SIGINT BELOW ZERO:

The Indications and Warning Role of

Canadian Forces Station Alert, 1958-1998

by

David A. Charters

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“For the folks at Alert, the Cold War was a real war, and they were the front line.”[1]

“I felt at the time and still do that we were at the pointy end of Indications and Warning throughout the Cold War.”[2]

DEDICATION

To the "Frozen Chosen" of all ranks, branches and services who braved the eternal darkness to keep us safe during the coldest war. Thank you for your service and for the listening.

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About the Author

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Introduction

Since 1958, the Canadian Forces have operated an important signals intelligence (SIGINT) station in the high Arctic. Located on the northern coast of Ellesmere Island, Canadian Forces Station (CFS) Alert was and is ideally situated to intercept communications originating in northern Russia, including from major military bases on the Kola Peninsula. It was a superior location than earlier near-Arctic sites at Inuvik, NWT and Churchill, Manitoba.[3] As such, SIGINT historian James Bamford says it is the most important Canadian SIGINT intercept site,[4] whose location and 'take' guaranteed Canada a seat at the 'Five Eyes' intelligence alliance table. Using the base's annual historical reports, declassified documents, interviews with military personnel who served there, and the few available secondary sources, this paper attempts to offer an historical perspective on the station's operations and their significance for Canadian and allied intelligence. The temporal boundaries of the study bracket its first forty years, from the station's founding until it became a remotely operated site. It must be acknowledged that, owing to the limits of the source material, this account falls short of a complete history. But this exercise might also allow us to answer an important research question: How much can we learn about a Canadian SIGINT operation from the kinds of limited open sources described above?

This study opens by setting the station's story in its strategic context: predominantly that of the Cold War and Canada's place in it. It then examines the role of SIGINT in Canadian intelligence in that period. The third section explores the station's founding and the successful Canadian effort to take the lead in Arctic SIGINT on behalf of its American and British partners. Part Four discusses the station's mission: SIGINT collection to provide Indications and Warning (I &W) of war. Part Five explains the arrangements for command and control of the station. It also explains how and why Alert was downsized and converted to remote operation in the 1990s.

The core of the paper lies in Part Six, which examines Alert's SIGINT operations, including collection priorities, targets, and the collection and reporting processes and systems. Part Seven examines possible collection results, and Part Eight, their potential significance. Finally, the conclusion attempts to assess the contribution of the Alert station to Canadian and allied intelligence and Cold War international security. It also tries to answer the research question regarding the utility and limits of open sources in the study of SIGINT.

Part 1: The Strategic Context

The Cold War was the 'dominant paradigm' for most of the period covered in this study.[5] It provided the *raison d'ètre* for the station's existence and the primary focus for its operations. The station was active during the major events of the Cold War, including the Berlin Wall crisis (1961), the Cuban Missile Crisis (1962), the Vietnam War (1965-75), the Soviet invasion of Czechoslovakia (1968), and the Soviet war in Afghanistan (1979-89). Of course, it also witnessed – or rather listened in on – the end of the Cold War, starting with the fall of the Berlin Wall (1989), and ending with the collapse of the Soviet Union (1991). Intercepting Soviet communications provided Canada and its allies with unique 'inside' access to Soviet military activities during those major events, in addition to its routine military operations.

Had the Cold War turned hot in Europe, it was thought likely to spread quickly to North America,[6] at sea and in the air. The Russian north contained a large concentration of Soviet military forces, including the Northern Fleet. As articulated in official Soviet writings on naval doctrine, its role would include "destroying the forces of the enemy fleet at sea and in bases, disrupting enemy oceans and sea lanes, and defending its own sea lanes…."[7] In practical terms this meant that its submarines were expected to break out into the Atlantic, to attack military shipping enroute to Europe, and to threaten North America with sub-launched missiles. The fleet

would also deploy its subs and surface ships to defend Soviet home waters – the 'bastion' for its intercontinental ballistic missile-launching submarines – from attack by NATO navies.[8]

As for the air threat, the shortest route for Soviet Long-Range Aviation (LRA: strategic bombers) to reach the United States lay through the Canadian North.[9] It was vast, barely populated, and virtually indefensible. One early post-war scenario posited Soviet airborne troops seizing an airfield in that region to be used as a forward base for bombers. Although the Russians were believed to have some limited capability to conduct such operations, intelligence estimates from the late 1940s into the 1950s suggested that the extreme weather and challenging terrain made that attack scenario unlikely.[10] But from the 1940s to the 1980s Canadian governments and the armed forces devoted considerable intelligence efforts to understanding the threat,[11] then wrestled with various options and schemes for defending the region. These included converting the early post-war army into an airborne Mobile Striking Force to fight any Russian ground incursions in the Arctic,[12] and creating joint air defence structures with the United States that were manifested in the North American Air Defence Command (NORAD) and the Distant Early Warning (DEW) Line of radar stations (later the North Warning System). The Russian strategic bomber threat changed over time from direct attack to stand-off attack using air-launched cruise missiles. To this day, the Royal Canadian Air Force (RCAF) and United States Air Force (USAF) frequently intercept Russian strategic bombers approaching the Air Defence Identification Zone. The Canadian Rangers, drawn from the indigenous population, provide a kind of regional militia. In the 1970s, a Northern Region Headquarters was established, and the armed forces trained and conducted aerial surveillance in the region. The focus on the North by government and the military waxed and waned over the decades, but their interest and presence, however inconsistent, provide the Canadian strategic context for the account that follows.[13] The

Alert station survived the ebb and flow of Canada's northern policies, because its role and value transcended purely Canadian interests and shifting national perceptions of threats and relevant responses. Its mission was also shaped by the interests of Canada's major SIGINT partners: the United States' National Security Agency (NSA) and Britain's Government Communication Headquarters (GCHQ). They ensured that Alert's role was and is timeless.

Part 2: SIGINT in Canadian Intelligence

Intelligence lies at the heart of warning of any impending or potential enemy action, though it cannot predict with certainty when an attack might occur.[14] The Second World War had proved the extraordinary value of SIGINT for that task. By the end of the war Canada had everything needed to support a post-war SIGINT capacity: military and civilian personnel with relevant experience and skills; a network of SIGINT stations run by the three services; a degree of respect among key allies (US and UK) for its wartime SIGINT work; and a consensus within the military and government that a SIGINT capability was useful and worth preserving. After contentious debate, the government decided to retain a national SIGINT and communications security (COMSEC) service, named and housed in a new organization: the Communications Branch of the National Research Council (CBNRC), which retained it until 1975.[15] The Canadian government spent the second half of the 1940s working to persuade its key allies (US and UK) that an independent Canadian SIGINT capability would be a useful partner. After lengthy negotiations, it succeeded; the 1949 Canada-USA (CANUSA) agreement laid the foundation for intelligence-sharing with the US and UK (and later Australia and New Zealand) in what has since become known as the 'Five Eyes' SIGINT alliance.[16]

Part 3: Arctic Origins

Alert originated in 1950 as a weather station, one of five sites in the Canada/United States civilian Joint Arctic Weather Station (JAWS) system that had been established in the late 1940s. The United States Weather Bureau had begun planning for such a network before the end of the Second World War. The US Congress approved the project in February 1946, and the Canadian cabinet had followed suit in January 1947.[17] In the meantime, with the Cold War deepening, the Canadian military began to consider the potential intelligence value of having a SIGINT station in such close proximity to the Soviet Union. Given Canadian and American concerns about possible Soviet military action in the north, developing a SIGINT capability in that region would appear to be a logical, even necessary step in those early Cold War years. But, for reasons discussed below that capacity did not emerge until 1958, when the Canadian Army SIGINT station established at Alert became operational.

Intelligence historian Wesley Wark identified three major hurdles that had to be overcome before the station became a reality. First, the CBNRC had to create a SIGINT capability in the form of intercept sites in the right locations. The process was not straightforward, but in constant flux. Canada had very limited SIGINT capacity at that time, and – oriented to the east and west coasts – it was not optimally located for or oriented to providing warning of Soviet military action in the Arctic. New stations were created, and some were moved or abandoned. All were run by the separate armed services, not in a centralized fashion. The CBNRC faced the dual challenges of finding enough skilled SIGINT operators, and also acquiring the necessary equipment, including high-quality aerials and receivers.[18]

Weather and terrain posed additional problems. In 1955, a trilateral (Canada/US/UK) “Northern Site Surveys Conference” recommended that the Alert location (among others) be

surveyed. Scientist David R. Gray, author of a book on Alert, suggests that intent of the survey was to determine the most suitable site for SIGINT operations.[19] Alert must have passed muster, because the following year, the RCAF established a small (one hut) listening post close to the JAWS station. According to the station's official website, the initial RCAF team did "research" on long-range, high Arctic communications. That may have been a euphemism for actual SIGINT work, since Canadian Forces SIGINT operators are referred to as 'Communicator Researchers'. In 1958, the Canadian Army Signal Corps took command of the post, which expanded considerably in the ensuing years.[20] In his book on the U.S. National Security Agency (NSA), James Bamford writes that in 1958 American SIGINT researchers were still trying to determine the value of such a northern base.[21] This suggests that in getting Arctic SIGINT started, the Canadians 'got the jump' on the Americans by a few years.

Alert may have been a desirable location from a SIGINT standpoint, but building and sustaining a station in that environment was going to be difficult. Moreover, Canada would have to rely on the US to provide the heavy lift (sea and air) to bring in building materials and supplies. Nevertheless, by February 1959 the site survey was complete. The Communications Security Board approved creation of the station, and pushed for rapid staffing. Prime Minister John Diefenbaker lent his weight to the project. The station was up and running by December 1959, with a complement of 95 personnel, of whom 45 were SIGINT operators.[22] However, a 1961 CBNRC document states that there were only ten *intercept* positions there at that time.[23]

The second challenge facing the station was funding. Wark says it remained "a significant and divisive issue" from the 1940s into the 1950s. Battles over funding often pitted the CBNRC against the armed forces; the former expanded dramatically during the Korean War to handle the increase in intercept traffic. The Army, however, resisted any increase in its share of the CBNRC

budget, because it was skeptical of the long-term value of penetrating Soviet communications, and because the Branch was not producing enough material of direct value to the Army, such as Soviet ground forces order of battle. In the wake of that war, the funding debates waxed and waned. The Army complained about the cost, while the Branch and its supporters argued that if Canada did not do its SIGINT part, the Americans would take its place. That did not sway the Army, and the matter remained stalemated until 1958, when General Charles Foulkes, the Chairman of the Chiefs of Staff Committee, broke the deadlock in favour of a larger CBNRC budget. He made the cases both for an independent Canadian SIGINT capacity – to allow Canada to make its own intelligence assessments – and for that capacity to be focused on the North. It also would give Canada product to trade for intelligence material from its allies.[24]

Winning over those allies was the third obstacle to be overcome. Edward Drake, the CBNRC's chief, conceived an audacious goal: to persuade the Branch's allied partners – the NSA and the GCHQ – not only to accept a Canadian role in Arctic SIGINT, but to make the Branch the lead agency there. Drake believed that this would cement Canada's place in the intelligence alliance, and would make an ironclad case for granting Canada full access to its allies SIGINT resources. But time was of the essence, since the NSA was doing site surveys in Greenland. If Canada did not act fast, it could be shut out of the Arctic SIGINT role. With that in mind, in 1957 he convened a conference in Ottawa on that issue. The CBNRC had five delegates, the NSA six, and GCHQ – not a major Arctic player, but a key ally – just one. Although Canada's reach exceeded its grasp, since its SIGINT presence in the North was still small, Drake's gamble paid off. The allies agreed that there should be a single center for processing Arctic SIGINT, and that the CBNRC should fill that role. The heads of the NSA and GCHQ approved the recommendations in August 1957. This gave the Branch the ammunition it needed

to win the funding battles discussed earlier.[25] With those three hurdles cleared, the SIGINT station could be established.

Part 4: The SIGINT Mission

Today, the station's official website acknowledges its SIGINT mission,[26] but such clarity had not always been the case. For decades, owing to the sensitivity and high security surrounding SIGINT, a legacy of the Second World War experience, even within government the actual mission of CF Station Alert was buried in bureaucratic bafflegab. For example, without naming Alert, a 1963 JIC paper on "The Canadian Intelligence Program" referred vaguely to collection objectives that included, "to exploit unique or specially advantageous Canadian collection opportunities", and to processing objectives that included, "to produce … reports in fields (for example, the Soviet Arctic) in which special Canadian opportunities and competence exist…."[27] Both the collection and processing efforts were seen as valuable for Canada's allies.

Public mentions of Alert referred only to a generic mission involving research on radio transmission in northern regions.[28] In 1967, the impending publication of David Kahn's book *The Codebreakers* prompted the Intelligence Policy Committee (IPC), which oversaw the CBNRC, to update the cover stories for the organization and for Alert in particular. The story for the CBNRC said simply that it "carries out research, development and production of aids in the field of Communications for the Defence and other Government departments."[29] That for Alert, unchanged from the 1960 version, said that it was established,

> "to collect data in support of research into basic problems of Arctic communications techniques and equipment. It is part of a standard Service research programming on problems of radio transmission and reception in Northern areas."[30]

A 1969 memorandum warned the Minister of National Defence that a reporter for *Time* magazine was planning to publish a story on the true purpose of CFS Alert. The Minister was advised to fall back on a previously agreed cover story, stating simply that the government "did not consider it to be in the national interest to confirm or deny any suggestion" that Alert was conducting SIGINT.[31] This may have deflected the reporter, but it would not have fooled the Russian military and intelligence services, who themselves were quite familiar with SIGINT. In any case, in 1974, following U.S. Congressional inquiries that exposed the NSA, the Canadian Broadcasting Corporation blew the cover on the CBNRC, which ran the Canadian SIGINT and cryptanalysis program.[32] From that point on, Canada's SIGINT role and Alert's place in it was a matter of public record.

That said, SIGINT collection was not an end in itself; it was a means to an important end: Indications and Warning (I & W), a specific function of intelligence focused on detecting indications that a potential enemy is preparing to launch an attack or a war. [33] During the Cold War, the advent of nuclear and thermonuclear weapons, paired with rapid delivery systems – ICBMs in particular – put a premium on early detection of indicators that would be used to warn decision-makers, ideally in sufficient time to prepare defenses, evacuations, and/or counter-strikes. Mark Lowenthal points out that the ability to intercept and read your opponent's communications (COMINT) is a good way to achieve I & W. This "relies to some degree on the regular behavior of those being collected against, especially among military units. Messages may be sent at regular hours or regular intervals, using known frequencies. Changes in those patterns – either increases or decreases – may be indicative of a larger change in activity."[34] As shown later in this study, this is exactly what the SIGINT collectors at Alert listened for. However, writing in the 1970s, CIA analyst Cynthia Gabo introduced a cautionary note. She argued that –

ironically – as an attack became increasingly imminent, there might be *fewer* indicators of war, not more.[35] Thus, I & W had to be seen as an imprecise art, not as a predictable science.

Part 5: Command and Control

After the brief initial RCAF operation, from September 1958 until 1966 the Army Signals Corps ran the Alert station, although some navy and air force personnel also were assigned there. With the reorganization of the military under the Unification program, in July 1966 all of the service-specific intercept stations were amalgamated into a single tri-service SIGINT formation: the Canadian Forces Supplementary Radio System (CFSRS). From 1966 the Canadian Forces exercised command and control of the CFSRS, being responsible for managing the stations, supplying and maintaining them, paying most of their operating costs, and providing the bulk of the personnel required to staff them. However, SIGINT tasking was exercised in a bifurcated (and sometimes competitive) manner. The CBNRC was responsible for strategic collection, cryptanalysis, and reporting for the government as a whole, and for providing SIGINT products (intercepts and analysis) to Canada's Five Eyes allies. But the Canadian Forces also assigned the CFSRS to collect SIGINT on its behalf for military operational purposes. The line between these two taskings was not always clear, and the 1970 report on Canadian intelligence operations by advisor Claude Isbister criticized the arrangement for being "unwieldy". Moreover, the NRC was uncomfortable with the SIGINT operation being housed within its domain. After the CBC exposé, the cabinet moved the unit into the Department of National Defence (DND), renaming it the Communications Security Establishment (CSE). It reported to the defence minister, but its products were shared across the government.[36] In 1976 the CFSRS was re-assigned to CF Communications Command,[37] and later, for military purposes it became the SIGINT arm of the Canadian Forces Information Operations Group (CFIOG), reporting to the DND Assistant

Deputy Minister (Information Management). On 1 April 2009, CFS Alert – by then a remotely operated site – came under command of 8 Wing, RCAF at CFB Trenton.[38]

At the station level, the commanding officer (CO) held the rank of Major, and he or she was normally supported by three other officers, and up to five Master Warrant Officers (or Chief Petty Officers). The COs and their staff were responsible for administration, operations, logistics, maintenance, food services, safety, the health and well-being of the station personnel, and all the related tasks associated with running a military base or unit.[39] The CO reported to the deputy commander of the CFSRS (Lt. Colonel), who normally would do one or two inspection visits per year. The CFSRS commander visited periodically, often accompanying VIP visitors on familiarization tours. Due to the varied posting cycles, the station leadership staff experienced constant turnover, with as many as three different COs and MWOs serving in their assigned positions over the course of a year.[40] However, at Alert, the Standard Operating Procedures (SOPs) for changes of command included a week-long overlap between incoming and outgoing leaders that ensured smooth transitions. Those being posted in knew what to expect and what was expected of them. Alert veterans also mentioned that everyone serving there in any capacity had to devote some of their 'down time' to the manual labour required to maintain the station. So, to help sustain morale, discipline and uniform standards were more relaxed.[41] Even more important for morale, health and fitness were the many clubs, sports, and recreational facilities, such as the ham radio station that provided a link to the outside world.[42]

Citing a 1958 letter from Army headquarters, Gray says the initial complement consisted of "21 radio and telegraph operators and technicians, 1 vehicle mechanic, 1 equipment operator, 3 cooks, and 1 medical assistant."[43] The station's military contingent grew rapidly thereafter: from 27 in 1959 to 130 in 1962, peaking at 266 in 1986. The CAF total dropped to 207 in 1987,

then declined gradually thereafter as the CFSRS prepared to convert the station to remote operation. By 1999, the CAF personnel on site totaled only 69, consisting solely of equipment technicians and maintenance staff. By far the largest CAF cohort consisted of the Communicator Researchers (MOC 291) – the NCOs and other ranks who did the actual SIGINT work, under the direction of the Operations Officer (Ops O). At its peak that cohort totaled 125.[44] Their tasks and roles are explained later. The Ops O was responsible for personnel and security of Operations and Technical Services. He/she supervised SIGINT, geolocation, High Frequency Direction Finding (HFDF) operations, and Technical Services, and was the account holder for Special Materials and Publications. They were in charge of the emergency defence plans, and were responsible for destruction of classified materials if needed. They wrote the weekly SITREPs that were sent to CFSRS, and compiled the annual Personnel Evaluation Reports (for the 120+ persons under their command in Operations and Technical Services).[45]

Initial postings were six months duration. Subsequent ones could be gradually reduced in length to as little as two-three months. Posting to Alert was not voluntary – at least for the junior NCOs and other ranks. Those serving in the pre-Unification three services and latterly in the CFSRS as 291ers could expect to be posted there every two-three years on a regular rotation. In between postings, they would serve at the 'home station' (CFS Leitrim) or at another one (e.g., Gander, Masset, or Bermuda), at CSE headquarters in Ottawa, or at the Signals Regiment, based in Kingston.[46] Petty Officer 2nd Class (ret.) Bill Neelin 'volunteered' several times after his first posting, in order to 'beat' the normal rotation cycle and serve in a period that suited him better.[47]

Throughout its first forty years Alert also included a small cohort of civilians from the Department of the Environment, responsible for operating the weather station, and four Inuit employees. The number of people on site expanded temporarily every spring and summer when

military and/or civilian crews flew in to do construction, maintenance and repair – a constant requirement due to the impact of the harsh climate on buildings and exposed technical systems.[48]

In the 1990s, CSE and DND decided to convert Alert to remote operation, a concept first suggested (for all CFSRS stations) as early as 1974 for reasons of cost.[49] Lt. Colonel (ret.) Chantal Cloutier served in the Project Management Office for Operation POLO (the CFSRS remoting project) from 1991 to 1993, and subsequently the CO of CFS Alert (1996-97). In her view, several factors drove the decision: the end of the Cold War; technological change that made remote operation practical; and cost: "Alert was a very expensive base to maintain." She recalls having to make the case to keep the station, in face of opposition from a Chief of the Air Staff, "who didn't see the value of intelligence generally, SIGINT and Alert specifically."[50] But context is important. During this period, and for the same reasons, the Canadian Forces were closing their bases in Germany, and were bringing the troops home. Likewise, the listening posts at Gander and Masset were converted to remote operation, and the HF/DF station in Bermuda was closed in 1993.[51] So the Alert decision and conversion did not occur in isolation or in a vacuum.

