

WALKER AFB AND ORFORD NESS

A COMMON MISSION

STEVE CLIFTON / OLAF KIRCHNER (IRGON)



BACKGROUND: THE PLACES



Separated by more than 5000 miles, the former Walker Air Force Base at Roswell, in arid New Mexico, and Orford Ness, a damp shingle spit off England's Suffolk coast, could not be more different geographically. They both, however, share a Cold War secret.

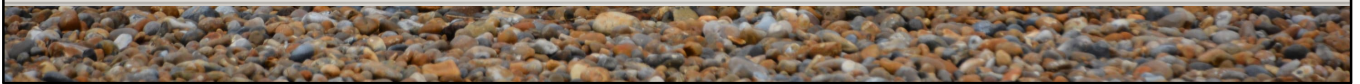
WALKER AFB AND ORFORD NESS

WALKER AFB

1. **Opened in 1941 as an Army Air Corps flying school**
2. **During the Cold War, became the largest base of the Strategic Air Command**

ORFORD NESS

1. **Opened in 1915 as a research centre for military aviation**
2. **During the Cold War, became an outpost of the Atomic Weapons Research establishment**



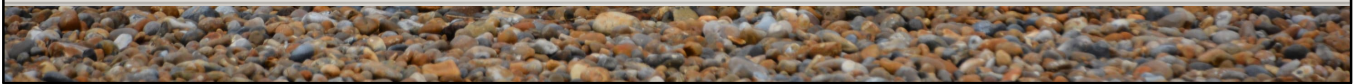
OUR (IRGON) INTEREST IN WALKER AFB

ABOUT IRGON

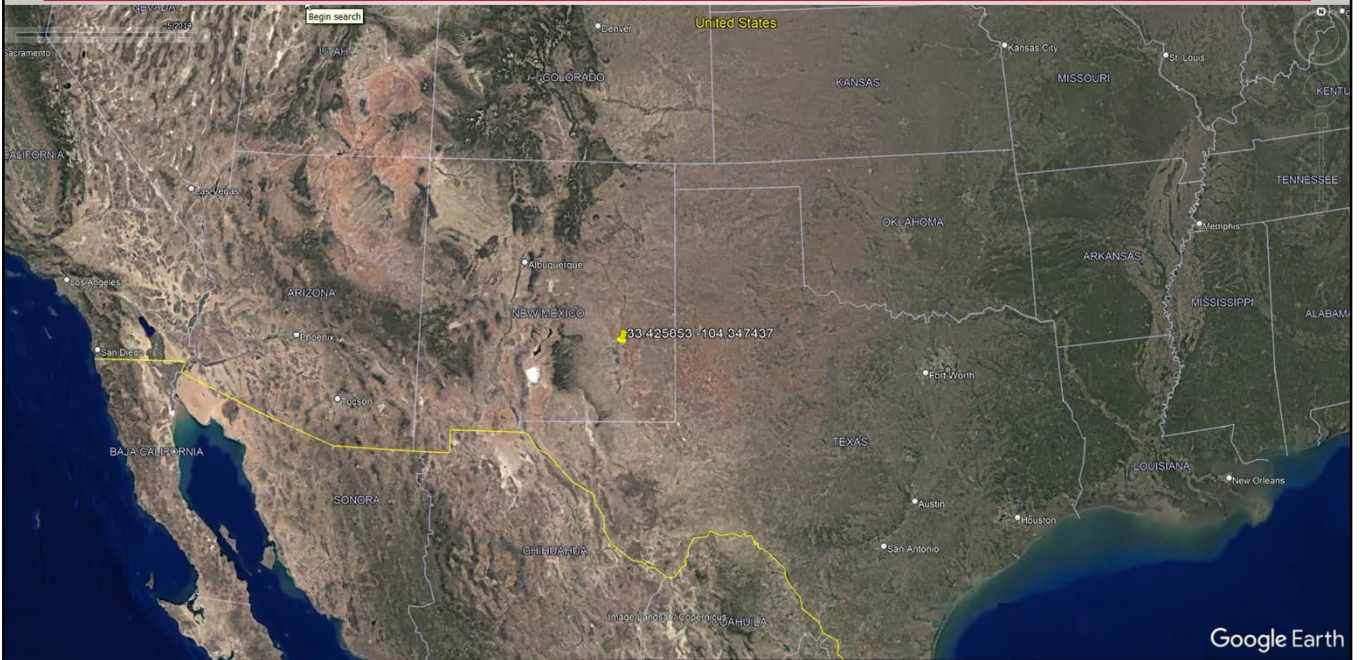
1. **International Research Group Orford Ness**
2. **We research the military history of Orford Ness**

