

# Heathrow Express Cofferdam: Innovation & Delivery Through the Single-Team Approach – Part 2: Management

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*Coaching, training and self belief were the keys to creating and motivating a winning team approach that successfully and timely completed a project that suffered an unexpected setback.*

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CHRIS RUST D'EYE

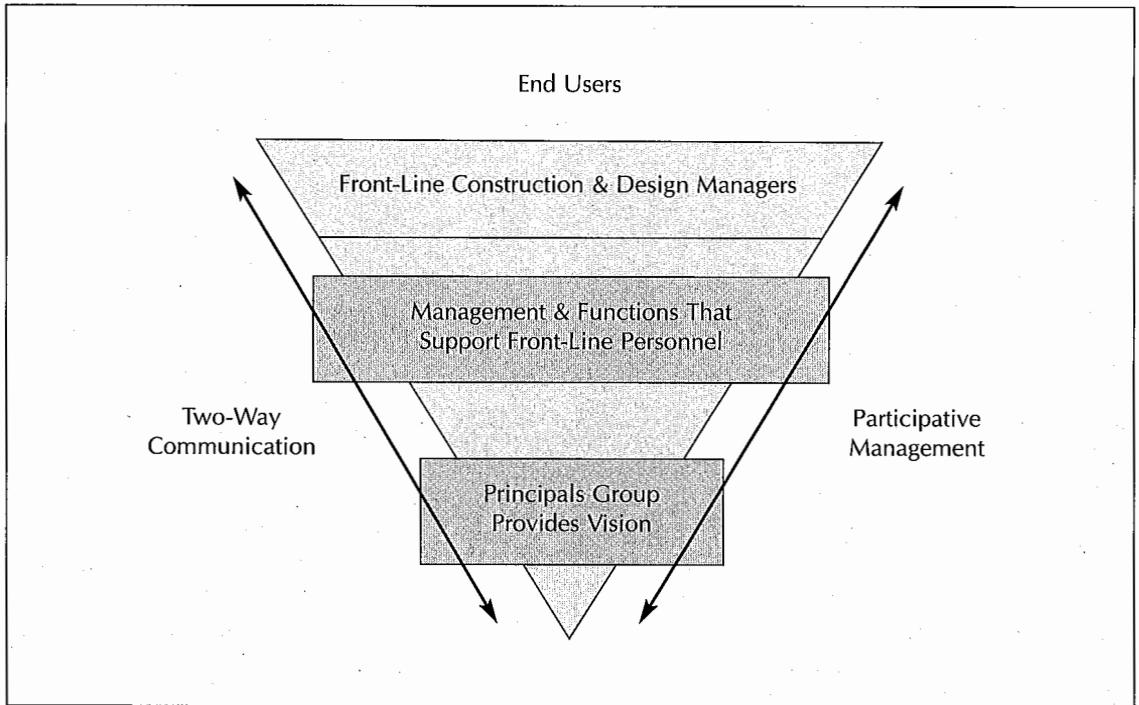
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**T**he whole rationale behind the single-team approach is that in any area of business (or, indeed, in any sport), the team that wins is the team that works best together. The aim of this approach is to bring out the powerful tools that exist within people and to use these tools to mold them together into a team that can believe in itself and that can achieve what may be considered

as almost the impossible. Examples of these tools are skills and knowledge. In addition, any sporting team needs coaches and trainers to be the best and achieve goals. This philosophy is key to the single-team approach and is the foundation on which the team can prosper and successfully achieve its objectives.

## **Partnering Innovation & Its Drivers**

In October 1994, the tunnels at the Central Terminal Area (CTA) of the Heathrow Express (HEX) Rail Link collapsed.<sup>1</sup> Luckily, no one was killed or injured. However, there was significant damage on this link between Heathrow Airport and London's Paddington Station. At the beginning of the project, the owner adopted a partnering arrangement that resulted in a single-team approach to the project's management. (The term *single-team* applies more to the guiding philosophy engendered by this partnering approach



**FIGURE 1. A paradigm that illustrates the factors driving innovation on the HEX Rail Link Project.**

adopted on the HEX Rail Link Project. There was no “single team,” or group, managing every detail of this project. Instead, there were many teams — each created for a specific purpose, or charge. Overall, these many groups together fostered the idea that *all* parties involved in the project were the members of one *single* team. It is that sense that is referred to here.) This single-team approach was responsible for managing the project. Soon after the collapse a Solutions Team was created. This Solutions Team considered a number of ways to salvage construction of the rail link. Ultimately, the team decided on a circular cofferdam solution and, in the end, the rail link was completed just six months late.

