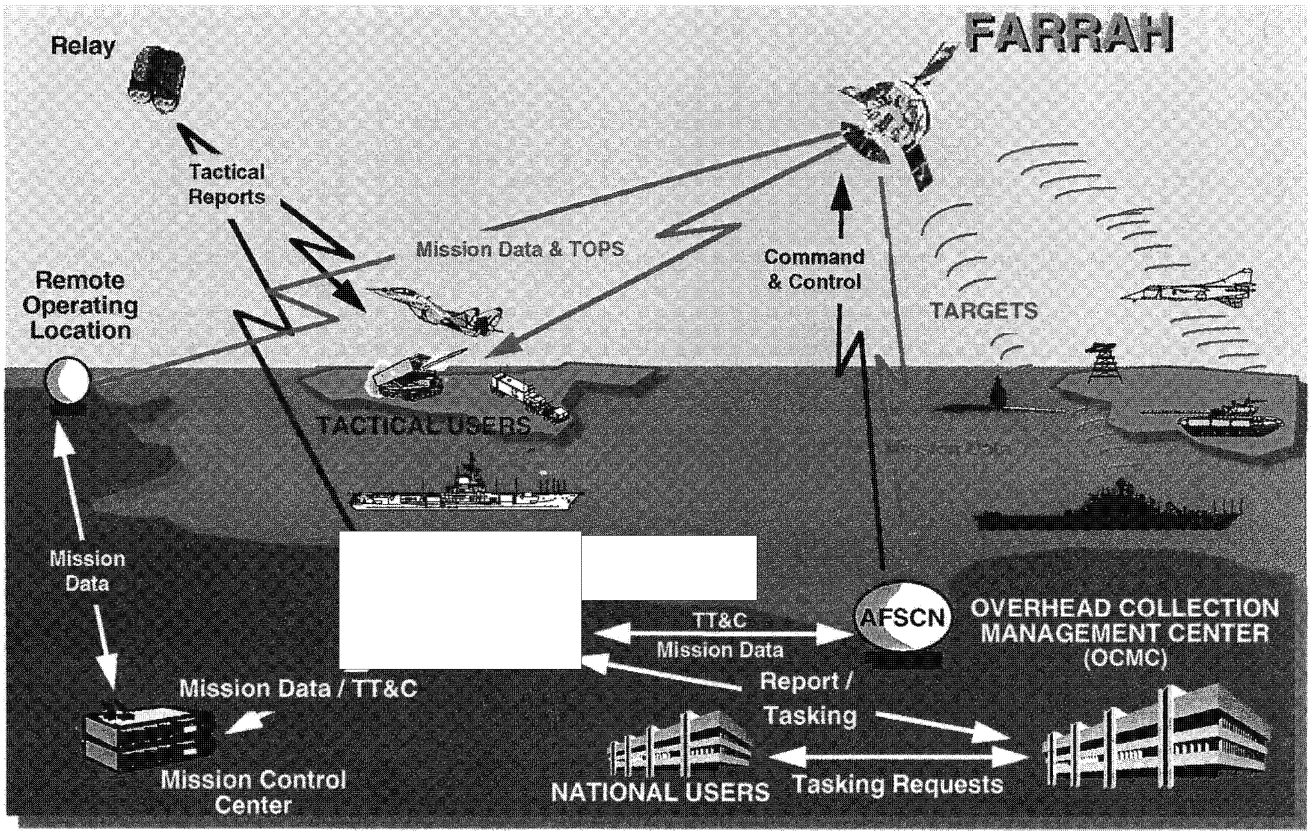
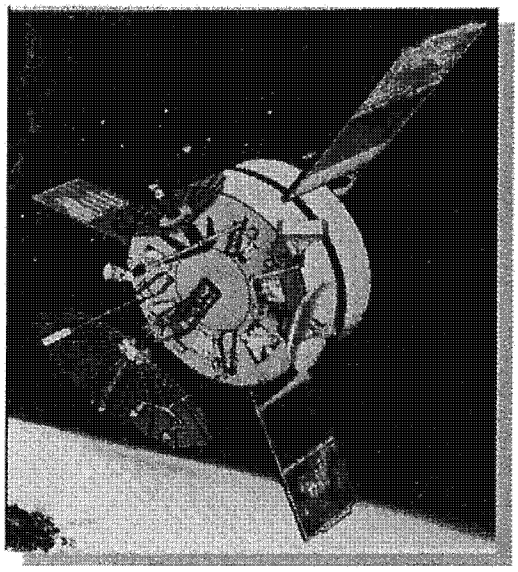
~~SECRET / BYEMAN~~



