The *Swallow* and *Caspian Sea Monster* vs. the *Princess* and the *Camel*: The Cold War Contest for a Nuclear-Powered Aircraft

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Introduction

Little noted publicly—though it was the subject of continuous intelligence interest—was a competition between the United States and the Soviet Union from the mid-1950s into the early 1960s to develop a nuclear-propulsion system for very long-range and long-endurance strategic bomber and reconnaissance aircraft. Nuclear scientists involved in the competing American and Soviet nuclear weapons development programs recognized the possibility that nuclear power could be harnessed not only for generating electric power but also for propulsion of surface ships and submarines—and even for powering aircraft. In the United States, as early as 1942, Enrico Fermi envisioned the use of nuclear power to propel aircraft. In June 1952, Aleksandr Kurchatov, chief designer of the Soviet atomic bomb, and other Soviet scientists thought nuclear-powered "heavy aircraft" could be built.[1]

The United States initiated its Nuclear Energy for Propulsion of Aircraft Project in May 1946. That research program was ended in 1951. However, renewed efforts would be undertaken by a growing number of governmental and private contractor organizations. In 1951, the Atomic Energy Commission (AEC) and the US Air Force (USAF) placed contracts with General Electric and Convair (General Dynamics). In the next few years, the Oak Ridge National Laboratory in Tennessee and the National Reactor Testing Station in Idaho, as well as Pratt & Whitney and Lockheed, were brought into the program.[2]

A number of proposals for producing an aircraft to be equipped with a nuclear propulsion engine as a flying-testbed were advanced but never approved. From July 1955 to March 1957, the Air Force flew two modified B-36 bomber aircraft 47 times testing massive radiation shielding by carrying as a "passenger" a three-megawatt test reactor, but no test of a nuclear propulsion reactor actually took place.[3]

Unknown at the time in the United States, the most significant consequence of these efforts was the impact they had on Soviet weapons planners. A post–Cold War Russian account of this period revealed that Soviet intelligence had determined that a US Air Force NB-36H (modified bomber) test flight in late December 1955 had been a successful test of radiation shielding of a nuclear reactor on board the bomber. The Soviets concluded that the flight was a step forward in a program to develop a nuclear-propelled bomber.

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The NB-36H in a test flight over Texas accompanied by a B-50. It was meant to test shielding of a reactor that was to power an aircraft nuclear propulsion engine. Source: https://commons.wikimedia.org/wiki/File:NB-36H_with_B-50,_1955_-_DF-SC-83-09332.jpeg.

This interpretation stimulated Soviet scientists working on aircraft nuclear propulsion (ANP).[4]

From 1952 to 1955 in the USSR there had been discussions and studies, even including the construction of full-scale mockup of a nuclear-powered bomber. The mockup was based on studies by leading Soviet aircraft and missile designers Vladimir Myasishchev (the designer of the *Bison* bomber), Andrei Tupolev (credited with the *Bull*, *Badger*, and *Bear* bombers), Semyon Lavochkin (the designer of the *Burya* strategic cruise missile), and Sergei Korolev, who designed many missiles, including the first Soviet intercontinental ballistic missile (ICBM) and *Sputnik*, the first artificial Earth satellite to have been launched. But ANP had not been a Soviet priority until 1955.[5]

From 1956 into 1961, the reinvigorated Soviet ANP program focused on development of an ANP testbed aircraft termed "Aircraft 119" or *LAL* (*Letayushchaya atomnaya laboratoriya*, the Flying Atomic Laboratory). It was affectionately called the *Swallow* (*Lastochka*). The *Swallow* was an adaptation of the largest Soviet bomber at the time, the four-engine turboprop Tu-95 (NATO code-name *Bear*). It was created in a large hangar at a nuclear complex near Semipalatinsk in Kazakhstan.

Extensive experimentation and analysis were undertaken in the laboratory, and multiple delays were experienced in working on the reactor. The *Swallow* finally took flight with a reactor on board (but not providing propulsion) in the summer of 1961. These flights, like the NB-36H flights in the United States, were successful, but it quickly became apparent that the problem of shielding the interior of the aircraft from the reactor's radiation was too great. In addition, the success of conventionally powered long-range aircraft and the development of ICBMs weakened the case

