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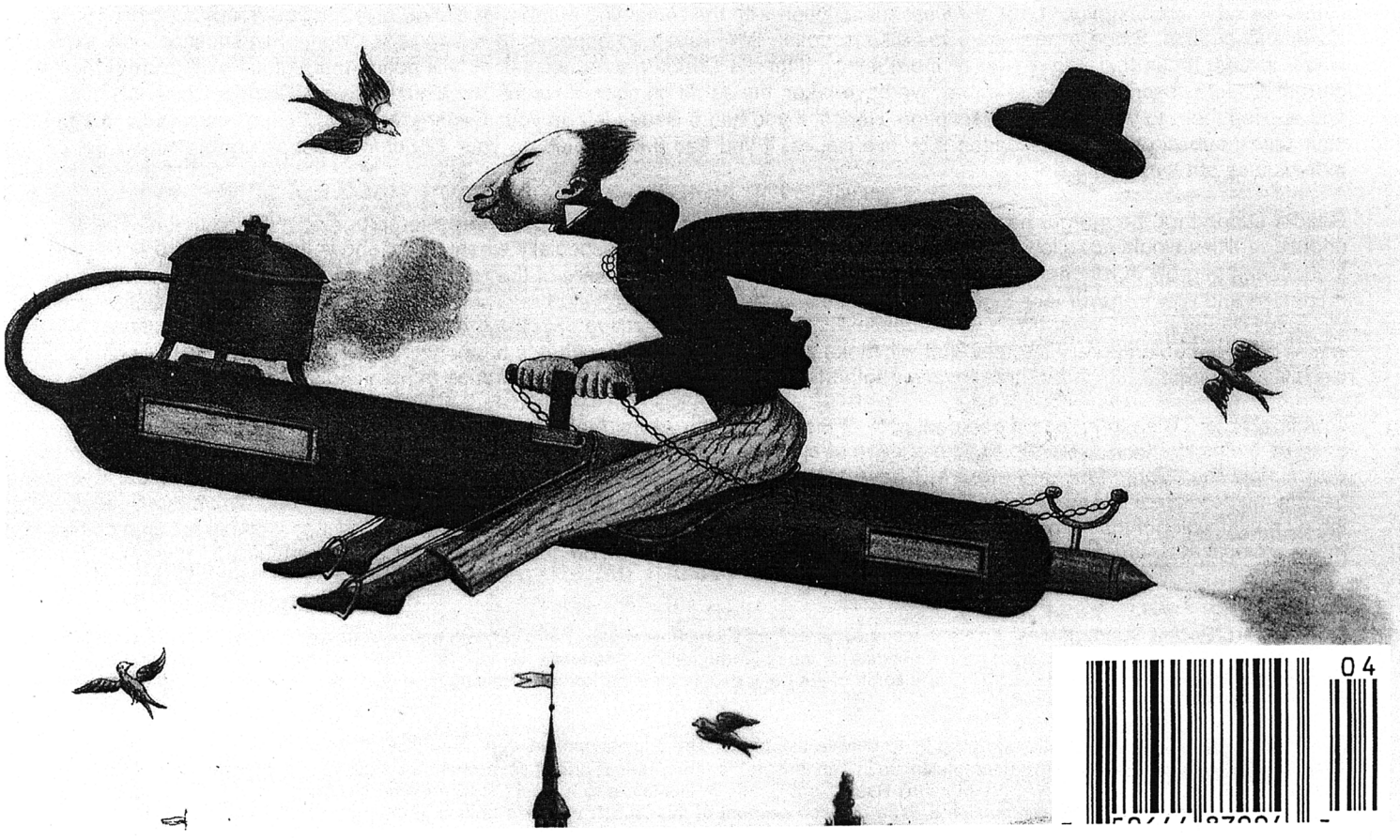

04

U.S. Reconnaissance Satellite Programs Part 2: Beyond Imaging

Jonathan McDowell

In the first part of this article I discussed United States satellites used for imaging reconnaissance. I will now cover satellites used for other forms of surveillance; here the picture is much murkier, but it is still possible to establish the broad outlines of each program from the open literature.

The Mystery Launches of 1964

On the whole, analysts have been pretty successful at deducing the general mission of most military satellite launches, but there are a few which are harder to figure out. The launch of an Agena D satellite, FTV 2355 (OPS 3762) on December 21, 1964 is particularly mysterious. Its low orbit led previous analysts to lump it with the CORONA missions, but the orbit was not quite consistent with that assumption, and it is not included in the official list of 145 bona fide CORONA flights. It was revealed at the 1995 USAF Space History Symposium by General Bradburn, the launch commander, that the mission was successful and lasted four days. Other documentary evidence suggests that one recoverable capsule was carried. This was a one-off mission - it could possibly have been carrying out signals intelligence on a particular target. Another likely possibility is that it was a radiometric mission gathering data on infrared background radiation for programs like MIDAS, but none of the MIDAS histories refer to it and such missions were usually carried out within the CORONA program.

There were two other strange Thor-Agena D launches in January and June 1964, each of which placed a pair of satellite payloads in medium altitude sun-synchronous orbits. Each payload must have been relatively small—perhaps 100 kg or so. The small size and high altitude make an imaging intelligence mission unlikely, but the sun-synchronous orbit makes some kind of imaging payload probable. The obvious interpretation is that the satellites are early Defense Meteorological Satellite Program payloads.

