

# “Leading Antenna Engineer”



**John Pack Shanklin**

**Presented for Historical &  
Educational Purposes**

**By: James “Jim” Robert Shanklin  
Rockwell Collins, Retired 1996**

**Based Upon  
“Leading Antenna Engineer”**

# Overview

Imaginative – Creative – Dedicated

Granted Fifteen Patents

*Major Contributor to United States Security  
& World Flight Safety*

# Early Childhood

**Born at His Parent's House on May 22, 1907 in Glendale, Ohio**

**Parents were James Robert Shanklin & Mary Padbury (Cooper) Shanklin**



**August  
1907**



**February  
1908**



**February  
1909**



**1911**



# Education – Grades 1 through 12

Started School September 22, 1913



1913



1914



1917



Alderson, WV Public High School  
1913 -- 1914



Bramwell, WV Public High  
School 1914 – 1918



Marion, VA Public High  
School 1918 – 1925

Graduated June 3, 1925

# The Beginning

- **Saw Wireless Telegraph in August 1920 on Mackinac Island**
- **Built His First Wireless Radio Station**
- **Manual Tests for Best Antenna Location**
- **House to House & House to Automobile Communication**
- **1922 – Listened to KDKA in Pittsburg and WLW in Cincinnati**
- **Crowds Gathered at the Shanklin House to Listen**

**W3CIJ**

*One of America's Early Amateurs*

*First Communication in 1922*

# Virginia Polytechnic Institute (VPI) (Virginia Tech)

- **Military College – Fighting Gobbler (Hokie Bird)**
- **Majored in Electrical Engineering**
- **AIEE Member**
- **100 Yard Track Star – 1927, 1928, 1929**
- *Graduated on June 11, 1929*



**Track Star**



**Patton Hall  
Engineering Bldg**

# Radio Corporation of America



- **Started June 17, 1929**
- **Trans-Oceanic Global Communication, Rocky Point, L.I., NY**
- **Chief Engineer – Harold “Bev” Beverage**
  - **HF Signal Fading Research**
  - **Diversity Reception**
- **Used W3CIJ as RCA’s Operator for 2nd Successful Transmission of Trans-Atlantic Communication at 200 Meter in HF Band**



**Power House & Headquarters  
Rocky Point -- 1929**



**Reception House  
Riverhead – 1929**

*Patent Granted for HF Signal System  
Using Three Inter-connected Thermionic  
RF Oscillators*

