Gus Fallgren, Al Hankinson and Dick Wright

Transistor Museum Historic Profile

Recognizing Significant Contributions to 20th Century Semiconductor History and Technology

Curator's Introduction

The First "Transistor Powered" Trans-Atlantic Amateur Radio Contact

Late in the evening of September 18, 1956, a clear sweet-toned continuous wave radio transmission was generated by a midget-sized homemade amateur radio transmitter operated by Gus Fallgren, W1OGU, in Chelmsford Massachusetts. Almost instantaneously, this transmission was received and acknowledged by Bo Brondum-Nielsen, OZ7BO, a Danish radio operator located in Copenhagen. To the amazement of the Danish radioman, Gus Fallgren explained that his signal, travelling over 3600 miles across the Atlantic ocean, was powered only by two tiny Raytheon germanium transistors. This contact is the first documented transatlantic ham radio transmission using transistor technology. The original concept and development of the transmitter was done in 1956 by three Raytheon employees, Gus Fallgren, Al Hankinson and Dick Wright, and the subsequent success of the project was featured in key industry journals of the time. This Historic Profile documents the original and historically important work done back in 1956 and, in addition, presents material resulting from recent Transistor Museum interviews with all three of the original transmitter developers.

Gus Fallgren in 1956 with Transistor Transmitter
Photo Copyright © 1957 by Radio &TV News

Radio & Television News was one of the most popular electronics industry publications in the 1950s, with a wide distribution to engineers, experimenters and amateur radio operators. Shown above is the cover title block from the February 1957 issue of the magazine, which featured a three page detailed article on the transistor transmitter, written by Al Hankinson and Gus Fallgren. At left is a cover page section from this issue showing Gus in action at his "radio shack", using the transatlantic radio transmitter. A careful look at the photograph will reveal the two small Raytheon transistors mounted on the top of the transmitter, and the single 6 volt black/red battery used for power.

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Above is a 2010 photo of Gus Fallgren, at left, and Dick Wright. They are holding the transatlantic transistor transmitter, constructed in 1956.

Al Hankinson, Dick Wright and Gus Fallgren compare their mite-sized transmitter with standard transmitter in background. Drastic reduction in size was achieved by using two Raytheon transistors.

The October 1956 edition of the Raytheon News featured a story on the transmitter. Shown above are Al Hankinson, Dick Wright and Gus Fallgren, inspecting the device.

The sepia toned photograph at right was taken in 1956 at Gus Fallgren's radio shack by G.E Meyers, who was a professional photographer hired by Raytheon to document the historic transmitter. A series of related photographs was taken at that time. Note the extra Raytheon transistor, shown positioned underneath the transmitter. The color photograph was taken at Gus's radio shack in 2010 and shows the current condition of the transmitter. Note the original blue Raytheon transistor mounted at the rear of the device. At some point in the 1960s, the other transistor was replaced with an updated germanium transistor, mounted in a ribbed heatsink. The transmitter has not been used for many years.

TransAtlantic Transistors, Page 3

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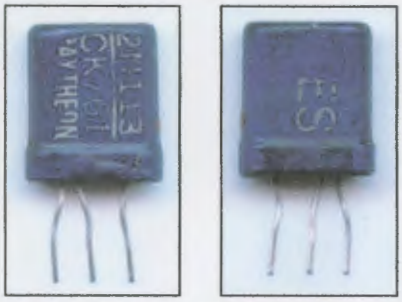

Shown above are both sides of one of the Raytheon transistors used in the first transatlantic contact. Standard production transistors were typically stamped with a manufacturing date code. This device is a pre-production Engineering Sample (ES) with no date code - it was likely produced in early 1955.

DATE TIME	STATION CALLED	CALLED BY	HIS FREQ. OR DIAL	HIS SIGNALS RST	MY SIGNALS RST	FREQ. MC.	EMISSION TYPE	POWER INPUT WATTS	TIME OF ENDING QSO	OTHER DATA
9/17/56	1855	W4KTN	X	59	59	14	PH			59 Rate RS
	2020	WBOCT	X	599	579	"	CW		2035	Detroit Mich TRANSISTOR X
	2036	W6PU	X	579	569	"	"		2043	Albany Calif
	2148	T12BZ	X	599	599	14	14		2222	San Jose Costa Rica Jose
					439					TRANSISTORS
9/18/56	0045	W1TW	X	599	549	"	"		0050	Newton TRANSISTOR
	2006	OZ7BO	X	599	599	14	14		2042	DENMARK Bo X
	(W2PTI)				339					TRANSISTOR
9/19/56	0700	KV4AA	X	599	599	"	"		0703	Virgin Isls

