

Narrative Statement

By this application, and pursuant to Section 5.3 (d), (g) and (i) of the FCC Rules, 47 C.F.R. § 5.3 (d), (g), (i) (2013), Booz Allen Hamilton Inc. ("Booz Allen") respectfully seeks a four month special temporary authority (STA) beginning May 15, 2015, to develop, test and demonstrate prototype remote sensors with low power communications equipment that will operate on channels centered on 313.7 MHz and 315.7 MHz or on alternative channels in the 313-316 MHz band selected by the Federal Communications Commission (FCC) or the National Telecommunications and Information Administration (NTIA) allocated for non-multilateration operations.

The following information is provided in support of this request:

1) Need for an STA

Booz Allen needs authority for a period of four months to accommodate a demonstration for sponsors that will be held June 16-19, 2015. Booz Allen is requesting a four month STA beginning May 15, 2015 to allow system calibration and preparation before the demonstration as well as validation and follow up evaluation after the demonstration.

2) Purpose of Operation

The proposed operation will allow Booz Allen to develop, test, and demonstrate a low power communication transceiver module for point-to-point land communications in a simulated environment for military operations in urban terrain (MOUT) as part of a June 2015 field experiment and demonstration located at the Atterbury-Muscatatuck Center for Complex Operations (AMCCO), Indiana, coordinated by U. S. Special Operations Command (USSOCOM) described in a federal solicitation at the following location (posted 2 March 2015):

https://www.fbo.gov/index?s=opportunity&mode=form&id=855bf3ada22f7e5a7061eedceafdc739&tab=core&_cvview=0

Booz Allen does not seek authority to conduct market studies or provide communications services under the requested experimental authority. The participants in the test will be advised that: (a) the test is being conducted under an experimental authority issued to Booz Allen, (b) Booz Allen is responsible for operations, (c) all operations are conducted on a non-interference basis, and (d) after the test is completed, Booz Allen will retrieve and recover all devices that do not comply with FCC regulations. Booz Allen understands that the FCC may specify these as well as other conditions on its authorization.

3) Experimental Basis

a. Prior Results and Purpose of STA

Booz Allen is developing sensor electronics with specialized communications capability and potential application to public safety, homeland security, law enforcement, and Department of Defense (DoD) agencies which have interest in advanced communications devices and systems for safety, security, and protection especially for DoD missions and applications. Prior experiments, licensed by the FCC, have enabled careful development of the new technologies.

Under its existing FCC Experimental License (Call Sign WG2XXV, ELS File No 0702-EX-PL-2013, as modified under ULS File No. 0058-EX-ML-2014), Booz Allen is developing the core radio technology with experiments operating in the 915 MHz band. This work has allowed and continues to allow Booz Allen to make significant design advances.

To address potential DoD end users interest in using the 300-350 MHz band, an important band for DoD ground, mobile, and satellite communications, in 2014 Booz Allen, with the support of interested DoD groups, requested permission and obtained FCC Special Temporary Authority (Call sign WH9XMQ, ELS File No. 0342-EX-ST-2014), to perform limited tests at a private, isolated test range to determine of performance of the prototype system operating in the 300-350 MHz band. The results of those tests indicated that there are differences in the propagation at different frequencies, and for some US Government entities, experiments and capability demonstrations in the 300-350 MHz bands are important to evaluate Booz Allen's system performance.

The research and experiments performed under EL 0702-EX-PL-2013 and STA 0342-EX-ST-2014 has been conducted in barren, desert environments. The current application will support experiments in a simulated urban environment, managed by the Indiana National Guard and U.S. Department of Defense, located at the Atterbury-Muscatatuck Center for Complex Operations (AMCCO), Indiana Army National Guard (INARNG). Although the actual demonstration for sponsors will be held June 16-19, 2015, Booz Allen is requesting a four month STA beginning May 15, 2015, to allow system calibration and preparation before the demonstration as well as validation and follow up evaluation after the demonstration.

b. Existing Primary Licensees

Booz Allen recognizes that operation in this band is primarily licensed to the United States military for mobile-satellite service and for fixed and mobile services. The U.S. military uses frequencies in the 300-320 MHz band for UHF Follow-On (UFO) ground to satellite communications, and for Mobile User Objective Systems (MUOS) ground to satellite communications. Finally, under Part 15, some tire pressure monitors and garage remote controls use 315 MHz transmissions at very low powers.