Before the recovery project was started, this single-team approach was agreed on at the highest level, following internal discussions among the highest levels of the owner’s and main contractor’s executive management. When the contract was being drafted, the owner added some words to it to underpin the single-team approach. This addition was relat-

ed to, and formulated on, several key principles, including:

- producing a successful enterprise for the end-user (the people who will pay to use the project; i.e., the traveling public);
- building trust among all team members at all levels;
- removing the potential for conflict for the front-line construction and design personnel;
- encompassing the participation of the suppliers and subcontractors whose components and work will produce the link;
- accepting that training and coaching are important elements of the task;
- emphasizing the scope for empowering and training front-line teams; and,
- accepting that there would not be problems, only challenges.

The single-team ethic was very much part of the management philosophy brought into the project by the owner. This ethic was grounded on meeting the end-users’ needs —

delivering a well-designed, well-built and smoothly functioning rail link. These end users would use the facilities constructed by the front-line staff, who in turn required management and functional support that needed to come from the senior managers. When thought of in this way, it was clear that the end-users' overriding needs were to have delivered a safe, quality railway that was built right first time and opened with as little delay as possible from the date originally targeted. This philosophy is illustrated by the upside-down triangle shown in Figure 1.

## Contract Conditions

It has been noted that the New Engineering Contract (NEC) can provide a less confrontational approach to a construction project.<sup>1,2</sup> NEC is a set of contract conditions devised to introduce a partnering theme into the rather "staid" world of contracts. Its aim is to ensure that both the owner (or client) and the contractor achieve certain criteria relating to timescales when key objectives need to be met that are critical to the successful outcome of the project. These criteria relate to program, cost and quality, and bring the client and contractor "together" to ensure agreement in areas that had traditionally caused significant challenges with the older forms of contract development and execution — for example, in determining the cost of variations within the scope of the contract.

## The Partnering Process

The top-down direction of the partnering approach adopted on this project was its most significant feature. The main components of this highest-level partnership were:

- forming a Principals Group of senior managers;
- engaging a facilitator and professional coaches;
- establishing an emphasis on clear and effective communication throughout all levels of the project by the appointment of a communications manager;
- instituting a dispute resolution procedure; and,
- establishing the formal creation of a single

team, the Solutions Team, to address the collapse.

## The Principals Group

The Principals Group was composed of key directors and senior managers from all the service providers on the project, including consultants and commercial managers. The group's role was to "own" the culture of the project, including scouting ahead to smooth the way for the main construction tasks. A deeper responsibility of the Principals Group was to engender trust and team building between all the project parties. This trust building was demonstrated, for instance, by the development of an efficient and timely payment schedule on which the contractor could rely.

## Change Facilitators, Coaching & Workshops

The owner employed six highly skilled human resource coaches to support the single-team process. These coaches were used to educate the owner's staff as well as the other project parties. They used a variety of methods, including individual sessions and workshops, which were adapted for the circumstances. For example, for the team composed of construction foremen, a group would be assembled, possibly on site, to establish how they should cooperate within the single-team framework.

The first workshop was between the main contractor and the owner, the second between the lead designer and the owner, and a third between the owner (which was supported by its construction manager), main contractor and the lead designer. Discussion in these workshops was purposely open-ended. Generally, six or seven people attended a workshop, with a facilitator who brought out the challenges (not problems) openly to decide where the project was at that time and what gap needed spanning to achieve project objectives. At the end of the workshop, an action plan would be drawn and the relevant parties who could act on these plans assigned their respective tasks. Table 1 sketches some of the ways ideas were generated in these workshop sessions that ultimately became items in an action plan.

