Fighting Fit

Delivering Defence and Security Infrastructure for the Future

November 2017

Balfour Beatty

About Balfour Beatty

Balfour Beatty is a leading international infrastructure group. With 15,000 employees across the UK, Balfour Beatty finances, develops, delivers and maintains the increasingly complex infrastructure that underpins the UK's daily life: from Crossrail and Heathrow T2b to the M25, M60, M3 and M4/M5; Sellafield and soon Hinkley C nuclear facilities; to the Olympics Aquatic Centre and Olympic Stadium Transformation.

Balfour Beatty has a strong track record of delivering defence projects in the UK. We deliver high-security infrastructure for all parts of the UK Armed Forces as well as for US Visiting Forces based in the UK. Our defence experience is extensive. We have delivered in excess of 1,000,000m^2 of defence facilities in the last 10-years. We were partners on four out of five of the original Defence Infrastructure Organisation (DIO) Regional Prime Contracts, the Housing Prime Contract and with Aspire Defence. We have also been appointed to the DIO National and Regional Capital Works Frameworks and have an active role in the development of the 'Next Generation Estate Contracts' programme.

Balfour Beatty has successfully delivered recent schemes at RAF Lossiemouth, the Ministry of Defence Lyneham training facility, and at RAF Brize Norton to develop a maintenance facility for the A400M, or Atlas, aircraft. We are working in partnership with Defence Estates on a seven-year framework for the upgrade of United States forces' married families' houses at RAF Lakenheath; and we have also recently undertaken delivery of heavy engineering and cabling works to the new Queen Elizabeth Class Aircraft Carriers for the Aircraft Carrier Alliance (BAE Systems, Thales, Babcock, DE&S).

Balfour Beatty Communities, a division of Balfour Beatty Investments, is one of the largest providers of military accommodation in the US. We deliver family housing services for the United States Army, Navy and Air Force. We offer comprehensive property management solutions and real estate expertise to customers in the multifamily and student housing sectors. We are responsible for 56 military housing communities in 26 states and Washington, DC. Approximately 150,000 residents in the US now live in townhouses, duplexes, single-family and renovated historic homes developed and maintained by Balfour Beatty Communities.

At the forefront of infrastructure delivery, Balfour Beatty takes a tailored approach to the design, development and construction work we undertake in defence and security. From offices, hangars, guardrooms, railways, army personnel accommodation and runways, our work helps support our Armed Forces as they live, work and train on the military estate. We play a key part in ensuring operational readiness, the delivery of new and existing military capabilities and a better defence estate. Our proven expertise in defence and aviation has enabled us to develop technically advanced delivery solutions that help to ensure a site's operational capability is maintained throughout our construction activities on base. Used to working to demanding timelines, we see it as part of our role to assist in driving down build and running costs and help improve estate utilisation.

Our specialist defence infrastructure team draws on Balfour Beatty's expertise across a range of sectors from highways management to aviation.

Balfour Beatty has rigorous security operating procedures as well as the certification and accreditation to handle protectively marked information. As existing sub-licensees to the Technical Assistance Agreement – US License TAA1276-14 we are International Traffic in Arms Regulations (ITAR) compliant and approved to handle Export Controlled information and F35 data. Our team is vetted and cleared through the Ministry of Defence, while our experience in delivering high security projects in restricted locations means that we understand and can manage the challenges of getting personnel and materials to the workface whilst maintaining schedule. We also have an approved digital collaboration platform for managing sensitive information in a secure environment. Balfour Beatty and our design partners Atkins and Burns & McDonnell have the infrastructure in place to handle information subject to UK and US Government security classification.

Executive summary

Future-proofing a defence and security estate of phenomenal size and complexity, with all the associated security requirements and costs is a significant challenge – especially against the backdrop of financial belt-tightening across Whitehall and a major reduction in the footprint of the military estate. But providing the infrastructure that enables our Armed Forces to live, work and train, plays a key part in ensuring the country's operational readiness and the delivery of new and existing military capabilities.

