Rising Opportunities for EMS Organizations
In the Medical, Industrial, and Aerospace/Defense/Homeland Security Segments

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As electronics manufacturing, design and after market services evolve into as a strategic option for today's electronics original equipment manufacturers (OEM), opportunities for further growth exist. Where outsourcing has been used significantly over the past decade by OEMs in computer systems, mobile communications, and consumer electronics, many possibilities exist within other growing industry segments for Electronic Manufacturing Service (EMS) companies.

Such include medical, industrial, aerospace, defense, and homeland security (HLS) products. We have conducted significant research in market growth, outsourcing trends, OEM selection criteria, business opportunities, and challenges for these expanding segments. In addition to statistical analysis, this research has utilized extensive interviews with industry executive in both OEM and EMS companies. This is an overview of this research, the executive interviews, and the conclusions reached regarding today's outsourcing of the medical, industrial and aerospace/defense/homeland security sectors.

The Overall Reasons for Outsourcing

In the medical, industrial and aerospace/defense/homeland security/homeland security markets OEMs are at the same point computer makers were in the mid-1980s concerning outsourcing. They view it as offering a competitive advantage in their pursuit of lower cost and the chance to tap into global markets. Significant trends are driving this increase in manufacturing outsourcing:

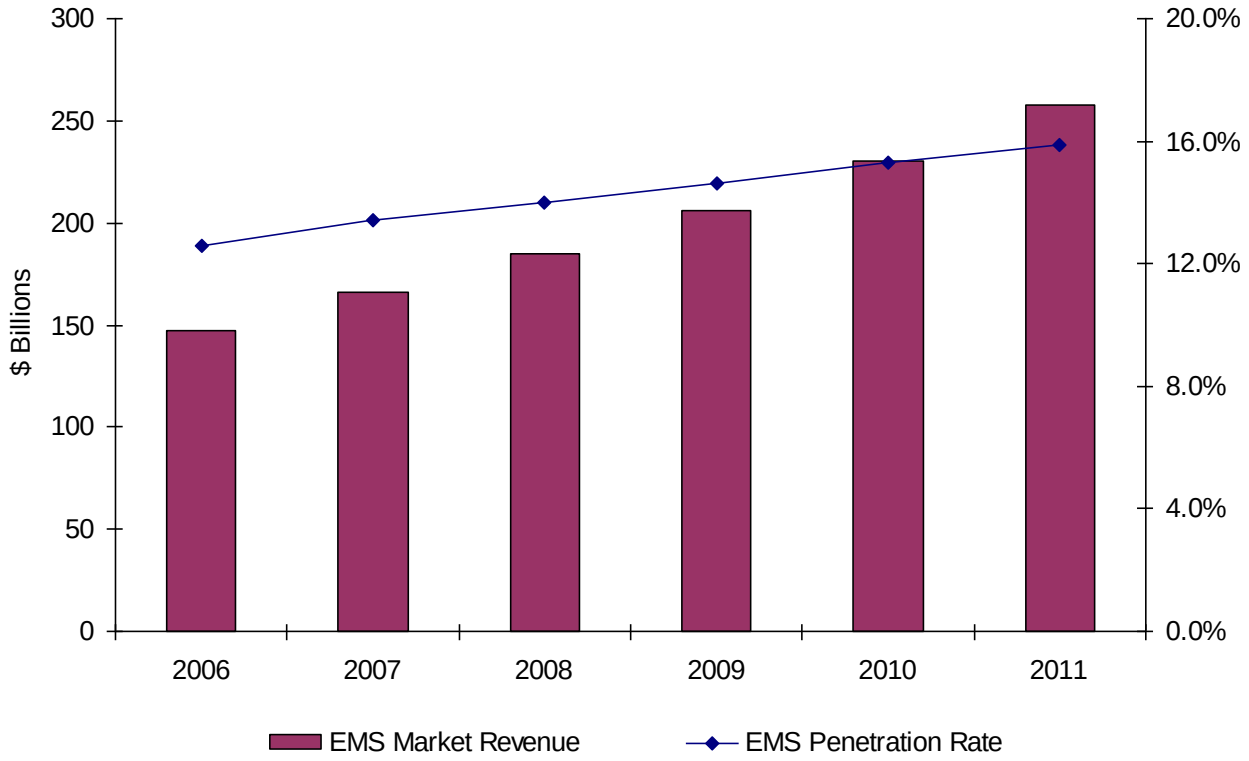
- Focus on core competencies of design, marketing, and quality controls
- Realize savings in both fixed and variable cost
- Accelerate time to market
- Achieve proximity to large developing markets
- Keeping abreast of electronic innovations

These are the same reasons that drove other electronics OEMs down the outsourcing path two decades ago. As OEMs embrace outsourcing as a strategic business decision, they will increasingly contract out electronics manufacturing. In many cases this will start with printed circuit board assembly (PCBA) and sub-assemblies manufacturing and will evolve into a full range of manufacturing services. This service portfolio includes pre-manufacturing, full product build, ship to distribution and end customers, repair and refurbishment, and warranty support.

Another area of growth for contract services is design support. Many companies that have successfully outsourced product manufacturing are now looking for outside assistance in design and associated support. External resources are often more nimble in terms of being able to take a product from concept to production in a shorter timeframe and at a lower overall cost. Today most EMS companies provide a level of design assistance to their OEM customers.

The Global EMS Market

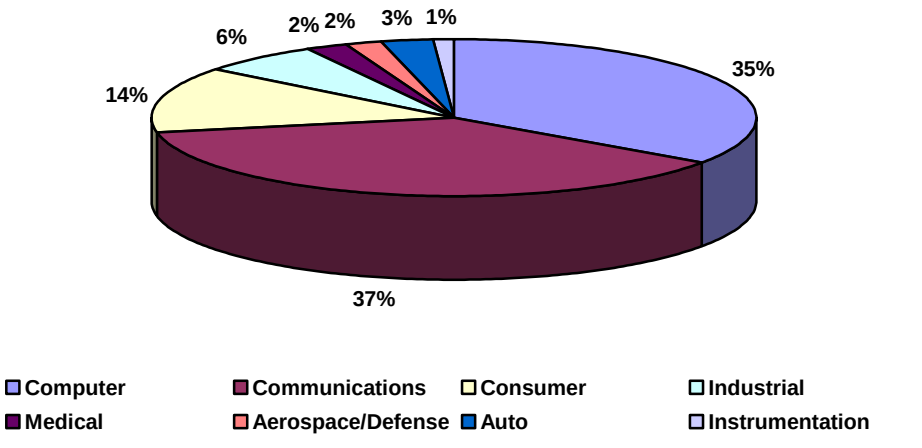
Although still facing challenges, the worldwide EMS industry is growing. We project the global market will grow at a 12% annual rate over the next five years to $222 billion by 2011. Whereas, EMS companies now produce 12% of the world's electronic products, TFI projects this capture rate of global Cost of Goods Sold to increase to over 16% by 2011 (Figure 1).



Source: Technology Forecasters

Figure 1 - Global EMS Market

Whereas the larger EMS providers derive almost three-quarters of their revenues from the 3C's (computer, communications, and consumer segments), the smaller companies serve a much more balanced market such as the industrial, medical, and aerospace segments. This can be explained. The larger suppliers are better situated to serve the high-volume, low-mix market for products such as personal computers, printers, cell phones, and consumer electronics. Smaller companies are positioned for the highly specialized, low-volume, high-mix segments with products such as industrial controls, military electronics, medical diagnostic equipment, semiconductor capital equipment, avionics, and X-ray equipment.



Source: Technology Forecasters

Figure 2 - EMS Market Revenue Segmentation – 2006

The industrial, medical, and aerospace/defense/HLS sectors are typified by their production being of a more high-mix, low-volume nature, the products themselves being somewhat more complex and containing significant intellectual property. And the production requirements of these items are less susceptible to the lure of the low-cost manufacturing regions of the world.

These markets provide a multitude of products suitable for outsourcing. Table 1 displays a variety of products and sub-sectors for these electronic segments.