**TABLE 1.**  
**Idea-Generation Methods Used in Workshops**

<b>Process Improvement</b>
Remove waste & downtime through data-gathering, analysis, team discussion by focusing on priority areas
For example, improvement made in spray concrete tunneling speed
<b>Process Improvement Extension</b>
Main contractor trained its staff in process improvement skills
<b>Design &amp; Construction Integration</b>
Treating front-line construction operations personnel as "internal customers" speeded up answering of design queries
Approach included locating designers full-time on site

The coaches were used as a resource to support the major influences in designing programs that included teams of middle management and front-line construction and design supervisors so that the single-team strategy could be understood and adopted by everyone involved in the project.

Managing the partnering process down to this front-line operating level necessitated a careful approach. If there were shortcomings in the arrangements on site (for instance, dissatisfaction with the canteen or some other local matter), it was essential to correct this matter quickly in order to demonstrate to potentially skeptical workers that the new working approach was not just management window-dressing.

Workshops were also held with suppliers and subcontractors who were visited by the owner's senior project managers and were offered coaching and support to adapt to the single-team approach.

### **Communications Manager**

One of the owner's supplier surveys indicated that the owner's approach to communications could be far better than the perceived industry norm if it took some fairly simple actions. Generally, the people who knew least about the project were those who were relied on most — the front-line supervisors, and third-

and fourth-tier subcontractors and suppliers. Comments from these surveys were treated very seriously and led to the appointment of a full-time Communications Manager. The role of the Communications Manager was not just to publish a newsletter but to ensure that the processes existed that permitted messages to flow accurately from the management team to the appropriate front-line personnel, and that the management team received reliable feedback on its actions. This position was necessary because it took considerable time for some early messages from the management team to reach front-line project personnel, and when these messages arrived they were not always accurate.

The Communications Manager thus supported the facilitator and coaching process, developed a communications strategy and ensured that everyone involved in the single-team effort was aware of project progress, changes and crucial information (see Table 2). Among other things, the Communications Manager prepared and distributed regular newsletters, which cost about £2,000 (\$3,400) per month to produce.

### **Dispute Resolution Procedure**

While problems (read, challenges) were dealt with as far as possible down the line where they occurred, it was necessary to have an

arbitration committee to handle any issue that could not be readily resolved at its point of origin. This committee was called the Star Chamber and it was composed of the owner's managing director for the project and a senior executive director, and the contractor's project director and managing director.

## The Solutions Team

A crucial step in the single-team approach was the formation of the Solutions Team to re-engineer the required construction after the collapse while allowing other work, such as the running tunnels, to proceed. The team not only comprised the owner, main contractor and the lead designers but also representatives from the owner's loss adjusters and its construction managers.

The Solutions Team was located at the site. While all members were not housed in the same office, they were all within close walking distance of each other, which fostered a strong team working ethic. The team debated the various means of recovering from the collapse, which necessitated some form of retaining structure but whose form and size was not immediately apparent.

Following the success of the Solutions Team in addressing the immediate issues for recovery in the CTA, which led to the development of a circular cofferdam, the single-team approach was used (wherever feasible) on other facets of the rail link project, and these teams specifically included appropriate members of the construction team. Thus, there were various teams established whose members were working on different aspects of the project:

- a common quality team;
- a common planning team;
- a forensics team (which worked with the government's Health and Safety Executive that was investigating the collapse); and,
- a single commercial team, which combined the quantity surveyors of the client and contractor.

The owner's construction manager used a senior engineer brought in by the main contractor to serve as deputy and, in turn, this deputy

**TABLE 2.**  
**Fundamental Tools Used**  
**for Communication**

Management Maintaining a High Profile
Large Meetings (70+ People)
Structured Meetings
Subcontractors' Club (Groups With Members Who Have a Common Interest)
Process to Check That Messages Reached Those to Whom They Were Addressed
Risk Management Process

formed a single team composed of representatives from the main contractor, the design consultant and the owner's staff. This group was responsible for the overall supervision of the project.