~~SECRET / BYEMAN~~
Handle Via BYEMAN / COMINT Control Systems Jointly

~~SECRET~~

FARRAH System



System

- Low Earth Orbit (LEO) Narrow Field-of-View (NFOV) reconnaissance system
- One satellite per mission (four active missions)
- Near-circular orbit at 435 nm and 85 degree inclination
- Area view time: about 10 minutes average per pass in primary area
- 1100 nm swath width on either side of nadir
- [redacted]
- RF Coverage: 2-18 GHz for FARRAH I, II, [redacted]

Mission

- Technical ELINT
- Operational ELINT
- COMINT Geolocation
- Foreign Instrumentation Signals

Attributes

- Polar orbit
- Sidelobe and mainbeam collection
- Flexible payload configuration suitable for multi-mission tasking against diverse SIGINT targets
- Fine grain technical parameter analysis
- Direct real-time downlink to EPDS, TEP and the follow-on (Mini-DAS) ELINT Processing and Dissemination vans/capabilities whenever the satellite is over an operational area; provides direct, assured, real-time, raw, and processible data in the dynamic tactical context
- [redacted]
- Record and playback to any of the USAF-operated remote tracking stations located around the world
- [redacted]
- Near-worldwide access and frequent revisits (two-satellite constellation revisits areas in the temperate zone 10 - 20 times per day)
- Tasking received from the Overhead Collection Management Center (OCMC) and the mission control center
- Rapidly changing intercept geometry for accurate geolocation
- Spin stabilization enables sequential sweeping of the Earth by antenna footprints

