Exhibit #1

Supports Form 442 Item #4

Frequency Assignment from FAA Office of Spectrum Policy and Management

Change 2,
RTCA DO-217
Minimum Aviation System Performance Standards DGNSS Instrument Approach System: Special Category I (SCAT-I)
Appendix F

VHF Implementation of SCAT-I Data Broadcast (Normative)

FEDERAL AVIATION ADMINISTRATION
800 INDEPENDENCE AVENUE, SW
WASHINGTON, DC 20591
Fax Number: 202-267-5901

Associate Administrator for Airway Facilities
Office of Spectrum Policy and Management, ASR-1

TO: DENNIS KING **DATE:** 3-24-97

FROM: TOM CHRISTEIN

FACSIMILE MESSAGE

Priority ☐ **Routine** ☐ **Number of Pages** ☐ (includes cover)

From: Office of Spectrum Policy and Management
Spectrum Engineering and Assignment Branch, ASR-100
Attn: Tom Christein

To: Raytheon Aircraft
2268 South 3270 West
Salt Lake City, Utah
Attn: Dennis King

Subject: DGPS test frequency for Flagler County Airport

The following frequency must be coordinated with with the FCC for use as experimental testing on SCAT-1 DO-217 compatible transmitting equipment at Flagler County Airport, FL as indicated:

Frequency:	113.25 MHz (time slot A)
Location:	Flagler County Airport, FL
Coordinates:	292804N/811239W
Power:	+39 dBm ERP
Emission:	14KG7DET
Service Volume:	20NM/10,000 feet
Identifier:	XAI

Please contact Tom Christein, ASR-100, (202) 267-9737, FAX(202)267-5901, if you have any questions.

Thomas Christein
Electronics Engineer
ASR-100

Appendix F:
VHF IMPLEMENTATION OF SCAT-I DATA BROADCAST (NORMATIVE)

F.2.1.1 Message Format

Formatting of the data broadcast message consists of a demodulator training sequence followed by application data and Forward Error Correction (FEC) as shown in Table F-1.

Table F-1:
Data Broadcast Message Format

Data Broadcast Message Segment
Training Sequence
Application Data
FEC

The data broadcast message begins with a 5 segment demodulator training sequence as shown in Table F-2. The training sequence allows proper demodulation of the message by the airborne subsystem.

Table F-2:
Training Sequence Format

Segment Sequence	Training Sequence Description	# of Bits
1	Transmitter Power Stabilization and Receiver AGC Settling Time	12
2	Synchronization & Ambiguity Resolution	48
3	Slot Group Identifier	3
4	Transmission Length	17
5	Header FEC	5
	TOTAL	85

Comment: *The definition of the physical layer modulation and training sequence is defined to be consistent with the ICAO Document AMCP/3-DP-8B. Consequently, some unnecessary functionality was included.*

F.2.1.1.2 Synchronization and ambiguity resolution

The second segment of the training sequence shall consist of the Unique Word sequence:

000 010 011 110 000 001 101 110 001 100 011 111 101 111 100 010

transmitted from left to right.

Comment: This sequence was designed to have a good auto-correlation sequence and to facilitate estimation of the center frequency.

F.2.1.1.3 Slot Group Identifier

The third segment of the training sequence shall be a single symbol (3 bits) representing the Slot Group Identifier. The Slot Group Identifier shall be transmitted as a numeric value from 0 to 7, corresponding to the letter designation of the first time slot assigned to a particular ground reference station, where slot A = 0 and slot H = 7. The Slot Group Identifier shall be transmitted LSB first. All messages in all time slots employed by a particular ground station shall contain the same Slot Group Identifier.

Comments: The purpose of the Slot Group Identifier is to allow the option of controlling data flow from the airborne receiver to other avionics equipment. Once the avionics equipment has determined which Slot Group Identifier is associated with messages containing the desired ground reference station ID, by monitoring all messages during an initial acquisition period, it may then instruct the airborne receiver to continue to relay only those messages with the appropriate Slot Group Identifier. Refer to the following examples of Slot Group Identifier coding:

Reference Station ID	*Time Slots Assigned*	*Slot Group*	*Transmission Sequence (left to right)*
GYUL	*A,C*	*0*	*000*
GYMX	*D,F*	*3*	*110*
GYSF	*G*	*6*	*011*

Because Slot Group Identifier values are determined directly from time slot assignments, there is no requirement for Spectrum Management authorities to separately manage the assignment of Slot Group Identifiers. It is not intended that the Slot Group Identifier be required in an airborne database.

