

# The DEWline – A Brief Introduction

By: Paul Kelley, DEWLiner, 1960-62.

## Background

Following is a summary of what took place prior to the DEWline opening for 'business':

**1949**-29 Aug – 1<sup>st</sup> **Soviet atomic bomb** - 20 kiloton device

**1951**-24 Sep – 2<sup>nd</sup> Soviet atomic bomb - 38 kiloton device

**1951**-18 Oct – 3<sup>rd</sup> Soviet atomic bomb - 41 kiloton device

### **1952 – MIT- Lincoln Laboratory**

**A** - Conducted study of requirements for air defence vis a vis the polar route from the Soviet Union.

**B** - Concluded that the existing **Pinetree Line** (49<sup>o</sup> N) and **Mid-Canada Line** (McGill Fence) (55<sup>o</sup>N) would not provide sufficient warning of an attack by conventional aircraft, piston engine or jet.

**C** - Recommended construction of another line at 69<sup>o</sup>N – the **DEWline**. If feasible, given the arctic conditions, this would provide **3 hrs early warning** of any attack.

**1952-1954** – Three prototype stations were constructed on the North coast of Alaska to determine the feasibility of the project both in terms of construction and operation. Both aspects proved viable.

**1954**-December – Recruitment of personnel began followed shortly by the construction of a line of 57 radar sites stretching approximately 2600 miles West to East from **Cape Lisburne** in Alaska to **Cape Dyer** on Baffin Island - one of the most challenging civil engineering projects ever undertaken. **Western Electric Corporation**, a division of AT&T, was the prime contractor. See **Addendum 4** in this document for some construction statistics which will put the magnitude of the project in perspective.

What was to become the Distant Early Warning Radar Line (**DEWline**) ran roughly along latitude 69<sup>o</sup> N with some stations above that latitude and some below, depending on geography. With a few exceptions the sites were situated such that they were accessible by sea – when not frozen. During this period, the Domestic Main Site (**DMS**) was also built in Streator, Il.

**1956**-Sometime – Training commenced at the DMS in Streator.

**1957-31 July** – The DEWline became operational. **Federal Electric Corporation**, a division of ITT, was the prime contractor responsible for the operation of the Line.

## DEWline Organisation

The 57 sites on the original continental part of the DEWline were of 3 types:

Main Sites	6
Auxiliary Sites	23 (aka Aux Sites)
Intermediate Sites	28 (aka I-Sites)

### Main and Aux Site Equipment

In addition to ground-to-ground, air-to-ground and site-to-site communications systems, each Main Site and Aux site was equipped with a rotating, back-to-back, two beam, pulsed, search radar – the raison d'être for the sites – 29 such units across the length of the Line at roughly 100 mile intervals. The search radar had a 160-mile range.

### Intermediate Site Equipment

Located halfway between each pair of Main/Aux sites, each of the 28 'I' sites had one operational purpose – to provide coverage of the gaps under the doughnut pattern of the search radars at the adjacent Main or Aux sites. The 'I' sites housed a pair of continuous wave (as opposed to pulsed) Doppler radar transmitters, one pointing East and one to the West. The corresponding receivers were at the adjacent Main/Aux sites. These transmitter-receiver combinations, also known as gap fillers, provided a fixed, multi-level electronic fence, or trip wire, between adjacent sites.

### Main Sites/Sectors

The largest of the three types, the 6 Main Sites were/are located 500 miles apart. Each had a permanent staff of about 150 (mechanics, riggers, logistics and maintenance personnel, catering staff, general help (including a varying number of Eskimo families), subcontracted aircraft crew and, of course, a team of Radicians. This population would increase substantially during the brief arctic summer when additional temporary personnel involved in construction, outside maintenance, re-supply etc., would be on site.