The early DMSP flights are still classified, but it is known that five Block 1 satellites were launched in 1962-63 on Scout rockets, and that a later generation were launched on Thor Burner 1 rockets starting in 1965, so the 1964 flights would fit in well. However, unofficial sources familiar with the early DMSP program have denied that Thor Agena was ever used, which leaves me without a good candidate mission for the pair of twins. Suggestions to the correspondence pages of *Quest* are welcome.

Signals Intelligence Satellites

Program 102 Ferret Satellites

Signals intelligence (SIGINT) is kept even more secret than overhead photography. The earliest signals intelligence spacecraft, colloquially known as ferrets, were used to catalog the characteristics of air defense radars in the USSR; later spacecraft also carried out COMINT (interception of voice radio communications) and TELINT (interception of telemetry from test launches of missiles).

The first ferret program was Program 102 (also known as 698BK). Program 102 may originally have been managed by USAF under the framework of the SAMOS project on behalf

Unidentified Missions: FTV 2355 and the Twins

Satellite	Mission No.	Agena No.	Date	Vehicle	Orbit	Period	Notes
OPS 3762 (FTV 2355)	(1964-87A)	2355	1964 Dec 21	TAT Agena D	238 x 264 x 70.1	89.5	Mission unknown
OPS 3367A	(1964-02B)	-	1964 Jan 19	Thor Agena D	801 x 830 x 99		
OPS 3367B	(1964-02C)	-	1964 Jan 19	Thor Agena D	811 x 825 x 99		
OPS 4467A	(1964-31A)	-	1964 Jun 18	Thor Agena D	828 x 842 x 99.8		
OPS 4467B	(1964-31B)	-	1964 Jun 18	Thor Agena D	828 x 842 x 99.8		

Program 102 Missions

Satellite	Mission No.	Agena No.	Date	Vehicle	Orbit	Period	Notes
(Ferret 1)	Unknown	2301	1962 Feb 21	Thor Agena B	167 x 374 x 82.0	92.0	
(Ferret 2)		2312	1962 Jun 18	Thor Agena B	370 x 411 x 82.1	92.5	
(Ferret 3)		2313	1963 Jan 16	Thor Agena D	459 x 533 x 81.9	94.7	
(Ferret 4)		2314	1963 Jun 29	TAT Agena B	484 x 536 x 82.3	94.8	
(Ferret 5)		2316	1964 Feb 28	TAT Agena D	479 x 520 x 82.0	94.7	
(Ferret 6)		2315	1964 Jul 3	TAT Agena D	501 x 529 x 82.1	94.9	
(Ferret 7)		2317	1964 Nov 4	TAT Agena D	512 x 526 x 82.0	95.1	
(Ferret 8)		2702	1965 Jul 17	TAT Agena D	471 x 512 x 70.2	94.5	
(Ferret 9)		2703	1966 Feb 9	TAT Agena D	508 x 512 x 82.1	94.8	
(Ferret 10)		2731	1966 Dec 29	TAT Agena D	486 x 496 x 75.0	94.4	
(Ferret 11)		2732	1967 Jul 25	TAT Agena D	458 x 513 x 75.0	94.3	
(Ferret 12)		2733	1968 Jan 17	TAT Agena D	450 x 546 x 75.2	94.5	
(Ferret 13)			1968 Oct 5	Thorad Agena D	483 x 511 x 75.0	94.6	
(Ferret 14)			1969 Jul 31	Thorad Agena D	462 x 541 x 75.0	94.7	
(Ferret 15)			1970 Aug 26	Thorad Agena D	484 x 504 x 75.0	94.5	
(Ferret 16)			1971 Jul 16	Thorad Agena D	488 x 508 x 75.0	94.6	

of NSA. The first launch in February of 1962 was a partial failure[1] since its Agena B engine failed to restart to circularize the orbit; the resulting elliptical orbit was similar to a CORONA flight and led Klass and Kenden to misclassify it. Program 102 may have been redesignated Program 770 in 1965.

Ferret Subsatellites

The Agena based ferret satellites were supplemented by smaller subsatellites, originally based on the P-11 bus developed by Lockheed. These satellites were launched attached to the aft rack of the Agena and fired a solid rocket motor to enter a higher orbit than the host Agena. Three test flights were made with science payloads before flights with SIGINT receivers were begun.