F.2.1.1.4 Transmission Length

In order to allow the airborne receiver to determine the length of the final Reed-Solomon block, the transmitter will send a 17-bit word, from least significant bit (LSB) to most significant bit (MSB), indicating the total number of bits of the transmission.

F.2.1.1.6 Order of Data Transmission

The order of transmission, for both the application data and FEC parity bits, shall be Least Significant Bit (LSB) first followed by the higher order bits of that field. See Section F.4 for an example. For a Type 4 message, each data block as described in Appendix M is one field.

F.2.1.2 Error Correction Encoding of Application Layer Data

In order to improve the effective channel throughput by reducing the number of required retransmissions, Forward Error Correction (FEC) shall be applied after the training sequence.

The FEC coding is accomplished by means of a systematic Reed-Solomon (255,249) 2^8-ary (3 error correcting) code capable of correcting up to three codeword symbol errors. The field defining primitive polynomial of the code shall be as follows:

$$p(x) = x^8 + x^7 + x^2 + x + 1.$$

The generator polynomial is given by:

$$\prod_{i=120}^{125} (X-\alpha^i).$$

For more information on Reed-Solomon codes, see Consultative Committee for Space Data Systems, "Recommendation for Space Data System Standards: Telemetry Channel Coding."

The first parity word out of the FEC encoder is treated as the most significant word of the six-word code and is the last parity word of the appended FEC transmitted. In addition, each code word is transmitted LSB first. The parity check words shall be appended to the data words. These words shall be transmitted low word first. For blocks less than 1992 bits long, the encoder and decoder shall fill the block with zeros. These zeros need not be transmitted.

The transmitted signal shall be $H(e^{j(2\pi ft+\phi(t))})$, where $H(\cdot)$ is a raised cosine filter with $\alpha = 0.6$ as defined in Section F.2.1.4.1.

Table F-3:
Data Encoding

X_k	Y_k	Z_k	$\Delta\phi_k$
0	0	0	$0\pi/4$
0	0	1	$1\pi/4$
0	1	1	$2\pi/4$
0	1	0	$3\pi/4$
1	1	0	$4\pi/4$
1	1	1	$5\pi/4$
1	0	1	$6\pi/4$
1	0	0	$7\pi/4$

A positive increase in $\Delta\phi$ represents a counter clockwise rotation in the complex I-Q plane of Figure F-3.

D8PSK may be produced as shown in Figure F-3 by combining two quadrature RF signals which are independently-suppressed-carrier amplitude-modulated by baseband filtered impulses. The baseband filters have a frequency response with the shape of a raised cosine with an excess bandwidth factor (α) equal to 0.6. This characteristic allows a high degree of suppression of adjacent channel energy, with performance dependent only upon hardware implementation of the modulating and amplification circuits.

F.2.1.4.2 Quadrature Modulation

The relationship between the quadrature components (I and Q) in the transmitted signal shall be +/- 3 degrees from quadrature and equal in amplitude within +/-1 dB. The carrier component of the RF signal should be at least -20 dB relative to peak RF amplitude of the modulated signal.

Comment: The quadrature requirements were chosen for no more than 1 dB transmitter implementation loss.

F.2.2 Transmission Characteristics

F.2.2.1 Symbol Rate

The symbol rate shall be 10,500 symbols/sec ± 0.005%, resulting in a nominal bit rate of 31,500 bits/sec.

F.2.2.2 FCC Emission Designator

The Federal Communications Commission (FCC) emission designator of this modulation technique is 14K0G7DET.

F.2.2.3 Nominal Output Power

The effective radiated power shall be such as to provide a field strength of at least 275 microvolts per meter (minus 97 dBW/m^2) within the defined operational coverage of the facility. (An example data broadcast power budget is provided in Table F-4.) Field strength shall be measured during signal transmission, not averaged over the time intervals between signal transmissions. Regardless of other constraints, the total integrated power over the 25 kHz bandwidth shall not exceed +43 dBm, when measured into a 50 ohm load.