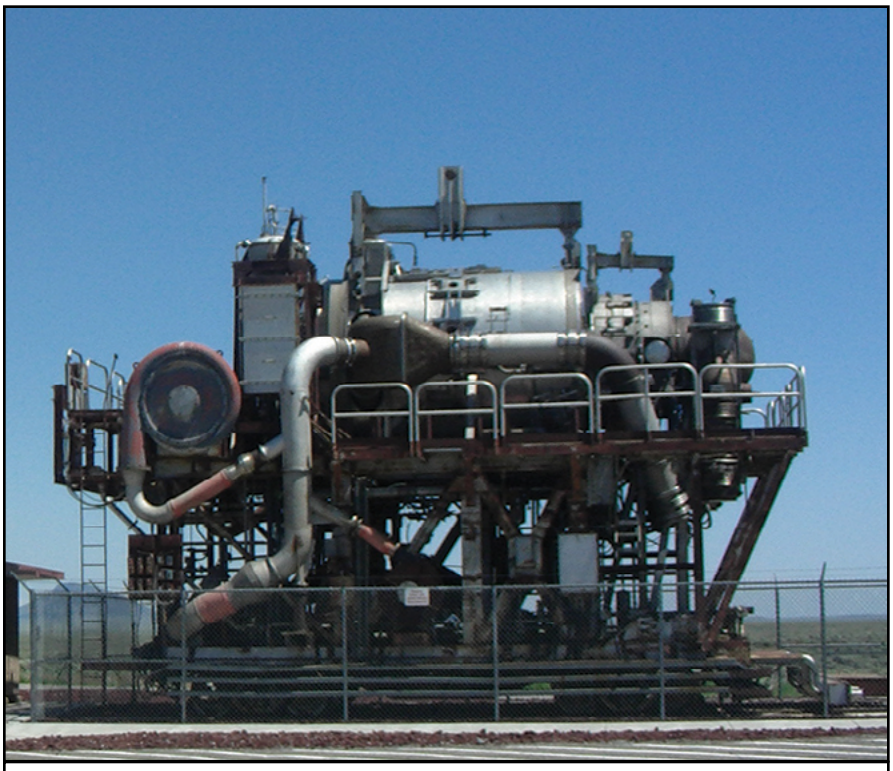
An image purporting to be of the *Swallow*, a modified Tu-95 designated the Flying Atomic Laboratory. Date and provenance of photo unknown. Source: https://en.wikipedia.org/wiki/File:Tu119side.jpg.

for trying to obtain nuclear propulsion of aircraft.[6]

At the same time as the Soviet Union pursued the quest for nuclear-powered aircraft, the United States had been active. From the effort's early beginnings in 1946, US interest had focused on developing a more advanced and powerful nuclear turbojet engine for a strategic intercontinental bomber. The principal program sponsored jointly by the AEC and the Air Force during 1958–61 was dubbed the *CAMAL* system, shorthand for a nuclear "Continuously Airborne Missile-launching And Low-level" penetration system (the use of *Camel* in this article is an exercise of poetic license).

ANP in general, and the *Camel* in particular, had ardent supporters in the Air Force and AEC. It enjoyed special attention and strong bipartisan support from the Joint Committee on Atomic Energy in the Congress. There also were doubters. A series of special commissions and senior officials in the Department of Defense and the White House sought on several occasions to limit or discontinue the costly program. But it persisted.[7]

In addition, the US Navy from 1955 had pressed for a program to develop a nuclear-powered turboprop flying-boat for long-endurance reconnaissance and early-warning missions. The requirements for such a system were less demanding than for an intercontinental penetrating bomber, and there were somewhat fewer demanding conditions for a seaborne aircraft.



One of two experimental reactors for development of aircraft nuclear propulsion on display at the Idaho National Laboratory as of July 2009. Photo: Wtshymanski released to Creative Commons 3.0, December 2009.

Still, the basic problems of large reactors and radiation shielding remained. Britain had three mothballed seaplanes called the *Princess* class, which it was prepared to sell to serve as testbeds for a nuclear turboprop system to power a seaplane. Funding and authorization of the program, however, were eventually denied, so the *Princess* seaplane testbed never actually served its intended purpose in the US ANP program. The Navy, however, continued research on a turboprop nuclear engine for some years.[8]

The focus of these and many other strategic efforts, of course, remained on ensuring a strategic strike capability for deterrence and, if necessary, for waging global nuclear war. Strategic bomber aircraft had been the principal deterrent in the 1940s and 1950s, but by the 1960s ballistic missiles were rapidly becoming the strategic weapon delivery system of choice. Nuclear-powered bomber aircraft remained a distant and less-than-assured alternative, and it became apparent that even technical success in developing them was unlikely to yield results justifying the costs, which in the United States had mounted to about $7 billion by 1961.[9]

Other considerations remained, including the interests of those who were incurring the expensive development costs and stood to gain from hoped for procurement of the systems. Not least among these considerations was the very fact of competition with the Soviet Union. Knowledge (or at least belief and fear) that the Soviet adversary was working to develop the same capabilities fueled the competition. So both intelligence—and even incomplete intelligence—on the adversary's

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pursuit of the same weapons played a role in perpetuating ANP efforts.

Reaction in the United States to the publicly unexpected Soviet successes in launching the first ICBM in August 1957 and the first artificial satellite of Earth (*Sputnik*) in October 1957 led to the creation in public and political minds of the infamous "missile gap." Largely unnoticed publicly, a lesser concern over an "ANP gap" also arose. This article is, to my knowledge, the first account of how an "ANP gap" influenced (and was influenced by) national intelligence estimates (NIEs) and fed a largely internal but sometimes intense debate over ANP among those most concerned in the United States.

The Intelligence Estimative Record

The annual top secret national intelligence estimate on the Soviet Union published on 12 November 1957 (NIE 11-4-57, *Main Trends in Soviet Capabilities and Policies, 1957–1962*) for the first time in such estimates referred to ANP, stating on page 31:

> *No positive evidence of Soviet research specifically devoted toward nuclear propelled aircraft has been obtained. However, we estimate that they are probably now engaged in development and testing of reactor components and subsystems.*

The NIE also suggested that by 1962 the Soviet Union might be able for propaganda purposes to demonstrate some nuclear-power contribution to an aircraft test flight.

