



White Paper

The Market for Control System Integrators

Prepared for
The Control System Integrators Association

by

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Executive Summary

Since the 1970s, integration of process and machine controls into larger process control systems and enterprise wide business systems has been a growing industry segment in the instrumentation, systems and automation market. By the early 1980s, there was a recognizable group of companies specializing in doing integration of control systems. By the 1990s, control system integrators were a recognized market segment in the industry.

With the exception of many articles in industry trade journals such as *Control Engineering*, *InTech* and *Control Design*, and a study by Tom Bullock¹, there has been no industry wide attempt to clearly define what a professional Control System Integrator is, what standards and Best Practices they should meet, and how to work with and select a professional Control System Integrator. Beginning in 1997, CSIA, the Control System Integrators Association took the responsibility of defining Control System Integration for the Industry. Their books *Selecting a Control System Integrator* and *Working With a Control System Integrator*, and the Registered Member third party audit program are the only organized attempt to set standards and practices for Control System Integrators outside of individual vendor-sponsored programs.

CSIA has developed data that indicates that the market for Control System Integration is considerably larger than it had been thought heretofore. CSIA predicts worldwide gross revenues for professional Control System Integrator companies to be US\$12 billion per

¹ **Industrial Automation & Control System Integrators, Tom Bullock, from IGI Group, Boston, 2000**

year, based on a total of 2200 companies that meet the CSIA definitions and qualifications. The actual number of companies that do some system integration is quite large, almost certainly exceeding 4000. CSIA data indicates that the average member company was producing approximately US\$5.5 million/year in revenue by 2000, and had grown to approximately US\$6.5 million/year by 2001.

The market for control system integration is growing at a rate of 9% to 10% per year. Control Systems Integrators are experiencing rapid growth in Latin America and Asia, as well as in North America. Control system integration is one of the largest growth segments in the instrumentation, systems and automation market. Control System Integrators are increasingly shifting from machine control and plant floor process control to true Enterprise Integrators as it becomes increasingly important to tie the plant floor systems to the business systems of the enterprise.

The development of control system integration

In the 1970s, there were manufacturers of instrumentation and controls, and there were contractors, and there were A&E firms. The contractors were mechanical contractors or electrical contractors, and they bid projects designed by consulting engineers or corporate engineering departments, and they put them in under the close supervision of the engineering project managers. The A&E firms, like Bechtel, would take a project and act as both the engineer and the contractor, and sometimes even operate the project for a specified time. Generally, from the 1970's to the late 1980s and early 1990s, control was either local, or distributed, through one or more of the proprietary Distributed Control System architectures provided by the DCS manufacturers such as Foxboro, Fisher Controls, Fischer & Porter, and Bailey Controls.

Manufacturers' representatives and distributors of field instruments and final control elements had always been willing to do the odd integration project with a sensor, a controller, and a valve or other final control element. With the invention and popularization of Programmable Logic Controllers (PLCs) from time to time these reps and distributors would agree to furnish a PLC programmed to accept signals from specific sensors and control specific operations. As the capabilities of PLCs grew, some of these companies began to be asked to do this type of integration on a regular basis.

As personal computers grew in popularity and power, from the late 1980s onward, software-based Human-Machine-Interfaces (HMIs) were developed to permit supervisory control over sensors and control systems. Systems such as Wonderware, Intellution, OnSpec, CiTect and others were developed to interface with sensors, analog controllers, valves, positioners, and PLCs themselves.

In addition, the PLC, with telecommunications added, began to replace the previous generation of analog long-range data acquisition and telemetry systems. Soon, there was a new industry for digital SCADA (Supervisory Control And Data Acquisition) systems and integration. These systems soon began to replace the proprietary architectures of the

DCS and “Direct Digital Control Systems” of the 1960s and 1970s. The PC/HMI/PLC architecture was in fact the beginning of the open systems movement.

The important feature of the PC/HMI/PLC architecture is that the control system can thus be built from more-or-less Commercial Off The Shelf (COTS) components, instead of having to choose a control system vendor and purchase all or most of the controls and sensors as well as the control system itself from them. This was true whether in-plant control was being sought, or remote data acquisition (SCADA) was desired.

The increasing capability of microprocessors, PCs, and the growing need for non-proprietary “open systems” led to the development, first, of software “virtual instruments” from Labtech and National Instruments; then to the development of software systems that emulate PLCs and other controllers, such as SoftPLC, and even to complete, software-based DCS systems like PlantWeb. Control System Integrators have been a significant influence in the growth of the Open Systems movement in automation and control. There are some specific reasons why this is true. One is that CSIs have a great need to provide custom solutions to problems for their clients. The more “open” the architectures and software systems available to the CSI are, the easier and more economical it is to provide truly customized solutions. With the limits of proprietary code and architectures, it is considerably more difficult to provide an optimum solution to a client’s problems, and this reduces the value that a CSI can add to a project. It is anticipated that the Open Systems movement will continue to grow throughout the next decade.

