THE SOVIET FRACTIONAL ORBITAL BOMBARDMENT SYSTEM (FOBS):

A SHORT HISTORY

Introduction

The Fractional Orbital Bombardment System (FOBS) was an orbital nuclear weapons system designed to attack the continental United States via the 'back door,' i.e. via the South Pole instead of passing through the net of radar systems at the northern approach corridor. The Soviet program name for the project has still not been revealed, although it is known that FOBS-related ideas were discussed as early as 1959 at the highest levels of the Soviet leadership [1]. By 1962-63, there appear to have been at least three major orbital weapons projects ongoing in the USSR. All were variations of the concept of launching nuclear weapons into Earth orbit and then waiting for the 'opportune' moment to reenter into the atmosphere and hit the U.S. mainland. The Soviets used the term 'global missiles' for such weapons.

Three Early Proposals

The earliest concrete proposal for a FOBS originated from OKB-1 Chief Designer Sergey P. Korolev who began preliminary work on the so-called Global Missile No. 1 (GR-1) in 1960. The Soviet Central Committee and the USSR Council of Ministers formally approved the project on 24 September 1962 [2].

For Korolev, the GR-1 was part of a long-range plan to develop the N1 superbooster for a flight to the Moon. His engineers designed both vehicles with many common elements of design. The GR-1, for example, used engines developed by OKB-276 headed by Chief Designer Nikolay D. Kuznetsov, the same organization developing engines for the N1. Kuznetsovís engines for the GR-1 were the NK-9 and NK-9V engines with a vacuum of thrust of about 45 tons each. Kuznetsov used these same engines as the basis to develop the main engines for all of the N1ís stages. The third stage of the GR-1, i.e. the retro-rocket stage for the warhead, used the 8D726 engine, one of the few engines developed in-house by the Korolev design bureau. The total mass of Korolevís missile was 117 tons. The explosive capability of the warhead was about 2.2 megatons. Circular Error Probability was estimated at +/- 3 to 5 kilometers [3].

The second FOBS roject originated at OKB-52 headed by General Designer Vladimir N. Chelomey. Original conceptions at his design bureau included plans for two global missiles, the GR-1 based upon the UR-200 ICBM, and the GR-2 based upon the UR-500 ICBM. The latter would have carried a 30 megaton warhead into Earth orbit [4]. Governmental decrees initiating work on the UR-200 and the UR-500 ICBMs were formally issued by the Central Committee of the Communist Party and the Council of Ministers on 16 March 1961 and 24 April 1962 respectively [5]. For reasons that are not clear, the heavy lift UR-500 option was abandoned in favor of using the much smaller UR-200 ICBM as the basis for Chelomeyís global missile. This variant, known as the UR-200A (with the 8K83 index), was a two-stage rocket with the RD-0202 engine on the first stage and the RD-0205 on the second [6]. Engine thrusts were 228 tons and 62 tons vacuum respectively. Semyon A. Kosbergís design bureau, OKB-154, developed these engines.

The third proposal for a global missile came from Mikhail K. Yangelís OKB-586. Some recently released information has provided for the first time the important milestones in this top-secret program. The Yangel effort to develop such a missile, called the R-36-O, was approved by a governmental decree signed on 16 April 1962. The document originally called for first flight tests in the third quarter of 1964 [7]. Engineers began work on a draft plan on the missile variant in December 1962.

The actual dynamics of the competition between Korolev GR-1, Chelomeyís UR-200A, and Yangelís R-36-O still remain unclear. Why did the Soviet government approve such projects when the United States refrained from exploring similar options? Why three instead of one program? To what stage was this competition supposed to reach? Although technical details are now becoming abundant, the policy decision-making behind the programs still remain shrouded in mystery.

We know that in early 1965, the Strategic Missile Forces (RVSN) carried out a comparative analysis of the three proposals. By this time, all three designers had managed to produce actual hardware, although none of the missiles (in their global missile variants) had flown. At the time, the RVSN selected Yangelís option as the most promising [8]. There were clearly political and personal forces at stake here, in addition to usual technical ones. Korolevís GR-1 missile appears to have been the furthest behind in development. Although the missile was displayed at various Moscow parades in the mid-1960s, it never flew a single flight. Engineers working on the project jokingly called the booster the "intercontinental missile from Moscow to Leningrad" since that was about how far it had ever traveled, i.e. from one plant to another plant [9]. The engine for the third stage of the missile, the 8D726, was later used as the basis for the engine for the famous Blok D stage used on the N1 and the Proton boosters.