Nevertheless, the change at Alert was dramatic. As of 1997, the CF contingent fell from 125 291ers to nine technicians and a sergeant.[52] Today it is staffed by 55 personnel from the CF, DND, Environment Canada, and civilian contractors. CF personnel normally stay six months, but some specialized positions are rotated every three months. By 2009 most SIGINT operations, except at CFS Leitrim, were being done remotely, with CF personnel performing only support tasks. Since 2009 RCAF has been responsible for all aspects of station operations.

Part 6: SIGINT Operations at CFS Alert

So, how did Alert conduct its assigned mission? Whether one thinks of the intelligence process as a simple 'cycle' or as a more complex, iterative process constantly refined by feedback loops, the basic stages remain the same. Someone or some office/unit establishes requirements that provide direction and priorities to the collectors, who then exploit their sources and methods to gather the requested information. Other branches process and analyse the information, turning it into intelligence, which they deliver to the consumer that requested it. At any point in this sequence, previous stages may be revisited to refine the products being generated. [53] In the case of CFS Alert, we can see the first two stages at work: direction by priorities; and collection and reporting from sources and methods, in this instance, SIGINT.

Direction and Collection Priorities

Although Joint Intelligence Committee (JIC) papers from the 1960s described Canadian intelligence tasking only in vague, general terms (e.g., the "Soviet Arctic"),[54] this belies the importance of the Alert station in the early Cold War period. A paper prepared by the CBNRC's Communications Research Committee (CRC) on Canadian SIGINT and COMSEC in 1960 stated that "the production of intelligence on the Soviet Arctic remains the overriding SIGINT task of the Branch."[55] The CBNRC regarded the establishment of the Alert station as its most important recent achievement. At that point in time, the CBNRC was responsible "for determining the objectives and operations at each station, and for the continuous review and control of its collection and processing tasks."[56]

Within the organization, the Coordinator Production exercised "general supervision of all SIGINT production operations", while C Group was responsible for "Intercept planning and control, communications, technical search and ELINT."[57] P Group was assigned to air and naval

COMINT, and Q looked after ground forces and non-military COMINT. Collection priorities were set in conjunction with input from the NSA and GCHQ liaison officers, but took into account the geographic limits of the Canadian SIGINT assets. So, their interests corresponded closely to those of Canada. In fact, they depended on Canada for SIGINT on the Soviet Arctic. As a member of the Canadian JIC, the CBNRC's director was familiar with the subjects of interest to the Canadian intelligence community. Each service intelligence directorate would state "its requirements direct to CBNRC, which translates them into SIGINT terms, and either forwards them to NSA or GCHQ for fulfilment, or, if they are on subjects within the CBNRC area of operation, incorporates them in the current work of the production groups."[58] The *AHR*s record numerous visitors from the CBNRC/CSE, CFSRS, the NSA, GCHQ, and other services.[59] Lt. Col. (ret.) Rob Martin recalls that under the USN's Personnel Exchange Program in the 1980s, one or two American DF personnel would be posted to Alert.[60]

Periodically the Assistant Director of CBNRC would meet with representatives of the service intelligence directorates. Together they would draw up an agreed list of intelligence priorities for Canadian SIGINT production. This list served as a general guide to determine the amount of effort to be assigned to the CBNRC's SIGINT production tasks.[61]

In 1960 the CBNRC had an extensive list of collection priorities, almost exclusively focused on Soviet activities in the Arctic, ranked in order of importance:[62] First priority was *Indication and Early Warning (I & W) Intelligence*, based on the list of indicators identified in the Tripartite Alerts Agreement (1957).[63] A Canadian JIC paper from March 1959, produced just as the Alert station was ramping up to full operational status, identified the various activities Soviet Russia would be expected to undertake prior to the outbreak of war. These were deemed to be I & W of a possible war. Many of them would involve communications that Alert's sensors

could intercept. They might include: suspension of aids to aerial and maritime navigation; COMSEC measures; civil defence alerts; dispersal and underground relocation of critical industry, government and military headquarters; increased activity at military headquarters, activation of new ones; mobilisation of reservists; cancellation of military leave; wartime alerts to military units; movement of long-range aviation (LRA); expanded training for new bomber, submarine, and missile launching crews; commencing of intensive, around-the- clock, active defensive measures (patrolling, augmented strip-alerts, full operational air defence alerts), particularly in the approaches to key military installations; sudden dispersal of naval vessels from major harbours or bases; urgent activity at LRA bases and nuclear storage sites; major deployment of LRA bomber and tanker aircraft to the Arctic or other forward airfields. The list goes on in considerable detail, including some actions that might not be detected by SIGINT or at least not by SIGINT alone.[64]

However, it also highlighted several activities specific to communications that would be natural SIGINT targets, including: unusual and widespread increase or decrease in the volume of or other abnormal activity in military communications at all levels, especially tactical; any noticeable decrease in COMSEC, due to high volume, haste and poor cryptographic competence, especially at tactical levels; military takeover of major civil communications facilities (telephone exchanges, radio stations, etc.); widespread jamming or other EW measures of key Western military and government communications, and of radar or SIGINT installations.[65]

In the intelligence domain, indicators could include: flights of strategic bombers toward Western target areas; air, sea, and ground reconnaissance efforts; weather reconnaissance over Western Europe, Canada and other areas (especially probable aerial-refuelling areas); and any

increase in the number and frequency of weather broadcasts to Soviet air defence, missile, submarine, and strategic bomber forces.[66]

Second, *Critical Subjects*, assigned priority monitoring, included the following:[67]

a. Developments possibly related to Soviet guided missile capability (including organization, base installations, airfields, submarine bases, logistic facilities, etc,).

b. Operations and capability of Soviet LRA (heavy and medium bombers).

c. Operations and capability of Soviet submarines in the Arctic, and in other waters of primary interest to the RCN.

d. Development of Soviet special [i.e., nuclear] weapons capability.

Third, and subsequent topics, subject to routine coverage, included: development of Soviet air defence capability; military air transport activity; out-of-area activity of naval units (e.g., Northern Sea Route naval convoy); Soviet bloc clandestine activity possibly aimed at Canada; military construction and production, other than those connected with *Critical Subjects*; organization and operations of Soviet civil aviation authorities; Arctic activities connected with the Soviet economic threat (e.g., production of important commodities such as gold and non-ferrous metals); organization and operations of surface transportation (including Northern Sea Route, river fleets, rail and road); organization and operations of tactical air forces; organization and operations of Northern Fleet forces in home waters; organization and deployment of Soviet military and para-military forces (including airborne forces and police); scientific activities; telecommunications; basic political and economic organization and activities (including economic councils, industry, agriculture, civilian construction, etc.); arrangements for Civil Defence; special activities related to Soviet guided missile or space programmes outside the

Arctic; Soviet armed forces activity in the Far East, as required. Other subjects (e.g., Soviet trawlers in the Northwest Atlantic) might be handled at any priority level by special request.[68]

While this list was drafted in the late 1950s, it is likely that these priorities did not change greatly over the duration of the Cold War. In fact, some probably remained relevant after that. And they certainly reflected the threat perceptions of the era – largely shaped by those of the United States intelligence community. In the late 1950s, there was a pervasive fear that the Soviet Union had outpaced the U.S. first, in production of long-range bombers, then – following the Russian launch of the *Sputnik* satellite in October 1957 – in strategic ballistic missiles. These were issues of considerable, divisive debate within the U.S. intelligence community and in national political campaigns. Ultimately, the estimates were shown to be incorrect; the U.S. had a numerical advantage in both fields. But even once those fears were put to rest, [69] detecting preparations for a possible surprise attack was still seen as vital to survival of the American strategic deterrent, as well as to the U.S. itself[70] – hence the highest priority assigned to I & W. The *Critical Subjects* and the remainder of the collection priorities flowed logically from the baseline threat perception. Changes in any one or more of these could be interpreted as indicators of preparations for war.

This list represented a massive burden to impose upon a single SIGINT station. But, at the time there was no alternative. Any Soviet attack on North America would traverse the Arctic region by air and sea, because that was the shortest route from the bases and waters in the Russian north. From an intelligence collection point of view, Soviet Russia was a “denied area”. Its sheer size – much of it inaccessible to foreigners – and its extensive internal security apparatus, the very epitome of a “counter-intelligence state”, made it very difficult for Western intelligence services to operate there.[71] Then, after the Russians shot down an American U-2

reconnaissance plane in May 1960, the US suspended overflights of Soviet territory.[72] Moreover, the American spy satellite program was still in its infancy then;[73] it would be years before it could provide coverage comparable to that provided by U-2 overflights. For the purpose of this study, however, the list allows one to deduce some of the specific collection targets within Alert's purview. But, given the limited original sources, what follows is selective, since it does not cover the full scope of the priorities identified above. Moreover, as Bill Neelin explains,

> "… special watches could be added at any time. During special activities, operators would be tasked with an additional assignment. Special assignment tasking for new targets or short-term monitoring was much more commonly the responsibility of CFS Leitrim. As operators we were simply given the pertinent information about the target and told what to watch for. We didn't know who wanted the information but could usually deduce why 'they' wanted it."[74]

In short, during a major crisis, Alert had a large menu of potential I & W and Critical Subjects collection targets. At their heart lay the technical target: Russian military radio communications.

Collection Targets

A. The Leningrad Military District

Writing in the late 1970s, American Soviet military analysts Harriet and William Scott explained that the Soviet military districts, organized geographically, were administrative and training commands in peacetime that could become 'fronts' or theaters of operations in wartime. All ground forces and 'frontal' (tactical) aviation units, along with any military schools, garrisons, and other installations within its boundaries were subordinate to the district's headquarters. There were exceptions: strategic rocket forces, LRA and transport aviation, national air defence units, naval headquarters and fleets. They reported to separate higher

service-specific headquarters under the General Staff. Similarly, a district would be expected to support MVD and KGB operations in their area, although those forces took direction from national-level ministries. The district headquarters staffs were considered large enough to conduct wartime military activities on their own if necessary. Orders would be passed from the General Staff to the district's military council, then to the chiefs of the forces assigned to the district: artillery and rocket troops, tank troops, chemical, signals, and engineer troops.[75]

The Leningrad Military District, which extended from the Arctic Ocean to the Baltic Sea, shared a long land border with Finland and a short one with Norway. To say that the district has presented Alert's SIGINT operators with a 'target-rich environment' would be a gross under-statement. The primary collection area, that closest to Alert, was the Kola Peninsula, which extends some 500 km east to west along the Barents Sea to the Norwegian and Finnish borders. Neelin explained that "the main depth of Alert penetration was probably about 100 kms deep along and above the North Coast of Russia, including the northern islands…. some tasks may have been deeper into central Russia."[76] This area was/is home to a vast array of Russian military installations. According to one source, in the early 1980s, there were some forty military and naval airfields on the peninsula.[77] There were more on the islands of Novaya Zemlaya, Severnaya Zemlaya, and Franz Josef Land.[78] But these were dwarfed in scale by the Russian naval installations. The most important of these were situated at or near the city of Severomorsk, a year-round ice-free port located on the northern flank of the peninsula. Since 1947 it has served as the main base for the Russian Northern Fleet. There are at least six other naval bases nearby. According to a 1968 CIA report, Severomorsk normally would host 25 major surface ships and a dozen submarines at any one time, the rest being deployed on exercises and operations. Soviet ballistic missile submarines (SSBN) were based at nearby Olenya Bay or Polyarny. Severomorsk

itself also served as a storage facility for munitions, fuel, and supplies.[79] All of the foregoing were collection targets for Alert's sensors and listeners.[80]

Looking at the district from a SIGINT perspective, the Scotts observed that "much of the Soviet Union is connected by underground cable, assuring a high degree of communications reliability in the event of war."[81] Such landlines, linking bases and their higher headquarters, would be shielded and secure from intercept. But Russia also used point-to-point microwave, short wave, and satellite communications.[82] James Bamford, writing some twenty years later, called into question Russia's reliance on buried landlines. He says that by the early 1960s, the Soviet military was increasingly turning to microwave and satellite communications rather than buried cables and HF transmissions. The former were expensive, given Russia's huge distances, and were difficult to install in the harsh terrain, while HF signals were seen as unreliable. Satellite communications were not affected by weather, and the narrow band microwave signals could carry voice and data securely via repeater towers spaced about 30 km apart.[83] Nevertheless, throughout the period under study here the Soviet armed forces based in the Northern Region used HF radio communications, employing (mostly un-encrypted) Morse Code (MC) with five extra Cyrillic characters.[84] As will be shown below, these Soviet communications systems were not secure from intercept by the operators at CFS Alert. The 1961 draft IPC paper on improving Canadian SIGINT operations made the point that in spite of Russia's increasing reliance on land-line communications, the volume of "exploitable" communications – those susceptible to intercept, i.e., short wave radio – had been expanding steadily. CBNRC had received about one million exploitable messages in 1958, and fifty percent more in 1960.[85]

Drawing upon KEYHOLE satellite photos, a 1971 report by the CIA's National Photographic Intelligence Center (NPIC) lends some weight to Bamford's position, and sheds

light on a suspected shore-based command, control and communications facility at Severomorsk. It was similar to those located by fleet bases at Sevastopol and Vladivostok and near [naval headquarters in] Moscow that were notable for "antenna types and azimuths peculiar to Soviet naval communications."[86] The report goes on to say that,

> "The Severomorsk Probable Naval Command and Control Facility … is associated with the Northern Fleet Headquarters at Severomorsk. The facility contains a probable command bunker, two microwave antenna towers each with two R-400 microwave dishes, six possible R-401 (MERCURY GRASS) antennas, and two R-122 (FORK REST) antennas. One R-400 microwave antenna is oriented in the general direction of the naval associated Severomorsk Radio Communications Transmitter Station West, situated 2.5 nm to the west. The transmitter station contains an R-400 microwave antenna with a reciprocal azimuth, which confirms this communications link. Because of the limited interpretability of available KEYHOLE photography of the Severomorsk Probable Naval Command and Control Facility, the azimuths of the remaining antennas cannot be determined."[87]

However, the report also indicates that the Russians had not completely abandoned VHF communications at that time.

Other major SIGINT targets in the Soviet/Russian north would have included: Severodvinsk, then the site of the world's largest submarine construction yard, and the sole nuclear support facility for the Northern Fleet.[88] Lying to the northeast, in addition to its airfields the island of Novaya Zemlya was the site Russia's ICBM testing facilities.[89] According to Bamford, the Barents Sea itself was an area of considerable interest, because it was where Soviet

subs started and ended their patrols hunting American subs in the Atlantic. It was also where the Northern Fleet conducted exercises year-round.[90]

B. The Northern Fleet

The 1968 CIA report opened with a blunt statement that, "The Northern Fleet, its units and operations, is of *prime intelligence interest*."[91] This was due to the fact that its SSBNs posed "an increasingly significant portion" of the Soviet strategic threat to NATO and the USA itself. Moreover, its long-range attack and missile-launching subs gave it a "considerable capability" against Western shipping and naval surface forces operating in the Norwegian Sea, the Atlantic, and the Mediterranean.[92] Clearly, the priority assigned to that fleet had increased since 1960.

A 1958 memorandum for the JIC had posited that in the event of war, the Northern Fleet would disperse its submarines to a number of 'havens' in Russian waters, such as near Novaya Zemlya, or in the Norwegian fjords (it assumed that Soviet forces would attempt to capture northern Norway). Other possible sites would include the waters off Spitzbergen and the east coast of Greenland. The memo identified several crucial criteria: that the havens must be easily defended, and be as close to the Russian homeland as possible consistent with safety. From the perspective of Alert's SIGINT tasks, the most important criteria were that "it will be necessary for the havens to be in communication with a central command at all times in order to be aware of the disposition of all friendly forces;[and that] the Soviet depot ships have the capability of communicating by radio with a central command by secure means."[93] Broadcast signals would not be used while ships were tied up alongside in Russia, and while aircraft were grounded at their bases. However, once they were underway on patrols or exercises, their on-board systems would be in constant use, and therefore potentially vulnerable to detection and intercept. Indeed, Soviet military doctrine, which emphasized centralised command and control, ensured that naval

units would maintain regular radio communication with higher headquarters.[94] So, ship-to-shore and ship-to-ship communications at sea, which relied on Morse Code, were vulnerable to intercept by the Alert station.