*Foundation for Collins  
DEW Line Dual Antennas  
& Diversity Receiver*

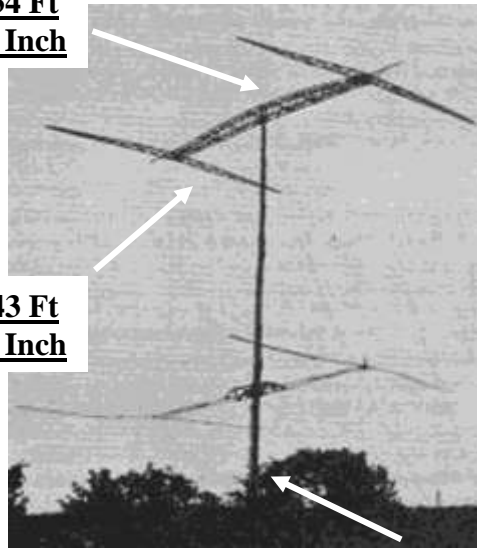
# Family Business Era



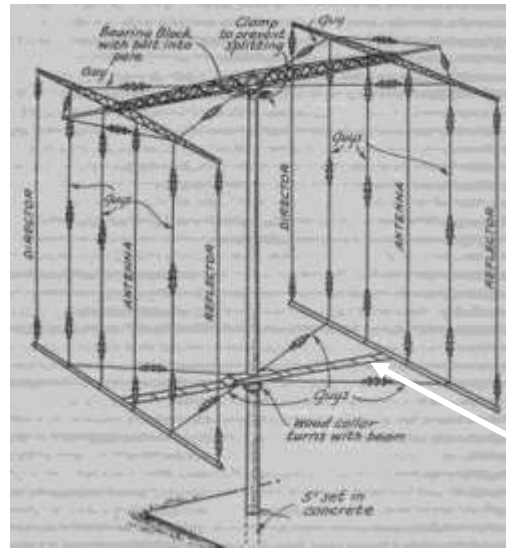
**Very Successful Manager of Shanklin Dairies  
Profitable During Depression**

## 1934 – Rotatable Vertical Directional Yagi Amateur Antenna

34 Ft  
8 Inch



43 Ft  
4 Inch



Director  
Guy Rod  
Guy Rod  
Antenna  
Guy Rod  
Reflector

Tie Rod

Same Site – 1922





# Family Business Era

## Terrestrial Radio Navigational System

### Ground Station System

- Area Divided into Zones with Two 180 Degree Out of Phase Transmitters
- Pre-assigned Frequency for Each Location in the Zone

### Vehicle System

- Two Receivers & Phase Meter to Determine Vehicle's Position by Comparison of the Out of Phase Signals
- Vehicle Could be in Motion or Stationery

*Separate Patents Granted for the Ground Station and Vehicle Systems*

*Decca Lawsuit Dismissed by Judge*

Sold Both Patents to Bendix Aviation Before WWII

**Married Mary Helen Romans – Three Children**

# Bendix Radio – Military



- **WWII Caused Major Near and Long Term Changes to John's Life**
- **Bendix Critical Skills Assignment Versus Artillery Captain in Europe**
- **Reported to Adam Abel in Towson, MD in June 1943**
- **1st Shipboard IFF L Band Antenna for Navy's MK-V Radar**
- **High Speed Aircraft in the South Pacific**
- **Separate Transmit & Receive on Yardarm Ends at Top of Main Mast**
- **Started on Feb 1, 1944 – Deployed in August 1944 on USS Wasp and Hornet**



**Radar**



**IFF Antenna  
AS-177/UPX**



**USS Hornet CV-12 March 1945**

**Pointed Out Antennas to  
Family after WWII**

# Bendix Radio – Military



## SCR-624 Radio Set VHF Antenna

- **Broadband Dipole/Discone Omnidirectional Replacement for Whip AN-94B**
- **Telescopic Long and Short Sections**



AN-94C VHF Antenna



## SCR – 624 Selective Calling System

SCR-624 VHF Radio Set  
Fighter Control  
Communications

- **Used Pulse Duration Instead of Pulse Counting**
- **Used Electrical Relays and Time-Delay Circuits**

*Patent Granted for “Pulse Length Measurement”*

# Bendix Radio – Railroad



## VHF Antenna

- For Tall Buildings & Towers at Airports, Ships, & for Command Centers
- Wide Band
- Omnidirectional and Vertically Polarized
- Railroad Operation 182 to 216 (Mhz)



*Patent Granted for "Antenna System"*

# Bendix – Railroad




## Railroad Tunnel HF Propagation

- Continuous Engine & Caboose Communication in/through Tunnel
- High Gain Antenna at Each End
- 7 Wires In Tunnel Ceiling
  - 2 Wire Rhombic Antenna
  - 5 Shield Wires

**Successfully Demonstrated  
June 28, 1946**

*Separate Patent Granted for “Propagation of Radio Waves Through A Tunnel” & “Co-Axial Coupling System for Antenna”*

Locomotive Antenna



- Vertical, Horizontal Polarization
- Co-axial Coupling

# Bendix Radio – Avionics



## Navigation Ground Antenna

- **VHF Localizer Transmission**
- **Omnidirectional**
- ***Circular, Horizontal & Vertical Polarization***
- **“Built for Department of Commerce – Civil Aeronautics Administration – Type CA-1246”**
- ***Major Background for Collins Navigation Antennas***