Table 1 - Example Product Categories for Electronic Segments

Industrial	Medical	Aero/Defense/HLS
Industrial controls	Diagnostic equipment	Electronic warfare
Semiconductor capital equipment	Patient monitoring equipment	Communications & navigation
HVAC equipment	X-ray equipment	Guidance/controls
Robotics	Hearing aids/ audiometry	Radar
Power electronics	Clinical & lab instrumentation	Sonar
Gaming	Infusion & inhalation equipment	Simulators
Construction equipment	Ultrasound	Electro-optical
Vision systems	Implantable devices	Military computers
Industrial automation	Anesthesia equipment	

Many EMS providers gravitate to these sectors as they are not as sensitive to consumer price pressure and often provide more opportunities for enhanced returns. Also, these segments may be somewhat immune to the off shoring trend of manufacturing, especially to China. That's because the labor content is often not high enough to justify the move. In addition, the concerns about product quality, regulatory issues, and protection of intellectual property (IP) may contribute to the reluctance of OEMs to outsource to certain low-cost geographies.

EMS captured 13% of the total global electronics market in 2006 with the major segments contributing to this being the computer, communications, and consumer segments (EMS 2006 penetration of 16%, 25%, and 10% respectively). This overall EMS market penetration is projected to grow to 16% over the next five years. But, another factor affecting the future of EMS companies is the increasing acceptance of outsourcing in the industrial, medical, and aerospace/defense/homeland security segments. The market growth of the three subject segments is displayed in Table 2. These segments have a much lower current rate of outsourcing and, therefore, offer significant opportunities for contract manufacturers over the next five years.

Table 2– TAM Growth and EMS Penetration of Total Market and Selected Segments

Segment	2006-2011 TAM CAGR	2006 EMS Penetration	2011 EMS Penetration
Industrial	5.7%	6.1%	6.7%
Medical	9.0%	6.9%	9.8%
Aerospace/Defense/HLS	6.3%	2.5%	2.9%
Total Electronics	**6.7%**	**12.6%**	**15.9%**

Source: Technology Forecasters

The Industrial Electronics Market

Industrial electronics is a broad and diverse category. It is driven mostly by exogenous factors such as GDP in heavily industrialized countries (particularly the US, Japan, and Germany), growth in China, India, and Eastern Europe, and oil prices.

Key issues that face industrial electronics include:

- Reducing power requirements
- Meeting new performance criteria while maintaining compatibility with legacy bus designs
- Incorporating communication modules
- Accommodating long product life cycles
- Producing mission critical products that operate reliably, often in harsh environments

The industrial segment is much less open to outsourcing than the computer, communications, or consumer industry. Industrial electronic requirements tend toward high-mix, low-volume designs, close integration with mechatronics, and direct service relationships between OEMs and customers. All these factors can make industrial a difficult segment for the EMS industry to penetrate.

For the EMS companies, market drivers include increased printed circuit board assembly and module assembly as the electronic content of industrial equipment rises. Also the segment is a significant opportunity for small to mid-size EMS companies, because many industrial OEMs depend on local satellite electronics partners.

We anticipate Total Available Market (TAM) growth of almost 6% annually from 2006 to 2011. Growth will be constrained in this market by a slowdown in the US Gross Domestic Product (GDP), offset to some extent, by pent up capital spending. A five year annual growth of almost 8% is expected for EMS revenue (Figure 3). EMS penetration will only increase from a current 6.1% to 6.7% over the next five years.

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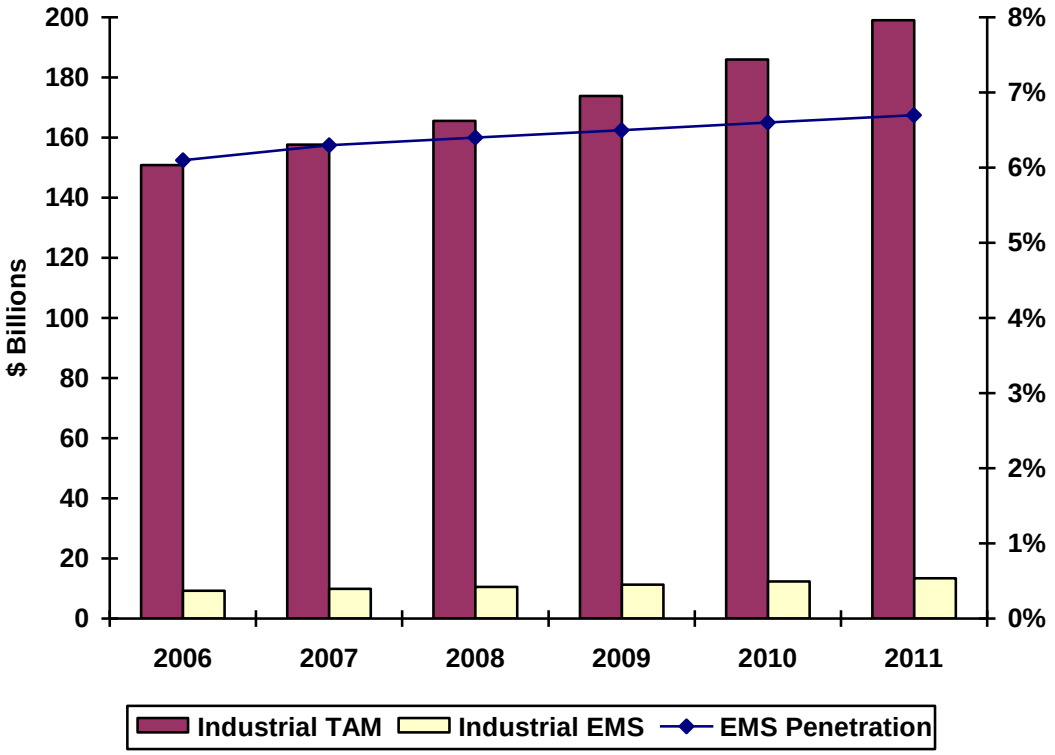

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Figure 3 – Industrial Electronics Market

In our survey of over 70 executives of OEMs that serve the industrial market, they were asked the significant reasons they choose to outsource electronic production. Not surprisingly a reduction in cost was the most significant factor. The major considerations they evaluate in making such decisions are displayed in Figure 4.

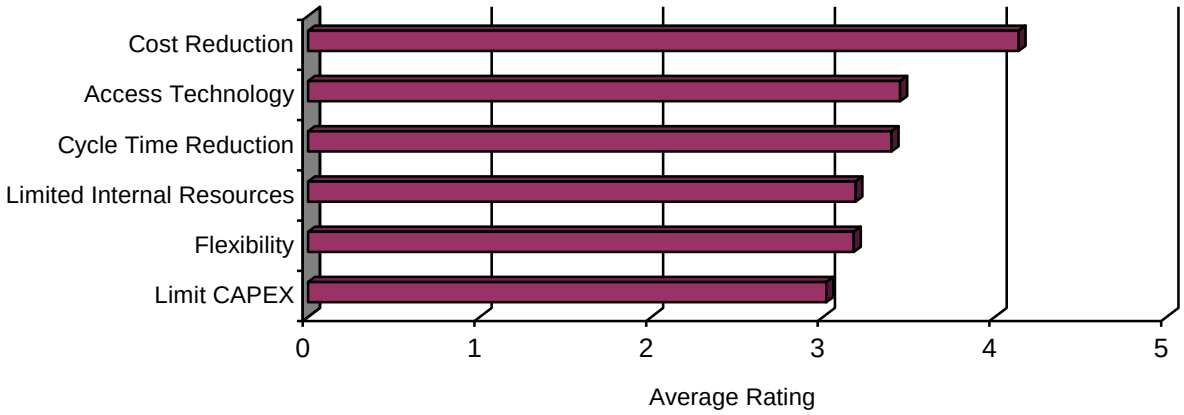
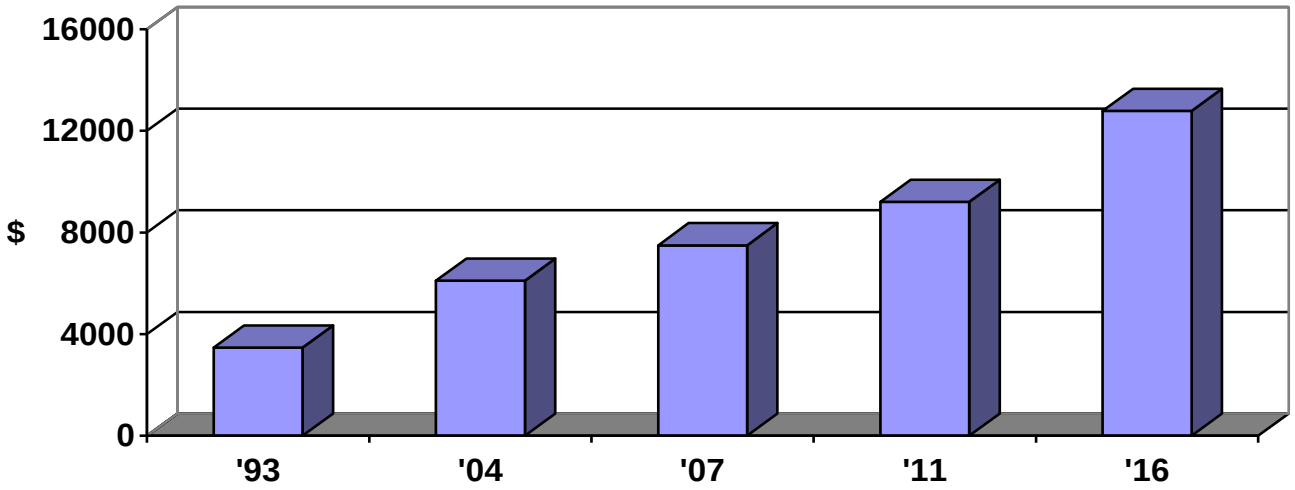


Figure 4 – Why Industrial OEMs Outsource

The Medical Electronics Market

Demographics, increased research, new technologies, and global opportunities are driving growth in the medical products industry. The breakthroughs in technology enable medical device manufacturers to generate new business, enhance procedural outcomes, and reduce long-term treatment cost. In these areas, electronics is enabling a growing number of applications. Electronics are the "brains" of medical devices. It is the means by which the diagnostic information is relayed to human users via a digital readout. Electronics are often the most expensive and complex components of a medical product. From an economic perspective, predictions are that US healthcare spending will grow from $1.7 trillion in 2003 to $4 trillion by 2016, or about $12,320 per person annually (Figure 5). Likewise, this will result in an increase in health care spending

from a current 16% of US GDP to 20% by 2015. Although the US currently leads the world in this spending, health care incentive for a growing consumer class will undoubtedly fuel growth in emerging markets such as China, India, Russia, and Brazil.



Source: *Wall Street Journal*

Figure 5 - US Annual Healthcare Spending per Person

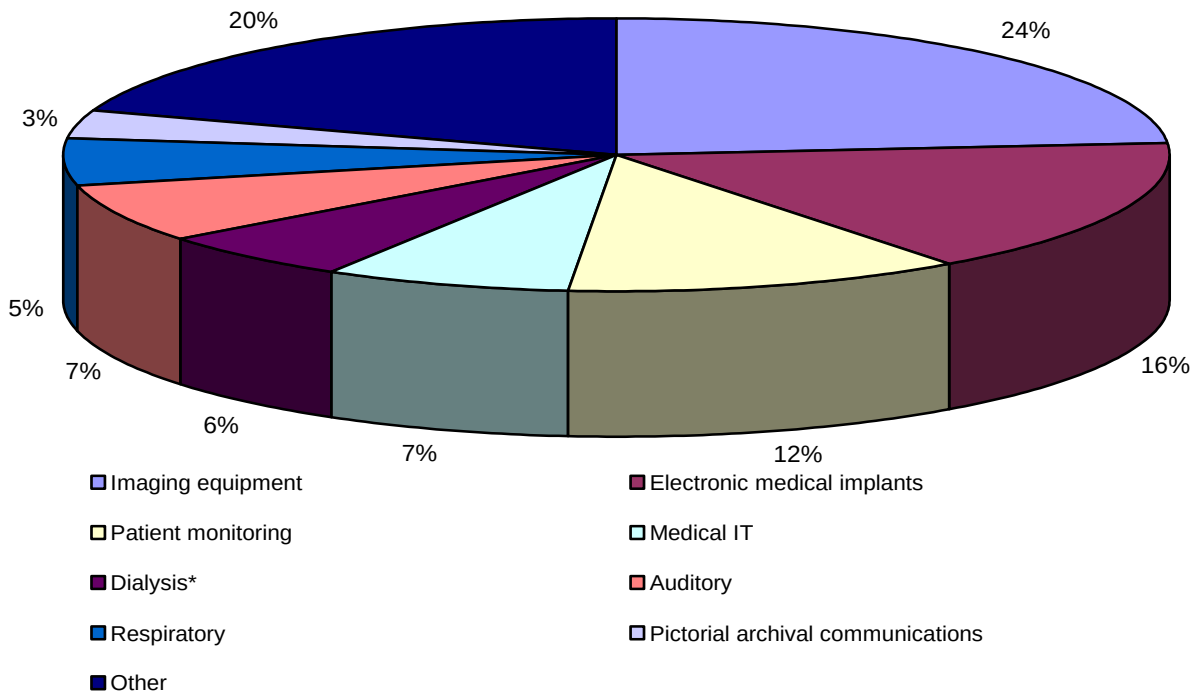
The role of electronics in medical services is increasing dramatically. In 2002, Intel, the global leader in semiconductor technology, conducted an in-depth marketing study to identify future needs in electronics. To the company's surprise, when consumers were asked what they hoped was on the horizon, it was not a larger, flat-screen, high-definition television or a smaller, sexier PDA. The dominant concern was, "How can you help me take care of my aging parents?"

> "*This is a golden moment to bring government, health care professionals, industry and academia together to accelerate innovation and investment for this critical issue. No company, no industry, no country can afford to ignore the economic and social impact this wave of aging people will create."*

Craig Barrett
Chairman of Intel Corporation
White House Conference on Aging

EMS providers now view medical as a major growth opportunity. It's attractive for a variety of reasons. It has stable growth rates; it does not have huge annual growth such as seen over the past decade in laptop computers, cell phones, or video game consoles, but it doesn't experience extreme cyclical ups and downs. And the fact that the medical equipment market is characterized by low-volume production does not appear to be a deterrent for many EMS providers.

We estimate that the TAM for the medical electronics market will grow from $49 billion in 2006 to $76 billion in 2011. UK-based research firm, MHM developed a product breakout of the worldwide medical electronics market for 2006. Imaging equipment is the largest category of medical electronics, representing almost one-fourth of the market. Other categories include electronic medical implants, patient monitoring equipment, information technology systems, dialysis equipment, auditory aids, respiratory equipment, and pictorial archival communications (See Figure 6).

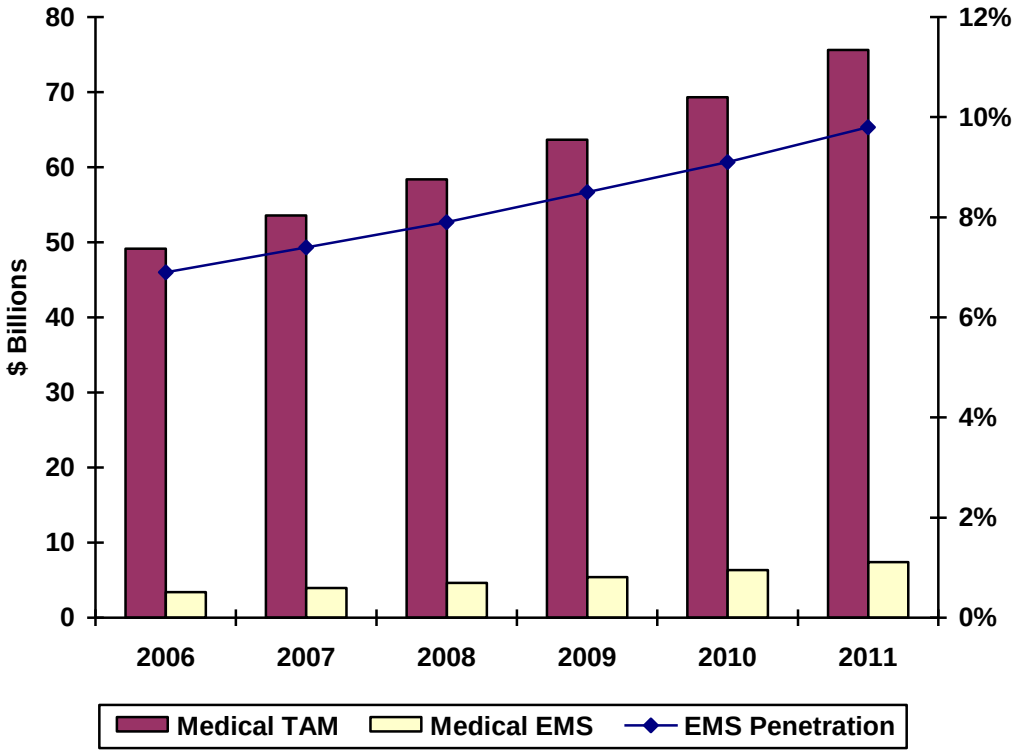


Source: MHM/Evertiq New Media

Figure 6 - Global Medical Electronics Equipment – 2006

* Dialysis equipment may have non-electrical content.
** Other includes blood glucose meters, image-guided surgery, dental, telemetry, enterprise wireless, and external defibrillation

Serving the total available market, the EMS services for medical equipment will grow at a 17% annual growth rate reaching a 2011 level of $7.4 billion (Figure 7). In 2006, we estimated the EMS industry captured 7% of the TAM for medical electronics. We forecast that the EMS sector would capture 10% of the TAM by 2011.



Source: Technology Forecasters

Figure 7 – Medical Electronics Market

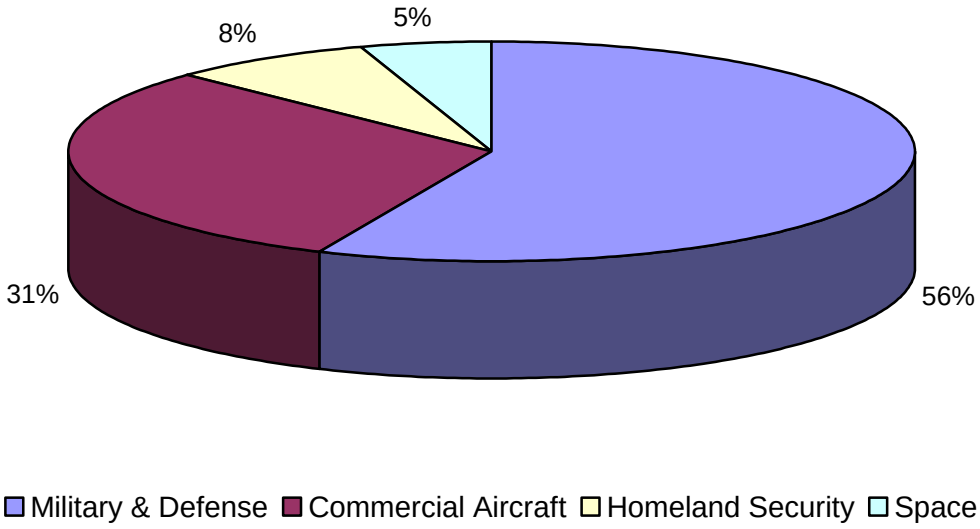
The growth in penetration will be driven by the strategic choices OEMs will make to focus on core competencies, reduce costs and investment, and boost time to market. Indeed, increasingly medical OEMs are already shifting from a vertically integrated manufacturing strategy, in which all manufacturing functions and controls are held by the OEM, to an outsourced manufacturing strategy. This shift parallels, though lags, the outsourcing trends seen in the computer systems and communications industries.

Although growing rapidly, it is difficult to see the medical electronics market going as far as the computer, communications, and consumer products segments in their commitment to outsourcing. The outsourcing focus will be somewhat inhibited by some requirements that are characteristics of the medical industry.

- High-mix, Lower-volume Products
- Quality Processes
- Regulatory Systems
- Reporting and Tracking Systems
- Medical Industry Experience
- Agency Clearance

The Aerospace/Defense/Homeland Security Market

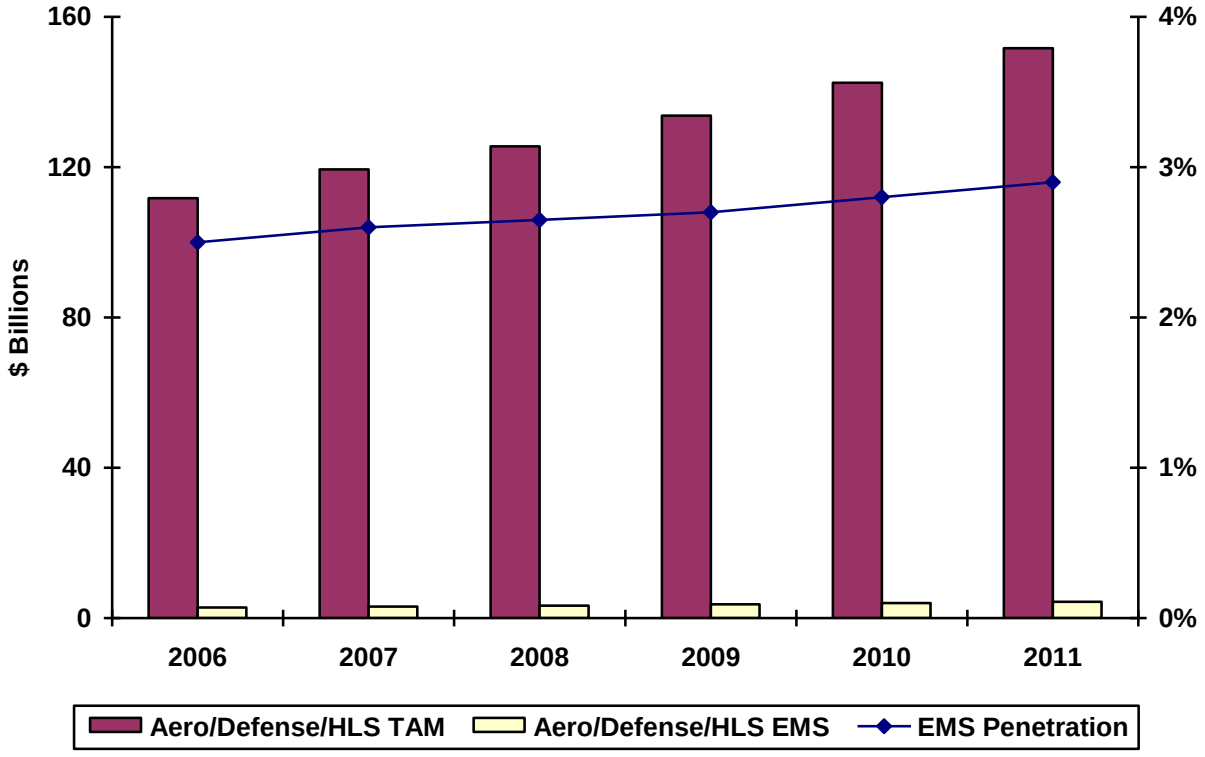
Supporting both commercial aviation and the redefined military and war on terror are the aerospace, military and defense, and homeland security industries. Today, these industries, heavily enhanced by electronics, provide a major impact to the global economy. Companies in these categories provide a range of products and services including computer systems, tanks, guided missiles, aircraft, navigation systems, arms, ammunition, security monitors and controls, and threat detection equipment. This market consists of four distinct segments—commercial aircraft, military weapons, space rockets and satellites, and homeland security.



Source: S&P/Technology Forecasters estimate

Figure 8 - 2006 Global Aerospace/Defense/HLS Industry Revenues

In 2006 the global aerospace and defense market was estimated to be $475 billion in total revenue. Another $40 billion was appropriated in the US for homeland security (Figure 8). Over one-fourth of this business is electronics. The aerospace/defense/homeland security industry is a major component of the US economy. Harris InfoSource reports over 4,000 US companies engaged in this industry. The Aerospace Industry Association (AIA) estimates that workers for the US aerospace/defense/homeland security market total 635 thousand.



Source: Technology Forecasters Inc.

Figure 9 – Aerospace/Defense/HLS Electronics Market

We project the aerospace, defense, and homeland security TAM will grow from its 2006 level of $112 billion to $152 billion by 2011, a 6.3% Compound Annual Growth Rate (CAGR). This TAM growth is lagging the overall defense budget growth, because we now see a greater emphasis being placed on supplies, ammunition, and other wartime outlays that are relatively less electronic intensive. Further we estimate the aerospace, defense and homeland security electronics portion of the total EMS market to grow from $2.8 billion to $4.4 billion over the next five years, a 9.3% annual growth (Figure 9). This growth will provide a significant opportunity for those EMS providers positioned to serve this unique sector.

The EMS industry has currently captured only about 2.5% of the production for aerospace/defense/homeland security electronics. We project the EMS capture rate of this business will increase slightly to 2.9% by 2011. This will be a two-phased growth. First the increase in aerospace/defense/homeland security production, coupled with the proliferation of new electronics technologies, will generate an increase in the market. Second, an increasing acceptance of outsourcing as a viable option will accelerate the outsourcing growth.

When EMS executives were questioned on the attractiveness of the aerospace/defense/homeland security market there was a very positive response. The opportunity for higher profit margins over traditional markets, and the opportunity to be involved in higher technology products were noted as attractive (Figure 10). Increasing military budgets and the probability that most production would remain domestic were other factors.

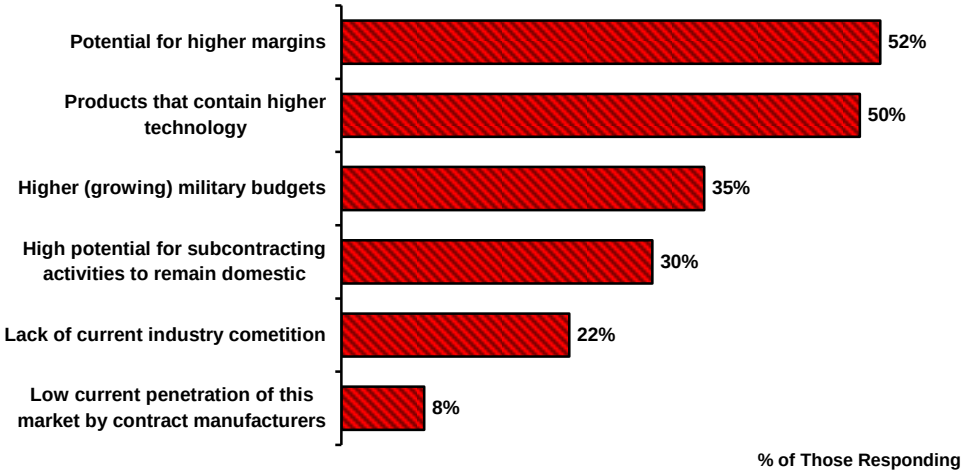


Figure 10
Attractiveness of Aerospace/ Defense/HLS Markets

Selection Criteria for Industry Suppliers

In studies on the industrial, medical, and aerospace/defense/homeland security markets, we questioned the OEMs on what significant factors are influential in choosing an EMS supplier. Table 3 displays these responses for the each industry in their descending order of importance. As we can see, quality provided by a supplier is the most important factors across all three segments. Also the technical capability of potential suppliers and the adherence to specifications and industry approved processes were significant factors. However, we do see some difference within these segments on evaluation criteria. In both the industrial and medical segments, cost are the second highest rated criteria, while within the aerospace/defense/homeland security companies, cost was fifth on the list. And surprisingly, on providing dependable delivery, medical OEMs rated this lower than the other segments. Previous experience within their specific industry was noted as significant in both the medical and the aerospace/defense/homeland security areas.

Table 3 - Factors Important in the OEM Outsourcing Decision for Selected Segments

Industrial	Medical	Aero/Defense/HLS
Quality	Quality	Quality
Cost	Cost	Dependable Delivery
Technical Capability	Technical Capability	Certified Processes
Dependable Delivery	Supply Chain Management	Technical Capability
Adherence to Specs	Industry Experience	Industry Experience
Flexibility	Product Transfer	Cost
Supply Chain Management	Dependable Delivery	Component Engineering
Cultural Compatibility	Customer References	Financial Stability
	Location	Supply Chain Management

Challenges for Suppliers

The OEMs in the survey group were also asked to identify the major challenges in outsourcing in these markets (Table 4). Cost control and the management of high-mix/low-volume production were seen as challenges in all three sectors. In the industrial arena quality and dependable delivery were noted as the main concerns based on experiences with the EMS providers. Interestingly, communications between buyer and supplier was also noted in this sector. For medical products, flexibility within the suppliers was the most noted problem. Also this segment was unique in including New Product Introductions (NPI) and after-life support as issues. And with aerospace/defense/homeland security the fluctuating and long program life cycles, low production volume, and cost management were noted as being the greatest challenges. Documentation control and transfer, plus security issues were cited. Quality as a concern for this segment was lower; presumably because of the high stands expected by the industry.

Table 4 - Challenges in OEMs Outsourcing

Industrial	Medical	Aero/Defense/HLS
Quality	Flexibility	Program Life Cycles
Dependable Delivery	Quality	High Mix/Low Volume
Communications	Cost Control	Cost Control
Cost Control	High Mix/Low Volume	Documentation Control
High Mix/Low Volume	Technical Capability	Security
Supply Chain Management	NPI	Quality
Change Control	After Life Support	Product Traceability

Study Conclusions

From these interviews with management of both OEMs and EMS providers in the industrial, medical, and aerospace/defense/HLS industry and our detailed analysis of the market size and use of contract services, the consulting team at Technology Forecasters reached the following conclusions.

- Global electronics COGS will grow at a 7% annual rate.
- EMS market will continue to grow at a 12% annual rate.
- EMS growth opportunities can be found in the high-mix/low-volume production contracts entailing complex technology, unpredictable schedules, numerous engineering changes, and containing significant Intellectual Property.

- The industrial, medical, and aerospace/defense/homeland security markets are typical of these product characteristics.
- While TAM growth rates for these segments are in the "average range" for the electronics industry, the current low rate of outsourcing provides business opportunities for EMS organizations.
- These segments are not as sensitive to consumer price pressure and often provide more opportunities for enhanced returns. Also they could be somewhat immune to the off shoring trend of manufacturing.
- Quality, cost, technical capability and dependable delivery are the major criteria for selecting an EMS supplier for OEMs serving the industrial, medical, and aerospace/defense/homeland security markets.

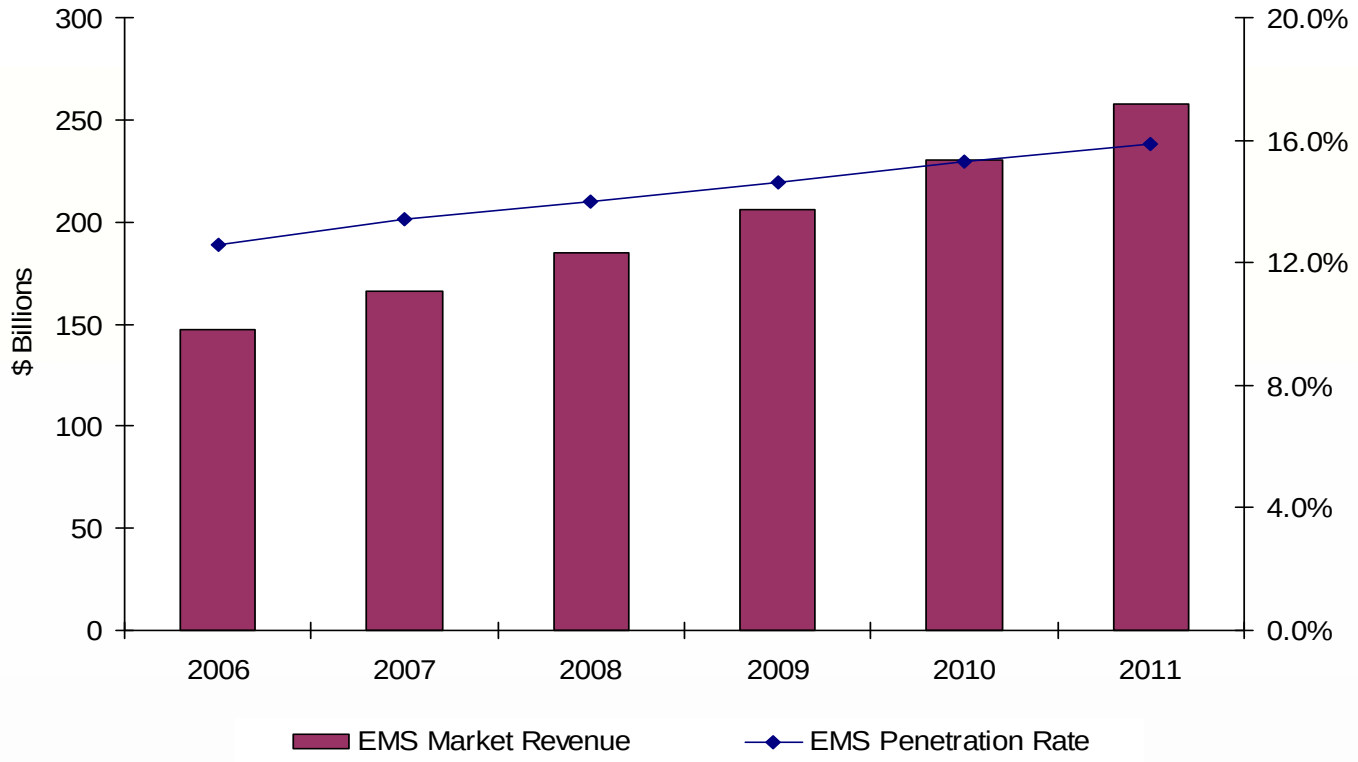
We welcome your comments on our analysis of the industrial, medical, and aerospace/defense/homeland security markets which will provide growth opportunities for the EMS industry over the next five years.

Rising Opportunities for EMS Organizations In the Medical, Industrial, and Aerospace/Defense/Homeland Security

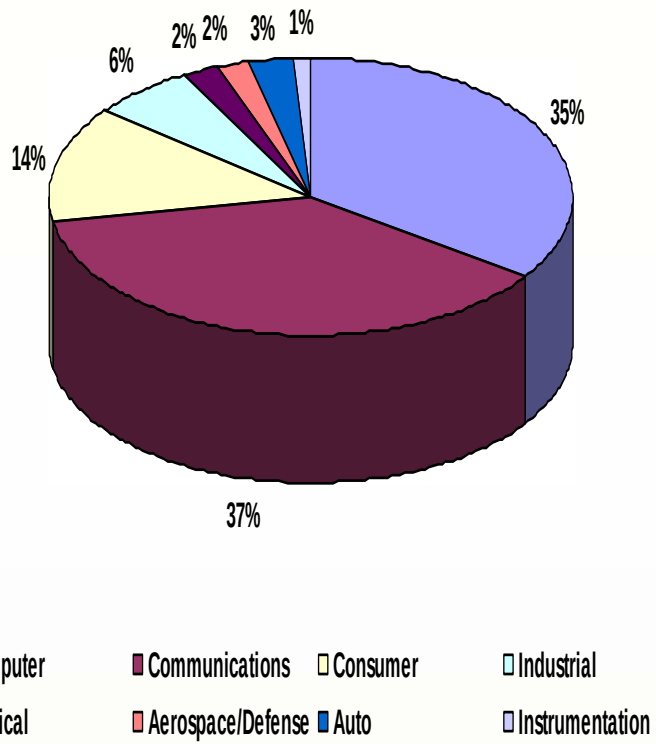
Charles W. Wade
Senior Consultant
Technology Forecasters, Inc.

April 1, 2008

EMS Market Forecast



EMS Market Segmentation & Growth



Segment	2006-2011 TAM CAGR	2006 EMS Penetration	2011 EMS Penetration
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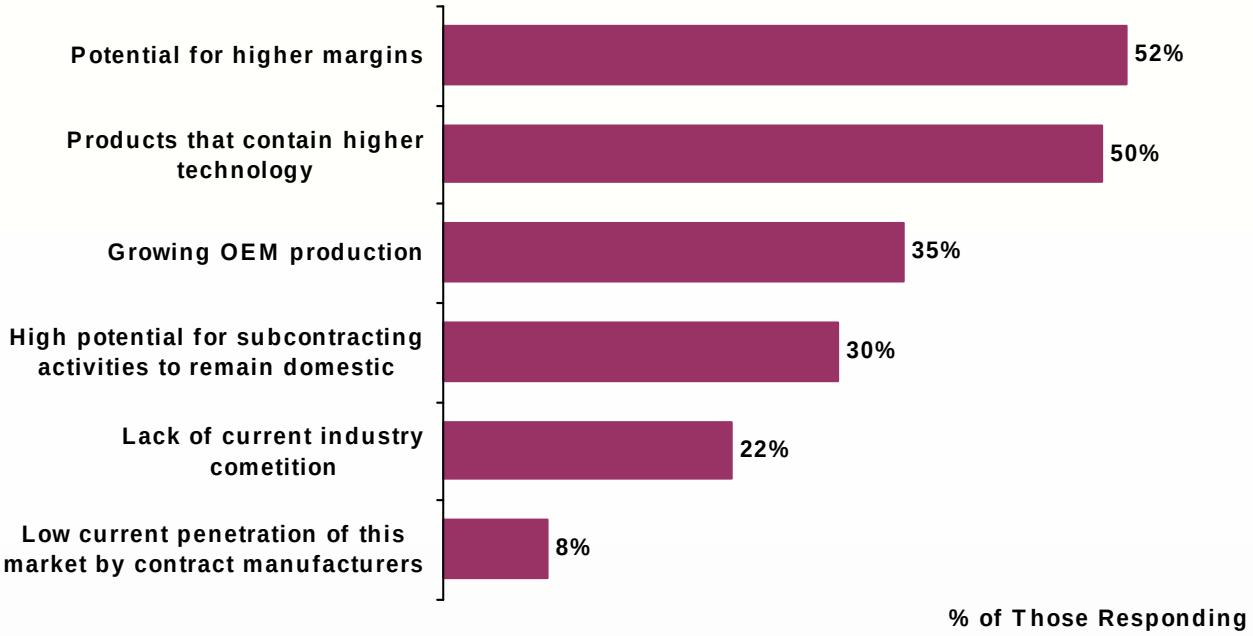
Total Electronics	**6.7%**	**12.6%**	**15.9%**

EMS
Advantages Target Market Segments



Example Outsourced Products

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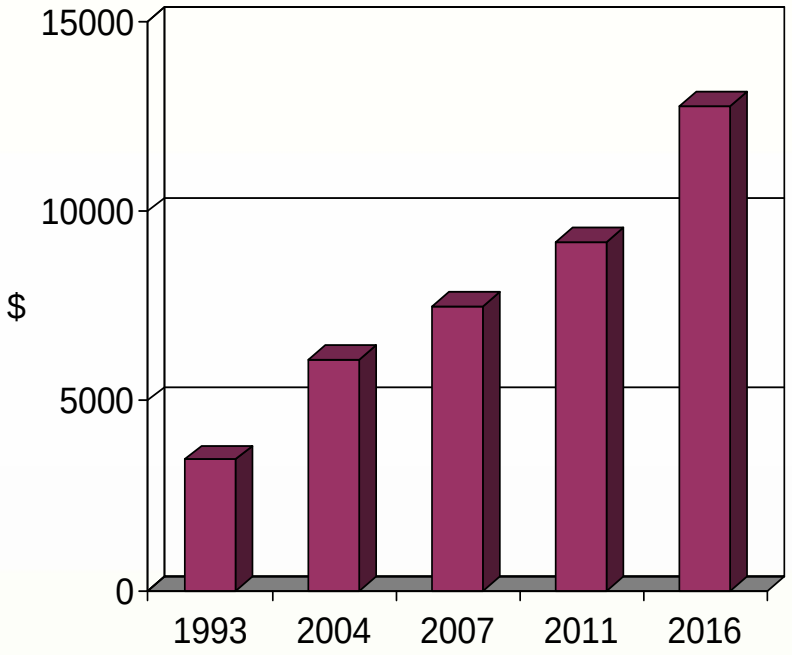
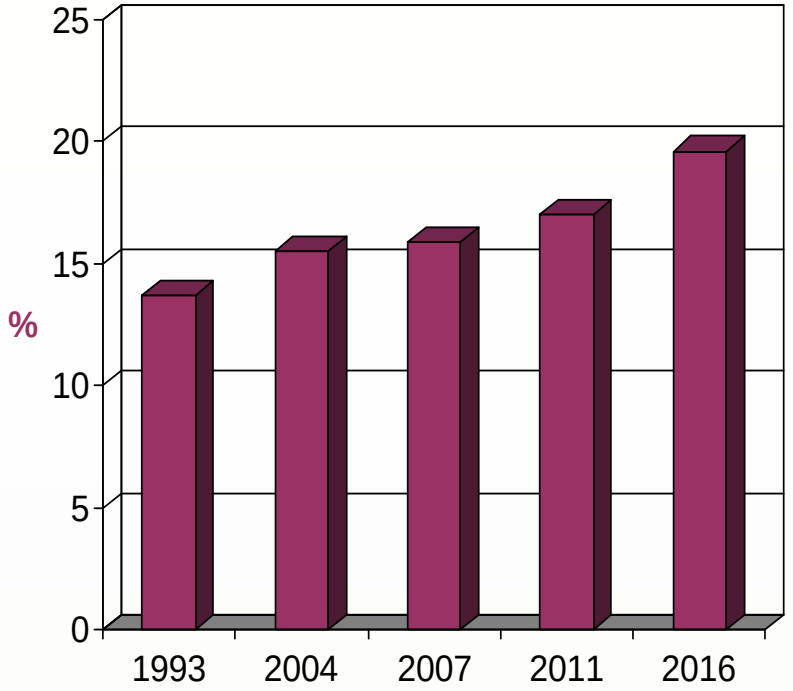
Vision systems	Implantable devices	Military computers
Industrial automation	Anesthesia equipment	