A Canadian JIC naval threat assessment drafted in the immediate aftermath of the Cuban Missile Crisis (and projecting forward from 1963 to 1973) asserted that – in the event of a war with the West – the primary roles of the Soviet navy and naval aviation would be to defend Russian territory, waters and shipping against carrier strike forces and missile-launching submarines. Russian subs would set up barriers stretching from Greenland in the west to the Norwegian sea in the east, and in the Barents Sea from Spitzbergen to North Cape. Second-order priorities would be sub-launched missile strikes against North America and attacks on Western shipping on the high seas.[95] (Submarines apart, at this time the Soviet Union did not have a full-spectrum 'blue water' navy.) The majority of these tasks would fall to the Northern Fleet. It is hardly surprising, therefore, that Dr. J. E. Keyston (Vice-chair of Canada's Defence Research Board) writing in late 1962, emphasized the implications of this assessment for Alert's SIGINT mission:

> "we cannot fail to recognize the gathering of the most complete intelligence regarding the deployment of Russia's submarines in the Atlantic as rating an exceptionally high priority. Moreover, for geographical reasons, Canada cannot escape the responsibility for accepting the main burden of this need on NATO's behalf as far as Russia's Northern Fleet is concerned."[96]

That fleet continued to grow, with submarines accounting for the greatest expansion. In 1968, the CIA estimated that it included about 150 operational subs, including 27 SSBNs, 27 cruise-missile-launching subs, and nuclear-powered attack [hunter-killer] submarines. New

SSBNs similar to the US Navy's Polaris class were being built at Severodvinsk; up to seven of these – designated by NATO as Yankee class – had been delivered as of September 1968. One of the three new Kresta class guided missile cruisers had been assigned to the Northern Fleet, where it joined two conventional cruisers. The fleet also included two Kashin class and one converted Kotlin class guided-missile destroyers, along with 18 gun-armed destroyers and 55 escorts shared with the Baltic Fleet. The report went on to note that all of the major Russian surface combatants built since 1960 had been equipped with missiles.[97]

An unclassified 1972 estimate stated that the Northern Fleet included: 30 SSBNs, 124 other subs of various types, seven cruisers (four with guided missiles), 20 destroyers (12 mostly carrying air defence missiles), 125 patrol craft, 46 minesweepers, and at least 60 other vessels.[98] However, apart from its submarines, the fleet was largely optimised for defending Soviet Russia's home waters, not for open ocean combat.

By 1989, the Northern Fleet had expanded further. It comprised: 39 SSBNs, 30 nuclear (SSGN) and seven non-nuclear cruise-missile subs, 58 nuclear (SSN) and 40 conventional attack submarines, two aircraft carriers, more than a dozen cruisers (including the *Kirov* class nuclear-powered guided missile battlecruiser), 22 destroyers (all but three equipped with missiles), nearly 50 frigates, 55 coastal/patrol ships, 65 mine warfare vessels, and over 180 various support ships. It was supported by a large, but aging fleet of LRA bombers and reconnaissance aircraft.[99]

In short, it was a formidable force – at least on paper. Admiral Vladimir Chernavin, then commander-in-chief of the Soviet navy, emphasized in 1989 that submarines and naval aviation together comprised the "main forces" of the navy, and that strategic strikes by the SSBNs remained its traditional primary task. But, as Pelham Boyer pointed out at that time, despite Soviet claims that its surface fleet was intended to defend the homeland, its size and upgraded

capabilities did not appear entirely defensive.[100] Indeed, it could be seen as the apogee of the Soviet push to create and deploy a globally capable 'blue water' navy.

In the post-Soviet era, however, the Russian navy suffered a prolonged period of decline. According to analyst Marlene Laruelle, it was "the biggest loser" in the severe cuts to the military budgets in the 1990s. The navy's share of the defence budget dropped from 23% to 9%. The Northern Fleet remained the most powerful of the four Russian fleets. It included about two-thirds of the navy's nuclear force. But, like the rest of the navy, it was hit hard by the collapse of the Soviet Union, and the budget cuts that followed.[101] However, its post-Soviet fate of the fleet lies outside the temporal scope of this paper.

This, then, was the collection target "of prime intelligence interest": the naval, air, and air defence forces of the Leningrad Military District, especially the SSBNs and LRA deployed on or near the Kola Peninsula. Canada was not alone among the Five Eyes in devoting attention and resources to that target. But no one else was better situated geographically to do the job. The next sections try to answer the question: how did they do it?

Collectors and the Collection Process

SIGINT collection at Alert was a non-stop operation: 24/7/365.[102] The station maintained this rigorous schedule by means of a constantly rotating watch/shift routine. Each day was divided into eight-hour shifts: days (0800-1600 hours), evenings (1600-2400 hours), and midnight (0000-0800 hours). Then a fourth eight-hour shift would advance the rotation each day. Veterans remember the sequences with slight differences. Rob Martin told the author that, "You'd work six day shifts, then [have] a day off, six evening shifts then a day off, six midnights then three days off."[103] Bill Neelin recalls the sequence as being: "six evenings … two days off, six days … [two days off?] six midnights … three days off.[104] Likewise, the number of operators

on each shift varied from 20 to 25. These discrepancies can be explained either by faulty memory or perhaps by minor changes in the station schedule at different periods over the years. Either way, the shifts always were fully staffed – no one recalled any shortage of watch personnel. Rob Martin said that if a position was to be vacated at Alert, there was extra manning at the other SIGINT stations; they would send personnel to Alert to ensure that it had a full complement. But that was not always the case. Various documents indicate that the Branch and DND struggled to maintain the full roster of intercept teams for all stations, sometimes including Alert.[105]

Since the Russian military used MC to transmit technical and operational information via short-wave radio, the 'work horses' of Alert's SIGINT effort were the Morse Code Operators, who normally were Privates, Corporals, Ordinary or Able Seamen. During their basic trades training all would have been trained to 'read' and type out MC to at least 25 words per minute. On the main floor of the operations building there were ten intercept positions or 'bays', each equipped with two receivers and a set of split headphones. One operator sat at each bay, monitoring two frequencies at the same time. One bay had four receivers, but only one set of headphones, limiting it to two frequencies. Another position did wide band search across the HF spectrum.[106] Although the operators were at their positions for eight hours, "they had lots of chances to take a break." They followed the schedule of the Russian senders, who would come on and go off at regular times. They were "doing the same thing over and over," Warrant Officer (ret.) Chris Ingersoll recalls. "They were set up the same way every time, you could tell what was coming on the next line." [107] According to Chief Warrant Officer (ret.) Jim Humes, "on International Mothers Day, the Russians [at military bases] would send messages to their mothers, in clear. [Alert] heard it all and recorded it."[108] Corporal (ret.) Peter Dalton said that the MC Operators could become familiar with a sender's traits: "Morse code communications were

sent by hand, and following a change in station identification (e.g. callsign) some Russian operators might do something unique at the end of each message, and that could be the key where one could say 'I know which station that is.' That wasn't something you could teach in a classroom, it was gained by experience."[109] However, Lieutenant (N) (ret.) Les Lindstrom recalls that, "When there was a lot of activity going on, you were nailed to your seat." He added, "there were hours of boredom punctuated by milliseconds of absolute terror."[110]

Rob Martin explained that a Master Corporal served as Block Task Controller, "who would determine what targets you were watching at any one time. Most were assigned to a position, so when you sat at your position, you knew what your job was." Rob's favourite was the "first bay on the right", listening to the communications of a Russian air defence network. It was "a critical one for the Russian western Arctic" that provided Alert with information about LRA assets flying in the region. "That was a priority: you sat on that 24/7." Due to its importance, the first bay was directly linked to the plot board. The MC Operators would provide information to the Sergeants, who would mark dots on a map corresponding to the data the operators gave them from the targets they were copying.[111] As Bill Neelin explains, a Russian net/network comprised a control station (headquarters) and a number of outstations – from as few as one to many more. Some nets all operated on the same frequency while others used a different frequency, hence the need for two receivers in each bay. Some nets only worked between station and headquarters while others could communicate with each other. Most nets were active 24/7. Given experience, an operator "would always monitor the control station and a selected second (out) station. They would … alternate the out station when required."[112]

With at least one tour as an MC Operator completed successfully, some 291ers might be selected to be a Processing and Reporting Coordinator (PRC) on their next tour. They would be

Master Corporals/Leading Seamen or Sergeants/Petty officer 2nd Class. The PRC collected the intercepted MC transmissions from the operators on their shift, transcribed them, and forwarded those reports to CBNRC/CSE.[113] Martin explained that the PRC was responsible for: "scanning all of the traffic that came off the positions … and looking for reportable criteria" – based on Station Operating Instructions from the Director of CSE: key words, code words, anomalies. "That's the part I loved, because you're looking at the pieces of a puzzle, and you're trying to assemble the whole puzzle."[114] He added that the senior PRC for the station was the interface between Alert and CSE.

Others might be selected, trained, then posted for Long Range Technical Search (LRTS), later re-named Signals Development (SIG DEV). Jim Humes explained that as an LRTS operator "your job was to search the signals spectrum for something new." This was the wide-band search position mentioned earlier. Case in point: Soviet Navy ship communications "would move all over the spectrum, you'd have to follow them."[115] The Russians also attempted to use deception to mask their shipping movements. When they wanted to transfer navy ships from the Arctic to another area, they would mix them into convoys of merchant ships, and the operators at Alert listening to the shipping communications "would have figure out whose call sign belonged to which ship." But the Russians' rigid routines undermined their *maskirovka* measures to some degree. Alert's operators would "watch for certain key words in the weather traffic, which indicated something special was going on. The Russians sent regular routine weather reports on the international weather channel from their ships, so you could track where they were."[116]

Peter Dalton took a three-month LRTS training course in 1969, in which he learned about the different parameters of radio signals, the effect the ionosphere has on them, and other course subjects related to radio communications. Then back at Alert he was analyzing signals from

Russia, not just copying them. “We were into some interesting signals,” and would analyse the signal parameters, and attempt to identify their purpose.[117] For example, he recalled one signal that was turned on and off at specific hours (e.g., 0800), so the MC Operators “would tune in to it at exactly that time. They would measure the frequencies, the bandwidth, all the technical parameters about the signal.” But Peter would go on five to ten minutes earlier and noted that the Russian operator would be “fiddling with the signal phase (positive or negative) until he got it right.” Peter would monitor what he was doing, whether that operator was “having a good or a bad day”. Then he would include that observation in the comments section of the logged record of signals for that shift.[118] When he became a SIG DEV Supervisor (1975-76), Jim Humes spoke to his designated CSE contact weekly (by radio).

When Chris Ingersoll was first posted to Alert, he was a non-Morse operator, in charge of monitoring the teletype recording machinery, making sure it was set to the right frequencies. Every few hours he would change the tapes, put them into big boxes, and they would go down to Leitrim on the next weekly flight.[119]

There were normally one or two Russian linguists on each shift. They would have been trained at the Canadian Forces foreign language school in Ottawa. Rob Martin, who served as a Russian linguist during his second to last tour at Alert, says that the Ottawa course was “full immersion, start to finish. The Russian teachers were awesome, fantastic.” As a linguist at the station “I was responsible for reading the traffic from my shift and entering that into punch tape” that would be sent down to CSE and on to others for traffic analysis. However, Alert operators did not do a lot of voice targets. It was more challenging because, as Humes recalls, “listening to Russian voice [communications] was hard, [since the] sound quality was patchy.”[120]

Each shift had three supervisors: an Operations Supervisor, whose job was to ensure that all assigned positions and duties were covered; a Shift Supervisor, "who mainly oversaw the morse collection of data as well as actively decoding segments of intercepted traffic", and a P&R Supervisor, "who oversaw the transcribing and forwarding of pertinent data."[121] The latter two reported to the Operations Supervisor, who in turn reported to the Ops O. This structure must have worked effectively, as it appears to have remained unchanged from the 1960s to the 1990s.

At the technical level, the intercept task was a constant 'cat and mouse game'. From the outset, the Russians were trying to protect their communications, and the Canadians were trying to break through the Russian COMSEC. The challenge for the Russians was to find a balance between simplicity and security of their communications. A 1960 CBNRC paper outlined the efforts they were making. Two changes stood out: first, a sharp reduction in the volume of "high echelon" communications of their LRA, and to a lesser extent of their ground and air defence forces. Second, Alert's listeners encountered "the virtual disappearance of pre-flight information relating to combat aircraft of all services."[122] The result, for CBNRC, was a reduction in the amount of information derived from SIGINT. If this were to continue, the main effects would be loss of order of battle data, and – more importantly – a reduction in the SIGINT capability to give I &W of potentially significant Soviet air movements. The loss of pre-flight information for LRA, such as departure times, routes, and destinations of bombers was serious. Naval bomber and reconnaissance aircraft pre-flight data was likewise reduced, but naval communications appeared to be unaffected, with no loss of intelligence. Fortunately, Northern area ground forces communications also "remained normal."[123] The implications for Alert's listeners included focusing more attention on air defence and air navigational communications, greater reliance on traffic analysis, and given time, cracking of the new Russian ciphers.[124]

One of the challenges that confronted all Western SIGINT in the 1950s and later was the Soviet military's adoption of "Short Signal" (burst transmission) messaging. In May 1960, the Canadian JIC's Electronic Intelligence Working Group circulated a two-part paper on the "Short Signal Problem". Part 1, which explained the features of a 'short signal' arbitrarily defined it as one that lasts "less than one-half second duration which passes a complete message, and occurs infrequently."[125] The paper emphasized that, "The prime advantage to a user of such a system is greater security, since such a system is difficult to intercept, because of the low probability of having a receiver tuned to the right frequency at precisely the right time."[126] This meant that a higher proportion of messages would not be intercepted. Furthermore, since the transmitter could not be located easily due to fewer intercepts and lack of position data, jamming or attacking it physically would be difficult.[127]

In Part 2, the paper explained that the challenges for SIGINT interception were that the operators would not know in advance the intended time of transmissions, the frequencies being used, and the location(s) of the senders and receivers.[128] In a 'normal' intercept situation, operators would be able to scan the transmission spectrum to search for new signals, examine them, and develop a response: locate them by DF, and record them. Not so with short signals. Tuning across the spectrum will not work; the interceptor must be on the right frequency at exactly the moment the signal is sent. Even if they are fortunate enough to achieve that, it may be difficult to distinguish the burst from forms of electrical interference, such as static or "the click of a light switch." Finally, a short signal leaves the interceptor no time to alert others to detect the signal.[129] This presents signals interceptors with a problem of enormous magnitude: to ensure capture of all relevant signals, they must monitor each possible communication channel on a full time basis, and be able to record all of the signals they pick up, so they can be reviewed later.

Thus, the intercept system will require at least two DF systems geographically separate but tuned to the same frequencies, some form of electronic memory, and 24/7 staffing.[130]

Given the technology of the time, it was expected that a submarine using this system would have to surface to send a signal. Since then, they have been able to use tethered antenna buoys sent close to the surface that can send burst signals while the vessel remains submerged, albeit at relatively shallow depths, still leaving them susceptible to detection by ASW systems.[131]

The Branch considered acquiring special equipment to capture short signals; in 1972 the USN offered it the FLR-15 to replace the FLR-19 passive countermeasures system used at Alert. But it did not serve the signal acquisition task, so CBNRC declined. It retired the FLR-19 the following year, after only five years in service. In any case, shortly thereafter the Russians changed their system, so the short signal problem ceased to be an issue at that time.[132] Later, computers became more powerful and sophisticated, allowing larger amounts of data to be 'compressed', and making encrypted burst transmission even more secure.

But that was one challenge among many. Jerry Proc's website quotes from the 1966 *Supplementary Radio Activities Consolidation Plan* (30 May 1966) as follows:

> "It is estimated that by 1970 Soviet high echelon circuits will be virtually immune from interception except where back-up circuits are called into use. [**2 1/2 lines redacted**]. Intelligence on Soviet order of battle and on certain aspects of operations, already gleaned chiefly from low-power, low echelon links, is not expected to be so seriously degraded. The very nature of the intelligence required demands that traffic from the lower echelons be located and intercepted, for it is this traffic, when analyzed in depth, which provides the valuable and unique intelligence."[133]

On Proc's site for CFS Leitrim, George Fraser said that: "These [Soviet Russian] communications were in plain language as were most of the Soviet communications in the very extreme north even some military detachments. That is why we were so successful in capturing the movements of their fighters when they scrambled in response to U.S. overflights. The USSR radar units also communicated in plain language."[134]

Collection Systems

Like Western military forces during the Cold War era, the Soviet armed forces relied heavily on HF (short-wave) radio communications. Bounced off the ionosphere, HF signals could travel thousands of miles. To intercept them, the 291ers listening in the intercept bays at Alert depended upon an array of receivers, antennae, and other complex technical systems, and upon the personnel who operated and maintained them. The latter were the Radio Techs, who worked alongside, but separate from, the 'listeners'. [135]

For obvious security reasons the scant available sources do not say much about the station's SIGINT collection systems. But Bill Robinson's SIGINT research website *Lux Ex Umbra*, and fragmentary references from the CFS Alert's *Annual Historical Reports* provide a few insights into the systems in use from the 1970s to the 1990s. Likewise, Jerry Proc, whose detailed blog on CFS Alert is reproduced on Robinson's website, provides some explanations of the technical systems deployed at the site. Interviews added a few details. Together, these provide a more complete picture of the collection systems and processes used at CFS Alert. Proc identifies several of the receiver units used at Alert, although he does not specify when all of them were used. These included: a Collins R388/URR, and an RCA AR-88, both used in 1958, when the station commenced SIGINT operations. They covered the frequency bands from roughly 500 KHz to over 30 MHz. The station also used a Hammarlund SP600J (the standard HF

receiver at all stations in the 1950s) and a Racal RA-117B, which succeeded it in the 1960s. The station had a Kay Sona-Graph, described as "an invaluable tool for signal analysis."[136] Given their roles in the collection process, the LRTS/SIG DEV operators likely would have used this unit. The station also used an AN/GSQ-53 Time and Frequency standard – essentially a highly accurate atomic clock – which was designed "to provide stable frequencies and real time analysis for signal analysis and data automation requirements."[137] In the early 1960s the station used a Hallicrafters BC 610 transmitter to send message traffic to Ottawa (it was also used by the station's ham radio club.) Alert also had a reel-to-reel tape recorder, two models of teletype machines, and unidentified sensitive equipment. Ray White was an LRTS supervisor in 1967 during one of his tours of duty. "During my tour at Alert we operated some quite revolutionary equipment – for that period – and most of it was sensitive to the point that we don't mention it even today."[138]

None of that equipment would have been useful without the capacity to intercept signals, and to send that data to Ottawa. This turns our attention to Alert's antennae. Again, the public record is incomplete, especially when researching the station's intercept capabilities prior to 1974. However, during the Branch budget discussions for FY 1957/58 the chair of the CSTG (Communications Security Technical Group) pointed out that the LF loop antennae being acquired for the Churchill, Aklavik and Whitehorse stations would also be needed for Alert.[139]

A 1962 IPC paper discussed the role of the Central Technical Section (based at and administered by then Army Wireless Station Leitrim) working with NRC in the successful design, development, and testing of a new intercept antenna specifically designed to meet the requirements of Arctic SIGINT operations.[140] Given the time-frame, this likely refers to a Log Periodic antenna that was tested at Leitrim, and was meant to be installed at Alert in 1961.[141]

The following year, the CRC submitted for the 1964-65 federal budget estimates a paper on SIGINT equipment needs. It argued that the requested systems were,

> "considered essential to offset deterioration of equipment which has been in continuous service for 10-15 years and which does not meet the very high standards required for the reception of non-cooperative transmitters at considerable ranges."[142]

The paper went on to say that in addition to equipment needed to do intercepts, the remaining estimates reflected "the complexity of equipment required to deal with new Russian signals after the immediate intercept operation…." This included new teletype machines to match the Russian ones, voice recording systems (reflecting voice transmissions as an increasingly important intelligence source), and the AN/GSQ53 Time Signal Sets needed to meet the accuracy standards required by the NSA and GCHQ.[143] Thus two complementary pressures were at play: technological change, and the need to meet the standards set by Canada's SIGINT allies.