Operationally each Main site was responsible for 500 mile 'sector' approx. 250 miles either side of it. There were 2 sectors in Alaska and 4 in Canada:

	<u>Site Name</u>	<u>Geographical Name</u>	
Alaska	<b>POW</b> Main	Point Barrow	
Alaska	<b>BAR</b> Main	Barter Island	
Canada	<b>PIN</b> Main	Cape Parry	District of Mackenzie, NWT
Canada	<b>CAM</b> Main	Cambridge Bay	"
Canada	<b>FOX</b> Main	Hall Beach	District of Franklin, NWT
Canada	<b>DYE</b> Main	Cape Dyer	"

The senior civilian among the site management was the **Station Chief**. Co-located at the Main Site were the Sector management team – **Sector Superintendent**, the senior civilian in each sector, **Sector Chief Communications & Electronics (C&E)** and **Sector Chief Building & Outside Plant (B&OP)**. Reporting to each of the latter were specialist teams available for support when issues arose in their sector beyond the expertise of local site personnel.

Each 'standard' Main Site was staffed by 7 Radicians and a Lead Radician. BAR Main and DYE Main had more due to the rearward links and, in the case of DYE Main, the northern link to Thule. The radicians and their equipment were the reason for the whole show and everything/everyone else was there in support and, as such, no less critical to the success of the operation.

Nearby each Main Site was a 5000-foot-long gravel runway with full hangar and refuelling facilities - suitable for most any piston engine aircraft of the time - as well as a garage for vehicle maintenance, warehouses, fuel storage tanks and transient personnel accommodation.



Figure 1. Map showing the entire DEWline.

### Auxiliary Sites

Between each Main Site, at intervals of 100 miles depending on the geography, there were 4-5 Auxiliary Sites. There were 23 of these in Alaska and Canada. Each Aux site was designated by the prefix of its western Main Station followed by a sequential number, e.g.:

- LIZ 2 & 3 The two Aux Sites West of Point Barrow (POW Main)
- POW 1, 2, & 3
- BAR 1, 2, 3, & 4
- PIN 1, 2, 3, & 4
- CAM 1, 2, 3, 4, & 5
- FOX 1, 2, 3, 4, & 5
- DYE 1, 2, 3, & 4 All in Greenland from 1962

Operationally (electronically) the Aux site was equipped almost identically to the Main site and, again, staffed by 7 Radicians and a Lead Radician who was usually, but not always, the Station Chief. Given that the search radar had a 160-mile range there was approximately a 60-mile overlap with the adjacent Main or Auxiliary Station. As with the Main site each Aux site housed the East and West Doppler radar receivers for their adjacent Intermediate sites.

Physically, the Aux sites were much smaller than Main Sites. The total staff was usually 20 - 25. These included all the same types as on a Main Site but fewer of them. Again, that number would increase during the summer months when temporary personnel involved in construction, outside maintenance, re-supply etc would be on site. One or two Eskimo families were also housed in separate accommodation on each site. As on the Main Sites, the Eskimo men generally operated the heavy equipment such as the bulldozer and grader for ploughing the runways and road(s) hauling fresh water to the site and removing the resultant waste etc, etc. The list of their jobs was long and varied.

Each Aux site was equipped with a 3000-foot runway (suitable for DC3/C47, C46 or smaller aircraft) but no hangar facilities other than for refuelling. In addition, there was the mandatory garage, fuel tanks for the diesel generators, and some transient accommodation.

### **Intermediate Sites**

As the name implies the I-sites were located approximately halfway between each Aux Site or Aux Site and Main site thus 50 miles distant from one or the other. There were 28 of them in Alaska and Canada.