The manufacturers’ representatives, distributors and electrical contractors who had been doing PLC-based integration projects were now able to compete directly with the major control system manufacturers such as Bailey, Honeywell, Fisher Controls, Fischer & Porter, and Foxboro. That they did so successfully is clear as evidenced by the fact that Bailey, Fischer & Porter, Foxboro, and Fisher Controls are no longer independent companies, and Honeywell is recovering from a failed merger attempt with General Electric.

By as early as the mid-1980s, there was a recognizable group of companies doing control system integration. This trend, and this group has been growing and expanding its capabilities ever since.

Defining control system integration

Many different companies do control system integration.

Some manufacturing companies do their own project integration. Others only do it on a small scale, preferring to contract out larger projects. Still others contract all their control system integration projects out.

Representatives and distributors still do occasional integration projects. This was originally done to provide a “package,” but is commonly done today as an attempt to compensate for the weakened position of reps and distributors in the supply chain.

Equipment manufacturers do turnkey control systems, and often build machines on skids complete with control system. These systems, however, tend to avoid customization, and are often “cookie cutter” systems that may or may not directly address the needs of most users. Most of these “skid” systems tend to require final stage integration into the process anyway, which is often difficult, complex, and costly.

None of these is a professional system integration company.

It is easy to define control system integration by what it is *not*. Neither rep, nor distributor, nor consulting engineer, nor contractor, a control system integrator combines features of all of these.

A control system integrator takes a problem that may have had some engineering input and that has general requirements and specifications and provides an integrated solution

for the problem, including final project engineering, documentation, procurement of hardware, any custom software development, installation of field instrumentation, wiring, controls, software, testing, and commissioning.

Control system integrators do not sell product *per se*. However, CSIs purchase for resale a very large amount of hardware (field sensors, controllers, actuators, PLCs, PCs, wiring, etc.) and software. Based on the data CSIA has collected, the ratio of “intellectual content” to hardware and installation labor “pass through” is roughly 60:40. This means that control system integrators purchase approximately US\$4.8 billion in sensors, controls, PLCs, computers, software, wiring components, cabinets, cable, and other automation products. They are viewed as a very large distribution channel by most automation equipment and software vendors. But what CSIs actually are is a very large customer base. Most CSIs have preferred vendors with whom they like to deal, but a CSI is not a captive to their vendors: if a customer wants Vendor X, then Vendor X it will be.

This is a key understanding of control system integration. The CSI uses only what meets the specific requirements to solve the specific problem. If Vendor X provides the optimum solution, Vendor X will be used. If on the next project Vendor Y is optimum, the CSI will use Vendor Y. This is a significant advantage to the end user customer of the system integrator over the single source provider who must fit the problem into the solutions that only that provider offers.

Very often, equipment and software suppliers do not understand this, and it makes for somewhat strained relationships between system integrators and suppliers.

CSIA defines a Control System Integrator²:

“A Control Systems Integrator (CSI) is an independent (or an independent profit/loss division) value-added engineering organization that focuses on

² CSIA Guide to Control System Specification and System Integrator Selection – Volume 1 REV(00)
October 9, 2000

industrial control systems, manufacturing execution systems and plant automation that requires application knowledge and technical expertise for sales, design, implementation, installation, commissioning and support.”

In addition, CSIA has established a minimum standard for membership. To qualify for membership as an integrator in CSIA, a company must derive at least 50% of its revenue from integration services, and that revenue must have exceeded US\$500K in each of the preceding three years.

How many CSIs exist?

At least one study³ has suggested that there are at least 4000 control system integrators worldwide.

It is estimated that there are approximately 1200 CSIs in North America (Canada, USA and Mexico) based on the definition of Control System Integrator used by CSIA. It is further estimated that another 500 – 600 smaller companies do some control system integration work in North America in any given year. In addition, there are the reps and distributors who do small machine control or motion control or process control system integration. There may be an additional several hundred of these “part time” integrators. CSIA has a membership of approximately 140 member companies, of which approximately 130 are in North America. This means that CSIA’s membership is close to 10% of the estimated total of North American control system integrators and close to 5% of the global total. CSIA’s growth rate is approximately 25% to 30% per year, and it is accelerating.

³ **Industrial Automation & Control System Integrators, Tom Bullock, from IGI Group, Boston, 2000**

Outside North America the picture is less clear. In the EC and Japan and Korea, many manufacturing companies have consistently operated as their own integrators, and the concept of an independent control system integrator is newer there. Great Britain has approximately 40 CSIs, while Australia and New Zealand account for another 50 - 60 CSIs.

The EC is estimated to have between 150 -- 200 control system integrators, depending on whether divisions of automation equipment manufacturers such as Siemens, which do integration, are counted. It is estimated that there are 30 – 40 control system integrators working in Eastern Europe as well. It is estimated that there are approximately 20 control system integrators working in the Middle East, and an additional 20 in Southern Africa.

Information for the People's Republic of China is not readily available regarding the number of firms engaged in control system integration internally. A simple Internet search reveals 10 companies that fit the profile of CSIA member companies. Logic indicates there are many more. In addition, in the People's Republic of China, the academic institutions do significant numbers of integration projects.

Japan, Taiwan, and other East Asian countries appear to have few independent control system integrators, since the major manufacturers of equipment and instrumentation, such as Toshiba and Yamatake, have always maintained integration divisions, as have equipment manufacturers such as Nishihara and Hitachi and Mitsubishi.

India appears to have approximately 150 companies that meet CSIA membership requirements, plus many smaller companies. A large software development industry seeking to support system integration efforts worldwide is rapidly developing in India as well. The difficulty in India and China is that the value of a project in US Dollars is so deflated compared to the value of a similar project in North America or the EC, that it is difficult to make detailed comparisons of companies and market size. So, while a

company may do the equivalent amount of *work* to meet the CSIA definition, the company's *revenue* may be less than the minimum.

In South America, it is estimated that there are approximately 100 companies that meet CSIA membership requirements, mostly concentrated in Brazil, Argentina, Venezuela, Chile, Bolivia and Peru.

CSIA's investigation, therefore, reveals that there are at least 2200 control system integrators worldwide that meet the criteria for CSIA membership. Using the number provided in the Bullock report, of 4000 professional integrators, gives an upper range, although other estimates exist that upward of 12,000 companies do some amount of control system integration.

Market size and growth for control system integration

Based on a study conducted from 1997 to 2000 and compiled from data submitted by CSIA members in the association's annual survey in 2001 by NEMA for CSIA, CSIA members ranged from US\$500K/year to over US\$30M/year in revenue, with an average annual revenue of US\$5.5M.

In addition CSIA also has data from an internal study of member data collected in a blind independent study of association members in 2001. This data, while not as complete as the NEMA survey, provides a clear indication that the revenue of CSIA members grew approximately 15% from 2000 to 2001. The average annual revenue of members surveyed in the 2001 blind study (after removing outliers) was US\$6.5 million. Because the 2001 data is not as complete as the NEMA study data, this paper is based primarily on the NEMA data. Spitzer and Boyes LLC also did independent research for this paper.

Approximately 60% of a CSIA member company's revenue is from integration services, with 40% being "pass through" sales of components, computers, package software, wiring, parts, and field instruments and control elements.

Over 40% of the CSIA membership lies above the average annual revenue of US\$5.5M.

CSIA estimates total revenue of its membership (140 members) to be on the order of US\$770M/year.

Expanding that revenue estimate worldwide, CSIA predicts worldwide gross revenues for control system integrator companies to be US\$12 billion/ year based on a total of 2200 companies that meet CSIA qualifications.

The automation market is said not to be growing. However, this appears to be incorrect if one looks deeply into the market niches. Major manufacturers have lost money, market share, and have had reduced sales. But other manufacturers, whether in process control or in factory automation, have reported significant growth and market gains. For example, while Invensys reports lower sales, Endress+Hauser reports double-digit growth in 2001. While Honeywell reports slow sales, Danaher appears to have good growth and is acquiring companies. Much of the apparent slowdown in the automation industry then, is company, and company management related. The market for Control System Integrators, however, clearly *is* growing. One very clear solution to the apparent discontinuity between the large company view of a shrinking market and the smaller company view of a growth market is the market for control system integrators, which has never before been quantified. Reports that the market for automation and controls is shrinking ignore the work being transferred to systems integrators and other non-traditional enterprises.

The market is split into three specific niches:

- Factory floor machine control
- Process control
- cMES/Supply Chain/CFR21 part 11

Factory floor machine control is growing at a rate that parallels the growth of the automation market, approximately 1-2% per year. Process control integration is growing faster than the market for process control instrumentation due to the continuing trend toward outsourcing by petrochemical, food, semiconductor and pharmaceuticals manufacturers, at approximately 5-6% per year. The largest growth in the control system integrator market, however, is in the cMES (Collaborative Manufacturing Execution Systems) niche. This niche was growing, from 1997 to 2000, at a rate greater than 20% per year, and has now slowed to about 5% growth in 2001. Early indications for 2002 are that this niche will continue to grow, and will once again increase its rate of growth. The emergence of the regulations in CFR21 part 11 (US Code of Federal Regulations) regarding documentation and validation of process have increased the drive to cMES for the pharmaceuticals and biochem industries to the point that it has been referred to as the “Y2K of process control.” It is anticipated that CFR21 part 11 will shortly be applied to the food and beverages and cosmetics industries with associated opportunities for market growth in control system integration.

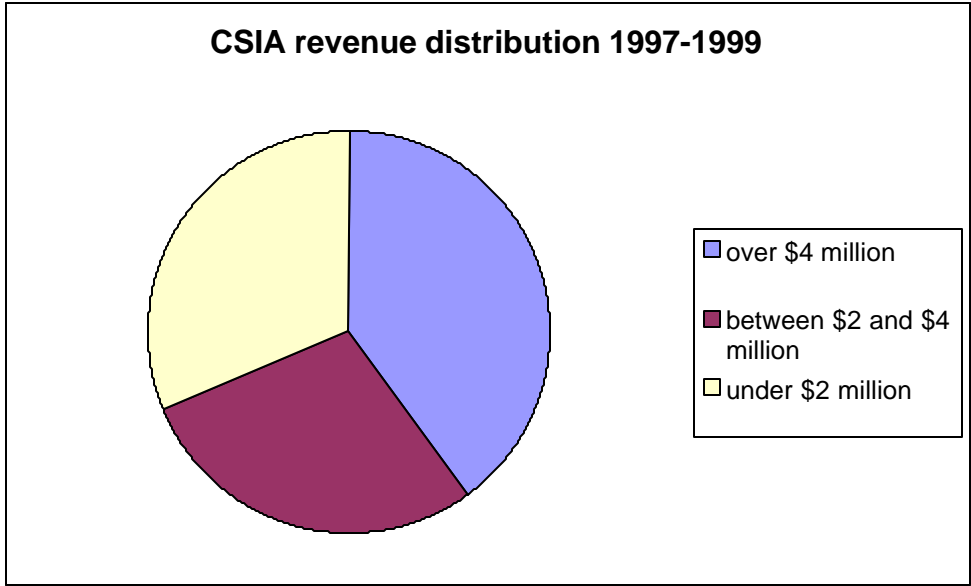
Assessing the market for control system integrators

Companies belonging to CSIA are typical of the full-time control system integrator company, worldwide. CSIA member companies are a representative sample of the total, roughly 10% of the total number of integrators in North America (using the CSIA definition) and roughly 5% of the total worldwide.

The NEMA study (2000) and CSIA’s internal study (2001) showed that CSIA members in North America ranged from US\$500K/year to over US\$30M/year in revenue, with average annual revenue of US\$5.5M in 1999/2000 up to US\$6.5M in 2001.

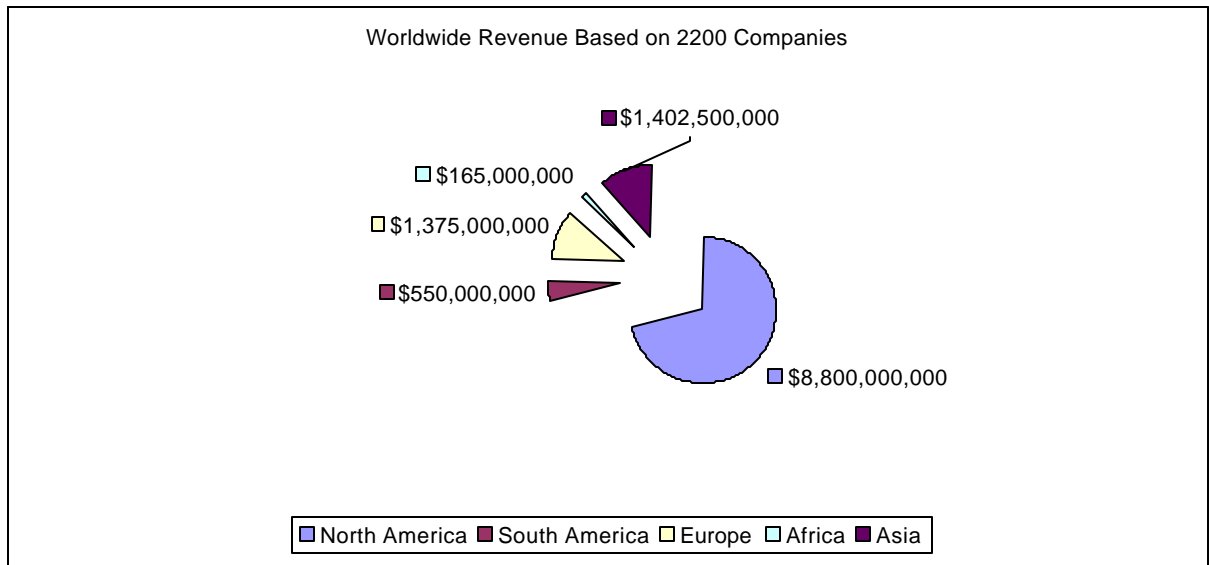
Approximately 60% of revenue was from integration services, with 40% being “pass thru” sales of components, computers, parts and sensors.

Over 40% of the CSIA membership lies above the average annual revenue estimate of US\$5.5M produced in 2000. It is estimated that the same proportion will be found to lie above the average annual revenue estimate of US\$6.5 M produced in 2001.



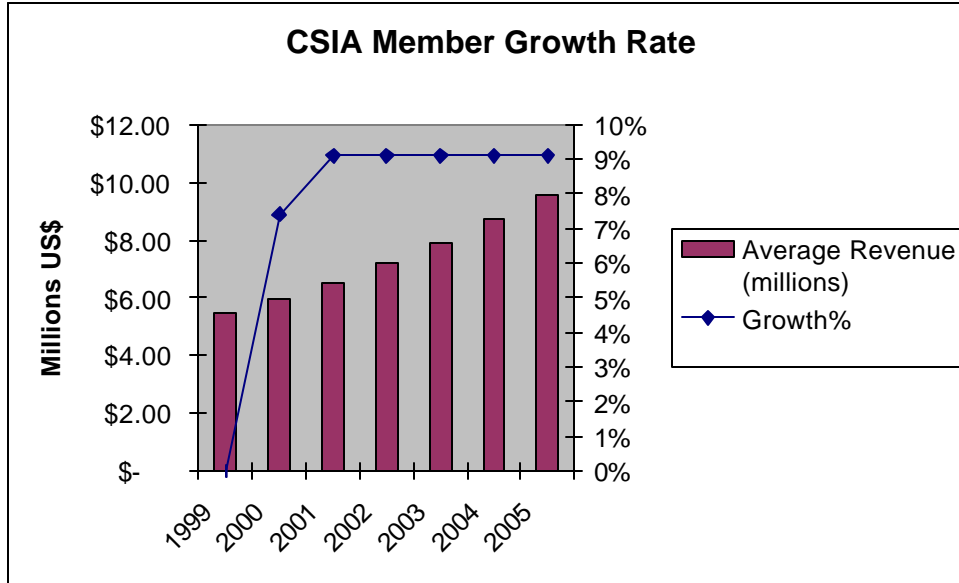
CSIA estimates total revenue of its membership (140 members) to be on the order of US\$770M/year, based on the 2000 data.

Expanding that 2000 revenue estimate worldwide, CSIA predicts worldwide gross



revenues for control system integrator companies to be US\$12 billion per year. This estimate is based on 2200 control system integrator companies worldwide. If the

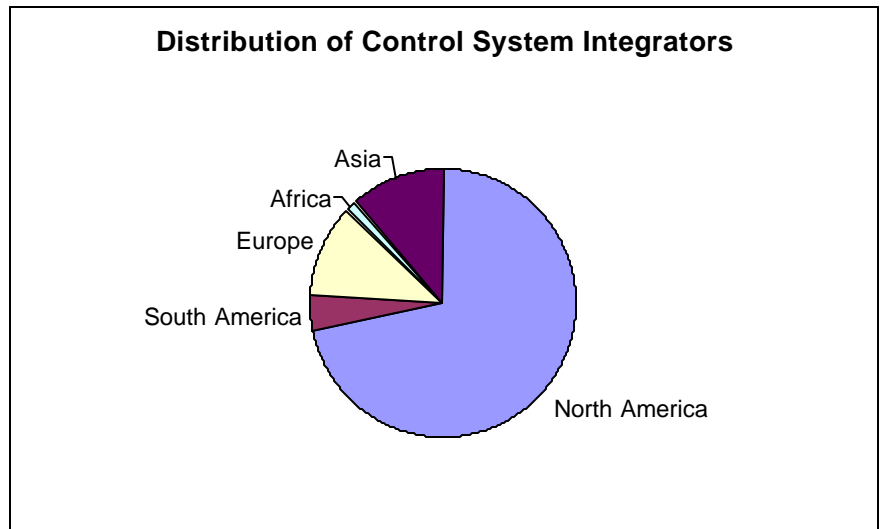
additional number of integrators assumed in the Bullock report⁴ is added in (smaller than the CSIA defined minimum) the worldwide gross revenues for CSI companies increases.



Since the disparity in numbers can be accounted for by the higher cutoff of the CSIA definition, it is likely that these additional integrators will only add

approximately 25% to the total. Thus, a reasonable upper limit for worldwide gross revenues for control system integrators would be US\$15 billion per year.

The 2001 study of CSIA members reveals that the average member is now producing approximately US\$6.5M/year in revenue, up from an average of US\$5.5 in the 1997-1999 timeframe. Projecting this growth, it is calculated that CSIA members



are growing at an average growth of between 8 and 10% per year. If this growth rate continues, by 2005, the average CSIA member will produce revenues of close to US\$9.5M/year. Projecting CSIA's own growth rate of approximately 25% per annum, CSIA members should, by 2005, be producing US\$3.25 billion/year in revenue.

⁴ ibid.

Noting the high percentage (40%) of this revenue stream that is “pass through,” the gross intellectual content for control system integrators worldwide would therefore be approximately US\$7.2 billion per year.

The North American Market

The North American market for control system integration is estimated to be approximately US\$8.8 billion per year. North America based integrators do a significant amount of global system integration. Within the North American market, there are groups of system integrators that specialize in one or more niches, including, among others:

- Automotive
- Central Utility Plant
- Building Automation
- Pulp and Paper
- Power
- Steel and foundry
- Food industry
- Pharmaceuticals and biochem
- Petrochemicals
- Machine control
- Water and Wastewater
- Amusement Parks and Theme Parks

Some of these CSIs limit themselves to machine control, or factory floor control, or process control. Some of them only do SCADA work. Some even limit themselves to only doing the control systems for theme park rides. Some only do MES and IT work such as Supply Chain Integration.

Others have diversified from the factory floor control systems of early days into the true enablers of enterprise integration. The top tier of CSIs offers a complete suite of control system integration products and services from the individual machine to the factory floor,

to the process control system, completely integrated to the enterprise business systems in a Collaborative Manufacturing Execution System. Many of these cMES/CSIs are now producing proprietary templates and XML (eXtensible Markup Language) Enterprise Application Interfaces (EAIs) to enable them to differentiate themselves from other system integrators and from the software and hardware vendors who are now creating and deploying integration subsidiaries of their own.

Europe, Mideast and African markets

Control system integrators in the Great Britain, the EC, Eastern Europe, the Middle East and Africa account for approximately 12% of the worldwide market, or approximately US\$1.54 billion per year. There are 40 CSIs in Great Britain, with 4 or 5 more in Eire.

The rest of the European Community has between 150 to 200 CSIs. The large equipment and automation companies like Siemens and ABB have dominated Europe. These companies, who maintain their own engineering/construction divisions, therefore have always provided in-house integration services.

In Eastern Europe, and the countries that were formerly part of the Soviet Union, there are approximately 40 CSIs that exceed the minimum requirements of the CSIA definition. There would be many more if the revenue requirement were lowered, since the hourly rate in Eastern Europe is much lower than it is in the EC or North America.

System integrators in Europe primarily service the Middle East, but there are indigenous integrators in Turkey, Israel and Egypt. It is estimated that there are 20 CSIs operating in the Middle East.

The outlook for system integration in the Middle East is primarily dependent on politics. The economies of Iraq, Iran, Israel, Syria, Jordan, Lebanon, and all of North Africa are depressed because of the ongoing political strife and its associated economic problems. While Iraq and Syria could have significant chemical processing and pharmaceuticals industries, their economies are retarded, and severely curtailed.

Africa, too, has a small number of Control System Integrators, probably about 20. These have been primarily concentrated in Zimbabwe and South Africa. The current severe economic dislocation in Zimbabwe, and the unrest and inflation in South Africa have caused slowdowns in economic activity and emigration of technical personnel.

The South American Market

South America is a growing market for automation and controls, and the market for Control System Integrators is growing as well. It is estimated that there are more than 100 CSIs that exceed the CSIA minimum definition in South America, concentrated in Brazil, Argentina, Venezuela, Chile, Bolivia and Peru. There are many additional companies doing control system integration that are too small to qualify according to the CSIA definition. South America is responsible for approximately 4%, or US\$550 million per year, of the worldwide market for control system integration. South America is expected to be one of the fastest growing segments of the CSI market in the next decade.

The Asian Market and the Pacific Rim

The Asian market for control system integration is large and heterogeneous. How integration is done varies widely throughout the Pacific Rim and across Asia. However, the Asian market corresponds to 11%, or US\$1.4 billion per year of the worldwide control system integrator market.

The market for Japan, Taiwan and Korea

Major automation suppliers such as Yokogawa and Yamatake with their own in-house integration and engineering subsidiaries dominate Japan, or by major Architectural Engineering firms like Chiyoda. It is likely that there are perhaps 20 firms in Japan that meet the CSIA minimum definition that operate as independent Control System Integrators. Korea, a much smaller market, on the other hand, has at least 10 CSIs not counting the offices of major control and automation suppliers and A&E firms

headquartered in North America, the EC and Japan. Taiwan also has a small number of CSI firms.

China

It is very difficult to quantify the Chinese market for system integration. There are several ways that project integration is done in China, including academic institutions that do automation projects, factories owned by the State or the Army, which provide integration services as part of their production program, and joint ventures between Chinese firms and North American, European, and Japanese companies. A cursory search of the Internet reveals a dozen CSI firms. It is likely that there are many more.

It is significantly difficult to match Chinese firms to the CSIA definition, because of the vast difference between billable rates in China and North America. Thus, there may be over 100 firms in China that are doing the same volume of work that, if billed at North American hourly rates, would be above the US\$500,000 per year minimum.

Singapore, Malaysia and East Asia

This part of the Pacific Rim is rebounding from the economic problems of the mid-1990s and the number of CSIs in the region is increasing. There are at least 15 CSIs in the region, and many more smaller firms that sometimes do some level of integration services. In addition, there are offices of all the major automation suppliers and their integrator subsidiaries, like Emerson Process Management.

The market for Australia and New Zealand

Australia and New Zealand have a lively market for control system integration. Much of the market is in SCADA systems in Australia, and in process control and water and wastewater in New Zealand. Although there are many more smaller firms, it is estimated that there are 60 CSIs in Australia and New Zealand.

The market for India

India, like China, is difficult to match to the CSIA definition because of the differential in the value of billable hours. It is estimated that there are over 150 CSIs in India, with

more in Pakistan. A large software development industry seeking to support system integration efforts worldwide is rapidly developing in India as well. There is a significant growth in the Indian market as infrastructure in Afghanistan is rebuilt following the US bombardment and the Afghan civil wars. Indian integrators are well placed to work in the “Stans” as they industrialize, as well. Projects are already being done in Kazakhstan and other former Soviet Republics, some by North America based integrators, some by EC based integrators, some by Russia-based integrators, and some by Indian companies. India is expected to provide significant upside for the world market for control system integration in the next decade.

Market trends in control system integration

There are some significant trends to watch in the market for control system integration. Some of them have been identified as general trends in the global automation market, and some are specific to system integration.

Consolidation

The major automation and controls vendors, and the major Architectural Engineering firms have been undergoing severe consolidation since the early 1990s. This trend has produced a steady stream of surplus engineers, programmers, and sales and marketing professionals. Partly, the emergence of the control system integrator can be traced to this stream of industry professionals.

Companies that formerly used the services of A&E firms, such as Foster Wheeler, or Jacobs Engineering, to supplement their own in-house engineering staffs no longer have those internal staffs. In the 1980s and before, DuPont maintained a central engineering department at Louviers in Delaware. This facility no longer exists. Many other companies in the chemical industry and in the pharmaceuticals industry have downsized their own plant engineering and central engineering staffs. This trend has also led to the growth of the Control System Integrator.

Competition from manufacturers and software vendors

The success of the CSI, and the growth of the market for control system integration to such a large worldwide value, have caused hard-pressed manufacturers and software vendors like Rockwell/Allen-Bradley and Invensys (Foxboro/Wonderware/Baan/AP V) and Emerson Process Management to establish their own integration divisions. In some cases, this means that CSIs are now competing directly with the companies that make the software and hardware the CSI has been using for years to integrate projects.

Providing proprietary value-add

One way that CSIs are combating encroachment by automation and controls vendors, and at the same time, differentiating themselves from other system integrators is by providing proprietary value-added features and services. For example, several high end CSIs that regularly operate in the cMES space are now providing proprietary templates and other proprietary tools and methodologies to their clients. These tools often include pre-scripted XML EAIs so that it becomes considerably more cost effective to link factory floor systems to the enterprise business systems.

Registration

Another way that CSIs are providing proprietary value-add is to become registered. Previously, there was no third-party standard for Control System Integration. Some manufacturers, such as Allen-Bradley, and software suppliers such as Wonderware, established ranking structures for integrators who use their hardware and software, but these rankings are proprietary and do not transfer to other vendors. So, for example, a Wonderware-approved integrator may be qualified to work with Intellution software, but not be approved by Intellution.

Generally, there was no way to tell the difference between a highly qualified control system integrator and one whose work, standards, and quality was considerably less valuable. In 1997, CSIA established its Best Practices and Benchmark standards

program in cooperation with its membership's leading Fortune 500 customers. These standards set up and measure a Control System Integrator's performance in six critical areas:

- General Management
- Human Resources
- Project Management
- Quality Management
- Financial Management
- Business Development

In 2001 CSIA established a registration program for CSIs that includes quality and methodology audits by third-party auditors based on the six criteria measured by CSIA's Best Practices and Benchmarks program. This program, in its first full year, has found considerable acceptance by vendors, such as National Instrument, and by user and client companies, especially in the pharmaceuticals and biochem industries.

Outsourcing of projects by manufacturers, especially MRO projects

Because of the downsizing of plant engineering and maintenance engineering personnel at industrial enterprises throughout North America and the EC, the role of control system integrators has increased dramatically. Now, where previously the plant engineering staff would lead a project to upgrade or do maintenance on a process vessel or process system, or a machine, industrial enterprises typically outsource these MRO (Maintenance, Repair and Operations) projects to a control system integrator, who acts as the plant engineering department or the maintenance engineering department. The integrator, not the plant personnel, does the final engineering, procures the relevant hardware and software, does the installation, does the testing, and, after an acceptance test, turns over the completed project to the plant, fully documented.

If there is involvement by an A&E firm to do the process design, it is becoming increasingly common for the A&E to work in parallel with the CSI to develop the control strategy and integration plan, rather than have the A&E perform that function and hand off a completed design to a contractor. Customers are driving this, because of the ability of the integrator to reduce the number of delays and design changes normal under the older system. The field of control is such a rapidly moving technology that it is being recognized that the control system integrator is a specialist who can perform that function more economically and efficiently than the former controls department of an A&E.

Continuing growth in cMES and enterprise integration

The growth of enterprise integration tools, and the increasing ease with which Enterprise Applications can be integrated through the use of XML schema and EAIs, indicates that integrating the factory floor to the enterprise systems will provide considerable growth for the control system integrator in the next decade. Previously too expensive to even consider for any company smaller than a Fortune 500 corporation, the proliferation of templates, scripts, and EAIs is making cMES available to smaller and smaller industrial enterprises, and creating a corresponding increase in the market for CSIs to do the cMES integration.

Supply chain consolidation

There are two effects of supply chain consolidation. One effect is that distributors and reps are doing more integration projects to bolster their own positions in the value chain, and provide differentiable value added services to their customers. The other is that the consolidation of the value chain from supplier to customer is driving the consolidation and integration of all of the manufacturing systems in the enterprise. The concept is to produce a fully transparent system, so that a customer can enter an order directly into the Manufacturing Execution System, and the system is so integrated that the product called for is procured, manufactured, tested and delivered as nearly automatically as possible. This is only just becoming possible without enormous expenditure and re-organization of business systems. Control system integrators are clearly able to deliver on this promise.

Increased marketing by automation manufacturers through system integrators

Not only are automation manufacturers attempting to compete with control system integrators by setting up their own integration divisions, but they have recognized the enormous amount of materiel and software that system integrators purchase as a new and valuable distribution channel, or more properly a *customer base*.

Control system integrators are responsible for reselling over US\$4.8 billion in automation products (hardware, software, computers, sensors, controllers, wire, wiring products, cabinets, I/O, etc.) per year in the course of providing their integration services.

Many automation manufacturers are attempting to capture this lucrative resale activity as a distribution channel, often with little success. The reason for this non-success is directly attributable to the “neither fish nor fowl” status of the control system integrator. The integrator is selling integration services. The \$US 4.8 billion in hardware is simply incidental to this primary objective. Integrators generally add between 15% and 20% to their cost on “pass through” hardware and software, which provides them a small profit over the transaction cost. This is far less than the profit from the actual intellectual property transfer that is the heart of the integration service itself. To a Control System Integrator, the hardware is a necessary evil, while to the traditional automation manufacturer like Foxboro and Emerson, it is the essence of their value add.

This difference between the goal of the automation system vendor and the control system integrator must be clearly understood by any company wishing to serve CSIs as a customer base.

Increasing importance of IT in the decision making process for system integration projects

There is a convergence between the process engineering function and the enterprise IT (Information Technology) function. Where previously, integration projects rarely left the

factory floor, they now often include cMES integration into the enterprise business systems. Thus, it is becoming more and more common for IT to be in at least partial charge of integration projects, rather than plant engineering. The Control System Integrator, with feet in both process and IT camps, is often used, not only as the vehicle to perform the integration, but also as the intermediary and translator between the engineering and IT functions within the enterprise. This trend is likely to continue in the next decade, as Control System Integration becomes more oriented to total Enterprise Integration.

The future of control system integration

Several trends are developing for the future of the control system integrator market that are worth watching:

- Outsourcing of projects by manufacturers, especially MRO projects
- Continuing growth in cMES and enterprise integration
- Supply chain consolidation
- Proprietary tools and value added by system integrators
- Increased marketing by automation manufacturers through system integrators
- Competition with system integrators by HMI and software/hardware manufacturers
- Increasing importance of IT in the decision making process for system integration projects
- Fieldbus technologies

- Open systems

Even though there have been companies performing control system integration for over thirty years, the profession is still in its infancy.

The establishment of Best Practices and Performance Standards, a third-party Registration program, and the acceptance of those standards by client companies and automation vendors alike will enable companies to select control system integrators based on commonly-understood and accepted metrics. This will differentiate the professional Control System Integrator from other companies, and ensure that there is a level playing field. Even large automation companies will be held to the Best Practices and Performance Standards of CSIA.

The market for control system integration is growing rapidly. In North America and the EC, it is growing in some niches, at more than 9% per year. Outside North America and the EC, the market is growing as fast as local development. In some cases in India, or other parts of Asia, this can be as high as 20% per year. Since many parts of Eastern Europe, Asia, South America and Africa remain to be industrialized on par with North America and the EC, the long-term growth potential of control system integration remains high.

Two other trends are extremely important to the future of control system integrators: fieldbus technologies and the movement toward open systems.

As noted previously, one of the technology issues that made control system integration practical was the ability to provide, using software HMI systems that ran on PCs, complete plant floor control systems from mostly OTS components. The movement toward all digital communications between the field instrumentation and the control system will work toward again making the integration process simpler and less costly. As fieldbus technology converges toward an industrialized version of the Ethernet

standard, using TCP/IP or its successors as a universal and transparent data transfer protocol, devices will become considerably closer to the type of “plug and play” commonly accepted (and expected) in the enterprise IT market. This will tend to drive down the cost of components, and will certainly drive down the cost of interconnection and wiring of components to the control system.

Finally, the movement toward open systems is the other side of the fieldbus interconnectivity issue. Completely open systems allow control systems integrators to maximize their value to the client by providing exactly the system called for by the project parameters, rather than having to try to cut and fit a particular proprietary system to the specific project. The future of control system integration will benefit from standardization of field instrument sizes, specifications, and communications as well as from open systems that will permit any desired configuration.

The future for control system integrators appears to be one of growth and diversification. Growth in the number of integrators outside North America and the EC argues for a robust market and increasing opportunity worldwide.