LOGISTICS & INFRASTRUCTURE: PROGRAM MANAGEMENT IN THE PANAMA CANAL EXPANSION

by

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Abstract - In 2006, the citizens of Panama voted to approve a national referendum for the **Panama Canal Expansion Program (PCEP)**. The goal of the program was to grow the global shipping industry infrastructure and expand the economic opportunities of Panama.

Program Management Definition - Program Management is the delivery of multiple, interrelated projects in a coordinated process for the benefit of the owning entity.

Autoridad del Canal de Panamá's (ACP's) Consideration of Program Management Models - Owner Management Model, At Risk Model, Consultant Management Model, Owner's Agent Model, Integrated Program Management Model

ACP Selection - **Integrated Program Management** and Program Management Services Contract Awarded to CH2M in August 2007

One Team One Mission Organization & Collaboration - Leveraging a cross-cutting approach from the program management development of tools and processes to establish the governance of the PCEP to a mirror manager approach of CH2M, with ACP counterparts, offering guidance, advice, and support for ACP's authority and decisions

PCEP Stakeholders: People of Panama, Autoridad del Canal de Panamá (ACP), Board of Directors and Global Maritime Industry

Risk Management - A key element of any Program Management model is the allocation of risks and responsibilities. Risk transfer works best when you get as close as possible to a "win-win" scenario. A risk profile with an imbalance inevitably leads to the detriment of one or more parties.

In the case of the PCEP, the integrated ACP-CH2M team identified the risks during the tendering process and the risk allocation was improved, in favor of the tenderers, as a result of open dialogue. This risk approach was maintained throughout the execution.

Relevance Statement - The relevance of this presentation can be generalized for future large infrastructure initiatives. For the Panama Canal Expansion Project, there were two main risk categories:

- Low-Bid Contracting and Delivery Risk and
- Reputational Risk

Keywords – Panama Canal, Program Management, Infrastructure, Megaprojects, Collaboration

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In 2006, the citizens of Panama voted to approve a national referendum for the Panama Canal Expansion Program (PCEP). The goal of the program was to grow the global shipping industry infrastructure and expand the economic opportunities of Panama. This program came after years of studies performed by the Autoridad del Canal de Panamá (ACP) in completing a Master Plan for the development, growth and improvement of the Canal with a 25-year outlook. This would be accomplished through an additional expanded size lane of traffic — via a new third set of locks — to double the Canal's tonnage capacity and allow the transit of much longer, wider ships through the existing canal waterway. When the expansion locks were inaugurated in June 2016 they increased ship throughput capacity to 18,000 vessels with an increase in capacity to approximately 14,000 TEUs, a standard unit for describing a ship's cargo carrying capacity or a shipping terminal's cargo handling capacity. See Figure 1 below.

Figure 1: Neo-Panamax Mega-container traverses the Panama Canal Expansion Project in June 2016

During the development of the PCEP concept, it became evident that the **Autoridad del Canal de Panamá (ACP)** could benefit from the services of a Program Management firm due to the program's risks in logistical and technical complexity; the interrelated multiple contracts; and the multi-billion-dollar budget which encompassed resource needs beyond the ACP's existing engineering and procurement support managing the operations and maintenance and routine capital improvement projects. Therefore, a decision was made to partner with an experienced Program Management firm to advise and assist throughout the execution of the expansion program.

Another key decision made by ACP was to continue the historic use of English as the contract/program language. ACP felt this would encourage bidding by a wider range of international contractors for the various PCEP contracts. At the time of the procurement, the top Program Management firms were U.S. firms, as ranked by *Engineering News-Record (ENR)*. Notwithstanding this selection of a common contract language, in practice the cohesiveness of project execution was affected by the fact that the four **Grupo Unidos por el Canal (GUPC -** Third Set of Locks' design-build contractor) shareholders are Spain's Sacyr Vallehermoso, Italy's Salini-Impregilo, Belgium's Jan de Nul and Panama's Constructora Urbana S.A. GUPC partners represented four countries and three languages. These linguistic distinctions manifested themselves as the Pacific Site spoke English under the leadership of GUPC partner Impregilo from Italy while the Atlantic site retained the Spanish language under the leadership of GUPC partner Sacyr from Spain.

Program Management Definition

Program Management is the delivery of multiple, interrelated projects in a coordinated process for the benefit of the owning entity. The need is often associated with a spending growth for capital infrastructure programs reflecting increased risks and complexity arising from the interfaces between multiple projects as well as the effects of varying project schedules. Program durations are longer than individual projects because programs encompass multiple projects and uncertainty is likely to be higher because of the likelihood of encountering environmental, financial, political, technical solutions and other changes. See Figure 2 below.

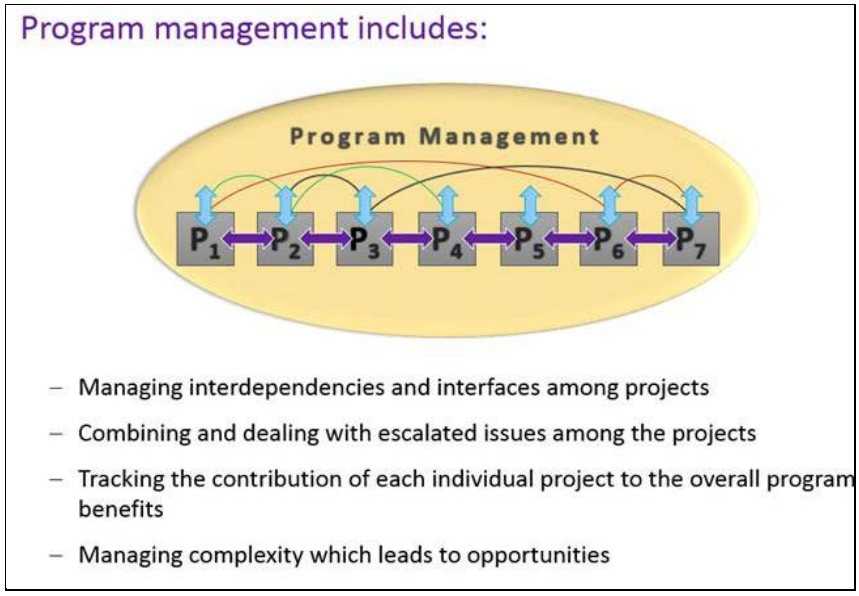

Figure 2: Program Management Interaction with Multiple Projects

Key Indicators that identify when Program Management is needed:

Complex or multiple projects

Increased capital spending required

Limited in-house client resources and expertise

Many projects of multi-year duration

Schedule pressure

Project delivery organization is not permanent

Single point of responsibility is desired

Goals are clear; delivery approach is not

Why Program Management?