The names in the "Satellite" column in the accompanying table are arbitrary designations, since no true code names for these missions are reliably known. Type A missions with the orig-

Ferret Subsatellite Type A Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period	Host Sat	Notes
P-11 (1)	-	1963 Mar 18	TAT Agena D	-		KH-6 LANYARD	Science [3]
P-11 (2)	1963-25B	1963 Jun 27	TAT Agena D	333 x 4132 x 82.1	132.5	KH-4 CORONA	Science
(SS A3)	1963-42B	1963 Oct 29	TAT Agena D	285 x 585 x 90.0	93.4	KH-5 ARGON	
(SS A4)	1963-55B	1963 Dec 21	TAT Agena D	321 x 388 x 64.5	91.7	KH-4 CORONA	
(SS A5)	1964-36B	1964 Jul 6	Atlas Agena D	297 x 377 x 93.0	91.2	KH-7 GAMBIT	
P-11 (6)	1964-45B	1964 Aug 14	Atlas Agena D	275 x 3748 x 95.7	127.4	KH-7 GAMBIT	Science
(SS A7)	1964-68B	1964 Oct 23	Atlas Agena D	323 x 336 x 95.5	91.1	KH-7 GAMBIT	

Ferret Subsatellite Type B Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period	Host Sat	Notes
(SS B1)	1965-31B	1965 April 28	Atlas Agena D	490 x 509 x 95.3	95.2	KH-7 GAMBIT	
(SS B2)	1965-50A	1965 Jun 25	Atlas Agena D	496 x 510 x 107.7	94.7	KH-7 GAMBIT	
(SS B3)	1965-62B	1965 Aug 3	Atlas Agena D	501 x 515 x 107.4	94.8	KH-7 GAMBIT	
(SS B4)	1966-39B	1966 May 14	Atlas Agena D	517 x 559 x 109.9	95.4	KH-7 GAMBIT	
(SS B5)	1966-74B	1966 Aug 16	Atlas Agena D	510 x 524 x 93.2	95.0	KH-7 GAMBIT	
(SS B6)	1966-83B	1966 Sep 16	Atlas Agena D	460 x 501 x 94.1	94.3	KH-7 GAMBIT	
(SS B7)	1967-43B	1967 May 9	Thorad Agena D	555 x 809 x 85.1	98.4	KH-4A CORONA	
(SS B8)	1967-62B	1967 Jun 16	Thorad Agena D	501 x 517 x 80.2	94.8	KH-4A CORONA	
(SS B9)	1967-109B	1967 Nov 2	Thorad Agena D	455 x 524 x 81.7	94.4	KH-4A CORONA	
(SS B10)	1968-08B	1968 Jan 24	Thorad Agena D	473 x 542 x 81.7	94.8	KH-4A CORONA	
(SS B11)	1968-20B	1968 Mar 14	Thorad Agena D	481 x 522 x 83.1	94.7	KH-4A CORONA	
(SS B12)	1968-52B	1968 Jun 20	Thorad Agena D	437 x 519 x 85.2	94.2	KH-4A CORONA	
(SS B13)	1968-78B	1968 Sep 18	Thorad Agena D	500 x 514 x 83.2	94.8	KH-4A CORONA	
(SS B14)	1969-26B	1969 Mar 19	Thorad Agena D	504 x 513 x 83.1	94.8	KH-4A CORONA	
(SS B15)	1969-41B	1969 May 2	Thorad Agena D	401 x 473 x 65.7	93.4	KH-4A CORONA	
(SS B16)	1969-79B	1969 Sep 22	Thorad Agena D	490 x 496 x 85.2	94.5	KH-4A CORONA	
(SS B17)	1969-82A	1969 Sep 30	Thorad Agena D	446 x 484 x 69.6	93.9	NRL SURCAL	
(SS B18)	1970-16B	1970 Mar 4	Thorad Agena D	442 x 514 x 88.1	94.2	KH-4B CORONA	
(SS B19)	1970-40B	1970 May 20	Thorad Agena D	491 x 503 x 83.1	94.6	KH-4B CORONA	
(SS B20)	1970-98B	1970 Nov 18	Thorad Agena D	487 x 511 x 83.2	94.6	KH-4B CORONA	
(SS B21)	1971-76B	1971 Sep 10	Thorad Agena D	492 x 507 x 75.1	94.6	KH-4B CORONA	
(SS B22)	1972-02D	1972 Jan 20	Titan 23D	472 x 549 x 96.6	94.9	KH-9 HEXAGON	
(SS B23)	1972-52C	1972 Jul 7	Titan 23D	497 x 504 x 96.2	94.7	KH-9 HEXAGON	
(SS B24)	1973-88B	1973 Nov 10	Titan 23D	486 x508 x 96.3	94.6	KH-9 HEXAGON	
(SS B25)	1974-20C	1974 April 10	Titan 23D	503 x 531 x 94.0	95.0	KH-9 HEXAGON	
(SS B26)	1974-85B	1974 Oct 29	Titan 23D	520 x 535 x 96.1	95.2	KH-9 HEXAGON	

Ferret Subsatellite Type C Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period	Host Sat	Notes
(SS C1)	1968-112B	1968 Dec 12	Thorad Agena D	1391 x 1468 x 80.3	114.5	KH-4A CORONA	
(SS C2)	1969-10B	1969 Feb 5	Thorad Agena D	1396 x 1441 x 80.4	114.2	KH-4B CORONA	
(SS C3)	1972-79C	1972 Oct 10	Titan 23D	1423 x 1469 x 95.6	114.8	KH-9 HEXAGON	
(SS C4)	1973-88D	1973 Nov 10	Titan 23D	1419 x 1458 x 96.9	114.6	KH-9 HEXAGON	
(SS C5) SSU-A	1975-51C	1975 Jun 8	Titan 23D	1389 x 1401 x 95.1	113.7	KH-9 HEXAGON	
(SS C6)	1980-52C	1980 Jun 18	Titan 23D	1331 x 1333 x 96.6	112.3	KH-9 HEXAGON	
(SS C7)	1983-60C	1983 Jun 20	Titan 23D	1289 x 1291 x 96.7	111.4	KH-9 HEXAGON	