# Collins Radio Company



Art Collins – 1947  
WØCXX

## *Antennas for Avionic Systems*

- **Joined Collins on November 13, 1947**
- **Lead Engineer of the Antenna Section in Dave McCoy's Group**



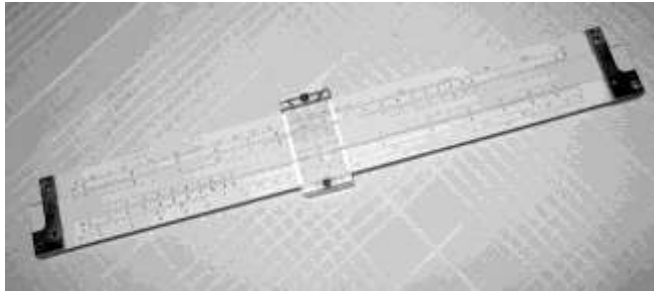
John Shanklin  
W3CIJ

- **Leading Role for All Major Commercial & Military Antenna Designs**
- **Articles for QST, IRE, & Antenna & Propagation Society Publications**
- **IRE & Antenna & Propagation Society Presentations**
- **Granted Eight Patents**



Main Plant – 1947

# Collins Radio Company Background



**Computer  
John's Slide Rule  
Math Calculations**



**Ground Plane Tests  
Aluminum Coated Scale  
Model DC-3**

## **First Integrated Flight System**

**1950 – FD-101**

**Equipped Twin Beech for Demos**

**Included Related Equipments**

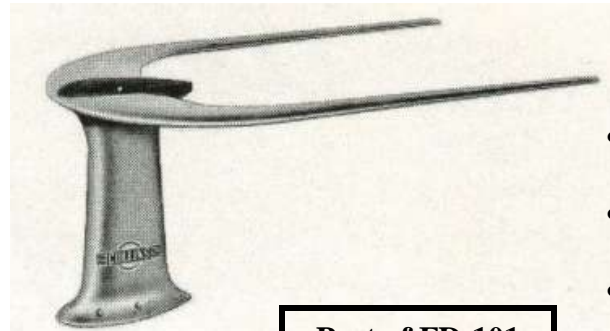
**Names Reflected  
Size & Shape**



# Collins Radio Company



## Avionics – 37J-3 VHF Navigation/Communication



Part of FD-101  
First IFS – 1950



51R-3 Navigation  
Receiver

331A-1 Course  
Indicator



### *“Deerhorn” Most Famous*

- VHF Omnidirectional Range (VOR) & Localizer
- Horizontally Polarized – Mounted Over Cockpit
- Cast & Sheet Aluminum – Plastic Filled
- Layout on Brown Lunch Bag Using Coke Bottle
- Bag Helped Win Lawsuit
- Commercial & Military Transport Aircrafts
- Over 10,000 Manufactured

- Continuously Received Two VOR & Localizer Signals for 51R Receiver
- Both Signals to IFS’s Course Computer for Triangulation
- Course Indicator Displayed Location, Distance, & Course

*Patent Granted for 37J-3’s Dipole & Feed Arrangement*

# Collins Radio Company

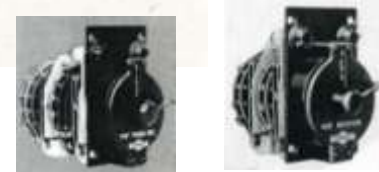


## Avionics – 37R-1 VHF Communication/Navigation

**“Half Deerhorn”  
AKA “Ram’s Horn”**



- VHF Transmit and Receive Communications
- Vertically Polarized – Quarter Wave
- Aluminum Construction & Foam Filled
- Mounted on Aircraft Top or Bottom
- Used with 51X Receivers & 17L Transmitters
- Towers, Aircrafts, Company, Taxi, & Vehicles



