



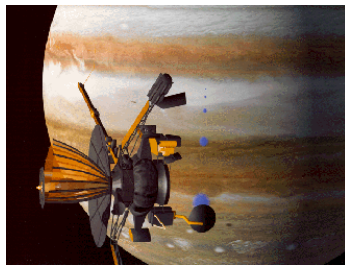
SAND2005-7323C

# **Sandia National Laboratories Microelectronics and Microsystems**

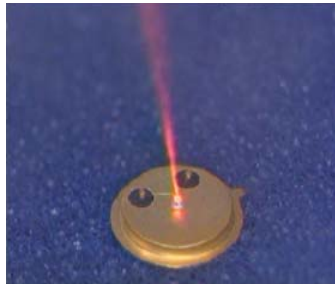
**Laminar Flow  
Clean Room**



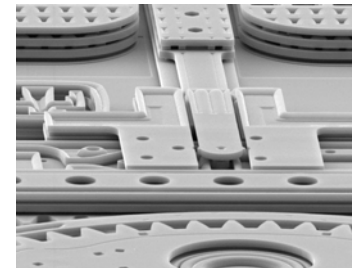
**Design/Build  
Galileo ICs**



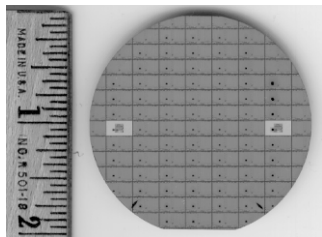
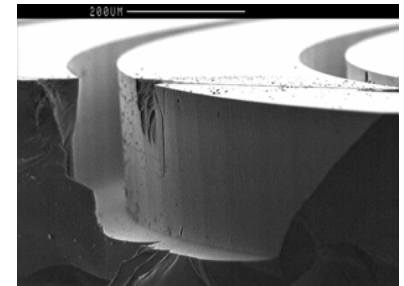
**High Efficiency  
VCSEL**



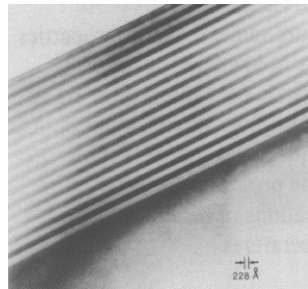
**5-Level  
Surface  
Micromachining**



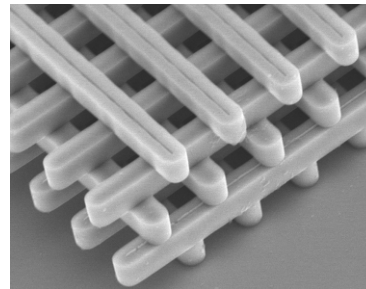
**Chem Lab  
on a Chip**



**Radiation  
Hardened  
CMOS**



**Strained-layer  
Superlattices**



**Photonic  
Lattice**



**Extreme  
Ultra Violet  
Lithography**



**3-D  
Microsystems  
Integration**

**1960s**

**2000s**

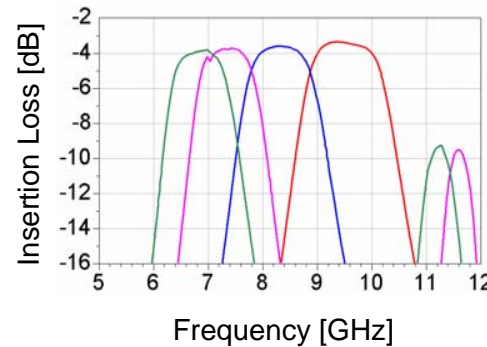
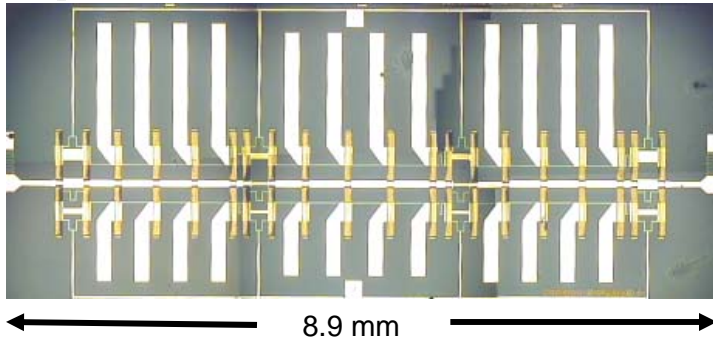
**"Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under Contract DE-AC04-94AL85000."**