Ferret Subsatellite Type D Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period	Host Sat	Notes
(SS D1)	1976-65C	1976 Jul 8	Titan 23D	628 x 632 x 96.4	97.3	KH-9 HEXAGON	
(SS D2)	1978-29B	1978 Mar 16	Titan 23D	639 x 645 x 95.8	97.6	KH-9 HEXAGON	
(SS D3)	1979-25B	1979 Mar 16	Titan 23D	621 x 628 x 95.8	97.2	KH-9 HEXAGON	
(SS D4)	1982-41C	1982 May 11	Titan 23D	701 x 707 x 96.0	98.9	KH-9 HEXAGON	
(SS D5)	1984-65C	1984 Jun 25	Titan 34D	689 x 711 x 96.1	98.8	KH-9 HEXAGON	
(SS D6)	-	1986 April 18	Titan 34D	-		KH-9 HEXAGON	Titan failed

Unidentified Subsatellite

Satellite	Desig.	Date	Vehicle	Orbit	Period	Notes
USA-41	1989-61C	1989 Aug 8	Shuttle	296 x 307 x 57.0	90.5	-

inal P-11 satellite entered relatively low orbits with perigees around 300 km. Type B missions followed in 1965, with 500 km orbits similar to the Program 102 Ferret satellites. Type C missions, which began in 1968, were placed in higher 1200-1400 km orbits, and are believed to monitor Soviet anti-ballistic missile radars.[2] In 1976 the low orbit type B missions changed to a slightly higher 600-700 km altitude, which I have designated type D.

It is not known how many ferret subsatellites were lost in launch failures. Based on the pattern of launches, failed Type A subsatellites might have been carried on the TAT Agena D failures of 9 November 1963 and 24 Mar 1964. Type B/C subsatellites might have been on the Atlas launch of 12 July 1965, or the Thorad Agena launch of 17 February 1971. It is assumed that a Type D subsatellite was lost in the failure of a Titan 34D in April 1986.

Finally, a small satellite was deployed from the Shuttle in August of 1989. The USA-41 satellite may have been related to the ferret subsatellites, or it might (as suggested to me by J. Richelson) be related to the Defense Intelligence Agency's COBRA BRASS measurement and signature intelligence (MASINT) experiment.

Titan II Ferrets

These satellites were launched by refurbished Titan II ICBM's into polar orbit from Vandenberg. Their orbit makes it likely that they are for signals intelligence, although some kind of imaging mission is also possible. The satellites enter a low, 200 km orbit together with the Titan II second stage. An attached rocket motor raises the orbit to its operational 800 km altitude. A Russian report claimed that the second satellite, USA-45, reentered from the initial parking orbit because of the failure of its motor.

JUMPSEAT

SIGINT satellites are the most highly classified variety of US spacecraft, and JUMPSEAT is among the most secret or "black" of all. Its existence was mentioned by Jane's All The World's Aircraft (1970-71) (and referenced by Kenden) as AFP-711, a highly elliptical orbit Titan 3 launched heavy ferret built by Hughes. However Kenden noted that no such launches had taken place as of 1978—he and other observers were fooled by the cover story that the series of launches which began in 1971 were part of a comsat program.

Orbital data in the table is based on submissions to the United Nations. The orbit for JUMPSEAT 6 is probably not the final orbit. The identification of JUMPSEAT and SDS satellites is not definite, and in particular the pairs SDS 3/JUMPSEAT 5 and SDS 4/JUMPSEAT 6 may be switched. Klass[4] identified the February 1978 and December 1980 launches as Jumpseat rather than SDS, but omitted discussion of the August 1978 and April 1981 launches.

Titan II Ferrets

Satellite	Desig.	Date	Vehicle	Orbit
USA-32	1988-78A	1988 Sep 5	Titan 23G	786 x 794 x 85.0
USA-45	1989-72A	1989 Sep 5	Titan 23G	
USA-81	1992-23A	1992 April 22	Titan 23G	800 x 800 x 85.0 ?

Jumpseat Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period
JUMPSEAT 1	1971-21A	1971 Mar 21	Titan 23B Agena D	328 x 39264 x 63.2	701.8
JUMPSEAT 2	-	1972 Feb 16	Titan 23B Agena D	-	
JUMPSEAT 3	1973-56A	1973 Aug 21	Titan 23B Agena D	392 x 39132 x 63.3	701.0
JUMPSEAT 4	1975-17A	1975 Mar 10	Titan 34B Agena D	295 x 39338 x 63.5	702.0
JUMPSEAT 5	1978-75A	1978 Aug 5	Titan 34B Agena D	315 x 39053 x 62.5	697.1
JUMPSEAT 6	1981-38A	1981 April 24	Titan 34B Agena D	188 x 708 x 62.7	93.0

