
Robotics and Autonomous Systems (RAS) Industry Study

*Presentation to the
National Defense Industrial Association (NDIA)
Robotics Division*



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Mr. Ted Mann
RAS Study Team**

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Agenda

- What is the Industrial College of the Armed Forces?
- Industry Studies...Mission and Focus
- Why Study the Robotics Industry?
- Analysis Frameworks
- The RAS Industry Study...
 - Study Team and Charter
 - Locations Visited
 - Industry Defined
 - Challenges and Outlook
 - Recommendations
- Goals for Next Year...



Robotics Division Mission Statement

- Advance the science, technologies and applications of robotics to maximize the effectiveness of our nation's defenders.
 - Advocate accelerated expansion of robotics applications to support America's defenders
 - Educate government officials on emerging robotics technologies and applications
 - Engage government policy makers, program managers and end users in policy discussions and other activities designed to strengthen the government-industry robotics team
 - Serve as a robotics technology and systems integration community of interest engaged in advising and assisting government officials and organizations





Industrial College of the Armed Forces (ICAF)

A senior professional military education institution with the mission...

To prepare selected military and civilians for strategic leadership and success in developing our National Security Strategy and in evaluating, marshalling, and managing resources in the execution of that strategy



**Location: National Defense University
Ft McNair, Washington DC**
**Students: Government (Military, Civilian)
Industry
International**



“I want to establish a little school....to preserve experience and keep in touch with industry.”

*Bernard Baruch,
Chairman
War Industries Board, WWI*





ICAF Industry Studies

Mission and Focus

The purpose of the Industry Study Program is to contribute to the ICAF mission by providing students the opportunity to gain knowledge and experience in analyzing industry from a strategic perspective. The IS Program provides a practical experience, or lab, in analyzing the status of industry. Program objectives are to:

- a.) Evaluate performance of industry in promoting economic welfare and serving national security needs.
- b.) Examine the role of government policy or regulation and its effect on the capacity of industry to contribute to economic welfare and the national security strategy.





Why Study the “Robotics Industry?”

- Robotics are critical to national security...
 - Many unmanned systems operating in Iraq and Afghanistan
 - Economic engine for future growth?
- Priority area for ICAF industrial research and study
 - Newest industry study
 - Significant student interest
 - Exciting educational opportunity
- 18-person seminar
 - 15 Students (Lt Col/Col equivalent)
 - 3 Faculty
 - 1 International Fellow (Israel)
 - 1 Industry Fellow (Rhein-Metall MAN)