To meet these challenges, Alert received new equipment in 1965. This included KIOSK (an interim wide band collection system), and receivers to monitor Russian navigational aids (along with an LRTS position to fulfill that task). The station also carried out field evaluation trials on QUINTAL, an experimental system designed to quickly disaggregate multiple messages on tape recordings and to produce a computer tape that provided a list of all recorded traffic.[144]

In June 1966 the IPC was notified by a CRC paper that action was underway.to equip Alert with wideband receiving equipment. This would allow a single intercept team (three persons, each working eight-hour shifts) to do simultaneous recording of a large number of transmissions on magnetic tape. A larger contingent of SIGINT operators based in Ottawa would later retrieve the individual signals for analysis.[145] This was made possible by closing the Whitehorse and Churchill stations, and reallocating some of their personnel to Ottawa and Alert.

Those changes also were part of the larger reorganization of SIGINT assets occasioned by the creation of the CFSRS under the unification of the Canadian Forces.

A 1971 station equipment program forecast (for the 1972-73 budget) identified several systems that were long overdue for replacement (at all of the intercept stations, not just Alert), including: 30 ten-year-old RC7A recorders; 232 Racal receivers, some as much as fourteen-years-old, that have "passed the point of economical repair"; and ten-year-old technical search oscilloscopes and cameras. This document went to the IPC for approval.[146] It not only tells us what some of the equipment was, but also that up to that point the Branch – and DND, which was responsible for the hardware – had not conducted a regular equipment renewal process. Rather, they had allowed some systems to atrophy, requiring costly simultaneous re-investment.

That equipment forecast had also pointed out that CFS Alert's GRD-6 High Frequency Direction Finding (HF/DF) array was old and "insensitive in the lower band". So, along with several rhombic antennas, it was to be removed and replaced by a new PUSHER antenna.[147] The station's *Annual Historical Report* for 1973 stated that site preparation for a PUSHER antenna was completed that year.[148] This system, designated AN/FRD-13, was a smaller, British-built (by Plessey) version of the AN/FRD-10 Circularly Disposed Dipole Array (CDDA) – often referred to as the 'Elephant Cage' due to its size – which was used for HF/DF and signals intercept. A PUSHER consists of two concentric antenna rings with an outer diameter of about 400 feet (roughly half the size of an AN/FRD-10). For the AN/FRD-13 the high-band receiving antennae comprises the inner ring and the low-band the outer (both with 24 dipoles). They are linked to a goniometer that rotates the array several times per second, so it could rapidly triangulate signals in the 2-32 MHz range. This made it ideal for locating and intercepting burst transmissions from Soviet submarines. The AN/FRD-10 had a receiving range of about 3,200 miles. The AN/FRD-

13's apparently had a similar range.[149] The *AHR*s for 1974 and 1975 were not available, but Bill Robinson says the array became operational in 1974, and it was situated north of the station.[150] The PUSHER antenna was the main HF/DF system from 1974 on. In addition to CFS Alert's primary SIGINT role, HF/DF also had a secondary role common to all Canadian intercept sites: to assist Search and Rescue operations.

In October 1977, CSE Chief Kevin O'Neill had submitted to the Interdepartmental Committee on Security and Intelligence (ICSI) a proposal to improve "the Efficiency and Productivity of the Signals Collection System", which, he asserted, was "badly in need of modernizing." [151] Up to this time, it had not been technically practical or affordable to replace the paper-based, person-intensive data handling procedures that had been in place for nearly twenty years. This precluded centralization that could improve efficiency. But now, he argued,

> "with established methods for long distance, interactive, computer aided data transfer, together with the availability at reasonable cost of long haul data links within inhabited Canada and the demonstrated practicality of a data link from our most important and remote intercept station at Alert, it is feasible to make changes which will very significantly increase the efficiency, productivity and timeliness of Canadian SIGINT collection."[152]

He proposed to transform the current process of "intelligence reporting, traffic handling and forwarding" by intercept stations into an "electronic data-handling system", with processing and reporting sections centralized in Ottawa. He envisioned that "all intercepted signals and traffic" would be combined into "data streams which can be passed to the central processing and reporting (P & R) unit." This also would allow the unit to serve as a "central mission control", which for the first time would give CSE the capability to switch tasks between the intercept

stations “on a timely basis.”[153] This proposal became Project PORCUPINE, of which more will be said shortly.

O’Neill also pointed out that the existing LF/HF communication link between Alert and Ottawa was “far too vulnerable to the vagaries of ionospheric propagation”, and was dependent on a USAF relay facility at Thule, Greenland, future access to which could not be guaranteed. So, CFSRS had formulated a proposal for an all-Canadian radio relay system (Project HURRICANE) from Alert to a location (probably Eureka), where the data signal could be up-linked to the Canadian ANIK satellite for down-link to Ottawa. The cost was estimated at $ 3 million.[154] O’Neill’s overall proposal was discussed by the ICSI at the end of January 1978. It yielded in 1982 the High Arctic Data Communications System (HADCS) discussed later.

In the meantime, modernization of Alert had continued with the installation in 1979 of a *Logarithmic Spiral Antenna* and a *Large Loop North/South Antenna* (discussed later).[155] Spiral antennae, consisting of two or more wire coils wrapped around each other, were developed in the 1950s. They are frequency-independent, able to receive signals from across a very wide bandwidth (from 1 to 30 GHz) without loss of efficiency. Their military applications include DF and frequency spectrum monitoring. One advantage of the spiral design is that the antenna can be relatively small.[156]

A *Beverage Antenna* was installed in 1980. It consisted of a long-wire receiving antenna, mainly used in the low and medium frequency bands for short-wave monitoring and military applications. The wire can be from tens of metres to several kilometres in length; the one at CFS Masset, British Columbia is one kilometre long. A *Beverage* is suspended above ground, in a unidirectional radiation pattern, with main lobe angled slightly toward the sky. It must be built with the wire pointing toward the transmitter[s] whose signals are to be intercepted. It is ideal for

receiving skip signals from transmitters over the horizon. It offers excellent directivity, wide bandwidth, and a strong ability to receive distant and overseas signals. Radio frequency currents traveling along the wire gain their maximum strength at the end where the receiver is connected. However, the size of the antennae requires a lot of space. Furthermore, a *Beverage* cannot rotate to change receiving direction, so some sites (CFS Leitrim, for example) used multiple units angled to provide wider azimuth coverage.[157] The *AHR* does not specify whether the one installed at Alert consisted of a single wire or multiples. If it was single, we may infer that it was oriented to intercept signals from a specific fixed Russian transmitter, probably identified and located by intelligence sources and methods provided by Five Eyes partners. Later, some antennae were mounted on the roof of the new Operations building (opened April 1981).[158]

In 1994, an *Andrew 6001-3-1k* circularly polarized parabolic antenna was installed at Alert for CSE. It is not clear whether it was used to send and/or receive radio signals; parabolic antennae can do both. Finally, as Alert was converting to a remote operating facility in 1997 the PUSHER was upgraded by the addition of a *Longroot* enhanced automatic DF processor.[159] Even if the foregoing record is incomplete, it indicates that from the 1970s to the 1990s Alert's intercept capabilities were upgraded frequently to keep pace with changing antenna technologies. By the 1980s, the Soviet Union had deployed multiple networks of communications satellites for military and civilian use. Since these relayed communications and data between space and earth, those signals would have been susceptible to intercept by large parabolic antennae.[160]

Turning our attention to transmitters used to send intercept product and other data and messages to Ottawa, those antennae were situated on a site about four miles south of the station. In 1972, the existing *rhombic* antenna had been damaged during the winter and was repaired.[161] A diamond-shaped antenna, suspended on four posts with its wires parallel to the ground, it was

used for long-distance, point-to-point HF communications. Highly directional, it operated in the 5-35 MHz frequency ranges.[162] That year saw the installation of the AN/FRT 39 HF/Single Side Band transmitter, seen as the first step in modernizing the transmitter facilities. The station also submitted a request for an LF communications system and a new transmitter building.[163]

The *Large Loop* or self-resonant antennae (installed in 1979) for short-wave frequencies vary in size inversely: the higher the frequency, the smaller the antenna, thus ranging from a diameter of 11 feet at 30 MHZ to 175 feet at 1.8 MHz. The loop itself can be any closed geometric shape (circle, square, triangle, etc.). A large loop antenna for lower frequencies is mounted horizontal to the ground with the antenna wire supported by masts along the perimeter. This produces a radiation pattern that is useful for producing a "Near vertical incidence skywave [skip] radio-wave propagation path that provides usable signals" over medium distances (up to 650 km). The large loop antenna is/was normally used for military communications.[164]

Alert's collection efforts would have been for nought if it had no means of managing the flow of data. As discussed earlier, Project PORCUPINE had been approved in 1978 to do just that. By 1981, however, PORCUPINE was in flux and under review. Costs had escalated from $3 million to $20 million, and the centralization of processing and reporting (P & R) it was intended to achieve now looked less appropriate for the post-1985 period. New computer technologies made a de-centralized approach feasible. While the review recommended that CSE continue to exercise centralized control of collection management, P & R would be done at the stations, where the operators could use distributed small computers to do raw and processed data entry and reporting in digital format. This would be more cost efficient and would save CSE several staffing positions. One of the five stations was already slated for closure. And, in a hint of the

ultimate fate awaiting the remaining ones, the review stated that it was now technically feasible to remotely control the receiver equipment at the intercept sites from a central location.[165]

A 1982 PCO paper on Canada's foreign intelligence program made the case for developing new SIGINT sources (without explaining what, where, and how), but also for investing more than $90 million in capital funding over seven years to upgrade and modernize existing facilities and capabilities. This was to include: "modernization of existing collection systems and equipment, and the application of advanced computer and telecommunications technologies to SIGINT processes."[166] CFS Alert benefited from this largesse. 1985 saw personnel from CFS Leitrim visit Alert to prepare it for the installation of a *Keelan/Annulet* system.[167] According to academic SIGINT researchers Desmond Ball and Richard Tanter, the *Keelan/Annulet* was an automated SIGINT data processing system, and was considered "hot stuff" by American military users at that time.[168] Bill Robinson discussed *Keelan/Annulet* in more detail as follows:

> "KEELAN (AN/GSQ-211) was "a printer collection group which receives and demodulates HF signals into FSK/DFSK baseband audio signals. The FSK/DFSK signals are stored on magnetic tape, processed by MD-1130 demodulator, digitized, and recorded on 9-track tape. The AN/GSQ-211 is operated from the operator console which communicates with two Digital Equipment Corporation (DEC) PDP-11/44 computers. The PDP-11/44s perform the command and control functions for the system. ANNULET (AN/GYQ-102(V)1) was 'a field scan system. A TTY terminal is provided for initialization of the system and for execution of diagnostic routines. Two high-speed printers present signal-related information to operators and supervisors.' [Both sets of quotations from '[U.S.] Army Modernization Information Memorandum', 1985]. It's not

> clear to me exactly what a lot of the foregoing means, but KEELAN has been described as a printer collection system (presumably mostly for Soviet radio printer traffic) and ANNULET as a processing system; the two seem often to have been deployed together. It was introduced at US Army, Air Force, and Navy sites beginning in the early to mid-1980s. KEELAN was reportedly deployed at Leitrim in 1985 and Alert in 1986."[169]

But, since technology was advancing rapidly, *Keelan/Annulet* was overtaken by newer systems. It ceased operating at Alert in October 1994, and it was removed the next year as part of the conversion of Alert to a remotely operated site.

During that process Alert acquired several 'state of the art' computerized systems: a "Morse/Non-Morse integrated collection system [called] *Mediator*"; a Unix-based "signals collection, analysis, reporting and mission support" system named *Tidytips*; and *Lookout*, a Hewlett Packard signals acquisition and analysis suite, all of which entered service at Alert between 1994 and 1997.[170] These allowed the station to dramatically downsize its staff, as the new systems took over the tasks that had been done by the 291ers.

Some uncertainty surrounds the installation of the new system called CENTREVELIC (alt. Centervellic) between 1992 and 1994. It also seems to have been associated with converting Alert to remote operation. In November 1992 a team from CFS Leitrim reconfigured the main operations floor in the Operations building to prepare for installing CENTREVELIC the next spring. Construction began in February 1993. In May, CFS Leitrim sent an eight-person team to do further preparation, including upgrades to the station clock, the signals distribution unit, and the PUSHER systems. They were followed by three more people from Leitrim and a five-person team from the NSA, who together installed the CENTREVELIC hardware and software. This was clearly a complex project, as work continued through the summer and late autumn, with

personnel from CSE, Leitrim, and the NSA working on installation. It seems that the project was not completed until December 1994, when CENTREVILIC's TOSS software version 7.1 was downloaded with assistance from a firm called ERA.[171] Bill Robinson offered the following commentary on CENTREVILIC:

> "A review of the 291 trade conducted in 1997 listed CENTREVELIC Operations as one of the roles of trade members but didn't explain the meaning of the term. Associated appendices showed all the positions occupied by 291ers at the time. These included 19 positions listed as CV OPs -- presumably CENTREVELIC operators -- and an additional 3 probably related 'C/V' positions, all shown to be at Leitrim. The information in the appendices is a little hard to interpret because it reflects the situation during but before the completion of the remoting project. Significant numbers of 291ers are still shown at Gander and Masset, for example. No listing is shown for Alert, but 34 of the positions at Leitrim are listed as "Alert offsets", which may mean that those positions were still at Alert at the time. If this is the case, possibly they were listed under Leitrim because they were officially on the station's strength and only attached-posted to Alert. For what it's worth, none of the CV positions are designated as Alert offsets. That said, a fellow named Henri St. Louis helpfully posted a resumé in 1996 that said he served as a 'Radio Technician, CENTERVELLIC [sic] /PUSHER TECHNICIAN' at Alert and Leitrim in 1995-96. He described his role as 'Part of the Operations team that installs, maintains and modifies HF Short Duration Collection & Direction Finding Resolution DF System, Experimental Ionospheric Testing System. Specific experience with Unix based computers and TCP/IP networks.' This suggests that CENTREVELIC was related to the Pusher system and that it pertained to the Pusher at Alert as well as the one at Leitrim.

> Still, there seems to be some difference between the two, as the 291 trade review listed 'Netted HFDF Operations' as its own role, distinct from 'CENTREVELIC Operations'. At various times in the past I've thought that CENTREVELIC and the Pusher were one and the same, but as you can see from the foregoing I'm currently doubtful about that."[172]

Chris Collin, a former 291er, offers some insight about equipment used by the 291 trade:

> "As of result of prevailing security, most kit was destroyed after it became obsolete. As the trade moved from operator/maintainers, to just operators, our connection with the equipment became somewhat distant in certain respects. We had techs to take care of equipment problems but they rotated in and out of the Supplementary Radio System. At times they did not always have the intimacy with the equipment that one might expect. As a Sig Dev'er, we were certainly close to our equipment, but once, and on a very dull mid-watch, I counted 150 different pieces of gear in the racks which I used while executing my duties. That was a lot to keep track of, especially when equipment was superseded by something of the same functionality but bearing a new model number."[173]

Reporting

The intelligence value of the 'take' from Alert's intensive collection effort depended upon its timely delivery to the analysts at CBNRC/CSE, DND, other departments, and on to Canada's Five Eyes partners. Not surprisingly, given Alert's location and climate, timely reporting proved to be a challenge. Up to 1982, the products of intercepted traffic were encrypted and sent directly to CFS Leitrim by High Frequency (HF) teletype messaging and by Low Frequency (LF) teletype via the US base at Thule, Greenland. Citing studies from the 1960s, Robinson describes the transmitter systems as follows: "10 kW at southern [Leitrim] end, using 'compromise

rhombic antenna', radio teletype with double frequency shift; 5 kW at northern terminal [Alert], using frequency diversity, with the same antenna system. Receivers: both are equipped with rhombic antennas and conventional high quality receivers."[174] Relying on three wire rhombic antennae, it had a "mean efficiency" of 67 percent. The station also was able to use a LF Tropo-scatter microwave link, first established in 1956, from Alert to Ottawa. According to one source, it had "a fairly consistent efficiency of 97 percent."[175] There were terminals at Alert and Thule. Later, some of the links suffered degraded performance and were shut down. The system was replaced by the HADCS and satellite link (from Eureka) between 1982 and 1985.

However, this early system could not handle the full volume of data from Alert, and it was vulnerable to periodic blackouts due to sunspot activity during the summer months. So, tapes of recorded intercepts were sent south by air once a week. But, according to Gray's book, in March 1961 the RCAF proposed changing the flight schedule from weekly to twice a month, so from November 1961 they occurred every two weeks. He goes on to say that in September 1962 the RCAF cancelled the flights from Trenton air base to Alert that had started after 426 Squadron was disbanded and its North Star aircraft retired earlier that year as part of the austerity program.[176] Gray says that the Vice-chief of the Air Staff agreed that the weekly flights were "of great benefit for *operational needs* and for morale", but that the aircraft were under-utilized.[177] But a bi-weekly schedule would have delayed delivery of Alert's tapes, and rendered their content even less timely and relevant.

But, the document record indicates that the weekly flights were still ongoing at that time, albeit at risk of being suspended. Dr. Keyston summarized the dilemma neatly in November: it was a matter of priorities versus costs. Canada had accepted the task of watching Soviet military activity in the Arctic on behalf of NATO. But, he asked, in a time of financial constraint, was it

reasonable to expect the Navy to forego a ship or the air force a jet fighter, "in the interest of doing our national best in regard to the provision of manpower and equipment for Alert?"[178]

At a meeting of the IPC 6 November 1962 the RCAF agreed to approach the USAF about providing a supplementary service to Alert via Thule, Greenland.[179] In the meantime, on 14 November it temporarily tasked 408 Squadron, which flew aging Lancaster bombers for Arctic mapping and reconnaissance, to land at Alert to pick up a classified tape for delivery to Army headquarters upon landing at the Rockcliffe air base.[180] In January 1963, the Chief of the Air Staff suggested that rather than asking the USAF, the RCAF could provide the airlift needed by continuing to double-task 408 Squadron's Arctic reconnaissance flights, providing they could meet the Army Signal Corps' security arrangements for handling sensitive materials. He thought this would resolve the issue.[181] The record is incomplete after that, but it appears that the matter remained unresolved in the fall of 1963. In light of an impending visit by Lt. Gen. Gordon A. Blake, Director of the NSA, to meet with the IPC on 1 October the "situation at Alert" was a matter of concern.[182] The IPC meeting went ahead, but the available records do not say whether or how the issue was discussed and resolved.

Because Alert was too far north to connect to communications satellites in geostationary position over the equator, in 1982 DND installed the HADCS approved in 1978. It consisted of a chain of six line-of-sight solar-powered microwave repeaters (sited on mountaintops) that stretched more than 500km from Alert to CFS Eureka on the west coast of Ellesmere Island. There, messages were uplinked to the ANIK satellite and then downlinked to Ottawa. HADCS was still in operation at time of writing.[183] Due to the extreme climate, it required annual maintenance by military engineers and civilian contractors under the auspices of Operation HURRICANE.[184] However, the advent of reliable direct electronic communications between

Alert and Ottawa improved the utility and timeliness of the station's intercepts, which could be incorporated into intelligence reports and analysis for their clients – both Canadian and allied.