Program management is the coordination of Resources to plan and deliver a collection of related projects to obtain benefits that would not be attainable if managed separately. Complex programs have traditionally been implemented using standard project management methods. As programs have continued to grow in risk and complexity, a more disciplined overall delivery method was developed—program management. With multiple ongoing projects, resources such as key staff, technical expertise, managers, electronic systems, buildings/facilities, tools, equipment, etc. are stretched and often duplicated to meet delivery demands. Program management optimizes resources to deliver benefits not attainable using the traditional project delivery model. See Figure 3 below.

While technical knowledge and experience are critical in all work, providing the best delivery method is equally critical—enabling each project to meet client goals and to be completed within budget and schedule.

Mentorship and career growth are essential for the industry and for clients – this is more readily available in a shared working environment with opportunities and empowerment of staff leveraging their experience.

Management of the interfaces between projects reduces program complexity. Every project and client has a unique set of delivery requirements that must be understood to develop efficient and effective solutions.

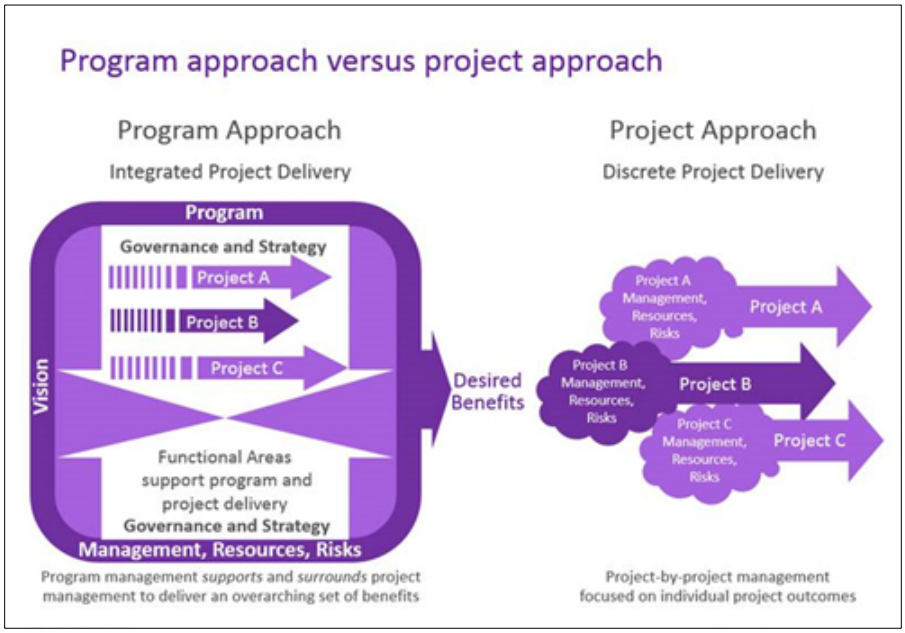

Figure 3: Program vs. Project Approach

Through extensive experience and lessons learned, we know that no two programs are alike and no model is right or wrong. Identifying the client's unique vision, goals and desired benefits are key to the program's success.

Program Management Framework and Best Practices

Four vital quadrants define Program Management Best Practices as in Figure 4 below:

Figure 4: Program Management Best Practices

The **Program Management Framework** then organizes and integrates these quadrants to optimize a value proposition based on lessons learned and best practices. A scalable Program Management Framework standardizes delivery strategy, processes, tools and resources around a common platform to successfully deliver programs tailored to clients' vision and to integrate seamlessly with their existing systems. The Framework includes the following four integrally related components which provide the tools and control for

efficient program delivery throughout all phases from the early concepts, during the initiation, and throughout the execution and closeout.

Program Initiation provides structured processes and tools for rapid client and program management team integration, allowing the PM team to focus on the client's goals and critical activities, while providing cost-effective, collaborative delivery practices. During Initiation, the Program Leadership is formed and the Management Model and Governance developed.

Program Delivery Guidelines provide an electronic Program Management Manual for implementing program-specific processes and procedures and applying the critical thinking to adapt the procedures to meet the program-specific requirements. The Platform documents the Delivery Model and related Tools and Controls for consistent delivery.

Program Performance Tools that allow program-specific information management for consistent critical data and program progress reporting, including a web-based dashboard. This transparent access to information enhances delivery efficiencies, program quality and decision making.

Program Maturity - Assessment tools are used to periodically evaluate the developmental status and operational effectiveness of the program's governance and infrastructure. This can be a matrix, spreadsheet, scorecard, etc.

Critical success factors include schedule, lowest overall cost, scope clarity, staff development, owner control and risk tolerance. Prioritizing and understanding these factors by use of several diagnostic tools, results in a program delivery model that best fits the client's needs and situation.

Program Management Economics

Before considering Program Management concepts, it is helpful to examine the economic benefits of a well-planned and well-executed program model. Various studies illustrate the value of Program Management on large complex projects and even on the smaller projects that form a Program Management portfolio. Each program is unique with its mix of social, economic and political complexity, but a key success factor is defining the program risks early. With little room for error in today's business environment, the proper identification and mitigation of risks as part of the overall Program Management process can serve to minimize cost and schedule overruns, assuming all stakeholders are aligned around a program's goals and objectives.

A direct correlation between staffing a PMO correctly and its ultimate success can be observed. In its *Pulse of the Profession™ In-Depth Report: The Impact of PMOs on Strategy Implementation*, the Project Management Institute reports that high-performing PMOs – those that complete 80 percent or more of projects on time, on budget and meeting original goals – are more than twice as likely to have the right skills base in regard to project management experience and training.[4]

In PMI's 2015 *Pulse of the Profession®: Capturing the Value of Project Management* research revealed that "high-performing organizations are far more likely to focus on talent management, establishing ongoing training, and formal, effective knowledge transfer."[5] This is especially important in project and program

[4] PMI's *Pulse of the Profession®* In-Depth Report: *The Impact of PMOs on Strategy Implementation (2013)*

[5] PMI's *Pulse of the Profession®* In-Depth Report: *Capturing the Value of Project Management* (2015)

management, where technical skills are enhanced by leadership and its strategic and business management capabilities that are nurtured through experience.

The size of the program team may also factor into the equation. Generalizations can be hard to make given that each program is unique in its size, scale and complexity. However, after a cursory review of some successful major infrastructure programs around the world, as compared to the total installed cost of the program being constructed, the size of the Program Management team (owner plus consultants) tends to hover between US $15 million to US $50 million of installed cost. More research is needed in this area in order to draw more accurate correlations around optimum staffing.

