

National Aeronautics and  
Space Administration  
**Goddard Space Flight Center**  
Greenbelt, MD 20771



Reply to Attn of:

October 6, 1999

410.2

NRAO  
ATTN: Dr. Paul Vanden Bout  
2015 Ivy Road, St. 219  
Charlottesville, VA 22903-1733

Dear Dr. Paul Vanden Bout:

Dr. Charles Bennett has requested that I prepare the enclosed Memorandum of Understanding (MOU) for your signature. If you concur with this agreement, please sign and return the original signed copy to me at:

NASA/GSFC  
ATTENTION: Linda Abbott  
Code 410.2  
Greenbelt Road  
Greenbelt, MD 20771

Upon receipt I will obtain Dr. Bennett's signature and return a signed copy of the agreement to you.

If you have any questions regarding the MOU, please refer them to Dr. Bennett at 301-286-3902.

Sincerely,

A handwritten signature in cursive script that reads "Linda".

Linda Abbott  
MAP Mission Business Manager



October 6, 1999

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**Memorandum Of Understanding (MOU) between the National Radio Astronomy  
Observatory (NRAO) and the Goddard Space Flight Center's (GSFC)  
Microwave Anisotropy Probe (MAP) Project**

1. **PURPOSE**

The purpose of this agreement (MOU) between NRAO and MAP is to establish an agreement between NRAO and MAP to safeguard and maintain the purchase agreement made with Hughes Research Labs regarding the MAP wafer with InP HEMPT devices.

2. **BACKGROUND**

In 1996, the MAP Project purchased from the Hughes Research Laboratories a wafer with InP HEMT devices (Contract #S514-026). These devices were designed for use in the cold HEMT amplifiers of the MAP instrument. The wafer was cut into quarter sections and diced. Subsequent measurements indicated that the MAP devices, which were passivated, would give degraded performance compared to devices from an existing NRAO wafer, also from Hughes Research Labs. So NRAO devices were used in the MAP 90 GHz amplifiers.

3. **DESCRIPTION**

NRAO has requested that some of the MAP devices be transferred to NRAO for use in building HEMT amplifiers for radio astronomy research. Since the NRAO Development Lab designs and builds state-of-the-art HEMT-based amplifiers used in radio astronomy research, the MAP project, as a service to the radio astronomy community, wishes to transfer one section of the MAP wafer (1448B) to the NRAO. This will leave MAP with two complete quarter-wafer-sections and one partial quarter-wafer-section, more than enough devices to cover any future MAP needs. The other sections of the MAP wafer, 1448A, 1448C, and 1448D should be moved to GSFC. The current and new locations for MAP wafer sections would be as follows:

<b>Wafer Section</b>	<b>Status</b>	<b>Current Location</b>	<b>New Location</b>
1448A	Partially used to build MAP amplifiers	NRAO	GSFC
1448B	Unopened	GSFC	NRAO
1448C	Unopened	NRAO	GSFC
1448D	Unopened	NRAO	GSFC

As part of the agreement with Hughes Research Labs, the MAP Project assured Hughes that devices from the MAP wafer would not appear in a competitor's amplifier or system. This agreement must be maintained for future uses of the MAP devices.

#### 4. AGREEMENT

NASA MAP agrees to transfer section 1448B of the MAP wafer to NRAO.

NRAO agrees that:

- a. Devices from the MAP wafer are not to be used in amplifiers or systems that might compete with a Hughes product or contract bid;
- b. Devices from the MAP wafer are to be used by NRAO to fabricate amplifiers for Observatory use or use by non-profit institutions – universities or other observatories;
- c. Devices from the MAP wafer may be given to (not sold to) non-profit research institutions which the NRAO deems competent to build high quality amplifiers;
- d. Sections 1448A, 1448C, and 1448D of the MAP wafer will be moved from NRAO to GSFC; and
- e. An electronic copy of the Hughes characterization of devices on the MAP wafer will be sent to Dr. Ed Wollack at GSFC.

Approved and Agreed to:



Paul Vanden Bout  
NRAO Director

10-26-99

Date



Charles L. Bennett  
MAP Principal Investigator

11-16-99

Date