

FY00 Proposal #88

TITLE: Advanced Microwave Power Amplifier Reliability

RESPONSIBLE NASA CENTER: NASA Glenn Research Center

PROGRAM GROUP: Electronic Parts Project

PROGRAM OBJECTIVES:

1. Evaluate presently available Microwave Power Amplifiers (MPMs) for space applications.
2. Identify potential failure mechanisms and corrective actions.
3. Publish results.

Description:

Microwave Power Amplifiers are a hybrid system that incorporates miniature traveling wave tubes with microwave monolithic integrated circuits (MMICs) with the associated thermal management and power supply systems in a single box. This novel combination of circuits provides amplification of RF signals with excellent efficiency with a significant reduction of size and mass compared to solid state power amplifiers (SSPAs) and traveling wave tube amplifiers (TWTAs).

TECHNICAL APPROACH:

Under this task, currently manufactured MPMs will undergo life test in ambient and space-like environments to determine potential failure mechanisms and mean time to failure (MTTF). We will collaborate with industry to identify cost effective means to eliminate the failure mechanisms and increase MTTF. This information will be distributed to potential suppliers and purchasers of MPMs.

BENEFITS: This proposal will lead to RF amplifiers with higher efficiency and potentially higher reliability in a smaller, lower weight package. SSPA's and TWTA's are used throughout NASA for communications and radar and may be replaced by MPMs. Thus, MPMs should benefit the deep space science missions of Code S, the communication missions of Code S and SOMO at NASA Glenn Research Center, and the earth observing systems of Code Y at GSFC.

DELIVERABLES:

1. Published reports.
2. Report on any failure mechanisms that are discovered.

PARTNERS:

1. Northrop-Grumman will supply MPMs with a 50% cost sharing arrangement.
2. Naval Surface Warfare Center/ Crane Division will share lifetest costs.

ENDORSEMENTS:

Chad Edwards, TMOD technology Manager of JPL has stated in email dated Oct. 9, 1998 that he requires higher efficiency TWTA's and SSPA's. We believe MPMs will be suitable alternatives to these.

SCHEDULE:

- Q1/99 Initiate MPM procurement
- Q2/99 Sign MPM contract
- Q4/99 Receive MPMs
- Q4/99 First year report
- Characterize MPMs
- Q1/00 Initiate lifetesting
- Q4/00 Publications on measured lifetime and failure mechanisms

Q1/01 Initiate corrective action plan to address early failures
Q1/01 Procure new MPMs
Q4/01 Write final report

PRINCIPAL INVESTIGATOR or CONTACT:

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NOTE:

The Electron Device Technology Branch of NASA Glenn Research Center is recognized as one of the foremost TWTA design and characterization groups in the country and the only TWTA group within all of NASA. While participation on this project by other NASA centers is welcome, no other NASA center has the expertise and facilities to contribute to this project. However, TWTA's are used in all radar and communication systems that NASA flies; thus, all of NASA benefits from the success of this project.