There are three key challenges for those involved in commissioning this infrastructure:

1. The need to keep costs down in delivering major schemes, while understanding the diversity of military infrastructure and the specific requirements and operational demands of the different services;
2. Building a strong relationship with contractors to ensure that skills and resource are ready and at the top of their game when and where they are needed;
3. Ensuring that defence and security infrastructure responds to the changing threat profile, as preparedness for war, anti-terrorist action and cyber-attack all demand different resources, skills and infrastructure.

In the short-term, meeting these challenges will involve moving to a different way of working between those responsible for commissioning schemes and the construction and infrastructure industry. This might, for example, include consistently using early engagement with the sector to provide a fuller understanding of price, value and the right outcomes, and ensuring contractors are invested in contract design from an early stage. It could also mean focussing more on performance specifications and less on prescriptive designs, and moving away from simply awarding contracts on the basis of the cheapest bid.

Over the longer-term, Balfour Beatty's view is that innovation will provide real solutions. New technologies, techniques and materials will bring significant changes to both the design and construction phase, and the life-cycle costs and performance of the infrastructure we build. That is why we are already offering digital features and products, and introducing analytics and other new digital services. Most recently, this has involved laser scanning, access control of workers via portals, and interactive "as-builts" to help us deliver our service more reliably.

However, construction is traditionally a risk-averse industry, nowhere more so than in the area of defence and security infrastructure sites. Innovation inevitably carries with it an element of uncertainty and risk. In particular, there is understandable concern within the defence and security community over potential security risks associated with new, connected technologies such as Artificial Intelligence (AI). Balfour Beatty believes that customers need to work with contractors more closely here to develop and adopt technology which meets security requirements, while at the same time delivering the efficiency and quality benefits it is delivering in other areas.

Innovation represents an enormous opportunity for all parties. Overly-detailed specification should be avoided where it prevents greater innovation and hinders suppliers in adapting to unexpected challenges which emerge once contracts have been signed. Barriers to developing and accepting innovative ideas must also be challenged, while those companies which pioneer innovative new ways to drive efficiency while maintaining quality should be rewarded.

By moving to a more partnership-based approach and using new technologies and innovation, those commissioning defence and security projects and companies such as Balfour Beatty will be able to work together to keep costs down while delivering the high-quality infrastructure our armed services need and deserve.

Key points

1. The relationship between contractors and those commissioning schemes must move away from being entirely transactional, as has been the case in the past, to become a partnership approach.
2. The best way of achieving a partnership approach is to align the objectives of the contractor and commissioning body, in order to encourage them to work together as a team to reduce costs and make savings.
3. Moving away from a traditional, fixed price arrangement can deliver significant benefits, especially for complex or high risk projects.
4. Commissioning bodies should consider introducing more flexibility into how contracts are delivered - while retaining clear outcomes. This could be delivered via outcomes-based commissioning.
5. Moving to a single contractor model also brings the opportunity to reduce costs and improve productivity by reducing duplication, leveraging volume deals with supply chain partners and estate standardisation.
6. Early contractor engagement can ensure that military operational considerations are fully understood and accommodated, avoiding disruption and potentially unplanned cost increases.
7. We must to move to a situation where tenders are assessed on true best-value criteria and not simply lowest initial cost. Lowest tender price rarely represents value for money for the taxpayer in the long run or the project outturn cost.
8. Over the next two decades, digital and other new technologies, such as advances in robotics and AI, will increase build efficiency and speed, while driving down operational costs.
9. Contractors must take into account the fact that in the defence and security sphere, new, digital technologies must be impervious to security breaches.
10. Barriers to developing and accepting innovative ideas, such as overly-detailed specification and automatically rejecting ideas proposed at tender or construction stage as non-compliant, must be challenged to ensure that new technologies can be mainstreamed and deliver benefits including cost savings.

Keeping costs down

The primary challenge in the commissioning and construction of defence and security infrastructure is the need to keep costs down, while maintaining quality. Customers will always rightly expect contractors to demonstrate fiscal restraint, reducing construction costs where possible, while improving project delivery and safety. Against the backdrop of fiscal restraint and a backlog of funding on defence and security infrastructure, it is even more important that those responsible for commissioning schemes find economies, and use and maintain assets more efficiently. Contractors must therefore find smarter ways of delivering the infrastructure that the armed services need. They cannot, however, do this on their own.