Over the following four years, 1958 through 1961, 11 NIEs addressed at least briefly the subject of a Soviet ANP program.[a, 10] Two NIEs were issued in 1958, and they were the most alarmist concerning possible Soviet capabilities.

The first, the Special NIE 11-7-58 issued on 5 June 1958, raised the possibility of an early Soviet test flight of a nuclear testbed for a future bomber. The Air Force, however, placed a dissenting footnote expressing its "belief" that "an aircraft nuclear propulsion system could now be undergoing flight tests in a prototype airframe." (p. 5)

NIE 11-4-58, issued on 23 December 1958, went a step further. It expressed the belief that "within the next few years the USSR could fly an airborne nuclear testbed." This time the intelligence chiefs for the Joint Staff and Navy took a footnote expressing the belief that such a testbed could be flown "during 1959," and the Air Force separately even stated that "an aircraft nuclear propulsion system could now be undergoing flight tests in a prototype airframe." (p. 37) In addition, the estimate referred to a newly identified bomber prototype (code-named *Bounder*):

> *The possibility for development of BOUNDER with a more advanced propulsion system exists, and the design intent for a nuclear-powered vehicle cannot be excluded at this time. However, present information is inadequate to permit an estimate of BOUNDER's probable development.* (p. 38)

The *Bounder*, later abandoned by Moscow as a failed attempt to find a successor to the marginally effective *Bison*, was never considered as a nuclear engine testbed. The Air Force after some time ended consideration of it as a part of the Soviet ANP program.

A hiatus in attention to ANP in NIEs occurred between December 1958 and February 1960, owing to the delayed approval (on 9 February 1960) of the two principal relevant estimates of 1959, NIE 11-8-59 on Soviet strategic attack capabilities and NIE 11-4-59 on overall Soviet military capabilities and policies. On the subject of ANP, these two NIEs contained precisely the same language, which emphasized the lack of concrete basis for any firm pronouncement. The NIEs noted that ANP had the potential to provide "a significant improvement over present Soviet heavy bombers," but they acknowledged on page 17 that

> *although there are indications of Soviet interest in nucle-*

a. Eight of these 11 estimates included footnotes of dissent by the assistant chief of staff, intelligence, USAF, proposing even earlier Soviet achievements than those estimated as possible in the main text. All of the dissents from 1958 through 1960 were taken by Maj. Gen. James Walsh, and the one dissent in 1963 was taken by Maj. Gen. Jack Thomas; both generals were known as "hard-liners" in evaluating Soviet capabilities and intentions. No dissents were taken by Maj. Gen. Robert Breitweiser, who served as the chief of USAF intelligence from 17 July 1961 through 14 March 1963.

ar-powered aircraft, no specific Soviet program directed toward the development of such an aircraft has yet been identified. We believe that the Soviets have such a program underway, but believe it unlikely that they will have any nuclear-powered bombers in operational status within the period of this estimate [to mid-1964].

The Air Force dissented in both estimates:

The Assistant Chief of Staff, Intelligence, USAF, believes that in view of the tactical and psychological advantage of a nuclear-powered bomber, the state of Soviet aviation and nuclear technology and the evident Soviet interest in the development of such an aircraft that a small number of nuclear [-powered] *bombers may appear in operational status by the end of the period of this estimate.*

No other agency joined in this or any of the other similar Air Force dissents in later estimates.

In 1960, three NIEs referred to ANP prospects: NIE 11-60 (12 April 1960), NIE 11-8-60 (1 August 1960), and NIE 11-4-60 (1 December 1960). All posited possible ANP testbed flights sometime in the few years after their publication, but no nuclear-powered aircraft in operational service was foreseen during the five years projected by these estimates (through 1965). There was no evidence of concrete activity on ANP in the Soviet Union to report. All of these estimates included the now standard Air Force dissenting footnotes predicting a possible operational flight by the end of the NIE time horizon.

The first two sentences were replaced with one sentence indicating that the IC's judgment about modest possible Soviet advances in producing a nuclear power plant depended not on what the Soviets could do in the* future *but on whether in the* past *"the Soviet ANP program that was initiated in 1956 had progressed..."

Following the 1959–60 period of marking time in estimates of the Soviet ANP program, 1961 began a gradual dismissal of ANP. NIE 11-8-61 (7 June 1961) stated rather lamely on page 21:

There are indications that the Soviets have been engaged in an effort to produce some sort of aircraft nuclear propulsion (ANP) system. We estimate that in 1960 the Soviets were capable of flying a nuclear testbed with at least one nuclear power unit providing useful thrusts during a phase of the flight, but there is no evidence that testbeds or prototypes have actually been built.