Part 7: Collection Results

In October 1958, shortly after the Alert station became operational, the Soviet Union carried out seven nuclear tests (four in the megaton range) on Novaya Zemlaya. They were part of a thirteen-test series, and they coincided with Northern Fleet exercises in the Barents Sea.[185] As explained earlier, both events would have been priority collection targets for CFS Alert.

A Canadian *Joint Intelligence Summary* from December 1959 brought attention to the sighting of a new class of suspected ballistic missile submarines, NATO-designated G (later Golf) class, being built at Severodvinsk, with at least one seen in the Northern Fleet.[186] Similar reports earlier in the year identified new Kildin class destroyers and radar picket ships seen in the Northern Fleet.[187] These visual reports may have cued the listeners at Alert to potential new intercept targets – if they had not already been located and identified.

Alert's capacity to monitor Soviet radio communications may have had its first real test during the 1962 Cuban Missile Crisis. According to historians Aleksandr Fursenko and Timothy Naftali, some of the ships carrying Soviet missiles, troops and equipment to Cuba during the summer departed from Severomorsk. However, they observed radio silence, so there were no signals to intercept. Then, on 23 October, in response to President Kennedy's televised speech announcing the naval quarantine of Cuba, the Soviet Presidium approved raising the alert level of Russian and Warsaw Pact forces. Leave was cancelled, and conscripts due for release from the strategic rocket forces, air defence, and the submarine fleet were ordered to remain on duty.[188]

Without access to the intercept reports from the station, it is impossible to assess with any certainty Alert's contribution to the I & W intelligence picture during that crisis. Given its location and assigned priorities, as it probed Russian communications in September and October it may have detected some of the indicators noted above. According to Dino Brugioni's insider's account from the vantage point of the CIA's NPIC, on 27 September four Russian Foxtrot-class diesel-electric attack submarines left the Northern Fleet base, crossed the Barents Sea, and sailed toward the Atlantic Ocean. Brugioni says, "It was an unusual move for these submarines, whose activities and patrols were in the past confined to waters in close proximity to their bases."[189] If they communicated by radio with their base on departure it is likely that the listeners at Alert would have intercepted their messages. Later, those subs were accompanied by an auxiliary oiler that was known to conduct submarine refueling, and by a refrigerator ship and an intelligence trawler.[190] Since Soviet SOPs would have required those surface ships – if not the subs – to report their locations by radio regularly, the USN and RCN probably had a good sense of where the subs were located throughout the crisis. Three of the four were later forced to the surface. George Fraser, quoted in *Lux Ex Umbra*, claims (without supporting evidence) that,

> "The most significant contribution made by our SUPRAD/SRS intelligence gathering system was during the Cold War and specifically during the Cuban Missile Crisis. When President Kennedy was able to confront Chairman Khrushchev and point out to him that 'we' are aware and have pinpointed the diesel-driven subs that were on their way to the Cuban area and that 'we' had targeted all of the Soviet Nuclear subs sitting on the bottom off the North American Coast from Newfoundland to Florida all of which would be destroyed if he (Khrushchev) didn't pull back his ships from breaking the U.S. Blockade.

> It was reported at the time that Khrushchev was visibly shaken by this news and immediately altered his stance with respect to delivering missiles to Cuba.[191]

However, the broader historical record does not support Fraser's bold assertions. Raymond Garthoff, a former CIA analyst who served on the staff of a member of Kennedy's Executive Committee during the crisis, adds some additional details from Russian archives and former Soviet officers, in an article published in 1998. He notes that Soviet forces were placed on increased alert status as early as 12 September, but there was no mobilization of reserves. Even at the height of the crisis, Russia's strategic rocket forces were on highest alert for only about six hours. He concludes that US intelligence "did not recognize the extent of Soviet military alert, in particular of Soviet strategic forces", because Russian alerts did not include some of the same procedures used by US strategic forces.[192]

Writing in 2000, and drawing upon a very slim tranche of NSA papers relating to the crisis, Professor David Alvarez (former scholar-in-residence at the NSA's Center for Cryptologic History) concluded that, "There is no evidence in the newly released documents that American signals intelligence was reading any Cuban or Soviet encrypted diplomatic, 'leadership', or military traffic. Of course, this is precisely the information the NSA, in its concern to protect sources and methods, routinely declines to reveal."[193]

In contrast to Fraser's claims, U.S. knowledge of the location of Soviet submarines does not appear to have figured noticeably in the exchanges between Kennedy and Khrushchev during the height of the crisis; their focus was on the missiles. Moreover, even if Alert had tracked the subs and other ships as they departed Russia's Arctic waters, the U.S. and its allies (including Canada) had other means of monitoring Soviet communications. The SOSUS network, aircraft,

and naval vessels probably provided most of the data on the location of Soviet submarines once they reached the Atlantic. They were not dependent solely on Alert's reporting.

In 1963, Alert's operators probably provided SIGINT data on the elements of the Soviet Northern Fleet deployed on an exercise that was monitored for intelligence purposes by the US Navy and the RCN. Three RCAF Argus maritime patrol aircraft also flew intelligence collection missions in support of the allied naval vessels.[194]

During 1965, collection on Russian air and air defence emphasized "extracting as much intelligence as possible from increased volumes of low echelon morse traffic, radio-relay voice, and Air Defence data transmissions."[195] Russian COMSEC measures made collection on naval communications traffic more difficult, although Canadian SIGINT was able to derive some intelligence on their submarine activity. This would not necessarily have been acquired by CFS Alert exclusively. However, that station was able to collect more information on Soviet ground forces in the Leningrad Military District "than ever before."[196] Although CBNRC devoted more technical resources to

> "converting the increasingly complex Soviet transmissions into a usable form for analysts … cryptanalysis became decreasingly effective against improved Soviet ciphers. Increasing effort and money had to be devoted to signals analysis and machine support in order' to cope with the variety and volume of the traffic to be processed."[197]

The 1965 SIGINT review advised that Soviet Arctic communications were becoming more efficient and secure. But their low and medium echelon circuits – the source of most of Alert's intercepts – continued to rely on manual MC transmission. Reporting on LRA paid particular attention to the potential value of weather traffic, communications abnormalities, and transport activity as indicators of impending LRA activity in the Arctic. Although changes in Russian air

defence tracking procedures reduced the intelligence on Russian air movements, “intensive collection efforts” showed that at least some of the information needed could be acquired by increasing exploitation of lateral [communications] nets and lower echelon communications.[198]

Overall, the CBNRC received some three million messages during 1965, averaging one million groups per day. This used the full capacity of its IBM 1401 computer, so the Branch was planning to acquire an IBM 360 to increase its data processing capacity.[199] It is likely that Alert supplied the majority of those messages.

Alert’s operators continued to perform the same intercept operations against the same targets in 1967 as in previous years: order of battle and operational data on ground forces in the Leningrad MD, medium and heavy LRA bomber operations, air defence organization and activity, surface-to-air missile order of battle and radar equipment capability, and activity of Soviet Navy surface ships and submarines in the Arctic. This included the navy’s annual transit of the Northern Sea Route [Barents Sea to Bering Sea or return], submarine under-ice operations, and the movements of intelligence collection trawlers. Alert also tracked the cargoes and movements of Russian merchant ships [which often provided logistic support to the navy]. A more recent target was the space and missile launch complex at Plesetsk, near Archangel; Alert was able to intercept some of its communications. Distinct from the routine COMINT role, Alert received ELINT equipment that allowed it to monitor selected navigational aids.[200]

However, the 1967 review offers a contradictory assessment of station productivity. Along with Inuvik, Alert suffered from a decline in the number of intercept operators. From the official establishment of 100 positions in CBNRC, the numbers decreased to 97 in 1965 to 92 in 1966 and 83 in 1967, plunging briefly to 75 in August of that year. On the one hand the review says that this had “a detrimental effect on collection” at both stations. Some assignments were

curtailed and others temporarily cancelled. Inevitably, there was a decline in intercepted traffic. Canadian intercepts of LRA communications circuits declined by about 40%. There was concern that this shortfall in staffing and production was jeopardizing Canada's commitments under the Five Eyes agreements. On the other hand, the review says that Alert (and the Ladner, BC station) managed to increase productivity, partially offsetting declines at Inuvik, Whitehorse, and Churchill. The review goes on to say that while the then six intercept stations issued 8,245 reports – an increase of 815 over 1966, the volume of reports issued by the Branch as a whole decreased from 853 and 1966 to 79 in 1967. In all, the stations intercepted some three million messages, two-thirds of which were manual MC.[201] This suggests that the reduction in intercept positions at Alert and other stations was not the source of the Branch's productivity problem.

In 1968 the number of Canadian SIGINT reports generated by the CBNRC declined by 21%, and the total number of intercepted messages decreased by 11%.[202] This can be attributed in part to reduced staffing of intercept positions with the closure of the Whitehorse and Churchill stations, which caused a 16% drop in the number of Canadian intercepts of Russian air defence morse code links. The phasing out of Whitehorse "drastically reduced" the number of Canadian intercepts on LRA radio circuits as well. The other contributing factor was improved Russian COMSEC. That reduced the volume of reporting on Arctic economic activities & developments. The annual review for that year also predicted that improvements in Russian COMSEC would increase Canadian SIGINT challenges. Radio-telephone communication had been an important source, but it was being superseded by [redacted: satellite?]. In the meantime, manual morse and data transmissions would continue to be the prime sources of information on military operations. Increased use of [redacted: encryption?] and introduction of sophisticated communications

equipment have forced [CANUKUS] SIGINT operations to rely heavily on [redacted: satellites?] "US airborne, covert, and other sensitive collection methods."[203]

In spite of these challenges, the Canadian Arctic collection effort continued to yield useful results. The review stated that, "The volume of intelligence reporting on Air Defence order-of-battle, equipment and operations in the Northern Air Defence District continued to grow and its high quality was maintained."[204] Canadian reporting focused on Russian airborne warning and control activity, and on the deployment and training related to the new Tu-128 FIDDLER long-range interceptor that had entered service in the mid-1960s. Canadian SIGINT was able to maintain an unspecified source of multi-channel intercepts on targets on the Kola Peninsula.[205] The review went on to add that,

> "New and significant intelligence was produced on Soviet Naval developments in the Arctic including submarine under-ice operations, involvement in nuclear testing … and various activities on the Northern Fleet Missile Complex. A substantial increase was noted in the level of Naval Air activity, particularly in the Norwegian Sea area."[206]

The volume of reporting on the Leningrad MD ground forces and tactical aviation showed "a marked improvement over the previous year."[207] This included exercises, troops movements, tactical air support, and order of battle changes.

In addition to these routine tasks, Alert appeared to have been "the most active participant" in a program devised to warn the NSA's DEFSMAC [Defense Special Missile and Aerospace Center] of "impending operational activity at the Plesetsk Missile and Space Complex."[208] It issued the initial tip-off report about 90% of the time, and sometimes was the first or only source to report operational activity there. However, changes in Soviet communications in April-May 1968 made it impossible for Alert's SIGINT operators to anticipate

operations at Plesetsk on a sufficiently consistent basis thereafter to justify the station's continued participation in the program.[209]

What is most striking about this review is what it did not say. It did not mention the political crisis in Czechoslovakia and the subsequent Soviet Bloc invasion – the most serious crisis in Europe since the 1961showdown over the Berlin Wall. Most of the Soviet and Warsaw Pact military activity took place in the western and southern regions of the Soviet Bloc, and it was monitored by US and NATO intelligence systems and assets closest to those areas. They were able to provide detailed reporting on military preparations and movements.[210] But given its capacity to detect HF traffic at very long ranges, it is possible that – along with those other sources – Alert would have detected and reported on the following I & W activities: the three Soviet/Pact military exercises mounted in June-August, that proved to be dress rehearsals for the invasion; Soviet air force preparations at the end of July for operations against Czechoslovakia; and the massive blackout of Soviet military communications imposed across central Europe on 18 August. That occurred on the same day that Soviet leaders were recalled *en masse* from their summer homes to Moscow for an unusual Politburo meeting. The timing of the blackout and the Politburo meeting was not a coincidence. Of those three exercises, the rear services one had the highest profile, because it involved calling up Russian reservists in the western Soviet Union, requisitioning civilian transport, and mobilizing Warsaw Pact forces from Latvia and Ukraine.[211] Perhaps forces based in the Leningrad MD were not involved, although that seems unlikely. It is inconceivable that these activities went undetected and unreported by CFS Alert; the blackout of communications alone would have been a dead giveaway. But we have no confirming sources.

The 1969 review did not indicate any major changes in collection efforts or in Russian activities. Intercept positions were maintained at about the same level as the two previous years.

Alert was staffed close to its establishment of intercept positions. The total number of MC and radio-printer messages intercepted (by all stations combined) increased from 2,707,055 in 1968 to 3,273,051 – 74% of these being manual MC messages. The stations issued 6,734 reports, an increase of seven percent over 1968. This reflected sharply increased reporting from Alert (31%) and Inuvik (127%) on Russian bomber aircraft. There was a substantial increase in Russian use of keyboard automatic MC, and a reduction in clear speech and radio-printer. Soviet communications systems and COMSEC continued to improve, posing difficulties for SIGINT intercept operations in the Arctic. The impending completion of a [redacted] was expected to presage a continuing "decline in the number of Soviet Arctic targets susceptible to Canadian collection and processing."[212]

Curiously, after noting the increased station reporting on bombers, the review states that Canadian cover of LRA communications was "virtually abandoned" in light of the effectiveness of U.S. intercept operations and the continuing shortage of intercept teams at Canadian stations. This apparent contradiction was not explained. By contrast, Canadian reporting on Russian air defence subjects continued to improve in both quantity and quality. Canada's collection sites continued to be "the most important source of intercept communications in the Kola Peninsula, which provides detailed information on Soviet Air Defence Systems."[213] The Branch introduced a new intercept programme at Canadian stations to maintain surveillance of Northern Fleet TU-95 bombers operating in the North Atlantic. They also monitored Russian military air transport support to Leningrad MD ground forces exercises, in order to learn about their troop-carrying, para-drop, and logistical capabilities. The collection sites continued to be the primary sources for intercepts of ground and tactical air force communications in the Leningrad MD. Finally, by the end of the year the Branch had completed preparations for converting the high-volume air

defence technical reports produced at Alert and Inuvik to a standard format designed to facilitate the electronic exchange of computer-processed data between CBNRC, the NSA and GCHQ.[214]

According to the 1970 Branch review, with minor exceptions CFS Alert was staffed consistently to its twenty-team commitment throughout the year. Inuvik, by contrast, suffered from a serious shortfall in intercept personnel. The teams at all stations together put in more intercept hours (341,789) compared to 1969 (319,872), but the number of intercepted messages (3,269,635) was marginally fewer than the previous year. There was increased volumes of data systems, enciphered speech, hand- and keyboard-automatic MC. Manual MC accounted for 75% of the total. Intercept of radio-printer continued to decline. Although Alert produced 40% more reports in 1970 (3,398) than in 1969 (2,241), the output of Canadian SIGINT stations overall decreased by 10%, due to a more than 60% decline at Inuvik and 33% at Ladner. Those reductions were due, in turn, to reduced Soviet LRA flights in the eastern Arctic, and termination of those stations' daily reporting on Russian merchant shipping activity in the Arctic. Alert's increase was attributed to a sharp uptick in Northern Fleet air force out-of-area flight activity.[215]

As in previous years, Canadian SIGINT requirements did not change, although there was increasing interest in information that might relate to Canada's economic interests, its territorial integrity, and its internal security. The latter topic is understandable; 1970 was the year of the October Crisis: the FLQ kidnappings and the Canadian government's dramatic response. The report stated that Soviet communications and cryptographic systems were increasing in volume and sophistication. It conceded that this presented "serious difficulties" for the Branch's ability to pursue its role as specialist in "collection, analysis, and reporting of Soviet Arctic SIGINT."[216] This was leading inevitably to a reduction in the number of targets "susceptible to independent Canadian interception and processing." In order to preserve its "hard-won position", the Branch

might have to "allocate more resources than in the past" to developing "new collection and processing techniques." It might also have to consider "the feasibility and desirability of exploiting additional non-Arctic targets."[217]

CBNRC's reporting on Soviet LRA fell 27%, due to reduced bomber flight activity in the North. LRA training missions declined by 25%, the first reduction since 1966. There were no LRA flights to the Atlantic or Pacific periphery of North America. However, the CANUKUS intercept stations maintained their current reporting role, alongside that of the NSA. By contrast, drawing upon the intercepts from Alert and other stations, the Branch produced more reports on the rapid modernization of Soviet air defence forces and C4ISR systems in the Russian North.[218]

The Branch continued to study and issue reports on the Soviet Navy, primarily on out-of-area deployments of the Northern Fleet, Russian naval intelligence collection vessels in the North Atlantic, transfers of ships via the Northern Sea Route, under-ice activities of the submarine fleet, and naval interest in the hydroacoustic research conducted by Russia's drifting ice stations. CBNRC issued a major detailed study of naval activity at Russkaya Gavan on Novaya Zemlaya island, indicating development of an underwater detection system [presumably similar to SOSUS]. CFS Alert's reporting on Northern Fleet Air Force operations increased 135%, "mainly as a result of the increased TU-16 [LRA] flights into these regions."[219]

CFS Alert's and Branch reporting on Soviet naval intelligence collection vessels found its way into a May 1970 Canadian JIC paper on Soviet Bloc intelligence collection against Canada. It noted that since 1956 the Soviet navy had been operating an expanding fleet of 'trawlers' specially equipped for SIGINT collection. Since 1964 at least one such vessel was always patrolling continuously off the east coast of North America. These ships operated from Northern

Fleet bases.[220] As such, they were routine collection targets for CFS Alert, when they deployed toward the North Atlantic and when they returned to their home bases.