As with the Aux Sites each I-site was designated by the prefix of its western Main Station followed by a sequential letter, e.g.:

LIZ A, B, C  
POW A, B, C, D  
BAR A, B, C, D, E  
PIN A, B, C, D, E  
CAM A, B, C, D, F  
FOX A, B, C, D, E  
DYE There were no I-sites in Greenland

The I-Sites were the smallest of the three types and staffed, usually, by a Radician, an inside mechanic, and outside mechanic and a cook. One of the mechanics or the Radician was usually the station chief. Sometimes the 'breadwinner' of an Eskimo family, quartered separately, was the outside mechanic but there were numerous variations in I site staffing so trying to generalise is tricky. Each site had the mandatory garage separate from the main complex with backup generator and disaster transmitter and all but one (FOX C) had a 3000' runway with limited refuelling capability – a few drums of aviation gas just in case. FOX C was serviced via helicopter from FOX Three.

Operationally, as mentioned earlier, the sole function of the I-sites was to house a pair (East and West) Doppler radar transmitters for which the adjacent Aux or Main site had the corresponding receivers.

The I-sites proved to be ineffective and unreliable and were all taken out of service around the middle of 1963.

### Note to Reader:

When on Day 2 of training at Streator we were introduced to all of the above. We were not introduced to what follows until the final weeks of the course – when we had received our Secret security clearances. However, as you are now familiar with how the DEWline was organised, this is as good a place as any to provide a brief overview of how it all worked in operation.

### Operational Overview

As mentioned earlier, operationally each Main site was responsible for a 500-mile Sector approximately 250 miles either side of it. There were 2 sectors in Alaska and 4 in Canada:

	<u>Site Name</u>	<u>Geographical Name</u>	
Alaska	<b>POW Main</b>	Point Barrow	
Alaska	<b>BAR Main</b>	Barter Island	
Canada	<b>PIN Main</b>	Cape Parry	District of Mackenzie, NWT
Canada	<b>CAM Main</b>	Cambridge Bay	“
Canada	<b>FOX Main</b>	Hall Beach	District of Franklin, NWT
Canada	<b>DYE Main</b>	Cape Dyer	“

### Sector Data Centre

The operational point of control in a Sector was the **Data Centre** at the Main site. The Data Centre was staffed by USAF/RCAF officers (**Controllers**) who were responsible for consolidating radar contacts reported from the sites in their sector and reporting rearward to North American Air Defence Command (**NORAD**) in **Cheyenne Mountain** near Colorado Springs, Colorado. There were usually 4 or 5 Controllers at a Main Site and their boss, the **Station Military Commander**. In Alaska they were USAF officers with one/two RCAF liaison officers and vice versa in Canada. They were the only military personnel assigned to each sector.

So, what was reported to the Controller by the sites in his sector? Basically, anything that moved but, obviously, North-South traffic had a much higher priority than South-North traffic. In both cases, the flight plans for all authorised flights in either direction, civil and military, were forwarded to the Controllers at some point well in advance of the appearance of the flight. Of course, those monitoring the radars on the sites had no such foreknowledge. I will deal with the detail of flight tracking at a later point. For now, as part of the big picture, I will focus solely on North-South traffic and...

### ... The Distant Early Warning Identification Zone - DEWIZ

The DEWIZ is a **180nm wide band running East-West between 68° N and 71°N**. Given that the DEWline sites in this area ran roughly along the parallel 69° N, the northern boundary of the DEWIZ was 120nm North of each site and the southern boundary 60nm to the South.

### Southbound Penetration

Any aircraft filing a flight plan that involved penetrating the DEWIZ, especially North-South, had to include time and location of anticipated penetration in their flight plan as filed with the **Air Movements Information Service (AMIS)**. All such flight plans would be forwarded to NORAD and the relevant Sector Controller on the DEWline.

Having committed to a time and point of penetration, the aircraft crew were then obliged to penetrate the DEWIZ within **10nm and 10 minutes** of the filed location and time. If, for whatever reason, the crew anticipated penetrating at a point outside these limits, they could re-file their flight plan via radio while en route.

When the aircraft was first picked up on the radar by one of the sites - usually well beyond the northern limit of the DEWIZ and prior to voice contact - the operator would submit a new contact report via teletype (TTY) to the Sector Controller. The latter (via voice) would request further position reports (called "tells") from the tracking site at 3 or 5 minute intervals and then consult his collection of flight plans to make a judgement as to whether the flight was a legitimate one or not.