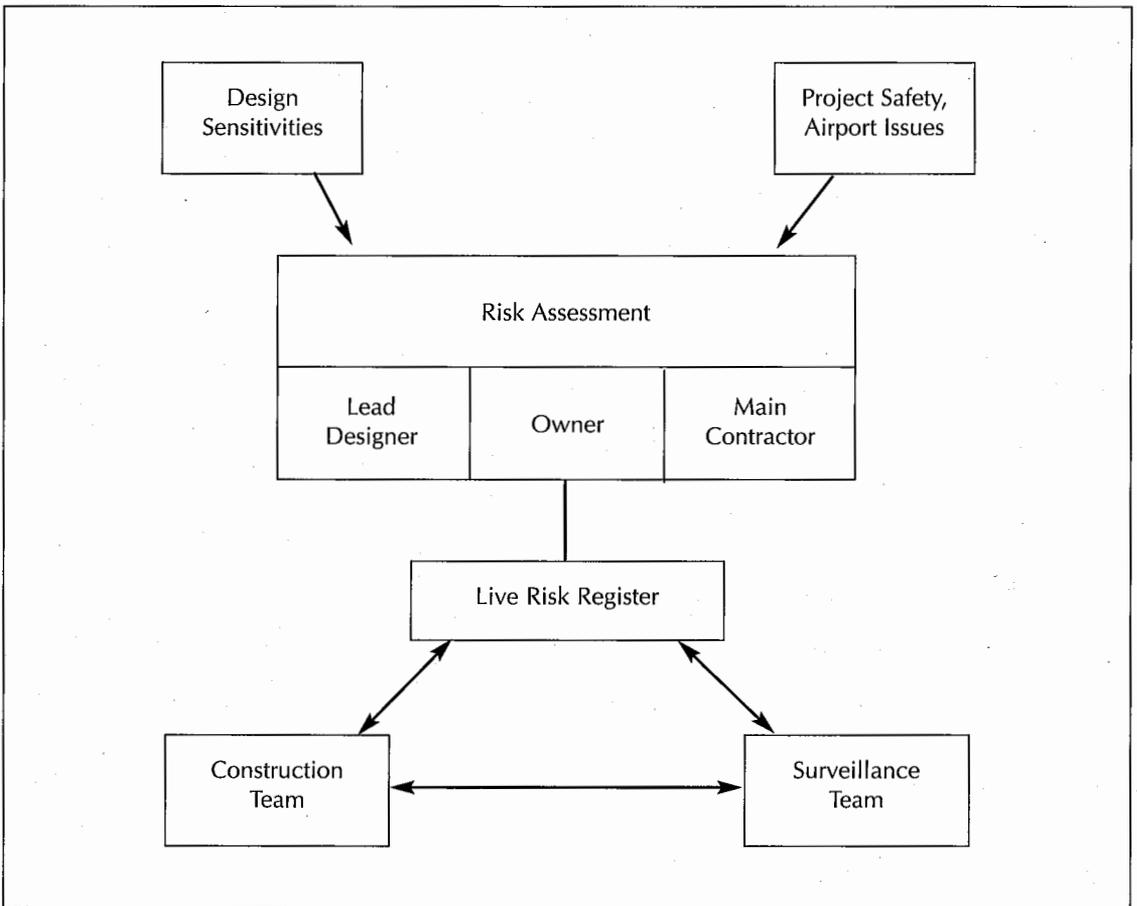
## Value Engineering & Risk Management

Much of the value engineering and risk management innovations in the HEX cofferdam scheme concerned controlling risk (a consequence of the recovery nature of the civil engineering task at hand). Of course, there was in place a process for monitoring ground settlements in the tunneling operations, but the collapse and additional uncertainties associated with the large cofferdam construction greatly sharpened the attention given to risk management.

## Project Innovations

The owner adopted extensive and wide-ranging measures to meet the exigencies of the situation, including:

- consulting with the British Atomic Energy Authority (AEA) to help formulate and assemble a viable risk management approach;
- taking on a specialist risk manager/coordinator whose whole responsibility was to assess project risk and run the risk management program;



**FIGURE 2. HEX Rail Link Project risk management process.**

- supporting the risk coordinator with two full-time facilitators (who were supplied by the owner's construction managers); and,
- developing a formalized risk management process that identified risks at a high level and then cascaded them through live risk registers to the teams that were managing the front-line design and construction operations (see Figure 2).
- *Red Risks:* Those risks that had to be managed in a special way and that needed increased monitoring and observation until the level of risk was reduced.
- *Amber Risks:* Those risks that needed watching through a regular key performance indicator (KPI) process to see if they moved in a red or green direction.
- *Green Risks:* Those risks that could be managed through normal management processes.

