Airport White Paper

Cables and cabling solutions to support new airport priorities

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PRESS CONTACTS

Céline Révillon
celine.revillon@nexans.com
Tel. : + 33 1 56 69 84 12

Pascale Strubel
pascale.strubel@nexans.com
Tel. : + 33 1 56 69 85 28

For more information : www.nexans.com

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Synopsis

This report is intended to give a general overview of the global airport market, and provide information about how Nexans is serving this market.

It opens with an overview of today's dramatic growth in air travel and explains the key forecasts in terms of passenger and cargo growth, aircraft size and movement. Even despite intense building and expansion, according to experts, the world will still have to face a 1 billion passenger shortfall by 2020; and so there is no likelihood of an abatement in airport development. The paper then reviews the new Airport Cities development and explains how a new paradigm shift is changing airport activities. The first section concludes with an explanation of why cables are so important for airports.

Part II looks at the specific area of airport infrastructure, and explains the relevant Nexans products and solutions.

I. CHANGES IN THE AIR

"Airports will shape business location and urban development in the 21st century as much as highways did in the 20th century, railroads in the 19th and seaports in the 18th."

Dr John Kasarda, Director of the Kenan Institute, Un. of N. Carolina

i. Dramatic growth in air travel

Although there are probably over 13,000 airports of all kinds worldwide, a far fewer number function as international gateways, or provide important regional and domestic service. Depending how they are counted (major versus minor), they could range from about 950 to as many as 1,643 premier airports worldwide (the current membership of Airports Council International/ACI).

These large building and runway complexes exert considerable impact on local, national and international economies. According to recent figures from IATA, in 2007, 831 million passengers flew internationally and 1,249 million flew within their own country of residence. This represents an 11% growth in international traffic and an 8% growth in domestic traffic relative to 2006.[1]

The economic benefits of business air travel, tourism and commerce are incalculable. It is evident that the 355% growth in world trade over the past 30 years owes much to air travel, and the international links that travel creates. Of course, the continued growth of air transport exerts pressure on airports, and their future development.

Airports worldwide employ over 350,000 people directly and over 4.5 million in airport-related jobs. Roberto Kobeh González, president of the Council of the International Civil Aviation Organization (ICAO), remarks that opportunities flowing from an upward trend in air traffic is enormous in terms of the economic contribution of civil aviation to world prosperity: "In the global economy, every 100 dollars of output produced and every 100 jobs generated by air transport trigger additional demands of some $325 and 610 jobs in other industries."[2]

In other words, air transport (and by extension airports) create terrific economic spin-off; and that is why so many countries are now strategically upgrading and expanding existing or "brownfield" airports, while others are creating new or "greenfield" airports, often in far-flung and unexpected places to serve the world's growing economies and markets.

Much of this high growth depends on cables, since energy and information infrastructures are at the core of airport operations, and are critical to issues like safety, security, efficiency and service, while making an important contribution to cost reduction.

ii. Forecasts: 2006–2025

To fully comprehend what is a "paradigm shift" in airport building and priorities, it is important to first survey the global traffic forecast between 2006–2025.[3] According to the Airports Council International (ACI), the main trends are visible in passenger travel, freight forecasts, aircraft movements and aircraft size.

Concerning **passenger travel**:

- By 2010, the number of global passengers annually is forecast to surpass the 5 billion mark and by 2025 there is expected to be in excess of 9 billion passengers globally (compare this to a mere 8 million passengers in 1945).

[1] See IATA's recent report on national and international passenger air traffic: http://www.iata.org/ps/publications/2007-results.htm
[2] According to Roberto Kobeh González's keynote address at the World Civil Aviation Chief Executives Forum of the Singapore Aviation Academy (SAA) on 11 December 2006: http://www.icao.int/icao/en/pres/kobeh/20061211_saa_en.pdf
[3] ACI Global Traffic Forecast 2006–2025 at : http://www.airports.org/aci/aci/file/Press%20Releases/2007_PRs/ACI_Forecast_Executive_Summary.pdf

- Overall, in the next 20 years, world passenger volumes will rise by 4% annually, with international flights outpacing domestic ones.

