

The Hunt for Red Hot Technologies

Steven C. Grundman
Director, Aerospace & Defense Consulting

James M. Hasik

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CHARLES RIVER ASSOCIATES

Corporate Headquarters
John Hancock Tower
200 Clarendon Street, T-33
Boston, MA 02116-5092

TEL (617) 425-3000
FAX (617) 425-3132
www.crai.com

Washington Office
1201 F Street, N.W.
Suite 700
Washington, D.C. 20004-1204

TEL (202) 662-3800
FAX (202) 662-3910

Houston Office
1001 McKinney St
Suite 1700
Houston, TX 77002-6401

TEL (713) 646-2200
FAX (713) 650-6906

Terry Pudas says that Force Transformation will change the strategic landscape by knocking down barriers



Key Barriers to Transformation

... challenges for the Department



Office of Force Transformation

- Cultural barriers
 - Speed of understanding vs speed of doctrine
 - Cognitive interoperability and exploitation of shared awareness
 - Values, attitudes and beliefs
- Physical barriers
 - Speed of mass (lift and mobility)
 - Speed of information (connectivity & interoperability)
- Fiscal barriers
 - Willingness and ability to devalue and devolve
 - Discretionary versus non-discretionary
- Process barriers
 - Transformation of the management of defense (*not addressed*)

Pierre Chao/CSIS talk about New Imperatives of success in the market for defense products and services

DEFENSE -
INDUSTRIAL
INITIATIVES GROUP



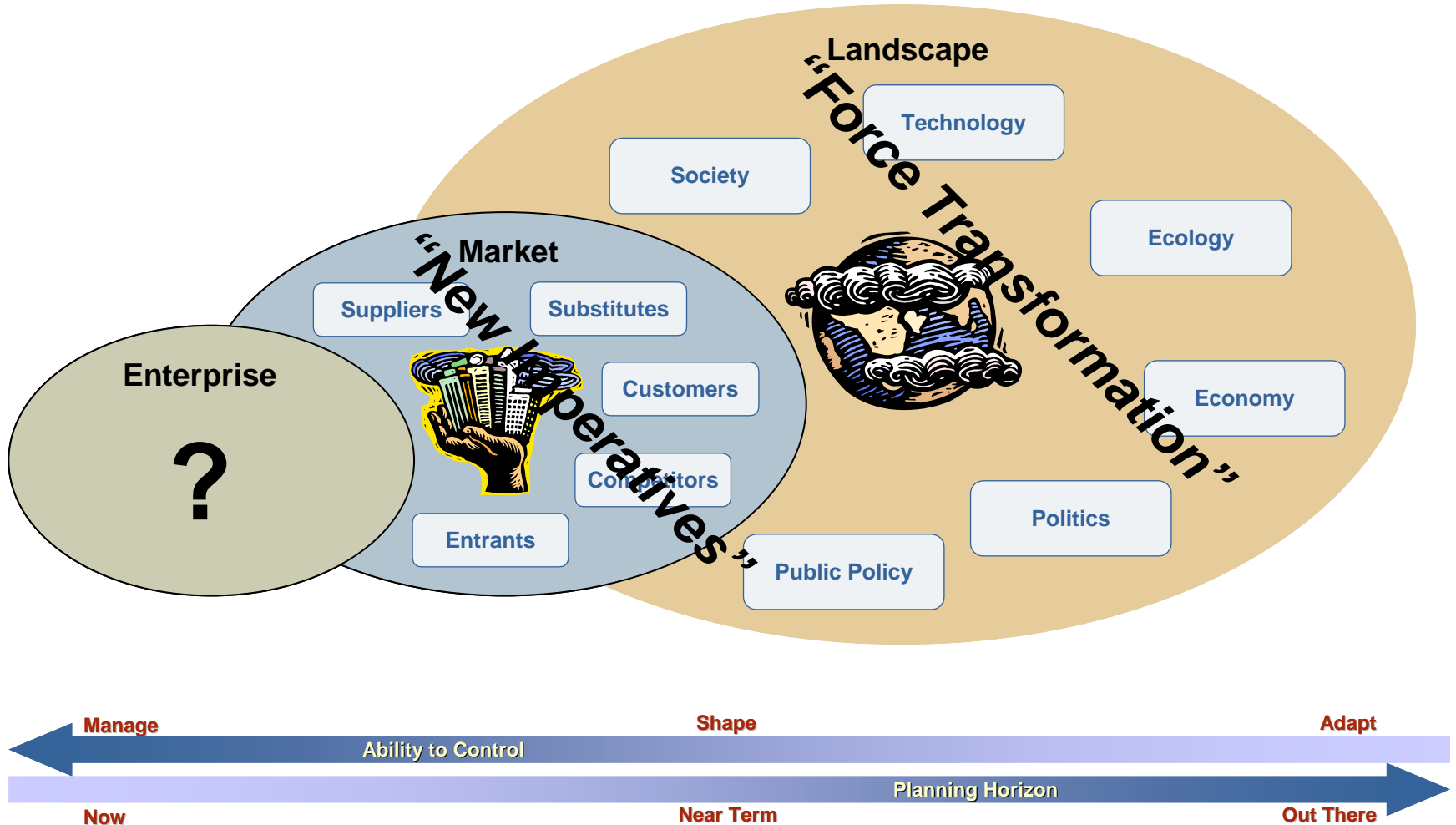
CSIS

Increased Imperative for Nimbleness and Creativity

- In defining solutions
 - How to solve non-traditional problems
 - How to leverage legacy assets
 - Get closer to the end-user

