The fire departments from the Arms Plant, Spring Lake Park, and New Brighton were required to put out the blaze we had started. Needless to say, we were closely supervised by the range people after that.

Although the equipment was designed to be installed in a target drone aircraft, it was never tested in the air. Bob Rhode and I took the final equipment to Eglin Field for installation and acceptance testing. Range time was tough to get there in Florida so Bob and I forced ourselves to boat, swim, and fish to kill time until we could demonstrate the ability of the unit to measure miss distance.

While were down there, I was call into General Mechling's office. I thought it was to report on our progress, but the General used me to announce that ERA had been picked to furnish an 1103 Computer for the Air Force. I didn't know an 1103 from a Model T Ford, so I headed for a phone and called Arne Cohen, and told him what I had just been told.

The Doppler Wind Drift Indicator was accepted by the Air Force, and like many of those early ERA projects, it was never heard of again. Glen Turner.



5. Others

As for other RRU airborne products, an advertisement in a military publication associated with the annual Aeronautical Electronics Conference in Dayton, Ohio, featured the following products:

- Magnetic Storage Drums
- Automatic Antenna Couplers
- Analog-to-Digital Converter
- Magnetic Core Storage Matrix
- Miniature Pulse Transformer
-

I presented one of the 122 papers at this conference, which was featured in the same publication.

[Marc Shoquist]

This UNIVAC advertisement at the right was scanned from the 1956 Military Electronics magazine shows Magnetic Storage Drums, Automatic Antenna Coupler, Analog to Digital Converter, Magnetic Core Storage (core plane shown), and Miniature Pulse Transformers. [lab]



Been reading lately and ran across this. Larry Bolton


In a book "The Lake Superior Iron Ore Railroads" by Patrick Dorin, 1969, on page 70-71 in describing the operation of the Great Northern Railway in the Duluth/Superior area, he writes:

"The General Yardmaster has the responsibility of the humping and classification of the road trains. The cars are weighed automatically while being humped. As each car nears the crest of the hump and on to the scale, a console operator punches on a keyboard the car number. A Univac computer pulls the tare weight of the car from its memory and a tape is punched in the ore dock office showing the net weight of ore in the car. This tape is then used to produce punch cards to be used for records such as block lists, mine waybills and ore vessel reports."


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—Matches aircraft radio antenna to transmitter line impedance from 2-24 megacycles.



Analog to Digital Converter
—Reverts and from any measuring device with a rotating shaft output.



Magnetic Core Storage Matrix—Offers storage of 4,000 words; can be arranged in stacks for additional storage.




Miniature Pulse Transformer—Used in triggering and counting circuits; 6-C isolation, impedance and pulse shaping.

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