



**TECHNICAL OPERATIONAL COORDINATION AGREEMENT
FOR THE JOINT USAGE OF THE BAND 14.0 - 14.5 GHz
BETWEEN THE NATIONAL SCIENCE FOUNDATION AND EARTH
STATIONS ABOARD AIRCRAFT (ESAA) OPERATED BY LEIDOS, INC.**

Version 1.0

May 26, 2017

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Radio Astronomy observations are conducted in the 14.47-14.5 GHz band in the USA at a number of Radio Astronomy sites. Leidos, Inc. ("Leidos") desires to operate a network of in-motion earth stations aboard aircraft (ESAA) in the continental United States only, which will operate in the 14.0 to 14.5 GHz transmit and the 11.7 to 12.2 GHz receive band. The present agreement is intended to facilitate operation of the Leidos system, without causing interference to Radio Astronomy stations.

1. General Information

- 1.1 The band 14.47 to 14.5 GHz is allocated to the radio astronomy service on a secondary basis.
- 1.2 The band 14.0 – 14.5 GHz is allocated in the United States to the Land Mobile Satellite Service ("LMSS") on a secondary basis, provided that LMSS stations include special protection to radio astronomy stations that observe in this band.
- 1.3 As listed at Attachment 1, Leidos has been granted (or is seeking) experimental authority from the FCC to operate technically identical transmit/receive in-motion ESAA satellite earth stations to operate in the 11.7 – 12.2 and 14.0 – 14.5 GHz frequency bands (number of technically identical stations specified at Attachment 1).
- 1.4 This agreement document has been developed to govern the use of all of Leidos' in-motion stations operating in CONUS to ensure the protection of radio astronomy stations operations in the 14.47 to 14.5 band.
- 1.5 The Electromagnetic Spectrum Unit of the National Science Foundation (NSF) has the authority to negotiate and sign this agreement for the radio astronomy sites listed in Section 2.1, and Leidos has the authority to negotiate and sign this agreement on behalf of itself.

2. List of NSF supported Radio Astronomy observatories observing or planning to observe in the band 14.47 - 14.5 GHz within the US and its territories

- 2.1 The following is a list of ten radio astronomy sites supported by NSF that are included in this agreement. Two of these sites, Green Bank, WV and Socorro, NM, require more stringent levels of protection, while the remaining eight sites, which are associated with

the Very Long Baseline Array (VLBA), require less stringent protection. See section 3.1 below.

Name	Latitude	Longitude	Type
Green Bank, WV	38.4331	-79.8397	SINGLE DISH
Socorro, NM	34.0789	-107.6183	INTERFEROMETER
Brewster, WA	48.1311	-119.6833	VLBA
Owens Valley, CA	37.2317	-118.2769	VLBA
Kitt Peak, AZ	31.9564	-111.6125	VLBA
Pie Town, NM	34.3011	-108.1192	VLBA
Los Alamos, NM	35.775	-106.2456	VLBA
Fort Davis, TX	30.635	-103.9447	VLBA
North Liberty, IA	41.7714	-91.5742	VLBA
Hancock, NH	42.9336	-71.9866	VLBA

This list of stations is subject to change. NSF shall give Leidos no less than 2 months advance notice of changes in the status of existing sites, or of any additional radio astronomy site being brought into use in the 14.47 - 14.5 GHz band. In case of any change to this list of stations, either party may reopen this agreement to address issues arising in connection with such change.

3. Technical Operational Coordination Agreement

NSF and Leidos agree to the following:

- 3.1 The purpose of this agreement is to provide protection to the radio astronomy sites listed in Section 2.1 in the 14.47 - 14.5 GHz band to the following aggregate pfd levels within that band:
 - -221 dB(W/m²/Hz) for the Green Bank and Socorro sites
 - -189 dB(W/m²/Hz) for the eight CONUS VLBA sites
- 3.2 This agreement shall be reviewed on an annual basis by all parties signing this document beginning within one year after Leidos has informed NSF of the start of service in CONUS under an operational license. The purpose of this review is to assess the effectiveness of this agreement as well as to update as applicable this or successor operational coordination agreements.
- 3.3 Each party shall inform the other party in a timely manner of changes in the points of contact as defined in Section 5.

Leidos agrees to:

- 3.4 Prevent transmissions from any ESAA that would exceed the threshold given in Section 3.1 above. Based on Leidos technical parameters and operational characteristics agreed to during direct Leidos/NSF coordination discussions, Leidos will achieve this by ensuring that the Leidos terminals will not operate within an exclusion zone around the radio astronomy sites listed in Section 2.1. The agreed upon separation distances for each NSF type are shown below:

Green Bank, WV (GBT).....	160 km
Socorro, NM (VLA).....	160 km
Seven Very Long Baseline Array (VLBA) Sites	
Other Than Hancock, NH	50 km
VLBA Site at Hancock, NH.....	25 km*

Until such time as Leidos terminals are able to coordinate based on both time and location, the terminals will not operate when within the given separation distances of the observatories. In the future, if Leidos terminals add the ability to coordinate based on time, restrictions on use will only apply when the terminals are within the specified separation distances and the observatory is scheduled to be observing in this band.

*The 25 km exclusion zone for the Hancock, NH VLBA site is based up the need to protect this site from Leidos stations operating outside of the Boston Metropolitan Area, recognizing that the noise floor within the Boston Metropolitan Area is significantly higher than the noise floor in the surrounding areas.

NSF agrees to:

- 3.5 Maintain an observation schedule for the band 14.47 - 14.5 GHz for the sites listed in Section 2.1 and make this schedule available upon request to the designated Leidos point-of-contact listed in Section 5.2, upon notification that Leidos terminals have achieved the capability of coordinating frequency use based upon time.
- 3.6 Provide, through NRAO, full access to Leidos representatives to data on interference that may be collected during observations that fall within the scope of this agreement.
- 4. Assignment and Termination**
- 4.1 This agreement shall be binding upon the parties hereto and their respective successors and assigns.
- 4.2 This agreement may be terminated by the written mutual agreement of the parties, upon 6 months notice.

5 Points of Contact

For Leidos:

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For NSF:

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For NRAO:

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6 Signatures

This Agreement is being made in good faith by both parties and is effective on the date on which the last party signs it. It may be executed in one or more counterparts, each of which will be deemed an original and all of which together will constitute one and the same instrument.

For the National Science Foundation

By: T. L. Wilson

Name: T. L. WILSON

Title: Electromagnetic Spectrum Manager

Date: 27 July 2017

For Leidos, Inc.

By: Salama Balume
Digitally signed by
salama.n.balume@leidos.com
Date: 2017.07.25 15:34:45 -04'00'

Name: Salama N. Balume

Title: Contracts Manager

Date: 25 July 2017

ATTACHMENT 1

Leidos FCC Grants/Applications

FCC Grants:

- Call Sign: WK9XSC; File No. 1755-EX-ST-2016 - EXPIRED
Operation of up to 5 identical terminals
- Call Sign: WI2XZF; File No. 0450-EX-CN-2017
Operation of up to 5 identical terminals

FCC pending applications:

- Call Sign: WJ2XAY; File No. 0613-EX-CN-2017
Operation of up to 9 identical terminals