If the controller judged the flight to be legitimate...

...**and** it penetrated the DEWIZ as filed

...**and** it confirmed its ID when voice contact was established

...**and**, if necessary, the aircraft's transponder replied correctly to an IFF (Identification Friend or Foe) radar interrogation...

...all would be well, and the tracking site would continue tracking the aircraft and submitting reports to the Controller until either he instructed the site to cease reporting or the aircraft disappeared off the scope to the South.

Failing any of the above – the most likely being failure to penetrate the DEWIZ as filed – then the aircraft would be classified by the Controller as a bogie and reported rearward to NORAD as such. My understanding is that this would provoke more than a little paperwork and 'interesting' exchanges between NORAD and the airline. In short, the aircraft crew, especially the navigator, had an incentive to get it right first time.

Should a real bogie have been detected in the Canadian sectors, fighters would be scrambled from the south and moved forward to Frobisher Bay on Baffin Island and Fort Churchill on Hudson's Bay. Both locations were the northernmost locations that had paved runways capable of accommodating jet fighters and associated military support facilities.

## Summary

**The operational objective of the DEWline was to detect air breathing aircraft up to an altitude of 50000 ft** – specifically, Soviet **Bear** and **Bison** strategic bombers – the counterpart of the US B-52. Having 'detected' and 'reported' rearward the DEWline's mission would be accomplished. It would play no part in any offensive or retaliatory role other than spectator and, as you might suspect, a very interested spectator indeed.

Nor had the DEWline any capability to detect high trajectory ballistic missiles over the horizon. These were the province of **BMEWS - the Ballistic Missile Early Warning System** which could track over the horizon for 3000 miles. There were three BMEWS stations - Clear, Alaska, Thule, Greenland and Fylingdales Moor in Yorkshire, England.

All of the above should give you a rough idea of how the whole set-up was organised and roughly how it operated. Time now to return to the chronological tale.

### **Addendum 1 – A Geographic Aside – Northern North America in 1960**

This addendum provides an overview of North American arctic political geography as it was 1960 with a few comments on later developments.

#### **Alaska (USA)**

	<u>Area (mi<sup>2</sup>)</u>	<u>Population (1960)</u>
<b>Alaska</b>	586,400	253,000

#### **Canadian Arctic**

The northern boundary of the Provinces of British Columbia, Alberta, Saskatchewan and Manitoba is 60° N latitude. In 1960 the area North of 60° N was divided into two territories:

	<u>Area (mi<sup>2</sup>)</u>	<u>Population (1960)</u>
<b>Yukon Territory</b>	207,076	15,000
<b>Northwest Territories (NWT)</b>	1,304,903	26,000

Thus, a population of approximately 41000 souls occupied an area half the size of the continental US (the 'lower' 48 states).

The **Northwest Territories** was further divided into 3 Districts.

#### **District of Mackenzie Boundaries:**

- South 60° N
- West Yukon Territory
- North North coastline
- East 102° W – northern extension of the boundary between Manitoba and Saskatchewan

#### **District of Keewatin**

- South 60° N
- West 102° W – boundary with District of Mackenzie
- North North coastline\*\*
- East Hudson Bay – including all islands in James Bay and Hudson Bay.

\*\* Keewatin does not include either Boothia or Melville peninsulas to the North. When originally surveyed in the dim distant past both peninsulas were thought to be islands and not part of the mainland.

#### **District of Franklin**

Consists of all islands in the Canadian arctic (other than those in James Bay and Hudson Bay) plus Boothia and Melville peninsulas.

Of the total population of 26,000 in the NWT in 1960 only three towns exceeded 1000 in population, all in the south of the District of Mackenzie:

Yellowknife	3245	
Fort Smith	1591	<b>Administrative Centre of NWT</b>
Hay River	1338	

What other concentrations of population there were were mostly in the range of 500 or less.

