

### A Word From ISA

In the last issue of *CAPacity* we talked about the differences between certification, licensure, and the various other professional title-granting programs. This current issue, in many ways, is a continuation of that discussion.

Now that the CAP exam is available, we expect many of you are considering applying for testing. We also expect that you, and many of the automation professionals across the country, are asking yourselves a very important question: Am I ready to become a certified automation professional? This question is important not only because it has an impact on your career, but because it has significant implications for the automation field as a whole.

To help you answer the question of whether or not to certify we're going to use this and the next issue of *CAPacity* to look at how the automation professional is defined by ISA and the CAP program, and try to assess the impact of certification on an automation professional's career.

We'll begin by examining the CAP program's job analysis study, which details the results of a survey about the job tasks automation professionals perform. This issue will give you a glimpse inside the CAP job analysis study, and how the manufacturing sector defines and quantifies the job tasks an automation professional should be able to perform. The second article in this

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### What Do Automation Professionals Do?

**T**hat might sound like an odd question for us to ask, especially considering ISA's devotion to furthering the long-term education of automation professionals. However, asking such a basic question is the ideal place to start thinking about certification.

The Certified Automation Professional Program (CAP) recently passed a highly anticipated milestone with the release of the program's job analysis study. This study is significant for two reasons: 1) It's the first time that the industrial automation field has been distilled into its basic functions, and 2) the study validates the CAP exam and ensures that the CAP exam questions accurately test the knowledge and skills automation professionals need to be effective.

Jim Henderson, Executive Vice President, who oversees psychometrics at CASTLE™ Worldwide, managed the job study analysis for the CAP program. As he explains it, "Job tasks can be grouped together in very general areas of responsibility called domains. Then for each task there would be knowledge and skill lists associated with it." As we began developing the CAP program, we created a panel of experts to develop such a list of domains associated with the automation field. ISA took the resulting list and surveyed 217 professionals and manufacturers to determine each task's importance in today's manufacturing environment.

The list of six "domains of practice" that the CAP panelists identified are:

1. **Feasibility Study** - Identify, scope, and justify the automation project
2. **Definition** - Identify customer requirements and complete high-level analysis of the best way to meet those requirements
3. **System Design** - Prepare the complete conceptual design of the control and information systems including specifications of the hardware and software to be used in the system
4. **Development** - Software development and coding
5. **Deployment** - Field installation, and checkout and startup of the systems
6. **Operation and Maintenance** - Long-term support of the system

The survey that produced the results detailed in the job analysis study asked respondents to rank each of the six tasks in terms of its importance, "or the degree to which knowledge in the domain is essen-

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tial to the minimally competent practice of [industrial automation],” criticality, “or the degree to which adverse effects (of some type) could result if the certified automation professional is not knowledgeable in the domain,” and frequency, or, “the percent of time the certified automation professional spent performing the duties associated with each domain.”

When the respective rankings done by the expert panelists and the respondents were compared, the analysis revealed that both groups ranked System Design as the most important, critical, and frequently applied domain.

The Job Analysis Study has a direct influence on the upcoming CAP exams because, having validated that the exams will test job-relevant competencies, the study provided a blueprint for test developers mapping out how many of the exam’s 175 questions would cover each of the six domains.

According to the test blueprint laid out in the Job Analysis Study, System Design will account for 24.94% of the test, which is a plurality at 44 test items. Operation and Maintenance, which the survey respondents consistently ranked near, or at, the bottom of each scale, will only account for 10.95%, or 19 test items.

If you’re interested in reading the entire report, which includes a more detailed distillation of the statistics presented in this article, you can download the CAP Job Analysis Study at ISA’s Web site by going to [www.isa.org/capanalysis](http://www.isa.org/capanalysis). The report is free for ISA Members, and costs \$150 for non-members.

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issue will provide you with a checklist of the knowledge and skill sets that will help you determine whether or not you’re in a position to take one of CAP’s upcoming exams.

We believe more than ever that those who choose to become certified through CAP will be the professionals distinguishing themselves for years to come.

We hope you choose to join them.

—The CAPacity Newsletter Team

# Inside the Industrial Automation Knowledge and Skills Domains

When asked if he thought that the Job Analysis Study covered the range of competencies an Automation Professional must master, Dr. Jim Henderson of CASTLE Worldwide answered, “We were successful, I believe, in covering the major areas and responsibilities that automation professionals have.”

We’ve covered the six major disciplines that an Automation Professional must know, but to do well on the CAP exam and, by extension, to do well on the job, what are the specific tasks that comprise each domain?

What follows is a condensed list of each domain with their accompanying tasks. Use this as a self-evaluation guide, and a possible indicator for your level of preparation to take the upcoming CAP exam.

## Feasibility Study:

1. Define the scope through established work practices to meet the business need.
2. Determine the degree of automation required through cost/benefit analysis.
3. Develop a preliminary automation strategy that matches the degree of automation required.
4. Conduct technical studies for the preliminary automation strategy, i.e. gathering data and conducting analyses to define development needs and risks.
5. Perform a justification analysis by generating a feasibility cost estimate and using an accepted financial model to determine project viability.
6. Create a conceptual summary document by reporting preliminary decisions and assumptions in order to facilitate “go”/“no go” decision-making.

## Definition:

1. Determine operational strategies through discussion with key stakeholders. Create and communicate design requirements.
2. Analyze alternative technical solutions by conducting studies that define the final automation strategy.
3. Establish detailed requirements and data: network architecture, communication concepts, safety concepts, standards, vendor preferences, instrument/equipment data sheets, reporting/information needs, and security architecture. Use established practices to form the design’s basis.
4. Generate a project cost estimate.
5. Summarize project requirements with a basis-of-design document and a user-requirements document to launch the design phase.

