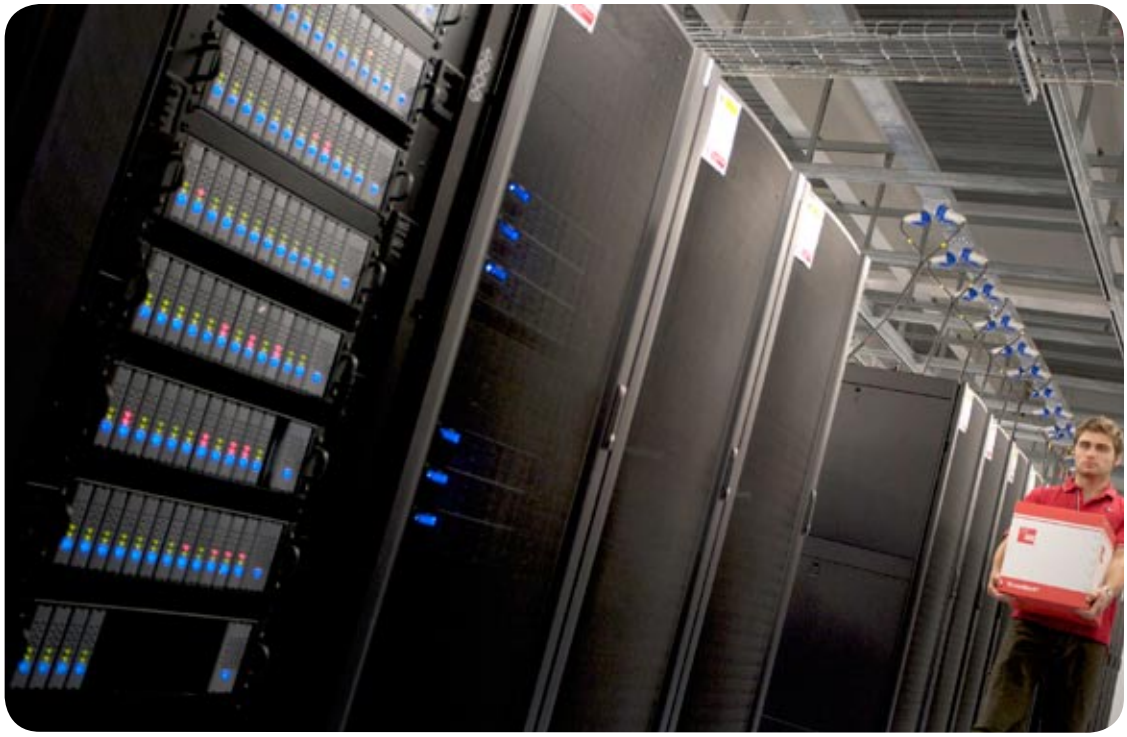
Heathrow Terminal 5: an IT infrastructure success story

CASE STUDY

Enough optical fiber to go around the equator, 2,485 miles of copper data cabling, 4,000 patch panels and 55,000 outlets spread over a site the size of more than 280 football fields; Heathrow Terminal 5 is one of the largest airport building projects of our time—doubling the size and capacity of Heathrow and due to make it the world's busiest airport by 2011.

And despite the operational problems, lost baggage and delays during the terminal's first weeks, the technology infrastructure worked perfectly from day one. It was designed for 24x7x365 fault-free operation.

When Heathrow's new Terminal 5 opened amid delays and baggage performance issues reported worldwide on TV news, the description "One of the most remarkable engineering stories of the 21st century, with innovative engineering and IT solutions at the very forefront of the achievement." would probably not have come immediately to mind.



Well, perhaps not. But these are the words of Dervilla Mitchell, head of design management at Heathrow T5 and director of Arup, the global design and business consulting firm. Despite the briefly notorious problems T5 experienced at the very beginning—which it needs to be said had nothing to do with the technology infrastructure—the comment is now actually perfectly reasonable.

Now that T5 is working well—which means of course it has disappeared off the front pages and TV screens—it is possible to see what an extraordinary project it is, and at the heart of it all is the massive technology infrastructure, which has worked perfectly from Day One.

The result is now up and running: ADC's total networking solution, based on its TrueNet® structured cabling system, combines copper and fiber connectivity with the best cable management products. It facilitates a range of data and voice applications, covering everything from supplying the data for passenger information displays, check-in desk computer systems and baggage handling security, through to point-of-sale units at the terminal's planned extensive retail and hospitality outlets.

"We selected ADC because it is a global company and has experience in providing robust solutions for data intensive, mission critical environments where any downtime can be disastrous," said BAA's Kevin Fallon. "The complexity of building T5 meant it was essential to have an end-to-end data and voice solution from one company that could respond quickly to our needs and had the technical resources to match our 24x7x365 operational needs."

Fundamental to that infrastructure is the structured cabling infrastructure and the networking and IT systems that are dependent on it. BAA called on their infrastructure provider Virgin Media (formerly NTL:Telewest), to design and implement the infrastructure which required a huge range of enterprise networking applications, based on copper and fiber connectivity solutions, to be deployed at T5. According to Virgin's program leader Kevin McLoughlin, ADC was the best solution for this critical role and they duly recommended them to BAA for use throughout the project.

"T5 has been a huge but exciting challenge for us," said Nick Norris, UK and Ireland sales director for ADC. "The new T5 building alone is big enough to fit around fifty football fields across its five floors, demonstrating the enormity of the task we faced. By working closely with Virgin Media and BAA, we have succeeded in providing what we consider are the best performance solutions available in the marketplace, which will guarantee a first rate service to the millions of staff and passengers who will work at and pass through the terminal in the future. And add to that, the fact that the TrueNet Solution, uniquely, guarantees performance with zero bit errors from any port to any port for a full 20 years, we have delivered a comprehensive, robust and future-proof infrastructure that will be the bedrock of T5's communications for decades to come."

Heathrow Terminal 5 is not the first time that ADC and Virgin Media developed the design and specification of the cabling system for a prestigious airport terminal, having successfully worked together during the building of Hong Kong's famous new airport. Both companies feel this experience was extremely valuable in helping them to create the right cabling solutions for T5.

The complexity of the T5 program is staggering. Virgin Media, one of three first tier system suppliers to BAA, headed the Systems Project, which included many applications such as Fire, BCMS and Systems Integration—but especially communications and security throughout the terminal. The Communications and Security Project itself divided into 15 sub projects, and had a total budget of almost $130 million. Massive though it was, the T5 Systems Project was just one of 18 major projects involved in building the terminal!

The statistics relating to T5 are equally impressive. When fully completed in 2010, it will enable Heathrow to accommodate 90 million passengers annually, cementing the airport's position as the world's busiest international airport. T5's total cost was over $5.5 billion.

Construction started in summer 2002—following the longest planning inquiry in British planning history! T5 is far more than a single building.

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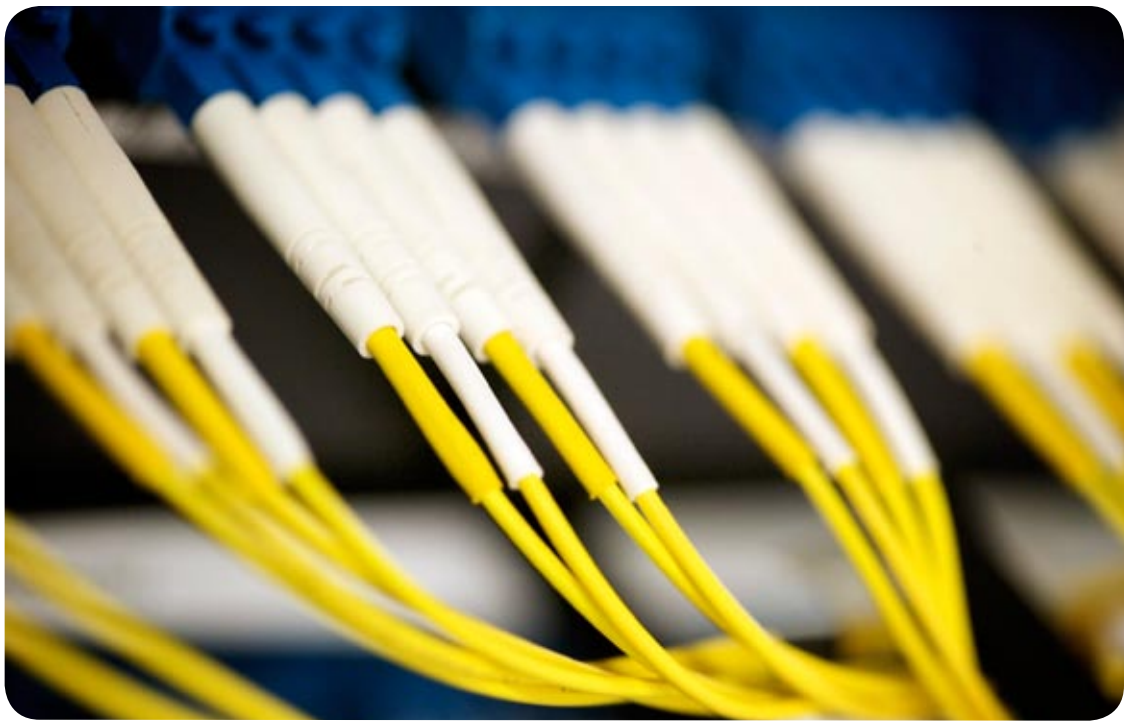


Apart from the main building T5A, it also comprises T5B, a satellite providing additional capacity and pier-served aircraft stands, and T5C, a second satellite building due to open in 2010. All three are linked underground by a Tracked Transit System (TTS), where driverless trains shuttle passengers to their gates. Other elements of the project include a six platform railway station underneath the main terminal, extensions to the London Underground Piccadilly Line and Heathrow Express, a spur road linking T5 to the M25 motorway, a new 285 foot tall air traffic control tower, and 60 aircraft stands.

The size of the entire site was 1 square mile. The Airside Road Tunnel, over ¾ mile, makes it the UK's seventh longest road tunnel. The steel used in the roof weighs over 18,000 tons, while that in the internal structure, at 27,500 tons, is equal in weight to 148 Boeing 747s.

For passengers, there are 96 self service kiosks, over 90 fast bag drops, 54 standard check-in desks, and 11 baggage reclaim belts that travel a distance of over 10 miles and can process 12,000 bags an hour. Some 1,700 miles of electric power cable have been used, with 20,000 13amp sockets installed.

ADC itself has some equally impressive statistics for the structured cabling infrastructure: it has supplied more than 435 miles of fiber cable, mostly single mode but also some multimode OM2. The fiber comprises a number of core counts, both internal and external, and if you add up the total equivalent of single core fiber installed at T5, it reaches the staggering figure of 26,000 miles (slightly longer than the distance around the equator). 3,500 fiber patch panels were needed to interconnect the fiber backbone.

The external fiber is ADC's steel wire armoured cable, and has already proved its worth. Following the recent emergency landing involving flight BA03 at Heathrow, the plane impacted airfield services. The only service still running after the event was that carried by the armoured fiber cable supplied by ADC.

In terms of copper cabling, ADC has supplied and implemented some 2,175 miles of Category 6 UTP; 155 miles of Category 6 S/STP shielded cable for T5's baggage handling system; and nearly 170 miles of multi-core Category 3 and Category 5e—here the equivalent length of single pair cable would be around 8,700

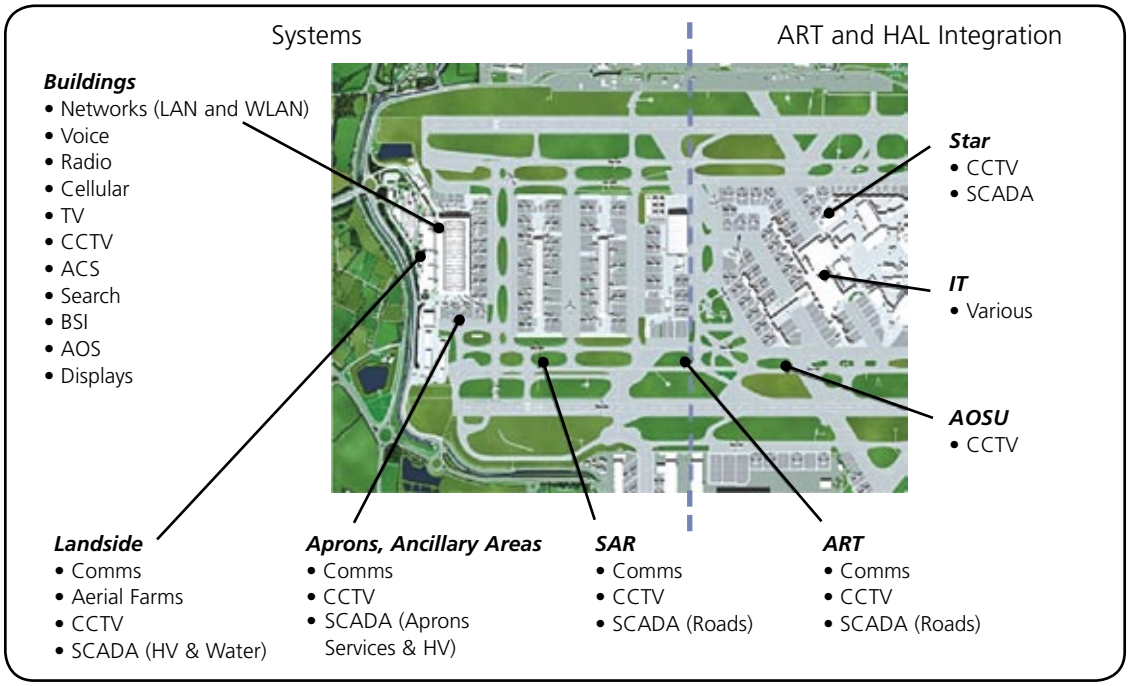


Figure 1

miles. Also installed are more than 55,000 Category 6 jacks, 3,500 fiber patch panels, 80,000 fiber pigtails, and 4,000 Category 6 copper patch panels.

All this infrastructure supports functions such as a 1,500 camera CCTV system, 1,100 secure access control points, a wireless LAN with 750 access points, and 2,800 telephones based on a hybrid architecture of analogue, digital and IP telephony.

The above diagram makes it clear that T5 is one of the largest projects of its kind that ADC has undertaken. ADC's cabling infrastructure supports virtually all the systems shown in Figure 1, even the radio and cellular are fed by the TrueNet fiber backbone.

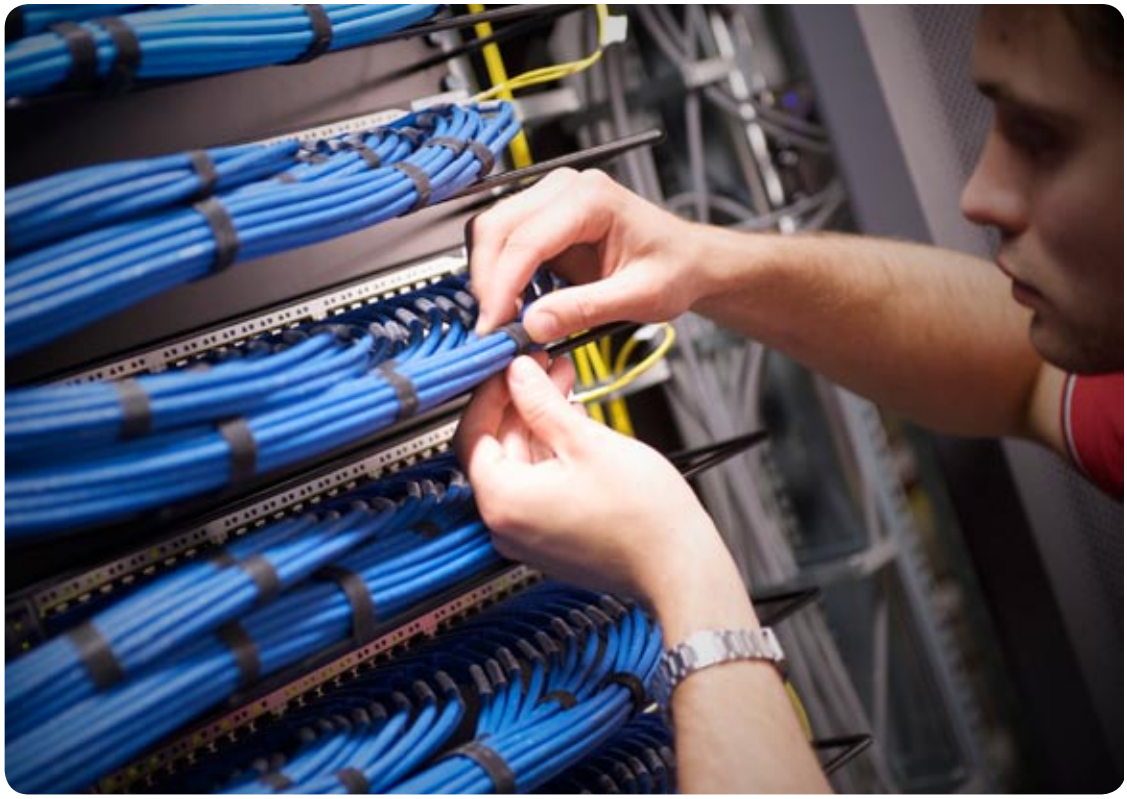
The application areas listed under Buildings* in Figure 1 all use ADC's fiber backbone and copper horizontal Category 6 cabling: LAN and wireless LAN (WLAN), voice, CCTV, access control system (ACS), and Security Search; while TV uses just the fiber backbone. The other three areas, Building Systems Integration (BSI), Airport Operational Systems (AOS) and Displays, covering flight information and baggage, also use the TrueNet cabling infrastructure.

On the Landside area is the multi-story car park, an energy center, and several small ancillary buildings. The aprons section concerns the clearing stands, areas around the buildings where planes park up for people to disembark and go into the buildings. All these stands have been provided with cabling infrastructure as well, to provide the same networking and communications facilities.

Additional systems supported include pre-conditioned air, a new technique for cooling the air on-board the plane as passengers board. Previously, this was done using the plane's engines, but the new systems now pump cooled air into the plane. Also supported are: lighting control, building control and building management systems—things like fan coolers and air handling units; metering, to show how much power and light is being used; digital media of various kinds other than the TV; and a network clock, which ensures all the terminal's clocks are on time.

Planning and installing the cabling and other infrastructure elements for all the systems described so far, and then getting them to work together, might sound challenging enough. But

* Within the T5 project, Buildings relates to all three terminals (T5A/B/C).



an equally demanding task related to the right hand side of Figure 1, titled ART (for Airside Road Tunnel) and HAL (Heathrow Airport Limited) integration.

Integration is the key word. T5 is providing increased capacity for Heathrow and for that to work effectively it was crucial that all existing systems were seamlessly integrated with the new ones being created. And even though many of the functional systems being put into T5 were ones already in place elsewhere in the airport, frequently the hardware, software and infrastructure supporting the new and the existing ones were different.

Integration was particularly important for applications like CCTV and SCADA (supervisory control and data acquisition), which had to be viewable across both sides of the boundary. Airport staff have to be able to use these systems to monitor and control operations from the airport's central control center. Achieving this in an effective, seamless way represented a huge challenge.

The second element of ART and HAL integration, was equally, if not even more challenging. BAA uses about 300 different software applications which needed to be implemented into T5. One being AOSU (airside operational safety unit) an operational center that monitors all non-air traffic on the runways. Again, all this is dependant on the structured cabling, either fiber or copper backbone, or the internal, horizontal Category 6 cabling.

To achieve the required integration, it was first necessary to establish the physical layer of the network, in terms of the fiber and copper, and ensure it was sufficiently resilient and diverse. Once that was in place, the core systems for the networks could be laid on top of the cabling. Then it was a case of making sure the connections worked well, and after that, ensuring people could actually view traffic from either end and control it.

Reflecting on the whole project shows how difficult it can be to accurately assess at the beginning exactly what is going to be involved, as Virgin Media's Kevin McLoughlin, program leader, explains. "For example, when we were going through the design stage, we had a huge increase in the number of Category 6 horizontal outlets that we had to provide. We started out originally with a requirement for around 12,000 across the airport, but by the time we finished our production design, and started the actual implementation of the project, that figure had increased to 55,000."

Unpredictability is exactly what happened when T5 first opened too. But as McLoughlin says, the teething problems were nothing to do with the technology infrastructure.

"Although it is true there were very unfortunate operational problems at the opening of T5, from the systems side, opening day was a success story. Our IT systems and infrastructure were fully stable, as they had been for some time, and they performed as needed, to fulfil the user requirements. We were happy! BAA was happy with the IT systems and now that it's fully operational, T5 is acclaimed as a major success story."

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