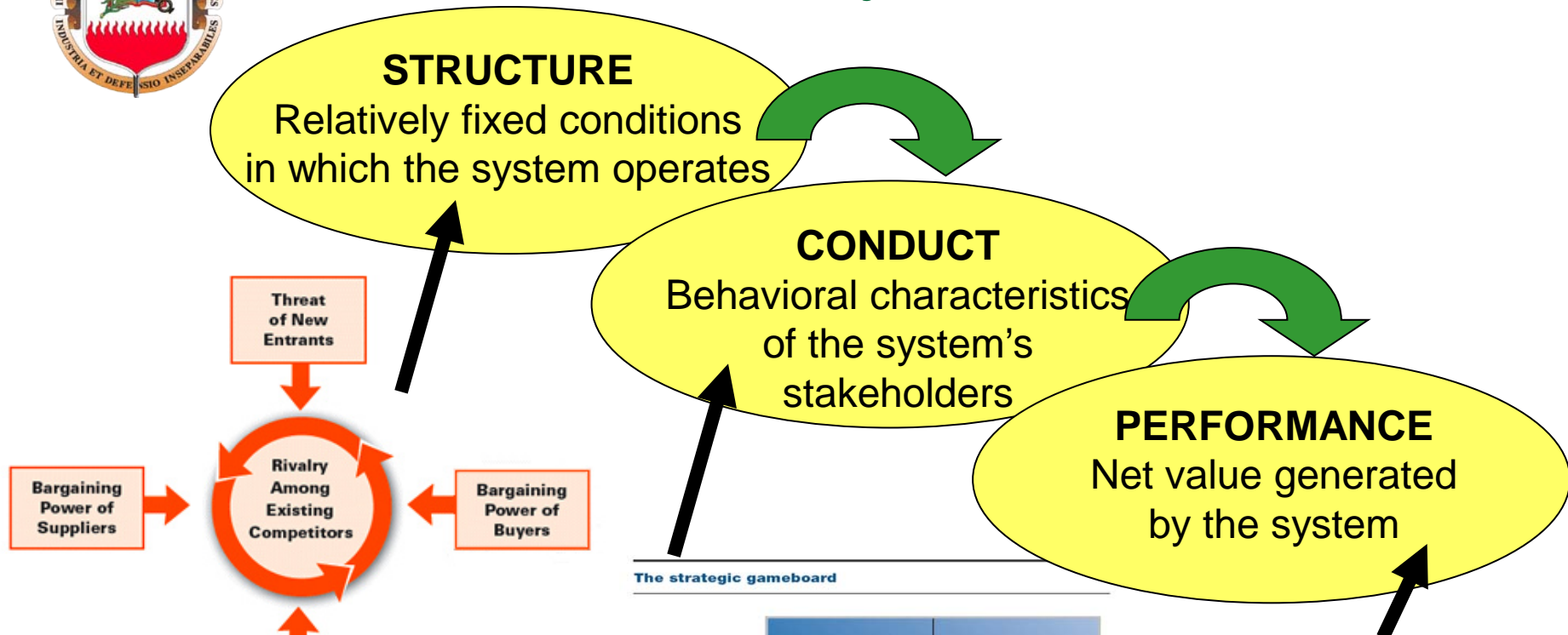
Major Student Tasks

- Individual IS Issue Paper
- Group Study Paper
- Firm Analysis





Analysis Frameworks



from "The Five Competitive Forces That Shape Strategy" by Michael E. Porter, *Harvard Business Review*, January 2008

The strategic gameboard

Where to compete	Across-the-board (entire market)	Emulate market leader's functional approach, strengths	Rewrite industry rules to exploit a unique, industry-wide advantage
	Selective (market niche)	Resegment the market to create a niche	Create and pursue a unique advantage
		Same game (traditional rules)	New game (rewritten rules)
		How to compete	

Financial Statements
Financial Ratios

Where to compete?
When to compete?
How to compete?





RAS Industry Study

The Team



Faculty

Dr. Stephen Ford
Mr. Ted Mann, Dept of State
Col Jerome Traugher, U.S. Air Force



COL Nir Barkan, Israeli AF
Lt Col Coby Bland, U.S. Air Force
Lt Col William Culver, U.S. Air Force
COL Wayne Epps, U.S. Army
Mr. Carl Hayden, Def. Acquisition Uni.
LTC Jim Higgins, U.S. Army
Mr. Guido Hoffmann, Rheinmetall
Lt Col Robin Hosch, U.S. ANG
CAPT Neil Karnes, U.S. Navy
CDR Scott Kraft, U.S. Navy
Lt Col Shane Riza, U.S. Air Force
Lt Col Rob Roberson USMC
Lt Col Scott Thompson, U.S. Air Force
CDR Craig Wevley, U.S. Navy
Mr. Stephen Widenhouse, Dept of State





RAS Industry Study

A Broad Charter in Year #1...

■ Problem Statement

- Assess the strategic importance of the Robotics Industry to US national security
- Examine the economic performance of the Robotics Industry in its various market segments both in the US and abroad
- Assess the impact of government policy (US and other governments) on the Robotics Industry

■ Scope

- Defense industrial base issues
- Market structure and its impact on innovation
- R&D and human resource investment
- Ethics and societal use of robots

***What is the health of the Robotics Industry today?
What about the future?***





RAS Industry Study

Local Site Visits and Speakers



Local Site Visits

- AAI Textron
- Aurora Flight Sciences
- Congress
- EODTECHDIV
- Northrop-Grumman (BAMS)