## System Design:

1. Perform safety/hazard analyses, security analyses, and regulatory compliance assessments.
2. Establish standards, templates, and guidelines as applied to the automation system using information gathered in the definition to satisfy customer design criteria and preferences.
3. Create detailed equipment specifications and instrument data sheets to purchase equipment and support system design and development.

4. Define the data structure layout and data flow model to provide specifications for hardware selection and software development.
5. Select the physical communication media, network architecture, and protocols to complete system design and support system development.
6. Develop a functional description of the automation solution to guide development and programming.
7. Design the test plan to execute testing relative to functional requirements.
8. Perform the detailed design for the project to provide detailed information for development and deployment.
9. Prepare comprehensive construction work packages to release project for construction.

**Development:**

1. Develop Human Machine Interface (HMI) to meet functional requirements.
2. Develop database and reporting functions to meet functional requirements.
3. Develop control configuration or programming to meet functional requirements.
4. Implement data transfer methodology that maximizes throughput and ensures data integrity to assure efficiency and reliability.
5. Implement security methodology to mitigate loss and risk.
6. Review configuration and programming to establish compliance with functional requirements.
7. Test the automation system to determine compliance with functional requirements.
8. Assemble all required documentation and user manuals to transfer essential knowledge to customers and end users.

**Deployment:**

1. Perform receipt verification of all field devices to ensure that devices are as specified.
2. Perform physical inspection of installed equipment to ensure installation in accordance with design drawings and specifications.
3. Install configuration and programs to prepare for testing.
4. Solve unforeseen problems identified during installation.
5. Test configuration and programming to verify that the system operates as specified.
6. Test communication systems and field devices to ensure proper operation.
7. Test all safety elements and systems to ensure safety functions operate as designed.
8. Test all security features to ensure security functions operate as designed.
9. Provide initial training for facility personnel in system operation and maintenance to ensure proper use of the system.
10. Execute system-level tests to ensure the entire system functions as designed.
11. Troubleshoot problems identified during testing to correct system deficiencies.
12. Make necessary adjustments using applicable tools and techniques to demonstrate system performance and turn the automated system over to operations.

**Operation and Maintenance:**

1. Verify system performance and records periodically to ensure compliance with standards, regulations, and best practices.
2. Provide technical support for facility personnel to maximize system availability.
3. Perform training needs analyses periodically to establish objectives for the training program.

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## What Could Certification Mean To You?

Since the CAP program is the first certification specifically for automation professionals, no one knows for sure how it will affect the careers of those certified. However, we can create a reasonable scenario of how CAP might impact the future automation job market by looking at how other IT and manufacturing-related certification programs have changed their respective industries.

The first of two articles in our next issue will attempt to answer the question, "How will certification affect your career?" The second article will feature a brief profile of the automation workers who responded to the job analysis survey. As with any certification program, CAP has a set of minimum education and/or work experience requirements. However, beyond these prerequisites, what other characteristics encompass the variety of automation professionals on the market? Do these characteristics have an impact on the decision to certify?

We hope that as you read *CAPacity*, all of your questions about the CAP certification program are answered. If you need more information about CAP, e-mail ISA at [CAP@isa.org](mailto:CAP@isa.org).

## CAP Knowledge and Skills

The development of a valid examination for the CAP certification process began with a clear and concise definition of the knowledge, skills, and abilities needed for competent job performance. Using interviews, surveys, observation, and group discussions, ISA worked with automation professionals to delineate critical job components. The knowledge and skill bases for the questions on the examination were derived from the actual practice of the automation professionals as outlined in the 2004 CAP Role Delineation Study. The knowledge, skills, and abilities determined fall into six performance domains and account for the examination's content.

- Domain I: Feasibility Study**
- Domain II: Definition**
- Domain III: System Design**
- Domain IV: Development**
- Domain V: Deployment**
- Domain VI: Operation and Maintenance**

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### CAP Testing Dates and Application Deadlines

The CAP exam will be held at several US locations on the following dates. Applications must be postmarked by the listed deadline date. For more information on the exams, including locations, visit [www.isa.org/CAP](http://www.isa.org/CAP) or call (919) 572-6880. Remember, if you have four or more people testing, we can set up a private site for your group.

Test Dates	Application Deadlines
11 December 2004	29 October 2004
19 March 2005	4 February 2005
16 July 2005	3 June 2005
8 October 2005	26 August 2005
10 December 2005	28 October 2005

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4. Provide training for facility personnel to ensure the skill level of personnel is adequate for the technology and products used in the system.
5. Monitor performance using software and hardware diagnostic tools to support early detection of potential problems.
6. Perform periodic inspections and tests to verify system or component performance against requirements.
7. Perform continuous improvement to increase capacity, reliability, and/or efficiency.
8. Document lessons learned to improve future projects.
9. Maintain licenses, updates, and service contracts for software and equipment to meet expectations for capability and availability.
10. Determine the need for spare parts to maximize system availability and minimize cost.
11. Provide a system management plan to avoid and recover from system failures.
12. Follow a process for authorization and implementation of changes to safeguard system and documentation integrity.

Please note that this is an abridged list. You can download and read the entire CAP skills and knowledge breakdown, for free, by visiting the CAP section of ISA's Web site: [www.isa.org/CAP](http://www.isa.org/CAP).