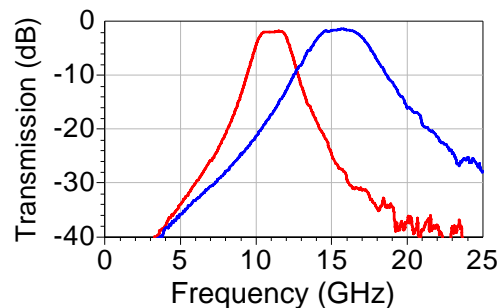
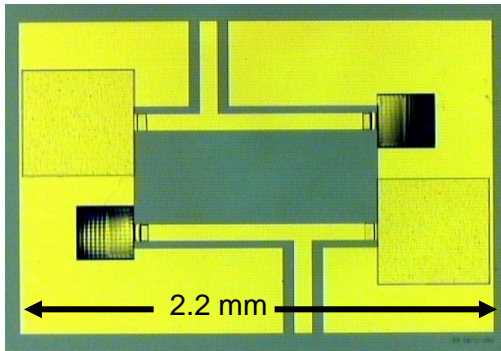


# Reconfigurable Circuits and Devices

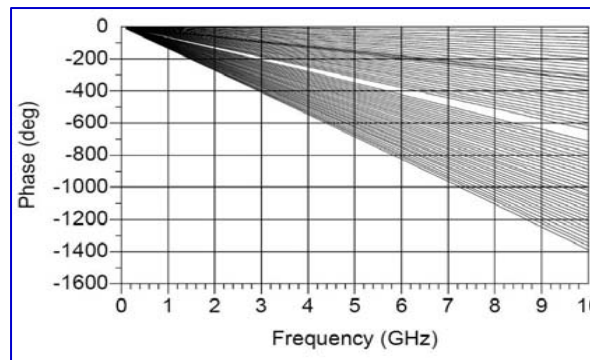
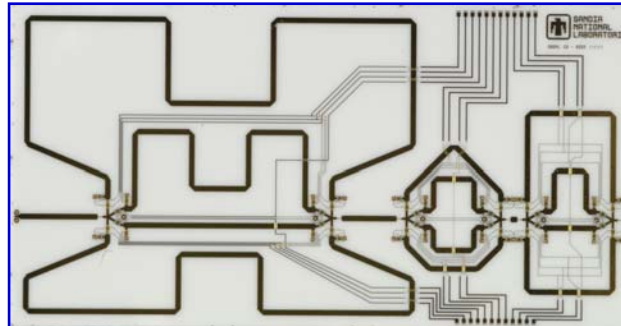
**6-10 GHz tunable filter**



**X-Ku band hopping filter**

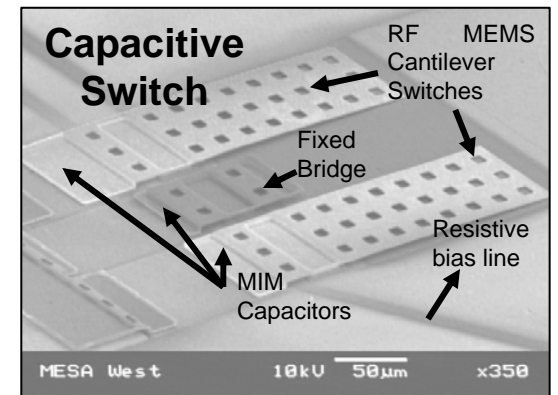
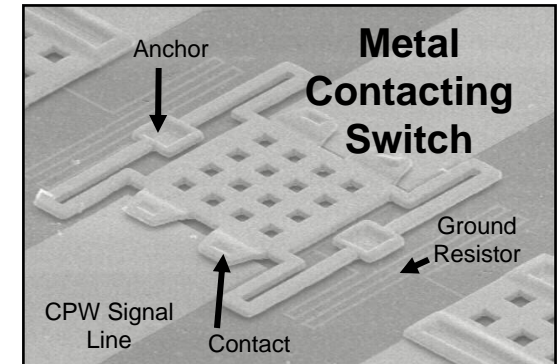