The UFO system uses a channel based approach to spectrum utilization outlined in Appendix A of "UHF TACSAT/DAMA Multi-service tactics, techniques, and procedures" (FM 6-02.90/ MCRP 3-40.3G /NTTP 6-02.9 / AFTTP(I) 3-2.53 August 2004). There is no UFO system utilization at 313 and 315 MHz, however. Specifically, MUOS is described as follows:

"The mobile user objective system (MUOS) is a narrowband military satellite communications (MILSATCOM) system that supports a worldwide, multi-service population of mobile and fixed-site terminal users in the ultra-high frequency (UHF) band, providing increased communications capabilities to smaller terminals while still supporting interoperability with legacy terminals. MUOS adapts a commercial third generation (3G) wideband code division multiple access (WCDMA) cellular phone network architecture and combines it with geosynchronous satellites (in place of cell towers) to provide a new and more capable UHF MILSATCOM system. The constellation of four operational satellites and ground network control will provide greater than 10 times the system capacity of the current UHF follow-on (UFO) constellation and a unprecedented level of availability and access-on demand to satellite communications."

(Nicholson, J., "Status of the Mobile User Objective System," *Military Communications Conference, 2006. MILCOM 2006. IEEE* , vol., no., pp.1,4, 23-25 Oct. 2006)

The MUOS system uses Spectrally Adaptive Wideband Code Division Multiple Access (SA-WCDMA) waveforms in four 5-MHz channels at 300-320 MHz. The SA-WCDMA modulation can coexist with many other users sharing the same bandwidth, enabling MUOS to share the band without serious performance degradation; in addition, adaptive signal processing will notch out interferers further protecting MUOS from interference.

c. Interference Mitigation Techniques

For this work, Booz Allen has identified several approaches to mitigate or eliminate interference to operations by existing licensees: location isolation, RF propagation control, careful test frequency selection, low messaging rate. Location isolation seeks to place sufficient physical distance between the test system and any primary licensee operation, such that the test signals are attenuated, by physical obstructions or free-space path loss to levels to cause no interference. RF propagation control uses antenna configuration that reduce test signal radiation in the direction of primary licensee operations; for instance, using antennas that radiate only in the azimuthal plane and significantly attenuate elevated signals will significantly mitigate interference to satellite operations. Careful test frequency selection mitigates interference by simply not operating on channels used by the primary licensee. Finally, Booz Allen will work with SOCOM frequency coordinators to verify and adjust the center operating frequency, and if necessary it can field tune the radios to prevent interference to other users.

4) Technical Specifications

a. Power Levels

- i. Transmitter Power Output (TPO): 1W peak
- ii. Effective Radiated Power (ERP): 3W peak
- iii. Necessary bandwidth:
 1. 5 kHz for low data rate operations
 2. 25 kHz for high data rate operations
- iv. Modulation: BFSK, QFSK, QAM
- v. Emissions: F1D, F2D
- vi. Frequencies: 313.7 MHz and 315.7 MHz. Experimental testing will only occur only at 313.7 MHz or 315.7 MHz, or at nearby frequencies as directed by the FCC or NTIA, as indicated in Attachment A.
- vii. Antenna: Antennas will be selected to direct radiated power into the horizontal direction, and significantly reduce power radiated in a vertical direction. Examples are single dipoles with <3dB gain in horizon/azimuthal direction and <-20 gain directly overhead/vertical; simple dipole arrays including directors will increase the directivity and further reduce interference to existing licensees.
- viii. Notes: Other emission modes may be utilized, but in no event will the emissions extend beyond the center frequencies and bandwidths requested. Consistent with the experimental power levels requested in this application, all power levels will comply with the limits set forth in the FCC's rules, including those relating to human exposure to radiation.

b. Antenna Information

The antennas that would be deployed under this license will not extend more than 3 meters above the ground.