The observational method played a key role in the management of risk, particularly through the technique of progressive modifications. Although this method was a technically developed innovation, it was driven by managing risk through demonstrably maintaining acceptable levels of safety. The core of the process was specifying risk categories and the requisite response for that category:

The initial risk register was generated by a facilitated risk session. The competencies of the persons attending this session were thoroughly analyzed to ensure that the group's skills met the objectives of the exercise. If the necessary skills and experience were not present, either measures were taken to import them or the team had to recognize that this

**TABLE 3.**  
**HEX Rail Link Project Risk Management Process**

<b>Identify</b> the risks by listing those things that could go wrong in carrying out a particular activity.
<b>Quantify</b> the risks by assessing the likelihood of their occurring and their severity (first without control measures in place, then without control measures).
<b>Qualify</b> the risks by making them less severe through the introduction of control measures.
<b>Specify</b> what needs to be done to ensure that the risk control measures are in place and are effective.

exercise reflected a unique instance where the risks were increased.

The risk coordinator worked with the facilitators to manage the process, train others, run option selection workshops and ensure that an open process was established and used to measure team and project progress – for instance, whether red risks were decreasing or increasing over time. The initial session set the scenario for risks to be cascaded via live risk

registers to the various areas of the project to use with their teams. A team could add risks as necessary and regularly reviewed its risk register as a single entity. The principles of the risk management process, and the detailed procedure, are set out in Figure 2 and Tables 3 and 4.

**Innovation Outcomes**

For the owner, the risk management process

**TABLE 4.**  
**HEX Rail Link Project Live Risk Registers**

Attendance at live risk register sessions by appropriate personnel.
Production of detailed method statements that address issues raised by the live risk register session.
Preparation of risk assessments using standard checklists to produce a detailed field control sheet.
Field control sheets detail the hazards and control measures.
Communicate the hazards and control measures to the people involved via task briefings.
Necessary training undertaken.
Control measures are effective.
Control measures are communicated.
New control measures are identified.
Regular field inspections are made.
Field control sheets are updated as necessary.
Regular review every other week of live risk register and surveillance reports to ensure that the details are accurate.

provided an invaluable learning exercise, improving its application within the company. This risk management process has now been transferred to all of the owner's other construction jobs, and is considered as insurance against similar incidents in the future. The lessons of the HEX Rail Link Project have been fed into a risk database, and staff have been trained to use the information.

The value engineering and risk management procedures developed for the project were regarded as strongly complementing the single-team partnering process, forming an integral part of the toolbox of innovative developments that emerged from the project.

The aim was to have a "no claims" atmosphere. The Star Chamber was also assigned the responsibility of ensuring that change orders would be dealt with quickly. The make-up of the Star Chamber was an empowered top-management group from the owner and the contracted parties. The owner's Construction Director and the contractor's Project Director were empowered by the Star Chamber to reach timely agreement on the majority of these matters. If any of these matters fell outside the authority of the two directors, a recommendation would be made to the Star Chamber to allow it to discuss and reach an agreement. The contract's final accounting was settled within the target cost and within three months after completion of the project.

On any fast-track project, success fundamentally depends on a senior team (such as the Principals Group) making decisions at the appropriate time. In some circumstances, the owner will not have a full understanding of the contractors' challenges and vice-versa. In order to ensure that misunderstandings were minimized, a director from the contractor became the deputy to the owner's construction director and the two separate teams (owner/contractor) were amalgamated into a single team with the common purpose of successfully completing the project. An example of how this teamwork helped was the process of assessing the KPIs that commenced on a Monday morning and that culminated every Tuesday afternoon with a meeting of the

team. The objective of these meetings was to make decisions on the key items that could affect successful achievement of the KPIs. This type of single-team approach made it easier for members to completely focus on the objective of the project, thus eliminating the waste that is usually present when the owner and contractor take sides.