The Branch continued to report on the activities of Soviet military and civilian agencies involved in underground testing at the nuclear weapons proving ground on Novaya Zemlaya. However, the CBNRC "virtually terminated" its collection efforts against the Plesetsk missile and space complex, due to personnel shortages, a lack of exploitable COMINT targets, and the inability of the Branch to make a useful contribution to the extensive work already done by the NSA and GCHQ. Its reporting on Leningrad MD Soviet tactical air forces increased greatly as a result of an agreement reached about division of labour on this target between the Branch, the NSA, and GCHQ. It essentially formalized existing informal arrangements between CBNRC and GCHQ. The Branch also issued more reports on the KGB Border Guards North and Northwestern Districts, including the addresses and location of border posts (information that would have been derived from intercepts). In the ELINT field, the Branch specialized in surveillance of low-frequency and Very-Low-Frequency (VLF) signals, and it began a new program to monitor Soviet navigational satellite signals in the VHF range over North America.[221] But those intercepts may not have been done at Alert. Along with CFS Leitrim, Alert began wideband intercept and retrieval operations in full 4-Mhz mode – considered "the most significant recent addition to Canadian intercept resources and … clearly the most outstanding engineering achievement of the year."[222]

Although SIGINT reporting experienced a decline during 1970, CBNRC anticipated that it would be conducting more analytic work in 1971-72, so it was planning for more analysts and technical support staff. In a May 1970 memo to the Director, the Coordinator Production identified a requirement for 39 additional staff. Sixteen of them would be assigned to topics on

which Alert's operators conducted intercepts: submarine operations in the Arctic; Northern Fleet; naval air forces; Arctic navigation; scientific research; Northern air defence district, and new air defence systems; missile and space developments; Leningrad MD ground forces; and Northern/NW KGB border guards districts.[223]

In 1971 CBNRC closed two intercept sites: Coverdale, NB and Ladner, BC. Their staff were re-assigned to other stations, although overall staffing still fell short of the 100 positions. Overall intercept productivity (measured in hours) rose almost 10% over 1970. Capture of keyboard automatic MC increased 138%, the second consecutive year of major increase in that mode, due entirely to more Russian usage. The volume of plain-language radio-printer and hand-speed MC intercepts in the Soviet Arctic grew slightly over 1970, accounting for 70% of all Canadian intercepts. The number of messages recovered from those transmissions rose 5 ½% to 3,459,210 – all from plain language MC. Total reporting from Canadian stations decreased noticeably, due mainly to reduced need for routine reporting of Soviet air transport activity. CFS Alert produced 2,750 reports in 1971 – a 24% decline over 1970.[224]

Otherwise, there were no significant changes to the intercept work carried out at CFS Alert. The decline in LRA Arctic region flights, which began in 1970, continued in 1971, dropping another 25%. That said, this constituted only 12% of Soviet-wide LRA activity. Two air bases were closed, but medium and heavy bombers showed flexibility in deployments between other bases. They also continued flights into the Norwegian Sea and the North Atlantic. There was confirmation of an LRA heavy bomber anti-shipping mission. The number and complexity of aerial refuelling operations was reduced during this year. In collaboration with the NSA the Branch carried out a major collection and reporting program for the US Strategic Air

Command on Soviet air defence topics, such as C2 procedures, reaction times, and new weapons and equipment.[225] CFS Alert would have been at the heart of the collection effort.

With regard to the Russian navy, the Branch continued to focus on out-of-area operations in the North Atlantic by various elements of the Northern Fleet. This included selected surface vessel operations in Maritime Command's areas of interest.[226] On 1 March 1971, the Supreme Allied Commander Atlantic (SACLANT) notified NATO Military Command that a Soviet flotilla of six submarines and one submarine tender was expected to pass through the Faroes/Shetland islands gap 5-6 March 1971 enroute to the Mediterranean. SACLANT considered this an excellent opportunity for the Standing Naval Force Atlantic to conduct surveillance of Soviet vessels.[227] Since this flotilla deployed from the Northern Fleet bases, it is likely that CFS Alert was the original source of SACLANT's intelligence on it.

Drawing on inputs from intercept stations (along with products from the NSA and GCHQ) the Branch continued to monitor developments in Russian strategic rocket forces and nuclear testing in the Arctic region, and on activities in the Leningrad MD. It also continued to specialize in surveillance of LF and VLF communications bands. Alert received a VHF intercept system "to conduct collection trials against Soviet aircraft air-to-air transmissions during flights in the polar basin." Both Alert and Inuvik installed new signal distribution units "to facilitate the intercept operator's choice of appropriate antenna."[228] Branch engineering was heavily involved in planning and developing more technically sophisticated systems meant to greatly improve collection and processing over the next few years. This included selecting the PUSHER HF/DF antenna system that was to be installed at Leitrim, Alert, and Inuvik.[229]

Unfortunately, the trail of annual Branch SIGINT reports goes cold at this point. Thus, the remainder of this study relies more on secondary sources and a less comprehensive selection of original documents. The result is more speculative and less authoritative.

Russia's OKEAN-75 naval exercise, held in April 1975, was the third by that name held every five years since 1965. Involving some 200 ships from all four fleets and 700 aircraft sorties deployed around the periphery of Eurasia, it was "the largest and most widespread of such Soviet maneuvers ever held."[230] The exercise tested the navy's proficiency in several aspects of naval operations, including the coordination of communications, surveillance, convoy interdiction, and ASW. It also reflected the fact that forward deployment was now routine for the Russian navy.[231] Given the participation of elements of the Northern Fleet, CFS Alert would have tracked those vessels and listened to their messaging as they departed then returned to their home stations.

1979 saw three large out-of-area exercises in the Norwegian Sea and the North Atlantic. The largest took place in March-April, involving some 70 surface ships and an unknown number of submarines and aircraft. The VTOL aircraft carrier *Kiev* served as the anti-carrier warfare target. Two subsequent exercises in May and June focused on defence of home waters in the same areas. The Northern Fleet provided the most vessels seen in the Norwegian Sea and the North Atlantic.[232] They would have been routine collection targets for the listeners at Alert.

Similar exercises were carried out in the same areas in 1980. The aggressor force was simulated by the *Moskva*-class helicopter carrier *Leningrad* and its escorts. They were opposed by strike aircraft from the USSR, and forces at sea, including the carrier *Kiev* and its escorts. In total, about 20 surface ships were involved, plus an unknown number of submarines.[233] Just as in previous years, Alert would have monitored the exercises, the vessels, and the aircraft involved.

However, there was no OKEAN-80, the first break in the five-year cycle. This, along with declining numbers of ships involved in the previous "Defence of the Homeland" exercises, and suggestions (by the Chairman of the US Joint Chiefs of Staff) that Russia's naval shipyard overhauls were backlogged, leaving their SSBNs out of service for extended periods,[234] may have indicated that the Soviet pursuit of a 'blue water' navy had reached its apogee in the late 1970s. Continuing in that vein, the authoritative *Soviet Armed Forces Review Annual* reported in 1982 that during the previous year the navy started withdrawing the Yankee-class SSBNs from service. Offsetting that, the *Novorossisk*, third of the *Kiev*-class aircraft carriers, the nuclear-powered battle cruiser *Kirov*, and the lead SSBN in the new *Typhoon*-class, underwent or completed their sea trials during 1981.[235] CFS Alert's listeners would have monitored those sea trials closely. By the end of the decade, although construction of various new classes of surface ships and submarines was underway, in step with the new national policy of *Perestroika* the Soviet navy was unilaterally disposing of large numbers of warships. Exercises and out-of-area deployments had continued to decline. But the Kola Peninsula remained a significant naval and air basing area,[236] and as such it remained the major SIGINT collection target of CFS Alert.

Part 8: Significance

CFS Alert was a challenging and expensive SIGINT investment for Canada. So, it is not unreasonable to ask: was the product worth the investment? Did it make a useful contribution to Canadian and allied intelligence during the Cold War?

It is difficult to give definitive answers with the limited sources at the author's disposal. The foregoing sections on collection and reporting give the reader a sense of the achievements, strengths, and weaknesses of CFS Alert's operations, within the larger context of the Branch's and CSE's efforts. Both the station and its parent organizations made valiant efforts to meet their

objectives, against the simultaneous challenges of fiscal limits, insufficient personnel, rapidly changing and increasingly costly technology, and the COMSEC efforts of their adversary. In the first four decades that Alert operated, with few exceptions Canadian officials and allies periodically re-affirmed the value of Canada's SIGINT program, and that of Alert in particular.

In 1967, the NSA was pleased with Canadian SIGINT, "which provided early information on Soviet air activity in the Arctic, mostly from Alert and Inuvik." The Canadian SIGINT Liaison Officer in Washington forwarded in February 1967 comments from the NSA which said in part: "Canadian stations' provide US consumers with general summary of Arctic activity considerably in advance of US wrap-ups and also provide unique information on a timely basis. We would greatly appreciate their continuation."[237]

A 1968 evaluation by DND's defence intelligence branch made several instructive points: first, because of DND's/Canadian Forces' global responsibilities, SIGINT is a timely, very high value intelligence source (especially for Canadian maritime forces on both coasts); second, the Branch meets only a small part of DND's/CF's intelligence requirements; third, Canada's SIGINT efforts in the Arctic are driven largely by American and British intelligence needs; fourth, the high value that the US and the UK place on Canada's Arctic SIGINT work yields the release of American and British SIGINT products to Canada; and finally, "any reduction of Canadian SIGINT Activity against the Soviet Arctic would cause great concern on the part of US and UK intelligence agencies."[238] In June that year, during a visit to the Branch, the Assistant Chief of Staff Intelligence at SACLANT and his Senior Intelligence Officer had rated the Canadian SIGINT input to the command's Special Security Office as a "unique and valuable contribution".[239] In 1969, the NSA asked the Branch for any information regarding "the annual transfer of nuclear submarines from the Northern Fleet to the Pacific Fleet area under the ice,

plus a comparison with similar operations in previous years." The request also stated that "in view of CBNRC's special capability on this subject, *which has consistently been comprehensive and of excellent quality*, we feel that CBNRC is uniquely qualified to respond to this requirement."[240] That was positive feedback on the value of Alert's SIGINT efforts to the NSA.

That same year Dr. Louis Tordella, the Deputy Director of the NSA, passed along to the Branch via the US Liaison Officer there, "*effusive appreciations* from US Naval Intelligence" for a "first-of- its- kind" report that had been sent "to all major US Fleet Commands". Dr. Tordella added his own "congratulations on an outstanding job of concise and logical reporting".[241] Typically, the British were more restrained. Their L/O wrote: "You might care to know that when my Director read (the report) he commented: 'A very good and interesting report on an esoteric subject'."[242]

In 1971, Canadian Ambassador to the U.S. Marcel Cadieux received positive feedback on Canadian SIGINT during a visit to the NSA. His report to the Director of Communications Security E. R. Rettie, is heavily redacted, but an NSA official commented that, "The Canadian contribution to SIGINT on this exercise [no details] was stressed. Alert, in particular had done well, obtaining [remainder redacted]".[243]

During a meeting of the Intelligence Advisory Committee (IAC) in November 1973, the DND Director General Intelligence and Security (Brigadier-General Reginald Weeks) cited a joint study by the CBNRC and CFSRS that asserted, "there is a continuing operational requirement for CFS Alert for the next 15 years…"[244] But he did not provide any data or analysis to support that position.

A year later, when the future – and possible remoting – of Alert was under discussion, DND Deputy Minister Sylvain Cloutier provided funding details. They showed that DND was

carrying over 88% of the cost of Canada's intelligence program, two-thirds of which arose from SIGINT collection and production. It provided 75.5% of the personnel devoted to intelligence (1,683 persons, SIGINT accounting for 1,154). But it was also the principal beneficiary, consuming over 70% (183,000) of the 258,000 SIGINT documents produced in 1973.[245] In a letter to Cabinet Secretary Gordon Robertson in September 1974, Cloutier presented two arguments in favour of continuing to operate the base: first, being the "only established settlement that far north", it was "important from a sovereignty point of view." Second, "because of geographic location, access to coverage of Eastern USSR is unique; this is a key factor in intelligence exchange agreements with USA and UK."[246] It is interesting, but quite in step with the Trudeau government's policies, that the sovereignty issue was given pride of place in justifying Alert's continued existence. Also interesting is the notion that Alert was uniquely positioned to cover the *eastern* Soviet Union, when the majority of its collection efforts were normally focused on Russia's north and west. Still, it is telling that DND felt it could justify Alert's future on the basis of its value to the two key Five Eyes partners. That was reiterated in the NSA's fulsome tribute to CSE Chief Stewart Woolner, upon his retirement in 1998 – with credit in passing to Alert.[247] But, as already noted, the Canadian defence, foreign affairs, and intelligence communities benefited greatly from the material they received in return.

By contrast, the Department of External Affairs offered mixed reviews over time. In July 1986 Alan Sullivan (ADM Political and International Security Affairs) wrote to CSE Chief Peter Hunt, almost begging him to assign a third Client Relations Officer (CRO) to DEA, because of the high demand for CSE's SIGINT product at the senior levels of the department.[248] Four years later, holding the same position as Sullivan, Jeremy Kinsman told Woolner that he valued SIGINT and believed that DEA's need for it would increase. He stressed that it played a "vital"

role in counter-terrorism. However, he noted that the issue was "over the general applicability of intelligence to our priorities in Government." He went on to say that "It is the general view of my colleagues that signals intelligence rarely directly affects the Canadian decision-making process. We are rarely breaking through on intelligence of a determining kind."[249] This perspective should not be surprising. DEA consumed less than 20% of the SIGINT take.[250] If it was used at all, it might show as a line item in an intelligence report, or the data or analysis might be folded into assessments. In either case, the source might not be identified.

Trying to put a positive spin on the problem, Kinsman suggested that DEA could help CSE's efforts become more relevant. "There is much we can do," he wrote,

> "to facilitate the more precise calibration of signals intelligence in the 90's to Canadian needs in the policy-making sphere as well as in terms of operational security … We would very much like to be able to indicate on a more regular basis just what our foreign policy priorities indicate in the area of signals collection…. There is the issue of choice. Then, there is the issue of means."[251]

The letter ends with an invitation to meet for lunch the following week to discuss this. Sources available to the author do not indicate whether Woolner and Kinsman met as suggested.

However, in 1993 a working group within the Department of Foreign Affairs and International Trade (DFAIT – DEA's new name) recommended changes to the distribution of intelligence within the department, to ensure that materials reached desk officers and others in manageable quantities and in a timely manner. When it came to SIGINT, they recommended that CSE's CROs "assume full responsibility for distribution of SIGINT to bureaus in the department."[252] The memo went on to say that,

> "if a director feels that a desk officer should see a SIGINT report shown to him by a CRO, he could ask the CRO to pass it to the desk officer. The regular CSE pulls of SIGINT messages that are now provided to analysts should be cancelled, since INSR has no practical means of reviewing this mass of material and selecting messages for user bureaus … The SIGINT spot reports now received directly by the IND comcentre should be cancelled, except for reports originated by CSE."[253]

There was even some doubt expressed within CSE itself. In March 1990, the Director L Group had written to Woolner, making the same points that Kinsman would make three months later. A report from the CSE liaison officer in the IAC "clearly demonstrates", he/she wrote, "that SIGINT is rarely used and never attributed, despite a major effort to encourage its use on the part of a number of CSE elements over the past year."[254] He went on to say at length that,

> "the lack of SIGINT's use and attribution could well leave some senior readers with the impression that SIGINT has little to say on major issues which such readers are concerned with. For example, a 1989 IAC assessment of Soviet actions and intentions concerning force reductions was issued without explicitly incorporating SIGINT. This was done despite the fact that SIGINT was extensively used to support the conclusions and even though the CSE representative at the ARG [Assessment Review Group] raised concerns that this might suggest to senior readers, especially in Defence, that SIGINT had nothing worthwhile to say on this topic."[255]

The writer laid the blame at the feet of the IAC Secretariat and some unspecified "intelligence agency elements", who – in the writer's view – were trying to write for as wide a readership at the lowest classification as possible. This, in effect, "devalued" the IAC's product, by leaving out what was "distinctive (and hence useful)": information "unavailable elsewhere" and conclusions based on it. "If intelligence reporting is to be successful it must rely clearly and explicitly on the

evidentiary process, and this must be seen as the essence of 'value added'."[256] The writer asserted that the IAC ought to be doing this to promote the use of intelligence, and thus to foster an "intelligence culture" that in their view was lacking in Canada.[257]

That criticism may have had a positive impact within the IAC. A 1992 CSE analysis of the IAC's use of SIGINT in its reports showed a marked increase since 1989, attributed in large measure to the expansion of CSE's IAC support desk from one to five persons.[258] The number of reports that the IAC issued at CODEWORD level had increased from 11% in 1989 to 21% in the first half of 1992. During and immediately after the 1991 Gulf War almost one-third of the IAC's reports were issued at that level. That event skewed the totals; without it, they would have been much lower. While SIGINT was viewed as a good source, its value was thought to diminish over time. It was only valuable to IAC members when it could "change a judgement based on other sources of information." Moreover, due to the desire to ensure wide readership of their own products, and to concerns about storage and handling of such sensitive material, some agency and department officials discouraged their analysts from using SIGINT materials "at all cost."[259]

The foregoing does not call into question the value of SIGINT generally or of the reporting specifically from CFS Alert. A quantitative analysis of the IAC's use of SIGINT in its reports is not the only measure of its value. But it highlights the fact that its utility was not universal across government. Unlike DND, for example, DFAIT did not need to know the minutiae of Russian military activities that the station collected daily. Rather, some of those details would have mattered only if and when they had been integrated into finished intelligence reports and assessments that addressed broad foreign and/or defence policy issues. However, as noted above, SIGINT as the original source might not have been obvious to the customers and

readers if it was not specified as such in the documents. But, including references to it might have limited readership of documents intended for a wider audience.

Conclusions

The research question posed in the Introduction was: How much can we learn about a Canadian SIGINT operation from the kinds of open sources listed in the Introduction? The short answer, illuminated by this study, is: *quite a lot, but not enough*. Piecing together data gathered from a limited selection of declassified documents, the annual historical reports, a few published sources, and a small number of interviews allowed the author to present a more complete picture of SIGINT operations carried out at CFS Alert than was previously available in public. The paper sheds new light on: the origins and creation of the station; the direction of SIGINT operations; Canadian and allied collection priorities and targets; collectors and the collection processes used at Alert; the technical collection systems (antennae and receivers) they used; and reporting of the collection products. In sum, this study informs the reader about Alert's contribution to the first two steps in the intelligence development process. It also explains some of the problems the station encountered: staffing; communications (for reporting); and delays in upgrading systems.

But, the longer answer must acknowledge, first, that this picture is incomplete. There are many gaps in the information, leaving some questions unanswered. For example, in the absence of hard evidence we are left to infer about which events and activities the station might have reported, given its capabilities and priorities. Second, the paper says little about the remaining steps that CBNRC and CSE would have taken to turn the information gathered at Alert into intelligence that they could disseminate to their domestic and Five Eyes customers. Likewise, it says very little about how those customers (such as DND's intelligence staff) exploited that intelligence, and whether Alert's contribution made a significant contribution to national and

allied assessments, decisions, or policies. Was the value of its Indications and Warning function ever proven? Finally, many of the original sources cited here do not focus solely on the operations of CFS Alert. They refer to those of other intercept stations and of CBNRC and CSE themselves. It is probably impossible – and perhaps a mistake – to try to examine and assess the efforts of a single intercept station in near isolation from its wider organizational context.

So, this study cannot be taken as the final word on the subject. It should be seen as an interim report. It might also serve as a signpost, pointing to directions for further research. If more sources become available, it may be possible for future researchers to fill in more of the gaps in Alert's story. That, in turn, could contribute to more complete histories of the CBNRC, CSE, the Supplementary Radio System, and the Canadian intelligence community as a whole.

NOTES

[1] Lt. Col. (ret.) Greg Jensen, interview with author, 12 May 2025.

[2] Lt. Col. (ret.) Rob Martin, interview with author, 26 May 2025.

[3] Those sites were too far from Russian transmitters to efficiently intercept their signals, especially in the low and medium frequency bands. See: W.N.A. Chipman, Secretary, Communications Research Committee, memo to CRC members, 26 June 1961, attachment: *Revision of Draft IPC Paper, Section III – Redeployment of Ground Resources*, CSE Committees - File 72-16 Part 1, CSE ATIP A-2023-00052.

[4]James Bamford, *Body of Secrets: Anatomy of the Ultra-secret National Security Agency* (New York: Doubleday, 2001), p. 142.