614 F-1 & 614G-1 Controls



51X-1 VHF  
Receiver



17L-4 VHF  
Transmitter



314Y-2  
Control

**Looked Like & Used as a Boomerang**

# Collins Radio Company

## Avionics – 37P-3 Airborne Glide Slope

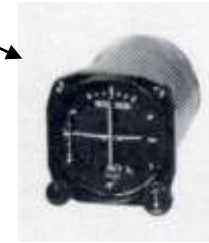


*Bullring AKA  
“Hook”*

- UHF Omnidirectional & Horizontally Polarized
- Made of Aluminum – Mounted on Aircraft’s Nose
- Received Azimuth & Altitude Signals for 51V Glide Slope Receivers
- Landings During Instrumental Meteorological Conditions (IMC)

Part of FD-101  
First IFS – 1950

329B-1 Approach  
Indicator



51V-1 Glide Slope  
Receiver



- Steering Computer Processed 51V Receiver Inputs for Displays in IFS Approach Indicator

**“DO NOT USE FOR PULLING” Sign**

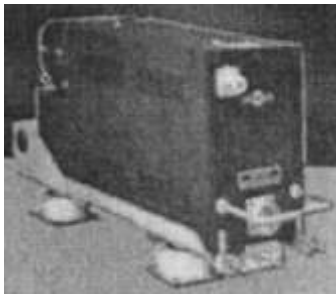
*Patent Granted for Key  
Features in the 37P-3*

# Collins Radio Company

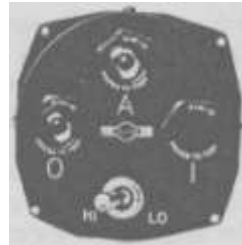


## Avionics – VHF Marker Beacon Cavity Antenna

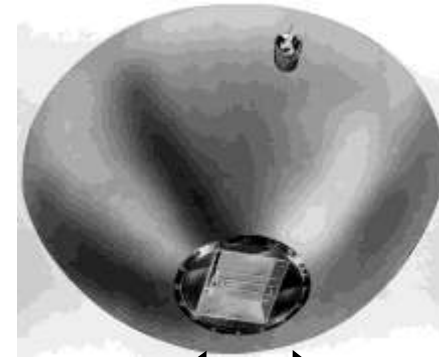
- Received 75 Mhz Ground Vertical Signals
- Vertical Polarized – Cavity Mounted
- Replaced Long Wire
- *One Foot Hole Cut in Plane Belly*
- *75 Feet of Coax*



51Z-1 Marker Beacon  
*Receiver Mounted in Wing*



327A-2  
Marker  
Indicator



One Foot Across

Cavity

**Airline Not Like**

**Replaced by 37X-1**

**No KNOWN Type Number**

# Collins Radio Company



## Avionics – 37X-1 VHF Marker Beacon

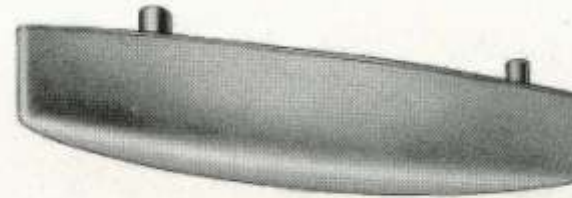
- Received 75 Mhz Ground Marker Beacon Vertical Signal
- Vertically Polarized
- Enclosed in Cast-resin Shell, Plastic Foam Core, Submergible

327A-2  
Marker  
Indicator



51Z-1 Beacon Receiver

“Canoe”



High Speed Aircraft

- Continuous Reception of Outer, Middle, & Inner Beacons
- Different Color Light Displayed for Each Beacon

Mounted on Aircraft's Bottom – Eliminated Hole in Plane For Cavity Type Antenna with 75 Feet of Coax or Long Wire Antennas