Speakers

- AUVSI (Mike Toscano)
- DARPA (Mike Perschbacher)
- JGRE (Robert Maline)
- TRADOC (LTC Stuart Hatfield)
- RSJPO (LtCol Dave Thompson)
- Naval Staff N2N6 (CDR Jack Thomas)
- AF/A2CU (Col James Gear)
- G3/5/7 Army Aviation Dir (LTC James Cutting)
- PEO LMW/PMS 406 (CAPT Duane Ashton)
- Naval Undersea Warfare Center (Mr. Joe Gillis)
- ONR (Dr. Michael Traweek, Marc Steinberg)
- OUSD AT&L DRE (COL Brian Bedell)
- IAI (Uzzi Rozzen)
- DLR (Dr Jurgen Drescher)





RAS Industry Study

Domestic Field Study Visits



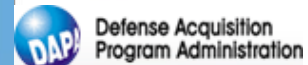
Warren, MI
Boston, MA
Pittsburgh, PA
Los Angeles, CA





RAS Industry Study

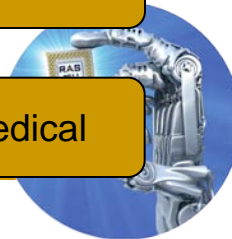
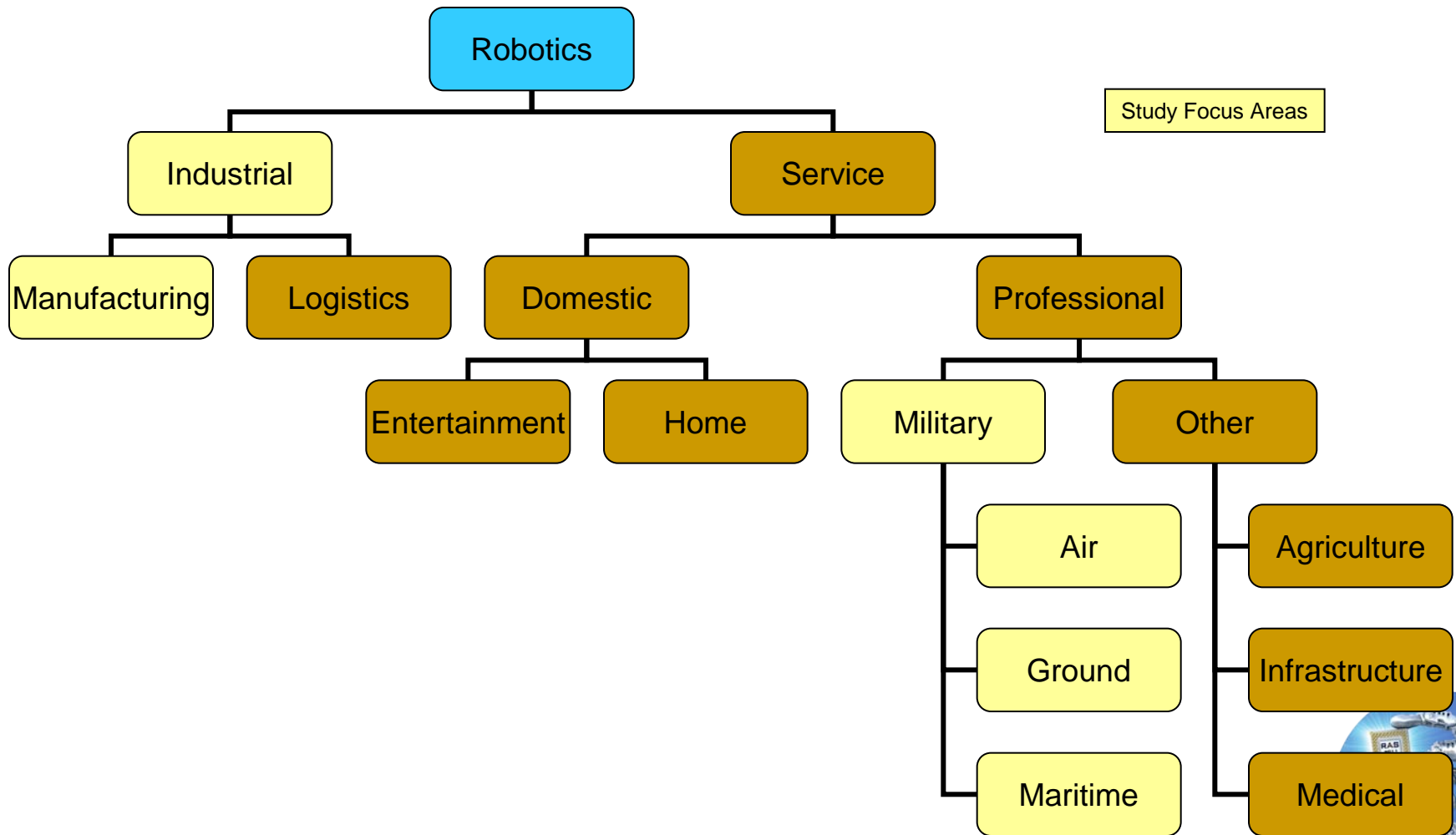
International Field Study Visits