WHAT WE HAVE IN COMMON:THE CONCRETE RING

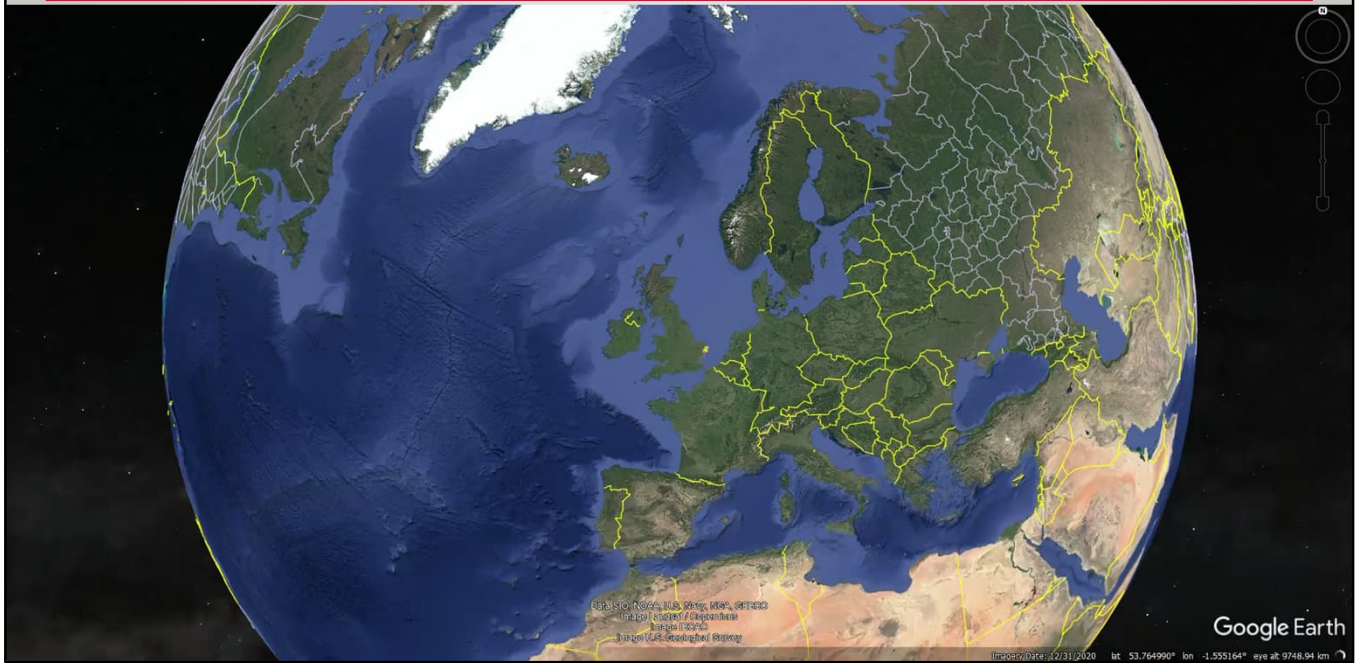
1. **We have a concrete ring on Orford Ness, which was a mystery for many years**
2. **We now believe to have discovered its purpose, and Walker AFB has the same ring**



WALKER AFB



ORFORD NESS



WHY NUCLEAR DETECTION?

Monitoring the Soviet threat

1. **Nuclear threat: Both the US and the UK wanted to monitor Soviet developments.**
2. **Timing: 1954 was considered the earliest a Russian A-bomb would be ready.**
3. **Joe-1: This was the first Soviet nuclear bomb, tested in 1949.**
4. **US reaction: AFOAT-1 was already set up, and this was renamed AFTAC in 1959.**

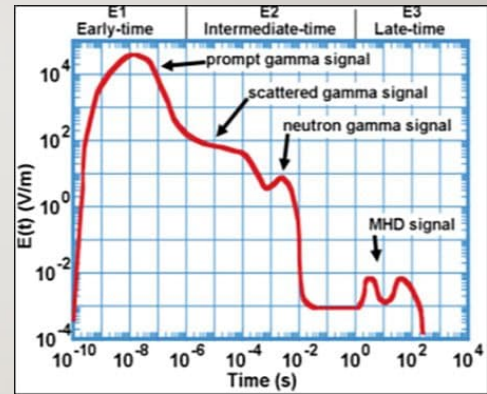
After World War 2, the US had a monopoly in nuclear weapons. The US and UK wanted to monitor the possible development of a Soviet atom bomb. The CIA did not expect the Soviets to be ready to explode an atomic weapon before 1954. The British were of the same opinion.

When Joe-1 was detonated on 29 August 1949 at 7:00 a.m. Moscow time, it came as a severe shock to the Western powers. They had not taken the vast amount of Soviet espionage into account, which gave the Russians a lead by leaking secrets of the Manhattan Project. In order to prevent further surprises, the US and UK beefed up their monitoring capabilities. AFOAT-1 was the agency initially tasked with monitoring nuclear explosions, this became AFTAC in 1959. AFOAT-1 was the Air Force Office of Atomic Energy-1, set up in August 1948. It was renamed the Air Force Technical Applications Center (AFTAC).

DETECTION VIA ELECTROMAGNETIC METHODS

The fact that an electromagnetic pulse is produced by a nuclear explosion was known in the earliest days of nuclear weapons testing.¹

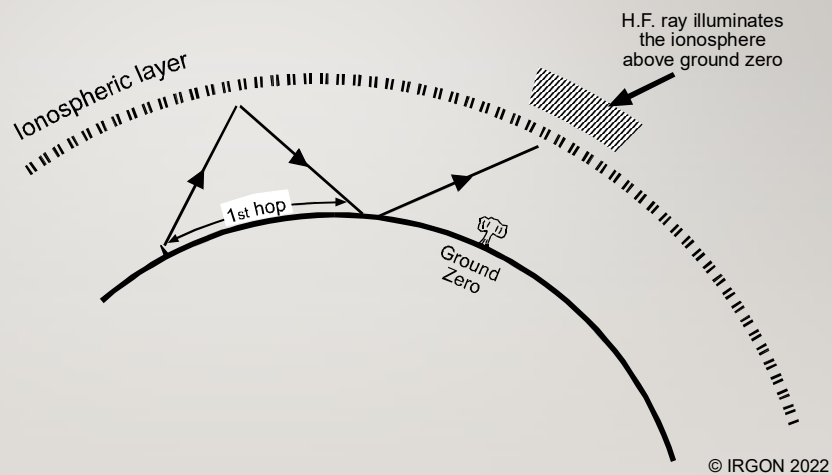
1. During the Trinity test, Enrico Fermi expected the electrical effects to be equivalent to a large bolt of lightning striking the vicinity. All signal lines were completely shielded, in many cases doubly shielded.²
2. Early British nuclear tests resulted in some instrumentation failures, attributed to “radio flash”.
3. Several electromagnetic detection methods can be used, including telluric currents, magnetic field measurements, VLF phase anomalies, and backscatter radar. This latter method was the one employed on Walker AFB and Orford Ness.