Program Management Models: Seeking the Right Balance

The ACP evaluated the various models of Program Management with a goal of selecting a working construct that aligned with its short- and long-term goals as well as its organizational and political objectives. The decision that fit the Panama Canal's Administration needs was that of an integrated Management team.

In addition, prior to awarding the Program Management Services contract, the ACP released a Request for Proposal for Program Management and Construction Management training, seeking a major university accredited as a Registered Education Provider by the Project Management Institute (PMI®). The University of Texas at Dallas was awarded the contract, and subcontracted CH2M, as the top-ranked (by *Engineering News-Record*) Program Management firm, to provide instructors. The Panama Canal certified 75 Program Managers under the PMP certification, also provided formal training to over 300 employees that were assigned to the Program.

Once the Program Management Services Contract was awarded, the ACP together and with the guidance and lead of CH2M developed a Program Management Plan for the Program and it was followed by over 1,200 ACP staff that were directly assigned to the Program.

Proyectos *JUNIO 2016*	Contratistas	Sub-contratistas	Total	Empleos Activos
Excavación del Cauce de Acceso Pacífico – CAP1	475	214	689	-
Excavación del Cauce de Acceso Pacífico – CAP2	492	620	1,112	-
Excavación del Cauce de Acceso Pacífico – CAP3	345	577	922	-
Ensanche y Profundización de las Bordadas del Norte del Lago Gatún	185	226	411	-
Entrada Norte del Cauce de Acceso del Pacífico	366	1,575	1,941	-
Dragado de la Entrada del Pacífico	817	520	1,337	-
Dragado de la Entrada del Atlántico	636	416	1,052	-
Excavación del Cauce de Acceso Pacífico – CAP4	2,069	1,047	3,116	
Diseño y Construcción del Tercer Juego de Esclusas	14,580	9,872	24,452	2,134
Reforestación y rescate de vida silvestre	1,345	0	1,345	48
Alquiler de equipo pesado	244	0	244	-
Servicios paleontológicos y arqueológicos	85	0	85	-
Otros Contratos	2,835	338	3,173	8
Subtotal	24,482	15,405	39,887	2,190
ACP			1,281	915
Proyección del Total de Empleos Directos Acumulados			*41,168*	*3,105*

Figure 5: PCEP Staff Allocation by Project

ACP's Consideration of Program Management Models

With an accelerated understanding of the discipline, ACP evaluated the following models with the intention of selecting a working construct that aligned with its short- and long-term goals as well as it organizational and political objectives.

Figure 6: Spectrum of Program Management Models

Owner Managed Model: Owner provides project definition, hires the engineers and contractors and manages all contracts.

Integrated Program Management Model: Program Manager may be either the Owner or the Consultant, with staff from both organizations integrated at multiple levels. The Consultant staff may augment positions within the Owner's organization where expertise or experience is lacking.

Consultant Management Model: Consultant Manager may supplement the Owner's staff in an advisory role. The Owner hires the Program Manager, the designers and the contractors.

Owner's Agent Model: Owner hires the program manager and contractors, and may also in some cases hire the engineers, but the program manager is responsible for providing direct management of engineering services.

At Risk Model: Owner has less direct project input and control because it has assigned more risk to the Consultant and also assigns commensurate control over the Program to the Consultant.

There is more than one "right" program delivery method for a given program. And hybrids can be created when owners and consultants sit down to discuss mutual objectives. The key decision factor is for an owner to decide how much control it is willing to relinquish to a consultant and how a consultant wants to be compensated for assuming the risk.

ACP Selection: Integrated Program Management

The ACP selected the Integrated Program Management model in alignment with the following:

- ACP maintaining complete control of the program
- ACP remaining as a unified organizational entity but created a Vice presidency (Engineering and Program Management) that would be dedicated to the PCEP
- Developing within ACP the knowledge and skills for managing future large complex programs – with minimal, additional outside consultation

ACP's selection of the Integrated Program Management Model followed an industry trend over the last two decades away from independence (where the consultant would make many, if not all, decisions on behalf of the owner) to an integrated model (with the consultants acting in the role of seconded staff working on site with the owner), incorporating alternative project delivery methodologies.

CH2M was awarded the Program Management Services contract in August 2007:

- To conform with the ACP's organization by providing an integrated team to serve as program and construction advisors to the ACP;
- To train and mentor the ACP staff in program and construction management best practices;
- To develop program/project discipline, processes and procedures; and
- To assist with claim/dispute defense and claim/dispute mitigation.

With an integrated model, a significant amount of formal and informal learning takes place naturally as everyone works together, side-by-side. Under the terms of the agreement with the ACP and, as the work progressed, CH2M would phase out its staff, leaving in place an owner team trained in advanced Program Management and delivery and capable of operating and managing a world-class operation.