**6-bit RF MEMS Time Delay**



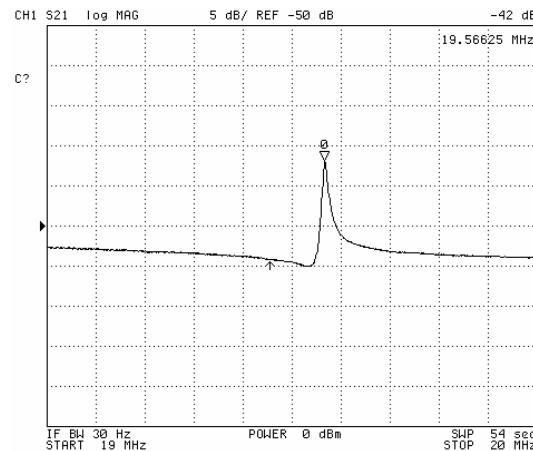
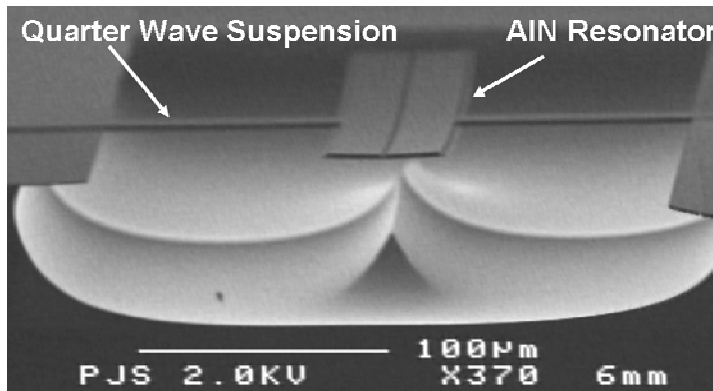
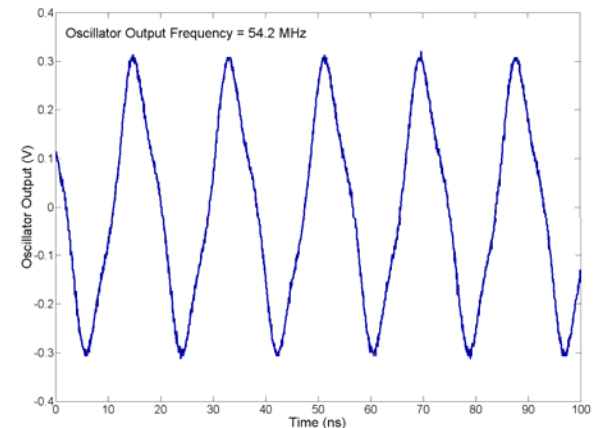
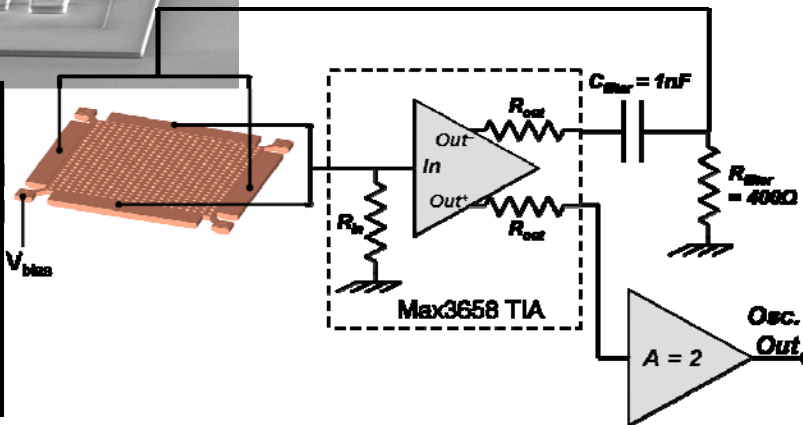
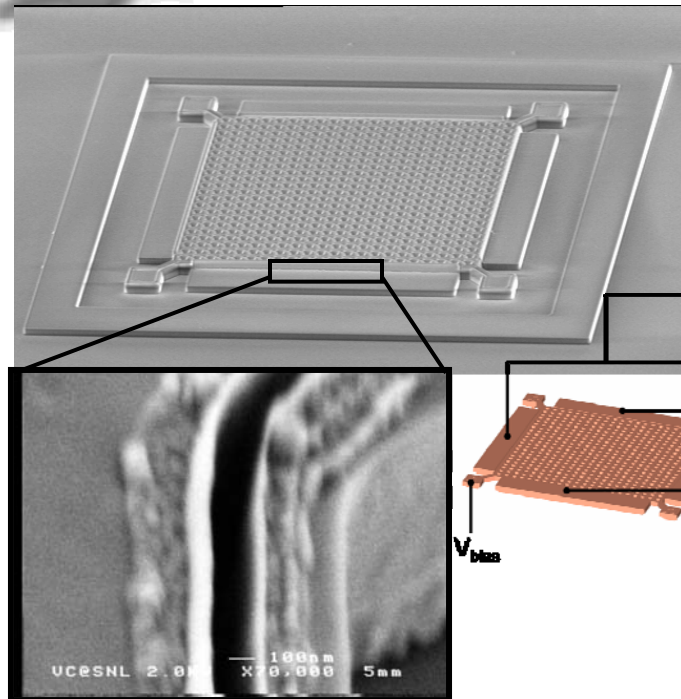
## RF MEMS Switches