### **01 April 1999 – Formation of Nunavut**

On this date, after years of discussion, the Inuit finally received their due – administrative control over a substantial piece of the Northwest Territories. The boundaries of the three former districts were redrawn with the new **Territory of Nunavut** encompassing all of the District of Keewatin, almost all of the former District of Franklin together with northern parts of the District of Mackenzie. The capitol of Nunavut on Baffin Island, formerly **Frobisher Bay**, was renamed **Iqaluit**.

### **Addendum 2 – Original 57 DEWline Sites**

This Addendum provides a list of all 57 DEWline sites together with the geographic name of their location. For more specific details – such as latitude and longitude – see the **Site Table** on Larry Wilson's excellent web site. [http://lswilson.dewlineadventures.com/site\\_table/](http://lswilson.dewlineadventures.com/site_table/).

#### **Notes:**

- 1 – All 57 sites became operational on 01 Jul 1957
- 2 – The 28 I-sites ceased operation during 1963 as they were deemed surplus to requirements as noted earlier.
- 3 – Most of the 6 Main sites and all of 23 Aux sites were progressively decommissioned between 1989-1993 and replaced by the North Warning System (NWS).

#### **---Alaska---**

#### **---POW Sector Boundary---**

LIZ-A	Cape Sabine
LIZ-2	Point Lay
LIZ-B	Icy Cape
LIZ-3	Wainwright
LIZ-C	Peard Bay
<b>POW Main</b>	Point Barrow
POW-A	Cape Simpson
POW-1	Lonely
POW-B	Kogru River
POW-2	Oliktok

#### **---BAR Sector Boundary---**

POW-C	Point McIntyre
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POW-3	Flaxman Island
POW-D	Brownlow Point
<b>BAR Main</b>	Barter Island
BAR-A	Demarcation Bay

**---Canada - Yukon and Northwest Territories---**

BAR-1	Komakuk Beach	<b>Yukon Territory</b>
BAR-B	Stokes Point	“
BAR-2	Shingle Point	“
BAR-C	Tununuk Camp	“

**---PIN Sector Boundary---**

BAR-3	Tuktyoyaktuk	<b>District of Mackenzie, NWT</b>
BAR-D	Atkinson Point	“
BAR-4	Nicholson Peninsula	“
BAR-E	Horton River	“
<b>PIN Main</b>	Cape Parry	“
PIN-A	Pearce Point	“
PIN-1	Clinton Point	“
PIN-B	Clifton Point	“
PIN-2	Cape Young	“

**---CAM Sector Boundary---**

PIN-C	Bernard Harbour	“
PIN-3	Lady Franklin Point	“
PIN-D	Ross Point	“
PIN-4	Byron Bay	“
PIN-E	Cape Peel West	“
<b>CAM Main</b>	Cambridge Bay	“
CAM-A	Sturt Point	“
CAM-1	Jenny Lind Island	<b>District of Keewatin</b>
CAM-B	Hat Island	“
CAM-2	Gladman Point	“
CAM-C	Matheson Point	“
CAM-3	Shepherd Bay	“

**---Fox Sector Boundary---**

CAM-D	Simpson Lake	“
CAM-4	Pelly Bay	“
CAM-E	Keith Bay	“
CAM-5	MacKar Inlet	<b>District of Franklin</b>
CAM-F	Sarcpa Lake	“
<b>FOX Main</b>	Hall Beach	“
FOX-1	Rowley Island	“

FOX-A	Bray Island	“
FOX-2	Longstaff Bluff	“
FOX-B	Nudluardjuk Lake	“
FOX-3	Dewar Lakes	“
FOX-C	Ekalugad Fjord	“

**---Dye Sector Boundary---**

FOX-4	Cape   Hooper	“
FOX-D	Kivitoo	“
FOX-5	Broughton Island	“
FOX-E	Durban Island	“
<b>DYE Main</b>	Cape Dyer	“