- In strategy
 - Be conduit for others in the defense world
 - Venture capital strategy
 - Be willing to destroy your own business
 - Break away from solutions industry has optimized around
 - Process innovation as critical as product innovation
 - More decentralized to address more complex problems

Steve Grundman asks: "What are the implications of Force Transformation and New Imperatives for the Defense Enterprise?"



A “transformed” defense industry will change the way big and small companies hunt for and cultivate discriminating technologies

■ What does this hunt look like from the big-company perspective?

- **Who’s doing it?**
- **What technologies are they buying?**
- **In which sectors?**
- **Examples**

■ What does this hunt look like from the small-company perspective?

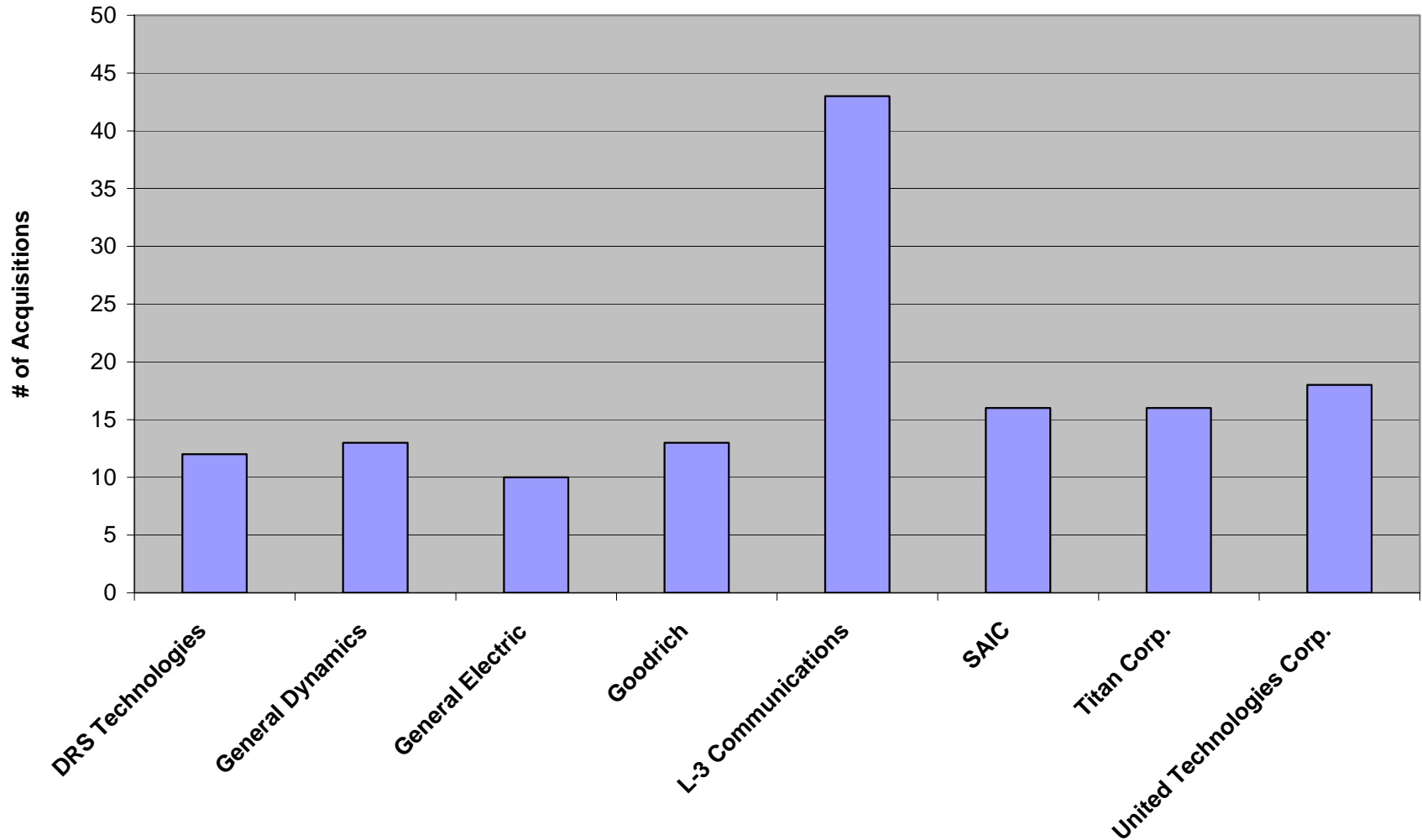
- **Theory of small firms and alliances**
- **Case study of General Atomics**
- **Case study of Incat/Austal**
- **Case study of Spectrum Astro**

■ So what?

