

# NASA TECH BRIEF



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## Highly Stable Microwave Delay Line

### The problem:

A need existed to determine the short-term stability of the hydrogen maser frequency standards used in the NASA deep space network. For this determination a highly stable microwave delay line was required. Commercial time delay devices covering the microwave spectrum do not have the necessary stability.

### The solution:

A TWM (traveling wave maser) comb structure that serves as a highly stable delay line. Cryogenic cooling is used to minimize signal attenuation and thermal noise.

The comb structures fabricated in approximately 1-meter lengths, are cooled to 4.2°K. With the inherent slowing factors of 200 to 300, such a comb structure provides a nominal delay of a few microseconds. The comb structure is optimized for use as a delay line by making the gap width between adjacent resonant elements as large as practicable.

### Notes:

1. With conventional manufacturing techniques, a few microseconds is the practical limit of delay attainable with the TWM comb structure. For a millisecond delay line,  $3 \times 10^5$  resonant elements (with a delay of  $3 \times 10^{-9}$  second per element) would be required. To meet the dimensional requirements for such a delay line would require special machining techniques.
2. Inquiries concerning this development may be directed to:

Technology Utilization Officer  
NASA Pasadena Office  
4800 Oak Grove Drive  
Pasadena, California 91103  
Reference: B67-10642

### Patent status:

No patent action is contemplated by NASA.

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Category 01