*Patent Granted for the Marker Beacon Antenna's Small Size & Packaging*

# Collins Radio Company



## Avionics – Combination Localizer & Swamping

- **Combined UHF Directional Antenna that Automatically Switched**

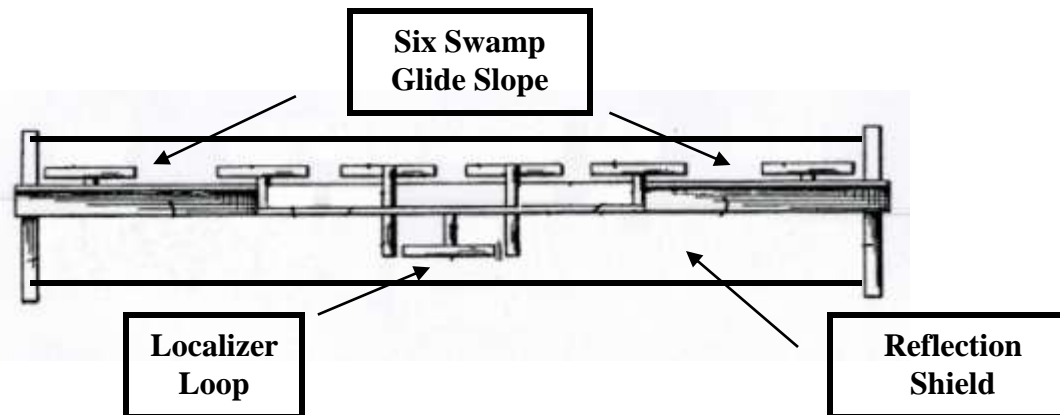
- **Azimuth Direction & Altitude Swamp (Glide Slope) Signals**

- **Airport Localizer Signal that Provided Aircrafts with Geographic Position**

- **Usage**

- **Located at End of Runways**
- **Course Navigation Over Swamp**
- **Instrumental Meteorological Conditions (IMC) Landings**

- **No Collins Pictures or Type Number**



*Patent Granted for "Combination Localizer and Swamping Antenna"*

# Collins Radio Company

## Avionics – VOR Ground System



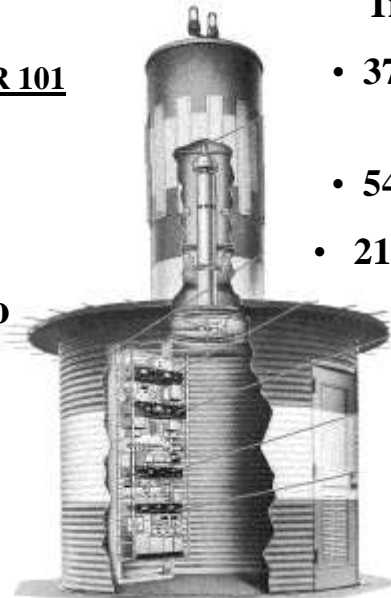
### 37Y-1 VOR Navigational Antenna

OR 101

- **Omnidirectional Horizontal Transmission with Suppressed Vertical Polarization**
- ***Pure Continuous* VOR & Localizer Signals to Aircrafts within 100 Mile Radius**
- **Permitted Aircraft to Compute Location, Bearing, Distance, Course Direction/Deviation to Approach**
- **143 Stations in the United States**

### Key Components

- 37Y-1 Antenna
- 242F-3 50 Watt Transmitter
- 37J-3 Monitor Antenna
- 54J-1 Monitor
- 218A-1 Housing



*Patent Granted for "Suppression of Vertically Polarized Radiation from an Omnidirectional Range Antenna System"*