Two more NIEs in 1961 addressed ANP using identical paragraphs except for an interesting change in the second, which based remaining uncertainty not on *future* Soviet progress but rather on knowledge of *past* Soviet efforts. The first, NIE 11-4-61 (14 August 1961), stated on page 4:

There have been fragmentary indications of a Soviet program to develop an ANP system over the past five years. If active and successful development is pursued, such a program could produce an aircraft nuclear power plant as early as 1963-1964. This might permit a first militarily useful nuclear-powered aircraft to become available in 1966. However, the lack of evidence of the program, the decreasing frequency of Soviet statements on progress, and the apparent general level of their reactor technology indicate that the effort may have encountered serious obstacles. Therefore, we believe it unlikely that the Soviets will obtain a militarily useful nuclear-powered aircraft during the period of this estimate [to 1966]. *However, considering the propaganda impact, the Soviets might at any time fly an aircraft obtaining part of its thrust from nuclear heat.*

The second, an estimate on Soviet nuclear programs, NIE 11-2-61 (5 October 1961), reproduced (p. 13) this entire paragraph with one change: the first two sentences were replaced with one sentence indicating that the IC's judgment about modest possible Soviet advances in producing a nuclear power plant depended not on what the Soviets could do in the *future* ("if active and successful development is pursued" in the earlier NIE), but on whether in the *past* "the Soviet ANP program that was initiated in 1956 [had] progressed with no major setbacks," and had been "supported continuously at a high level"—all of which were said to be "uncertain." The wording of the rest of the paragraph of course cast heavy doubt on whether these criteria had been met. There were no dissents to either estimate.

The final reference in NIEs to a possible Soviet ANP program (in mid-1963) was encapsulated in a single sentence: "The Soviet aircraft nuclear propulsion program appears to have been delayed and may have been cut back or even canceled."

There was no reference whatsoever to ANP in the final relevant estimate in 1961, SNIE 11-14-61, *The Soviet Strategic Military Posture, 1965–1970* (21 November 1961), notwithstanding its longer time horizon, through 1970. In addition, no references to ANP appeared in any of the relevant estimates of 1962. NIE 11-8-62 (6 July 1962) substituted (p. 9) a new concern over possible Soviet development of directed energy weapons (such as laser-particle weapons).[a]

After two years of silence on ANP in NIEs, Air Force intelligence (under a new chief) reintroduced a footnote to NIE 11-8-63 (18 October 1963) noting (p. 37) that a "possible nuclear-powered bomber" might be introduced in "about 1968." It was an unusual dissent because it did not object to a specific judgment in the NIE. Rather, it objected to the absence of any reference at all in the NIE to a Soviet aircraft nuclear propulsion program.

The final reference in NIEs to a possible Soviet ANP program was encapsulated in a single sentence in the conclusion of an estimate dealing with Soviet nuclear energy programs as a whole, NIE 11-2-63 (2 July 1963):

> *The Soviet aircraft nuclear propulsion program appears to have been delayed and may have been cut back or even canceled.*

Although hesitant and not conceived as an obituary notice, in effect it was.

The US ANP Lobby

Unlike the well-known missile gap, public interest in the "ANP gap" was slight. There were, however, active constituencies for a US ANP program. Within the Intelligence Community there were persistent advocates who saw possible Soviet pursuit of ANP as an additional spur to the US counterpart, particularly from 1957 to 1961, as well as a possible future capability that should be matched and exceeded. Within the Joint Atomic Energy Intelligence Committee, the Air Force and AEC members were the strongest and most consistent alarmists over possible Soviet progress on ANP.

In the broader defense policy community, the strongest supporters of the US ANP program were the Air Force, the Navy, and some in the AEC—as well as the private contractors who conducted most of the research and development, primarily Pratt & Whitney (of United Aircraft) for the Navy, and Convair (of General Dynamics), and General Electric for the Air Force. The AEC was of course a central body, in particular its Aircraft Reactor Branch and its National Reactor Testing Station in Idaho (where one of 16 separate—and widely separated—independent test centers was devoted to ANP). Finally, the Joint Committee on Atomic Energy of the Congress (and especially its Subcommittee on Research and Development) was an active and vigorous (and bipartisan) proponent of the ANP.

We noted earlier that NIEs addressed ANP for the first time in the wake of Soviet successes in 1957 in testing an ICBM and orbiting *Sputnik*. Although the ensuing debate about ANP was largely internal, advocates of an American ANP program seized on aroused public concern about Soviet technical and military prowess to spark a brief firestorm of public attention to an alleged ANP gap.

Their vehicle was a sensational article published on 1 December 1958 in the trade journal *Aviation Week*. Entitled "The Soviet Nuclear-Powered Bomber," the article argued (in the words of the journal's editor) that "once again, the Soviets have beaten us needlessly to a significant technical punch," owing to "the technical timidity, penny-pinching, and lack of vision that have characterized our own political leaders."

The article stated flatly that "A nuclear-powered bomber is being flight tested in the Soviet Union." (p. 27) It cited what it claimed to be precise details and dimensions of the aircraft and its engines, stating it

a. Concern—most strongly expressed by the Air Force—over Soviet "particle beam" or "directed energy" weapons became a major concern of NIEs in the 1970s and 1980s, fueling far more expensive US research and development costs than had ANP. Only after the collapse of the Soviet Union was it discovered (and verified on site) in 1992 that the suspected directed energy weapons development center was actually investigating a possible nuclear-powered rocket for an eventual mission to Mars.

was not a mere flying testbed such as those contemplated (but never flown) by the United States in the *Princess* and *Camel* projects. It even provided artist's sketches of the airplane and its engines. Finally, the article stated that the Soviet nuclear-powered aircraft had been completed six months earlier and now had been observed test-flying in the Moscow area.