Comment: The reusability of the frequency is dependent on the actual transmitted power. Accordingly, the transmitted power should be reduced to that required to achieve the minimum required field strength. In addition, the received field strength specified above provides a 10 dB signal margin above the minimum required sensitivity specified in Section F.2.3.2 as shown in Table F-4.

emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

The FCC spurious requirement may not provide adequate protection of nearby aircraft or SCAT-I ground subsystem GPS receivers from harmful interference, especially VHF 14th harmonics. Depending upon the implementation, additional filtering, shielding and/or separation from GPS receivers in the same area may be required.

F.2.2.6.3 Adjacent Channel Emissions

The amount of power during transmission under all operating conditions when measured over a 25 kHz bandwidth centered on either of the first adjacent channels shall not exceed 0 dBm.

The amount of power during transmission under all operating conditions when measured over a 16 kHz bandwidth centered on either of first adjacent channels shall not exceed -20 dBm.

The amount of power during transmission under all operating conditions when measured over a 25 kHz bandwidth centered on either of the second adjacent channels shall not exceed -25 dBm and shall decrease 5dB per octave until -52 dBm (See Table F-5).

F.2.3.4 Undesired Signal Rejection

The airborne receiver shall provide the specified error rate with a desired signal strength of -84 dBm in the presence of a co-channel SCAT-I D8PSK signal that is 20 dB lower than the desired signal.

The airborne receiver shall provide the specified error rate with a desired signal strength of -84 dBm in the presence of an undesired SCAT-I D8PSK signal on the adjacent or any other assignable channel that is 40 dB higher than the desired signal.

<u>Comment:</u> The co-channel protection criteria defined above is not consistent with the objectives being pursued in the development of the VHF Data Link (i.e., to achieve as close to 14 dB co-channel protection criteria as possible). Changes in the VHF Data Link physical layer definitions are being pursued to achieve the co-channel protection criteria objectives. Therefore, the SCAT-I physical layer definition and associated co-channel protection criteria defined above may not be consistent with the final definition of the VHF Data Link.

F.2.3.5 Interference Immunity Performance

The receiving function shall provide the specified error rate with a minimum signal strength of -84 dBm, and with one or more out of band signals, except for VHF FM broadcast signals, having a total interference level at the airborne receiver input of -33 dBm.

The receiving function shall provide the specified error rate with a minimum signal strength of -84 dBm, and with one or more VHF FM broadcast signals having a total interference level at the airborne receiver input of -5 dBm.

F.2.3.6 Slot-to-Slot Receiver Dynamic Range Performance

The airborne receiver shall provide the specified performance over the dynamic range at the tuned frequency when maximum sized application messages (1776 bits) are present in adjacent time slots but separated in signal level by up to 40 dB. To provide future growth, the airborne receiver should be able to receive signals in all time slots under these conditions.

F.3 MEDIA ACCESS SUBLAYER USING TIME DIVISION MULTIPLE ACCESS (TDMA)

The high speed nature of the physical layer offers more capacity than is required by any single SCAT-1 ground station. As a result, spectrum efficiency is achieved through the use of a Time Division Multiple Access (TDMA) technique that partitions the total capacity offered by a single SCAT-1 frequency assignment to individual proximate ground stations. The paragraphs of this subsection describe the time partitioning approach to be used for the SCAT-1 VHF data broadcast.

Table F-6:
TDMA Timing Budget

Budget Item	Number of Bit Periods
Timing Tolerance (Early)	3
Training Sequence (as per Table F-2)	85
Application Data	1776 (max)
FEC	48
Fill Bits*	2
Ramp Down	12
Propagation Guard	39
Timing Tolerance (Late)	3
Total	1968

* Required for transmission of whole symbols.

Two symbol durations (6 bits) are allowed for the transmitter timing tolerance. This provides a transmitter triggering tolerance of ± 1 symbol period (95.2 μsec) of the nominal burst time. A propagation guard time of 13 symbols allows for a one way propagation range of approximately 200 nmi.

Comment: The ground station transmitter may relax this timing tolerance by reducing the maximum application data message length provided all other requirements are met, including F.2.2.6.4.

F.3.3 **Mapping of Application Data onto TDMA Bursts**

From Section F.3.2, it can be seen that a maximum of 1776 bits (222, 8 bit words) are available per burst after the overhead associated with the physical layer and media access sublayer. For SCAT-1 DGNSS operation, messages as defined in Appendix A are to be mapped directly into the Application Data portion of the DGNSS burst with no additional overhead of the intervening layers. No broadcasting of messages across multiple bursts will be supported; messages must be completely contained within a single burst.