# Collins Radio Company – Moon

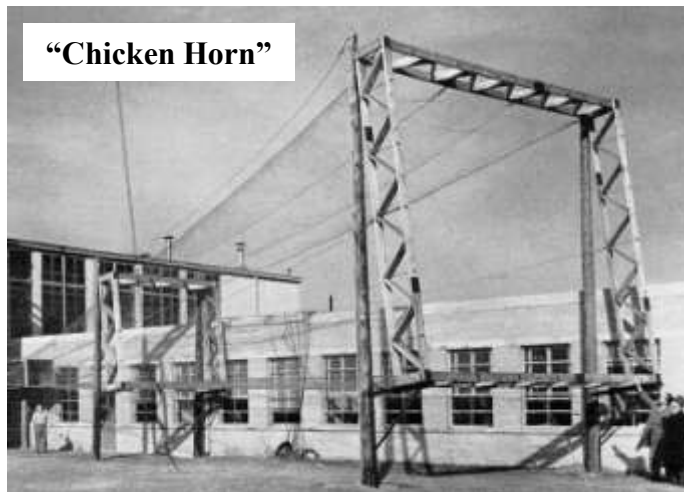


- Art Collins – Moon to Reflect Signals from His Amateur Station
- Set Up Team – *Irv Gerks, John Shanklin, Leon Griswold*

- Faced the East Horizon
- Iowa Electric Power Arrangement
- Heated Hanger Sheet Metal
- 2–1/2 Seconds – 500,000 Miles to CRPL
- 800 Ground Miles to Sterling, VA

**1<sup>st</sup> Successful UHF Long  
Telegraphic Message  
November 8, 1951**

***“What Hath God Wrought”***



- 75 Ft Long Tapered Wave Guide Horn
- 20 X 20 Ft Opening
- Metallic Wire Mesh
- 418 MHz (72-cm) Coded Signal
- 20–kilowatt Transmitter – Collins Liquid Cooled Resnatron Tube
- 26.3 dbi of Gain – 10 Megawatts of EIRP



# Collins Radio Company

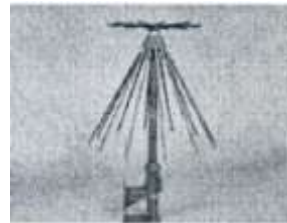
## Military – Move to UHF – GRC-27



- Squirrel Cage – Vertically Polarized – *Omnidirectional*
- Four Bay Configuration – Three Aircraft Operation – One Spare
- AS-505 Rotating Shack Tests



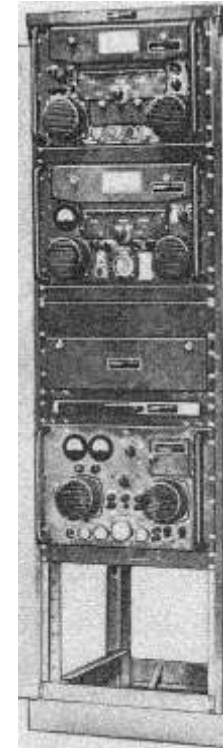
AS-505/GR



AT-197/GR  
Omnidirectional – AF



AS-450/GR – Directional Army



AN/GRC-27  
Air Force

AN/GRC-27 including AT-197/GR, AS-505 – DEW Line

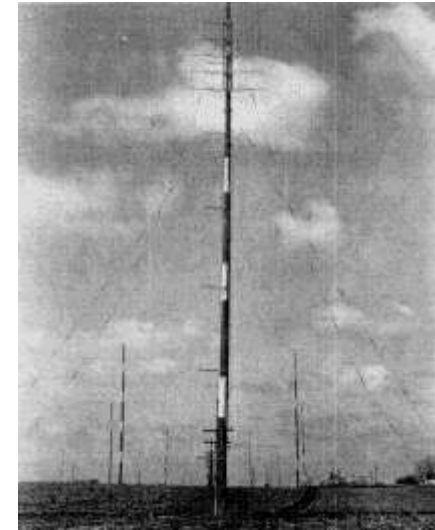
*Patent Granted For Squirrel Cage Alford Lawsuit Denied*

