

Organization(s): Mayo Foundation

Title: System Architecture Design Challenge for a Mixed
Technology Inertial Navigation Unit for Airborne Applications

Duration of Effort: September 2000

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Objective

Collaborate with government agencies and contractors on the development of performance criteria for medium accuracy navigation sensors for airborne applications. Establish criteria and verify methodology for the design and creation of navigation sub-system sensors, with the resulting devices simulated both as independent technologies and in a mixed technology environment. Work with contractors in the Composite CAD Program on the development of components of navigation sub-system sensors suitable for fabrication. Evaluate the information flow through the design process to ensure that the integrity of design elements and data sets remains high throughout the design process.

Progress/Results

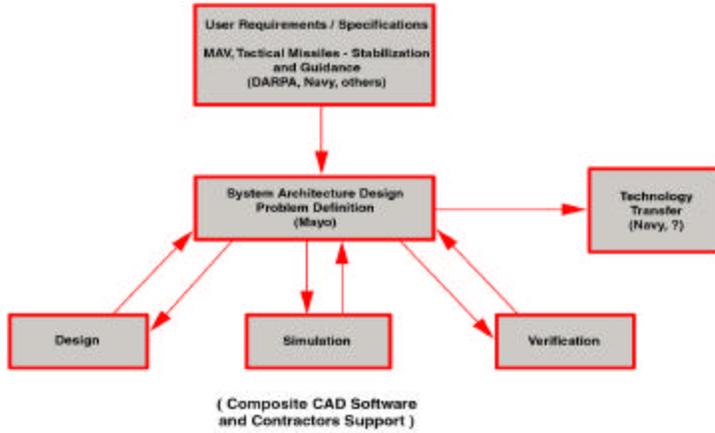
- Stabilization requirements for an Airborne Applications has been identified and the devices are starting to be designed to meet these requirements.
- Mayo Foundation has obtained some Composite CAD Software - MEMCAD 4.5, Tanner MEMS Pro, Saber, Nodas.
- Initial evaluation Tanner MEMS Pro, Saber, and Nodas are completed. Reports are currently in progress.

Status

- Pursue other Composite CAD Software (MEMSCAP, Coyote Systems, etc).
 - Conduct additional design and simulations to address "out of plane" devices.
 - Provide feedback to collaborators on their software.
 - Establish a path for successful insertion of this activity into the Navy.
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FLOWCHART DEPICTING PROGRAM ORGANIZATION AND PROGRAM PLAN FOR THE INS FOR AIRBORNE APPLICATIONS PROGRAM



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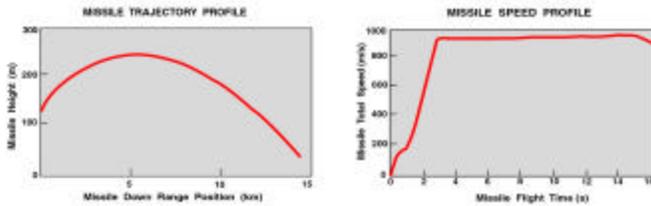
EXAMPLE OF TYPICAL MISSILE NAVIGATION SYSTEM SPECIFICATIONS (Taken From Strapdown Inertial Navigation Technology, Titterton and Weston)

<u>Typical Navigational Accuracy Requirements:</u>	
Position - all axes	50 m
Velocity - all axes	10 m/s
Attitude - yaw, pitch and roll	1°
Linear Acceleration - all axes ²	0.1 g
Angular rate - all axes ²	1°/s
<u>Environmental Requirements:</u>	
Maximum lateral acceleration - pitch and yaw	50 g
Maximum longitudinal acceleration	50 g
Maximum turn rate - all axes	5 rad/s
Vibration power spectral density	0.05 g ² /Hz in bandwidth 10 Hz-1 kHz
Shock	1000 g, 0.5 ms
Operating temperature range	-20°C to +50°C
Rate of change of temperature	5°C per minute
Maximum altitude	15 km
<u>Physical Characteristics:</u>	
Mass	<3 kg
Size	System must be capable of being accommodated within a cylinder of length = 10 cm diameter = 20 cm (-3 liters in volume)
System Reaction Time:	<2s

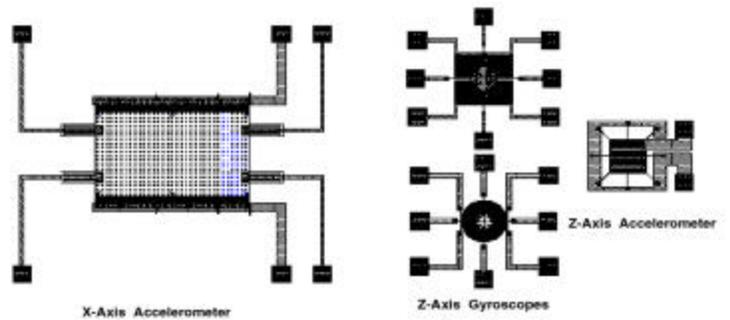
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INERTIAL SUB-SYSTEM DEVICES DESIGNED AND SIMULATED UNDER THE AUSPICES OF THE INS PROGRAM-CURRENTLY IN FABRICATION AT MCNC

EXAMPLE OF TYPICAL MISSILE TRAJECTORY AND SPEED (Taken from Strapdown Inertial Navigation Technology, Titterton and Weston)



12 / 1998 / TMS / 15880



06 / 1999 / TMS / 16402