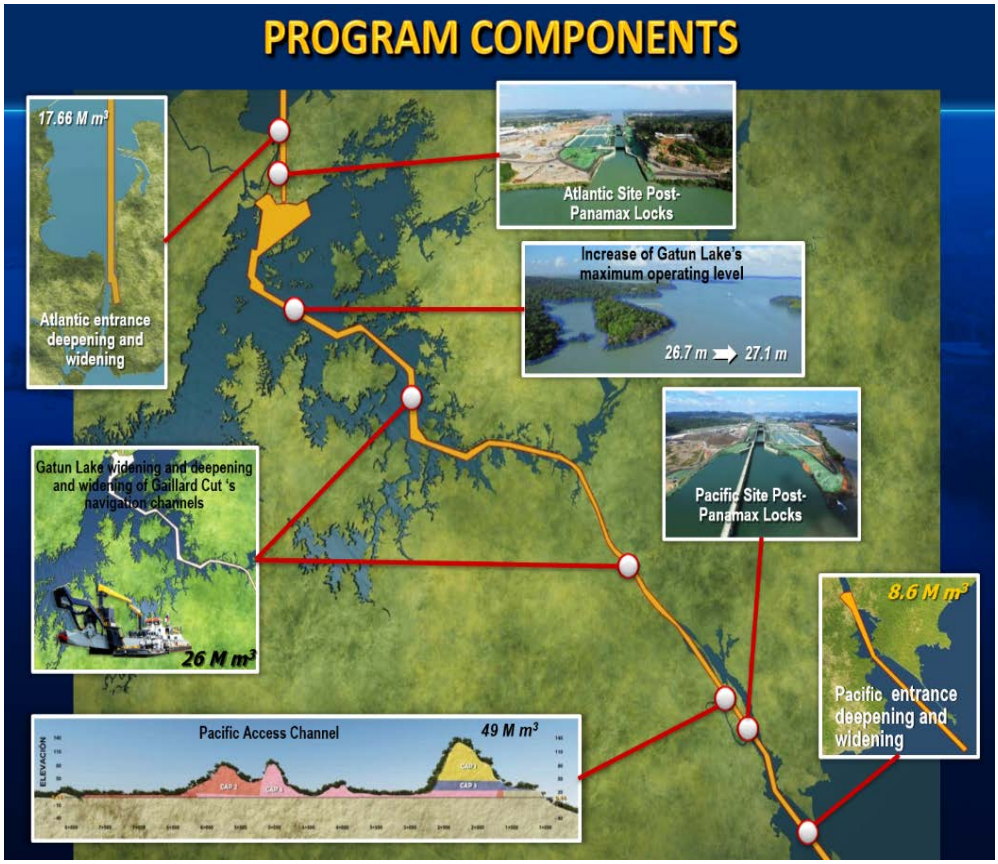

Figure 7: Seven Elements of Panama Canal Expansion Program

Figure 7 provides a graphic representation of various projects under the full PCEP. During the early integration of CH2M into the program, some of the major over-arching contract requirements, such as quality assurance and the program management information system, were established for the benefit of all seven elements of the PCEP. However, as time progressed and in alignment with the decision by ACP to execute the program management resources in an integrated team approach, a majority of the CH2M team focused on the largest program risk, the design-build Third Set of Locks Project (TSLP).

At its peak, CH2M reached a maximum staffing level of 40 supporting the ACP (with 150 staff assigned to the Third Set of Locks Project) in program management, construction management, risk management, quality assurance, project controls, document controls, correspondence, contract development, contingency

planning, design oversight support and specialized support. With the successful implementation of the knowledge transfer strategy, that number stands at seven full-time CH2M/Jacobs staff today (still supporting 40 remaining ACP staff), whose primary focus is on post-construction activities such as engineering, quality assurance, mentoring as well as management and claims consultation.

PCEP Stakeholders

Four primary stakeholders are driving the PCEP:

People of Panama: Ultimately, the people of Panama are the primary stakeholders. They are the ones who gave approval to proceed and now benefit from the success. The Panama Canal is not only an immense source of pride and identity for Panamanians, it also is a major contributor of employment opportunities for the populace. In addition, the Panama Canal generates significant revenue that is distributed annually to the government, providing sustainable funding for the country's economic growth. The success and well-being of the Canal and its expansion is vital to Panama's economic future.

Autoridad del Canal de Panamá (ACP): The autonomous State-owned entity responsible for the operation and management of the Panama Canal. The ACP has financial autonomy, as well as ownership of the canal's assets. ACP has taken great pride in the successful administration of the canal for nearly 20 years and has a strong orientation toward self-performance.

Board of Directors: The eleven-member group responsible for establishing the Canal's policies for operation and management pursuant to the National Constitution, the Panama Canal Authority Organic Law and ACP Regulations.

Global Maritime Industry: The Canal's ultimate customers who will benefit from increased loadings, larger vessels, reduced canal transit times and lower transportation costs. The shippers expect reliability and efficiency of Canal operations for the safe and timely transit of their vessels. The impacts on the PCEP are already being felt as ports on both U.S. coasts rush to modernize their facilities to take advantage of the larger, neo-Panamax cargo ships that pass through the new locks.

One Team One Mission Organization

During the Canal transition from the American Panama Canal Commission (PCC) to the Autoridad del Canal de Panamá (ACP), the slogan "One Team, One Mission" referred to the coordinated and harmonious work accomplished between 1979 to 1999.

Expressing the meaning of the slogan at that time, a PCC employee said:

> We all attended the work meetings with the same spirit of cooperation, without egoism or arrogance…. We are all aware that we are part of the same objective and that the goal is not to reach December 31, 1999, but to proceed without showing that there has been a transfer.[6]

Within the PCEP, the slogan was revitalized as an attempt to overcome the struggles within the collaborative relationship between ACP and CH2M. By adopting the Integrated Program Management Model with ACP maintaining complete control of the program and CH2M serving in an advisory, mentoring role, the slogan once again emphasized the importance of teamwork in a collaborative effort that was intensified with a prescribed one-on-one structure for critical roles.

In a recent monograph on *Chaperoning* and practices of collaboration in the PCEP, Dr. Smits opined:

[6] Smits, K. (2013).

> The relation between ACP and CH2M Hill is more complex than what the slogan "One Team, One Mission" suggests or as the Invitation to Bid prescribed. In fact, these messages contradicted each other: the slogan refers to an equal relationship while the Invitation to Bid states that ACP is superior to CH2M Hill. Given the ambiguity of these formal relations, it is not surprising that project participants struggle to find satisfactory conditions for collaboration. [In the words of one ACP engineer in 2012]: *Somos la sombra de CH!* (We are the shadow of CH2M Hill). [7]

Within the institutional and professional mentorship of ACP's staff throughout the execution, this approach was cross-cutting from the program management development of tools and processes to establish the governance of the PCEP to a mirror manager approach of CH2M, with ACP counterparts, offering guidance, advice, and support for ACP's decisions.

As recognized by Dr. Smits in 2012: "In the transition period [1979-1999], role segmentation existed between the American Government as a mentor and the Panamanian protégé. Back then, the local employees were subordinate to the foreign leaders, and with chaperoning, a similar relationship is created…. Today [2012], however, the collaboration is intensified with a "one-on-one" structure. ACP indicates to aim at an equal relationship between the Americans and the Panamanians, just like how the transition phase is remembered.[8]

ACP and CH2M Teaming Arrangement

To meet the ACP's expectations, the CH2M team worked towards the goal of a fully integrated teaming arrangement which had the CH2M team embedded within the client's organizational team. This was all geared towards the One Team One Mission objective. The CH2M team was fully embedded with the ACP's organizational team.

This required collaboration, calibration and hard work as the ACP and CH2M groups came to the organization with very diverse and different backgrounds, cultures and disciplines, and formed into one team and to work as a disciplined unit. Partnership with outside entities was not a normal cultural practice for the client. The prerequisite ACP considered for CH2M personnel was a minimum of 20 years' experience in their area of expertise and prior work experience on a mega-program (>$1B). This proved to be an invaluable decision by ACP to bring to the PCEP CH2M personnel who had decades of experience dealing with challenging situations that might be encountered and then had the ability to pass along this experience by mentoring ACP counterparts.