- Enabling technology
- $<0.1$  dB loss
- Near-zero Power
- High Linearity



# Sandia $\mu$ Resonator Technologies

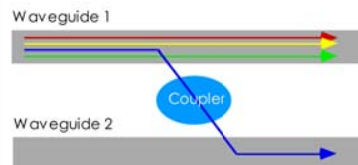
## Narrow Gap PolySi Resonator Process for Miniature Oscillator References and IF Filters



## AIN Resonators for Low Impedance, Lithographically Defined Filters

# Distributed Acoustic Circuits

Novel Channel-Drop Microfilter

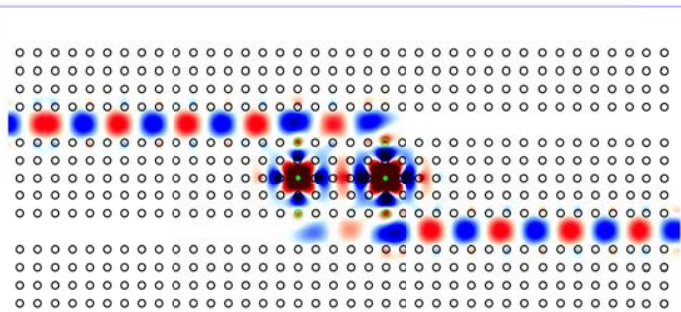


Criteria for Perfect Channel-dropping

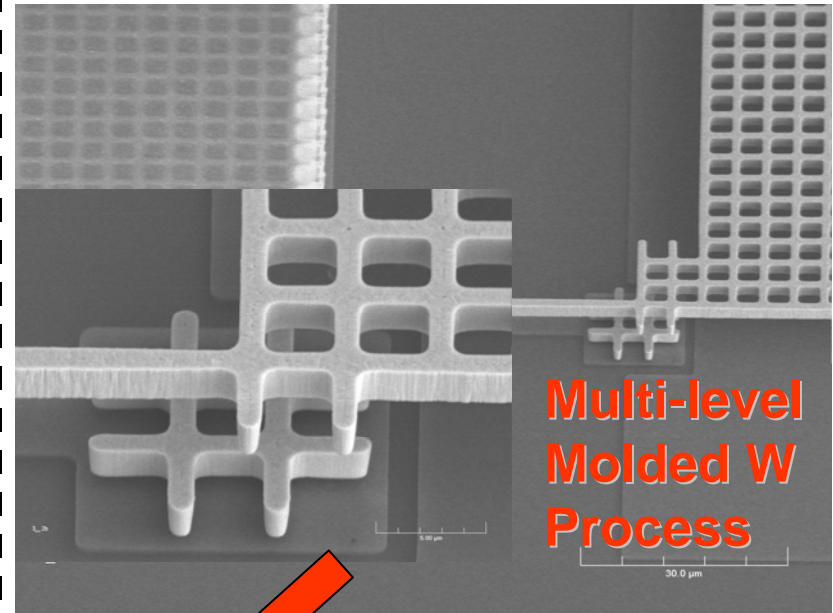
Two resonant modes with even and odd symmetry

