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CARRIE

Concept Of Operations

August 8, 1996

[redacted]
Commander, [redacted]

[redacted]
Chief, F75

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CL Reason: 1.5(c)
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1.0. ~~(S/B/TK)~~ **Introduction and Background.** CARRIE was originally designed as a small satellite (SMALLSAT) experiment funded by the Defense Advanced Research Project Agency (DARPA) and executed under the auspices of the National Reconnaissance Office (NRO). CARRIE is a heritage based system from the GLORIA I & II (M7243 & M7244) SMALLSAT spacecraft series. CARRIE was launched aboard the first TAURUS booster on 13 Mar 94, completed early orbit operations on 24 Mar 94, and started the experimental phase on 1 Jun 94. Appendix A briefly outlines the original CARRIE experiments and objectives.

1.1. ~~(S/B/TK/C)~~ **Mission Overview.** CARRIE is a Communications Intelligence (COMINT) mapping system originally designed to support the tactical user (Army ELINT Processing Dissemination System (EPDS) and Air Force Tactical ELINT Processing (TEP) vans). At the conclusion of the experiment, the NRO made a decision to nationalize the spacecraft to support national tasking requirements in conjunction with the tactical user requirements. CARRIE provides on-board processing of collected emitters and transmits these directly to the tactical user in the TADIXS-B format, via the spacecraft's DDL. In support of national tasking requirements, the collected data will be received at the

1.2. ~~(S/B/TK)~~ **System Architecture.** Figure 1, Operational Concept provides a generic high level depiction of the overall concept of operations, while Figure 2, Operational Architecture provides a semi-detailed overview of the system architecture and processes as they exist today and in the future.

1.2.1. ~~(S/B/TK)~~ **Spacecraft Architecture.** CARRIE is a spin stabilized spacecraft, spinning approximately 20 rpm, with a variable North/South spin axis. It is in a 105° inclined, 16 revolutions/day, retrograde orbit, at an altitude of approximately 300 nautical miles. The spacecraft is a 3 ft cube with two 42-inch spiral antennae and weighs approximately 400 lbs. Its frequency collection coverage ranges from 100 - 850 MHz and is capable of supporting 240-300 minutes of tasking/day.

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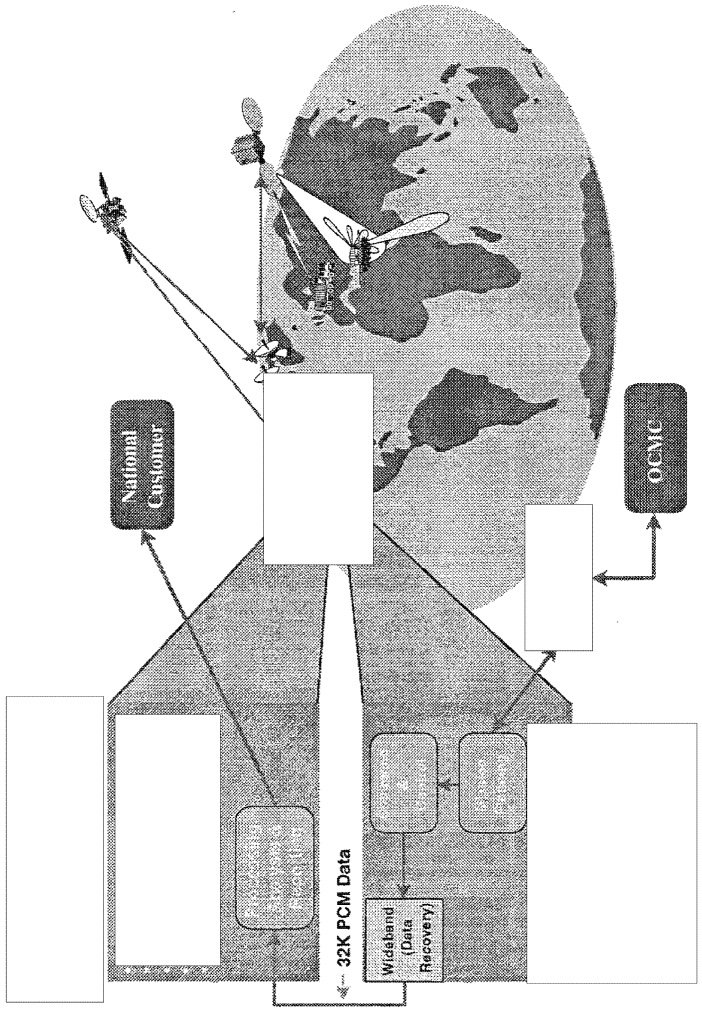