# Collins Radio Company

## Transhorizon Communications



- 1945 Study for Navy Concluded 1,200 Miles for VHF Ionospheric & 350 Miles for UHF Tropospheric Achievable
- 1951 VHF 770 Mile CRPL & 1952 700 Mile Dallas Tests with 1,000 Ft Rhombic & 20-kw Transmitter at Hangar
- 1951 Tests with 1,100 & 770 VHF Ft Rhombic with Modified AN/FRT-6 40-kw HF Transmitter
- Built Four 500 to 2,000 Ft VHF Rhombics at Konigsmark



*Aug 19, 1952 AF VHF Ionospheric Demo with 500 Foot Rhombic & 40-kw Transmitter*

**AF Bought Eight IS-101s DEW Line Long Distance Rearward Data Transmissions**

**VHF 51M Receivers, 242F-2 & 242F-3 Transmitters, & VHF Antennas for Aircraft Communications**

# Collins Radio Company

## Transhorizon Communications – Tropospheric



- Normal HF & Line of Sight VHF Unreliable Performance in Arctic Atmosphere & Climate Conditions
- 1954 UHF Test – 28 Foot Parabolic Dish On Tower Behind Engineering Building (120) – Faced Southwest
- 28 Foot Parabolic Dish & 60 Foot Billboard at Lamar – Faced Northeast
- Transmitters – Dishes – 240E-1 1-kw – Billboard – 10-kw



Engr Bldg



Lamar

### 1<sup>st</sup> Use of Dual Diversity Receiver

- Automatic Detect Multiple Incoming Signals from Omnidirectional or Directional Source
- Determine Strongest Signal & Its Direction – Supply Transmitter

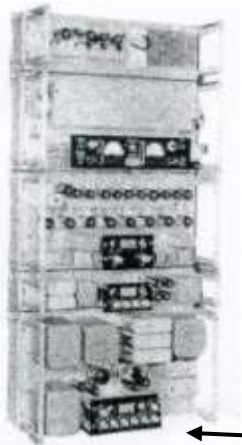
Late 1954 AF Tests Over Three Links – Acceptable

**Patent Granted for Diversity Receiver**

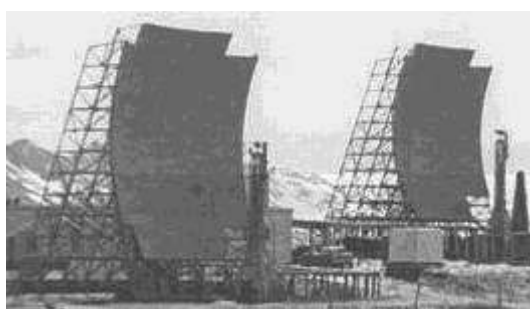
# Collins Radio Company



## White Alice – DEW Line



- Authorized in 1954 – UHF Tropospheric for Communication & Data
- 52 Initial Sites – Installed 1955 – 1957 – Expanded to 71-- Updates
- Wideband System – 132 FM Channels – About 900 Mhz
- Various Configurations – Minimum 2 Receive & One Transmit Antennas, 1 Diversity Receiver & 1 Transmitter System Per Site
  - AN/FRC-45 – 1-kw Transmitter
  - AN/FRC-47 – 10-kw Transmitter
  - 60 Foot Billboard Antenna
  - AN/FRA-45 30 Foot Parabolic Antenna
  - 50G-1 Diversity Receiver



Boswell Bay, AK – First Commissioned  
Last Decommissioned



**Collins Only Supplier in 1950s  
Complete Military & Commercial  
Transhorizon Systems**

**Army Mobile Tropospheric**

**Commercial – Transportation,  
Telephone, & Petroleum  
Communication & Data Terminals**

**John Designed All DEW Line Communication Antennas**

# Collins Radio Company



## Strategic Air Command Communications



Gen LeMay & Art

- General Curtis LeMay wanted **Reliable Instant & Continuous Communication with Any SAC Plane in the World**
- **Conventional HF AM Limited Range, Polar Fade Out, & Interrupted Communication**
- **Project Birdcall – RADC 1955 Contract to Develop & Test Improved Air-to-Ground & Point-to-Point Communications**
- **General LeMay (KØGRL) Convinced HF SSB was Solution**
- **Speed up Procurement with a Series of Flight Tests KWS-1 Transmitter & 75A-4 Receiver – HF Antenna at Konigsmark**
- **Vice-Commander Major Gen Francis “Butch” Griswold (KØDWC) in Charge**
- **Planning Meetings**