Domestic Healthcare Spending

US Healthcare Spending per Person

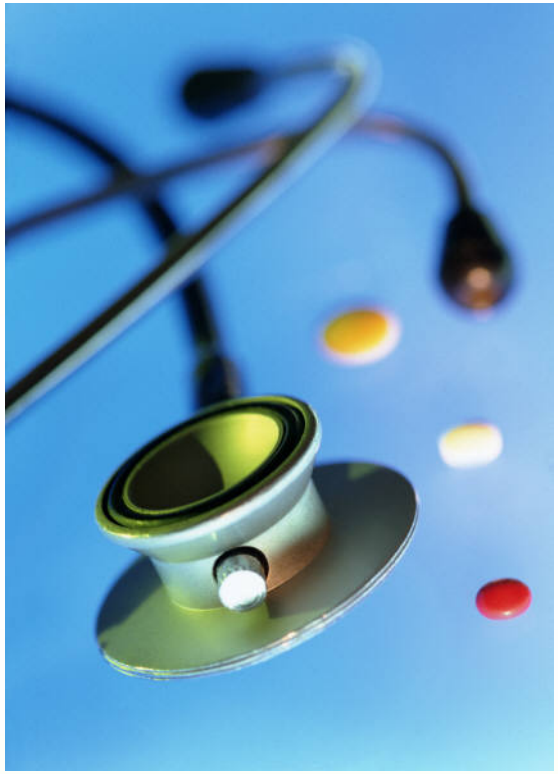


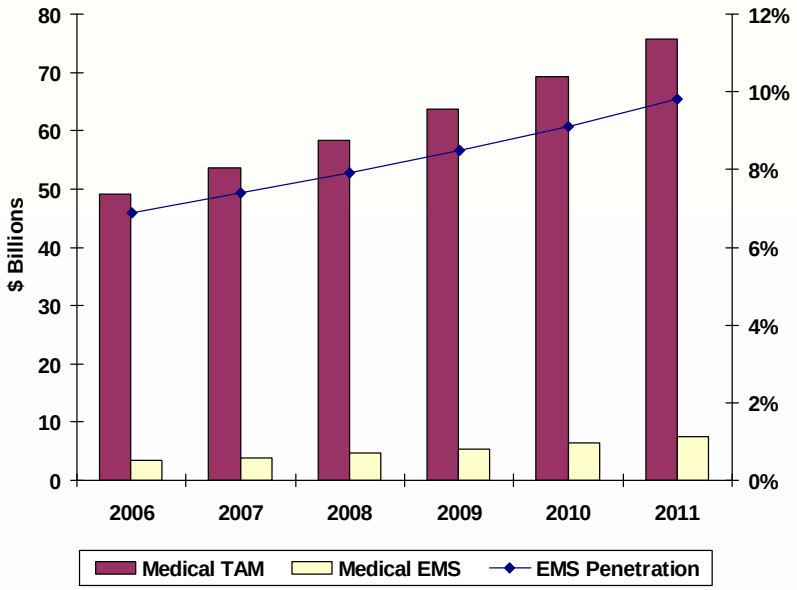
US Healthcare Spending as % GDP



Source: *Wall Street Journal*

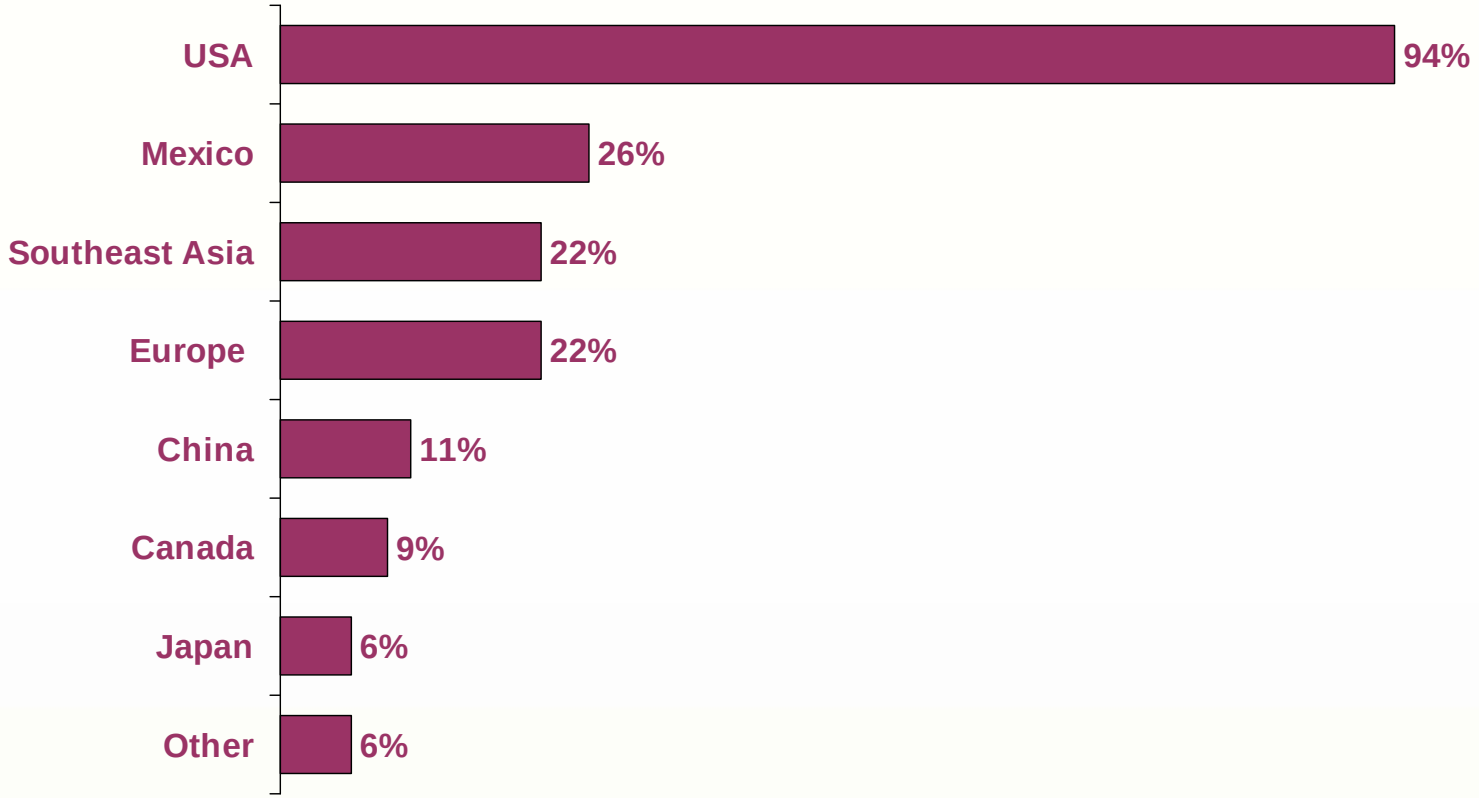
EMS Forecast
Medical





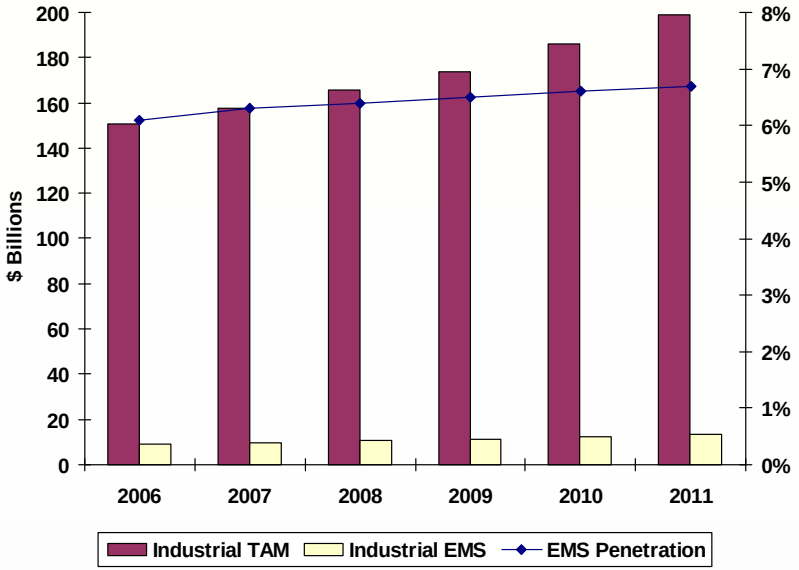
Current Outsourcing Locations of Industrial Electronics

Location of Contract Manufacturers

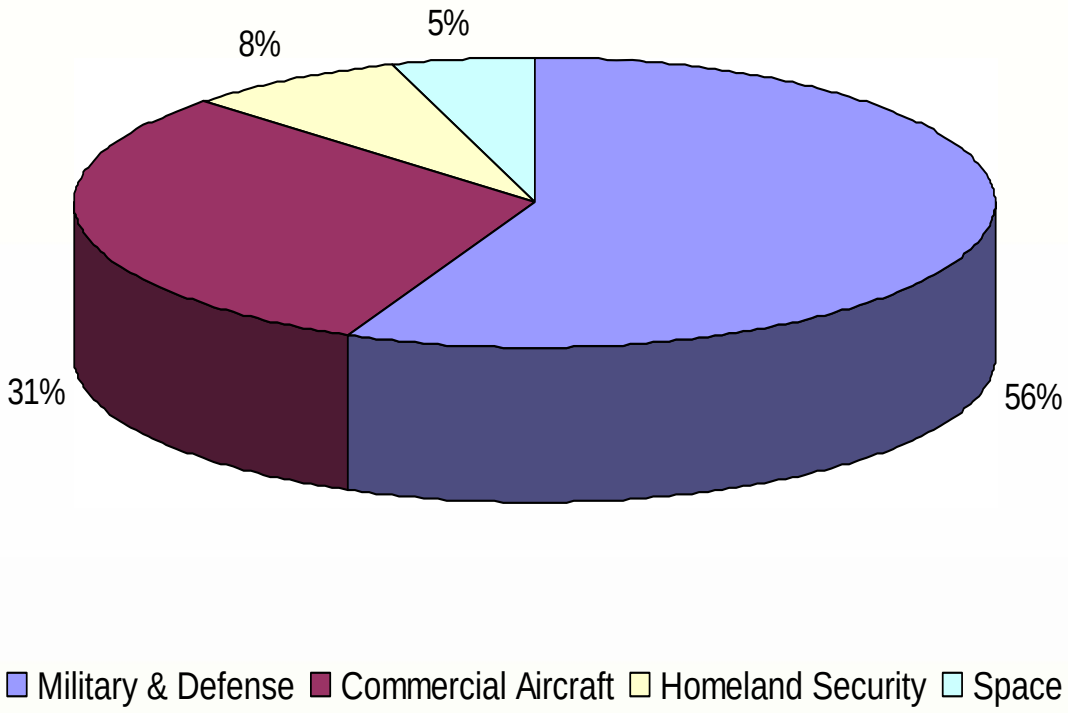


Source: Technology Forecasters

EMS Forecast
Industrial

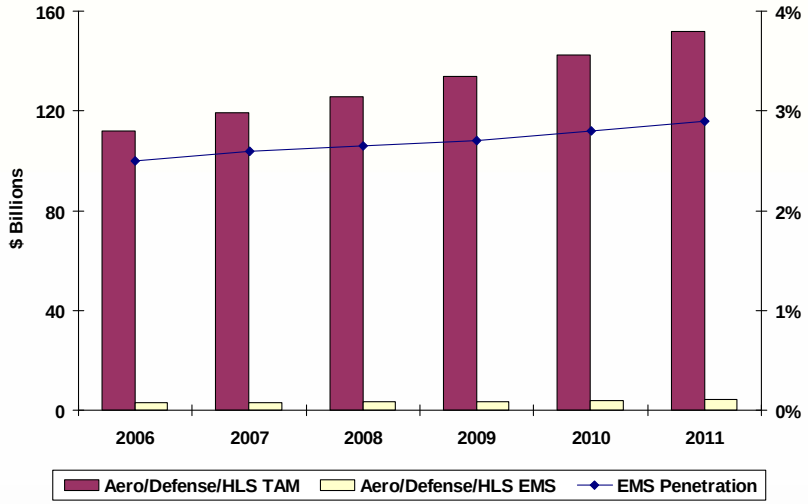


Global Aerospace/Defense/Homeland Security Industry Revenue



EMS Forecast

Aerospace/Defense/Homeland Security



OEM Evaluation Criteria

Industrial	Medical	Aero/Defense/HLS
Quality	Quality	Quality
Cost	Cost	Dependable Delivery
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Flexibility	Product Transfer	Cost
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Cultural Compatibility	Customer References	Financial Stability
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EMS Challenges in Serving Markets

Industrial	Medical	Aero/Defense/HLS
Quality	Flexibility	Program Life Cycles
Dependable Delivery	Quality	High Mix/Low Volume
Communications	Cost Control	Cost Control
Cost Control	High Mix/Low Volume	Documentation Control
High Mix/Low Volume	Technical Capability	Security
Supply Chain Management	NPI	Quality
Change Control	After Life Support	Product Traceability

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Information, Insight, Interaction for Effective Manufacturing Relationships

- A market analysis and strategy consultancy for
  - Outsourced electronics manufacturing
  - Profitable environmental implementation
- Founded in 1987; headquarters in Alameda, CA
- Numerous industry contacts who respect TFI as objective 3rd party
- Consultants with extensive experience with OEMs, EMS, ODM, and supply chain members

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Thank you!