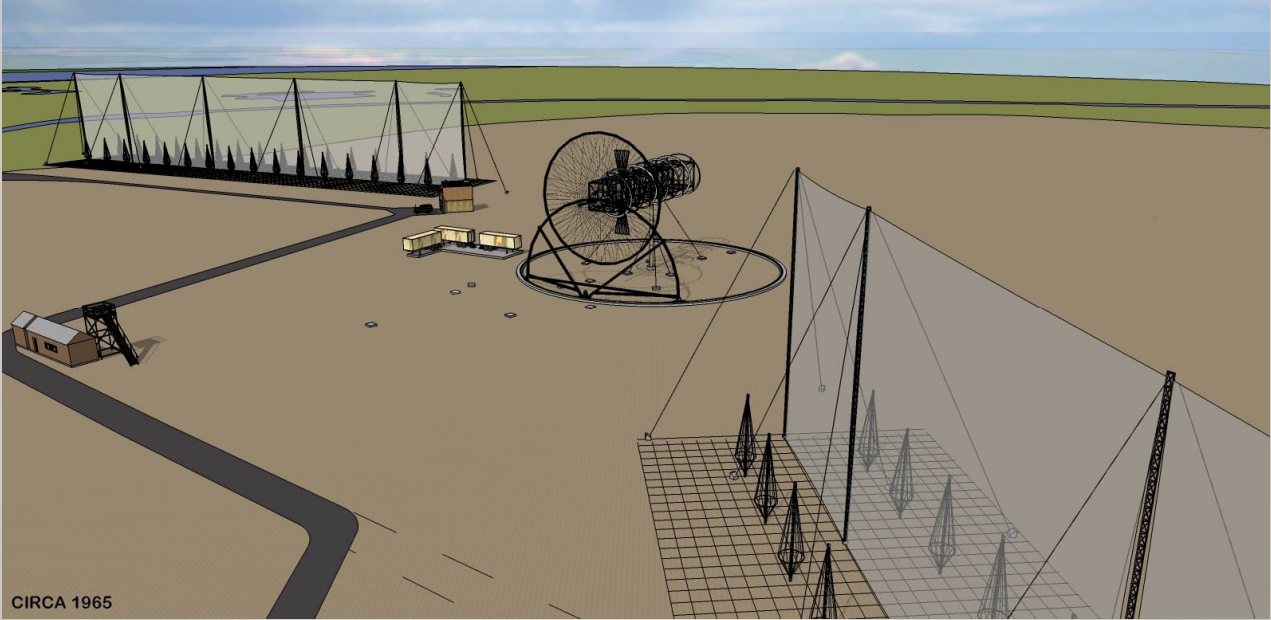
DETECTION VIA HF BACKSCATTER

The HF backscatter method uses high frequency radio waves which have the property of bouncing off the ionosphere. To detect nuclear explosions beyond the horizon (or other transient events like missile launches), a method is needed to deal with the static clutter inherent in this technique.

Early experiments on Orford Ness used a photographic integration method. Later equipment e.g. the "R" system at Roswell, used more refined methods.



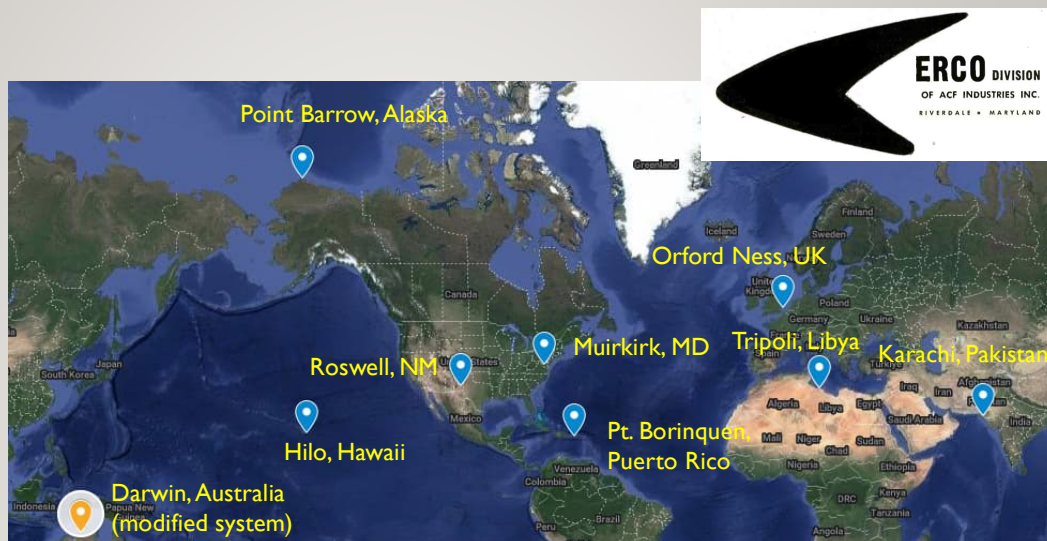
AFTAC “R” SYSTEM



“R” SYSTEM – DEVELOPMENT & DEPLOYMENT

The AFTAC use case, nuclear explosion detection, required a series of radar installations at various locations.

Ed Lyon was the chief designer, and was aware of most of the locations. But he never knew one of his “babies” was installed on Orford Ness until informed by an IRGON researcher in 2020!



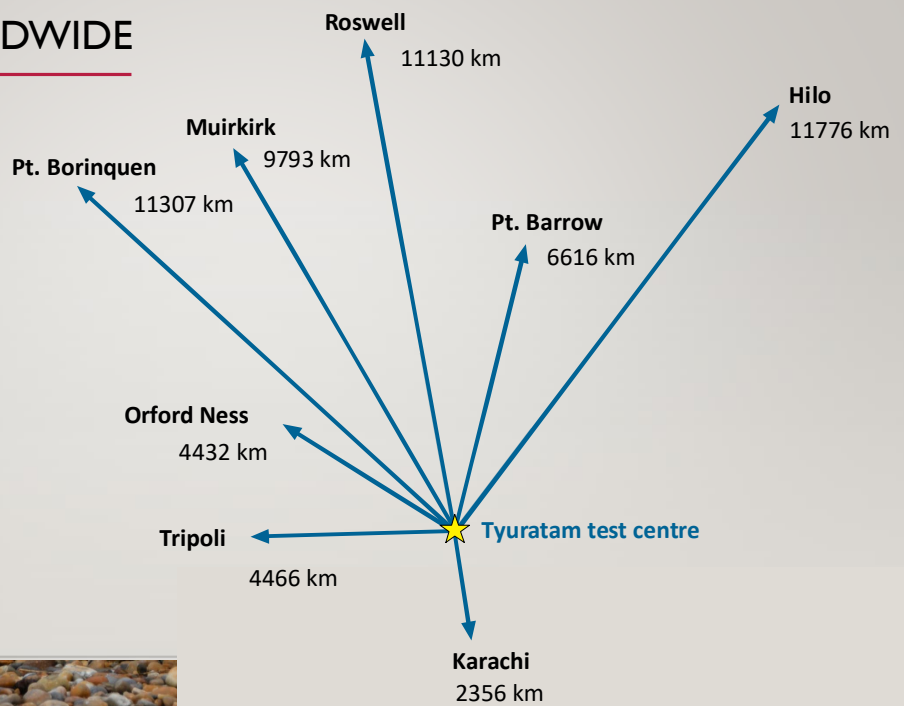
The contract for a global detection chain was awarded to ACF Industries, which had recently taken over the ERCO (Engineering & Research Corporation) of Riverdale, Maryland.⁵ This organisation was the same one which had been monitoring the Hardtack series in the Pacific.