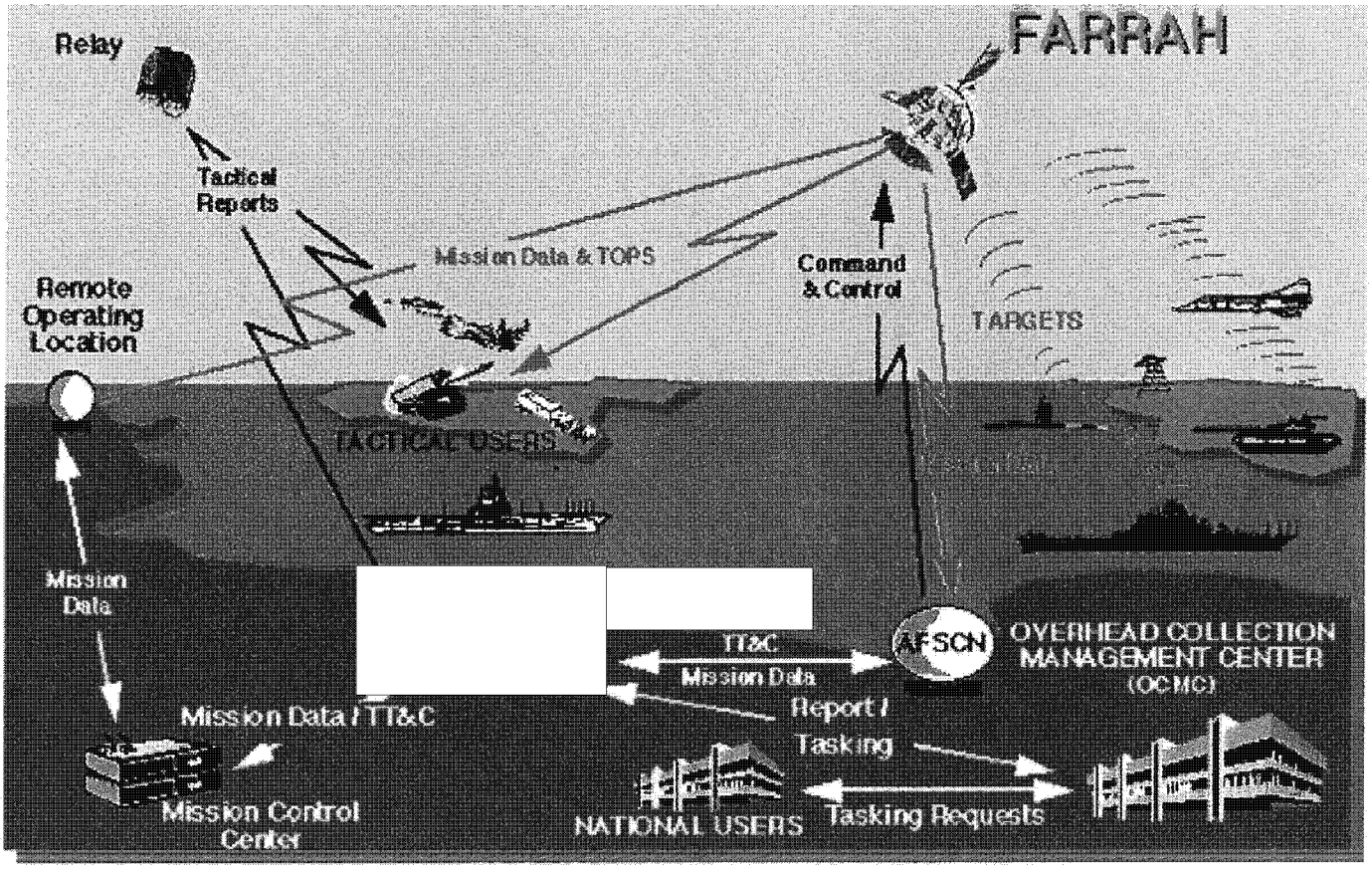
~~SECRET~~
HANDLE VIA BYEMAN CONTROL CHANNELS ONLY

~~SECRET~~

FARRAH System

- [redacted]

Architecture



SPACE

- [redacted] operational satellites
- Structured as an aluminum cylinder
- Weight: 3200 pounds (FARRAH I [redacted]
- Three direction finding (DF) antennas alternately and selectively coupled with highly sensitive, wide instantaneous bandwidth multichannel receivers; six omni-directional antennas which may be coupled with 2-channel omni pulse and CW receivers; eight wide angle polarimeter antennas which can be coupled with a 2-channel polarization analysis receiver; a technical intelligence receiver which can be selectively coupled with DF, omni, or polarimeter outputs
- Each satellite encrypts and downlinks encoded signal data on a different assigned frequency to avoid interference at ground stations

25X1

GROUND

- Nine USAF-operated Remote Tracking Stations (RTSs) and three Remote

~~SECRET~~
HANDLE VIA BYEMAN CONTROL CHANNELS ONLY

Operating Locations (ROLs), each linked

-
-
- RTSs (Oakhanger, England; Thule, Greenland; New Boston Air Station, New Hampshire; Falcon AFB, CO; Vandenberg AFB, CA; Kaena Point Oahu, HI; Anderson AFB, Guam; Diego Garcia; and Mahe, Sehchelles) uplink satellite commands and acquire analog and digital data
-
- Mission planning performed at Mission Planning Operations Center at MCC-III in
- Command and control is the responsibility of MCC-III

Products

- Half of total overhead TECHELINT production generated by FARRAH (approximately 5500 reports per day)
- Reporting provided in various formats and tailored to operational intelligence, term analysis, or summary reporting in the COMINT, ELINT, and FISINT domains

Dissemination

- TDDS. Selected OPELINT reports immediately disseminated via global broadcast network directly to operational forces equipped with tactical receivers
- CRITICOMM. All products sent from NSA to the intelligence community (DIA, JICs, etc.) via CRITICOMM or GCS
- Secondary Distribution. NSA provides secondary distribution to other consumers (e.g., CIA, DEA, FBI, and STRATCOM)

System Status

- FARRAH satellites designed to provide a 3-year mean mission duration (MMD) and a 4-year design lifetime
- FARRAH I: on orbit 14 years; residual status, but reactivated for limited direct operational readout to the EPDS/TEP vans in support of Bosnian situation
- FARRAH II: on orbit 12 years; residual status, but reactivated for limited direct operational readout to the EPDS/TEP vans in support of Bosnian situation