CANYON Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period
CANYON 1	1968-63A	1968 Aug 6	Atlas Agena D	31680 x 39862 x 9.9	1436.0
CANYON 2	1969-36A	1969 Apr 12	Atlas Agena D	32672 x 39251 x 10.2	1436.0
CANYON 3	1970-69A	1970 Sep 1	Atlas Agena D	31947 x 39855 x 10.3	1441.9
CANYON 4	-	1971 Dec 4	Atlas Agena D	-	
CANYON 5	1972-101A	1972 Dec 20	Atlas Agena D	31012 x 40728 x 9.7	1440.4
CANYON 6	1975-55A	1975 Jun 18	Atlas Agena D	30200 x 40800 x 9.0	1422.0
CANYON 7	1977-38A	1977 May 23	Atlas Agena D	34325 x 34500 x (0.3?)	1440.0

CANYON

Another NSA/USAF satellite program which was successfully hidden for decades was CANYON (Program 827), the first geosynchronous signals intelligence satellite. The CANYON satellites, which were used to intercept communications,[5] were launched by Atlas Agena D rockets from Cape Canaveral into distinctive near-geostationary elliptical orbits. They were misidentified by Kenden and other analysts as infrared missile early warning satellites in the Defense Support Program. Further confusion arose from the erroneous report that 1975-55A was launched by a Titan 3C. CANYON and RHYOLITE launches can be distinguished using reference 6, except for the 1977 launches. The May 1977 launch is identified as a CANYON on the basis of the size of the nose shroud in launch photos, although fragment 1977-38C is registered with the UN in a synchronous orbit with an inclination of 0.3 degrees instead of the higher inclination expected from a CANYON mission.

RHYOLITE

Better known than CANYON is the CIA's geostationary signals intelligence satellite, RHYOLITE, which was used for telemetry interception.[7] RHYOLITE became notorious after the trial of spies Lee and Boyce in 1977; they had sold the secrets of RHYOLITE to the Soviets. Program 720 RHYOLITE was thus renamed Program 472 AQUACADE.

VORTEX, MAGNUM and ORION

Program 366 CHALET (renamed VORTEX after the CHALET name was leaked in 1979) was the COMINT successor to CANYON. Launched to geostationary orbit by Titan 3C, they were originally confused with the DSP early warning satellites, but the secrecy surrounding their launches and the absence of the scientific radiation monitor payloads which were carried aboard the DSP's alerted analysts to the fact that a new series of satellites was aloft. It appears that their orbits were elliptical and inclined, like CANYON. A rumor that VORTEX 4 had a Transtage failure and was stranded in transfer orbit was incorrect, and arose from the DoD's practice of only announcing the transfer and not the final orbit. However, it appears that VORTEX 5 did indeed fail to reach its final orbit, and six years later a number of debris objects in transfer orbit were cataloged as coming from the 1988-77 launch.

The CIA RHYOLITE telemetry interception satellites were replaced by the larger MAGNUM payloads launched by the Shuttle. The payloads were inserted into geostationary orbit by a two stage solid IUS rocket. After the MAGNUM codename was leaked, the name was reportedly changed to ORION. Now that has been leaked, the name is presumably changed once again.

An advanced geostationary signals intelligence satellite, possibly replacing both MAGNUM/ORION and VORTEX, was developed for launch on the Titan 4 Centaur. Two appear to have been orbited to date. I will call the program ADVANCED ORION for lack of a better name. The second launch has a larger shroud than the first, and may be a different program.

A heavy payload was launched into a JUMPSEAT-type orbit in May 1994 by a Titan 4 Centaur rocket. It is tentatively assumed that this spacecraft is a signals intelligence satellite, which I refer to as ADVANCED JUMPSEAT because of its orbit. However, it is not clear if their is any relation between the mission of the new satellite and the old JUMPSEAT series. A second payload of this type was launched in July of 1995 (since this article was submitted to Quest, the author has informed us that the correct codename has been revealed to be "TRUMPET."—*ed.*)

US Naval Intelligence Satellites

NRL Elint Satellites

A number of classified satellites launched by the Naval Research Laboratory may have carried electronic intelligence (elint) payloads. These small satellites had masses between 20 and 50 kg. In the official list of NRL satellite launches[8] a number of classified satellites are identified as "gravity gradient experiments" in addition to the unclassified GGSE flights. It is probable that these flights are technology precursors to the PARCAE interferometer system (see below) and possible that they also carried elint payloads. The table of NRL elint satellites should be considered as provisional as the identification of the payloads in NRL's multiple launches remains uncertain.

RHYOLITE Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period
RHYOLITE 1	1970-46A	1970 Jun 19	Atlas Agena D	35804 x 35863 x 0.1	1426.5
RHYOLITE 2	1973-13A	1973 Mar 6	Atlas Agena D	35855 x 36679 x 0.2	1435.0
AQUACADE 3	1977-114A	1977 Dec 11	Atlas Agena D		
AQUACADE 4	1978-38A	1978 Apr 8	Atlas Agena D		

PARCAE

The US Navy's only major space reconnaissance system, the Naval Ocean Surveillance System or PARCAE used a cluster of three subsatellites. The satellites were released from a dispenser attached to the upper stage, designated object A in the RAE Table; object B is a plume shield and not a rocket as reported elsewhere. The dispenser may carry a secondary payload which operates for about a month, but is not an active part of the subsatellite interferometry system or a "main" satellite, although it is assigned a USA code name. The subsatellites maintain precisely known distances to each other, to locate surface shipping by interferometric measurements of their radio transmissions. PARCAE is also known by the unclassified nickname WHITE CLOUD. The satellites are built by Martin Marietta, although the first two flight systems were built by the Naval Research Laboratory. The system arose from gravity gradient experiments carried out by NRL in the 1960s.