The initial step to achieve a "One Team One Mission" team was an intensive team training event occurring off-site with key management members prior to starting the Locks project. Physical training events, team competitions as well as integration of cultural themes (outcome was to benefit an indigenous Indian tribe) helped to break down barriers and assist in building a cohesive team arrangement. Such teaming sessions had been used within ACP before PCEP and continue today under the current CEO Jorge Quijano.

With the extensive scope of the program it was essential for the program and, later the Locks Project, to have an integrated organization along all key roles and functional areas. This required not just complete integration but the ability to work vertically and horizontally within the client's organization, so as to work effectively and harmoniously. Everything from project controls to safety, the environment, risk, design, contracts, claims, quality, and construction management - all needed to work smoothly just like the water rising and lowering in the Locks Chambers with minimal turbulence to the massive ships passing across the Canal.

[7] Smits & van Marrewijk (2012)

[8] Ibid.

Communication is the Key

As noted above, the integrated organization was cross-cutting both vertically and horizontally. As the team was large and physically spread out, this was purposely addressed with integration occurring at all critical physical locations such as the Atlantic and Pacific construction sites and the ACP central office locations. This occurred amongst different program functions including quality, project controls, risk, safety, and further covered at the TSLP functions of design, construction management, resident engineering, quality assurance, claims and contracts, document controls, etc.

CH2M's internal publication, *The Little Yellow Book*[9], written by co-founder Jim Howland to immortalize the company's core values of respect and integrity, has been used for decades amongst its employees and with clients. This was shared by many CH2M staff with other members of the integrated team to reiterate such simple concepts such as "No matter what the organizational structure, if the people in it want it to work, it will."[10] Even in a difficult and complex program, this was preached.

Communications were essential amongst the program team for success. This meant meetings at all levels strived to include attendance of ACP and CH2M, communications and meetings with the contractor were jointly held and leverage of decisions made by ACP were assisted by the knowledge of the integrated team being well informed and advised appropriately in consideration of moving the project forward. To achieve the goal of "One Team One Mission," communications with the shared knowledge of critical events and activities allowed timely and sound decisions. In following this process, ACP's communications extended to all stakeholders and was openly demonstrated with the public being allowed to visit the construction progress prior to the flooding of the new Locks in 2015.

Beyond the ACP / CH2M Team

The One Team One Mission did not only pertain to ACP and CH2M. As with any type of large program, the core values of integration, communication and common objectives were set to be inclusive of other entities supporting ACP's program execution. This included consultants, technical experts, and other professionals all sharing the vision for the expansion to become reality. While their scope was focused in the areas of support, the shared communications and drive towards acting as one unit was overarching.

In addition, the interfaces with the Contractor were conceived, again, towards obtaining the goal of completing the project. As challenges were faced, the ACP / CH2M Program team looked towards resolving situations timely and relied upon the contractual basis for support. Some hurdles were very complex as they involved time and financial impacts. All parties understood that, for the work to be completed, all parties would be relied upon to accomplish the goal. ACP decisions were geared towards achieving the ultimate goal - completing the Panama Canal Expansion Program successfully.

Mirror Management Counterpart Teaming

The organization was formed with the concept of 'mirror management' and 'counterpart teaming.' Many of the key program organizational management positions had a mirror counterpart. That mirror counterpart was a CH2M partner in a teaming arrangement with the ACP counterpart. It was always clear to the Contractor (and CH2M) that the ACP partner was the contractually empowered entity and had full authority. However, the CH2M mirror manager offered guidance, advise, support, etc. to assist ACP's decision making and management of the works. This created an ability to mentor senior level talent, experience and background in the pursuit of the best possible outcome. The objective was for ACP to take over the management role solely and for CH2M to work themselves out of the counterpart role which was achieved as shown in Figure 8 where only two of eight CH2M positions remained as primary roles by 2013. As part

[9] Howland (1982).

[10] Ibid.

of One Team One Mission, the partner roles also had the benefit of the differences in perspectives, cultures and experiences with the common objective of moving the program forward.

The combined 2010 and 2013 organizational charts in Figure 8 demonstrate the concept of the mirror management of the ACP and CH2M partners early in the program (2010) and later (2013) with various ACP managers having taken over the management roles.

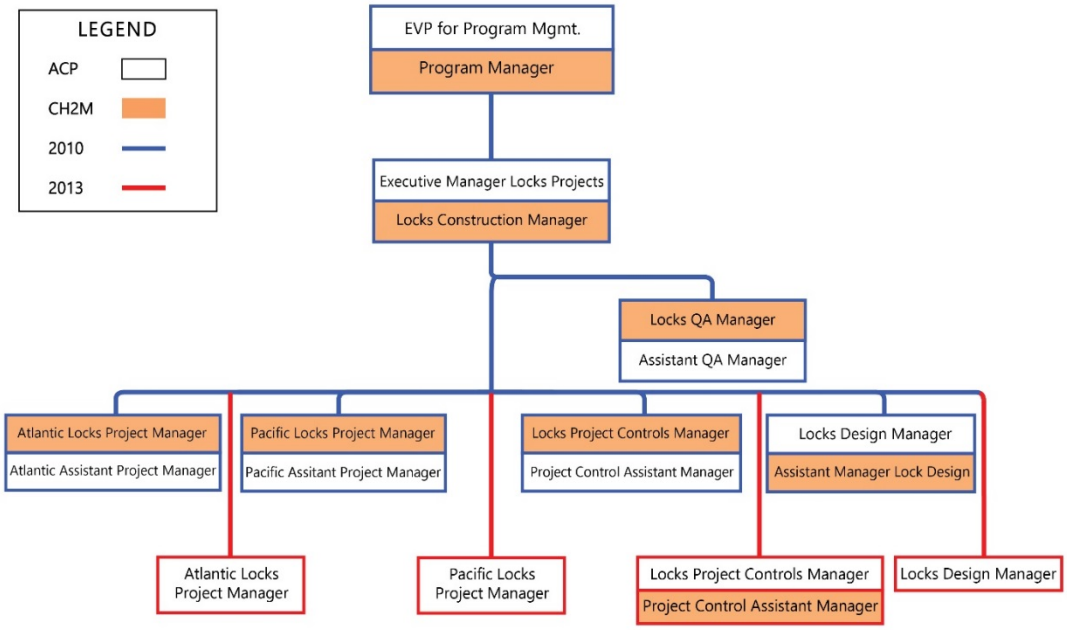

Figure 8: Comparison of 2010 and 2013 Organization Charts

During execution of the program, there was a continuous drive by senior management of ACP and CH2M to adhere to the one team concept of execution to leverage the advice, strengths and experiences of team members, as appropriate. The ultimate decisions were made by ACP but the organizational set-up was all pushing for the same objective - to succeed in the Expansion efforts with the best outcome for the new facilities in a timely manner and with responsible financial management.