Chelomeyís fortunes meanwhile had taken a drastic turn for the worse when one of his main patrons, First Secretary Nikita S. Khrushchev, was overthrown in a coup in October 1964. Ironically, the UR-200 ICBM program had already been terminated *before* Khrushchevís fall, and Chelomeyís desperate attempts to retain the global missile element of the project proved to be in vain.

The RVSN review formally recommended that the Soviet Union pursue only Yangelís proposal for a global missile.

R-36-O & OGCh Design

Yangelís R-36-O orbital bombardment missile was based on his superheavy R-36 (SS-9) ICBM. In terms of production designations, the R-36 was the 8K67 while the R-36-O was the 8K69. Like its ëparent,í the R-36-O was a multistage missile working on storable hypergolic propellants. Glushkoís design bureau designed engines for both stages. The first stage was powered b y a single RD-251 engine (itself comprising three twin chamber RD-250 engines) with a total sea level thrust of 241 tons. The second stage used a single two-chamber RD-252 engine, which was an altitude version of the RD-250. Vacuum thrust was 96 tons. Both engines used nitrogen tetroxide and unsymmetrical dimethyl hydrazine (UDMH) [10].

For actual deorbiting of the warhead and trajectory corrections, the R-36-O incorporated a third stage for which the Soviets used the generic designation of Orbital Payload (OGCh). This comprised:

ï an instrument section;

ï the retro-rocket engine; and

ï the warhead.

The instrument section included the OGChís guidance system comprising an accurate "gyro-stabilization platform" for precise aiming of the warhead to its target on a trajectory from orbit to impact. This system, officially known as the Orientation, Guidance and Stabilization System (SUOS) was an autonomous inertial navigation system. The system was supplemented by a "radio-altimeter" which would aid trajectory correction twice: once at the start of the orbital trajectory; and second before the deorbit burn.

The retro-rocket engine was a single chamber engine, the RD-854, with a vacuum thrust of 7.7 tons. This was one of the first rocket engines developed in-house at the Yangel design bureau. The engine used the same propellant combinations as the missile itself. The main engine would transfer the OGCh from an orbital trajectory to a ballistic one. Four nozzles on the sides of the main engine (working on exhaust gases from the main engine) would provide steering capability. Four additional tangentially located nozzles would provide yaw capability. Each nozzle was throttle-capable. The entire engine was placed in the center of the OGCh, "pushed" inside the torroidal propellant tanks, thus allowing a significant reduction of mass. The third stage, like the first and second stages of the launcher, were maintained at constant fueled condition for launch [11].

There are conflicting data regarding the actual firepower of the warhead. A recent Russian source states the warhead explosive power was "up to 20 megatons" [12]. Recently declassified U.S. intelligence reports, however, suggest otherwise. A report from 1976 described the FOBS spacecraft as weighing 4,000 kilograms. The reentry vehicle itself had a mass of 1,450 kilograms which included a 1,200 kilogram warhead with a yield of 2.0 to 3.5 megatons. The OGCh was said to be equipped with "an inertial guidance system, and a storable-liquid retro-rocket orbit propulsion system with enough fuel for about one minute of engine operation" [13].

The overall length of the R-36-O missile was about 33 meters. Its base diameter was 3 meters. Total launch mass was about 180 tons.

Mission Profile

According to the CIA, the mission profile of a typical FOBS mission was as follows:

The system is targeted before launch and it does not require nor can it use tracking or external guidance updating during a mission. The mission profile consists of three phases: (1), launch, (2) coast, and (3) reentry. During the launch phase, the booster and second-stage engines of the SS-8 [sic] place the spacecraft into orbit. After the spacecraft separates from the second stage, the coast phase begins. During the coast phase, just prior to retrofire, the spacecraft initiates a pitch maneuver to reorient itself for reentry. After approximately one minute of retro-engine operation, shutdown occurs and the reentry vehicle separates from the spacecraft. The RV [reentry vehicle] then continues on a ballistic trajectory until impact, which occurs about 1.5 to 2.0 minutes after separation [14].