From the tortuous intelligence assessments made on a top secret basis from November 1957 to July 1963 reviewed above, it is evident that the heart and most of the bones and flesh of the *Aviation Week* article were manufactured out of whole cloth to mobilize support for the US ANP program rather than to inform on the state of the Soviet ANP program. Yet the article did disclose some secrets found in NIE 11-4-58, which described the *Bounder*, recently observed at the Zhukovsky Flight Test Center near Moscow, although not in flight—much less nuclear-powered flight (the article appeared more than three weeks *before* NIE 11-4-58 was issued on 23 December; the source of the security leak was never traced or, at least, never publicly disclosed).[a]

President Dwight D. Eisenhower angrily declared in a press conference on 10 December 1958 that "there is absolutely no intelligence to back up a report that Russia is flight-testing an atomic-powered aircraft." Six months later, AEC Chairman John A. McCone, testifying before the Joint Committee on Atomic Energy, not only denounced the *Aviation Week* claims but also acknowledged the thin basis for the NIEs: "I think any statement made by anyone as to when the Soviet [Union] might fly a [nuclear] plane is purely a matter of conjecture. I know of absolutely nothing. I don't know of anyone in the Government that has any dependable information concerning the Soviet nuclear-powered [aircraft] program."[11]

From the mid-1950s on, a number of articles in the Soviet press mentioned the possibility of nuclear-aircraft propulsion.[12] Indeed, Soviet officials and press articles on several occasions in the latter half of the 1950s acknowledged that the Soviet Union was examining the question of a nuclear-powered aircraft, although there was no formal announcement or acknowledgment of the Soviet ANP program.

Perhaps the most authoritative statement came in November 1959 from Vasily Yemelyanov, the head of the Main Administration for the Utilization of Atomic Energy of the USSR (Glavatom). Yemelyanov was in the United States as the head of a delegation of Soviet nuclear scientists. At a press conference following a visit to the AEC's National Reactor Testing Station in Idaho (although not including the ANP reactor test facility there), he was asked if press reports that the Soviet Union had flown a nuclear-powered aircraft were correct. He said they were not: "If we had flown an atomic powered aircraft we would be very proud of the achievement and would let everyone know about it."[13]

I was serving as the interpreter for the Soviet delegation and had interpreted his reply to the newsman. Later, in private, I asked Yemelyanov about the Soviet ANP program. He told me that indeed the Soviet Union had underway a program to develop ANP—"it would be foolish not to"—but that he did not (despite his position) know the status of the program because it was "entirely in the hands of the military." His nuclear reactor specialists were no doubt consulted, and indeed had developed the reactors for Soviet nuclear submarines, but his claim to be uninformed on the state of the military ANP program was probably true.[b, 14]

Two Silent Deaths

After the flight tests of the *Swallow* in mid-1961, the Soviet leadership decided to cancel the ANP program. The Soviet decision undoubtedly was driven by the same inherent difficulties and growing doubts

a. The editor of *Aviation Week* later made a weak defense of his journal's claim that a nuclear-powered flight had actually occurred. While acknowledging it may have been overstated, he argued that "Whether or not this aircraft has actually flown on nuclear power ... is not really the point." (!) He went on to contend that the point was that the United States was falling behind in a race for a nuclear-powered bomber. (Cited in *Hearing*, 192–93.)

The *Bounder* was not actually test-flown until 27 October 1959, and thereafter for a total of 19 test flights, ending on 9 July 1961. It was then consigned to a classified aviation museum.

Radio Moscow on 1 January 1959 predicted that the Soviet Union would fly a nuclear-powered civilian airplane during the year—which of course it did not. This broadcast was cited as supporting the claim of a "successful" Soviet program in a rebuttal to criticism of the *Aviation Week* article of 1 December 1958.

b. I was assigned from CIA to serve as interpreter for both the visit to the Soviet Union of an American delegation headed by AEC Chairman McCone in October 1959 and the reciprocal visit to the United States of a Soviet delegation in November.

In 1958, in the post-Sputnik period of alarmist concern, the Air Force, the Joint Committee on Atomic Energy, and the AEC had succeeded in thwarting an initial National Security Council decision to cancel the US ANP program.

in the United States of the ultimate practicality and cost effectiveness of the effort. In fact, in the United States cancellation had been considered for three years.

In 1958, in the post-*Sputnik* period of alarmist concern, the Air Force, the Joint Committee on Atomic Energy, and the AEC had succeeded in thwarting an initial National Security Council decision to cancel the US ANP program. In June 1959, President Eisenhower agreed to sharp cutbacks in the program. In 1960 the program was further curtailed, and a decision was taken to leave the fate of the program to the incoming administration. The new administration of President John F. Kennedy reviewed the issue in early 1961, and on 28 March, impressed by the success of the US ICBM program, it decided to cancel the entire US ANP program.[15]

In the Soviet Union, when Nikita Khrushchev moved in December 1959 to establish a new military service arm, the Strategic Missile Forces, he cut back the role of strategic bombers (including cancellation of the *Bounder*—never procured beyond the test plane). Interest in long-range manned bombers, with or without nuclear-powered engines, waned.

1961 was the turning point. Discussions of ANP, even on a theoretical basis, came to an end. The US-Soviet ANP competition was over.