Comment: When multiple messages are mapped into a single transmission burst, the successful receipt of second and subsequent messages of a burst are dependent on the successful reception of the preceding messages of the burst.

F.3.5 Airborne Receiver Operation

The airborne receiver shall be capable of receiving and processing data for any two specified time slots in a single frame. Note that if evolution to Category I, II, or III precision approach is desired, an airborne receiver should be capable of receiving all time slots to meet potentially higher CAT I, II, and III throughput requirements.

F.3.6 Spectrum Management of SCAT-1 Ground Stations

SCAT-1 operators will be issued VHF TDMA data broadcast license to transmit that have both a frequency assignment as well as one or more DGNSS time slot assignments. Frequency assignments will be issued for 25 kHz channel centers (i.e. 112.025, 112.050, etc) in the band 112-117.950 MHZ. Time slot assignments will be issued for slots "A" through "H" as defined in Section F.3.1. relative to GPS time. A SCAT-I ground system shall not use more than two (2) slots per frame (3926 bit periods), and must demonstrate that the additional throughput offered by a second slot is required.

Comment: *Note that CAT-I, II, and III ground systems may utilize more than 2 time slots, depending upon the requirements developed for those systems.*

F.4 Data Formatting Example

This section contains an example of how a Type 1 Application Layer message defined in Appendix A is formatted for transmission using the physical layer protocol described in this appendix. The example below contains a six step process which may be used by a SCAT-I service provider to assist in the development and test of the SCAT-I data broadcast specified in this appendix.

Step 1: Generate Application Layer Message

Step 1 contains a sample application layer message that is desired to be transmitted and conforms to the Type 1 message format specified in Appendix A. Table F-7 represents an example of a Type 1 Application Layer message format for a single satellite and the equivalent bit-oriented representation. The reader should refer to Appendix A for the definition and functionality of the specific data fields shown in this example.

1st Field LSB
↕
Application Data Separated By Fields
10011001 | 111010011000001000110100 | 00 | 100000 | 01101000
0011010010000 | 1000 | 0101011 | 001100 | 0110010011011000 01101001
| 111100011001 | 00110000 | 1010000 | 00110000 | 1010000

For clarity in this example, this data is separated into a byte-by-byte version. Note that no bit stuffing is performed.

Application Data Separated By Bytes
1001 1001 | 1110 1001 | 1000 0010 | 0011 0100 | 0010 0000 | 0110 1000
0011 0100 | 1000 0100 | 0010 1011 | 0011 0001 | 1001 0011 | 0110 0001
1010 0111 | 1100 0110 | 0100 1100 | 0010 1000 | 0001 1000 | 0101 0000

This message stream, starting with the LSB of the first byte of the first field is injected into the 32-bit shift register implementation as shown in Appendix A, Figure A-10. Note that the seed/register is initialized to all zeros. The shift register implements the polynomial:

$$G(x) = x^{32} + x^{31} + x^{24} + x^{22} + x^{16} + x^{14} + x^{8} + x^{7} + x^{5} + x^{3} + x + 1$$

Comment: If the CRC is being mathematically verified, then it is necessary to append 32 zero bits to the message stream.

Once the M(x) has been sent through the CRC, the resultant CRC for the example shown above is (separated by bytes):

0110 0111 | 1101 1100 | 0100 0000 | 0101 0101

Comment: If this value is then input to the shift register, or appended in place of the zeros used when mathematically validating the CRC, the resultant value will be all zeros.

TRAINING SEQUENCE (Separated By Field)
Slot
Group   Header
Ident. Transmission Length   FEC
000 | 0000011100000000 | 10111 | 1001 1001 | 1110 1001 | 1000 0010 | 0011 0100 | 0010 0000 | 0110 1000
0011 0100 | 1000 0100 | 0010 1011 | 0011 0001 | 1001 0011 | 0110 0001
1010 0111 | 1100 0110 | 0100 1100 | 0010 1000 | 0001 1000 | 0101 0000
0110 0111 | 1101 1100 | 0100 0000 | 0101 0101 | 0100 1101 | 1010 0001
0010 0110 | 1001 0110 | 1000 1000 | 0110 0001
Application Data, 32 Bit CRC, & 48-Bit FEC Separated By Bytes

Step 5: Scramble Message block and Arrange Into Message Symbols

The data stream shown in Step 4 is scrambled as described in Section F.2.1.3. The resultant scrambled data stream is shown below with the scrambled data stream grouped into 3-bit symbols (low bit first) for conversion into three separate binary streams in preparation for data modulation. Note that although the scrambled data stream in this example contains an even multiple of 3-bits as shown in the last symbol of the data stream shown below, this will not always be true.