Figure 1, Operational Concept

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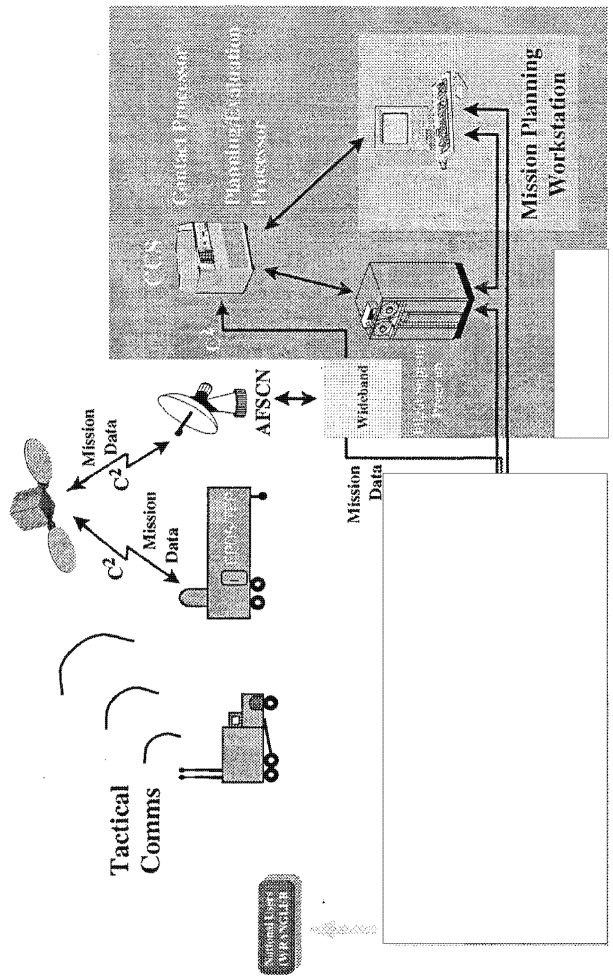

Figure 2, Operational Architecture

1.2.2. ~~(S/B/TK)~~ Ground Architecture At The existing ground architecture supporting CARRIE at

1.2.2.1. ~~(S/B/TK)~~ Mission Planning. Mission planning is conducted at Mission planning is comprised mostly of Commercial Off-The-Shelf (COTS) hardware and software merged with existing M7300 systems. A MacIntosh computer, utilizing both COTS and custom developed software to model CARRIE, is used for mission planning. Mission Planning is responsible for all M7300 and M7245 vehicle deconfliction.

1.2.2.2. ~~(S/B/TK)~~ Command & Control (C^2). The existing M7300 C^2 architecture is utilized for CARRIE C^2 operations. All C^2 operations occur in is responsible for loading the vehicle, collecting and recovering the mission data, and routing it to the

1.2.3 ~~(S/B/TK)~~

1.2.3.1. ~~(S/B/TK)~~

1.2.3.2. ~~(S/B/TK)~~

1.3 ~~(S/B)~~

1.3.1 ~~(S/B)~~

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1.4.2. ~~(S/B/TK)~~ Operations.

1.4.3 ~~(S/B/TK/C)~~ Reporting.

1.4.3.1 ~~(S/B)~~ There will be no requirement for reporting during the initial phases while the CGPW is located in the Should a requirement for reporting arise during activities, will coordinate with the for reporting approval.

1.4.3.2 ~~(S/B/TK/C)~~ Operational. Operational reporting will be accomplished via the following reporting vehicles/formats:

REGIME-X	Non-realtime narrative reports issued by the analysts.
REGIME-167	STRUM reporting to COMINT databases.
REGIME-200	COMINT GEO report to WRANGLER.
DSR	Direct Search Report to NSA customers.

1.4.3.3. ~~(S/B/TK)~~ TRAP. MESGEN provides the capability to generate TRAP reports, however, at this time, TRAP reporting will not be conducted. Should the requirement arise in the future, will consider TRAP reporting at that time.

1.4.4. ~~(S/B/TK)~~ Data Storage. The CGPW will provide for 30days of short-term storage for payload data and the Format Specification Tool (FST) files generated from the payload data for SUNSHINE. The M7300 Data Management

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System (DMS) will provide up to 2 years of long term storage for both the payload data and FST files generated from the payload data.

2.0. ~~(S/B/TK/C)~~ Roles & Responsibilities.

2.1. ~~(S/B/TK)~~ Overhead Collection Management Center (OCMC). The OCMC will be the adjudicating authority for all tasking concerning CARRIE. Upon receiving validated tasking requests, the OCMC will forward these requirements, via [redacted] to the [redacted] The tasking priorities will be the same as those used for M7300. The OCMC will be responsible for adjudicating conflicts between national tasking requirements and tactical tasking requirements for CARRIE.