Omnidirectional antennas will be used in experiments that produce azimuthal coverage and significantly limit emissions above the horizontal plane.

c. Proposed Locations

Booz Allen seeks authority to conduct its experimental operations at the test ranges at the Atterbury-Muscatatuck Center for Complex Operations (AMCCO), Indiana Army National Guard (INARNG).

For this work, Booz Allen plans to test and demonstrate equipment only at the Indiana test ranges listed in the Table in Section 8. Specifically, Booz Allen seeks authority to operate and demonstrate products at the premises of entities working under Booz Allen's authorization in the design and development of the devices and related products. Indeed, these operations would be consistent with the requirements set forth in Section 2.803 of the Commission's marketing rules and 47 C.F.R. § 2.803 (2013); *see also Revision of Part 2 of the Commission's Rules Relating to the Marketing and Authorization of Radio Frequency Devices*, ET Docket No. 94-45, *Report and Order*, released Feb. 12, 1997, at 11-13, 19-20 ("Marketing Rule Revisions"). These operations would also be consistent with the requirements set forth in 47 C.F.R. § 15.231a.

d. Equipment To Be Used

Booz Allen proposes to deploy only a limited number of units which, as noted above, would operate at low power levels. It expects that it will be able to complete its experimentation and demonstration with a maximum of 5 units per test location. In all experiments, Booz Allen will also limit the power, area of operation, and transmitting times of these units to the minimum necessary to evaluate the equipment.

e. Primary Licensee Interference Mitigation Plan

As described in Section 3, Booz Allen is requesting an experimental license to perform limited testing at 313.7 and 315.7 MHz at up to 30 dBm ERP, frequencies and levels that would satisfy DoD requirements and advance our understanding of device operation in urban environments.

Booz Allen understands that the primary licensee in this band is the DoD. To mitigate interference, Booz Allen will use the techniques outlined in Section 3.c.

Testing will be performed at Atterbury-Muscatatuck Center for Complex Operations (AMCCO), Indiana Army National Guard (INARNG); based on the size of the test facilities and attenuation estimates provided by NIST in publication <http://fire.nist.gov/bfrlpubs/build97/PDF/b97123.pdf>, Booz Allen estimates free path loss from the test area to areas outside the test range will reduce RF levels by >100 dB.

Testing will use antennas that radiate preferentially in the azimuthal plane and attenuate signals above ground elevations. A typical dipole will produce 2-3 dB of gain uniformly about the azimuth, however, into the direct overhead elevation attenuation will be >20 dB.

To mitigate or eliminate interference to primary licensee services, based on past guidance and FCC STA licensing, Booz Allen is requesting test frequencies, 313.7 and 315.7 MHz, chosen at spectrum locations away from existing licensee UFO channels and at the boundary of MUOS channels.

Booz Allen will configure its electronics to produce a low rate of RF messages, and those messages will be less than one second duration. It anticipates operation will generate less than ten messages a day, and these messages will occur at random times. Our analysis predicts testing will use the RF spectrum less than 0.01% of time.

Finally, the Booz Allen system is frequency agile; if the requested frequencies are not concurrent with the FCC or NTIA, it may operate at nearby frequencies as directed.

Based on this mitigation plan moreover, Booz Allen submits that its experimental operations and demonstrations are highly unlikely to cause interference to existing frequency licensees.

5) Restrictions on Operation

Booz Allen understands that the FCC permits (a) companies to enter into agreements and contracts to manufacture new products and (b) manufacturers to sell—but not deliver—products on a conditional basis to wholesalers and retailers. Booz Allen also understands that the FCC permits the operation of equipment for, among other things, compliance testing, demonstration at trade shows and other exhibitions with appropriate notices displayed, and evaluation of product performance and customer

acceptability at the manufacturer's facilities or at certain non-residential sites during the developmental, design and pre-production stages. See Marketing Rule Revisions, § 2.803; Part 15 Revisions, 6 FCC Rcd 1683, 1685 (1991).