Scrambled Data Shown As Modulation Symbols
000 100 111 111 101 111 001 111 111 010 011 111 101 101 001 101 000 011 111 111 111 111
111 001 011 100 001 010 111 010 001 100 111 101 101 110 101 011 011 000 101 010 001 000
001 110 000 010 100 101 011 000 001 000 101 010 001 001 000 001 011 000 010 101 011 101
010 001 010 111 111 010 110 101 110 010 110 001 001 011 010 001 001

Step 6: Add Unique Word Sequence and Generate Absolute Modulation Symbols

The Unique Word referenced in Section F.2.1.1.2 (shown in modulation symbols) is then inserted at the beginning of the message. Each 3-bit symbol is then converted into three separate data streams X, Y, Z which are the transmitted carrier phase (ϕ) for each symbol transmitted as described in Section F.2.1.4. Note that two zeros (00) have been padded in the last symbol (100) of the transmitted message below.

Exhibit #2

Supports Form 442 Item #10

a) Description of the complete program of research and experimentation proposed including description of equipment and theory of operation.

b) The specific objectives sought to be accomplished

Attached is the descriptive portion of a memorandum of agreement in place between Flagler County Airport, Embry-Riddle Aeronautical University, Rockwell-Collins Commercial Avionics, and Raytheon Aircraft-Montek Company, for the performance of Differential GPS flight trials. This describes the program and specific objectives to be attained. Also included is a description of the equipment.

c) How the program of experimentation has a reasonable promise of contribution to the development, extension, expansion, or utilization of the radio art, or is along line not already investigated.

The use of D8PSK in a Differential GPS Data Link, located in the Aviation VHF VOR/ILS band is a new concept recently adopted by RTCA in DO217, and FAA in Order 8400.11 for aeronautical use. The practical implementation of this type of link is in its infancy. Part of this program will be to collect data on coverage and error rate characteristics of the new signals and equipment. The research results will be provided to the FAA.

1.0 Purpose

The purpose of this Memorandum of Agreement (MOA) is to establish a general understanding of the overall goals/objectives of the activities to be performed and the corresponding level of responsibility of the parties involved with the differential GPS (DGPS) trials to be held at the Flagler County Airport in Bunnell, Florida. If necessary, as the work progresses throughout these trials, the MOA will be updated to incorporate additional levels of responsibilities. The updated MOA will be distributed for review and signature to all parties involved with the trials.

The parties involved are Embry-Riddle Aeronautical University, Flagler County Airport, Raytheon Aircraft - Montek Company, and Rockwell - Collins Commercial Avionics.

2.0 Goals and Objectives

The goals and objectives of the DGPS trials at the Flagler County Airport are:

- Demonstrate and validate precision approach capability at Florida's Flagler County Airport.
- Demonstrate operation of Raytheon's DGPS ground-based equipment and Collins airborne equipment.
- Develop equipment installation procedures and data measurement, data analysis and data reporting criteria.
- Perform flight testing and data collection to substantiate the flyability of a Local Area Augmentation System.
- Utilize data collected and experience gained from the trials to secure certification of both the air and ground systems, including operational approval for SCAT-I at Flagler County Airport.

3.0 Level of Responsibility

The level of responsibility to be performed by the involved parties is listed below. The list does not imply absolute responsibility nor does it attempt to cover all the various aspects of the trials. Rather, it is prepared as a means to document the possible level of effort by the performing parties. Each party shall bear the cost of their own participation in these trials unless otherwise mutually agreed.

