Financial benefits of combining automation and safety projects

Collaborating on seemingly disparate projects could help companies save money by having the different departments focus on areas where their interests and agendas overlap.

Almost every mid- to large-sized manufacturer has dedicated engineering and environment, health, and safety (EH&S) departments. Because the purpose, goals, and objectives of these departments have traditionally had very little overlap, it's not too uncommon to find these departments working with no knowledge of what the other is doing. Engineers constantly work with operations to find new ways to improve productivity and efficiency. Safety professionals are assessing, reducing, and managing risks while juggling regulatory requirements. So it's not a big surprise that these two departments rarely cross paths throughout a given year. As more advanced technologies continue to hit the marketplace, especially technologies designed to provide a safer and more productive work environment, the importance of cross functional collaboration between these departments becomes critical for survival.

Many companies don't realize how much money the company could be saving by collaborating, even on seemingly disparate projects. One of the biggest areas of financial impact for collaboration between EH&S and engineering can be on everyday projects that involve machinery and equipment. Chances are projects involving machinery and processes consume a majority of the company's capital budgets. Not collaborating could be costing the company money when it isn't necessary.

Until recently, the primary method to reducing risk was to add physical guards to equipment to prevent employee access to hazardous conditions. Over the years, the industry has slowly progressed into developing risk reduction measures, which has allowed easier access to equipment by replacing the physical guards with intelligent safeguarding devices. These devices were typically connected to a single-purpose, safety-rated logic device that is independent of the machine's control system to create a dedicated safety system. At the time these safety devices and systems were being installed, it really was the only cost-effective option available. However, with safety measures being integrated into standard automation devices, there are financial incentives for EH&S and engineering to collaborate on corporate strategies and future capital projects.

Collaboration case study

To determine the true savings of collaboration, a

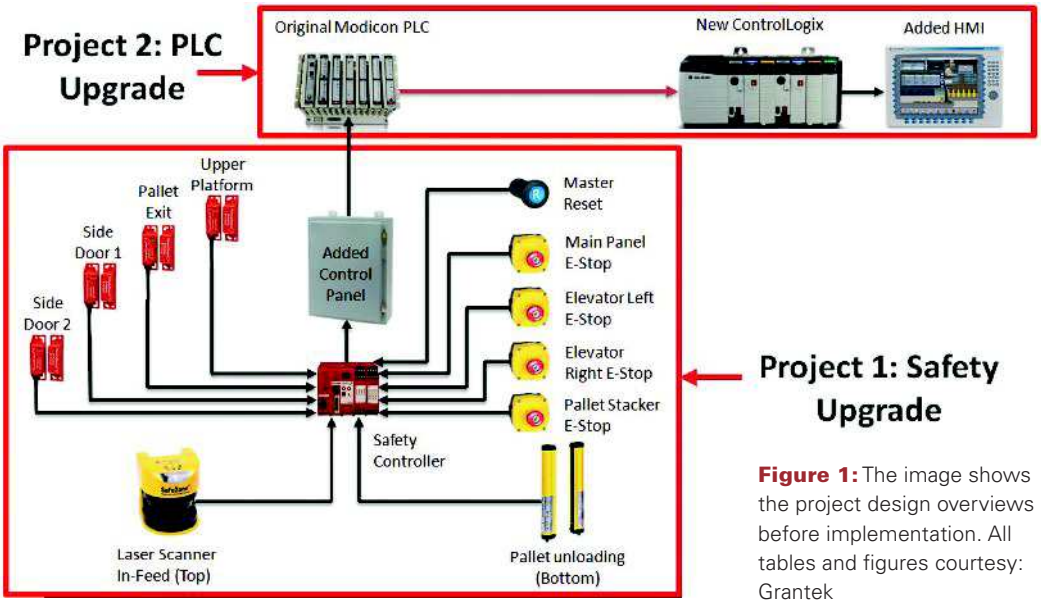

Figure 1: The image shows the project design overviews before implementation. All tables and figures courtesy: Grantek

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KEY CONCEPTS

Upgrading controls systems can save companies more money over the long term.

Operations should work with the engineering department for better collaboration and long-term, cost-saving initiatives.