A challenge a project often faces is to "enable" a process that meets the demands of the construction teams in answering construction queries within a sufficient timescale to meet the needs of a fast-track six- or seven-day-a-week working project. In order to answer these queries in a timely manner, the management and design teams adopted a service-level agreement mentality with the front-line operations teams. This process meant that the consultants reorganized their ways of working and put teams of designers on site who were there during the same hours as the construction teams were. This process ensured that oppositional issues, which could have held up production and thus could have created waste, were avoided. Fundamental to this approach was thinking of the construction workforce as the internal "customer."

### **Summary of Beneficial Outcomes**

A project that encompasses complex processes can achieve a predictable outcome if all parties within the project work together to achieve a common goal — in this case, recovery from the collapse of the CTA tunnels and reducing the overall delay to the completion of the HEX Rail Link Project. The culture that is required to work toward such a common goal has to be owner-led from the top down. The lessons learnt at the HEX project range from the way in which the senior management teams supported each other within a "no-blame" culture to the mutual respect that all members of the team showed each other — that is, there was no blaming the workforce if the management team could not get its act together. This way of working can be applied to other projects, provided that the leaders of each of the major participants are prepared to work in a trusting manner and not "hide" behind the contract.

The use of coaching skills is not something that is just used in sports. The use of trained professionals in the art of coaching significantly supports the "planting" and "growth" of a culture similar to what was created in this project. Again, this approach can be applied to projects where people have a willingness to learn from others and where people wish to ensure that the front-line design and construction teams support each other in driving waste out of the project.

The identification and empowerment of top managers to form a Star Chamber to settle contractual issues, without recourse to arbitration and other legal processes, can significantly help in smoothing the process of project management as well as smoothing the process of making the final contractual settlements. The emphasis is on not "letting things get out of hand" because if there is not a fast, "clean" method to settle disputed items, then the teams that should be moving the project forward will be spending too much of their time sorting out and dwelling on matters that have occurred in the past instead of moving forward. This type of behavior can lead to the whole project losing sight of its goals and objectives.

Communication throughout all levels of the supply chain is vital to the success of a project. Communication should be treated as a key process and designed to perform crucial functions. It is very important that the whole team understands the vision of the project and is able to meet and discuss with the management team the challenges of the project. Communication with interested third parties and stakeholders is also vital and a member of the owner team must take on the whole communications process.

Risk management is a management tool and should be used in that way; it is not just a process that is aimed at safety improvement. The use of a very strong risk management process ensured that risks were allocated correctly and efficiently throughout the project. Top-management risks were cascaded and management was able to fully understand the risks of the front-line design and construction teams. Projects often have the "bottom-up" risks well defined but the "top-

down" risks are often not covered sufficiently. In this case, the top-down risks were sufficiently addressed.

## Conclusions

The main outcomes of the single-team approach for the HEX Rail Link Project as a whole were:

- saving the owner a minimum of £100 (\$170) million on what would otherwise have occurred — perhaps £40 (\$70) million in capital costs and £60 (\$100) million in lost revenues;
- maintaining payments and cash flow not only to prime contractors but also to a large number of subcontractors who faced unknown delays or possible termination of their contracts following the collapse;
- providing passenger benefits by minimizing delays in opening the new express line;
- providing relief from congestion to non-passenger traffic along the Heathrow route, compared to what would otherwise have been endured;
- boosting partnering in construction;
- improved communications between all members of the project team; and,
- improved decision making based on factual data, rather than custom or gut reaction, to set KPIs in order to monitor significant project attributes and challenges.

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planning, management and construction and excavation of this recovery solution that has required close and effective teamwork.

CHRIS RUST D'EYE, a Civil Engineer by profession, spent the beginning of his career in infrastructure design and construction supervision at airports. He moved into project management of terminal building construction, becoming Head of Engineering at Heathrow Airport and, subsequently, Construction Director on the Heathrow Express Project. Currently, he works for the Home Office, a

government organization, as Project Manager on a new Headquarters Building in Central London.

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