“Butch” & Art

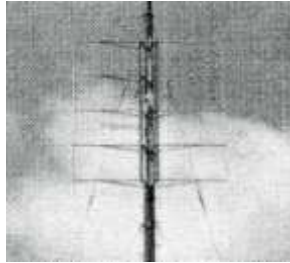


**Four 1956 Test Flights with Art as the HF SSB Operator for the First Two – Used WØCXX Tests Proved HF SSB was Superior to HF AM**

# Collins Radio Company



## SAC – Beam Switching Antenna System



Big Talk

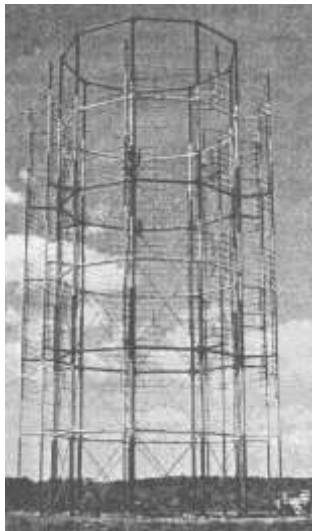
- Electronically Compute Frequency Beam for HF Array of Omnidirectional Antennas & Automatically Switch the Beam any Direction in Its Azimuth without Moving the Antennas

- Four-bay Array System Testing At Konigsmark

- Project Big Talk – Emergency Procurement of Beam Switching Billboard Antennas & SSB Equipment

- Collins Installed Eight Six-bay Array Billboard Antenna Systems in Six Weeks

- Beam Switching in Nine-bay Array for SAC's HF Birdcall & Short Order Billboards & Collins' Antenna Farm's Six-bay & Nine-bay Array Systems



Birdcall – Wullenweber



Konigsmark

Patent Granted for "Antenna Computing Means"

# Tributes

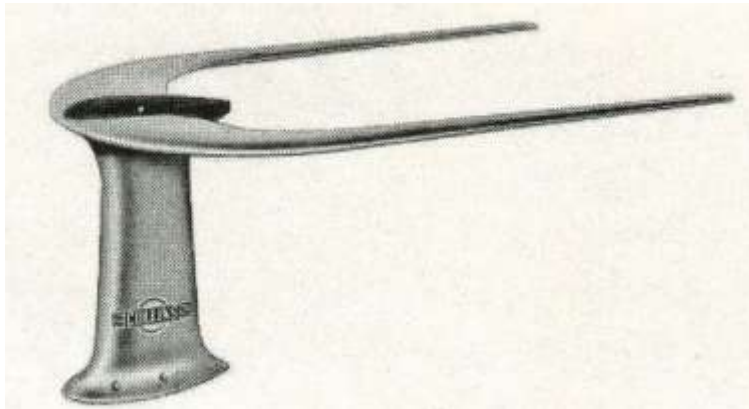
**Navy Inspector – “A Tremendous Bag of Tricks to Solve the Difficulties that Keep Popping up in Antenna Work”**

**Collins Employees – “Good Idea to Have John Shanklin Looking over Your Shoulder if You Wanted Your Antenna to Meet Its Requirements”**

**Dave McCoy – “He’s Out Engineered What are Known as the Leading Men”**

**Rome Air Development Center Office – Closed for a Day Out of Respect**

**1956 August Column – “The Leading United States Antenna Engineer”**



*Most Famous Antenna*



**John Pack Shanklin**  
May 1907 – June 1956