NDIA Firepower Symposium
Common Guidance Common Sense – 16 Jun 2004

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Low Cost, High-g MEMS-IMU …for Precision Strike

Technology & Manufacturing Development

FY01 FY02 FY03 FY04 FY05 FY06 FY07

- Same performance
- >100 X G survivability
- 62.5% Reduction in Power Rqmts
- 75% Reduction in IMU Weight
- > 90% Reduction in IMU Volume
- 76% Reduction in Cost ($1.2K per IMU)

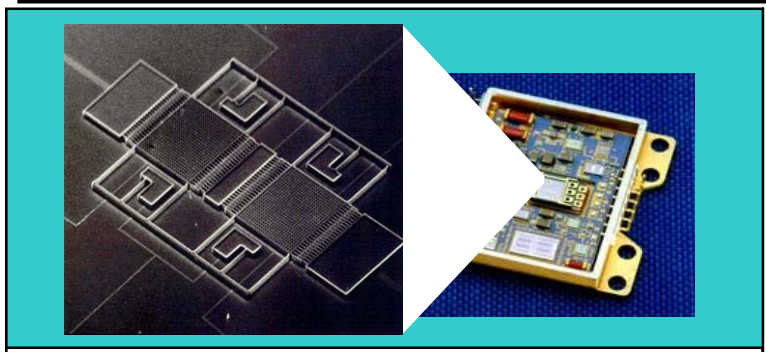
Today: Large volume, expensive, operation in Low g environment only

Honeywell HG-1700

Weight:	*2*	*lbs*
Volume:	*33*	*cu in*
Power:	*< 8*	*Watts*
Bias Stability:	*1*	*deg/hr*
Shock:	*10 - 100*	*g*

Economy of Scale

High G: Tightly packaged, low cost, extremely small, tactical performance IMU/DIGNU suitable for munitions, missiles, personnel guidance and other applications

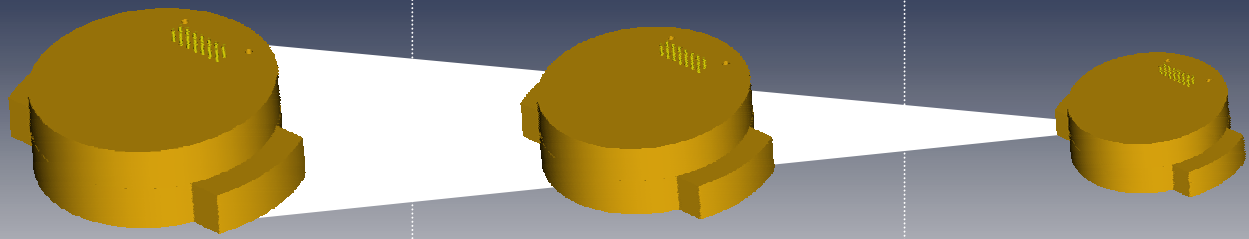


MEMS-IMU/GPS

Weight: ~ 0.5 lbs
Volume: < 2 cu in
Power: < 3 Watt
Bias Stability: 1 deg/hr
Shock: 20,000g