RAS Industry Study

The “Industry” Defined





RAS Industry Study

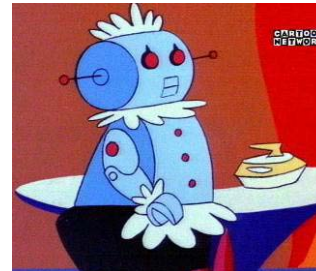
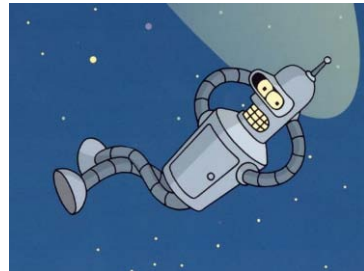
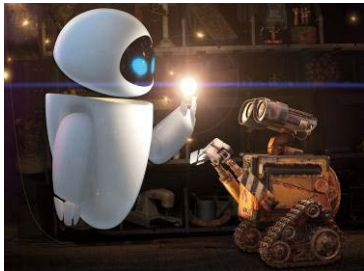
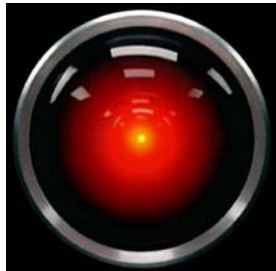
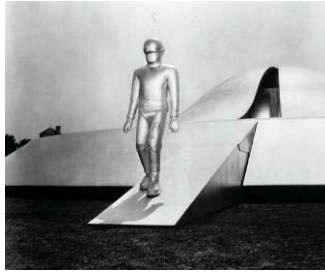
No “Industry” Consensus on Definitions

- Study Team Definitions
 - Robot – a device, either mechanical or virtual, that performs tasks on its own or by following instructions
 - Robotics – the science and technology of using robots
 - Autonomy – defined along a continuum from remote control to interpreting data and making decisions based on programmed parameters
 - Autonomous System – a device [system] with the capacity and freedom to act independently without human intervention