Ground Infrastructure

At the Tyura-Tam range, officially known as the Scientific-Research and Testing Range No. 5 (NIIP-5), the RVSN created an extensive infrastructure to support the OGCh program. The total ground-testing complex comprised:

ï a technical position at site 42;

ï a horizontal assembly and testing station at site 40 which apparently was protected against attack by some kind of arched covering; and

ï the right hand pad for flight-testing located at site 67 (also known as Object 351).

Original RVSN plans were to install an initial complement of six Separated Launch (OS) shafts 10 to 15 kilometers from each other. These would form the first element of the operational R-36-O launch force [15].

The site for the test launches, site 67, had originally been built for R-36 ICBM launches. In January 1965, the

RVSN began rework on the pads there to handle the R-36-O. This work was officially finished on 30 November 1965, 16 days before the first test launch. As launches got underway, the RVSN sanctioned the use of new launch shafts from a different site, site 162 (also known as Object 401). Here three shaft units were created and put on ready status by 30 August 1966. Just 19 days later, the RVSN fired its first R-36-O from a shaft at site 162. By 1967, additional shaft launch units were created for flight-testing at sites 160, 161, 163, 164, and 165 [16].

Flight-Testing

The Chairman of the State Commission to test the R-36-O was Lt.-Gen. Fedor P. Tonkikh (1912-87) who from 1963-85 was the Commander of the famous Military Academy Named After F. E. Dzerzhinskiy. The Commissionís original plan was to conduct the testing in two phases:

ï launch from surface pads to the Kamchatka peninsula (4 launches);

ï launch from OS shafts to orbit and then deorbit over the equator of the Pacific Ocean (15 launches).

The units responsible for testing the missiles at Tyura-Tam were the 2nd Testing Directorate (military unit no. 54333) and the 39th OIICh (military unit 14332) who made up a total of 2,200 persons.

The table below lists the complete series of launches in the R-36-O / OGCh program. I have included comments as available for each launch. There were a total of 24 attempted launches in Yangel's FOBS program, all using the R-36-O (or 8K69) variant of the basic R-36 ICBM. The system was declared operational by a decree of the Central Committee and Council of Ministers dated 19 November 1968 [17]. This was after the 20th launch attempt in the program.

The first battalion of R-36-O missiles was put on combat duty on 25 August 1969 at sites 160-165 at Tyura-Tam under military unit 21422 under the command of Lt.-Col.-Eng. A. V. Mileyev. Between 1969 and 1971, two more divisions were introduced into duty. These were the military unit 29432 at sites 191-196 and the military unit 21648 at sites 241-246. All three military units were part of the 98th missile brigade until 1974 when they were transferred institutionally to the Orenbugh Missile Army of the RVSN. These three brigades comprised the 18 R-36-O missiles put on active duty by the Soviet Union [18].

Beginning 1982, the RVSN began to dismantle its R-36-O / OGCh launch installations as a result of the (never-ratified) SALT II treaty. The actual governmental order was issued in January 1983 and by the following month, the last R-36-O was removed from duty. In May 1984, the Soviets began to remove missiles and equipment from the shafts. All 18 shafts and associated equipment were later destroyed in explosions.

The Perspective of U.S. Intelligence on FOBS

Declassified CIA documents provide a unique perspective on U.S. perceptions of FOBS. In a document from late 1962, the CIA states that "the Soviets have the capability to develop an orbital bombardment satellite and might decide to launch and deorbit a space weapon at an early date for propaganda or political reasons" [19]. There was a strong implication that such weapons would only be effective as propaganda weapons and be seen as militarily ineffective by the Soviets. In mid-1963, the CIA prepared a dedicated report on Soviet orbital bombs which did not deviate significantly from the findings of the earlier pronouncement:

We have thus far acquired no evidence that the USSR plans to orbit a nuclear-armed satellite in the near term, or that a program to establish an orbital bombardment capability is at present seriously contemplated by the Soviet leadership. However the USSR does have the capability of orbiting one or possibly a few nuclear-armed satellites at any time, and at comparatively small cost [20].

The report suggests that the CIA did not believe that the Soviets would deploy orbital bombing systems by the end of the 1960s. This assessment was, no doubt, revised once the FOBS launches commenced in 1965-66.

The CIA originally designated the R-36-O vehicle as the "SS-X-6." This designation was changed by sometime between 1969 and 1971 to "SS-9 mod 3."