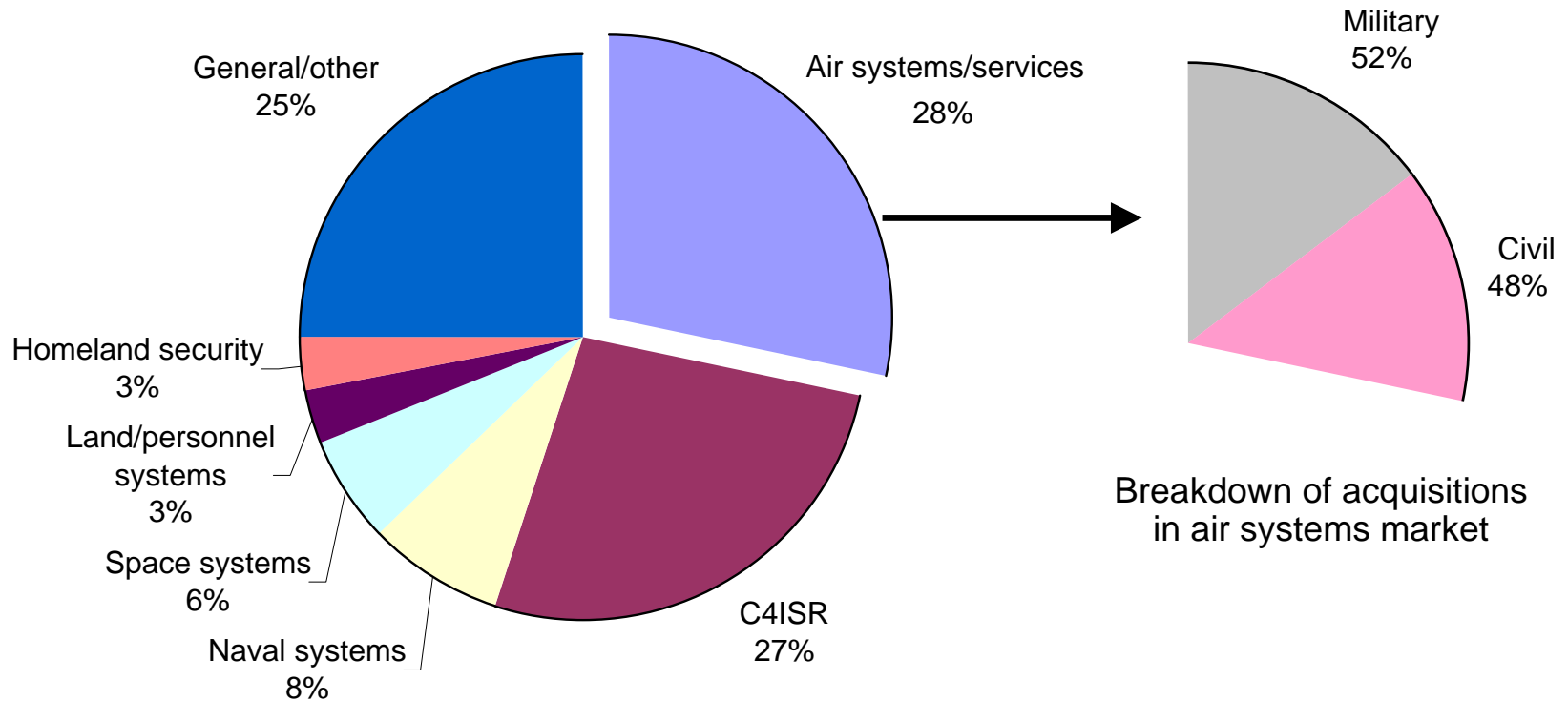
- **Implications for large firms**
- **Implications for small firms**
- **Implications for the Pentagon**

What companies are doing the most hunting and how much?

