

# Profile



After 16 years in the Army, **Major Nick Francis** is making the move into civilian engineering. What have been the highlights of his career so far and what has he learned in the military that will help his new employer? Jackie Whitelaw reports.



**Nick Francis spent much of the last two years** on 24 hours' notice to move, watching the news and expecting a call ordering him and his multidisciplinary team of engineers and construction experts to get on a plane and go and solve a crisis.

This was towards the end of his 16-year contract with the British Army – and after all that time being on the edge of his seat, it's no surprise that he is looking forward to switching to civilian life in a couple of months and knowing he'll be available to take his two young daughters to school when they are old enough.

Francis is starting work with Eadon Consulting – a multidisciplinary firm that specialises in movable structures such as moving bridges, suspension bridge gantries, bespoke equipment for offshore construction and – good timing given the recent Hinkley Point C announcement – the nuclear sector.

He's thoroughly looking forward to the new role, but is clear that he has enjoyed his career as a military engineer, confirming his decision to sign up after he completed a Masters Degree in Engineering Science at Durham University was a good one. "In the UK we live in a bit of a bubble and I was interested to see if the Army would take me outside of that bubble. At the same time I wanted to do something worthwhile," he says. "I just knew the Army would offer me

experience I would not get elsewhere."

After the Royal Military Academy at Sandhurst, Francis served as an officer in the Royal Engineers, which included commanding counterterrorist search teams in Bosnia and Kosovo, running basic training for recruits and serving with the Gurkhas in Iraq. He instructed at the Royal School of Military Engineering and chartered as a civil engineer after working for Westfield and Arup as part of the qualification process.

Latterly, he has been leader of a squadron of 200 Royal Engineer soldiers, and then senior manager of an 18-strong Specialist Team of Royal Engineers within 170 Infrastructure Support Engineer Group who have been dragged and dropped on instant notice into various areas in support of the UK government's international objectives. 'International' in this sense has meant not only designing infrastructure to withstand very large suicide bomb attacks in Afghanistan, post-earthquake structural assessments in Nepal and designing hurricane-safe houses in Montserrat, but protecting the Hampshire town of Romsey from the 2014 floods (Box).

## Battling Ebola

The biggest challenge of his career came in late 2014 designing and building clinically safe emergency hospitals in the Sierra Leone jungle at the height of the Ebola crisis in West Africa.

"That was one of those late-afternoon phone calls," Francis remembers. "The last four years have been the pinnacle of my time in the Army and Sierra Leone was when I really brought everything I had learned together – the engineering and the leadership," he says.

"My boss had been sent out to Africa at 12 hours' notice. My team was supposed to be going to Cyprus but he called and said 'don't fly'. That was the Sunday. At 5pm on the following Wednesday we were told, 'Right, you are all leaving at 10pm tonight for Sierra Leone'.

"We all picked up a bag of jungle kit and were dropped at various airports to fly to Morocco and then converged at Casablanca. From there we got on the last remaining flight to our destination."

The following morning Francis and his team were told they had 10 weeks to open six Ebola hospitals. "The first question was, 'What's one of those?'" he says. "We were starting from scratch though there were some existing health facilities, but they had horrendous rates of infection for health staff, with over half of the people catching the disease. We knew we had to get the clinical safety right."

Francis, working under the direction of the Department for International Development (DfID), worked up what the principles were to establish clinical safety and created a standard design with materials that could be sourced locally and adapted for the six 200m × 200m hospital sites (Figure 1). "Basically it was simple blockwork



 **Figure 1**  
Makeni Treatment  
Unit, Sierra Leone

for ablutions and laboratories, and disaster relief plastic tents on concrete pads for treatment spaces, so we could fit the electricity and water supply systems through to them. The main complexities were agreeing the clinical procedures with all stakeholders, the remoteness of the sites, and the onerous mechanical services requirements.

“Waste was incinerated on site or buried. And no contaminated sewage could leave site.” That amounted to 400 litres per patient per day, with a planning figure of 100 patients. “It was vast.” Three

types of water supply were piped in separate ring-mains around the hospitals – raw water for showers and drinking, low-chlorine for handwashing, and super-chlorinated to treat the sewage which was sent to septic tanks in the ground.

“The tanks were going to be the most time-consuming element of construction; therefore, we innovated with buried shipping containers encased in concrete and local plastic water tanks to cut the construction programme from three weeks to three days,” Francis says. “The level of chlorination was so high that we were confident there was no risk of the Ebola virus surviving; in fact, the only problem was it killed all the bugs in the septic tanks so we had to take that into account.”

Work conditions in the heat and humidity were challenging. “We had considered bringing in British soldiers to work as the principal contractor, but this would have been very inefficient. So all the work was done through local contractors. Usually they need to score above 60% in the prequalification assessment to get the contract, and some of them were just scraping 23%. Yet we needed every contractor we could get, so my team was inserted to mentor them closely.”

Francis's team was responsible for the delivery of the three most remote hospitals, but his training and experience meant he was not fazed by the trial of building all these schemes at speed on different sites or coming up with a design solution from scratch.

“I am used to working out of a rucksack and from first principles. And in the Army you don't have the option of giving up; you just keep going. You are looking for the quickest solution using the resources available – the best solutions are usually innovative, but look simple; no one gives you extra credit for doing something clever, it just has to work.”

## Controlling the floods



“During the 2014 floods a stream running through the centre of Romsey was overtopping an earth embankment which was on the cusp of collapse,” Francis explains. “Working with the Environment Agency we identified a point upstream to divert the flow, but it could only be accessed by foot through flooded woodland.”

Working on the hazardous fast-flowing river, the team constructed a scaffolding A-frame in the flow, then clad it with plywood, successfully dropping the downstream water levels. However, overnight the sheer force of the water scoured away the riverbed under the weir and the structure started to deform.

“I knew we needed a durable solution, so took the decision to strip out the failing weir and re-design from first principles, using the lessons learned from the first attempt,” he says.

Using ropes and plastic bottles as floats to position scaffold poles on the riverbed, Francis was able to design and construct an improved structure, successfully taking 6t/sec out of the flow in the critical stream. The weir saved the embankment from failing, allowed flooded properties to be drained into the lowered stream, and was still working to protect the town over a year later.

“What you do need is the ability to see the wood for the trees. You have to be able to zoom right out and get the big picture, and then zoom all the way in to the nub of the issue and understand the particular technical detail that will make the difference. You are forced to focus on the critical and when you are leading a team that’s vital, as is enabling them to understand what is important and instilling the mindset to get the quality right first time.”

Sierra Leone gave Francis the most nerve-racking moment of his military career. “Work at one of the treatment units was coming to an end. Now, we were employing 300 people on each site and were the number one source of cash to the local community. Our priority was to push to get the job done as quickly as possible, but they could only see the end of their income. Tensions were rising between the workforce, tradesmen from the capital and the local army, which was also on site.”

The British Army is held in very high esteem in the country as it is credited locally with ending the terrible civil war in 2002. “So at no time did I feel threatened; but I was walking through the site seeing people starting to fight and could hear the local soldiers cocking their rifles.”

Fearing a nasty incident could kick off at any moment, Francis spoke with the local main contractor and from him understood that the motivation for the unrest was money. “So we called a pay line. Everyone sat down in a straight line to get their money and was paid slowly, over half a day, so by the evening the situation was diffused.”

### Building bridges

That victory was matched by another more engineering-led success when Francis spotted that the main bridge on the arterial route through West Africa linking Guinea, Sierra Leone and Liberia – a 250m span structure – had been fatally damaged by a bulldozer on a flat-bed trailer and was on the edge of collapse. He came up with a design for a repair (Figure 2) – working through the night with his *Structural Engineer’s Pocket Book* – but the bigger challenge was dealing with the politics of getting the repair carried out.

The British Army didn’t want to offend the local government by being seen to take over. “But I was an engineer, I’d seen the problem, I had to do something. DfID told me to work out how to get the bridge fixed. So I used one of our contractors to manufacture the steel box to be slotted in to effect the repair, I paid them through a variation order and rang the local highways agency to tell them I’d seen the bridge was about to collapse but had got a contractor ready to do the repair at no cost to them. It was all done in 96 hours.”

Francis has always loved bridges – he designed an award-winning oak and stainless steel footbridge for the 200th anniversary of the Royal Engineers in Chatham, Kent (Figure 3). “I got hold of a copy of the RE 1877 bridging manual and picked out the key principles, but made it modern-day best practice. I wanted the construction to be mainly timber because it was traditional. But it was also practical, the site was only accessible through a tunnel and all the material had to be manhandled in.”

### Demob happy

His desire to design is what has driven him in his search for a civilian post. “I am desperate not to lose touch with engineering and wanted a career where I could do technical design. But when you have been in the Army most companies look at you and think your natural next step is project management.” Eadon Consulting is giving him this chance.

“They are passionate about engineering and I liked that I would have the opportunity to work on challenging projects and develop my engineering skills across both structural and mechanical engineering,” Francis says.



Figure 2  
Repair to damaged  
bridge, Sierra Leone



Figure 3  
Oak and stainless steel  
bridge, Chatham, UK

He knows that adapting to civilian engineering will have hurdles. “In the Army there is a budget and everything needs to be accounted for, but ultimately you get what you need and if the priority is time, for instance, then you get a helicopter to fly kit in. And the absolute luxury I will miss is the human resource that is available when something is important and urgent. You just accept that you and everyone else works flat out until the job is done.”

He says that there is a useful technique that could be transferred to civilian engineering, particularly in the current drive to be more collaborative. “It is true there is a lot of shouting in the Army and I’ll have to curb my instinct to take charge. But in the Army you are allowed to question what’s being done, but only in a constructive way. We call it constructive dissent. ‘If you think something is wrong, tell me, but on the understanding that if I still tell you to do it, you will do it’. That has been a useful technique for keeping a team together.”

As his new career gears up, what advice would Francis give his younger self. “Pay attention,” he answers. “Absolutely everything that you learn, no matter what the topic, is going to be useful; you just don’t know when.”