

# Automated Tuning of Microwave Filters

## PROBLEM / OBJECTIVE

Modern radar and communications systems use filters to produce the desired signal and eliminate noise and other extraneous signals. Common filters include bandpass and lowpass types. Manual methods have traditionally been used to tune microwave filters, leading to high costs, high rework rates and a potential for production bottlenecks.

This Manufacturing Demonstration (MD) replaced existing manual processes used for tuning microwave filters with an automated tuning station based on the application of best design and manufacturing practices. The newly developed tuning process was integrated into the Patriot Program's production line for the Patriot Enhanced Capability-3 (PAC-3) missile, and used to produce fifty filters for the PAC-3 missile's Master Frequency Generators to demonstrate automated assembly and tuning of high frequency filters.

## ACCOMPLISHMENTS / PAYOFF

### **Process Improvement:**

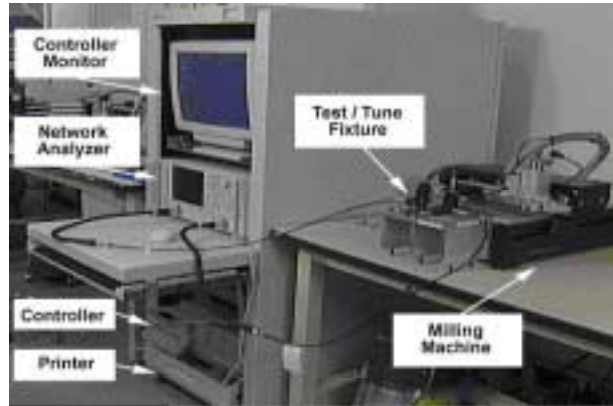
An automated tuning / test station was developed that is capable of removing material from capacitors and measuring filter performance. Filter tuning / test time was reduced from over two hours to less than 10 minutes. Associated assembly time was reduced from over 7 hours to less than 2 hours. Total processing time was reduced from nearly 10 hours to less than 2 hours.

### **Implementation and Technology Transfer:**

This MD was operated in conjunction with the Patriot Advanced Capability-3 (PAC-3) Advanced Master Frequency Generator effort. The PAC-3, THAAD, and MEADS missiles are slated to insert this technology.

### **Expected Benefits:**

The cost avoidance to investment ratio was 11.8:1, with a Net Present Value (NPV) of \$14.3M. This is based on a reduction in the tuning labor cost from \$650 to \$115 per filter. However, additional



Microwave Filter Tuning Station

savings (up to \$15 per filter) from further tuning time reductions and assembly optimization, and increased procurements, are expected to increase the cost avoidance. This filter tuning technology has widespread applicability and the potential insertions could readily increase the cost avoidance to investment ratio to 30:1 or greater.

## TIME LINE / MILESTONE

Start Date: August 1998

End Date: June 2001

## FUNDING

Army ManTech: \$1.000M

Cost Sharing:

Patriot PM: \$0.400M

Lockheed Martin: \$1.000M

## PARTICIPANTS

Lockheed Martin

Patriot Project Office

U.S. Army Aviation and Missile Command