Buyers with 10 or more acquisitions since 1998

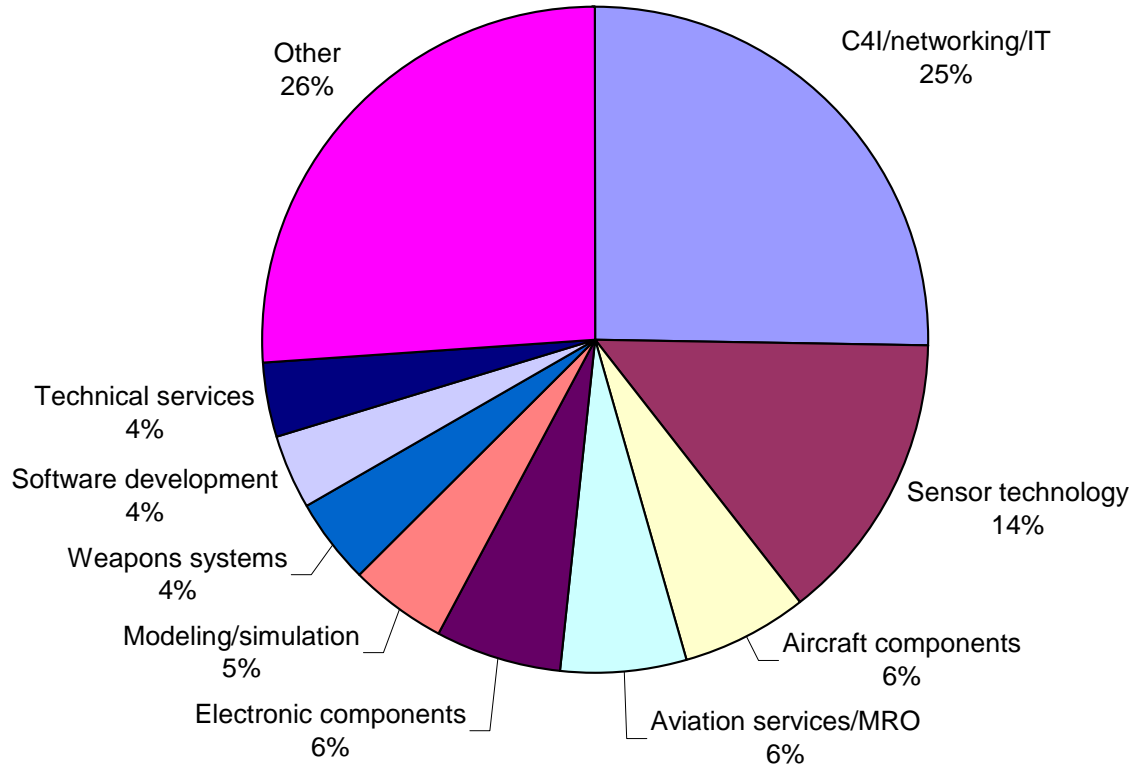


In which segments of the industry are hunters finding the most targets?



- Data set of more than 250 acquisitions of small aerospace & defense companies by industry-leading large companies from 1998-2004
- Categorized deal rationales in terms of market sectors most frequently targeted

What technical capabilities are these hunters bagging?



A&D Market Sector	Total
C4I/networking/IT	25.2%
Sensor technology	14.2%
Aircraft components	6.1%
Aviation services/MRO	6.1%
Electronic components	6.1%
Modeling/simulation & training	4.9%
Missiles/PGMs/munitions	4.1%
Software development	3.7%
Technical services	3.7%
Environmental/thermal management	3.3%
Logistics/management services	3.3%
Engine technology	2.8%
Power systems	2.8%
Systems integration	2.8%
Space technology	2.0%
Materials technology	1.6%
Test equipment & services	1.6%
Law enforcement/homeland security	1.2%
Naval technology	1.2%
Control systems	0.8%
UAVs	0.8%
Emergency management	0.4%
R&D	0.4%
Robotics	0.4%
Shipbuilding/overhaul	0.4%

- Small company acquisitions by large A&D businesses from 1998-2004
- Identified most sought-after technologies motivating transactions

Examples of technology-driven transactions (1 of 2)

Date	Acquired Company	Buyer	Product/services
Mar-04	Mission Research Corp.	Alliant Techsystems	directed energy, electro-optical and infrared sensors, aircraft sensor integration, high-performance antennas and radomes, advanced signal processing, specialized composites
Nov-03	GASL, Micro Craft	Alliant Techsystems	hypervelocity and air-breathing systems for next generation space vehicles, missiles and projectiles
Oct-02	Science and Applied Technology	Alliant Techsystems	design, engineering, development and testing of precision-guided military weapon systems
Sep-04	ALPHATECH	BAE SYSTEMS	software consulting & systems engineering for net-centric warfare; image and signal processing, multi-intelligence fusion, intelligent systems
May-04	STI Government Systems	BAE SYSTEMS	hyperspectral imaging, sensor fusion
Mar-03	Advanced Power Technologies	BAE SYSTEMS	RF and EO sensor systems, information processing, communications networks
May-04	Frontier Systems, Inc	Boeing	UAVs
Jul-00	SVS, Inc.	Boeing	electro-optical systems and image processing solutions
Dec-04	Night Vision Equipment Company	DRS Technologies	night vision products and combat identification systems; lightweight, affordable image intensification (I2) night vision, uncooled thermal imaging, and reflective combat identification
Oct-02	Nytech Integrated Infrared Systems	DRS Technologies	uncooled thermal imaging systems for portable weapons, head gear, hand-held devices and vehicle-mounted sights
Aug-02	Command System, Inc.	General Dynamics	rapid development and deployment command and control software and hardware. Sold 300k+ licenses in 8 countries for off-the-shelf command and control suites
Mar-99	Advanced MicroMachines Inc.	Goodrich	micro-electromechanical systems (MEMS)

Examples of technology-driven transactions (2 of 2)


