

Additional Information for Frequency Application File 0426-EX-PL-2011

Avionics Engineering Center, Ohio University

Rev. 9 September 2011; DCB/AAW

This frequency application requests the approval and assignment to use two frequencies in the military UHF band (225-400 MHz) for research on the Joint Precision Approach and Landing System (JPALS) Increment 2 Land-Based System.

Additional details relating to FCC Form 442 are listed below:

Section 4. Exhibit for Government Contract

Joint Precision Approach and Landing System (JPALS)

Solicitation Number: R2204

Agency: Department of the Air Force

Office: Air Force Material Command

Location: Electronic Systems Center (ESC)

Contracting Office Address: 75 Vandenberg Drive, Building 1630, Hanscom AFB, MA

Point of Contact: Linda Grasso linda.grasso.ctr@hanscom.af.mil

General Description. The Air Force Material Command will soon release a Request for Proposals (RFP) for the development and procurement of the Joint Precision Approach and Landing System (JPALS) Increment 2 Land-Based capability. JPALS Increment 2 will provide fixed and mobile precision approach and landing systems that will support 200 ft decision height (DH) and 1/2 statute mile visibility (Category I minima) while operating in the military or civil modes. The system must also support auto-land capability for suitably equipped aircraft (to include Army, Navy, Marine Corps, and Air Force aircraft), must operate in the Global Positioning System (GPS) jamming threat environment, and must be capable of successfully passing a FAA flight inspection and commissioning check. The JPALS ground system for the Increment 2 must also support civil interoperability with the Ground Based Augmentation System (GBAS) for Category I precision approaches. JPALS equipped aircraft must also be interoperable with the Satellite Based Augmentation System (SBAS).

Specific Use of Requested Frequencies. One of the requirements of the JPALS Increment 2 system is that it uses an encrypted data link in the UHF band (225 – 400 MHz) with a LAAS-like waveform, which is Differential-8 Phase Shift Keying (D8PSK). This application for an experimental radio license is to perform Independent Research and Development (IR&D) on JPALS, an effort for which the Department of the Air Force's GPS Directorate (AFSPC) at Los Angeles AFB has already specifically approved the use of military GPS receivers. This frequency will be used to develop and test a candidate JPALS ground-air datalink at the Ohio University airport (KUNI). Ohio University's extensive LAAS and related VHF Data Broadcast (VDB) experience enabled it to specify the UHF Data Broadcast for JPALS use with the F-35 Joint Strike Fighter (JSF), and will help ensure that at least one datalink solution for JPALS Increment 2 datalink is viable for DoD and compatible as much as possible with civil use. Thus,

the use of the requested UHF frequencies at Ohio University is in the best interest of the U.S. Government, DoD and the U.S. National Airspace System (NAS).

Section 6. Exhibit for Research Project

- a. General Description. The Joint Precision Approach and Landing System (JPALS) Increment 2 Land-Based capability provides fixed and mobile precision approach and landing systems that will support 200 ft decision height (DH) and 1/2 statute mile visibility (Category I minima) while operating in the military or civil modes. The system will also support auto-land capability for suitably equipped aircraft (to include Army, Navy, Marine Corps, and Air Force aircraft), operate in the Global Positioning System (GPS) jamming threat environment, and be capable of successfully passing a FAA flight inspection and commissioning check. The JPALS ground system for the Increment 2 will also support civil interoperability with the Ground Based Augmentation System (GBAS) for Category I precision approaches. JPALS equipped aircraft will likewise also be interoperable with the Satellite Based Augmentation System (SBAS). Ohio University's Independent Research and Development (IR&D) project will develop, test and demonstrate a candidate architecture including encrypted UHF datalink.
- b. Necessity of the Requested Frequencies. The requested frequencies will be used for up to two simultaneous ground-to-air datalinks at different frequencies. The information transmitted to the aircraft will be essentially that required by the FAA's Local Area Augmentation System (LAAS), namely GPS range corrections observed at the airport, aircraft precision approach path coordinates, and similar information. The JPALS Increment 2 System Requirements Document (SRD) version 0.8 states the following in paragraph D.1.3, LB-UDB Waveform Function in JPALS (p. 131):

The [Land-Based] LB-UDB waveform is transmitted using a 25 kHz bandwidth signal operating in the UHF frequency band (225 to 400 MHz). The LB-UDB waveform is broadcast from the [Fixed System] FS or [Mobile System] MS and received in the aircraft. The LB-UDB waveform communicates the [Ground Station] GS data to the [Air System] AS. The data is encrypted, although the header is not. Maximum data transmission rate (including overhead) is approximately 31.5 kilobits per second (kbps).

The requirement to operate in the UHF band is as follows (p. 144):

[4080] The LB-UDB shall be capable of operating on carrier frequencies within the range of 225 to 400 MHz, inclusive, on 1.0 kHz channel centers with 25.0 kHz bandwidth.

- c. Inadequacy of Existing Communications Facilities. Ohio University does possess a frequency license for D8PSK LAAS transmissions at 114.450 MHz, which lies in the FAA-administered VHF navigation band. However, this frequency is not within the required UHF band of 225 – 400 MHz. Ohio University has no other UHF frequency licenses that would support this UHF requirement.

Section 12. Exhibit for Applicant Type. The applicant is the Avionics Engineering Center (AEC), a research organization within the Department of Electrical and Computer Engineering at Ohio University's Russ College of Engineering and Technology. The AEC is an element of the government of the State of Ohio.

Section 19. Exhibit for Station Location.

- a. NGT number: None (yet)
- b. Peak Envelope Power (PEP): 100 W (0 W horizontally polarized, 100 W vertically polarized)
- c. Type of antenna: Antenna not selected yet, but will be omnidirectional with respect to azimuth; objective for elevation pattern is with 0 dB at zenith and -1 dBi at zero deg elevation.
- d. Transmit antenna gain: Omnidirectional with respect to azimuth; objective for elevation pattern is with 0 dB at zenith and -1 dBi at zero deg elevation.
- e. Elevation above sea level of the antenna site: 767.7 ft
- f. Height above ground of the focal point of the antenna: 20 ft
- g. Antenna polarization: Vertical
- h. The azimuth that the antenna is pointed or appropriate designator to indicate whether the antenna is rotating, non-directional, etc.: Omni-directional azimuth pattern and a shaped vertical pattern which is similar to a dipole.
- i. Pulse repetition rate (PRR) that the equipment is capable of operating on to include PRR stagger sequences if appropriate, whether the PRR is adjustable and what PRR's the equipment can accept, and any other information that would be helpful in understanding the pulse characteristics of the equipment: Two 62.5 ms bursts of D8PSK every half second (two adjacent "slots" out of eight available slots on assigned frequency each half second), as per the *GPS Based Precision Approach Local Area Augmentation System (LAAS) Interface Control Document (ICD)*, RTCA DO-246C, April 7, 2005. Based on the ICAO VDL Mode 3 standard, with D8PSK and 25 kHz channel spacing, except with 16 slots per second instead of 4. Emission designator is 14KG7DET.
- j. Pulse width: 62.5 ms
- k. Equipment nomenclatures: Antenna not selected yet.
- l. Whether the equipment is capable of blanking transmissions in certain azimuths and any limitations with respect to blanking: No azimuth blanking capability
- m. Radius of operations if appropriate: 20 nmi at 10,000 ft AGL
- n. Detailed description of the proposed operation to include any technical parameters that will be altered during operations: During operation, the transmitter will be left on for continuous D8PSK transmission at maximum power. No technical parameters will be varied other than the data content in the uplink.