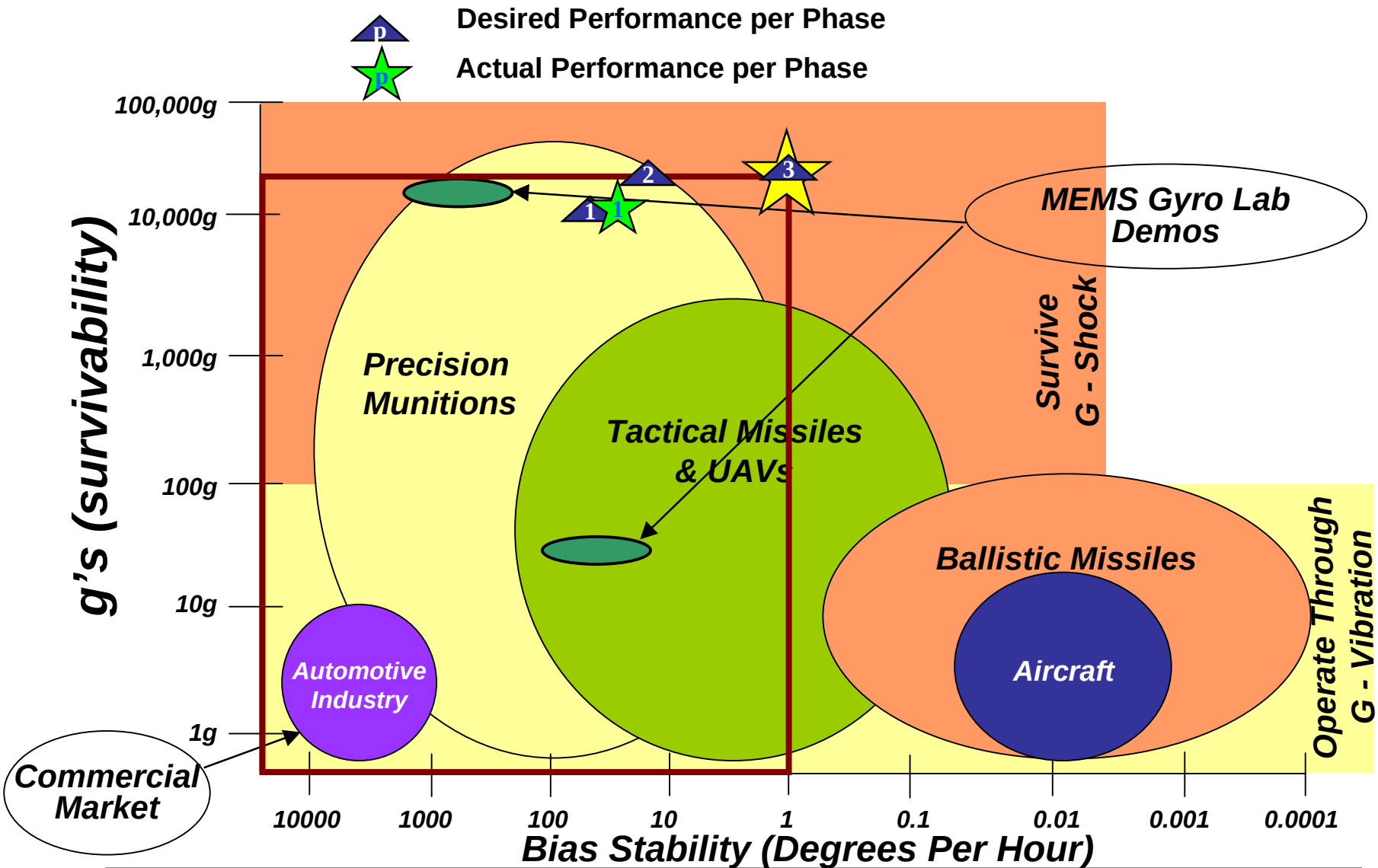
Meets Accuracy & Size Needs for >90% DoD Precision Weapons

High-G MEMS IMU Evolution

Phase 1	Phase 2	Phase 3
		
<75 Deg/Hr <8 in3 >10 K Gs <9 mg	<20 Deg/Hr <4 in3 >20 K Gs <4 mg	<1 Deg/Hr <2 in3 >20 K Gs <1 mg
18 Months	18 Months	24 Months