Date	Acquired Company	Buyer	Product/services
Jun-04	AVISYS, Inc.	L-3 Communications	EW avionics systems engineering and integration, IRCM, DIRCM, laser warning and countermeasures, missile warning systems RF threat warning, support programs
Dec-02	Wescam Ltd. [Canada]	L-3 Communications	wireless visual information systems, capture of images from mobil platforms and real time transmission to tactical command sites
Jul-02	ComCept, Inc.	L-3 Communications	Network-centric warfare, requirements development, modeling, simulation, communications and systems development and integration for ISR
Jul-01	Software Technical Systems	L-3 Communications	chipsets, RF cards, software for next generation SAASM GPS receivers
Oct-04	Sippican Holdings, Inc.	Lockheed Martin	ship countermeasures, ASW training, sub comms, oceanographic instrumentation
Jun-03	ORINCON Corporation	Lockheed Martin	systems and technologies in knowledge management, information assurance, signal & image processing and data fusion
Jul-03	XonTech	Northrop Grumman	missile defense, and sensor and intelligence data analysis
Aug-00	Comptek Research, Inc.	Northrop Grumman	tactical systems, EW simulation/stimulation, and technical services
Jul-99	Teledyne Ryan Aeronautical	Northrop Grumman	unmanned airborne reconnaissance, surveillance, deception and target systems.
Mar-03	Solipsys Corp.	Raytheon	data fusion, data distribution and display, and modeling and simulation
Mar-04	Cercom, Inc.	United Defense Industries	advanced ceramic materials producer, supplier of lightweight ceramic armor
Feb-04	Kaiser Compositek, Inc.	United Defense Industries	filament winding, resin transfer molding, autoclave molding, compression molding, surface finishing for aircraft, missiles, engines, spacecraft, marine vehicles

BAE SYSTEMS NA: A string of acquisitions motivated by adding discriminating technologies to its portfolio

	<i>Deal</i>	<i>Price / Revenues</i>	<i>Target Business</i>	<i>Motivation</i>
2002	Condor Pacific	\$58.5M / ?	Guidance, Navigation & Control: Inertial systems	Technology: - Same customers - Complementary products
2003	APTI	\$27M / \$26M	ISR systems: RF and optical sensor products & processing	Technology: - Same customers - Complementary products
2004	STI Government Systems	\$27M / ?	ISR systems: Hyperspectral imaging & sensor fusion	Technology: - Same customers - Complementary products
2004	Practical Imagineering	\$8.3M / ?	Real-time signal processing: DSP algorithms, s/w & h/w	Technology, Market Share: - Complementary products - Same and new customers (e.g., Intel community)

Curtiss-Wright: Forging a franchise in embedded computing through acquisition of small technology/engineered products companies

	<i>Deal</i>	<i>Price / Revenues</i>	<i>Target Business</i>	<i>Motivation</i>
2001	Lau Defense, Vista	\$44.8M / \$50M	Embedded processors	Technology, Growth
2002	Penny & Giles, Autronics	\$59.5M / \$62.2M	Control electronics	Technology
2003	Collins	\$11.8M / \$8.3M	Position sensors	Scale, Market Share
2003	Peritek	\$3.2M / \$2.7M	Video & graphic display boards	Technology, Market Share
2003	Systran	\$18M / \$15.1M	Data communications electronics	Technology, Market Share
2003	Novatronics	\$13.6M / \$12M	Position sensors, electric motors	Technology, Market Share
2004	Dy 4	\$110M / \$72M	Embedded processors & computing systems	Scale, Market Share
2004	Primagraphics	\$21M / \$12.5M	Graphics processing & display systems	Technology, Market Share
2004	Synergy	\$49M / \$23M	Embedded processors & computing systems	Scale



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■ So what?

- **Implications for large firms**
- **Implications for small firms**
- **Implications for the Pentagon**

The imperatives of Transformation can actually favor small firms and regulate the relative attractiveness of alliances vs. acquisitions

Factors Favoring Alliances Between Large and Small Firms

Market conditions favoring **small firms** over large firms:

- Innovative, but not research-intensive, solutions
- A high proportion of skilled labor in the input factors
- Medium-speed learning in production

Market factors favoring **alliances** over mergers and arms-length procurements:

- Considerable change with respect to processes and goals
- Moderately “leaky” knowledge
- Moderate potential for a “shakedown”

Case studies of small firms which won contracts for high-profile military platforms suggest—

Common attributes of the systems

- Humble origins
- Critical need
- Small scale
- Repeatedly proven
- Adaptable

Common attributes of the firms

- Not many more than 1000 staff
- Subject of media attention
- Non-traditional entrant
- Engineering driven
- Privately held

RQ-1MQ-9 Predator
General Atomics



Aluminum Car Ferries
Incat and Austal



SBIRS-Low
Spectrum Astro



Case Study: the Predator unmanned aircraft

General Atomics' Predator is now an everyday part of combat operations



*Serbian T-55s spotted by a Predator
Bosnia, 1995*



*Wreckage of Abu Ali's Land
Cruiser
Yemen, 2002*



Predator with Hellfire missile

- *Humble origins* — developed by a team of about a dozen engineers from a bankrupt company
- *Critical need* — eighteen-month Advanced Technology Concept Demonstration (ATCD)
- *Small scale* — still produced by a business unit with less than 1000 staff (1900 in all of GA)
- *Repeatedly proven* — reconnoitering Bosnia and Kosovo; attacking targets in Afghanistan and Iraq
- *Adaptable* — seemingly the favored entry in the Broad Area Maritime Surveillance (BAMS) program