This required different staff of both entities to recognize that, over time, their individual roles on the program/project would result in an element of 'musical chairs.' For example, the Figure 8 excerpt of the Organization Charts for the years of 2010 and 2013, respectively, clearly depicts that, over that 2.5-year period, the CH2M mentors soon either completed their project roles and demobilized or were moved into a subsidiary position to their ACP counterparts just as ACP staff were elevated to more senior roles in the organization.

The mentorship did not stop at the level of the mirror management roles. It also extended to the junior staff of ACP. ACP's organization already had a strong standard of continued education and training amongst its employees. However, with the execution of a large program and the mix of experienced team members, the continuous mentorship on various program and industry practices occurred. This included areas such as safety, quality, document controls systems, management, etc. Many of these continued to provide technology transfer or experiences, processes and tools to enhance the team and grow ACP staff. Thereby also fulfilling the role of CH2M working themselves out of particular roles to grow ACP overall.

Reach Back

The teaming arrangement between ACP and CH2M also allowed for leverage of CH2M resources on a reach back basis. This was utilized periodically for limited short-term assistance of experienced professionals and assisted in bringing new resources to the program team. New resources were needed as departures are unavoidable on a large program but also were used to cover new positions required, on a part-time or full-time basis as the program evolved during execution of the works.

Growth of a Nation

One of the outcomes of the One Team One Mission teaming arrangement and mentorship is the ensuing success of individuals associated with the Expansion program for the Panama professions and for ACP. Many of the mentored ACP staff are today moving forward with their careers based on their shared experiences and many are now working within the greater Panama professional engineering and construction community.

Design-Build Contract Development

The strategy for developing the PCEP was tailored to meet ACP's administrative requirements and the needs of the various construction projects that make up the overall program. The scope of work for many projects was focused on dry excavation and dredging, both of which were familiar to ACP. These projects, many of which were self-performed by ACP's existing maintenance crews, were treated in a relatively routine and conventional fashion, typically on a unit-price basis.

However, the **Third Set of Locks Project (TSLP**), by far the largest single capital works construction project performed in Panama (since the original Panama Canal construction) and was something entirely new. The project also needed to be integrated with the overall program. The project incorporated design concepts from various facilities around the world and no single installation used all the elements planned for the Panama Canal. Also, the sheer scale differentiated the project from the other locks, so a different approach was needed.

The ACP commissioned a detailed evaluation of applicable contract strategies and ultimately selected a design-build approach with the design and construction to be performed by a "world-class" consortium. The ACP felt this was the best way to manage risk, increase flexibility and innovation, bring appropriate expertise to the project and place full delivery responsibility with one entity. The requirements for the locks would still be controlled by ACP but the choice of how to deliver to the requirements would be owned by the design-build contractor.

Third Set of Locks Selection Process

The prequalification and selection of the design-build contractor for the Third Set of Locks contract was a process that spanned 23 months and involved several steps. The first was issuing a series of informational communications to the design and construction industry regarding the anticipated project concept, timeframe and other details. These communications were intended to generate awareness and interest across the industry worldwide.

Next, a Request for Qualifications (RFQ) was published with the intent to pre-qualify up to four tenderers which contained various experience and financial requirements. Although a joint venture or consortium was not specifically required, it was generally understood that the requirements of the RFQ would not likely be satisfied by any one individual company. The submitted Statement of Qualifications (SOQ) packages were evaluated and scored by the ACP and four separate teams were pre-qualified and invited to submit tenders for the project.

During the SOQ submission and evaluation period, the ACP/CH2M team continued preparation of the project Request for Proposals (RFP). The initial RFP was issued shortly after the pre-qualification process results were announced.

During the tender preparation period, a series of meetings was held with the tenderers to promote the exchange of ideas about the project's scope and the composition of the ACP's tender package. Prompted by comments and concerns raised by the tenderers, several refinements to the RFP evolved during this process and were incorporated into the tender documents. The process also gave the parties a chance to get to know each other and for the ACP to better judge the tenderers' concerns about subjects such as risk tolerance, financial capacity and dispute resolution expectations.

Risk Management

A key element of any Program Management model is risk allocation. For design and construction projects that are executed in traditional ways, the methods of assigning risk between an owner and contractors are well established. The basic principles are that risk should be assigned to one of the following:

- The party best able to manage risk
- The party best able to mitigate or minimize risk
- The party best able to overcome the adverse effects of actualized risk

Risk transfer works best when you get as close as possible to a "win-win" scenario. A risk profile with an imbalance inevitably leads to the detriment of one or more parties. Such analysis lends itself well to game theory and other analytical tools. The analysis of the risk profile itself also can be performed through probability analyses and simulation techniques.

Several risk allocation approaches can enhance chances for successful partnering:

- To the extent practicable, identify risks clearly and completely. Risks that are well understood can be readily quantified and will generally facilitate negotiations.
- Establish fair and reasonable provisions for relief of performance, cost or schedule commitments contained in given risk allocations. Fair and reasonable provisions for accommodating "uncontrollable circumstances" with appropriate risk allocation to both parties are more likely to be satisfactory than if contract provisions are viewed to be heavy-handed and one-sided.
- Recognize, through risk allocation and pricing provisions, that risk has an economic impact. For example, risk acceptance may require additional compensation. In so doing, avoid assigning risks to parties that do not have adequate power to control or manage the risk.

In the case of the PCEP, the integrated ACP-CH2M organization identified the risks and responsibilities during the tendering process and risk allocation was improved as a result of open dialogue. This risk and responsibility approach was maintained throughout the execution.

The relevance and importance of risk management can be generalized for future large infrastructure initiatives. For the Panama Canal Expansion Project, there were two main risk categories:

- Low-Bid Contracting and Delivery Risk; and
- Reputational Risk

With an eye toward a potential fourth set of locks program, it is interesting to note that the original canal efforts spanned more than 30 years, primarily because of a 20-year abandonment of the project between the French initiation and US completion, at a 2014 cost equivalent of almost US $17 billion. In contrast, the

Third Set of Locks project and overall canal expansion was completed within a consecutive nine years at a final cost which is expected to be significantly below the equivalent cost of the original canal construction.