- In the immediate future (by 2007), due to its strategic location between distant markets and populations, the Middle East is predicted to be the fastest growing region and the only region expected to see double-digit growth.

- Asia, driven by the fast pace of growth in India and China, is forecast to see high growth rates of up to 9% up until 2009.

- North America will still remain the largest aviation market, but by 2025 will decline to a quarter of all passengers globally (i.e. Asia will take over as the leading aviation market).

- The mature European market will continue to grow by 6.2% annually, driven by low-cost carriers and strong Eastern European development.

Although, we tend to think of air travel only in terms of the number of passengers carried, the air cargo revolution is not to be underestimated. Over the past three decades, air cargo has climbed 1,395%. In fact, 40% of the total economic value of all goods produced in the world (comprising 1% of the total weight) is shipped by air. This includes over 50% of US exports, which are valued at $554 billion. Raw materials and bulkier items are still shipped by sea; however, nearly everything we associate with post-industrial, value-added goods, like microelectronics, pharmaceuticals, medical devices, luxury items, and many agricultural and seafood products are air-freighted.

This is why the ACI's **freight forecasts** are equally revealing, and even more economically significant:

- Freight operations (measured in tonnes) are expected to grow faster than passenger operations, tripling to 214 million tonnes by 2025 (i.e. 5.4% growth per annum).

- Most freight volume will be outbound from Asia.

- Strategic location, available oil supplies and new passenger hubs in the Middle Eastern region will benefit freight operations in that area (for warehousing, distribution, logistics).

Finally, **aircraft movements and aircraft size** will also have an impact on airports:

- Total movements are predicted to double by 2025 (from 68 to 119 million), requiring not only new airport infrastructure but also investments in en-route and terminal air traffic control systems.

- In the long term, Asia is forecast to be the high-growth region, tripling the volume of movements by 2025 (this will place it behind North America, but ahead of Europe).

- Wide bodied aircraft will continue to dominate certain areas (like the Middle East), but there will also be a huge influx of single aisle aircraft for domestic markets.

Geographically, the ten fastest growing aviation markets between 2006–2025 are expected to be: 1) India 2) China 3) Indonesia 4) Thailand 5) Turkey 6) Brazil 7) Mexico 8) France 9) Malaysia 10) Australia.[4]

[4] See the ACI World Report at http://www.airports.org/aci/aci/file/World%20Report%202004/WorldReportDec2006.pdf. The reason why the Middle East does not appear on this long-term list is that after having achieved double-digit growth in 2006, the ME is expected to "tail off swiftly," according to the ACI's Global Traffic Forecast quoted above.

iii. Despite expansion, a billion passenger shortfall by 2020

Thus the dramatic increase in passenger travel, along with freight and aircraft movement and aircraft size is what has led countries to launch 300 new projects to build or refurbish airports worldwide, including 46 major hubs.[5] It has also led Airbus to develop the new A380 jumbo jet aircraft, which will carry 530 passengers, meaning 35% more passengers and baggage. Already, major airports in Singapore, Hong Kong and Kuala Lumpur are designed to accommodate the new jumbo jets; and airports in places as distant as San Francisco, Munich, New Delhi and Mumbai are positioning themselves to receive them, as well. According to Pierre Jeanniot, Director "General Emeritus of IATA, about 20 major hubs around Europe, North America and the Pacific Rim will be ready to handle the A380 by 2007; and another 40 airports are expected to follow by the end of the decade." However, in terms of future capacity, there is a major problem as well, which was dramatically stated by Robert J. Aaronson, Director General, ACI:

> Seven billion passengers will use the world's airports by 2020. But given the current pace of construction and constraints on airport capacity, airports globally are likely to be equipped to handle over 6 billion passengers. A one billion shortfall in passenger capacity means extreme congestion, or turning away customers, at certain airports – a poor choice indeed for a vital industry.[6]

In other words, airport builders cannot build fast enough. This fact is compounded by the general aging of airport infrastructure, and the need to refurbish and expand quickly, which can be very difficult because of citizen concerns over noise and disruption, and complex approval processes in the mature aviation markets of North America and Europe. In the US, Denver is the only major new airport to have been built in the past 30 years. In Europe, only Athens and Oslo obtained new airports in the last decade. Regulatory red tape and public enquiries accounted for the fact that it took six years for Heathrow to get permission to begin construction on Terminal 5, and Auckland seven years to get approval for a second runway.

iv. Airport Cities or Aerotropolises

Despite relative stagnation in Europe and North America, a new concept is emerging from the East which will eventually impact established airports everywhere. One of it's leading proponents is John Kasarda (quoted at the head of this White Paper) who believes that since airports are the driving force of the global economy, rather than banish airports to the edges of cities, we should move them to the center and build our cities around them.[7] In fact, an aerotropolis can be defined as a city in which the layout, infrastructure and economy are centered around a major airport. "Airports are now effectively a part of global production systems," Kasarda says, "and without that connectivity, you're out of the game."

In other words, individual companies are no longer competing for business; rather supply chains, networks and systems compete with each other. The airport is the mechanism that makes it possible to order a laptop by e-mail from a distant supplier, and then receive it within days or even with 24 hours via a Boeing 747. That is why factories, warehouses, offices, homes and schools will have to be built in near proximity to serve airport priorities, its workers, and the surrounding commercial and manufacturing community.

[5] To see some examples of current upgrades and expansion worldwide, please consult the Appendix: Current major airport projects in the world.
[6] Robert J. Aaronson: "Meeting the Global Challenge of Sustainable Airport Infrastructure" presented at the World Aviation Chief Executives Forum, Singapore, 11 Dec. 2006t: http://www.airports.org/aci/aci/file/Speeches/RJA_SIN%20speech_final.pdf
[7] See "Rise of the Aerotropolis" by Greg Lindsay at: http://www.fastcompany.com/magazine/107/aerotropolis.html

As the above map shows, there are already over a dozen airport cities or aerotropolises existing, under construction or being planned in the world, mostly in the Asia-Pacific region, but also in Europe and even in the US.[8] The major ones (and other significant regional initiatives) are:

1. **Hong Kong:** Hong Kong is basing its entire world-trade strategy on the primacy of its $20 billion airport. Chek Lap Kok already has a mini-city stationed on a nearby island for its 45,000 workers, and SkyCity, a complex of office towers, convention centers, and hotels will be within close proximity. It offers a quadramodal link for users (air, highway, rail, sea)

2. **Beijing and Guangzhou:** Beijing Capital Airport City is a $12 billion master-planned city of 400,000, capable of handling 80 million passengers in 2015, and will be prepared for the 2008 Olympics. Guangzhou on the Pearl River Delta is also undergoing massive airport expansion. Note that since 1990, China has experienced a boom in airport construction. Forty-seven new airports have been built while 90 airports were upgraded or expanded. A further US$6.7 billion over a four-year period on 37 new airports and the expansion of 31 others in the west of the country will bring the number of airports to 186.

3. **Seoul**: Another airport-centric city is growing around South Korea's Incheon International Airport. At its core is a quadramodal complex which combines retail areas, office blocks, logistics, manufacturing facilities, Information and Communications Technology (ICT), tourism, leisure and exhibition activities. On the Yellow Sea, 54 km south of Seoul, New Songdo City, is billed as the most ambitious privately-financed project in history. The metropolis of 350,000 people, many of them expatriates living and working on-site for multinationals, is being built on a man-made peninsula the size of Boston. The estimated $20 billion cost is being underwritten by Korea's largest steel producer and American real-estate developers.