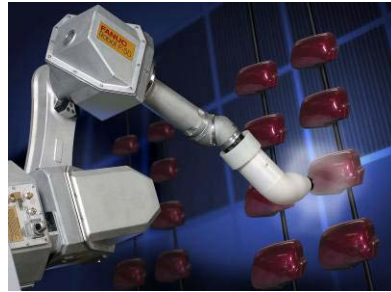


Public Perception of a Robot





Reality of Robotics Today





RAS Industry Study

Small (Light) UGV Market Segment



The Korea Herald

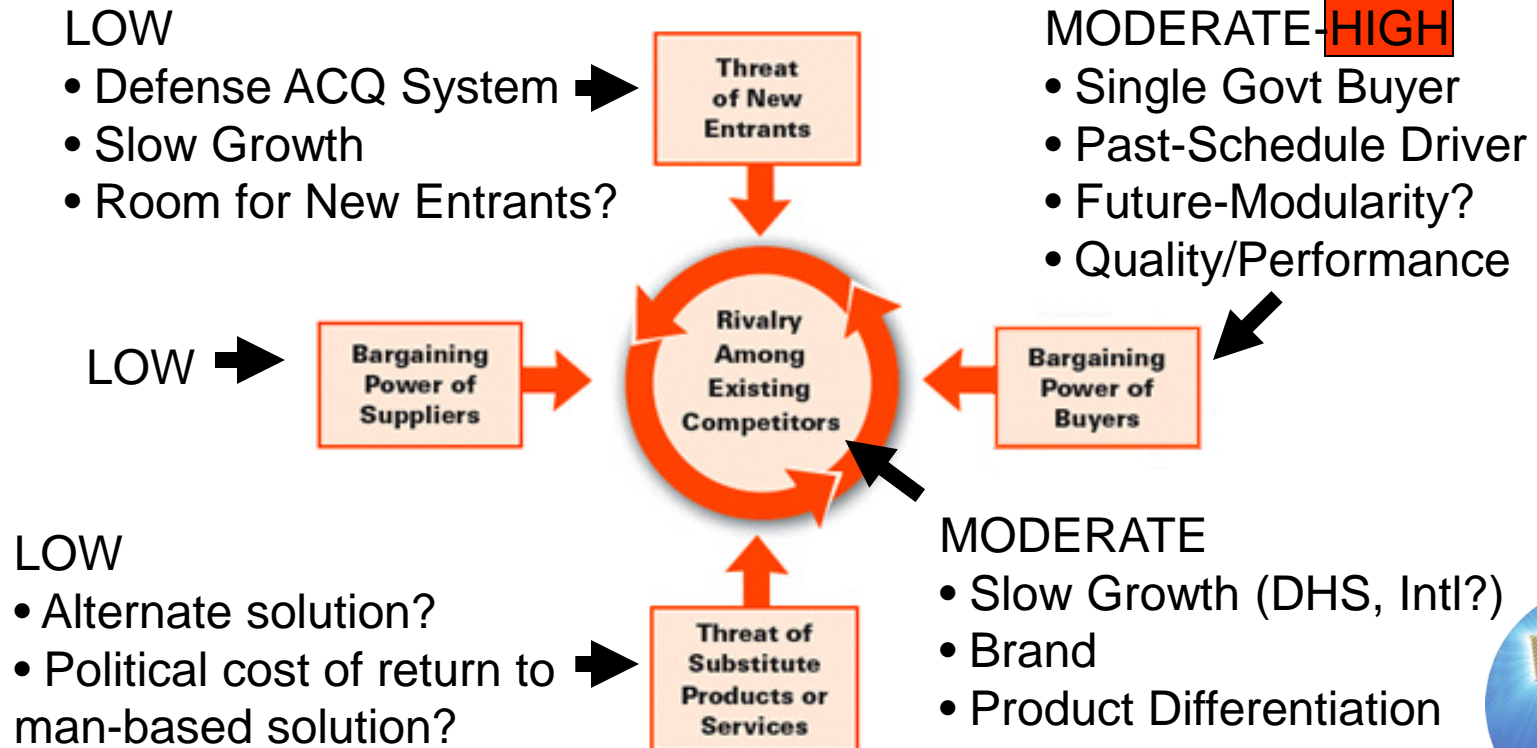


Small (Light) UGV Market Segment

Porter's "Five Forces" Analysis

EXTERNAL FACTORS

- Fiscal crisis
- Defense budgets
- Troop drawdown SWA



from "The Five Competitive Forces That Shape Strategy" by
Michael E. Porter, *Harvard Business Review*, January 2008