Last Comments

Although FOBS missiles and associated instrumentation was destroyed, one element of the system survived into the 1990s: the third orbital bombardment stage of the R-36-O. Originally, after a government order on 21 June 1967, the plan was to use the R-36-O third stage, named the S5M, as the third stage of a new launch vehicle based on the R-16 (SS-7) ICBM. This booster, retroactively named the Tsiklon-1, was never built. A new order in August 1968 tasked Yangel to build a booster based upon the R-36 instead of the R-16. Following an official governmental order on 20 June 1970, Yangel tasked his engineers to re-adapt the stageís design and electronics for use as the third stage of the Tsiklon-3 space launch vehicle [21]. The new S5M stage uses the RD-861 engine instead of the almost identical RD-854 used on the R-36-O. The new engine has a vacuum thrust of 8 tons. Now Ukrainian property, the Tsiklon-3, with its S5M stage, is still in use to this day.

Launch History

NOTE: ALL DATA IN THE TABLE IS FROM THE ARCTICLE BY O.URUSOV UNLESS SPECIFIED.

Public Designation	No.	Launch Time (Moscow Times)	Launch Date	Launch Pad	Comments
-	1	-	Dec 16 1965	67P	malfunction in OGCh stabilization system, overshot target by 27 km
-	2	1520	Feb 5 1966	67P	large deviation of payload from desired trajectory due to malfunction in retro-rocket engine
-	3	0100	Mar 16 1966	67P	launch did not take place because missile caught fire during fueling as a result of premature disconnection of main propellant line
-	4	2200	May 20 1966	67L	success; in Mar 1967, CIA gave date as May 19 1966, and stated that the second and third stages and the reentry vehicle were launched on an 8,500 km ballistic trajectory with an apogee of only 220 km; CIA also stated that it was the last of three suborbital tests of FOBS
-	5	0135	Sep 18 1966	162	first flight from shaft; targeted to Novaya Kazanka at the Kapustin Yar

					range; the mission was a failure since the OGCh did not enter orbit because a device for controlling range did not issue the main command for switching off the RD-262 second stage main engine; CIA in Mar 1967 correctly identified as failure
-	6	0350	Nov 2 1966	162	identical problem as on previous launch; CIA in Mar 1967 correctly identified as failure
Kosmos-139	7	1655	Jan 25 1967	162	first full success; OGCh reached target at Kapustin Yar; CIA in Mar 1967 correctly identified as success
-	8	1705	Mar 22 1967	161	failure; CIA in Apr 1968 correctly identified as failure
Kosmos-160	9	1905	May 17 1967	161	success; CIA in Apr 1968 incorrectly identified as failure
Kosmos-169	10	1945	Jul 17 1967	162	success; CIA in Apr 1968 correctly identified as success
Kosmos-170	11	1945	Jul 31 1967	161	success; CIA in Apr 1968 correctly identified as success
Kosmos-171	12	1905	Aug 8 1967	162	success; CIA in Apr 1968 correctly identified as success
Kosmos-178	13	1745	Sep 19 1967	161	success; CIA in Apr 1968 correctly identified as success
Kosmos-179	14	1705	Sep 22 1967	36, 162	success; CIA in Apr 1968 correctly identified as success
Kosmos-183	15	1630	Oct 18 1967	35, 161	success; CIA in Apr 1968 correctly identified as success
Kosmos-187	16	1615	Oct 28 1967	162	overshot target by 12 km owing to reduced working level of operation of the retro-rocket engine; three more tests added to series; CIA in Apr 1968 identified as success
Kosmos-218	17		Apr 25 1968	162	success; CIA in Jun 1969 correctly identified as success
-	18		May 21 1968	162	to the equator, success
-	19		May 28 1968	161	to the equator, success
Kosmos-244	20	1635	Oct 2	161	success; first flight of series produced

			1968		model; CIA in Jun 1969 correctly identified as success
Kosmos-298	21	1900	Sep 15 1969	191	success; second flight of series produced model; CIA in Jul 1971 correctly identified as success
Kosmos-354	22	0100	Jul 23 1970	191	success; third flight of series produced model; CIA in Jul 1971 correctly identified as success
Kosmos-365	23	1700	Sep 25 1970	191	success; fourth flight of series produced model; CIA in Jul 1971 correctly identified as success
Kosmos-433	24		Aug 8 1971	191	success; fifth flight of series produced model

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