8 LOCATIONS WORLDWIDE

Site	Location	Coordinates		Tx	Rx	Rx pointed at	Comments
Muirkirk	Maryland, U.S.	39.053611 - 76.878056	39°03'13"N 076°52'41"W	Helical	1	034° true (NE) towards UK	prototype; at least six Rx arrays tested
Roswell	New Mexico, U.S.	33.426389 - 104.346944	33°25'35"N 104°20'49"W	Helical	2	330° true (NW) and 030° true (NE)	first production array; Tx still present 1968, destroyed by wind storm 1981
Aguadilla	Puerto Rico	18.509444 - 67.098889	18°30'34"N 067°05'56"W	Helical	2	330° true (NW) and 030° true (NE)	Rx orientation to be confirmed
Point Barrow	Alaska, U.S.	unknown		Collins log periodic	1	000° true	one further Rx array destroyed destroyed by foundation collapse
Hilo	Hawaii, U.S.	unknown		Helical	2	330° true (NW) and 030° true (NE)	Rx orientation to be confirmed
Karachi	Pakistan	unknown		Collins log periodic	1	unknown	Rx to be confirmed; used only to detect activity in Ukraine (Kazakhstan?)
Tripoli	Wheelus AFB, Libya	unknown		Helical	2	unknown	Tx confirmed by image from AFTAC Alumni Magazine; two Rx delivered
Orford Ness	Suffolk	52.086845 - 1.569443	52°05'13"N 001°34'10"E	Helical	2	020° true (N) and 075° true (E)	built from array stored at McClellan AFB, CA

The helix was omitted from the Alaskan system due to worries about ice accretion. The system in Karachi was intended to be less conspicuous... And was probably located near to the similar CIA sensor, which was also designed without a helix.

8 LOCATIONS WORLDWIDE



Tyuratam is known today as Baikonur Cosmodrome, in Kazakhstan.

PROJECT CLEAR SKY

Following discussions between US and UK experts in 1962, an agreement was signed to formalise test ban monitoring.

AWRE, MoD and the Foreign Office were involved in the project, and AFTAC and the Arms Control and Disarmament Agency in the US.²³ The HF backscatter technique was only one of the techniques being:

- Acoustic
- Telluric
- Geomagnetic
- Atmospheric Fluorescence
- VLF Phase
- Broadband EMP
- Cosmic Noise
- Seismic
- Air sampling

DEPLOYMENT OF TECHNIQUES

The proposed UK operated stations are given below in two groups. Those listed under (A) are regarded as essential and those listed under (B) are regarded as highly desirable:

(A) <u>FIRST PRIORITY</u>		<u>Techniques incorporated</u>
(1) UK	Orfordness	Backscatter Radar
	Feltwell	Acoustic
		Telluric
		Geomagnetic
		Fluorescent
(2) Pakistan	Peshawar	VLF Phase
		Broadband EMP
		Cosmic Noise
		Seismic
		Acoustic

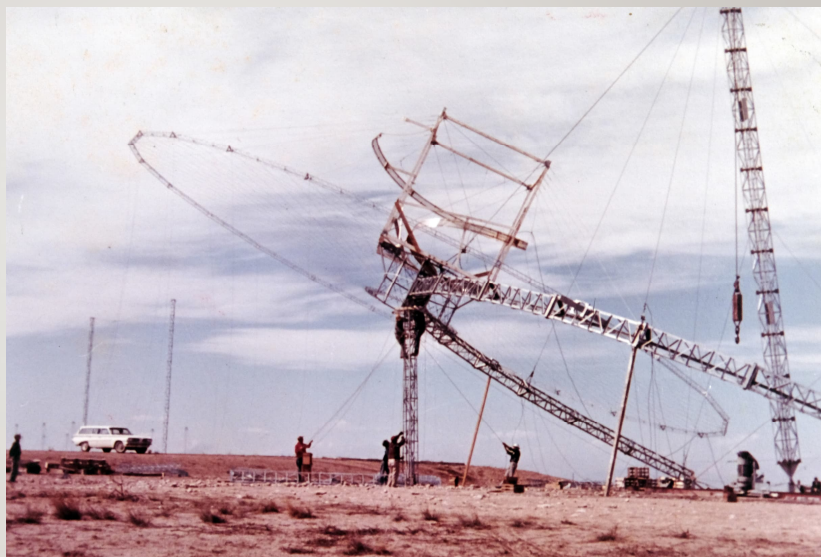
The Partial Test Ban Treaty was signed in Moscow on the 5th August 1963 and went into effect two months later.