Structure-Conduct-Performance (SCP) – Industrial Robotics

STRUCTURE

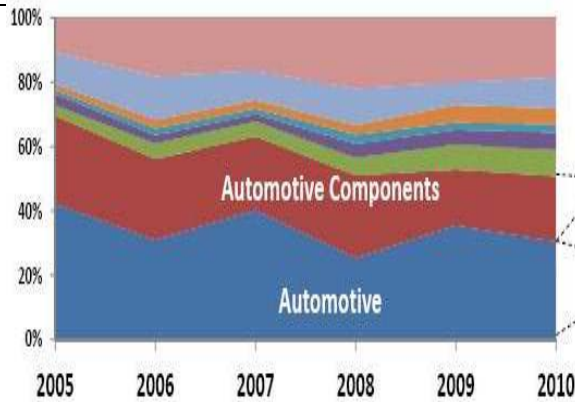
- Hardware manufacturers dominated by non-US firms such as: Fanuc, Hyundai, Kuka
- Barriers to entry high for hardware due to efficient sizing of competitors
- Oligopoly (few suppliers)
- **Many (generally smaller) integrators**

CONDUCT

- Shift toward non-automotive applications
- Packaging, food processing, etc.

PERFORMANCE

- Steady growth over the last two decades
- Robotic density – US 9th in the world

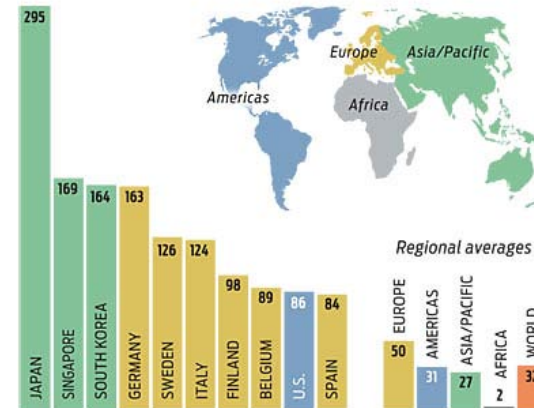


Percentage of Robotics Sales
(Source: Robotics Industry Association)



TOP 10 COUNTRIES BY ROBOT DENSITY

(Industrial robots per 10 000 manufacturing workers)



(Source: *The Atlantic*, Jul 23, 2010)

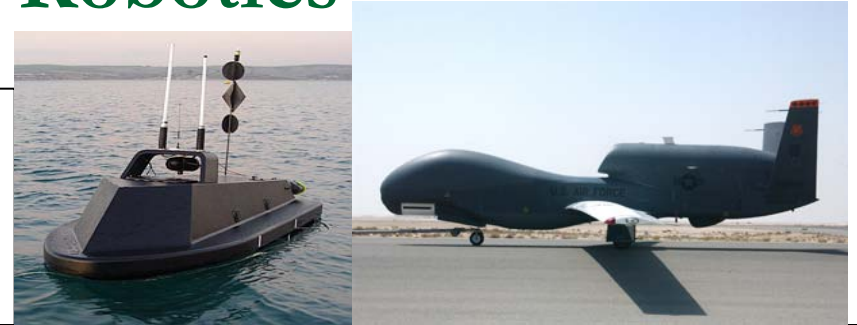




Structure-Conduct-Performance (SCP) – Military Robotics

STRUCTURE

- Structural forces dominated by **single government buyer** (monopsony)
- Public funds – annual appropriations
- Decisions made in public view
- **Fiscal constraints (severe?)**



CONDUCT

- Acquisition of smaller firms common
- Market share protected by maintaining niche capabilities and brand recognition

PERFORMANCE

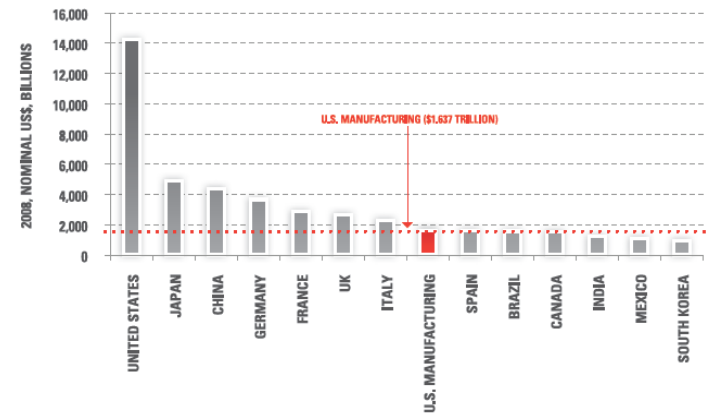
- Varies across markets and domains
- **Reliance on OCO funding**