The Soviet abandonment of ANP, like the program's earlier commencement and pursuit, was not publicized. The change in US intelligence assessments—as noted earlier, beginning in 1960 and becoming more definitive in 1961 and 1963—was gradual because there was no concrete information beyond the absence of data on an existing program and because the Air Force was reluctant to accept the absence of evidence itself as evidence of change. In addition, until the final cancellation of the US ANP program, there was reluctance to undercut competition from the Soviet Union as part of the rationale for a US program. In fact, changing US intelligence estimates of the Soviet ANP program correlate more closely to doubts about and eventual cancellation of the US program than to what little was known of the Soviet program.

Aftermath—Not Entirely Useless Efforts

Without addressing the subject further here, it is appropriate to note that although both powers abandoned pursuit of ANP in 1961, their programs to develop nuclear-powered surface ships and submarines continued apace. Research and development work on nuclear propulsion of unmanned rockets also continued, increasingly focused on nuclear propulsion of unmanned spaceships for long-range expeditions, such as to explore Mars. In both countries, the earlier work on nuclear propulsion for aircraft contributed to their work on possible nuclear propulsion for space exploration (in the Soviet Union, this included using the facilities of the former *Swallow* "nest" near Semipalatinsk).

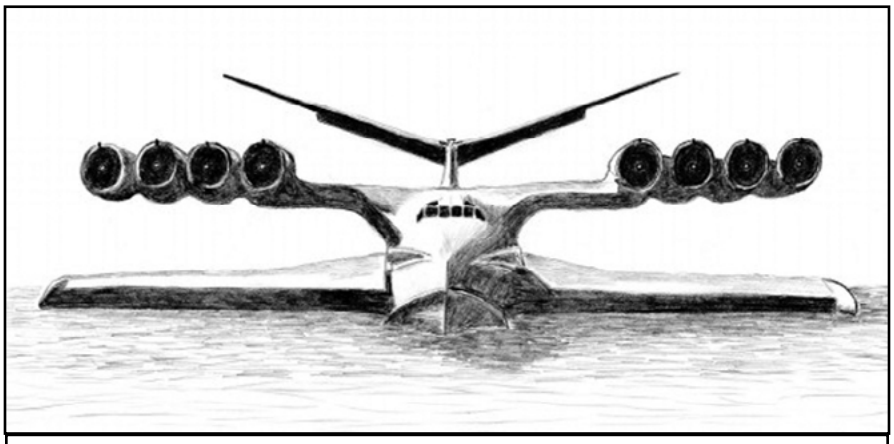
From the mid-1950s to the mid-1970s, a series of US programs to develop nuclear-powered unmanned rockets, mainly for use in space exploration or warfare—projects *Pluto*, *Orion*, *Rover*, *Nerva*—cost more than $3.9 billion (in 1996 dollars). From 1984 to the mid-1990s, Strategic Defense Initiative projects SP-100 and *Timberwind* cost another $557 million.[16] But beginning in 1991, there was increasing US-Soviet and US-Russian cooperation in space exploration. During 1991–92, the United States even purchased a Russian reactor for spaceships and considered a joint effort in space exploration. Both countries, however, soon decided the costs of nuclear propulsion in space were prohibitive as well.[17]

The Caspian Sea Monster

The fourth member of the menagerie of projects mentioned in this article's title, the *Caspian Sea Monster*, deserves brief discussion owing to the suspicion held for several years by some US intelligence specialists that the unusual aircraft given this designation in the United States was involved in the Soviet ANP program. First sighted next to a dock on the Caspian Sea littoral during 1958–61, the strange-looking, large aircraft was readily identified by CIA analysts as a reconfigured Tu-95 *Bear*. It was powered by four turbojet engines and modified with pontoons for sea duty.

At the time it was a subject of interest, it was never observed in flight or known to have been flown. At one point, it was suspected of being intended to test radiation shielding as was done with the US NB-36H in the 1950s and the Soviet *Swallow* in 1961. US analysts probably did not become aware of the *Swallow's* function until long after the Soviet ANP program had ended, but the Soviet need for such experimentation was understood. In addition, the United States, under the *Princess* program, had planned for a seaplane with nuclear-powered turboprop engines.[a] Moreoever, US intelligence analysts in 1960 had received the translation of a Soviet work on nuclear propulsion that disclosed and described a 1950 Soviet proposal for a gigantic seaplane propelled by four nuclear-powered turboprop engines (although that proposal had not been pursued).[18]

Thus, it was appropriate to regard the mysterious *Caspian Sea Monster* as a "program of interest," if not a formal suspect, in examining Soviet activities relating to ANP. Some doubted the monster had a role in the program, a question that remained unresolved because of the aircraft's apparent inactivity. At the time, assumptions of its purpose went unchallenged by any other explanation of its existence. It remained an enigma and faded from attention after it appeared that the Soviet ANP program had ended.



An artist's rendering of the *Caspian Sea Monster*. Source: K. E. Cepreев, 22 March 2013, Creative Commons.