A partnership approach

Part of the solution to this lies in building a better relationship between contractors and those commissioning schemes, rather than operating on a solely transactional basis, as has been the case in the past. The best way of achieving a partnership approach is to align the objectives of the contractor and commissioning body, in order to encourage them to work together as a team to reduce costs and make savings. There are several different forms this could take. Perhaps the fairest and simplest model, is to agree a straight 50:50 split of all over/underspend. Such an approach helps develop partnering behaviours by ensuring that both parties share the risk and potential rewards equally, so both are incentivised to innovate, but take into account the financial risk of doing so.

There are a number of other ways the split can be agreed, depending on the behaviours and outcomes the parties want to achieve – for example, splitting the first 10% of any over/underspend equally but then giving the contractor a greater share of the overspend; or introducing a limit to the commissioning body's exposure in terms of overspend. However, the aim of all of these agreements is the same: to incentivise a more efficient approach. Moving away from a traditional, fixed price arrangement can deliver significant benefits, especially for complex or high-risk projects.

Similarly, commissioning bodies should consider introducing more flexibility into how contracts are delivered - while of course retaining clear outcomes. This could be delivered via an increased focus on performance specifications and less on prescriptive designs: a type of outcomes-based commissioning. Again, this is a form of partnership approach, where both parties work towards the delivery of a shared goal, using innovative solutions to drive costs down, rather than the contractor seeing individual targets that must be hit.

Using a single contractor

Reducing the number of potential different contractors also brings the opportunity to reduce costs. A single contractor reduces inefficiencies, maximizes productivity and establishes a strong culture of collaboration, delivering significant commercial savings, for example, in the following areas:

- Less duplication: The use of a single contractor can generate substantial direct and indirect savings. For example, if several contractors are appointed, there will, as a result of each contractor's governance rules, be unavoidable duplication across the different delivery teams – meaning several people employed to do the same thing. A single contractor mitigates this duplication, leading to a more streamlined team.
- Site accommodation: A single contractor can offer one team, co-located in a central command and control facility. If works packages are combined, allowing the efficient procurement and mobilization of site accommodation across the station, this has the potential to generate overall savings.
- A more efficient supply chain strategy: Savings generated via volume deals with supply chain partners can be leveraged and used to keep costs down.
- Whole life cost: On-going operation and maintenance costs can be reduced through estate standardisation. Efficiency can also be delivered by ensuring that products incorporated into the works are consistent, making maintenance easier and less costly.

Engaging earlier

The customer can also ensure a more efficient build by thinking more rigorously upfront about time, cost and quality to allow early engagement with the construction industry. Contractors need to be fully invested in contract design from an early stage. Earlier contractor engagement establishes practical, realistic logistical strategies and stakeholder engagement. It also ensures that military operational considerations are fully understood and accommodated, while avoiding unplanned and spiralling costs to both the contractor and the commissioning authority.

A bidding process for the long-term

Ultimately, the more precise and timely information potential bidders have access to, the lower the risk and the easier it is to price bids accurately. It is therefore in the interest of the commissioning body to ensure the data provided to the industry in advance of pre-construction/pre-tender is accurate, consulting industry where relevant (which often has its own, fulsome data) or changing the process to allow companies to bid to their own data.

More generally, the aim must be to move to a situation where tenders are assessed on true best-value criteria and not simply lowest initial cost. Lowest cost almost never represents value for money for the taxpayer in the long run. Contracts should not be awarded to organisations that bid the outright cheapest rates or prices – they are unlikely to deliver in the long run, either through lack of suitably qualified and experienced personnel, sub-contractor dissatisfaction, lack of cash, or due to wider commercial risk.

Finally, and taking a longer-term view, because so much front-end design work (and construction project management) is currently being procured through the Procurement Services Provider (PSP), it is increasingly difficult for consultants who are not on the PSP framework to keep up to date with relevant work and consequently to demonstrate the levels of recent experience invariably requested in pre-qualification questionnaires (PQQ). Balfour Beatty believes that this will, over the long-term, lead to a reduction in the number of companies able to bid for the work, which will lessen competition and increase prices, while impacting the industry's skills base. This should be addressed.

Long-term solutions

Over the next two decades, adopting and mainstreaming digital and other new technologies, such as advances in robotics and artificial intelligence AI, will be a game-changer for the construction and infrastructure industry. A new wave of innovation will increase build efficiency and speed, while driving down operational costs.