A second generation NOSS system uses triplets of satellites launched by Titan 4 rockets. There is some evidence that the A object from each launch is a separate payload in a lower orbit, and the second table gives amateur-observed orbits for these objects. USA-59 was first launched into a 250 km altitude orbit, and was then observed in a 450 km one; the triple cluster was then seen in an 1100 km orbit. The dual orbit change strongly suggests the deployment of another payload in the 450 km orbit. Furthermore, the cargo capacity of the Titan 4 to this orbit is around 15000 kg, compared to under 2000 kg expected for NOSS. Against this, only four USA code numbers were assigned, corresponding to the expected three subsatellites and the upper stage dispenser.

The USA code numbers are assigned to each DoD satellite by Space Command in the order that they are tracked and cataloged, which explains why the numbers are not always in sequence. The first launch of the series was from Cape Canaveral, with the subsequent ones from Vandenberg. The third payload was destroyed when its Titan 4 launch vehicle failed.

VORTEX Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period
CHALET 1	1978-58A	1978 Jun 10	Titan IIIC	29929 x 42039 x 12	1446.3
VORTEX 2	1979-86A	1979 Oct 1	Titan IIIC	30443 x 41497 x 7.5	1445.5
VORTEX 3	1981-107A	1981 Oct 31	Titan IIIC		
VORTEX 4	1984-09A	1984 Jan 31	Titan 34D/Transtage		
VORTEX 5	1988-77A	1988 Sep 2	Titan 34D/Transtage	465 x 39449 x 26.7	708.9
VORTEX 6	1989-35A	1989 May 10	Titan 34D/Transtage		

MAGNUM Missions

Satellite	Desig.	Date	Vehicle	Orbit	Notes
MAGNUM 1	1985-10B	1985 Jan 24	Shuttle/IUS	Geostationary	
ORION 2	1989-90B	1989 Nov 23	Shuttle/IUS	Geostationary	

ORION and ADVANCED JUMPSEAT Missions

Satellite	Desig.	Date	Vehicle	Orbit	Period
ADV ORION 1	1994-54A	1994 Aug 27	Titan 401/Centaur	Geostationary	
ADV ORION 2	1995-22A	1995 May 14	Titan 401/Centaur	Geostationary	
ADV. JUMPSEAT 1	1994-26A	1994 May 3	Titan 401/Centaur	1323 x 39034 x 64.4	717.9
ADV. JUMPSEAT 2	1995-34A	1995 Jul 10	Titan 401/Centaur		

Early Warning Satellites

MIDAS

The final component of the original WS-117L system was the ability to detect enemy missile launches. The missile warning program seems to have stayed entirely with USAF rather than being made an NRO responsibility, but I have included it here for complete-

(a) Probable NRL Elint Flights

Satellite	Date	Orbit	Period	Desig.	Notes
NRL PL 120	1962 Dec 13	231 x 2786 x 70.4	116.3	1962 βτ 1	
NRL PL 121	1962 Dec 13	229 x 2785 x 70.3	116.2	1962 βτ 5	
NRL PL 112	1963 Jun 15	181 x 829 x 69.9	94.8	1963-21E	
NRL PL 135	1964 Jan 11	905 x 934 x 69.9	103.5	1964-01E	
NRL PL 142	1965 Mar 9	910 x 939 x 70.1	103.5	1965-16A	Possibly scientific
NRL PL 176	1969 Sep 30	906 x 940 x 70.0	103.5	1969-82G	Classified

(b) NRL Classified Gravity Gradient Experiments

NRL PL 151	1967 May 31	915 x 927 x 69.9	103.4	1967-53G	Grav grad
NRL PL 153	1967 May 31	915 x 926 x 69.9	103.4	1967-53H	Grav grad
NRL PL 161	1969 Sep 30	906 x 941 x 70.0	103.5	1969-82B	Grav grad
NRL PL 162	1969 Sep 30	907 x 940 x 70.0	103.5	1969-82D	Grav grad
NRL PL 163	1969 Sep 30	906 x 941 x 70.0	103.5	1969-82E	Grav grad
NRL PL 164	1969 Sep 30	906 x 940 x 70.0	103.5	1969-82F	Grav grad
NRL PL 171	1971 Dec 14	983 x 999 x 70.0	104.9	1971-110A	Grav grad
NRL PL 172	1971 Dec 14	983 x 999 x 70.0	104.9	1971-110C	Grav grad
NRL PL 173	1971 Dec 14	982 x 997 x 70.0	104.9	1971-110D	Grav grad
NRL PL 174	1971 Dec 14	981 x 997 x 70.0	104.9	1971-110E	Grav grad

ness.

The first USAF satellite to test a missile warning capability was MIDAS, built around the Agena spacecraft. Unfortunately, the system was plagued with false alarms and was temporarily abandoned. A second generation MIDAS also known as the Research Test Series was flown in 1966, and contributed to the design of the later successful DSP program. The first RTS satellite, MIDAS 10 or FTV 1351, was stranded in transfer orbit when its Agena failed to restart, but the other two appear to have been successful.