Only later, in the late 1960s, was the *Sea Monster*'s raison d'être discovered. In 1966 a new and even larger seaplane was identified, also in the Caspian Sea. This truly monstrous newcomer was given the same name that had been bestowed on its predecessor. The new *Caspian Sea Monster*, flight tested in the autumn of 1966 and subsequent years until it crashed and sank in 1980, was soon identified as a hovercraft or hydroplane, a "surface effects" craft that flew low above the sea or land. It was powered by conventional turbojet engines (the reliable Dobrynin VD-7, the same engine used to power the four-engine *Bison* bomber).[19] CIA analysis of this giant seaplane concluded that the original *Caspian Sea Monster* had in fact been an unsuccessful attempt to devise a large hydroplane and had not ever been intended to serve as a testbed for the ANP project.[b, 20]

Were ANP Projects Disinformation?

Did the United States or the Soviet Union ever conduct a disin-

a. Even after the demise of the US ANP program in 1961, some efforts to restore parts of the program resurfaced, notably a US Navy contract with Lockheed to develop concepts for converting Lockheed's huge C-5A transport aircraft to nuclear power. (See Schwartz, *Atomic Audit*, 125.)

b. In a post-Cold War essay concerning Soviet science and technology Clarence E. Smith noted: "Although it [the purpose of the *Sea Monster*] took many years to resolve, by the late 1960s we were able to conclude that the Soviets had two different classes of such [surface effect] vehicles being studied." This reference clarifies an erroneous understanding of the origin of the designation of the "Caspian Sea Monster" that appears in the Wikipedia article cited in note 19 about the aircraft first tested in 1966.

This understanding holds that the designation derives from attributing to a KM marking on the aircraft the interpretation "Kaspian Monster" rather than the correct interpretation "Korabl' Maket" (Ship Prototype). In fact, the CIA designation for the aircraft first test-flown in 1966, like the name given the earlier aircraft, derives from the location it was sighted and its strange appearance. The error appears to stem, at least in part, from the fact that all published discussions of the *Caspian Sea Monster* (at least all of the dozen I have been able to find, most included in Wikipedia) other than this article and Smith's chapter in *Watching the Bear* refer only to the second giant hovercraft first identified in 1966, their authors evidently unaware of the existence of an earlier *Caspian Sea Monster*.

Thus, it was appropriate to regard the mysterious Caspian Sea Monster as a "program of interest," if not a formal suspect, in examining Soviet activities relating to ANP.

formation campaign to induce the adversary to undertake unproductive ANP projects or unnecessary countermeasures? Such deception operations are among the most secret and least likely to be acknowledged even long after they have expired. In the case of such a campaign centered on a major military system, neither country would be likely to embark on a disinformation campaign without first ruling out the danger of accidently priming real achievements, which both countries had, in effect, done by cancelling their ANP programs as impractical.

We do not know if the United States undertook a disinformation campaign related to ANP, but no indication that it did, or that it even considered such a deception effort, has surfaced. On the Soviet side, however, there is clear relevant evidence. Thanks to a period of relative openness in the early 1990s, when many former highly secret Soviet archival records became available—some only briefly—many Soviet Cold War secrets, including deception campaigns, have been revealed. One of them was a proposal made on 14 November 1961 by Minister of Defense Marshal Rodion Malinovsky and General Pyotr Ivashutin, chief of the Main Intelligence Directorate of the General Staff, "to promote a legend about the invention in the Soviet Union of an aircraft powered by a closed-circuit nuclear engine, with successful flight tests demonstrating the high technical performance of the power-plant and its reliability...." The disinformation "legend" would be: "On the basis of the M-50 Myasishchev aircraft [*Bounder*], with consideration of the results of its flight tests, a strategic bomber with a nuclear engine and unlimited range has been designed."[21]

It is conceivable that the claims in *Aviation Week* in 1958, the subsequent brouhaha in the United States about the *Bounder*, and a *Bounder* fly-by at a Soviet air show in July 1961 witnessed by Western observers led Soviet military intelligence leaders to think that a deception built around that story might be effective. We do not know whether this disinformation proposal was approved, but there is no indication that it was ever undertaken. Indeed, the July 1961 flight was *Bounder*'s last. Test flights had proved the aircraft was not worth producing, and in light of the new emphasis on ICBMs as the principal strategic nuclear weapons delivery system of the future, the program's cancellation was inevitable and came quickly. Although US intelligence did not know in late 1961 that *Bounder* would never fly again, Soviet military leaders would have known the aircraft could not easily be resuscitated after 1961 to tempt the United States to raise the stakes in a game that had in fact ended.

The competition over ANP collapsed when both the United States and the Soviet Union canceled their ANP programs. The *Princess* had never left storage docks in Britain; the *Camel*, which had never, so to speak, gotten off the ground, was clearly dead; the *Swallow* was retired from its nuclear nest; and the *Caspian Sea Monster* was never even in the game.