DOCUMENTING THE HISTORIC TRANSMISSION

The exchange of QSL cards by the two communicating parties involved in an amateur radio contact is the standard method for documenting the contact. The QSL cards are typically the size of a post card and are mailed using the postal system. The cards contain the basic information relating to the actual radio contact. Shown at top is a scan of one side of the QSL side mailed to Gus Fallgren by Bo Brondum-Nielson from Copenhagen confirming the first transistor transatlantic contact. Amateur radio operators also maintain a formal log of their contacts, and shown above is a section of Gus's log from September 1956. The yellow highlighted section documents the first contact at 20:42 Eastern Time, on 9/18/56. Note the QSL card has a Sept 19 date, which reflects the six hour time difference between Chelmsford and Copenhagen. The contact was done on the 20 meter (14 MC) frequency band.

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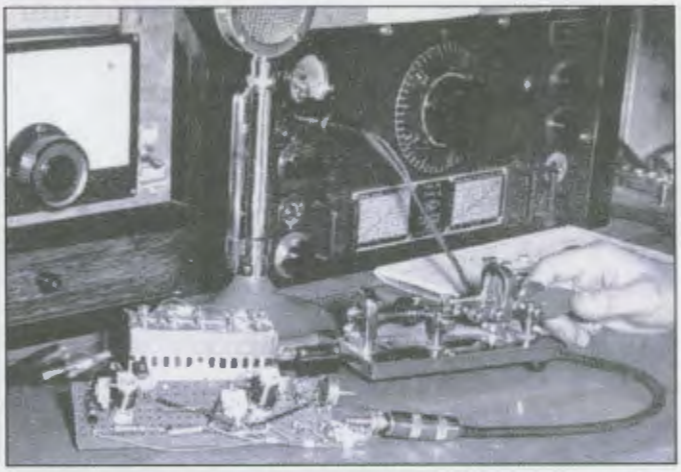
COVER PHOTO: Gus Fallgren tries out his history-making transmitter, the first to span the Atlantic on transistor power. Two Raytheon transistors are used. See article, page 37. (Ektachrome by G. E. Meyers, Raytheon)



Shown at top are two scans from the 1957 R &TV News article. At top left are Al Hankinson and Gus Fallgren illustrating the final output adjustment procedure for the transmitter. The power output of the transistor transmitter was .08 watt (80 milliwatts), and the distance of the transatlantic contact was 3600 miles – another way of expressing these values yields the impressive tag line, "45,000 Miles-per-Watt". Note that the Italian language version of this magazine article used the metric system equivalent, "72,000 Km. per Watt". At lower left is a 2010 photo of Gus Fallgren, shown holding the original transistor transmitter and seated next to his current rig, which has a power output of 1500 watts! At lower right is a photo from the November 1956 issue of QST magazine, which is the official publication of the ARRL (American Radio Relay League). The photo shows Gus at work with a prototype version of the transmitter, and noting long distance international contacts with KP4, TI2, OZ7 and G3 (Puerto Rico, Costa Rica, Denmark, and England).

TransAtlantic Transistors, Page 5

Gus Fallgren, Al Hankinson and Dick Wright

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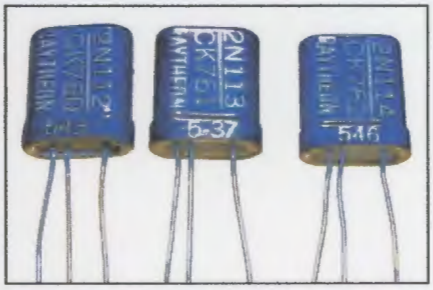
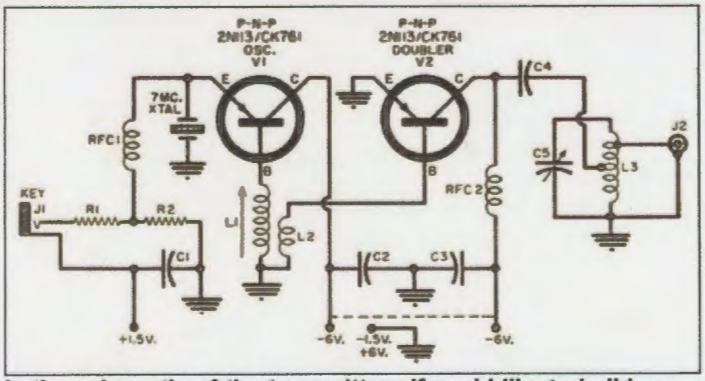
The First "Transistor Powered" Trans-Atlantic Amateur Radio Contact