General Atomics' next big thing is the Mariner, a naval drone to be produced in alliance with Lockheed Martin



*Predators on the flight line
Balad Air Base, Iraq*



*Altair UAV assembly
San Diego*



Mariner UAV concept

Small Firm Advantage? **YES**

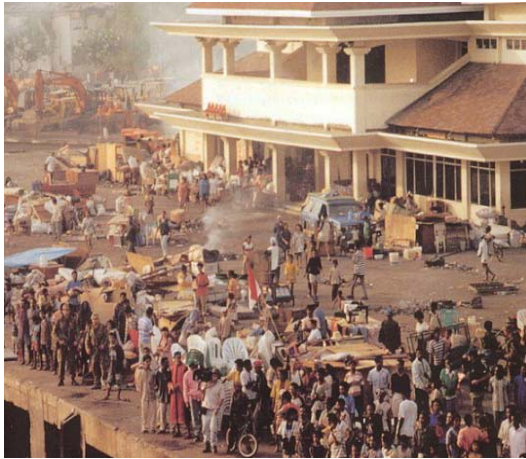
- *Innovative, but not research-intensive* — recombinative use of off-the-shelf subsystems
- *Dependent on skilled labor* — individually hand-made
- *Medium-speed learning* — production has averaged 10 annually, increasing of late

Alliance Advantage? **YES**

- *Considerable change* — unmanned aircraft design is pre-paradigmatic
- *Moderately leaky knowledge* — systems integration is one of the primary challenges
- *Some potential for shakedown* — sexy aircraft, but still just a platform

Case Study: Aluminum-hulled car ferries

Austal and Incat's car ferries may be a part of the Navy After Next



*The piers on first approach
East Timor, 1999*



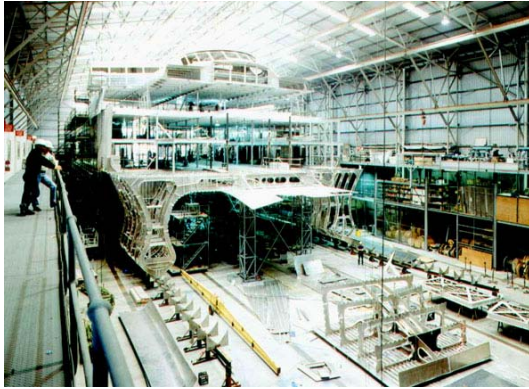
*HMAS Jervis Bay alongside
Success
East Timor, 1999*



*Marines board MV Westpac Express
Okinawa, 2001*

- *Humble origins* — built as car ferries, now functioning as small frigates
- *Critical need* — first leased on short notice to replace disabled RAN amphibious ship
- *Small scale* — produced by several firms with less than 1000 staff
- *Repeatedly proven* — Jervis Bay, Westpac Express, Joint Venture, Spearhead, Swift
- *Adaptable* — now the basis for the Joint HSV, the LCS, and RN's Global Corvette

Small Australian and US builders are expanding and teaming up with large, diversified defense contractors



*Austal's assembly hall
Western Australia*



*Welding at Austal's facility
Western Australia*



*Sea Fighter at Nichols
Brothers
Puget Sound, 2005*

Small Firm Advantage? **YES**

- *Innovative, but not research-intensive* — large-scale aluminum structures
- *Dependent on skilled labor* — one of the most skilled of the heavy industrial trades
- *Medium-speed learning* — neither aircraft carriers not armored vehicles

Alliance Advantage? **YES**

- *Considerable change* — a new set of threat slides (e.g., no more Northern Fleet)
- *Moderately leaky knowledge* — new technological concept, but not fully unique
- *Some potential for shakedown* — still just a platform

Case Study: Brilliant Eyes

Spectrum Astro's stunned the industry with its SBIRS-Low win in 1999



The Scud



The EKV



The Shemya Island Radar



Artist's concept of SBIRS-Low

-
- ***Not so Humble Origins*** — Spectrum Astro started small, but replacing the DSPs meant something big
 - ***Critical need*** — SBIRS-Low would be the key link in a chain of missile defense assets
 - ***Small scale*** — only one prototype would be needed for concept demonstration
 - ***Not quite proven*** — STSS is still nowhere close to battle-ready
 - ***Not fully adaptable*** — STSS is basically useful for missile defense

Spectrum Astro's lack of scale and scope led to its acquisition by General Dynamics in 2004 and relegation to subcontracting on the 'Dream Team'