AFTAC “R” SYSTEM AT ROSWELL

It appears that ATFAC’s “R” system originated as a joint CIA/ATFAC development ⁴ following successful experiments in the Pacific during the Hardtack test series.⁶

The “R” system was designed to detect large diffuse echoes from ionisation caused by missiles or nuclear explosions.¹⁵

Right: The “R” system being erected at Roswell, 1961



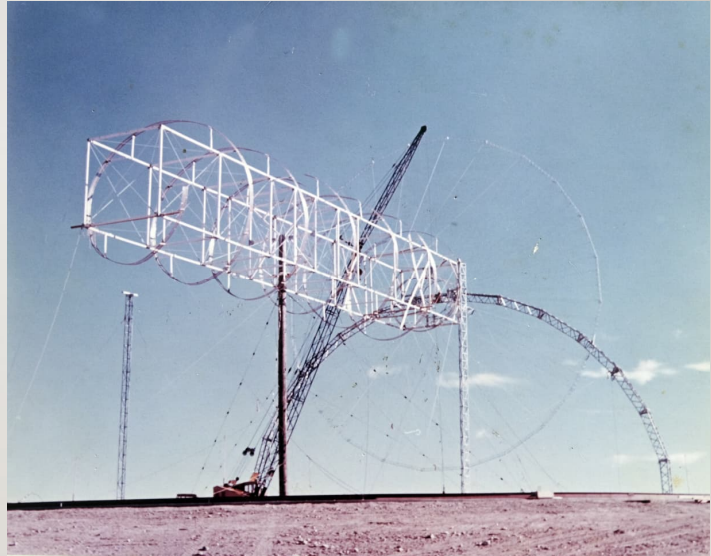
CHAPLAIN/EARTHLING was intended primarily to detect ICBM or earth satellite vehicle launches from the Tyuratam missile complex. The engines of such missiles continue to burn until they reach an altitude well above 100 kilometres, thereby creating an enhanced radar cross section which can be 3 to 5 times larger than the actual radar cross section of the body of the missile. This effect is caused by excess electrons generated by the ionization process of the missile exhaust.

This picture was taken during antenna construction within the Walker AFB Defense Area, Roswell, NM, USA.

AFTAC “R” SYSTEM AT ROSWELL

The installation at Roswell in 1961 was the first operational deployment of the “R” system.

The “R” system being erected at Roswell, 1961



AFTAC “R” SYSTEM AT ROSWELL

The CIA used the code name EARTHLING for very similar equipment, while AFTAC referred to it as the “R” system, in their alphabetical classification of nuclear detection techniques.

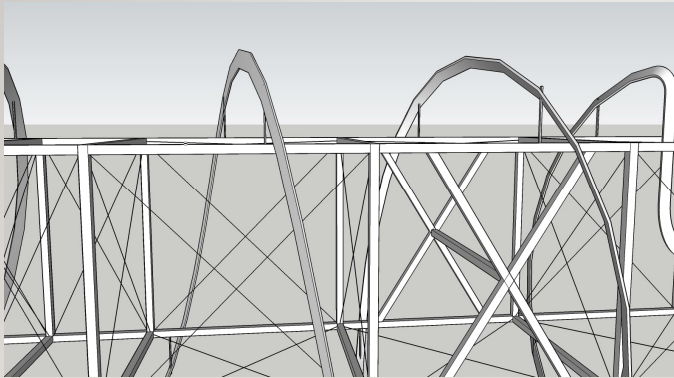
The British installation had the AWRE code name POUND NOTE, but was also referred to as the “R” system.



EARTHLING differed from the “R” system in respect of its ability to deliver longer pulses, necessitating a larger peak power. It did not use a helical TX antenna, otherwise the two systems were very similar.

AFTAC “R” SYSTEM TRANSMITTING ANTENNA

This picture shows the wooden frame to which the helix was attached. The resulting helical antenna was the world's largest at the time (150 feet long).

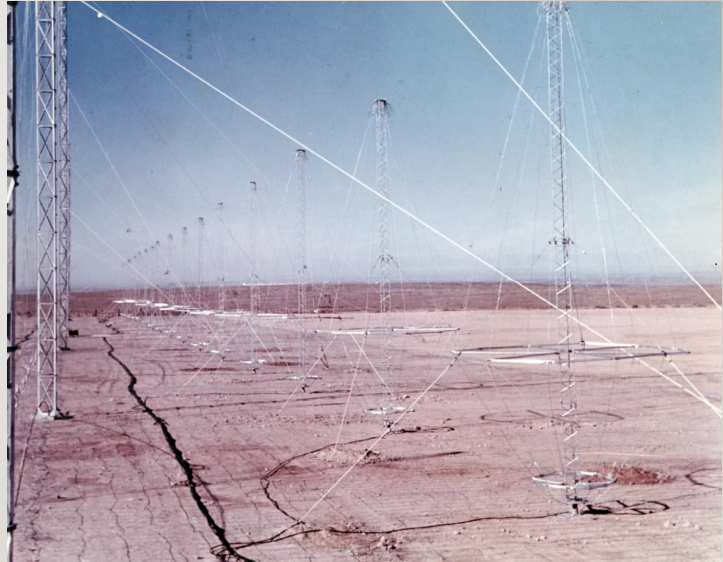


This helix is covered in the text book «Antennas», by John D. Kraus, second edition.

AFTAC “R” SYSTEM AT ROSWELL: RECEIVING ANTENNA

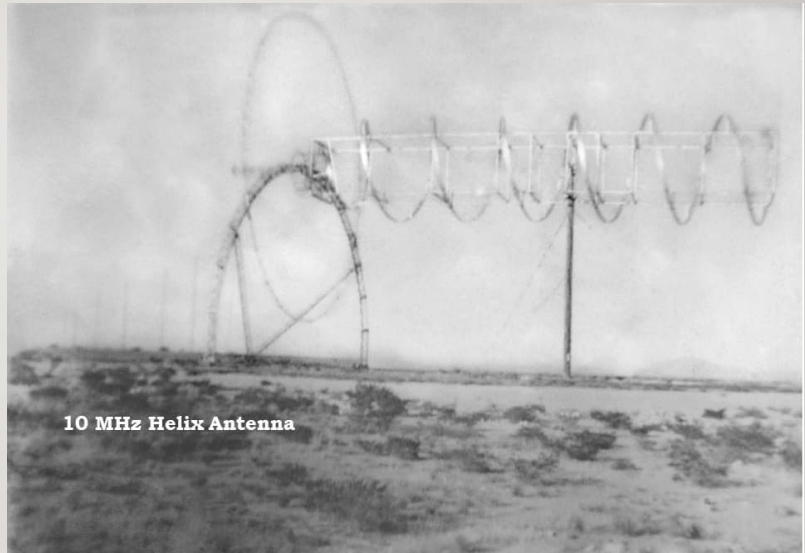
The receiving antenna took the form of a vertical screen with a series of biconical monopoles on either side.