The benefits of digitization are clear to companies such as Balfour Beatty, which is already using them across the business and the projects it is working on. For example:

- Projects can be delivered more effectively and efficiently by harnessing the power of cloud computing and enhanced mobile technology.
- Building Information Modelling (BIM) in the form of 3D digital representation of projects overlaid with 4D detail on scheduling and cost, together with augmented- and virtual-reality technology enables seamless interaction between offices and sites facilitating a "build right first time" approach, keeping cost down.
- Drones allow teams to track progress safely, more efficiently and with increased accuracy, collecting data more frequently than human surveyors.
- Telematics are tracking how our vehicles are used, ensuring that we drive them economically, safely and sustainably.
- We are using data analytics to predict and prevent problems as they arise in infrastructure, rather than the slower, more expensive and less reliable "find and fix" model the industry has relied on for decades.
- Equipment with embedded sensors will also increasingly enable updates alert teams to the fact that they need maintaining or repairing, lessening health and safety impacts and time delays.
- Construction will get faster, with the advent of 3D printing of bespoke components and even entire buildings, and 4D printing where self-transforming objects respond to changes in heat, sound or moisture levels to change shape.
- Wearable technology will reduce injury and improve health while increasing productivity.
- New technologies will help improve accuracy and reduce human error.
- Balfour Beatty has been using VR simulation for Health and Safety training. The fully immersive simulation means that we can prevent on-site accidents through better training. Featuring different real world scenarios, the virtual experience gives workers the opportunity to experience live and potentially dangerous site environments, understand the space of the build, work out where heavy equipment should be placed and plan how complex elements of the scheme can be best undertaken – all from the safety of an office or training room and without the need for lengthy manuals, training sessions or specialist personnel.

Of course, in the defence and security sphere, new, digital technologies used must be impervious to security breaches and contractors need to take this into account. Balfour Beatty uses an approved digital collaboration platform for managing sensitive information in a secure environment when it works in these areas.

Balfour Beatty believes that continued investment in new technologies will also help address skills shortages, by helping to change out-dated perceptions of the industry, enabling us to attract a more diverse, skilled labour force and preventing the wage inflation we are currently seeing in key roles across the construction industry. Increasing use of robots and automation will also mean that the industry becomes more productive, creating new roles for skilled workers in cutting-edge areas, while reducing the need for those undertaking repetitive, manual tasks[1] such as bricklaying, lessening long-term health risks. Similarly, moving to off-site construction techniques such as precasting, prefabricating and preassembly has the potential to address the shortage of skilled labour while also maximising efficiency, consistency and precision, and improving health and safety. As a consequence, the industry's productivity is likely to significantly increase.

However, in spite of investment by companies such as Balfour Beatty, there is some way to go before we are able to deliver these solutions more consistently. Steps which still need to be taken include:

- Customers must demonstrate courage and help companies adopt new technology by, for example, examining the incentives, both regulated and non-regulated, that govern infrastructure networks, to address the fact that they often promote low-risk behaviour and impact on procurement processes. Although some more risk-averse customers say they are keen on innovation, in practice, alternatives proposed at tender or construction stage are rejected as non-compliant, even though the risk may be sitting with the contractor.
- Overly-detailed specification should be challenged where it prevents greater innovation and hinders suppliers in adapting to unexpected challenges which emerge once contracts have been signed.
- Barriers to developing and accepting innovative ideas must also be challenged and innovation enouraged, while those companies which pioneer innovative new ways to drive efficiency while maintaining quality should be drawn out for reward.
- The digital technologies used to operate and maintain infrastructure will continue to evolve once the infrastructure has been built. Infrastructure owners and operators will therefore need to develop strategies to integrate and use different generations of technology as well as Intelligent Information, effectively managed and reused.