RAYTHEON TRANSISTORS

At upper left is a section of a 1955 Raytheon ad, confirming leadership in germanium transistor technology. New "high frequency" devices - the CK760, CK761 and CK762, using the PNP fusion alloy process, were now available. Shown above are production versions of these devices, all dated 1955. Raytheon used a proprietary "CK" numbering system, and early devices used this and the standard "2N" system. The Transatlantic Transmitter used two 2N113/CK761 transistors, rated at 10MC high frequency capability. The "ES" samples used in the transmitter were provided by Frank Dukat, who was the transistor product manager in Norm Krim's Semiconductor Products group. The striking iridescent blue color of these early Raytheon transistors, and the equally appealing cardboard packaging (shown above) are easily identified characteristics of historic Raytheon germanium devices such as the CK761 and the more famous CK722.



Above is the schematic of the transmitter. If you'd like to build one, use the link on the next page to view the construction details in the 1957 article.

TransAtlantic Transistors, Page 6

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CONTRIBUTOR'S COMMENTS

GUS FALLGREN
Date First Licensed as Amateur Operator: **1946**
1956 Call Sign: **W1OGU**
Current Call Sign: **W1OG**
Working on the 1956 TransAtlantic Rig:
I was working as a technician at Raytheon Missile Systems; I had a hard time convincing my boss to let me have time off during the day to work on the transmitter. We used my antenna, which was a 3 element rotary beam mounted on a 40 feet windmill tower. I also remember watching the engineers assemble units of the first Raytheon point contact transistors in 1950.

AL HANKINSON
Date First Licensed as Amateur Operator: **1946**
1956 Call Sign: **W1OSF**
Current Call Sign: **KC3QU**
Working on the 1956 TransAtlantic Rig:
I was working with Gus as a technician at Raytheon Missile Systems; before then I had 10 years of experience with maritime mobile radio with the Merchant Marines. I was the primary author of the R&TV News article. I remember that the article caused a lot of excitement and was published in the Soviet Union and Japan.

DICK WRIGHT
Date First Licensed as Amateur Operator: **1952**
1956 Call Sign: **W1UBC**
Current License Call Sign: **W1UC**
Working on the 1956 TransAtlantic Rig:
I got my novice license (WN1UBC) in 1951 in high school. I was a senior at Worcester Polytechnic Institute, majoring in Electrical Engineering, when we worked on the rig. I just had a summer job as a technician between my Junior and Senior year when the 80 milliwatt transmitter was created. I remember studying transistors at WPI, and was successful at building a multivibrator that was able to operate up to 1MC. High frequency performance was a real challenge for transistors at that time.

CURATOR'S SUMMARY

This Historic Profile has been devoted to documenting the creativity, technological accomplishments and commitment to the amateur radio community demonstrated by Gus Fallgren, Al Hankinson and Dick Wright over 50 years ago when they designed, constructed and operated the first transistor-powered ham radio transmitter to span the Atlantic ocean. Their work achieved an important and historic milestone in the timeline of radio and transistor technology:

1901: The first trans-atlantic radio transmission is completed by Marconi using a spark gap transmitter to span 1900 miles from England to Newfoundland.
1948: The newly invented transistor technology is first announced to the public by Bell Labs/Western Electric.
1952: George Rose, K2AH (SK), completes the first transistor-powered amateur radio transmission, using a single experimental RCA device and spanning 25 miles.
1956: Gus Fallgren completes the first transistor-powered transatlantic amateur radio transmission, using two CK761 Raytheon devices and spanning 3600 miles.

To the credit of the amateur radio community, the use of transistors to power radio transmitters was accomplished very soon after this technology was invented, first with George Rose's point contact transmitter and then with the transatlantic transmitter developed by Gus Fallgren, Al Hankinson and Dick Wright.

You'll find many more pages of related historical material at these sites:

Norm Krim Early Raytheon Transistors

Mike Rainey (AA1TJ) Historic Transistor Transmitter

Radio and TV News 1957 Article

Raytheon News 1956 Article