DSP

The first successful infrared early warning satellites were TRW's Program 647 Defense Support System or DSP satellites,[7,9] which used spinning infrared Schmidt telescopes from geostationary orbit. The first DSP was launched in November of 1970, but a failure of the Transtage upper stage left it in sub-synchronous orbit. Nevertheless, some tests were carried out. The next three launches were stationed over the Indian Ocean, Panama, and the Pacific respectively, completing the Block 1 constellation. A launch in 1975 failed shortly after it reached geosynchronous orbit when a fuel line ruptured. Flights continued into the 1980's, and in 1989 the first of a new generation was orbited, the Block 14 DSP, on the initial flight of the Titan 4 rocket.

Comments

With the Cold War over, the veil on early US military activities in space is beginning to lift. It is already clear that space assets played an important stabilizing role by showing that the worst fears of a missile gap were unfounded, and later by providing the confidence that hostile preparations would be detected and that some level of arms control verification was possible. The huge sums of money expended on military spaceborne intelligence may be offset by the even huger sums that might otherwise have been spent on extra offensive weapons to cover worst-case scenarios. Much as the enormous arms race of the Cold War affected the American economy and American society, it was less extreme than envisaged by some military planners prior to the first CORONA photos arriving to dampen the missile gap paranoia. As we enter a period when the US intelligence community in general and the NRO in particular is facing significant budget cutbacks, we need an understanding of the history of space

PARCAE Flights

Satellite	Subsats	Date	Vehicle	Orbit	Desig.
PARCAE 1	SSU 1-3	1976 Apr 30	Atlas F	1092 x 1128 x 63	1976-38A,C,D,J
PARCAE 2	SS 1-3	1977 Dec 8	Atlas F	1054 x 1169 x 63	1977-112A,D,E,F
PARCAE 3	EP 1-3	1980 Mar 3	Atlas F	1048 x 1166 x 63	1980-19A,C,D,G
PARCAE 4	-	1980 Dec 9	Atlas E	-	
PARCAE 5	SS A-C	1983 Feb 9	Atlas H	1052 x 1168 x 63	1983-08A,E,F,H
PARCAE 6	GB 1-3	1983 Jun 9	Atlas H	1051 x 1170 x 63	1983-56A,C,D,G
PARCAE 7	JD 1-3	1984 Feb 5	Atlas H	1052 x 1172 x 63.4	1984-12A,C,D,F
PARCAE 8	USA 15-18	1986 Feb 9	Atlas H	1049 x 1166 x 63.0	1986-14A,E,F,H
PARCAE 9	USA 22-25	1987 May 15	Atlas H	1045 x 1179 x 63	1987-43A,E,F,H

Advanced NOSS Flights

Cluster	Subsats	Date	Vehicle	Orbit	Desig.
NOSS II-1	USA-60, USA-61, USA-63	1990 Jun 7	Titan 4	1067 x 1150 x 63.4	1990-50B,C,D
NOSS II-2	USA-74, USA-76, USA-77	1991 Nov 7	Titan 4	1052 x 1164 x 63.4	1991-76C,D,E
NOSS II-3		1993 Aug 2	Titan 4	-	

Advanced NOSS main payloads (provisional)

Satellite	USA Desig.	Date	Vehicle	Orbit	Desig.
?	USA-59	1990 Jun 7	Titan 4	447 x 447 x 61.0	1990-50A
?	USA-72	1991 Nov 7	Titan 4	300 x 590 x 63.5	1991-76A

MIDAS Flights

Satellite	Agena No.	Date	Vehicle	Orbit	Period	Notes
MIDAS 1	1008	1960 Feb 26	Atlas Agena A	-		Agena failed
MIDAS 2	1007	1960 May 24	Atlas Agena A	484 x 511 x 33.0	94.4	
MIDAS 3	1201	1961 Jul 12	Atlas Agena B	3358 x 3534 x 91.2	161.5	
MIDAS 4	1202	1961 Oct 21	Atlas Agena B	3496 x 3756 x 95.9	166.0	
MIDAS 5	1203	1962 April 9	Atlas Agena B	2814 x 3382 x 86.7	153.0	
MIDAS 6	1205	1962 Dec 17	Atlas Agena B	-		Atlas failed
MIDAS 7	1206	1963 May 9	Atlas Agena B	3604 x 3680 x 87.4	166.5	
MIDAS 8	1204	1963 Jun 12	Atlas Agena B	-		Atlas failed
MIDAS 9	1207	1963 Jul 18	Atlas Agena B	3670 x 3727 x 88.4	167.8	
MIDAS 10	1351	1966 Jun 9	Atlas Agena D	174 x 3616 x 90.0	124.9	Agena Failed
MIDAS 11	1352	1966 Aug 19	Atlas Agena D	3680 x 3700 x 90.1	167.6	
MIDAS 12	1353	1966 Oct 5	Atlas Agena D	3682 x 3702 x 90.2	167.6	

intelligence, with both its successes and failures. In these articles I have tried to provide a summary of the scope and nature of the US reconnaissance satellite programs, which I hope will serve as a useful backdrop for the policy analyses being carried out by other researchers.