4. **Kuala Lumpur**: The Malaysian Government plans Kuala Lumpur International to anchor the southern end of a Multimedia Super Corridor – a high-tech government, commercial, education and residential zone the size of Chicago.

5. **Singapore**: Currently, the world's most popular airport, Changi has created a compact airport city which functions as a pivotal transportation node in an island-wide aerotropolis (see Appendix ii). It offers modern commercial, business and leisure functions, as well as an Airport Logistics Park operating as a free trade zone and logistics center. A $1.8 billion 3rd terminal opened in 2008.

[8] These stories are largely documented in the foregoing article by Greg Lindsay, and "Planning the aerotropolis" in *Airport World*: Vol 5, No 5, Oct-Nov 2000, and "Asia's Emerging Airport Cities" in *Urban Land Asia*, December 2004.

6. **Bangkok**: On the border of Bangkok's suburbs, a new $4 billion mega-airport, Suvarnabhumi (the "Golden Land") airport has become the largest terminal in the world. By 2036, a city of 3.3 million people – larger than Chicago – will have grown about around it. A half-billion dollar high-speed train will connect it to downtown Bangkok.

7. **Indian cities:** Although there are no aerotropolises, as such, many airports are being significantly upscaled. With robust annual growth of over 40% in air traffic, Delhi and Mumbai airports are being endowed with world-class infrastructure. For the Commonwealth Games (2010) Delhi Airport will handle 37 million passengers per annum (and eventually 100 million). India's busiest airport, Mumbai International, has two new rapid taxiways and doubled the number of check-in counters. There are four new greenfield airports planned, and 35 others being upgraded to world-class standards.[9]

8. **Dubai**: Dubai Logistics City, with the Jebel Ali Airport at its center, started operation in 2007. The $33 billion, 140 km^2 project can handle 120 million passengers, and has 16 air cargo terminals to move 12 million tonnes of cargo per annum. Accommodating 100,000 people, it includes several small cities to cater to financial, industrial, services and tourism sectors.[10] Some 1.2 million m^2 of factory and warehouse space will serve customers including Boeing, Caterpillar, Chanel, LVMH, Mitsubishi, Porsche and Rolls-Royce. Second-ring, free-trade zones will host IBM, Microsoft and Oracle. And an outer ring will house residents, malls, hotels, office towers and a golf course. It will have twice the capacity of Frankfurt's airport, with three times the cargo capacity of the FedEx hub in Memphis. Due to its strategic location between east and west, this aerotropolis was destined to become one of the world's premier trading platforms. It is also less than an eight-hour flight from half the world's population.

9. **Amsterdam**: With 58,000 people employed on the airport grounds, Amsterdam's Schiphol Airport is already a functioning aerotropolis with a mix of shopping, dining and entertainment facilities, hotels, office buildings and multimodal transportation open to both travelers and the general public. It now operates as a full-fledged metropolitan Central Business District (CBD). Schiphol accounts for 1.9% of the Netherlands' gross domestic product, and this is forecast to grow to 2.8% or $14 billion by 2015.

10. **Detroit**: Henry Ford's once vibrant Motor City is now seriously considering a vast airport design which could turn it into the next commercial/industrial complex and global portal, providing an engine of development for a largely dormant region.

v. A paradigm shift for airports

Having established the fact that passenger and cargo growth is exerting internal pressure to build new airports and to expand and modernize existing ones, often resulting in self-contained mega-airports, there are several factors that are determining how this new building is to be done. According to Urs von Euw (of Unysis):

> Profound transformation of the air transport industry has impacted airport infrastructure and driven the need for next-generation innovation, especially in the areas of passenger handling and terminal management.[11]

The complex dilemma facing airport designers can be simply stated: How do we move more people, more freight, more airplanes within airports and between airports, especially in the face of current world instability and asymmetric threats (i.e. global terrorism)? Given the complexity and density of air traffic, overall flight safety has become a top concern. Airports increasingly need enhanced equipment, systems and networks to assure safe takeoffs, landings and ground and air control. Terminal and building safety is also an issue, especially since the dramatic fires in Dűsseldorf (1996, 17 dead, 62 injured), Amsterdam's Schiphol (2005, 11 dead, 15 injured), and Istanbul's Ataturk airport (2006, cargo area, 3 injured).