[1] Will robots steal our jobs? Economic Outlook, PwC, March 2017

Case Study:

Building a new hangar for the A400M (or Atlas) at RAF Brize Norton

Following the 2010 Strategic Defence Review, it was announced that RAF Brize Norton would be the single UK station for all RAF air transport. RAF Brize Norton is the Royal Air Force's largest station and is home to its air transport and air-to-air refuelling fleets. The Defence Infrastructure Organisation (DIO) contracted Balfour Beatty to complete the structure of a 3 bay steel-frame hangar for in-depth maintenance of the RAF's new transport aircraft, the A400M or Atlas, at a cost of £42 million. The 45-metre long aircraft can carry 25 tonnes of cargo for more than 2,000 nautical miles and has a wingspan of nearly 42.5 metres.

At 28 metres high, the hangar covers 24,000m^2 and used 3,200 tonnes of steel to construct. The roof houses 600m^2 solar panels to provide up to 70 kilowatts of electrical power. The finished structure includes three separate bays to hold aircraft, a ground equipment store, engine and tyre bays, and a three storey office and amenities block. The hangar can house three A400M Atlas aircraft as well as the C17 Globemaster and the A330 Voyager when static.

The project was split into three parts: the 'enabling' stage, the works contract and the main building contract. Early stages of the project included levelling the site, diverting underground pipes and cables and installing emergency water storage tanks.

The building is clad in long-span composite cladding panels, which eliminated the need for large amounts of secondary steelwork and led to a quicker build time. Steel frame construction tolerances were tightened to enable the cladding to be directly fixed to the frame. Offices and other accommodation are housed in a separate building.

Beside the obvious structural needs the building also had to meet a range of other criteria. This included the Crown Fire Standards (CFS), with the ability to interface with existing and future site-wide systems including radar, security, energy strategies and infrastructure networks.

Balfour Beatty invested significant time and resource in planning and collaborative working on this scheme and focused on selecting high performing Tier 2 suppliers for key construction elements.

It was a challenging project, with construction taking place close to a live runway and within an operational RAF base with all the associated security requirements. But it was completed to time and on budget, safely and to specification.

Case Study:

Preparing RAF Marham for the new F-35B Lightning II Joint Strike Fighters

In March 2013, the Secretary of State for Defence confirmed that RAF Marham would become the main operating station for the UK's fleet of F-35B Lightning II jets. The UK has ordered a number of state-of-the-art F-35B aircraft so that frontline aircraft will be available to the Royal Navy and Royal Air Force for land- or sea-based deployments in the UK from mid-2018. This programme is vital to the future capability of the UK's Armed Forces and will ensure that the UK has a battle-winning fleet of jets deployable anywhere in the world. A large number of changes need to be made to the existing infrastructure in order to facilitate the arrival of the new aircraft.

Balfour Beatty is constructing three new facilities across 25,000m^2 of technical accommodation on behalf of BAE Systems to support the arrival of the F-35 Lightning II aircraft in 2018, these are:

- Integrated Training Centre;
- Logistics Operations Centre;
- Maintenance and Finishing Facility.

Throughout construction, Balfour Beatty is using digital tools including 4D modelling and BIM.

Balfour Beatty worked closely with BAE Systems, its customer Lockheed Martin, the UK Ministry of Defence's Lightning Project Team and RAF Marham to prepare for the project, meaning that the team was fully up to speed and that construction could begin swiftly.

This project builds on our existing experience of delivering highly complex and technically challenging projects for the UK Ministry of Defence (MoD) on live operational bases.

Balfour Beatty is dedicated to providing sustainable benefits to the local communities in which it operates and has planned to channel a minimum of £25m of project spend via SMEs. As members of The 5% Club, Balfour Beatty will ensure that the project generates opportunities for 15 apprentices, three graduate trainees and a further three work placements for students. The project will see 300 construction workers employed at peak.

Completion is scheduled for summer 2018, ready for the arrival of the F-35B Lightning II fleet in 2018.

Conclusion

Defence infrastructure is of critical importance to the UK, enabling the armed forces to train and prepare for operations and ensuring that they are able to effectively defend the country's national security.

Balfour Beatty is keen to lend its expertise to the delivery of a smaller, more efficient, better quality defence and security estate. The most pressing challenges facing those responsible for achieving that goal are the value for money imperative and the need to keep costs down. We believe that a combination of moving to a partnership model, early contractor engagement, using single, rather than multiple contractors and incentivising and supporting the adoption of new technologies would deliver significant savings, enabling the delivery of a defence and security estate that is fit for the future.

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