Request for Proposals

The RFP was generally based on the International Federation of Consulting Engineers (FIDIC) Yellow Book – a widely accepted international form of contract – since it was not known where the tenderers would be based and because it includes standard construction terminology well known in the industry. ACP requested permission and modified some clauses to add certain ACP requirements. As it turned out, the tenderers included companies from Europe, North America and Asia. It was decided to have a single contract for both the Atlantic and Pacific Locks to ensure consistency, maximize efficiencies and increase coordination.

A significant effort was made to find an appropriate balance between performance-oriented and prescriptive employer's requirements. Although the ACP wanted the design-build contractor to have the greatest flexibility possible, certain requirements were necessary to meet specific concerns and needs. This included having the new locks facilities interface properly with existing, ongoing operations.

Ultimately the RFP incorporated updates of the tenderer stipend amount, several risk-sharing provisions, allocation of responsibilities, extensive information regarding the existing geotechnical site conditions, key construction materials escalation protection and an advance payment scheme to help the design-build contractor with early cash flow. All these enhancements were designed to minimize uncertainty for the tenderers with the critical goal of reducing the tender price and ensuring the Third Set of Locks project would be able to progress without delay, and that it would be completed within the required budget parameters.

The tender process was based on a fixed-price contract with selection based on best value, considering both technical merit and cost**.** Tender packages were evaluated and technical considerations were scored by the ACP. Subsequently, separate cost proposals were opened, and the successful tenderer was determined by the ACP based on the numerical combination of the technical score and cost, according to the formula outlined in the RFP. The ACP team led the proposal and tendering process through its procurement procedures, as modified for the PCEP.

Tendering Process Results

The tendering process resulted in the ACP receiving three qualified tenders with a wide range of tender prices. The lowest price, which was submitted by Grupo Unidos por el Canal (GUPC), was a few percentage points below the employer's estimate and roughly $1 billion below the next lowest tender. ACP also gave GUPC the highest technical score. The tender process accomplished its goal of receiving a qualified tender at a price that was within the established estimate, but the relatively low bid and large range in tender prices was an indication that difficulties might lie ahead.

Achieving Collaboration Among Diverse Cultures

The Next Generation Infrastructures Foundation of The Netherlands funded a four-year research project by Karen Smits on collaboration practices in the PCEP. This research resulted in the 2013 publication previously referenced in footnote 6 above. Dr. Smits' year-long research as an embedded PCEP researcher resulted, among other findings, in the following ***Collabyrinth***[11] depiction of the manifest and concealed

[11] Smits, K. (2013)

practices which can ultimately enhance or hinder the collaborative practices in the everyday organizational life of project participants.

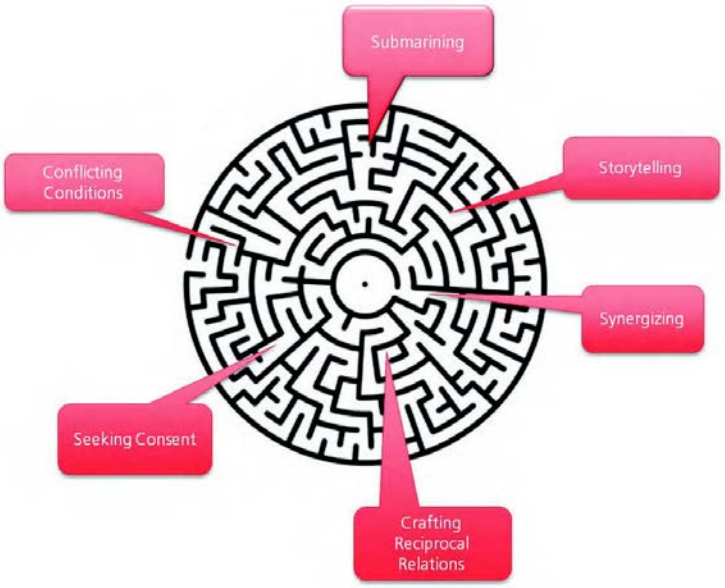

Figure 9: *Collabyrinth* as developed by Karen Smits, Ph.D.

In the PCEP relationship between ACP and CH2M both manifest and concealed practices consisting of interconnected actions and activities are illustrative of how different project participants make sense of the cultural complexities in their everyday work environment.

By observing the collaborative efforts of both parties to the integrated program management model implemented for PCEP, Dr. Smits cited examples which exemplified elements of the scholarly literature on organizational management. For example,

- The partners struggled over the different interpretations about the role that CH2M consultants would play in delivering program management services. CH2M was guided by its traditional independent delivery role while ACP envisioned a purely advisory role of training, monitoring and mentoring. The parties soon became aware of these routine practices and changed toward a more discursive mode suitable for project enhancement, confirming the scholarly literature.[12]
- Conflicts over goals are present in everyday organization practice and are, essentially, an evident part of collaborative projects.[13]
- A great sense of pride dominated the project narratives told by ACP and CH2M employees resulting in a more profound relationship with the project again confirming the scholarly literature.[14]

Conversely, GUPC's collaboration was rather loose as project participants saw themselves as only being in a temporary state of working together. Additionally, the distance between the Atlantic and Pacific project

[12] Smits (2013) but see also Bresnen & Marshall (2011), Engwall (2003) and Van Marrewijk et.al. (2008)

[13] Smits (2013) but see also Gherardi (2000), Nicolini et.al. (2003) and Vaaland (2004).

[14] Smits (2013) but see also Veenswijk and Berendse (2008).

sites (approx. 60 kms) and the linguistic differences between the two sites created a scenario where competition between the two site offices was often stronger than collaboration. This situation provided a ripe environment for CH2M to create collaborative opportunities between the parties (and the subcontractors) to the TSLP Design/Build contract.

Although the construction sector is not unique in the elements of risk and uncertainty in the workface, the key driver for collaboration in megaprojects is the need to surmount the lack of competencies and scarce resources to create value together while crafting reciprocal relations of mutual trust and respect.[15] Tellingly, Dr. Smits concluded that "collaboration advanced due to a strong personal drive to finalize the project successfully rather than because the project organization stimulated such a work environment."[16]

In a recent paper presented on behalf of ACP at the Dubai International Project Management Forum what differentiates the Canal Expansion project from most others is, without a doubt, the diversity of labor. Over40,000 jobs were generated and, of those, over 37,000 were Panamanian workers who contributed their efforts and dedication to make it possible, in contrast to what occurred with the construction of the original Canal.[17]

To this number, several thousand were a foreign labor pool of men and women coming from different parts of the world: Spain, Portugal, Colombia, Italy, Venezuela, Chile, Romania, Nicaragua, United States, Mexico, Belgium, Costa Rica, Moldova, Argentina, Holland, Peru, Dominican Republic, Great Britain, Honduras, Hungary, Brazil, Ecuador, Poland, Uruguay, El Salvador, Korea of the South, Ireland, Philippines, Cuba, South Africa, Germany, Ukraine, Canada, Russia, Albania, Angola, Bosnia and Herzegovina, China, France, Guatemala, Korea of the North, Paraguay, Sweden, British Indian Ocean Territory, Bulgaria, Croatia, Slovenia, Turkey, Vatican City, Bahamas, Bolivia, Eritrea, Haiti, India and Iceland.