[5] As Timothy Sayle points out in his book, *The Next War: Indications Intelligence in the Early Cold War* (Calgary: University of Calgary Press, 2025), pp. 17-18, the fear of a major war between the United States and the Soviet Union actually pre-dated the end of World War II.

[6] Sayle, p. 27.

[7] Donald Daniel, "Navy" in David R. Jones, *Soviet Armed Forces Review Annual* [hereafter *SAFRA*] vol. 3 (Gulf Breeze, FL: Academic International Press, 1979), p. 66.

[8] Marc Milner, *Canada's Navy: The First Century* (Toronto: University of Toronto Press, 1999), pp. 228-29, 271-72.

[9] Sayle, p. 22.

[10] Alan Barnes, *Watching the Bear: Canadian Intelligence Assessments of the Soviet Threat to North America, 1946-64* (Vancouver: University of British Columbia Press, 2025), pp. 89-93. For a 1948 assessment, see: Sayle, pp. 50-52, 190 ns. 13, 20, 21. For a 1952 assessment see: HQ Western Command to Director of Military Intelligence, Army HQ, *Intelligence - ALCANUS Conference*, 18 Oct 1952, Appendix D, Department of National Defence, Directorate of History and Heritage [hereafter DND DHH] 2005/17 Box 4 File 2111-91/A4-1; Canada, Joint Intelligence Committee [hereafter JIC], *Soviet Capabilities for Northern Operations* (1952-1953), Joint Staff Files, Library and Archives Canada [LAC], RG24 Vol. 20862 File 7-27-0-1 Part 1, copies in Canadian Foreign Intelligence History Project [hereafter CFIHP] archive. Unless otherwise indicated, subsequent Canadian document citations are from CFIHP.

[11] See JIC *Minutes*, 500th meeting, 18 July 1956, LAC, RG146 Vol. 6040, File IA10-4-8-56; JIC, *Extracts from Minutes*, 501st meeting, 25 July 1956, LAC, RG24 Vol. 21467, File 2106-1 Part 1; and *Memorandum for the JIC:* [re: preparing a paper on] *Soviet Technical and Tactical Capabilities for the Conduct of Military Operations in the Arctic and Sub-Arctic*, 26 July 1956, LAC, RG24 Vol. 21467 File 2106-1 Part 1.

[12] Sean M. Maloney, "The Mobile Striking Force and Continental Defence, 1948-1955," *Canadian Military History*, vol. 2, no. 2 (1993), pp. 75-88.

[13] Kenneth C. Eyre, "Forty Years of Military Activity in the Canadian North, 1947-1987," *Arctic*, vol 40, no. 4 (December 1987), pp. 294-98; and P. Whitney Lackenbauer and Matthew Farish, "The Cold War on Canadian Soil: Militarizing a Northern Environment," *Environmental History*, vol. 12, no. 4 (October 2007), pp. 921, 923, 925, 928, 929-33, 935-36.

[14] See the warning role described in: *Canadian JIC Paper 370/3 (60), The Canadian Intelligence Programme*: *A Report by the Joint Intelligence Committee*, 13 July 1960, p. 2, Global Affairs Canada [hereafter GAC] Special Registry File 29-1-1-Canada Part 4 - Intelligence Policy and Plans, DEA Documents - Intelligence Policy 60-05-26 to 69-06-12, from Department of External Affairs [hereafter DEA] Special Registry files. See also: Cynthia Grabo, "Strategic Warning: The Problem of Timing," *Studies in Intelligence*, vol. 16, no. 2 (Central Intelligence Agency, Spring 1972), pdf, p. 1.

[15] N. K. O'Neill and K. J. Hughes, *History of CBNRC* (Ottawa: Communications Security Establishment, 1987), vol. I, ch. 1, pp. 1-3, ch. 2, p. 2, ch. 5, pp. 1-2, and Vol. VII [Chronological Summary]; "Do Gentleman Read Each Other's Mail? The Debate Over a Post-war Canadian SIGINT Agency," in Wesley K. Wark and Privy Council Office [hereafter PCO], *A History of the Creation of Canada's Post-World War II Intelligence Community, 1945-1970* (Ottawa: PCO, 2000-2002), ch. 2; David A. Charters, *Canadian Military Intelligence: Operations and Evolution from the October Crisis to the War in Afghanistan* (Washington, DC: Georgetown University Press, 2022), pp. 30-31.

[16] See Wesley K. Wark, "The Road to CANUSA: How Canadian Signals Intelligence Won its Independence and Helped Create the Five Eyes," *Intelligence and National Security*, vol. 35, no. 1 (2020), pp. 20-34.

[17] Daniel Heidt and P. Whitney Lackenbauer, *The Joint Arctic Weather Stations: Science and Sovereignty in the High Arctic, 1946-1972* (Calgary: University of Calgary Press, 2022), pp. 2-3, 193, 195, 197-98, 205; David R. Gray, *Alert, Beyond the Inuit Lands: The Story of Canadian Forces Station Alert* (Ottawa: Borealis Press, 1997; repr. 2004), p. 11.

[18] "Locations of Canadian SIGINT Stations," Appendix A and B, *Canada Intelligence Policy and Plans - Organization and Structure*, January 1946, GAC Special Registry File 29-1-1 Part 1. See also, Wesley K. Wark, "Favourable Geography: Canada's Arctic Signals Intelligence Mission," *Intelligence and National Security*, vol. 35, no. 3 (2020), pp. 320-21.

[19] Gray, pp. 15-16.

[20] Heidt and Lackenbauer, p. 269; "Canadian Forces Station Alert", https://www.canada.ca /en/air-force/corporate/alert.html

[21] Bamford, *Body of Secrets*, pp. 139-41.

[22] Wark, "Favourable Geography," pp. 320-22.

[23] The CBNRC intercept program had a personnel cap of 100. To keep Alert fully staffed would require closing some intercept stations and redistributing personnel to others. See Chipman, memo to CRC members, 26 June 1961, attachment: *Revision of Draft IPC Paper, Section III – Redeployment of Ground Resources*, pp. 3-4.

[24] Wark, "Favourable Geography,", pp. 322-25.

[25] Ibid., pp. 325-26.

[26] "Canadian Forces Station Alert".

[27] *Canadian JIC Paper 468/2 (63), The Canadian Intelligence Programme*: *A Report by the Joint Intelligence Committee*, 4 September 1963, pp. 1-2, LAC A-2016-00704, RG25 BAN 2017-

00434-0 Box 26 File 1-3-12-2-1 Part 1, IPC Documents – Minutes 60-06-03 to 64-12-31, from DEA Special Registry files.

[28] Gray, p. 14.

[29] D. F. Wall, Secretary IPC, *Memorandum to Intelligence Policy Committee: Intercept Activity*, IPC 2/67, 18 July 1967, Annex A, CSE Committees - File 72-16 Part 3 CSE ATIP A-2023-00052.

[30] Ibid, Annex B.

[31] Office of the Chief of Defence Staff, *Memorandum for the Minister: Possible Question About Canadian Communications Intelligence Activities*, 23 April 1969, DHH, 73/1223 Box 225, File 2578, DND Int Documents - Intelligence-General, 69-02-25 to 72-08-16.

[32] CBC TV, "The Espionage Establishment of 1974," on *The Fifth Estate*, 9 January 1974.

[33] CBNRC, Communications Research Committee, *SIGINT and COMSEC in Canada, CRC/213 (Final)*, 31 May 1960, Appendix C, GAC Special Registry File 29-1-1-Canada Part 4 - Intelligence Policy and Plans; *Canadian JIC Paper 370/3 (60), The Canadian Intelligence Programme*, 13 July 1960, p. 2. See also, Sayle, pp. 107-8.

[34] Mark M. Lowenthal, *Intelligence: From Secrets to Policy*, 6th ed. (Los Angeles: CQ Press/Sage, 2019), p. 119.

[35] Grabo, pp. 1-2.

[36] See brief outline of CFSRS in Archieon; Message, Commander P.J. Pratley, Director of Intelligence Operations, to Director, CBNRC, 11 August 1966, and SA Grey, *Getting to the Roots of a 291er*, 23 Jan. 1993, p. 55, both from CSE ATIP A-96/0837. See also: Brig.-Gen. Lloyd Everett Kenyon, interviews by Chris Bell, 1983-84, University of Victoria Oral History Program [notes compiled from interview tapes by Alan Barnes]; DND, "SIGINT Box – Factual Statement on the Decision-Making Points Within the Canadian Intelligence Community," input

to C.M. Isbister, *Intelligence Operations in the Canadian Government, Privy Council Office Report 70-11-09* (Ottawa: PCO, 1970), LAC, RG25, BAN 2017-00434-0, Box 21, file 1-1-1-1, part 1; Charters, *Canadian Military Intelligence*, p. 69, and notes 4-8.

[37] "History of Canadian CESM," http://www.rcsigs.ca/index.php/History_of_canadian_cesm #The_70s_and_Onwards

[38] "Canadian Forces Station Alert".

[39] Lt. Col. (ret.) Chantal Cloutier, list of CFS Alert commanding officer duties, provided to author, 22 May 2025. She commanded the station from June 1996 to January 1997.

[40] This is based on details recorded in the *Annual Historical Report*s over the period under study.

[41] See Cloutier, interview and email to author 31 October 2025; Chief Warrant Officer (ret.) Jim Humes, interview with author, 23 May 2025; Warrant Officer (ret.) Chris Ingersoll, interview with author, 26 May 2025. See also Chief Warrant Officer (ret.) Bill Neelin, written answers to author's questionnaire, 24 May 2025.

[42] This was emphasized by every Alert veteran interviewed by the author. Some of the early recreational activities are described in colourful detail in: "'Life in CFS Alert' Nov 1961-Aug 1962", chapter from personal memoir by David Smith. Copy in email to author, 21 May 2025.

[43] Gray, p. 28.

[44] See the *AHR*s for the specified years. The personnel total shown in the 1959 *AHR* is considerably fewer than the figure cited by Wesley Wark for that year (see note 17). The figure of 125 '291ers' comes from the 1997 *AHR*, but it was not the total for that year; 1986 is more likely. The 291 MOC designation came into effect with Unification of the armed forces in 1967.

[45] Cloutier, list of CFS Alert Operations Officer duties, provided to author, 22 May 2025.

[46] Corporal (ret.) Peter Dalton, interview with author, 21 May 2025, and email to author, 20 November 2025; Humes, interview; Ingersoll, interview.

[47] Neelin, written answers.

[48] The *AHR*s for almost every year recorded construction, maintenance, and repair in some detail.

[49] Letter, Sylvain Cloutier (Deputy Minister, DND) to R.G. Robertson, Secretary to the Cabinet, PCO, 23 August 1974, pp. 1-2, and Annexes A and B, PCO Special Registry "IAS Files" Box 2 File S&I 2-1-1.

[50] Cloutier interview. No relation to the former DM at DND cited in note 45. Cost factors relating to Alert are explained in *Canadian Forces Supplementary Radio System* (1990), p. 2, and CFS Alert addendum, CSE ATIP A-96/0837 (provided to CFIHP by K. Jensen).

[51] David A. Charters, "SIGINT in Paradise: Canadian Forces Station Bermuda, 1963-1993 (2024), p. 11. An abridged version will be published by CSIS as part of the proceedings of the 2024 conference on Canadian intelligence history.

[52] *AHR* 1997.

[53] Lowenthal, pp. 83-85.

[54] *Canadian JIC Paper 370/3 (60)*, p. 2. See also: *Canadian JIC Paper 8-96 (69) (Final) The Canadian Intelligence Programme*, 13 Nov. 1969, p. 2, GAC Special Registry File 29-1-1-Canada Part 4 - Intelligence Policy and Plans.

[55] CBNRC, *SIGINT and COMSEC in Canada*, p. 6.

[56] Ibid, p. 8.

[57] Ibid, p. 7.

[58] Ibid, p. 11. On the role of Canadian, US, and UK liaison officers in setting collection requirements, see: CBNRC, *SIGINT and COMSEC in Canada, CRC/213* (Draft), 2 May 1960, Part 3, para 5.3 "Methods of Liaison".

[59] See *AHR*s for 1970, 1976, 1979, 1981-89, 1991-93.

[60] Martin interview.

[61] CBNRC, *SIGINT and COMSEC in Canada*, p. 11.

[62] Ibid, Appendix C.

[63] Sayle, pp. 105-7, 160-61, 169-70 explains how the agreement and its terms came about.

[64] *Canadian JIC Paper 312/2 (59) Probable Enemy Activities Prior to Outbreak of War Alert Indications Intelligence Room*, 31 March 1959, pp. 1-15, LAC, RG24 Vol. 8143 File 1480-12 Part 1.

[65] Ibid, p. 16.

[66] Ibid, p. 18.

[67] CBNRC, *SIGINT and COMSEC in Canada*, Appendix C.

[68] Ibid.

[69] Lawrence Freedman, *U.S. Intelligence and the Soviet Strategic Threat*, 2nd ed. (Princeton NJ: Princeton University Press, 1986), pp. 25, 62-80. See also U.S. *National Intelligence Estimate (NIE) 11-56* and *Special NIE 11-7-58* on the 'bomber gap'; and *NIE 11-5-57*, *SNIE 11-10-57,* and *NIE 11-8/1-61* on the 'missile gap', in Donald P. Steury, ed. *Intentions and Capabilities: Estimates on Soviet Strategic Forces, 1950-1983* (Washington, DC: CIA, Center for the Study of Intelligence, 1996).

[70] James J. Wirtz, "Indications and Warning in an Age of Uncertainty," *International Journal of Intelligence and CounterIntelligence*, vol. 26, Issue 3 (2013), pp. 553-54.

[71] Lowenthal, pp. 326-27.

[72] See Michael Beschloss, *Mayday: Eisenhower, Khrushchev and the U-2 Affair* (New York: Harper and Row, 1986).

[73] See Robert Dienesch, *Eyeing the Red Storm: Eisenhower and the First Attempt to Build a Spy Satellite* (Lincoln, Nebraska: University of Nebraska Press, 2016).

[74] Neelin, written answers.

[75] Harriet Fast Scott and William F. Scott, *The Armed Forces of the USSR* (Boulder, CO: Westview Press, 1979), pp. 173-77.

[76] Email, Neelin to author, 24 May 2025.

[77] Julian Critchley, *The North Atlantic Alliance and the Soviet Union in the 1980s* (London: Macmillan, 1982), p. 137.

[78] Alfred L. Monks, "Air Forces," in David R. Jones, *SAFRA, 1* (1977), p. 62.

[79] Central Intelligence Agency [hereafter CIA], *The Soviet Northern Fleet*, 9 July 1968 [declassified 29 August 2000], pp. 6, 8, https://www.cia.gov/readingroom/docs/CIA-RDP79B00972A000100220005-2.pdf

[80] Jensen interview; Cloutier interview.

[81] Scott and Scott, pp. 246-47.

[82] Ibid, p. 247.

[83] Bamford, pp. 366-67.

[84] This was explained by several interviewees.

[85] W. N. A. Chipman, memorandum to CRC members, 29 May 1961, attachment: *Draft IPC Paper: Improvement in Canadian SIGINT Operations*, p. 2, CSE Committees - File 72-16 Part 1, CSE ATIP A-2023-00052.

[86] CIA, National Photographic Intelligence Centre, *Selected Probable Naval Communications Facilities*, April 1971, accessed 9 Apr 2025 at: https://www.cia.gov/readingroom/docs/CIA-RDP78T05162A000200010022-5.pdf

[87] Ibid. The MERCURY GRASS antenna was for VHF radio relay. FORK REST was also a VHF transmitter.

[88] CIA, *The Soviet Northern Fleet*, p. 9.

[89] Critchley, p. 137

[90] Bamford, p. 167.

[91] CIA, *The Soviet Northern Fleet*, p. 1. Emphasis added.

[92] Ibid, p.1.

[93] *Memorandum for the JIC: Submarine Havens for Soviet Northern Fleet*, 20 May 1958, LAC RG25 Vol. 7954 File 50028-CL-40 Part 1.

[94] On the Soviet practice of centralized control, see: Scott and Scott, pp. 23, 81, 100, 102-3, 111-13, 246, 377.

[95] *Canadian JIC Paper 454/2 (62) The Maritime Threat to Canada 1963-1973*, 19 December 1972, pp. 1-3, LAC RG2 Box 134 File I-2-2 1962, JIC Assessments – General 62-01-24 to 62-12-21, from PCO main registry files. [see also: CIA, National Foreign Assessment Center, *Naval Aviation in Soviet Antiship Attack Planning: An Intelligence Assessment*, September 1979, https://www.cia.gov/readingroom/document/0003230237 .

[96] Dr. J. E. Keyston to R. B. Bryce (Clerk of the PCO, 8 November 1962, PCO documents, released under Access To Information.

[97] CIA, *The Soviet Northern Fleet*, pp. 2-4; CIA, Directorate of Intelligence, *Intelligence Report: The Soviet Y-Class Submarine Construction Program*, October 1968, https://www.cia.gov/readingroom/docs/DOC_0002775033.pdf

[98] Robert Berman, "Soviet Naval Strength and Deployment, November 1972" in Michael MccGwire, ed., *Soviet Naval Developments* (Halifax, NS: Centre for Foreign Policy Studies, Dalhousie University, 1973), pp. 114-17.

[99] Pelham G. Boyer, "Navy" *SAFRA* 13 (1989), pp. 101-03.

[100] Ibid, pp. 219-20.

[101] Marlene Laruelle, "Russian Military Presence in the High North: Projection of Power and Capacities of Action, in Stephen J. Blank, *Russia in the Arctic* (Carlisle, PA: US Army War College, Strategic Studies Institute, July 2011), pp. 70, 72.

[102] Jensen interview.

[103] Martin interview.

[104] Neelin written answers.

[105] Martin interview. As of June 1961, Alert had ten intercept positions per shift. In order to maintain that level through six-month rotations would require personnel increases at both the Churchill and Inuvik stations, which would serve as the staffing bases for Alert. See: letter, Commander J.B.C. Carling (RCN Director, Supplementary Radio Activities) to Secretary, Communications Research Committee [CRC] *Revision of Draft IPC Paper*, 29 June 1961, and W. N. A. Chipman, Secretary, CRC, *Memo to: Members of CRC, re Revision of Draft IPC* Paper, 26 June 1961, att. *Redeployment of Ground Resources*, both in CSE Committees - File 72-16 Part 1, CSE ATIP A-2023-00052. For later personnel discussions, see: CRC, *Memorandum for the Intelligence Policy Committee: Review of Canadian SIGINT Operations – 1967 IPC 2-68 (Final)*, 27 September 1968, pp. 2, 6-7, CSE Committees - File 72-16 Part 3, CSE ATIP A-2023-00052; and, Kevin O'Neill, Chief CSE, *Memorandum for the Interdepartmental Committee on*

Security and Intelligence, 17 January 1978, pp. 3-4, CSE A220 Committees File 3/3-1, CSE ATIP A-2023-00051.

[106] Martin interview; Neelin written answers, and email 24 October 2025; S. A. Grey, *Getting to the Roots…*, p. 42 says that as of 1960, a naval Radioman Special trained at HMCS Gloucester had to read/copy MC at 22 wpm (Neelin: for 20 minutes with 95% accuracy), and to type at 30wpm (Neelin says it was 35). Some of them were posted to Alert where, Dalton says, the minimum copying standard required was 25wpm.

[107] Ingersoll interview.

[108] Humes interview.

[109] Dalton interview.

[110] Lieutenant (N) (ret.) Les Lindstrom, zoom interview with author, 16 June 2025.

[111] Martin interview.

[112] Neelin, written answers, and email to author, 24 October 2025.

[113] Ingersoll interview.

[114] Martin interview.

[115] Humes interview.

[116] Ibid.

[117] Dalton interview.

[118] Ibid.

[119] Ingersoll interview.

[120] Martin, Humes interviews.

[121] Neelin, written answers, and email 24 October 2025.

[122] CBNRC, *Memorandum for the Intelligence Policy Committee: Review of Recent Measures by the USSR to Improve COMSEC*, IPC Paper 10/60, 4 October 1960, p. 1. CSE Committees - File 72-16 Part 1. CSE ATIP A-2023-00052.

[123] Ibid, pp. 1-2.

[124] Ibid, pp. 2-3.

[125] Canadian JIC, Electronic Intelligence Working Group, *Short Signal Problem*, 11 May 1960, "Features of a Short Signal System,", p. 1, LAC, RG24, Vol. 33676 File 1480-44 Part 2.

[126] Ibid, p. 1.

[127] Ibid, pp. 1-2.

[128] *Short Signal Problem*, "The Technical Problem of Intercept of Short Signals," p. 1.

[129] Ibid, pp. 1-2.

[130] Ibid, pp. 2-4.

[131] *Short Signal Problem*, "Features …," p. 2. See also: "Communication with Submarines," *Wikipedia*, accessed 19 April 2025, at: https://en.wikipedia.org/wiki/Communication_with_submarines

[132] O'Neill and Hughes, *History of the CBNRC*, vol. 3, Chapter 12, pp. 48-49, 56.

[133] Quoted in Proc, CFS Alert

[134] Quoted in Proc, CFS Leitrim

[135] Humes interview.

[136] "CFS Alert," https://jproc.ca/rrp/alert.html , accessed 29 April 2025, via *Lux Ex Umbra,* https://luxexumbra.blogspot.com/, no pg. #; O'Neill and Hughes, vol. 3, Chapter 12, pp. 18, 20.

[137] "CFS Alert".

[138] Ibid.

[139] O'Neill and Hughes, vol. 3, Chapter 12, p. 20.

[140] *The Central Technical Section*, IPC /7-62, 4 April 1962, attachment to: Memorandum to the Intelligence Policy Committee, 4 April 1962, CSE Committees - File 72-16 Part 2, CSE ATIP A-2023-00052.

[141] O'Neill and Hughes, vol. 3, Chapter 12, p. 28.

[142] Communications Research Committee, *SIGINT Equipment Programme and Vote 712 (Primary 89) Estimates Fiscal Year 1964-65*, CRC 239 (Revised), 26 November 1963, p. 1, CSE Committees - File 72-16 Part 3, CSE ATIP A-2023-00052.

[143] Ibid, pp. 1-2, and the attached itemized list in CRTG/11, 24 October 1963.

[144] *Memorandum for the Intelligence Policy Committee: Review of Canadian SIGINT Operations – 1965, IPC/5-66 (Final)*, 9 November 1966, pp. 1, 5, CSE Committees - File 72-16 Part 3 CSE ATIP A-2023-00052.

[145] *Memorandum for the Intelligence Policy Committee: Intercept Redeployment*, IPC/2-66, 16 June 1966, CSE Committees - File 72-16 Part 3, CSE ATIP A-2023-00052.

[146] *The 1972-73 Station Sigint Equipment Program Forecast & Explanatory Notes*, attached to Memorandum from C. E. Denning (Coordinator T, CBNRC) to Acting Director [and others], 7 April 1971, and D.F. Wall (Secretary IPC), *Memorandum for the Intelligence Policy Committee: SIGINT Papers for IPC Consideration*, 19 July 1971, in CSE Committees - File 72-1 Part 2, CSE ATIP A-2023-00052.

[147] O'Neill and Hughes, vol. 3, Chapter 12, pp. 52, 55.

[148] *AHR 1973*, p. 1.

[149] Ian W. Cummings, "Wullenweber CDDA Antenna Homepage," KB1SG's Amateur Radio Rhombic Pages, https://www.mapability.com/ei8ic/rhombic/wullen.php . See also: "AN/FRD-

10", *Wikipedia*, accessed 31 March 2025. Note that the abbreviations CDDA and CDAA are often used interchangeably to describe the same antennae array.

[150] "CFS Alert."

[151] *A Proposal to Increase the Efficiency and Productivity of the Signals Collection System*, 7 October 1977, p. 1, att. to, letter, Kevin O'Neill (Chief, CSE) to T.D. Finn (Secretary, ICSI), 12 October 1977, CSE A220 Committees File 3/3-1, CSE ATIP A-2023-00051.

[152] Ibid, p. 1.

[153] Ibid, p. 1.

[154] Ibid, pp. 2-4.

[155] *AHR 1979*, pp. 2-3.

[156] JEM Engineering Blog, "Large Bandwidths in Small Packages: Spiral Antennas," (December 2020), https://jemengineering.com/blog-spiral-antennas/ . On bandwidth, see "Antenna Theory", https://www.antenna-theory.com/antennas/travelling/spiral.php .

[157] "Beverage Antenna," *Wikipedia*, accessed 31 March 2025. See aerial photos of the Leitrim Beverage array.

[158] The Toronto Sun published a photo of the new operations building with the antennae on the roof, but it is not available.

[159] *AHR 1994, 1997*, Annex B; Andrew Corporation, *Andrew Catalog 26 (1969) Antennas, Transmission Lines*, p. 36, found at: https://www.worldradiohistory.com/Archive-Catalogs/Miscellaneous-Manufacturers/Andrew-Catalog-26-1969.pdf ; see also: Global Security, "Longroot", https://www.globalsecurity.org/intell/systems/longroot.htm The Andrew catalogue shows earlier 6000 series antennae.

[160] *Report by the Intelligence Advisory Committee: Soviet Military Policies and Capabilities Relative to NATO – North America and Europe. IAC Assessment 4/81*, 12 March 1981, para. 184, LAC, RG146 Box 5864, File B1-379 (from RCMP Security Service files). See also: "Signals intelligence operational platforms by nation," *Wikipedia*, accessed 24 April 2025, at: https://en.wikipedia.org/wiki/Signals_intelligence_operational_platforms_by_nation. See also: Desmond Ball, Duncan Campbell, Bill Robinson, and Richard Tanter, *Expanded Communications Satellite Surveillance and Intelligence Activities utilising Multi-beam Antenna Systems,*" *NAPSNet Special Report*, (Berkeley, CA: The Nautilus Institute for Security and Sustainability, 28 May 2015).

[161] Proc; *AHRs 1972*, p. 1, *1980*, p. 8.

[162] https://www.antenna.be/rh.html

[163]*AHR 1972*, p. 2.

[164] "Loop Antenna," *Wikipedia*, accessed 31 March 2025.

[165] *Project PORCUPINE II Draft # 2*, 14 August 1984, pp. 1-4, att. to *Memorandum to the Members of the Interdepartmental Committee on Security and Intelligence*, 17 July 1985, CSE A220 Committees File 3-1 Part 6, CSE ATIP A-2023-00034.

[166] *Foreign Intelligence Program – Strategic Overview and Operational Plan 1983-1986* (PCO, 1982), p. 9.

[167] *AHR 1985*, p. 8.

[168] Desmond Ball and Richard Tanter, *'US signals intelligence (SIGINT) activities in Japan 1945 – 2015: A Visual Guide,' Nautilus Institute NAPSNet Special Report*, 22 December 2015, pp. 248, 320, at http://nautilus.org/napsnet/napsnet-special-reports/ us-signals-intelligence-sigint-activities-in-japan-19 45-2015-a-visual-guide.

[169] Email, Bill Robinson to Jerry Proc and the author, 14 June 2025. FSK refers to Frequency-Shift Keying: "a frequency modulation scheme in which digital information is encoded on a carrier signal by periodically shifting the frequency of the carrier between several discrete frequencies." See: Wikipedia [source cited in n. 1.]

[170] Ball and Tanter, pp. 320-21; and see: Annex B (Operations) in *AHR*s *1993*, *1994*, *1995*, *1997*.

[171] *AHRs* 1992-94. The author has not been able to identify what TOSS and ERA stand for.

[172] Robinson to Proc and author.

[173] Quoted in "CFS Leitrim," https://www.jproc.ca/rrp/leitrim.html.

[174] Quoted in "CFS Alert," jproc website

[175] Ibid [Pratley – note 10].

[176] Gray, p. 95.; "CFS Alert", jproc website.

[177] Gray, p. 95. My emphasis. See also: PCO, Memorandum to the IPC – attachment: *Flight Service to Alert*, IPC/23-62, 25 October 1962, CSE Committees - File 72-16 Part 2, CSE ATIP A-2023-00052.

[178] Keyston to Bryce, 8 Nov. 1962.

[179] Letter, D.B. Dewar (Secretary, IPC) to Air Marshal Dunlap (Chief of the Air Staff), 20 Dec. 1962, LAC RG2-B-2 Box 134 File I-2, PCO Documents – Intelligence 60-02-09 to 66-07-22 from PCO Central Registry files.

[180] Message RCAF HQ to 408 Squadron, 14 Nov. 1962, LAC RG24 Vol. 41725 File 801-100-J269, JIC Documents – General 42-11-30 to 63-07-24 from RCAF files.

[181] Dunlap to Dewar, 4 Jan. 1963, attachment to *Memorandum for the Intelligence Policy Committee: Flight Service to Alert*, 8 Jan. 1963, in LAC RG2-B-2 Box 134 File I-2.

[182] Letter, N. G. Robertson (chairman, Intelligence Policy Committee) to Bryce (deputy minister, Department of Finance), 10 Sept. 1963, in LAC RG2 Vol. 136 File I-2-4, IPC Documents 62-01-31 to 66-09-23 from PCO Central Registry files.

[183] "Canadian Forces Station Alert", https://www.canada.ca/en/air-force/corporate/alert.html ; see also: https://www.canada.ca/en/department-national-defence/services/operations/military-operations/current-operations/operation-nevus.html; and Gray, pp. 74-75.

[184] "CFS Alert". Also discussed in several interviews.

[185] DSI [Directorate of Scientific Intelligence, DND], *Intelligence Brief no. 274*, 16 September 1958, LAC RG25 Vol. 7943 File 50028-BC-40 Part 11, *JIC Reports - Intelligence Briefs* 58-07-02 to 61-07-27 from DEA Special Registry**;** Canadian JIC, *Joint Intelligence Summary no. 297, no. 301*, 19 September 1958, 31 October 1958, LAC, RG24 Vol. 21822 [no file number] JIC Summary Part 10, JIC Periodic - *Joint Intelligence Summary* 58-01-10 to 58-12-23, from DND Joint Staff files.

[186] Canadian JIC, *Joint Intelligence Summary no. 347*, 18 December 1959, LAC, RG24 Vol. 21822, JIC Summary Part 11, JIC Periodic - Joint Intelligence Summary 59-01-09 to 60-01-22, from DND Joint Staff files

[187] Ibid., see the summaries for 20 March and 3 April 1959.

[188] Aleksandr Fursenko and Timothy Naftali, *"One Hell of a Gamble": Khrushchev, Castro and Kennedy, 1958-1964* (New York: Norton, 1997), pp. 192, 247-48. They cite an original document from the Archives of the President of the Russian Federation.

[189] Dino A. Brugioni, *Eyeball to Eyeball: The Inside Story of the Cuban Missile Crisis* (New York: Random House, 1990), pp. 385-86.

[190] Brugioni, p. 386.

[191] Quoted in "CFS Leitrim", via *Lux Ex Umbra*, accessed 2 May 2025.

[192] Raymond L. Garthoff, "US Intelligence in the Cuban Missile Crisis," *Intelligence and National Security*, vo. 13, no. 3 (1998), pp. 32, 59, note 38.

[193] David Alvarez, "American signals intelligence and the Cuban missile crisis," *Intelligence and National Security*, 15:1 (2000), p. 175.

[194] Canadian JIC Minutes, 63-02-06, JIC 943rd meeting, LAC RG25 Vol. 7908 File 50028-C-40 Part 7, *RCN Participation in USN Intelligence Gathering Operations*; 946th mtg – June 5 1963, LAC RG25 Vol. 7904 File 50028-B-40 Part 14.

[195] *Review of Canadian SIGINT Operations – 1965, IPC/5-66 (Final)*, 9 November 1966, p. 1.

[196] Ibid, Annex to IPC/5-66. Alert's operators were able to tap into the Leningrad MD tactical voice communications on a regular basis.

[197] Ibid, p. 2.

[198] Ibid.

[199] Ibid, p. 6.

[200] *Memorandum for the Intelligence Policy Committee: Review of Canadian SIGINT Operations – 1967, IPC/2-68*, 27 September 1968, pp. 1-2, 4-6, 7, CSE Committees - File 72-16 Part 3.

[201] Ibid, pp. 2-4, 6-7.

[202] *Memorandum for the Intelligence Policy Committee: Review of Canadian SIGINT Operations – 1968, IPC/2-69*, 17 September 1969, pp.1-2, CSE Committees - File 72-16 Part 4 CSE ATIP A-2023-00052.

[203] Ibid, pp. 1-3.

[204] Ibid, p. 3.

[205] Ibid, p. 3.

[206] Ibid, p. 3.

[207] Ibid., p. 4.

[208] Ibid, p. 4.

[209] Ibid, p. 4.

[210] CIA, "The CIA and Strategic Warning: The 1968 Soviet-led Invasion of Czechoslovakia," in CIA, *Strategic Warning & the Role of Intelligence*, undated, approved for release 2006, https://www.govinfo.gov/content/pkg/GOVPUB-PREX3-PURL-gpo15421/pdf/GOVPUB-PREX3-PURL-gpo15421.pdf , pp. 9-10.

[211] Ibid, pp. 9-11; CIA, Directorate of Intelligence, *Intelligence Memorandum: Military Developments in the Soviet-Czech Confrontation*, 2 August 1968, pp. 1-5 in "Declassified Documents: The Soviet-Czechoslovak Crisis Unfolds," *Strategic Warning & the Role of Intelligence*, pp. 42-46.

[212] *Memorandum for the Intelligence Policy Committee: Review of Canadian SIGINT Operations – 1969, IPC/5-70*, 13 October 1970, pp. 2-3, 6, CSE Committees - File 72-16 Part 4, CSE ATIP A-2023-00052.

[213] Ibid, p. 3.

[214] Ibid, pp. 4, 6.

[215] *Memorandum for the Intelligence Policy Committee: Review of Canadian SIGINT Operations – 1970, IPC/6-71,* September 1971, pp. 2, 7-8, CSE Committees - File 72-16 Part 5, CSE ATIP A-2023-00052.

[216] Ibid, p. 2.

[217] Ibid, p. 2.

[218] Ibid, pp. 3-4.

[219] Ibid, p. 4.

[220] *Canadian JIC Paper 2-90 (70) Soviet and East European Air Space and Maritime Intelligence Gathering Activities Against Canada*, 21 May 1970, p. 5, LAC RG146 Vol. 5745 File IA 10-4-19. JIC Assessment - Soviet Intelligence Gathering 70-05-21, from RCMP Security Service files.

[221] *Review of Canadian SIGINT Operations – 1970,* pp. 5-6.

[222] Ibid, p. 7. Those Alert veterans interviewed did not recall doing ELINT intercepts.

[223] J.E. Dornan, Coordinator Production, *Memo to the Director, re: SIGINT Program – 1971-72*, 15 May 1970, CSE A220 Committees File 3-1 Part 2, CSE ATIP A-2023-00034.

[224] *Memorandum to the IAC: Review of Canadian SIGINT Operations – 1971*, August 1972, p. 9, CSE Committees - File 72-16 Part 5, CSE ATIP A-2023-00052.

[225] Ibid, pp. 5-6.

[226] Ibid, p. 6.

[227] *Memorandum for Minister of National Defence: STANAVFORLANT Unscheduled Surveillance Mission*, 16 March 1971, in DND DHH 73/1223 Box 225 File 2578, DND Int Documents - Intelligence-General 69-02-25 to 72-08-16, from DND Office of the CDS files.

[228] *Review of Canadian SIGINT Operations – 1971*, pp. 7, 8, 10.

[229] Ibid, p. 10. A PUSHER also was installed at CFS Bermuda in 1973-74.

[230] Donald C. Daniel, “Navy”, in *SAFRA* 2 (1978), p. 155.

[231] Ibid, pp. 154, 155.

[232] Daniel, “Navy (VMF)”, *SAFRA*, 4 (1980), pp. 202, 206.

[233] Daniel, “Navy” *SAFRA*, 5 (1981), p. 143.

[234] Daniel "Navy" *SAFRA*, 3 (1979), p. 75; Daniel, "Navy (VMF)," *SAFRA* 4 (1980), p. 198 noted that the downturn in new SSBN construction coincided with an upturn in building general-purpose subs.

[235] Daniel, "Navy," *SAFRA*, 6 (1982), pp. 211, 213, 214.

[236] Pelham G. Boyer, "Navy", *SAFRA*, 13 (1989), pp. 217-19.

[237] O'Neill, vol. 3, Chapter 10, pp. 14-15.

[238] Letter, E.M. Drake (Director CBNRC) to BGen N. H. Ross (DGIS, DND), 11 Dec. 1968, re: *Paper on Canadian Special Communications Facilities*, CSE A220 Committees File 3-1 Part 2, CSE ATIP A-2023-00034.

[239] O'Neill, vol. 3, Chapter 9, p. 52.

[240] Ibid, Chapter 10, p. 8. Emphasis added.

[241] Ibid, Chapter 11, p. 86. Emphasis added. It is not clear if these comments (August 1969) refer to the requested report on the movement of Russian submarines or to a different document.

[242] Ibid, p. 86.

[243] Letter, Ambassador Marcel Cadieux to E. R. Rettie (Director of Communications Security, DEA), 30 March 1971, p. 3, reporting on visit to NSA, GAC Special Registry File 29-1-1 Part 5.

[244] Minutes, IAC, 15 November 1973, p. 5, briefing by Major-General Reg Weeks (Director General Intelligence and Security), PCO Special Registry "IAS Files" Box 2 File S&I 2-1-1.

[245] Letter, Cloutier to Robertson, 23 August 1974, and Annexes A-C, CFS Alert and Canadian Sigint Program CBNRC, Summary of Supply and Distribution of Intelligence in Canada, prepared for ICSI meeting 74-09-04 PCO Special Registry "IAS Files" Box 2 File S&I 2-1-1.

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[256] Ibid, pp. 1-2.

[257] Ibid, p. 2.

[258] CSE, *Analysis of the Intelligence Advisory Committee's Use of SIGINT*, distributed 24 July 1992, para. 4, CSE 1155 Intelligence Reports - IAC File 1, CSE ATIP A-2024-00028.

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