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**Addendum 3 – Additional DEWline Sites**

**Note:**

1 – The following 5 sites became operational in 1962. They were constructed totally differently from the original sites, employed a later generation of search radar and are a subject unto themselves. See Larry’s site for further detail. All 5 were deactivated between 1988-91. Since then DYE2 and DYE3 have been gradually sinking into the ice cap and, in 2010, can be seen only as black blobs on Google Earth

**---Greenland---**

DYE-1	Qaqqatooq
DYE-2	Ice Cap 1
DYE-3	Ice Cap 2
DYE-4	Kulusuk

**---Iceland---**

DYE-5	Rockville
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**Addendum 4 – Rearward Comm Sites**

**Notes:**

1 – All of the following sites became operational coincident with the 57 original DEWline sites on 01 Jul 1957.

2 – RES-X-1 and RES-X provided both teletype (TTY) and Voice communications rearward. They remain active in 2010 but were functionally replaced in 1988 and 1991 by elements of the North Warning System (NWS).

3 – The other four sites employed the IS-101 ionospheric scatter system for teletype communication rearward. They were decommissioned in 1963.

RES-X-1	Brevoort Island	District of Franklin
RES-X	Resolution Island	“
AGE-X	Anchorage	Alaska
NEL-X	Fort Nelson	British Columbia
WAT-X	Waterways	Alberta
BIR-X	Bird	Manitoba

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#### Addendum 4 – DEWline Construction Statistics

The following is extracted from the book "The DEW Line Story" produced by Western Electric Company in 1958

##### 1 - Surveying

Mapping teams travelled more than 1,000,000 miles and reviewed more than 80,000 aerial photos as part of siting and mapping activities

##### 2 - Purchase Orders

More than 113,000 purchase orders were issued to 4650 supplier companies in the US and Canada as follows:

Country	Orders	Total Amounts
U.S.	47,137	\$148,849,000
Canada	66,295	\$198,151,000

##### 3 - Material Transported

By Aircraft	140,400 Tons
By Naval Convoy	281,600 Tons
By Cat Train	17,600 Tons
By Barge	20,300 Tons
TOTAL	459,900 Tons

##### 4 - Petroleum Fuels, Oils and Lubricants

75,000,000 gallons of petroleum products were shipped to the Line, enough to fill 9375 tank cars in a train 65 miles long. Some 43,000,000 gallons of this was shipped in 818,000 drums, which would connect New York to Pittsburgh with a two-foot wide pipeline.

##### 5 - Airlift

This is the largest commercial airlift operation ever reported, with 45,000 commercial flights in 32 months delivering 120,300 tons over an average distance of 720 miles per flight. Involved were some 50 Canadian and 31 U.S. commercial airlines.

## **6 - Construction**

Gravel produced was more than 9,600,000 cubic yards, enough to build two replicas of the Great Pyramid or a road 18 feet wide and one foot thick from Jacksonville Florida to San Diego California.

Airstrips in the Arctic covered 26,700,000 square feet, or 625 acres. 46,000 tons of steel were used - more than enough for a USS Forrestal. 1800 piles were sunk an average depth of 12 feet into permafrost. Generating capacity of power generation equipment installed is 155,000 kilowatts per day - enough to supply a city the size of Spokane Washington.

## **7 - Personnel**

If all 4650 suppliers employed as few as 350 people each a total of over 1,600,000 people worked on DEW Line projects. Three construction companies used a total of more than 20,000 people in two and a half years on direct work. Peak numbers actually inside the Arctic at any one time was about 7500 men.

## **8 - Miscellaneous**

22,000 tons of food was shipped in 1,000,000 containers in 32 months; 12 acres of bed sheets; 6 acres of rugs; 3 miles of window shades; 100,000 copies of 600 different manuals prepared to cover operation and maintenance of the line.

Originally written in 2010.

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