This cultural diversity represented a new challenge. All cultures, styles and personalities united for a common purpose. The goal was fulfilled because early on, each one assumed, the Panama Canal Expansion as their own work.[18]

Locks Project Claims and Disputes

The locks project dispute process detailed in the contract begins with a notice of claim and subsequent details of claim to be provided by the contractor. The employer responds to the claim with an approval/disapproval followed by a determination. At that point, if there is no agreement, either party can refer the issue to the project Dispute Adjudication Board (DAB), which has been established jointly by the contractor and the employer to rule on referred disputes. After a DAB ruling is issued, if either party is dissatisfied, it may escalate settlement of the dispute to be decided by International Chamber of Commerce (ICC) arbitration.

During the seven-year life of the TSLP contract, significant numbers of claims were lodged by the contractor. Both the contractor and the owner established teams dedicated to the preparation and response to these claims. Ultimately, these numerous contractor claims became specific DAB referrals. Those that have not been agreed by both parties, as well as several employer counterclaims, are currently before the ICC arbitration tribunals in separate distinct multimillion dollar cases between the parties.

[15] Smits (2013) but see also Sackmann & Friesl (2007) and Vangen & Huxham (2003).

[16] Smits, K. (2013).

[17] Marotta, I. (2016).

[18] Ibid.

Grand Opening of the Panama Canal Expansion Project in June 2016

In June 2016, all stakeholders celebrated the opening of the Third Set of Locks as well as the start of a three-year maintenance contract which extends through June 2019.

At the time, the CEO of the Autoridad del Canal de Panamá stated that CH2M had been a trusted partner since the PCEP began:

> *Their proven experience in the international program management arena has added tremendous value to our integrated team. Providing professional support at all levels of their organization, CH2M worked with the Canal Authority to assist in achieving successful completion.*

Figure 10 Grand Opening of the Panama Canal Expansion Project in June 2016

Megaproject Lessons for Future Infrastructure Initiatives

As is normal on programs of this size and scope, there are several lessons that can be generalized for future large infrastructure initiatives. For the Panama Canal, these fall into four main categories.

Low-Bid Contracting and Delivery Risk: Interdependence has become the norm in the global economy. The Third Set of Locks Project has required the planning, design and construction expertise of many firms from around the world. To that end, the ACP adopted a Program Management model that promised ownership control over the PCEP while balancing the risk appropriately to the design-build contractor. For the selection of the contractor, the ACP utilized a Non-Negotiated tender process based on Best Value for the Third Set of Locks Design-Build Project. However, with the significantly lower bid, as compared to the other bidders, the construction risk was essentially transferred back to ACP, which has gone to extraordinary lengths with the contractor to enable the successful completion of the work.

To date, the progress of the PCEP has followed the path of many “mega-programs” with respect to cost and schedule overruns. The large, complex, inherent nature of these programs make them subject to a wide array of challenges. Each program is unique and the challenges associated with each also are unique. In the case of the PCEP, one of the primary lessons learned is that a bid that is significantly lower than comparable bids, and the extent to which price contributes to the outcome of a mega-program contractor selection, should constantly be challenged. In fact, one could easily question the value of low-bid contracting in any selection process, especially when considering the need to rapidly monetize the resulting business benefits.

For the ACP, the resulting funding issues and eventual temporary work stoppage on the locks construction required a weighing of the cost to continue with the current contractor versus implementing a contingency plan and selecting a new contractor. While this is a significant ongoing cost risk, the cost and potential delivery risks of changing contractors would also have been significant while resolution of existing claims would still be ongoing. As with any major program, alternate scenarios to complete the work must be kept intact – this too is a risk management measure that is necessary no matter what program management model is in place.

Reputational Risk: In today's world of instant communications, the need for fast-paced understanding of situations and potential resolution is paramount. Cultural incompatibilities must be identified and, in some cases, may actually represent a fatal flaw to a program's ultimate success. Contract terms and conditions are a tool and cannot by themselves be expected to resolve overwhelming differences. More than ever, the understanding of a win-win relationship is critical.

Language and Customs: On major programs – particularly those with regional, national and international significance – learning and respecting the political, cultural and economic environment is essential to establishing a trusted relationship with the owner and all stakeholders. In the case of the PCEP, beyond absorbing and understanding Panama's social and political culture, there is an added challenge of collaborating with people from around the world all bringing with them their particular values, work ethic, customs and languages.

The invaluable aspect of Program Management to the PCEP is the management of the interrelated portfolio of projects and execution of work with ACP senior managers approving and signing off on all plans, incorporating the applicable processes and procedures. While English was the contract language, it was not the primary language for all contractors which posed some challenges in practice.

For that reason, special care and attention should be taken to ensure all parties involved clearly understand actions and intent – colloquialisms or slang must be avoided. And for the CH2M team, though all program and project plans, documentation and reporting are conducted in English, fluency in Spanish has become essential for the primary program staff in developing stronger bonds with the ACP. The overall integrated program efficiency was increased by providing staff who were proficient in the local language. With any of the program models, communications issues – not necessarily technical challenges – can lead to the most substantial program risks.

Broad Skill Set: The PCEP confirms that today's program management teams need to go well beyond providing technical expertise. Working hand-in-hand with stakeholders and peers, an integrated team includes:

- Excellent communicators with strong interpersonal skills (bilingual)
- Workplace ambassadors, collaborating with a wide range of culturally diverse stakeholders to develop and implement win-win strategies
- Trusted advisors managing change, complexity and unpredictability
- Business managers balancing cost and schedule requirements with the terms of the contract
- Risk and quality agents helping to realize a strong return on investment for owners and stakeholders
- Safety advocates, making sure that workers are returned to their families safely at the end of the work day
- Human resource counselors, creating a positive work environment
- Politicians, considering all stakeholder perspectives and building consensus
- AND technical experts, bringing engineering best practices and solutions to the challenge at hand.

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