[9] Atreyee Dev Roy : "Towards world-class airports" in *The Financial Express* at http://www.financialexpress.com/fe_full_story.php?content_id=163463
[10] See *Airport Cities* magazine, available at http://www.lnnnews.com/images/ac1.pdf
[11] Urs von Euw: "Security, Service and Cost Reduction: A paradigm shift in airport IT applications towards low cost and maximum security" White Paper, available at www.unisys/transportation/insights/white-papers

In its January 2007 issue, *BusinessWeek* dramatically stated: "With global terrorism, environmental concerns, and increasing numbers of passengers, airports must change to meet new needs." For example, the need for increased security checks not provided for within the original architectural design of airports has led to bottlenecks and retrofitting. Since people must go through security well in advance of their flights, there is also a pressing need for new entertainment, shopping and leisure facilities that go far beyond the now redundant "duty-free zone" concept. Mugs, souvenirs and T-Shirts are now being replaced by new concepts of specialty retail, where airport shops and malls provide a real alternative to sophisticated downtown shopping. The world's top ten airports for 2006 clearly demonstrate that facilities and service within the airport environment were what generated high traveler satisfaction.[12]

Airports are continuing to evolve from simple transport infrastructure towards complex commercial enterprises. A definite trend has been the privatization of airports or public/private partnerships whereby airports become independent airport authorities which are run like self-supporting, profitable businesses dedicated to innovation, entrepreneurship and commercialization. Airports such as Copenhagen, Zurich, Malaysia Airports, Frankfurt and the Airports Company of South Africa have all gone this route. Ironically, given its market tradition, it is still illegal to have a privatized airport in the US.

However, unlike other commercial enterprises, airports are vulnerable sites in terms of security. And as Urs von Euw points out, precise and safe operations are often at odds with profitability and attempts to optimize the cost of operations. This contradiction has created a need for greater efficiency at airports at all levels. Operators must simultaneously reinforce safety and security, maximize capacity, enhance the customer experience and increase revenues, which is quite a challenge.

vi. New airport priorities

These called-for changes reflect new airport priorities, and affect virtually every aspect of airport operations, safety, security and services. And as you will see, in the second part of this paper, they involve an entire range of cables for all airport infrastructures, from national energy and communication networks to multiple terminals and hangars, control towers, and runways. For mega-airports (aerotropolises), they will even include warehouses, buildings and entertainment and business facilities, and multi-modal transport links.

Energy applications for airports resemble other industrial, transport and building market segments. However, IT applications show some striking contrasts and high growth. Currently airports worldwide are spending around US$3 billion on IT annually, and 64% of them increased IT investment in 2006.[13]

IT spending (including infrastructures) has been driven by several initiatives to improve airport efficiency: from IATA'S **Simplifying the Business**, which recommends leveraging technology to reduce the cost of complex industry processes, including passenger ticketing, cargo invoicing, check-in and baggage handling, to the FAA's **NextGen** initiative. The latter strives for:

> …safer and more efficient movement of people and goods throughout the US and around the world. It will be a smarter system, allowing pilots to have greater control of their flight paths and giving them vastly improved situational awareness through greater use of new technology. It will be a system flexible enough to accommodate whatever type and mix of aircraft we might see in our skies by 2025.[14]

[12] The World's Best Airport Awards 2006 went to : 1) Singapore Changi, 2) Hong Kong International, 3) