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THE STRATEGIC DEFENCE OF NORTH AMERICA

Prepared for the
Standing Committee on External Affairs and National Defence
of the
House of Commons

by

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DEVELOPMENTS FROM 1945 TO 1972

The Rise of the Air-breathing Threat to North America

early 1950s	Bull (B29)	
1956	Bison, Bear	still operational in 1985
1985	Bear H in production with ASM	

WWII type air defence capable of attrition of perhaps 5% to at most 25% against bombers

This type of defence, based on interceptor aircraft, ground radars to detect the bombers and control the interceptors, antiaircraft guns, and surface-to-air missiles was installed in North America in the 1950s.

At its peak in the early 1960s there were 2,600 interceptors, 256 ground radars, and 90 AA missile and gun formations in North America. Of these about 200 CF-100 interceptors, and 28 large radars, were manned by Canada, and some additional aircraft and radars located in Canada were manned by the USAF.

The provision of air defence since WWII faces an acute problem of identifying civilian air traffic. Very extensive information needs to be made widely available regarding flight plans and last-minute changes. But when communications fail to satisfy the defences the ultimate means of identification is visually, by an interceptor aircraft.

Had the Soviet bombers carried WWII type conventional bombs, this defence would have exacted a heavy penalty for repeated attacks, and would have reduced the damage that could have been inflicted on North American cities.

However, after the first Soviet test of a nuclear fission device in 1949, and of a fusion device in 1953, it could be assumed that their intercontinental bombers would be armed with nuclear weapons. By 1960 there were about 150 Bison and Bear bombers in service, each probably armed with 2 hydrogen bombs.

In remembering what weapons appeared, and when, it is important to recognize that decisions precede deployment by several years, and decisions are based on forecasts which may or may not prove to be accurate. For example, once a Soviet nuclear weapon had been successfully tested it was natural to forecast subsequent deployment of operational nuclear bombs, but not possible to know just how many would be produced or when they would appear.

The USA was about ten years ahead of the Soviet Union in its early buildup of a nuclear stockpile, and had more than enough bomber aircraft based in America, Europe, Africa, and Asia to deliver the weapons.

Deterrence

In 1954 the American Secretary of State, John Foster Dulles, announced the doctrine of massive retaliation, according to which the USA would use its striking power to punish aggression, whether against itself or its allies.

Between 1950 and 1960 there was a state of unilateral nuclear deterrence between West and East. It will probably never be known what particular aggressions were prevented during that period by the unilateral nuclear deterrence. It is known that the superior American nuclear force was never used, in this period of the Cold War which included the Korean War, the formation of the North Atlantic Alliance and the Warsaw Pact, the Berlin crisis, the Hungarian uprising, and the Suez crisis.

By the mid 1950s it was evident that the state of unilateral nuclear deterrence would soon come to an end as the Soviets built up their strategic striking force. Defence would not prevail against hundreds of nuclear bombs. The only practical expedient was still nuclear deterrence, but soon it would be mutual rather than unilateral.

The Need for Early Warning

Prior to the 1960s the means of strategic deterrence resided with the bomber aircraft. Based on large airfields in well-known locations, they were extremely vulnerable to a surprise attack by nuclear weapons. One thermonuclear bomb delivered with mediocre accuracy would destroy every bomber on the base. With the memory of Pearl Harbour still fresh, the possibility of a war that began with a surprise attack was taken very seriously indeed.

Thus the maintenance of strategic deterrence, which in the 1950s required only that the US Strategic Air Command's bomber aircraft be capable of offensive operations, would demand in the 1960s that the bombers be able to survive a surprise nuclear attack on their home base.

The way to save the bombers was to get them off the ground before the bombs fell, whether or not they were armed and ready to counterattack. This required early warning, preferably a couple of hours.

The routes by which bombers of the 1950s and 1960s would come from the bases in the USSR to those in North America lay across Northern Canada, or along the East and West coasts of Canada. Early warning could be obtained by placing lines of radars across these routes. Two such lines were built across the Canadian north: the DEW line and the Mid Canada Line, both coming into service in 1957. Detection was extended over the sea by American radar-equipped aircraft flying between Iceland and the Azores, and between Alaska and Hawaii, by American radar picket warships off the US coasts, and by Texas tower platforms mounted on the seabed.

Early warning had other uses, of course, such as alerting of the national leadership and of the active defences. But the main objective was to preserve the strategic deterrent. For this purpose the operations of the active defences were modified, giving priority to defence of SAC bases rather than to protection of population centres.

The problems of identification and early warning are of continental rather than national dimensions. The operations of the radars, interceptors, and communication of the warning and control systems had little connection with the US-Canadian border, and the evident need for constant effective cooperation led to the formation of NORAD in 1958.

Although Canada did not operate any of the offensive weapons on which the deterrent depended, its territory was made available to operation of the US Strategic Air Command for overflights, staging, refuelling, and dispersal. In addition to their 40 bases in the continental United States,

SAC bases were located in Goose Bay and Stephenville, as well as in Alaska, Greenland, and 22 in other countries. This widespread network was made necessary by the limited range of the aircraft that made up the majority of the inventory of the 1950s.

The Intercontinental Ballistic Missile

Using knowledge acquired during World War II, mainly by the Germans, both USA and USSR initiated aggressive programs to develop long range rocket weapons.

Once multistage rocket propulsion had been mastered, ranges and payloads were extended very rapidly. Tactical surface-to-surface ballistic missiles with nuclear warheads were deployed by both USA and USSR. In 1957 the Soviets launched the first earth satellite, the famous Sputnik, into orbit. Obviously if they could put a payload into orbit around the earth, they could deliver a considerably larger payload to any point on the earth. The Intercontinental Ballistic Missile had arrived.

The rocket employed to launch Sputnik was an SS-6, a few of which were deployed as ICBMs in 1959. Forecasts of a large deployment faster than could be matched by the USA produced fears of the 'missile gap'. In fact the USA built ICBMs faster than the Soviets, their total not being surpassed until 1969. However, the Soviet ICBMs were very real, and by 1964 the number exceeded their inventory of intercontinental bombers.

ICBMs faced North America with a threat more acute than did bombers. The missiles travelled at thirty times the speed of subsonic aircraft. In 1960 no possibility of interception existed. The radar systems built to detect aircraft would not detect missiles. However it was possible to design very large and powerful radars that could detect missiles in flight, and by locating them where they could see the apex

of the trajectories from the USSR to the USA it would be possible to give about fifteen minutes of warning prior to impact.

The BMEWS system was deployed in Alaska, Greenland, and England. It could give an estimate of the general area in which a missile would impact. BMEWS could also detect satellites, both operating and defunct, together with the accumulating debris such as spent rockets which remained in orbit around the earth. Later on another early warning system was deployed in geosynchronous satellites, carrying infrared sensors able to detect the heat from large rockets, and thus provide about thirty minutes of warning.

NORAD soon found itself operating two different types of warning systems, against a background of unidentified aircraft and of objects in orbit. In order to achieve the conflicting objectives of assured identification of hostile action but minimum sounding of false alarms it was essential to collect intelligence of many kinds from worldwide sources, including an increasing number of devices to monitor space activity, and integrate it in the Headquarters in Colorado Springs. SAC and other users had to modify their alerting procedures so that they could take steps to survive attack given warning likely to be no more than ten or twenty minutes.

The Submarine-Launched Ballistic Missile

Although the USSR were the first to put ballistic missiles on submarines, it was not until 1968 that they deployed their SS-N-6 missiles on Yankee class submarines and instituted regular patrols off both coasts of North America. These missiles, and their even more capable successors can reach any target in North America and would give less warning than available from ICBMs with a longer trajectory. Bomber bases located near the coasts of the United States were particularly exposed to attack for which warning would be minimal.

NORAD obtains warning of SLBM attack in three ways. One is by the monitoring of the movements of Soviet submarines, carried out by the navies of several of the North Atlantic navies, including Canada. A second is through the Satellite Early Warning System, which detects the hot booster rocket exhaust of SLBMs as well as ICBMs and gives a rough position of the launching submarine. The BMEWS radars were too far north to detect the most probably trajectories of SLBMs, but other radars were installed along the US coasts for this purpose.

Ballistic Missile Defence

Although the problem of hitting a small hard ballistic missile reentry vehicle moving at a speed of four miles a second seemed insuperable in the 1950s, research was pursued. By the end of the 1960s, with powerful and agile phased array radars, rapid high capacity computers, and antimissile missiles with very rapid acceleration it became possible to intercept an incoming reentry vehicle near the end of its intercontinental trajectory, with a miss distance likely to be within a mile. To destroy the target it would be necessary to use a large nuclear warhead for high altitude interception, or a smaller neutron warhead for interception within the atmosphere.

In the late 1960s the US planned an ABM system labelled 'Sentinel', intended to give a modest level of defence to the entire country, with emphasis on the protection of cities. Later this was reduced to a less ambitious plan called 'Safeguard', intended to defend retaliatory weapons sites and Washington, D.C. Safeguard would have involved Perimeter Acquisition Radars, Missile Site Radars, and antimissile batteries sited around the periphery of the USA, with some additional radars and missiles in more central locations. The first phase of construction began in 1971 at Grand Forks, ND, and Malmstrom, Montana, both centres of Minutemen ICBM complexes. The USSR built a comparable system around Moscow.

SALT I

During the period 1969 to 1972, while SALT I was being negotiated, a state of mutual and stable nuclear deterrence existed between the USSR and the USA. Each had a large and invulnerable ICBM force (the US remained at 1,054 ICBMs from 1967 to 1980, the Soviets increased from 1,050 in 1969 to 1,527 in 1972). The USA had a large and invulnerable SLBM force (which remained at 656 missiles from 1967 to 1979) while the Soviets had a smaller but growing force (rising from 160 SLBMs in 1969 to 560 in 1972). The number of long range bombers deployed by the United States dropped from 560 to 455, while the Soviet complement went from 150 to 140.

Both superpowers were probably fairly satisfied with the situation, but concerned over the possibility that ballistic missile defence would consume resources and stimulate a greater buildup of missiles to overcome the new defences. SALT I froze the offensive forces at the level of 1972, even though these were not equal and symmetrical, and, in the ABM Treaty, put severe limits on the size and scope of ballistic missile defences. Following a protocol to the treaty signed in 1974, the US dismantled its antimissile missiles and retained only the Perimeter Acquisition Radar Attack Characterization System (PARCS) at Grand Forks.

Canadian Contribution 1945-1972

The biggest Canadian contribution to North American defences was 28 Pinetree Line of ground control radars in Southern Canada and 200 CF-100 all-weather interceptors on five Canadian bases. When early warning of bomber approach became vital, Canada designed, financed, and operated the Mid Canada Line, and cooperated in the installation of the DEW Line.

Further efforts which proved abortive included the Velvet Glove air-to-air missile, which would have extended the usefulness of the subsonic CF-100, and the design of the supersonic Avro Arrow, which would have been the best interceptor aircraft of its time, but was abandoned in 1959. The CF-100's were replaced by 66 American F-101B Voodoo interceptors. Deployed to Bagotville, Chatham, and Comox in 1961, they were armed with nuclear air-to-air missiles in 1964. In 1970 they were replaced by 60 F-101F's.

The other nuclear air defence weapon deployed in Canada was the Bomarc surface-to-air cruise missile. Fifty-six of these were based in North Bay and Lamacaza. They were part of a coast-to-coast chain, with six other Bomarc bases in the Northern USA.

The manual system of filtering, transfer, processing and display of data from the radar stations and flight planning authorities was replaced by an electronic system known as SAGE. The Canadian part was controlled from a large SAGE computer in the underground operations centre at North Bay.

As the ballistic missile threat surpassed the bomber threat, and little could be done to defend against the greater threat, the effort devoted to atmospheric defence of North America was reduced. The Mid Canada Line was deactivated in 1964, along with early warning activities over the sea. The number of stations on the DEW Line was reduced from 81 to 31 (21 in Canada), and the number of long range radars went down from 250 to 80, involving the closure of 11 Pinetree radars and the assumption by Canada of all 28 that remained. Bomarc was removed in 1972, in both countries, along with most of the other surface-to-air batteries in the USA. The total number of interceptors came down to about 650, compared to the peak of 2,600.

DEVELOPMENTS FROM 1972 TO 1985

MIRVS

As rocket payloads became larger, and nuclear warheads achieved higher yield-to-weight ratios, it became possible to put several warheads into one missile. When these fell with uncontrolled separation from the trajectory of the parent missile, the destructive potential against a large soft area target such as a city would be increased, as would the probability that some of the warheads would succeed in penetrating a BMD. But when independent guidance of each warhead became possible, so that each would attack a separate designated target, the possibility arose that one missile could destroy several opposing missiles in their silos, resurrecting the spectre of the surprise counterforce first strike.

The USA introduced the Multiple Independently Targeted Reentry Vehicle, or MIRV, in 1970, on the Minuteman III ICBM, and in 1971 on the Poseidon C3 SLBM. The number, energy yield, and accuracy of these did not constitute a threat to Soviet ICBMs. In 1975 the Soviets deployed MIRV on their SS-17 ICBMs, soon following with SS-18 and SS-19. The large payload of these three missiles permitted 4, 10, and 6 warheads to be mounted, and, with their large yields, as their accuracy is improved they are posing a threat to the American Minuteman ICBMs. By 1978 the long range Soviet SS-N-18 SLBM appeared with 7 MIRVs, and in 1981 the SS-N-20 was deployed on the huge Typhoon submarine with 9 MIRVs.

Concern over the destabilizing properties of MIRVs led to their inclusion in the SALT II negotiations.

Long Range Bomber Aircraft Since 1972

The subsonic long range bomber aircraft which first appeared in the mid 1950s still represent the mainstay of the strategic air breathing forces of 1985, for both the USA and USSR. However, the useful lives of the American B52G and the Soviet Bear are being extended by giving them air launched cruise missiles. The ALCM can be sent from the aircraft before it had to penetrate air defences, and uses terrain guidance to follow a programmed path over hundreds of miles to its designated target. New Bear H aircraft adapted for AS-15 ALCMs with a range of 1,600 n mi are being produced today.

The USAF is to be equipped with a new supersonic bomber, the B1-B, also able to carry ALCMs, and it is expected that a Soviet counterpart, the Blackjack, will be in service about 1988.

Strategic Submarines

The Soviet Yankee SSBNs needed to come down from the bases in the Kola peninsula, cross the Greenland-Iceland-United Kingdom gap, and take up patrol positions within about 1,000 miles of North America before they had important strategic targets within range, or to come most of the way across the Pacific. The last Yankee joined the fleet in 1975, and since then over a dozen have had their missiles removed in order to comply with the SALT I limit of 950 SLBMs in modern submarines. Since 1973 a total of 38 Delta class SSBNs have been added, 22 with SS-N-8 missiles having more than twice the range of the SS-N-6 in the Yankee submarines, 14 with the SS-N-18 of which one version carries 7 MIRVs, and two with the new SS-NX-23. Finally, the enormous Typhoon, which displaces 25,000 tons submerged, carries twenty SS-N-20 SLBMs, with 4,500 n mi range and nine MIRVs in each missile. These Delta and Typhoon submarines based in the Kola peninsula do not need to leave the northern seas in order to

threaten targets in North America, and those based in Asia need not approach close to the Pacific Coast.

A new sea-launched cruise missile, the SS-NX-21, is small enough to fit into the torpedo tubes of Soviet attack submarines. With a nuclear warhead and a range of 1,600 n mi it will give a strategic capability to several classes of submarines heretofore confined to the antishipping and antisubmarine roles.

Continental Air Defence, 1972 to 1985

Although the overall effort devoted to continental antibomber defence continued to decline after 1972, some positive steps have been taken.