IRGON was able to determine that at Roswell the monopoles were also installed on both sides.



AFTAC “R” SYSTEM AT ROSWELL

According to Major Wolff, the Roswell antenna survived until the mid-1980s.



10 MHz Helix Antenna

Apparently, a storm brought down the structure in the mid-1980s. Besides the concrete ring, fragments of the substantial wooden support pole, some insulators, and bundles of wire from the RX screens remain scattered on the site today.

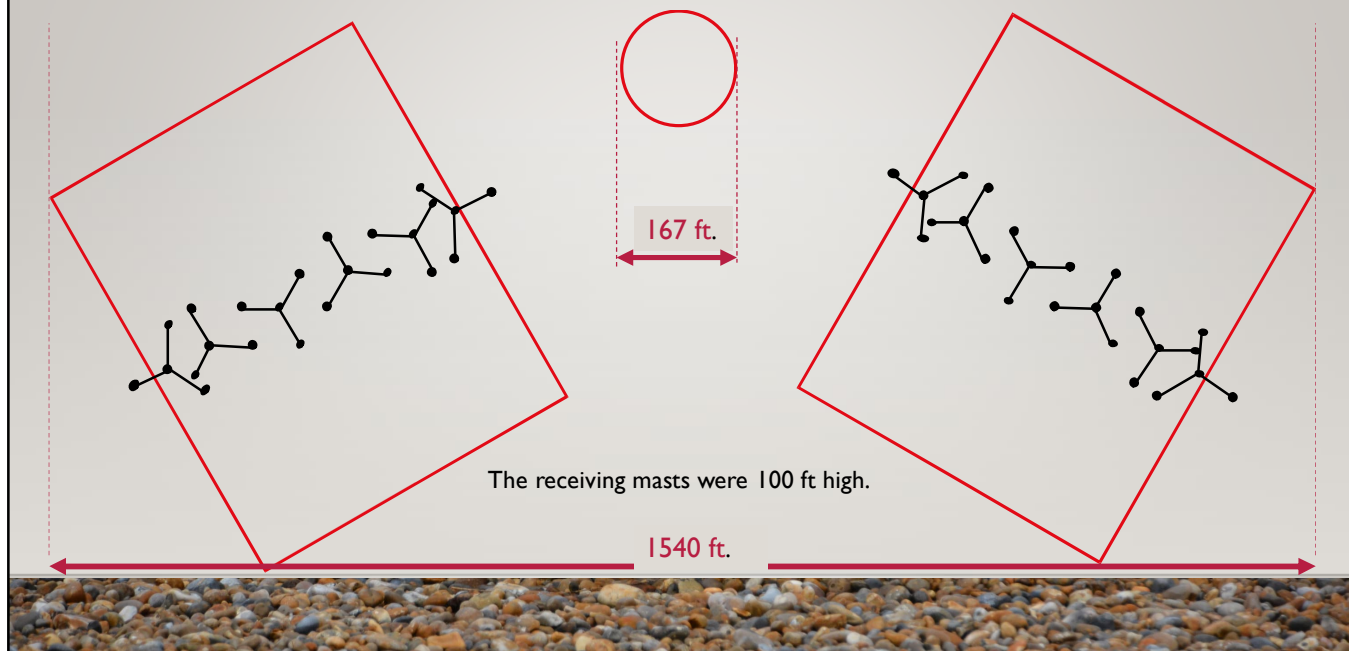
AFTAC “R” SYSTEM AT ROSWELL: LIDAR



LIDAR stands for “Light Detection and Ranging” and is a method for determining ranges by targeting an object or a surface with a laser and measuring the time for the reflected light to return to the receiver.

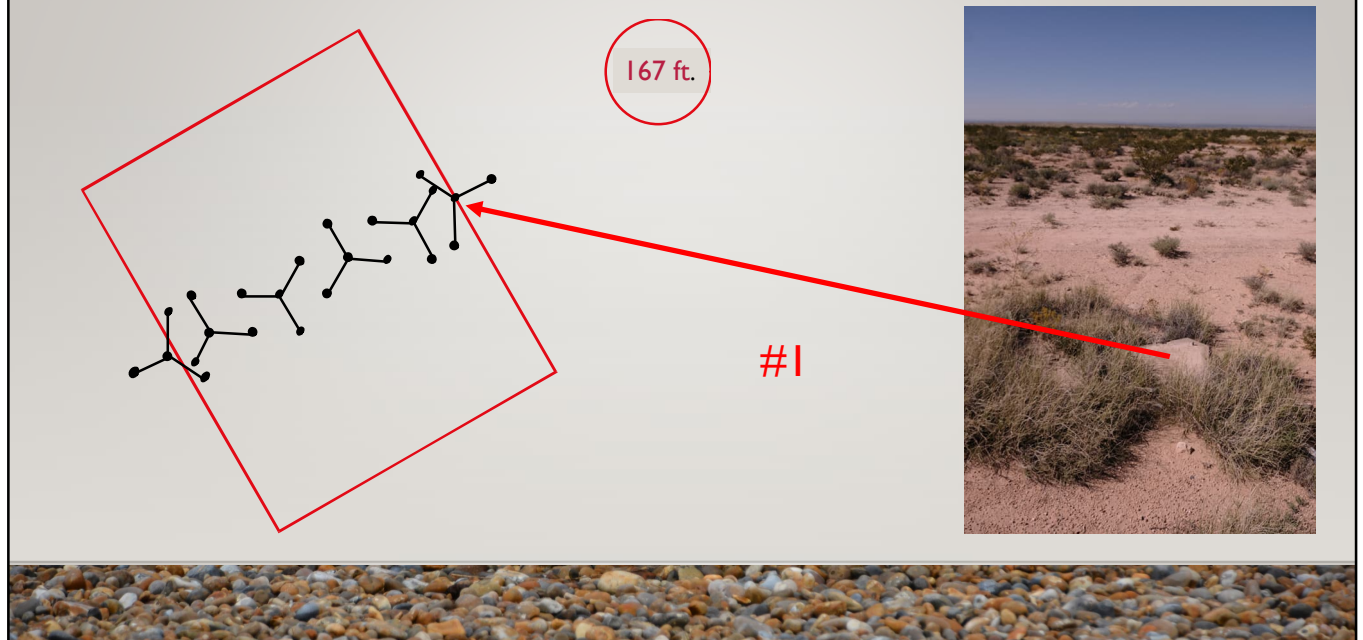
Thanks to LIDAR imagery, we were able to determine the location of the receiver curtains at Roswell.