Notes:

In Part 1, the launch date of Discoverer 4 should read 1959 Jun 25.

Part 1 of this article described the Improved CRYSTAL imaging reconnaissance satellites. A third satellite in that series was launched on December 5, 1995, into a 156 x 976 km x 98.7° orbit.

A payload launched by the Space Shuttle in November of 1990, USA-67, is still a mystery. It will be discussed in a later issue of *Quest*.

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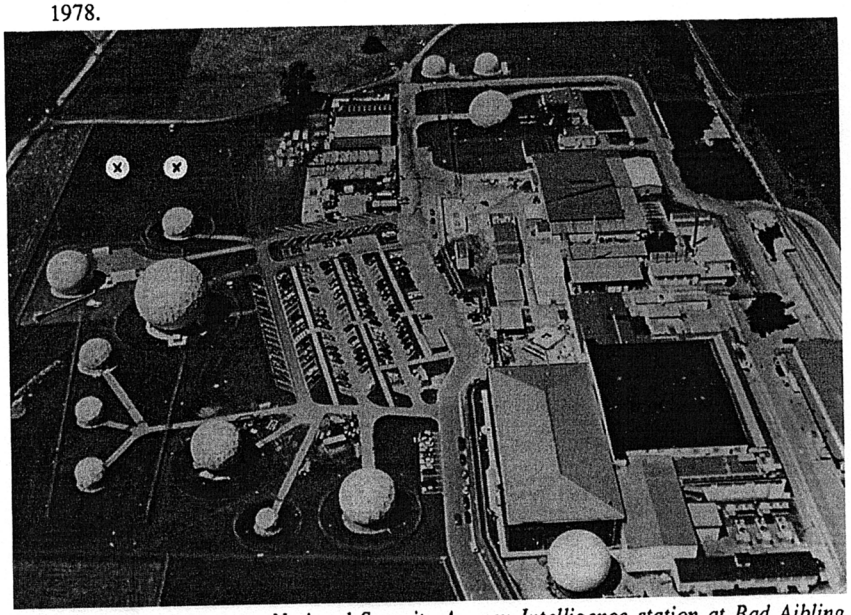

A rare photo of the secret National Security Agency Intelligence station at Bad Aibling, Germany. The large radar domes ("golfballs") are used to receive and relay transmissions from the NRO's constellation of signal intelligence satellites (SIGINTs). These may also be used to intercept signals from civilian communication satellites and Russian spacecraft. This facility is operated by the U.S. Army. Two additional golfballs have been constructed at the Bad Aibling installation (at the two crosses) since this photo was taken, probably to support the NRO's new geosynchronous SIGNITS. Photo originally appeared in the July 1995 issue of "Communications World" and reprinted with permission.

DSP Flights

Flight	Satellite (Production)	Desig.	Date	Vehicle	Orbit	Period
DSP F1	DSP 1	1970-93A	1970 Nov 6	Titan IIIC	26050 x 35886 x 7.8	1197.1
DSP F2	DSP 2	1971-39A	1971 May 5	Titan IIIC	35651 x 35840 x 0.9	1434.0
DSP F3	DSP 3	1972-10A	1972 Mar 1	Titan IIIC	35416 x 35962 x 0.2	1429.9
DSP F4	DSP 4	1973-40A	1973 Jun 12	Titan IIIC	35777 x 35786 x 0.3	1435.9
DSP F5	DSP 7	1975-118A	1975 Dec 14	Titan IIIC	35671 x 35785 x 3.0	1436.0
DSP F6	DSP 8	1976-59A	1976 Jun 26	Titan IIIC	35620 x 35860 x 0.5	1433.3
DSP F7	DSP 9	1977-07A	1977 Feb 6	Titan IIIC	35532 x 35755 x 0.1	1436.0
DSP F8	DSP 11	1979-53A	1979 Jun 10	Titan IIIC	35712 x 35854 x 1.8	1435.9
DSP F9	DSP 10	1981-25A	1981 Mar 16	Titan IIIC	35463 x 35527 x 2.0	1421.2
DSP F10	DSP 13	1982-19A	1982 Mar 6	Titan IIIC	35520 x 35598 x 2.0	1424.4
DSP F11	DSP 12	1984-37A	1984 April 14	Titan 34D/Transtage	35530 x 35530x 1.3	1423.0
DSP F12	DSP 6R	1984-129A	1984 Dec 22	Titan 34D/Transtage	35915 x 36190 x 3.4	1445.8
DSP F13	DSP 5R	1987-97A	1987 Nov 28	Titan 34D/Transtage	35514 x 35558 x 2.9	1423.3
DSP F14	DSP 14	1989-46A	1989 Jun 14	Titan 4/IUS	35614 x 35699 x 3.1	1421.8
DSP F15	DSP 15	1990-95A	1990 Nov 13	Titan 4/IUS	35614 x 35699 x 3.1	1421.8
DSP F16	DSP 16	1991-80B	1991 Nov 25	Shuttle/IUS	35795 x 35787 x 2.5	1421.9
DSP F17	DSP 17	1994-84A	1994 Dec 22	Titan 4/IUS		