BUIC (1 in St. Margarets)

ROCCs (2 in North Bay)

CF-18A fighters

36 to replace CF-101 Voodoos for North American air defence

USAF providing 252 fighters from TAC

90 F-15s Alaska

126 F-4s, 35 F-106s ANG

augmentation from naval, marine and air forces

AWACS

North Warning System

Modern minimally attended radars on the DEW Line

OTH for E, S, W

Space Surveillance

becoming more important

- necessary to catalogue background of older orbiting material
- necessary to know activity of surveillance satellites

NORAD Space Defence Operations Centre

- obtains information from SEWS
  - BMEWS
  - Spacetrack radars in Turkey, Aleutians
  - optical tracking cameras in US, St Margarets, South Korea, Italy, Hawaii, New Zealand
  - radar equipped ship
  - radars in Pacific Islands
  - radars in Florida
  - naval space surveillance system in USA

NORAD also obtains EW on ballistic missiles forces

- PARCS (North Dakota)
- radars in Pacific and Atlantic islands
- anti-SLBM radars on coastal sites

SALT II

The framework of the SALT II agreement set equal numerical limits for each side, but allowed freedom to mix systems differently within agreed totals. Bomber aircraft, cruise missiles, and air-to-surface ballistic missiles (ASBMs) were included, as were MIRVs. No mention was made of any defensive systems, the ABM Treaty remaining unchanged.

The Soviets' 818 modern SS-17, 18, and 19 ICBMs each have versions with and without MIRV and the USA has 550 MIRVed Minutemen III. Even with 100 MIRVed MX missiles both powers would remain under the agreed limit of 820 MIRVed ICBMs.

Another SALT II limit was 1,200 for the total number of MIRVed ICBMs, SLBMs, and ASBMs. With less than 820 MIRVed ICBMs and no ASBMs the USSR is allowed 380 MIRVed SLBMs, a number they have not yet reached. They have removed missiles from several Yankee SSBNs in order to keep within the SALT I limits of 62 modern SSBNs and 950 SLBMs.

SALT II set at 1,320 the ceiling for a total of MIRVed missiles plus aircraft equipped with ALCM. With about 1,100 MIRVed missiles the USSR could then deploy 220 bombers with ALCM. It seems probable that they will elect to use some of the 220 for more MIRBed SLBMs.

The only SALT II ceiling which constrains the Soviet forces at present is the total number of strategic nuclear delivery vehicles, set at 2,400 at the time of signing in 1979, to be reduced to 2,250 by the end of 1980.

Even though SALT II was not ratified by the US government, its provisions have been observed by both parties, in the main if not in every detail. SALT II was due to expire at the end of 1985.

Removal of the 580-odd SS-11 and SS-13 ICBMs and 350-odd SS-N-6 SLBMs would represent a reduction of about 38% of the total inventory of Soviet strategic nuclear delivery vehicles, although it would leave over 85% of the warheads still operational.

The Case for Integrated Defence of the North American Continent

- a nuclear attack against North America could be delivered
    - by ICBMs, coming from the north across Canada
    - by SLBMs, coming from the northeast or east from the Atlantic
      the northwest or west from the Pacific
    - by bomber aircraft, coming from the northeast, north, or northwest
      over or close to Canada
- early warning can be provided, using a worldwide system of sensors and a worldwide intelligence network
- deterrence of nuclear attack rests with the offensive forces based in the United States,
  namely their ICBMs
  their SLBMs
  their bomber aircraft

- the prime role of NORAD is to provide these forces with early warning

- the function requires the use of Canadian territory and airspace and the full cooperation of Canada

- future problems which will probably have to be faced before the end of the century, such as

    - defence of North America against the ALCM
    - defence of North America against the SLCM
    - use of new technology to defend North America against the ICBM and SLBM

    - may also need the use of Canadian territory and airspace, and the full cooperation of Canada

- a very good basis from which to arrive at sensible continental-wide decisions would be the excellent sharing of knowledge and experience that has been characteristic of NORAD since its foundation in 1958.