*Spectrum Astro's 'Factory of the Future'
Scottsdale, Arizona*



*Northrop Grumman's STSS concept
(GD Spectrum Astro subcontracting)*

Small Firm Advantage? **NO**

- *Innovative and very research-intensive* — miracles required in five of six areas
- *Dependent on skilled labor* — makes shipbuilding look easy
- *Low-speed learning* — several satellites annually (e.g., GPS, SBIRS) is a lot

Alliance Advantage? **NO**

- *Considerable change* — technical future of missile defense is still very uncertain
- *Insufficiently leaky knowledge* — very loose program management, future competitions
- *Little potential for shakedown* — mission-critical payload drove customer interest

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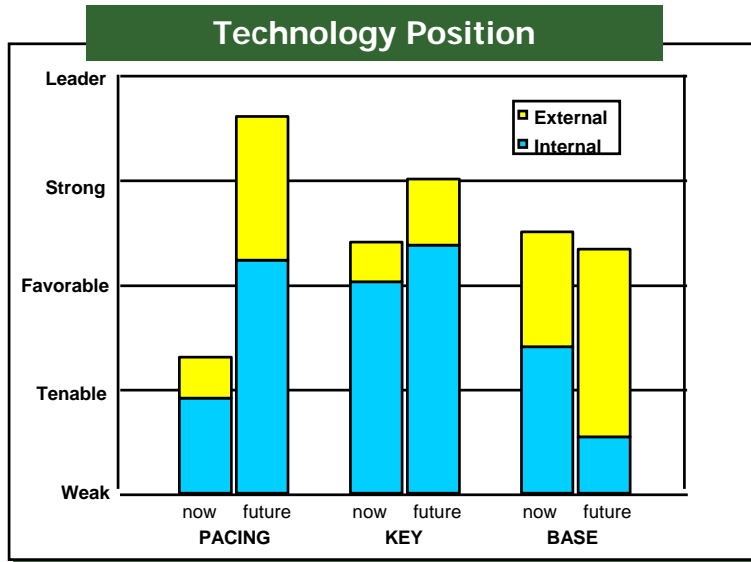
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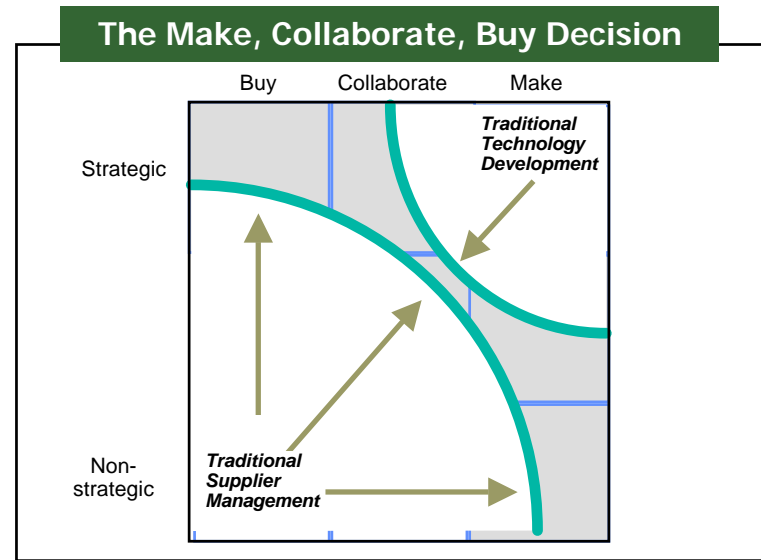
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Large firms that want to succeed in a transformed defense industrial base need deliberate technology-sourcing strategies



The best companies concentrate internal resources on strategic technologies (key & pacing) that create market advantage- and leverage external resources to provide less-competitive (base) technologies.

As procurement becomes more strategic and technology more market oriented, leading companies carefully manage a “gray zone” of split responsibility across these functions.



After all, isn't this what world-class information age companies do?



CORNING



intel.

Microsoft

- Leading-edge computer hardware and software firms are constantly absorbing smaller firms with technologies critical to their products
- Acquisition makes sense if the technology is more useful to the buyer than the seller. This is true in two cases:
 - transaction costs come to exceed organizational costs, or
 - the acquisition cuts off a competitor's access to the technology
- Industries cycle through phases of integration and modularity, so today's strategy will require periodic reevaluation

Small technology companies that want to maximize their value in the marketplace need deliberate alliance and exit strategies

Advantage to an alliance?