Notwithstanding these general rules, the FCC requires parties to seek authorization to use devices that normally require a license to operate or that will be operated at residential locations. Such authority may be granted under the FCC's experimental rules set forth in Part 5 of the Code of Federal Regulations, 47 C.F.R. Part 5 (2013). Accordingly, Booz Allen seeks an experimental license to conduct experimental operations permitted under Part 5 of the Commission's rules. Those rules permit such operation provided that: (a) participants are advised that the service or device is granted under experimental authority and is strictly temporary; and (b) the devices are owned by the licensee.

Booz Allen does not propose to market, sell, or lease any prototype equipment to end users, however. After the experimentation and demonstrations cease, Booz Allen would recall and recover all devices. If any different treatment becomes necessary during the course of its experimentation and demonstrations, Booz Allen will seek separate and additional authority from the agency.

Booz Allen also recognizes that the operation of any unapproved or unlicensed devices under experimentation must not cause harmful interference to authorized facilities. Should interference occur, Booz Allen will immediately take reasonable steps to resolve the interference, including if necessary discontinuing operation. To that end, Booz Allen would advise entities using the equipment that permission to operate the equipment has been granted under experimental authority issued to Booz Allen, is strictly temporary and may be canceled at any time. It will also advise entities that operation is subject to the condition that the equipment may not cause harmful interference. Specifically, Booz Allen proposes to label the equipment conspicuously as follows:

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Permission to operate this device has been granted under experimental authority issued by the Federal Communications Commission to Booz Allen Hamilton Inc., is strictly temporary, and may be canceled at any time. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received including interference that may cause undesired operation.

This device has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or sold until the approval of the FCC has been obtained. Thus, the user does not hold a property right in the device and may be required to return the device.

Moreover, Booz Allen submits that its experimental operations and demonstrations are unlikely to cause interference. Booz Allen intends to monitor use of the relevant frequencies before commencing transmissions, and it will not operate if the frequencies are in use.

6) Public Interest

Booz Allen submits that issuance of a license is in the public interest, convenience, and necessity. Grant of a license will permit Booz Allen to develop innovative equipment that will accommodate the communications needs of the U.S. military.

7) Contact Information

a. Technical Point of Contact

Dr. John C. Swartz, Senior Lead Eng
Booz Allen Hamilton Inc.
511 Davis Drive, Suite 400
Morrisville, NC 27560
Office: (919) 595-4825
Facsimile: (919) 595-4825
Email: swartz_john@bah.com

b. Legal Contact

Ms. Debra Storms, Principal
Booz Allen Hamilton Inc.
8283 Greensboro Drive
McLean, VA 22102
Office: +1-703-377-1456
Email: storms_debra@bah.com

c. FCC Legal Counsel

Kurt DeSoto, Esq.
Wiley Rein LLP
1776 K Street, N.W.
Washington, DC 20006
Office: (202) 719-7235
Facsimile: (202) 719-7049
Email: kdesoto@wileyrein.com

8) Location Information

Location 1:

10 kilometer radius of
Muscatatuck Complex
Muscatatuck Urban Training Center
4230 E Administration Drive
Butler, IN 47223

(N 39° 02' 58", W 85° 31' 45") – NAD83

Location 2:

16 kilometer radius of
Camp Atterbury, IN

(N 39° 17' 04", W 86° 01' 00") – NAD83

Location 3:

Within 10 km radius of
Jefferson Proving Grounds, IN

(N 38° 56' 00", W 85° 24' 55") – NAD83

Attachment A – Proposed Frequencies

Experimental testing will occur on channels centered on 313.700 MHz or 315.700 MHz, or on nearby frequencies as directed by the FCC or NTIA.