2.2 ~~(S/B)~~ [redacted] has the overall responsibility for C^2 operations, mission planning implementation and execution, recovery of mission data via the Air Force Satellite Control Network (AFSCN) Remote Tracking Stations (RTS), spacecraft safety & health, spacecraft engineering, and spacecraft anomaly support/resolution. As part of the mission planning process, mission planning will be responsible for deconfliction of M7300 passes with M7245 passes to avoid overloading of the DDT.

2.3. ~~(S/B/TK/C)~~ [redacted]

2.3.1 ~~(S/B)~~ [redacted]

2.3.2. ~~(S/B/TK)~~ [redacted]

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CARRIE Experiment

A.1. ~~(S/B)~~ **CARRIE Experiment Objectives.** There were four fundamental objectives of the CARRIE experiment as described in A.1.1 thru A.1.4:

[redacted]

A.1.2. ~~(S/B)~~ **Demonstrate Advanced Technologies.** There were three (3) advanced technology demonstrations programmed for CARRIE. They are:

A.1.2.1. ~~(S/B/C)~~ Demonstrate the design concepts and capabilities of a high speed, reprogrammable Central Processing Unit (CPU) to support the on-board processing (OBP) software for geolocation and limited identification of COMINT emitters.

A.1.2.2. (~~S/B/C~~) Enhanced co-channel interference determination algorithms. These new efficient algorithms allowed for the OBP of COMINT emitters. There were also automatic thresholding algorithms which were designed to dramatically simplify payload commanding.

A.1.2.3. ~~(S/B)~~ Mini-Global Positioning System (GPS) receiver on-board the spacecraft to allow OBP with realtime spacecraft ephemeris, via GPS, without the need to periodically upload ground generated ephemeris.

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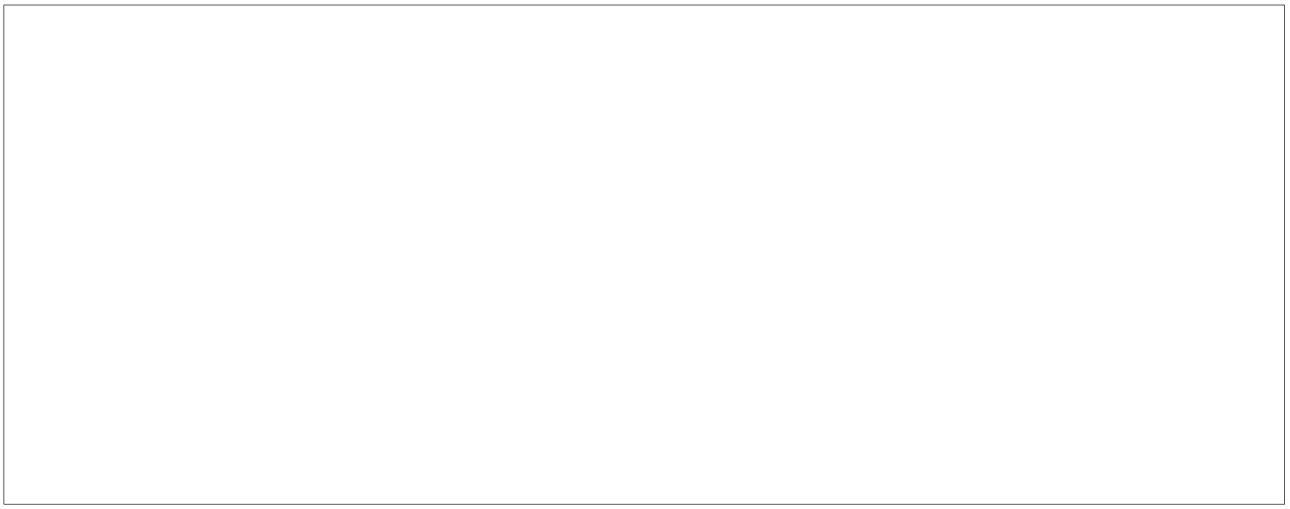

Figure 3, LEO/HEO COMINT Coverage

A.1.3. ~~**(S/B/TK) Minimum Infrastructure**~~. Develop a ground system utilizing as much of the existing systems, architecture (M7300) and COTS products, as possible, to minimize manpower, hardware procurements, software development, and operational impacts.

A.1.4. ~~**(S/B/TK**~~) **Tactical Utility of Dedicated Assets.** Develop a system and architecture which the tactical user has direct control over its tasking and collection management process, provide focused collection on their requirements, meet their performance needs via the direct-down link (DDL), direct feedback for task execution, and the capability of the tactical user to change spacecraft tasking/collection in realtime by commanding the spacecraft's collection configuration.

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