Embry-Riddle Aeronautical University

- Allocate 1-2 aircraft on which the airborne equipment can be installed and flight tested. The installation will be performed on a non-interference basis such that at a minimum the aircraft can be used for training purposes in parallel with performing the DGPS trials and demonstrations.
- Perform the installation of airborne equipment on the various aircraft.
- Perform field maintenance of the ground equipment.
- Assist with the maintenance of the airborne equipment.
- Assist with the DGPS trials flight test planning and data collection planning. Planning sessions may be held in Cedar Rapids and/or Bunnell.
- Perform flight tests with the airborne equipment.
- Perform the DGPS trials data collection, data analysis and data reporting, with assistance from Raytheon Aircraft - Montek Company and Rockwell - Collins Commercial Avionics.
- Submit research funding requests to the State of Florida and/or the FAA for the purposes of DGPS validation testing. This includes effort to integrate the ground and airborne segments as well as performing flight tests, data collection, data analysis and data reporting. Any funds received for this effort will be distributed as mutually agreed between the Parties.

  NOTE: Performance of the tasks defined in this MOA is not contingent upon the receipt of any grants which may be pursued.
- Coordinate with FAA region on certification issues.

Flagler County Airport

- Allocate 1 aircraft on which the airborne equipment can be installed and flight tested for purposes of data collection and demonstrations.
- Perform survey of runway thresholds and provide data to the parties involved with the trials.
- Obtain frequency authorization and installation approval for the ground station from the FAA.

Raytheon Aircraft - Montek Company

- Support Embry-Riddle on maintenance of the DGPS ground station.
- Support ground station / airborne equipment integration testing in Cedar Rapids, Salt Lake City and Bunnell.
- Assist with the DGPS trials data collection, including determination of data to be collected and data analysis phase.
- Continue to upgrade the protocol of the ground station to support inter-operability between ground stations and airborne equipment.
- Obtain ground station Type Acceptance from the FAA.
- Coordinate with the FAA Region on certification issues.

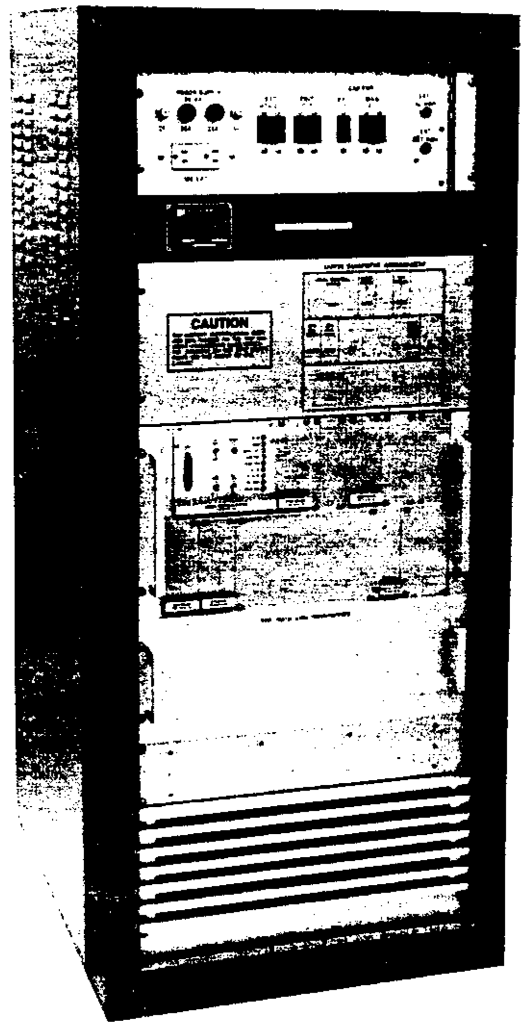
Rockwell - Collins Commercial Avionics

- Provide a minimum of one (1) airborne pallet containing a modified VHF-900 data radio, GPS-4000, VHF radio controller, RTU for CDI display purposes and aircraft power inverter. If possible, a second pallet may be made available to support additional testing and training.
- Update current equipment interfaces to support the protocol utilized by the Raytheon ground equipment. Continue to upgrade the interface to support inter-operability between ground stations.
- Support the installation and maintenance of the airborne equipment.
- Support ground station / airborne equipment integration testing in Cedar Rapids, Salt Lake City and Bunnell.
- Assist with the DGPS trials flight test planning and data collection planning. Planning sessions may be held in Cedar Rapids and/or Bunnell.
- Assist with the DGPS trials data collection, including determination of data to be collected and data analysis phase.
- Perform program coordination of the trials.
- Obtain avionics certification from the FAA.
- Coordinate with the FAA region on certification issues.

E-Systems
A Raytheon Company

DIAS-3100

DIFFERENTIAL GNSS LOCAL AREA AUGMENTATION SYSTEM FOR CATEGORY I PRECISION APPROACH



The E-Systems Montek Division DIAS-3000 Series DGNSS Instrument Approach System introduces a revolutionary new generation of precision approach and landing guidance equipment. Utilizing the Global Positioning System (GPS) satellite constellation, the DIAS-3000 Series equipment makes precision approaches practical at airfields and heliports not equipped with precision landing aids, at a cost far below ILS or MLS.

The first product to be introduced is the DIAS-3100 Differential GNSS Local Area Augmentation System Reference Station. The DIAS-3100 is fully compliant with FAA Order 8400.11 and RTCA MASPS DO-217 for Special Category I (SCAT-I) and provides all the equipment necessary to establish a special private-use DGPS ground facility. The DIAS-3100 provides differential GPS corrections, integrity alarms and approach waypoint data with its VHF (VOR) and optional Mode-S datalinks. It provides complete inter-operability with all SCAT-I approved avionics.

In addition to providing Category I precision approach capability today, the modular architecture of the DIAS-3000 Series equipment has been designed with Category II and III upgradeability in mind.

- **Supports Category I Precision Approach**
- **Supports Multiple Approaches from a Single Ground Station**
- **RTCA DO-217 and FAA Order 8400.11 Compliant**
- **Available in Single or Redundant Configurations**
- **Configured for Internal or External Environmental Conditions**

BACKGROUND AND EXPERIENCE

E-Systems Montek Division, with over 40 years of experience, is a leading producer of both civil and military ground-based air navigation aids and air traffic control systems. Today, hundreds of E-Systems products are in operation, supporting airspace users in over 40 nations. E-Systems vast experience in system design and manufacturing, airport facility planning, site selection, installation, certification, training and long-term maintenance and operational support offers comprehensive and risk-free performance.

FEATURES

The DIAS-3000 Series equipment has been designed from the ground up to meet the stringent accuracy, integrity and continuity of service requirements for safety-critical, all-weather flight operations. In addition, extensive built-in test, fault logging and local/remote maintenance monitoring make this equipment easy to install, operate and maintain. Major features include:

- **RTCA DO-217 MASPS and FAA 8400.11 compliant hardware and software**
- **All FAA/RTCA approved datalink message types, including approach waypoints**
- **Configurable with single or dual redundancy on key modules (GPS, data link, processor)**
- **Standard dual redundant power supply**
- **Two separate 12-channel, all-in-view, GPS receivers for reference and integrity channels**
- **Optional high performance GPS antenna**
- **Extensive built-in-test, fault logging and remote maintenance monitoring via modem**
- **Transient suppression, EMI and lightning protection per FAA-STD-019B/020 and FAA-G-2100**
- **Configurable for either rack mount or weather-proof outdoor enclosure use**
- **Growth capability to Category II and III through module exchange and software upgrade**
- **Four-hour battery backup option**

SPECIFICATIONS

System Performance

Compliance:	RTCA/DO-217 FAA 8400.11
Coverage:	0 – 20 nautical miles
PR Correction Accuracy:	1.1 meters RMS
Integrity:	$< 3.0 \times 10^{-6}$ per approach
Time to Alarm:	< 3 seconds
Continuity of Function:	$< 3.8 \times 10^{-5}$ per approach
Reliability:	> 5000 hours
Maintainability:	< 30 minutes

Software

IAW DO-178B Level B

Data Link - VHF (Standard)

Frequency:	112 – 118 MHz
Protocol & Modulation:	IAW DO-217, App F (D8PSK, 31.5 KB)

Data Link - Mode S (Optional)

Frequency:	1030 MHz
Protocol & Modulation:	IAW DO-217, App G

Environmental

Temperature:	–10 °C to +50 °C
Solar Radiation:	per MIL-STD-810E
Humidity:	5 – 90 percent
Altitude:	0 –10,000 feet
Wind:	100 mph (operating)
Ice:	1/2 inch thick radial
Rain & Salt Fog:	per MIL-STD-810E
Sand & Dust:	per MIL-STD-810E
Lightning:	FAA-STD-019/020
EMI:	per MIL-STD-461C

Electrical

AC:	90 – 265 VAC, 48-63 Hz, 1 Ph
Power:	Approx 400 Watts
UPS (opt):	4 Hour Battery