Incrementally Shrink Volume and Power While Improving Performance

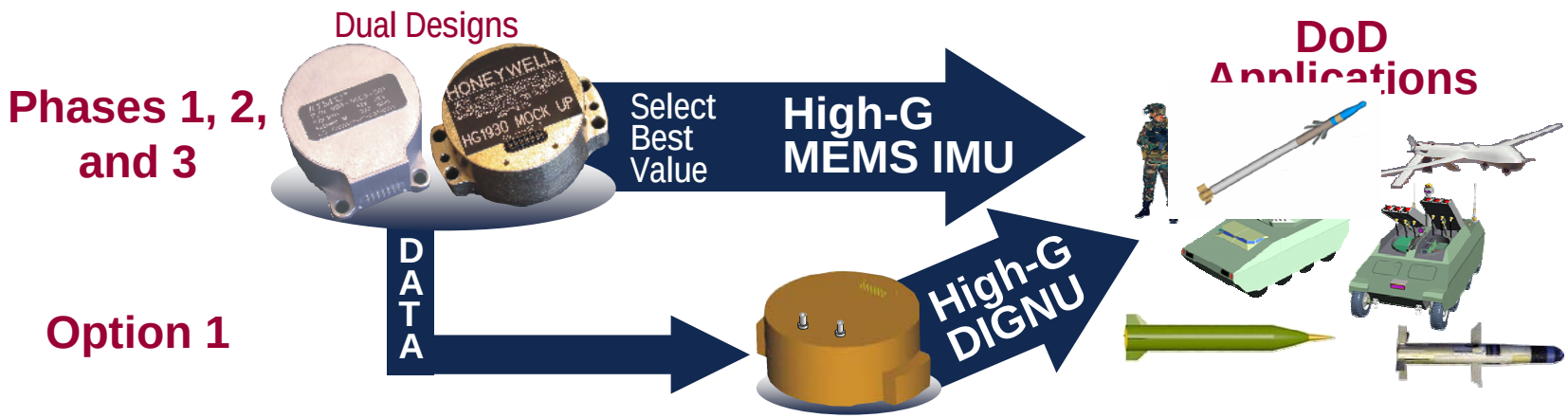
IMU Performance Demands



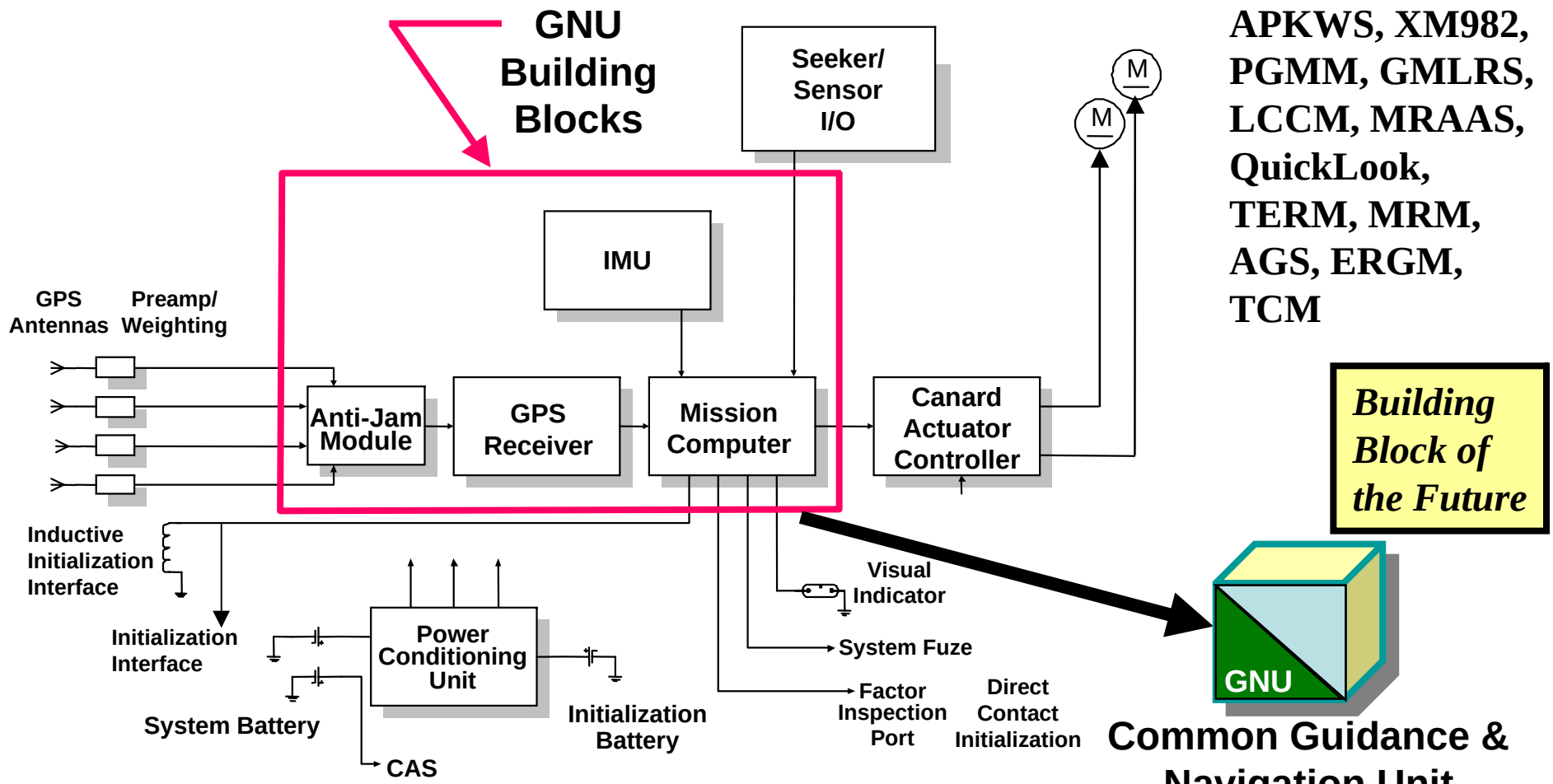
Technology and Manufacturing Program Launched
……affordable, high-g, Precision IMU & IMU/GPS

Program/Business Strategy

- **Go To Multiple IMU Design / Manufacturing Teams**
  - L3/IEC
  - Honeywell/Draper/Rockwell Collins
- **Build to Common Requirement**
- **Leverage Process Improvements into Multiple DoD Applications**
- **Teams Incorporate Common IMU into Common, Deeply Integrated (GPS/IMU/AJ) Guidance & Navigation Unit (DI-GNU) Built to Common Specification**