AFTAC "R" SYSTEM AT ROSWELL: DIMENSIONS



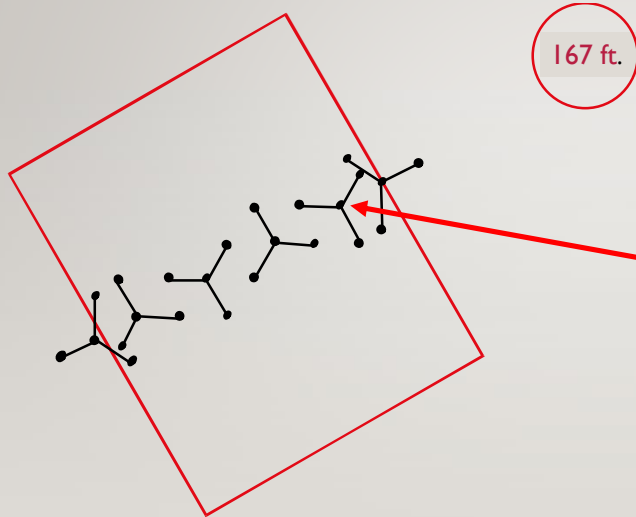
No detailed map was available of the "R" system at Roswell, but there appears to be an exact match with the data which IRGON has obtained from Orford Ness, once the general orientation had been confirmed by LIDAR.

AFTAC "R" SYSTEM AT ROSWELL: OUR SURVEY OCT 16TH



IRGON discovered all 6 receiver mast bases of the westerly array.

AFTAC "R" SYSTEM AT ROSWELL: OUR SURVEY OCT 16TH



#2



AFTAC “R” SYSTEM AT ROSWELL: ARTIFACTS



Insulator from the helix: same as found on Orford Ness

AFTAC “R” SYSTEM AT ROSWELL: ARTIFACTS



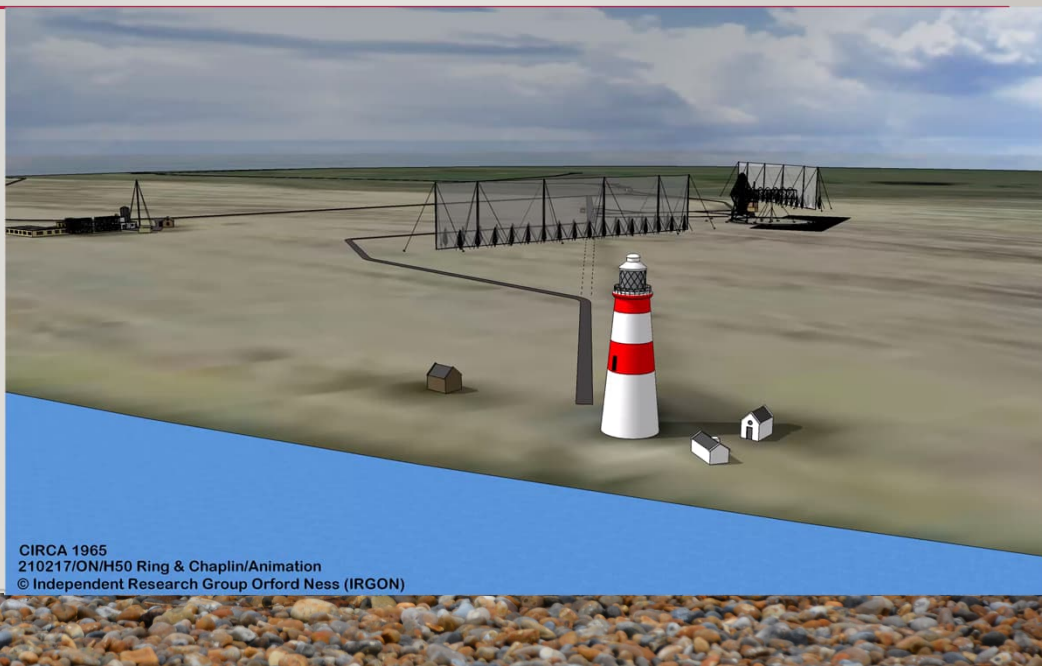
Wire and ceramic insulator, probably from the receiving array backscreen

We will analyse this wire and insulator further

THE “R” SYSTEM ON THE NESS

The equipment was installed ca. 1965 near the Bomb Ballistics Building and operated by a US crew. Data was forwarded to a joint intelligence centre.