Modes must be degenerate

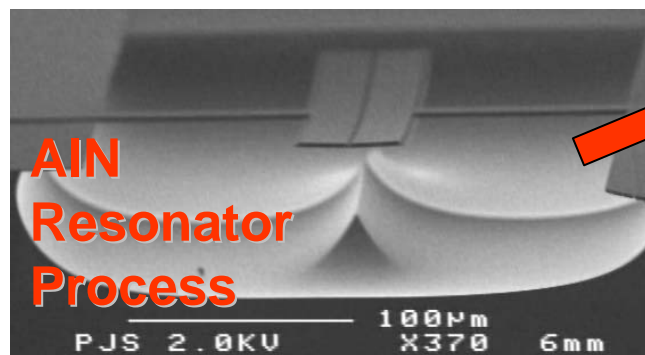
Modes must have equal decay rates



## Photonic Band Gap Circuits and Modeling



Multi-level Molded W Process

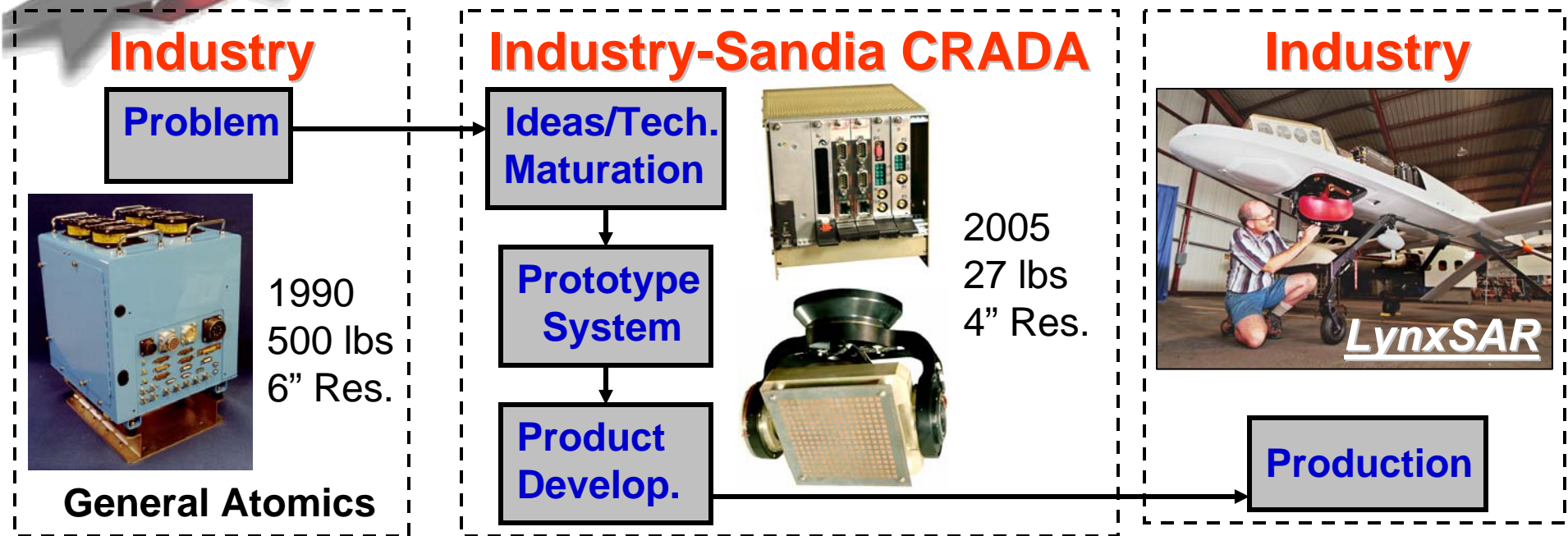


AIN Resonator Process

## Miniaturized Acoustic Circuits

- High Q Filters
- Phase Shifters
- Delay Lines
- Wave Guides
- Duplexers

# Partnerships and Tech. Transfer



## ➤ Why Sandia

- Infrastructure
- Researchers
- Secrets
- Tax Supported- Partner with Many
- Prohibited from Competing with Industry

**\$563 Million**  
**MESA Complex**