Typical GN&C Functional Block Diagram



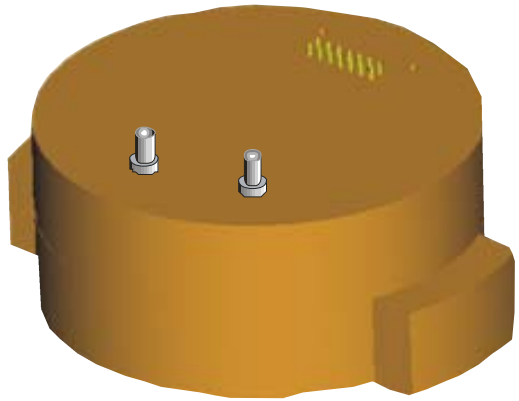
Typical
As used in:
APKWS, XM982, PGMM, GMLRS, LCCM, MRAAS, QuickLook, TERM, MRM, AGS, ERGM, TCM

Building Block of the Future

Common Guidance & Navigation Unit (GNU) Module Single Processor Architecture

Currently, Each Subassembly Represents One or More Circuit Card Assemblies, Each With One or More Processors

Deeply Integrated Guidance and Navigation Unit (DIGNU)



- **Traditional GPS/INS Integration Enhances A/J Loss of Lock Capability**
- **Deep Integration Concept Provides 15-20 db A/J Over Conventional Tightly Coupled Solutions (SW Solution Only)**
- **Improves Weapon Effectiveness by Decreasing CEP**
- **Common Interface Control Document (ICD)**
- **Single Processor Architecture**
- **Higher Reliability**

Knowing Where You Are
And Where You Need To Be

Technology Investment Areas

S & T	***ManTech***
PERFORMANCE DRIVERS •Size •Weight •Performance •Power •Environment •Reliability	**COST DRIVERS** •Touch Time •New Capital Equipment •New Process Development •New Product Development •Low Volume Production
PERFORMANCE IMPROVERS •Technology Development - Design - Test - Evaluate •Improve Design •Improve Technology •Do It Again	**COST REDUCERS** •Automation - Improved Consistency - Reduce Touch Time •Upgrade Equipment -Better Control -Improved Yield •Consolidate •Economy of Scale

Using Manufacturing Technology to achieve Technical Performance Goals

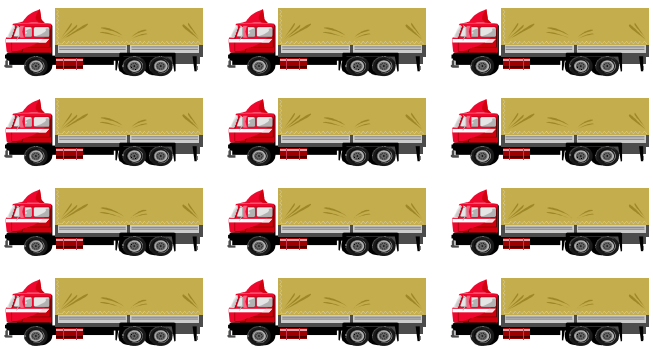
What's the Payoff

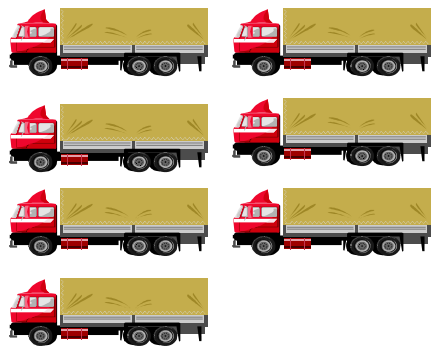
Common Guidance provides:

- common performances across multiple platforms
- cost reduction

More accuracy has a cost "ripple" effect

- fewer firings
- smaller footprint/field of view
- positive benefit on logistics





Program Output

- ***Common Interface Control Document for compatibility across multitude of platforms***
- ***Common Performance Specification for consistent output signals***
- ***Two qualified suppliers producing interchangeable devices***

Provide Common MEMS IMU/DIGNU
for 90% of all DoD Applications

Summary

- ***Honeywell and L3 are committed to producing MEMS IMUs for future DoD systems***
- ***Program will develop two contractors that can provide MEMS IMUs & DIGNUs for the military at program completion***
- ***Utilizing ManTech dollars allows program to achieve aggressive S & T goals***
- ***Next public presentation of the ICD and performance specification to potential end users will occur at the MEMS IMU Industry Day targeted for September 2004***