RAS Industry Study Challenges

- Big Picture
 - Mismatch between technological capability and consumer expectations
 - Social [and organizational] acceptance of robotics technology
- Post-Conflict Funding
- Technological Limitations
- Export Control Restrictions
- US Industrial Robotics Lag



Sources: International Monetary Fund and U.S. Bureau of Economic Analysis





RAS Industry Study

Outlook – Industrial Robotics

■ General

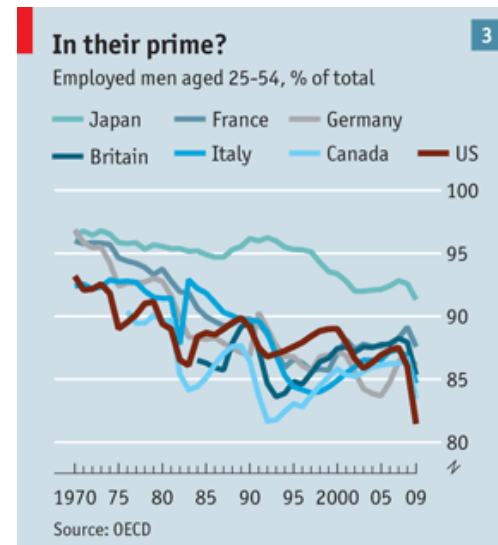
- Japanese, German, Korean firms will continue to dominate hardware market
- Robotics integrators and non-automotive markets key to long-term success in the US

■ Short Term (1-5 Years)

- High US unemployment rate will hamper the greater use of industrial robotics

■ Long Term (5-20 Years)

- Improvements in AI, sensors, material sciences will allow new applications
- Relatively lower overall robot density provides an opportunity





RAS Industry Study

Outlook – Military Robotics

■ General

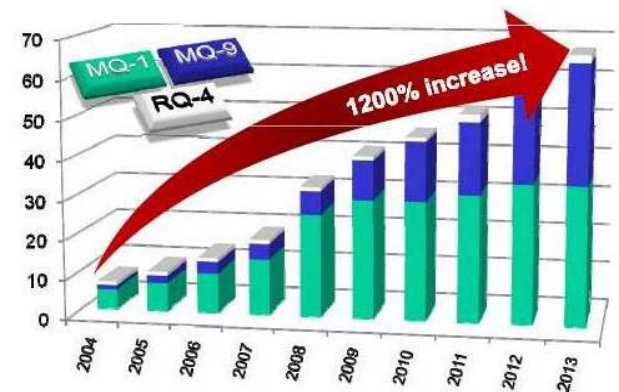
- US is and will remain the preeminent leader
- Unmanned systems are secure in the US military
- R&D investments continue to improve capabilities

■ Short Term (1-5 Years)

- Drawdown of overseas contingency operations will present challenges
- Maritime firms/markets at greater risk
- Overseas competition will not eliminate US lead

■ Long Term (5-20 Years)

- Industry consolidation
- Commoditization, modularity, improved interoperability



UAV Combat Air Patrols
(Source: Colonel J.R. Gear
HQ AF/A2CU, RPA TF)





RAS Industry Study Recommendations

- Develop National Strategic Plan for Robotics
- Create a Strategic Robotics R&D Plan
 - Target improved power sources and communications
- Bolster Holistic Engagement with Industry
 - Emphasize need for common language and architectures
 - Institute a Robotics Advisory Council
- Define Realistic Regulatory Requirements
 - Address National Airspace System management





Goals for Next Year...

- Shift study focus to service robotics
 - Better understanding of market segments
- Push for more analytical rigor in the study
 - More quantitative...
- Paper Topics?
 - Industry study issue papers
 - Research fellow topics