~~SECRET~~

[redacted] Status
November 1996

TK Mission	M7346	M7347		M7245
[redacted] Name	FARRAH - I	FARRAH - II		CARRIE
Current Status	Bosnia / [redacted] Collects* August 95			Operational
Launch Date	11 May 82	25 Jun 84		13 Mar 94
Booster	Titan 34-D			Taurus
Altitude	383 nm			300 nm
Inclination	96 deg			105 deg
Receivers	Direction Finding (Pulse & CW) Omni Directional (Pulse & CW) Technical Intelligence (TI)			CW, GPS
Frequencies	2 - 18 GHz			100 - 850 MHz
Daily Tasking	40 Min	40 Min		240 Mins

* Data Downlink to Vans and Some Data Processed by Ground Station

~~SECRET~~

Handle Via BYEMAN Channels Only

~~SECRET~~

Tape Recorder Status
November 1996

	7346 Launched 11 May 82 Reactivated Tape Cycles (22 Feb 91)	7347 Launched 25 Jun 84 Vans XPonds Only Tape Cycles (23 Jan 91)
1	8763 Failed 30 Jul 88	12117 Failed 23 Jan 91
2	12289 Failed 22 Feb 91	11322 Failed 23 Sep 89
3	7210 Failed 22 Mar 87	9917 Failed 8 Dec 88

~~SECRET~~

Handle Via BYEMAN Channels Only

~~SECRET~~

FARRAH Description

1. System/Mission. FARRAH is a polar orbiting NFOV reconnaissance system that conducts worldwide sampling and reporting of SIGINT target activity on a daily basis. The FARRAH system provides NSA and the intelligence community with a worldwide wideband general search, SIGINT mapping, and mainbeam technical intelligence production capability. NFIP - derived mission objectives include EOB production, general search, technical intelligence, directed surveillance, COMINT / FISINT mapping, and specific emitter identification. DoD augmentation objectives (starting 1978) include raw data collection with downlinking to Army Electronic Processing and Dissemination System (EPDS) and Air Force Tactical ELINT Processing (TEP) vans, tactical on-board processing with direct downlinking, and COMINT recognition with direct downlinking. In response to basic and special mission guidance from the OCMC, FARRAH continually generates detailed ELINT and COMINT reports on weapon systems and platforms under surveillance for identification of new and emerging threats, arms treaty verification (power levels), indications and warnings, and science and technology assessment. Operating FARRAH assets are collectively designated as NRO Mission 7300 and the TK control system. ROSTER is the NSA-internal name for FARRAH.

2. Architecture. The FARRAH system encompasses both residual and operational assets of the FARRAH project, initiated in 1977, and operational assets of the advanced FARRAH project, initiated in 1982. The main elements of the operational baseline are two operational satellites, nine remote tracking stations (RTSs), three remote operating locations (ROLs), a mission control center (MCC)

The nearly circular orbit (435 nm, 85°) maximizes access to the northern latitudes, where ballistic missile early warning systems are most prevalent. Mission data is downlinked to a remote site (RTS or ROL), each of which is linked by communication satellite, ground equipment, and landline with the MCC at

The AFSCN RTSs (Oakhanger, England; Thule, Greenland; New Boston Air Station, New Hampshire; Falcon AFB, Colorado; VAFB, California; Kaena Point Oahu, Hawaii; Anderson AFB, Guam; Diego Garcia; and Mahe, Sehchelles) uplink satellite commands and acquire analog and digital data. The ROLs

3. Products. Half of the total U.S. overhead TECHELINT production is generated by the FARRAH system. Customers for FARRAH's SIGINT products include the NSA, DIA, joint intelligence centers, other SIGINT producers and analytic centers, and users equipped with tactical receivers. NSA provides secondary distribution or access for additional consumers product reporting is provided in various formats (ROSTER - 152, ROSTER - 155, ROSTER - 164, ROSTER - 167, or CW STRUM, ROSTER - 174, ROSTER - 182, ROSTER - 200, ROSTER - 203, KLIEGLIGHT, TACREP, EGRAM / SPOT, ELT, and TDDS TADIXS B), which are variously tailored to operational intelligence, term analysis, or summary reporting in the COMINT, FISINT, and ELINT domains. Selected OPELINT reports are immediately disseminated via the global TDDS broadcast network directly to operational forces equipped with tactical receivers. All products for the intelligence community, routed depending upon the intelligence content of the report and the requirements of the user, are disseminated through NSA's CRITICOMM or GCS networks.