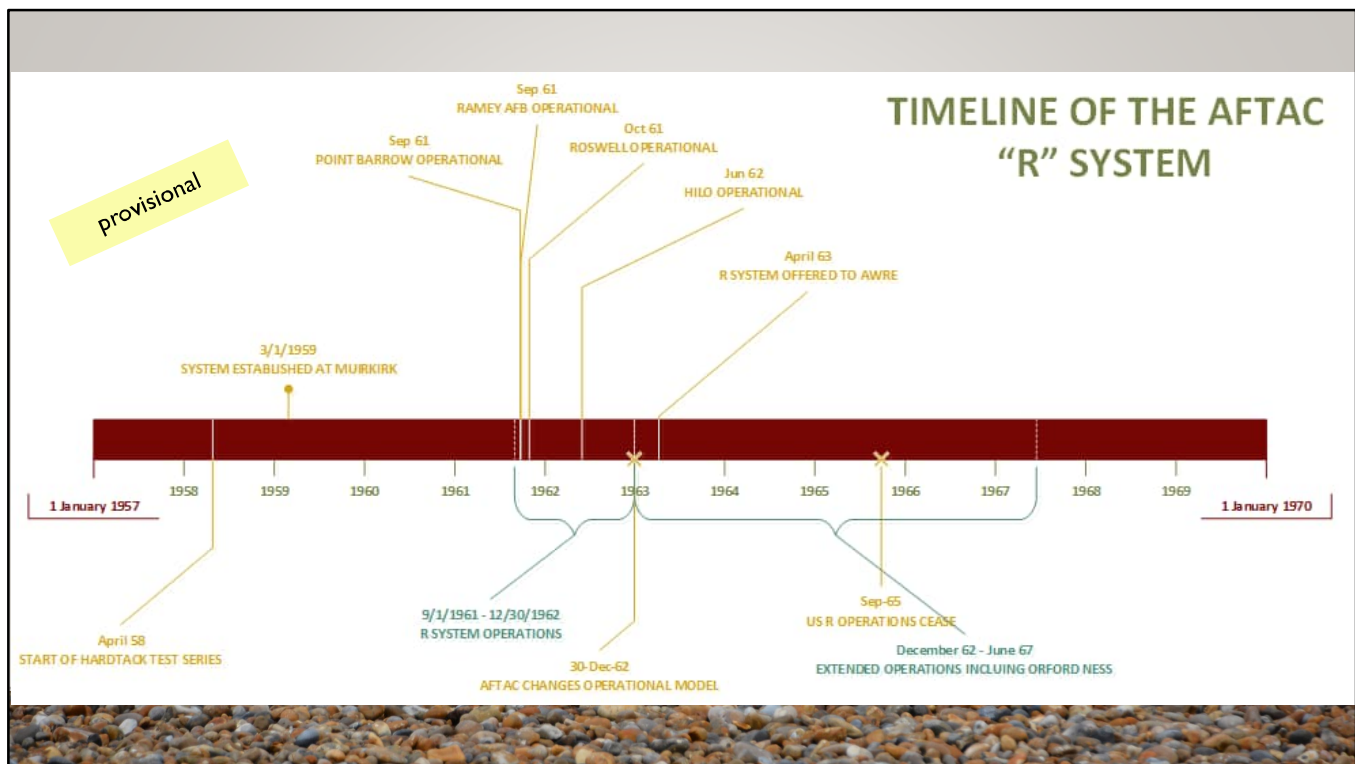
IRGON is not yet sure how long it remained in operation, but we know the aerial was still present in 1968.



CIRCA 1965
210217/ON/H50 Ring & Chaplin/Animation
© Independent Research Group Orford Ness (IRGON)

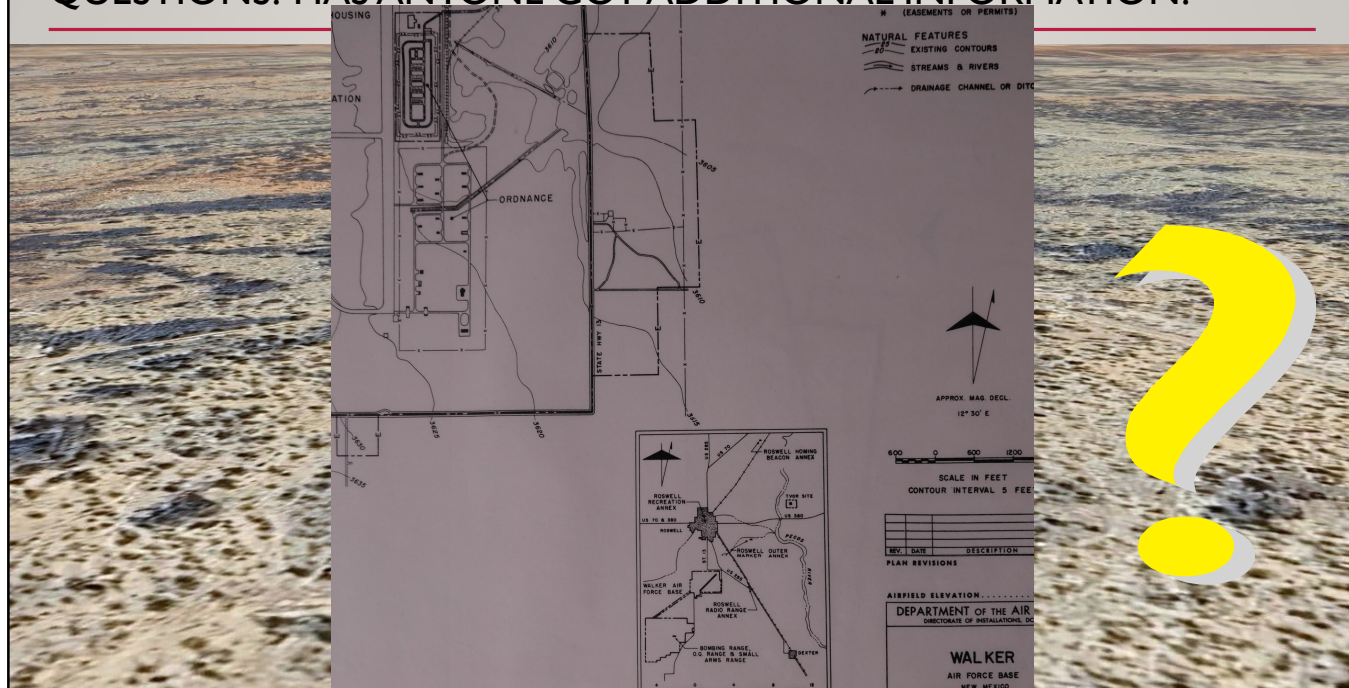
The “R” system used a fully steerable transmitter aerial and two fixed receiving arrays with monopoles on either side. The receiving arrays could be electronically steered using time delay techniques, allowing beam forming $\pm 32^\circ$ either side of the perpendicular.

The Clear Sky agreement meant that all output from the “R” system was sent over a joint UK/US intelligence link to a processing centre (probably at RAF Feltwell). To date, IRGON has not yet been able to trace any output from the Orford Ness installation.



Monitoring of the HARDTACK atomic tests in the Pacific in 1958 were carried out with a precursor to the "R" system.

QUESTIONS? HAS ANYONE GOT ADDITIONAL INFORMATION?



REFERENCES I

Note: not all references will be found in this slide set

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- 22. *World's largest log-periodic antenna*, Journal of the Structural Division, American Society of Civil Engineers, Yen H. Dong, September 1971
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