		YES	NO
Advantage to the small firm?	YES	Ally with a big guy	Sell the product
	NO	Ally “defensively”	Sell the company

For the Pentagon, as the Deputy General Counsel said, defense-industrial policies should be “predictable, competitive, and open,” not prescriptive

TWENTY FOUR CASE STUDIES OF EMERGING DEFENSE SUPPLIERS				
Company Name	Annual Sales		Location	Enabling Technologies
	Total (\$ Millions)	Defense ¹ (%)		
Combat Support				
EluSys Therapeutics	\$2.0	100%	Pine Brook, NJ	Anthrax Vaccine
iRobot	n.a.	n.a.	Somerville, MA	Intelligent robotics
Nomadics	7.0	80%	Stillwater, OK	Advanced sensors
Oakley	476.9	n.a.	Foothill Ranch, CA	Human form accessories
Sarcon Microsystems	0.0	0%	Knoxville, TN	Infrared sensors
Power Projection				
Aerovirement	50.0	50%	Monrovia, CA	Energy systems and UAVs
Amptek	7.0	5%	Bedford, MA	Space instrumentation
i2 Technologies	986.0	15% ²	Dallas, TX	Logistics software
Precision Engagement				
C-CAT	2.0	50%	Fort Worth, TX	Carbon-carbon components
Foam Matrix	4.0	100%	Inglewood, CA	Net molded structures
Homeland and Base Protection				
Coherent Technologies	19.2	52%	Lafayette, CO	Laser radar technologies
Riptech	45.0	10%	Alexandria, VA	Managed security services
RSA Security	282.7	10%	Bedford, MA	Network security products
SRD	7.5	50%	Las Vegas, NV	Fraud prevention software
Symantec Corp	1,160.0	n.a.	Cupertino, CA	Network security products
Viisage Technology	30.5	10%	Littleton, MA	Biometrics technologies
Integrated Battlespace				
Actuality Systems	1.0	65%	Burlington, MA	3D visualization technology
AirFiber	n.a.	n.a.	San Diego, CA	Wireless equipment
Delta Information Systems	7.0	40%	Horsham, PA	Communications equipment
Sabeus Photonics	2.0	0%	Chatsworth, CA	Sensor technologies
SRA International	361.0	95%	Fairfax, VA	IT systems and consulting
The Insitu Group	2.0	65%	Bingen, WA	Long-range UAVs
Vanu	n.a.	50%	Cambridge, MA	Software radio
Zaplet	1.0	67%	Redwood Shores, CA	Collaborative software

¹ When military and civil government sales aggregated, most relevant government sales figure presented
² Next year's target for new licensing revenue
n.a. = not available
Note: Companies listed are representative; the list is not exhaustive. Inclusion or exclusion does not imply future business opportunities with or endorsement by DoD.

Source: Emerging defense suppliers interviews

Steven C. Grundman
Vice President
Director, Aerospace & Defense Consulting
(617)425-3168
sgrundman@crai.com

James M. Hasik
CRA Consultant
(512)299-1269
jhasik@jameshasik.com



CHARLES RIVER ASSOCIATES

Corporate Headquarters
John Hancock Tower
200 Clarendon Street, T-33
Boston, MA 02116-5092

TEL (617) 425-3000
FAX (617) 425-3132
www.crai.com

Washington Office
1201 F Street, N.W.
Suite 700
Washington, D.C. 20004-1204

TEL (202) 662-3800
FAX (202) 662-3910

Houston Office
1001 McKinney St
Suite 1700
Houston, TX 77002-6401

TEL (713) 646-2200
FAX (713) 650-6906



- **Steven C. Grundman** is a Vice President and Director of Aerospace and Defense Consulting. His broad experience spans both the government and the private sector. In government, Mr. Grundman served as Deputy Under Secretary of Defense for Industrial Affairs and Installations, spearheading key industrial-strategic and defense-reform initiatives of the DoD's acquisition management system. In particular, he supervised the DoD's antitrust and foreign investment reviews of mergers and acquisitions, was a leading advocate of the policy to integrate the U.S. and European defense-industrial sectors, and reshaped the relationship between the Pentagon and Wall Street. He also led the Department's defense-reform initiatives to outsource commercial functions, privatize housing and utilities, and close and redevelop excess bases. Prior to 1998, Mr. Grundman served in the Office of the DoD Comptroller, where he organized the Defense Resources Board's review of the military departments' annual program and financial plans. Mr. Grundman also has worked as a corporate planner at the CNA Corporation/Center for Naval Analyses, where his assignments included initiatives in corporate communications, marketing and outreach, and Board relations and development. Mr. Grundman has been a commissioned officer in the U.S. Army and a consular officer in the U.S. Foreign Service. A graduate of Georgetown University, Mr. Grundman also holds a Masters in Public Policy from Harvard's Kennedy School of Government.

Steven C. Grundman
Vice President and Director, Aerospace & Defense Consulting
Charles River Associates Incorporated
200 Clarendon Street, T-33
Boston, MA 02116-5092
(617) 425-3168 (office-direct)
(857) 222-3347 (mobile/nights/weekends)
(617) 425-3132 (fax)
sgrundman@crai.com

- **James M. Hasik** is a Consultant to the Aerospace & Defense practice at Charles River Associates. His most recent activities include studies of innovation and industry structure, the interrelationship between network economics and network-centric warfare, and the strategic significance of the 2005 Base Realignment and Closure (BRAC) process. Before entering private practice, Mr. Hasik was a consultant with IBM Global Services, Viant, Andersen Consulting (now Accenture), and ANSER. He started his career as a US Navy officer.

James M. Hasik
Aerospace & Defense Consultant
(512) 299-1269
jhasik@jameshasik.com
www.jameshasik.com