4. Attributes. FARRAH's main attributes are its polar orbit, solitary spin - stabilized satellite, sidelobe detection and direction finding (DF), multi - mission reconfigurability, centralized SIGINT processing, fine - grain technical parameter analysis, and direct operational readout. The two - satellite constellation revisits areas in the temperate zones 10 to 20 times per day. Spin stabilization maintains constant

alignment of the satellite's spin axis with the Earth' polar axis and enables sequential sweeping the Earth by antenna footprints due to the 50 rpm rotation of the satellite. Selectable, independently controlled multiple combinations of antennas, receivers, special processors, and recorders enable flexible payload configuration suitable for multi-mission tasking against diverse SIGINT targets. All collected data is sent

ELINT, COMINT, and FISINT signals of interest. Operational intelligence reports sent via TADIXS B and CRITICOMM include ELINT

Off - line, detailed analysis of processed and raw digital and analog data from multiple collections of the same SIGINT target (fused with data collected by other overhead and conventional systems) identifies and geolocates new signals / modes, provides fine - grain signal characterization, and satisfies community needs for technical intelligence and tip - off to other collectors. The data downlinked to EPDS / TEP vans whenever the satellite is over an operational area is direct, assured, real-time, raw, and processible in the dynamic tactical context.

5. Salient Features. Structured as an aluminum cylinder (8 feet high, 9 feet diameter), an advanced FARRAH satellite weighs 3200 pounds The payload includes three DF antennas with guard inhibit horns, which are alternately and selectively coupled (in concert with the spinning action of the satellite) with highly sensitive, wide instantaneous bandwidth, multichannel receivers for detection of sidelobe radiation from pulsed and CW signals in up to five 2 GHz bands of the 1.2 - 18 GHz range; six omnidirectional antennas, which provide additional inhibit protection for selected high - gain DF antennas' forward lobes and which can also be coupled with 2 - channel omni pulse and CW receivers for detection of mainbeam radiation from pulsed and CW signals in a 2 GHz bands of the 1.2 - 18 GHz range; eight wide angle polarimeter antennas, which can be coupled with a 2 - channel polarization analysis receiver to determine polarization of handover DF and omni signals or of signals detected by a fixed tuned bandwidth (T) receiver, which can be selectably coupled with DF, omni, or polarimeter outputs to provide pre - detection collection of handover DF and omni signals or of RF energy detected by a fixed tuned bandwidth (mode dependent 10, 13, or 0.75 MHz) in the 1.2 - 18 GHz range. DF pulse measurements include RF, amplitude, pulse width, AOA and TOA. DF CW measurements include RF amplitude, AOA, and time of measurement (TOM). Omni pulse measurements include RF, amplitude, pulse width and TOA. Omni CW measurements include RF, amplitude, and TOM. Polarimeter measurements include RF, pulse width, amplitude for both right and left hand circular polarized (RHCP, LHCP) antennas, phase difference between RHCP and LHCP antennas, and pulse TOA, and CW TOM. The TI receiver measures CW RF, pulse and CW amplitude, pulse TOA, and CW TOM. The TI receiver can also output analog data to enable waveform analysis

6. Satellite Status. [redacted] The on - orbit constellation includes first generation FARRAH I (13 years on orbit) and FARRAH II (11 years on orbit), both of which are in residual status and used only for limited direct operational readout to the EPDS van [redacted]

Spacecraft on - orbit engineering support and command and control are provided by MCC - III. Command loads are sent via the DSCS to an appropriate RTS for transmission to the FARRAH satellite by means of a [redacted] Payload calibration is accomplished using the MRC for signal transmission and the MCC for both signal collection and analysis.