Physical

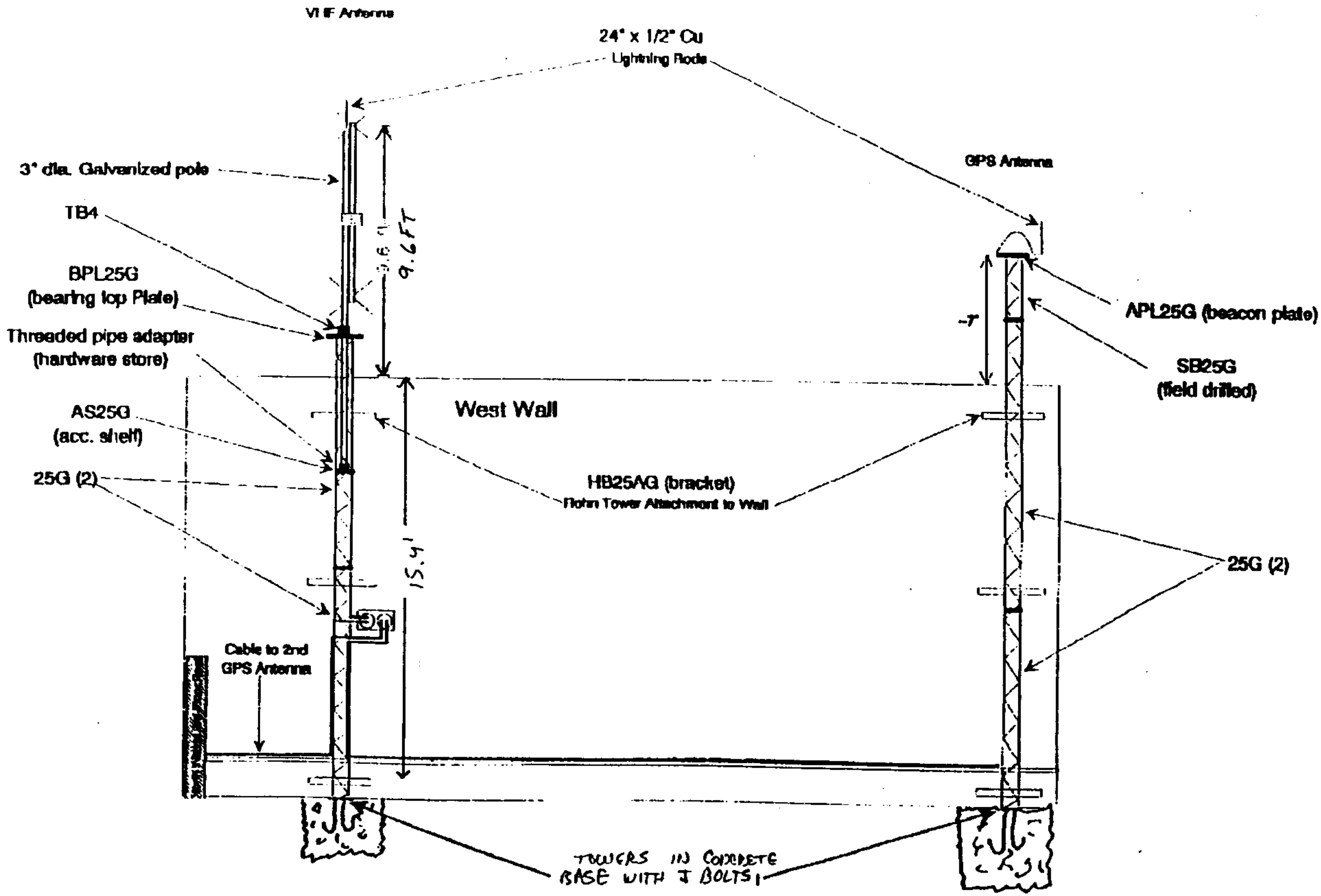
REF STA:	56"H × 27"W × 26"D	350 lbs.
RCSU:	7"H × 19"W × 11"D	25 lbs.
RSI:	5"H × 6"W × 9"D	4 lbs.

2268 SOUTH 3270 WEST • SALT LAKE CITY, UTAH 84119 • PHONE (801) 973-4300 • FAX (801) 974-7581

Exhibit #3

Supports Form 442 Item #15

Vertical Profile Sketch



NOT TO SCALE

Rohn Tower Mounting