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case study was conducted by reviewing two different project proposals at a large food and beverage company. The project proposal requests occurred within a six-month span of each other and happened to be on the same pair of 15-year-old depalletizers. The purpose of the project was to upgrade the safeguarding and safety systems on both depalletizers. The driving factor for this project was the occurrence of a recent serious injury and the awareness that the current safeguarding measures were insufficient. Since the scope of this project was only upgrading the safety-related aspects of the machine, a secondary control panel was needed to add the additional safety control components (see Figure 1). The scope of the second project was to upgrade the original (and now obsolete) control system and the operator station with a new programmable logic controller (PLC) and modern human-machine interface (HMI).

Table 1 shows the cost breakdown of each respective project as it was originally proposed.

Cost analysis 1: Combining projects

The first cost analysis exercise was to explore the potential savings of combining these two independent projects into one project. In developing a new proposal to reflect the anticipated savings, it was assumed that the scope and engineering solution of each project would remain exactly the same. By keeping the solutions the same, it was easy to determine the added costs associated with keeping these projects separate. Table 2 shows that roughly combining these projects to take place at the same time would save $45,000.

Many factors were determined in coming up with the calculations for the combined project in Table 2, but a few of the noteworthy discoveries were:

Project management savings (30%) were achieved through a reduction in mobilization time (project understanding, kick-off meetings, information gathering, etc.) and management time (scheduling, financial monitoring, etc.).

System integration savings (40%) were achieved through a reduction in duplicate software programming efforts that were mainly comprised of eliminating unnecessary code modifications on the safety project to communicate with the original PLC.

Electrical design savings (35%) were achieved through a reduction in schematic modification and development time. The safety project required modification of 12/15 existing drawings with the addition of 14 new drawings. The PLC project would have required modification of 15/15 drawings with the addition of only four new drawings instead of 14.

Table 1: Separate projects, both depalletizers

	Safety upgrade	PLC upgrade with HMI	
Project management	**$7,130**	**$5,060**	
System integration (software)	$13,040	$18,400	
Electrical design	**$30,520**	**$20,240**	
Mechanical design	$4,800	$0	
Electrical hardware	**$46,064**	**$30,954**	
Mechanical hardware	$40,000	$0	
Installation (electrical, mechanical)	**$40,000**	**$9,000**	
Commissioning, startup support	$23,080	$15,640	
Total	**$204,634**	**$99,294**	**SUM $303,928**

Table 1: This table displays the cost breakdown for independent projects.

Table 2: Costs of combined projects, savings

	Combined project cost	Savings
Project management	$8,533	30%
System integration (software)	$18,864	40%
Electrical design	$32,994	35%
Mechanical design	$4,800	0
Electrical hardware	$77,018	0
Mechanical hardware	$40,000	0
Installation (electrical, mechanical)	$46,550	5%
Commissioning, startup support	$29,040	25%
Totals	**$257,799**	**15.2%**

Table 2: This table shows the cost of projects if done together, with 15.2%, $46,129, savings compared to the sum of the columns in Table 1.

Table 3: Re-engineering combined projects adds more savings

	Re-engineered totals
Project management	**$8,533**
System integration (software)	$18,864
Electrical design	**$32,194 (2% less, $800 more savings)**
Mechanical design	$4,800
Electrical hardware	**$76,018 (1% less, or $1,000 more savings)**
Mechanical hardware	$40,000
Installation (electrical, mechanical)	**$36,550 (21% less or $10,000 more savings**
Commissioning, startup support	$29,440
Total project cost, re-engineered	**$245,999 (19.1% total savings, $57,929)**

Table 3: Re-engineering combined projects creates extra savings of $11,800, in three (bold) of eight areas, for $57,929 total savings, or 19.1%, less than Table 1.

Table 4: Project change orders add costs

	Number of change orders performed (out of 84 machines)	Average cost per change order with non-integrated solution	Average anticipated cost per change order with an integrated solution	Overall project savings with an integrated solution
Functional modification requiring design change of safety system	**51**	**$8,500**	**$5,000**	**$178,500**

Table 4: Project change orders can add significantly to overall project costs.

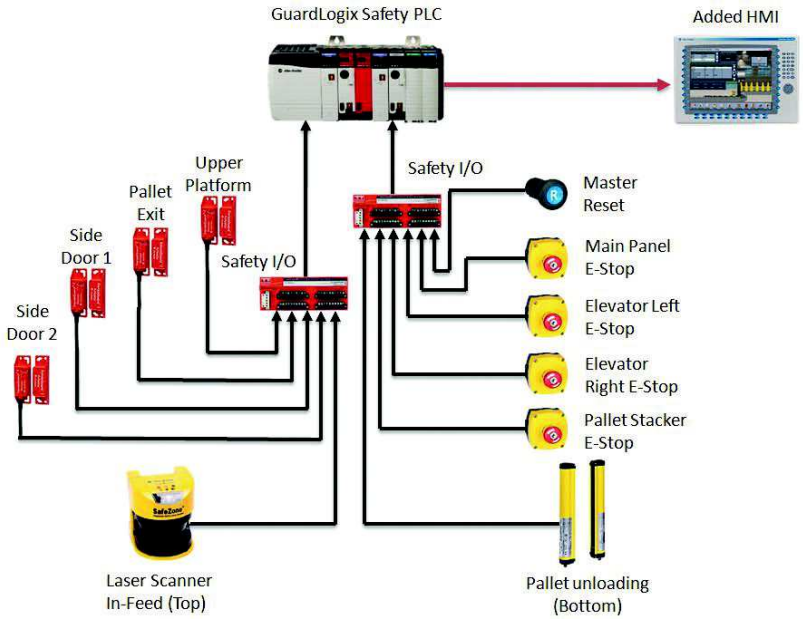

Figure 2: This image shows the schematic for the re-engineered safety and PLC solution.

Commissioning and start-up savings (25%) were achieved through reduction in duplicated site acceptance testing, I/O checks, system debugging, and travel/expense time.

Cost analysis 2: Re-engineering projects

When any engineering-related projects are combined into one single project, there are potentially additional cost savings options available through alternative solutions. Engineers are no longer restricted to focusing on independent solutions which serve a "single purpose." Instead, they are able to re-engineer solutions to be streamlined and simplified. For example, if the machine's PLC is being replaced as part of the upgrade, there would be no need to add a secondary control panel to support a dedicated safety control system. Why not just use a safety PLC to simplify the engineering and design efforts? Expanding on the first cost-analysis exercise, an additional proposal was developed to reflect a "re-engineered" solution (see Figure 2) to accommodate a simplified solution.

The single, biggest advantage of using an integrated safety solution from a project perspective would be installation time. The new solution avoids having a dedicated safety controller in a separate panel, which provides a simpler, cleaner installation. A safety PLC is more expensive than a standard PLC and separate safety controller, but the overall solution costs less to implement. Overall hardware costs, electrical design costs, system integration and wiring costs, and on-site labor costs are less.

Operational benefits

There are myriad day-to-day and long-term operational benefits from using an integrated safety solution such as downtime reduction and reduced exposure to hazards. Most of these benefits are well advertised by all the hardware manufacturers. What is often not addressed as part of an integrated safety solution is the cost associated with making modifications (either change orders to the existing project requirements or future changes) to the system. On a small project like the one mentioned earlier, the changes may not be as noticeable.

However, when a company is tackling a larger-scale safety or control project, these costs can add up. Table 3 shows the anticipated cost savings on a larger project associated with change order requests when utilizing an integrated safety solution. The project for this evaluation consisted of 84 packaging machines with a total of 51 change orders throughout the entire project (ranging from simple programming tweaks to in-depth functional changes). As high as this number of change orders may sound, it's on par with typical large-scale, multi-plant projects. With an integrated safety solution, a majority of these requested changes are now capable of being accomplished through programming, as opposed to physical changes, to the hardware. On average this reduces costs by about $3,500 per change order (averaged out over the 84 machines).

Financial benefits

In any given year Grantek performs around 300 to 500 controls systems upgrades and around 50 to 75 safety upgrades. Only around 5% of these projects address both upgrades at the same time. This shows that most companies are not considering the cost benefits of considering both projects. There are instances, however, when there is no advantage to combining these projects. For example, there are safety upgrades that are mechanical in nature and require little to no safety controls.

On the flip side, the savings can grow even further when technologies are combined as part of the solution. For example, servos and variable frequency drives (VFDs) now have built-in safety capabilities, and in this case, it may be worth considering evaluating the upgrade of motion components when addressing either controls- or safety-related projects.

The lines between automation and safety are becoming more blurred, especially in recent years. Don't fall in the trap of missing opportunities to save money by continuing to keep these two technologies and disciplines separated. **ce**

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