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Endnotes

1. For Fermi's recognition see R. W. Bussard and R. D. DeLauer, *Fundamentals of Nuclear Flight* (McGraw-Hill, 1965), 1; for Kurchatov's statement see Mikhail Rebrov, "Legends and the True Story of the 'Swallow'," *Krasnaya zvezda* (*Red Star*), Moscow, July 7, 1993, 2. The earliest non-fiction reference to possible nuclear propulsion of aircraft that I have found was in a Russian *Popular Science*-type journal a decade before the "atomic age": O. Petrovsky, "An Isotope Gun," *Tekhnika molodezhi* (*Technology for Youth*), Moscow, Vol. 1, 1935.
2. *Aircraft Nuclear Propulsion Program, Hearing Before the Subcommittee on Research and Development of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Sixth Congress, First Session on the Aircraft Nuclear Propulsion Program, July 23, 1959* (United States Government Printing Office, 1959), 113–14. Hereafter cited as *Hearing*.
3. *Hearing*, 32, 151, 178.
4. Rebrov, *Krasnaya zvezda*, July 7, 1993. Rebrov, a retired colonel in the Technical-Engineering Service (an identification not made in the cited article), used authorized interviews and conducted research in now declassified Soviet records.
5. Ibid.
6. Ibid.
7. *Hearing,* 6-7, 13-14, 22-33, 70–75, 160–63.
8. Ibid., 49–57.
9. See Stephen I. Schwartz, ed., *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940* (Brookings Institution Press, 1998), 123–24.
10. Three estimates appeared in the annual 11-4 series on overall Soviet military capabilities and policy: NIE 11-4-58 (December 23, 1958), NIE 11-4-59 (February 9, 1960), and NIE 11-4-61 (August 24, 1961); two in variants: NIE 11-60, *Trends in Soviet Military Capabilities in the Period 1965-1970* (April 12, 1960), and NIE 11-14-61, *The Soviet Strategic Military Posture, 1961–1967* (November 21, 1961); three in the 11-8 series on strategic attack capabilities: NIE 11-8-59, *Soviet Capabilities for Strategic Attack Through Mid-1964* (February 9, 1960), NIE 11-8-60, *Soviet Capabilities for Strategic Attack Through Mid-1965* (August 1, 1960), and NIE 11-8-61, *Soviet Capabilities for Long-Range Attack* (June 7, 1961); one in a new series: NIE 11-2-61, *The Soviet Atomic Energy Program* (October 5, 1961); and two in "Special" NIEs on bomber development: SNIE 11-58, *Possible Soviet Long-Range Bomber Development, 1958-1962* (March 4, 1958), and SNIE 11-7-58, *Strengths and Capabilities of the Soviet Long-Range Bomber Force* (June 5, 1958). (All these estimates were classified Top Secret except SNIE 11-58 and NIE 11-60, classified Secret.)
11. *Hearing*, 65.
12. For translations of most, if not all, of the extensive Soviet publications on the overall subject of nuclear-powered aircraft during 1957–59, after which few if any appeared, see the 1959 *Hearing*, 209–413. For writings by a prominent Soviet military expert during 1956–59 on overall trends in military applications of advanced technologies including discussion of ANP, see Maj. Gen. G. I. Pokrovsky, *Science and Technology in Contemporary War*, translated and annotated by Raymond L. Garthoff (Praeger, 1959), especially 82–87 and 140–41.
13. The newspaper account of Yemelyanov's comments in Idaho appeared in Carl Hayden, "Red Scientist Tells [of] Work for A-Plane," *Salt Lake Tribune*, November 10, 1959.
14. I have described these visits in some detail in "Intelligence Aspects of Cold War Scientific Exchanges: US-USSR Atomic Energy Exchange Visits in 1959," *Intelligence and National Security* 15, no. 1 (Spring 2000), 1–13.
15. See Robert F. Little, *Nuclear Propulsion for Manned Aircraft, The End of the Program, 1959–1961* (USAF Historical Division Liaison Office, April 1963), 1–13; James Killian, Special Assistant to the President for Science and Technology, *Sputniks, Scientists and Eisenhower* (MIT Press, 1977), 178–84; and Peter J. Roman, *Eisenhower and the Missile Gap* (Cornell Univ. Press, 1995), 168–70.
16. For information about these programs, including costs, see Schwartz, *Atomic Audit*, 165–66, 292, and, for a reference to the contribution of ANP to these programs, 480.
17. For discussion and sources on the US-Soviet/Russian work on nuclear propulsion for spacecraft, see Raymond L. Garthoff, *The Great Transition: American-Soviet Relations and the End of the Cold War* (Brookings Institution Press, 1994), 449–50.
18. Roman G. Perel'man, *Yaderniye dvigateli* (*Nuclear Propulsion Engines*) (Moscow, 1958); translation as R. G. Perel'man, *Soviet Nuclear Propulsion* (Triumph Pub. Co., Washington, 1960), 31.
19. See https://en.wikipedia.org/wiki/Caspian_Sea_Monster, also for 10 references therein to the *Caspian Sea Monster*. To see the aircraft in "flight" go to https://www.youtube.com/watch?v=V8Nu94khHoo
20. See Clarence E. Smith, "CIA's Analysis of Soviet Science and Technology," in Gerald K. Haines and Robert E. Leggett, eds., *Watching the Bear: Essays on CIA's Analysis of the Soviet Union* (CIA Center for the Study of Intelligence, 2003), 125.
21. This disinformation proposal was made in a memorandum to the Central Committee of the Communist Party of the Soviet Union on November 10, 1961 (in St.2/35c, 14 November 1961, TsKhSD [Central Repository of Soviet Documents], Moscow, Fond 14, Opis 14, Delo I and II, 10-14); cited by Vladislav M. Zubok, "Spy vs. Spy: The KGB vs. the CIA, 1960-1962," in the *Cold War International History Project Bulletin* 4 (Fall 1994), 30 and 33 (with a slightly varying translation).

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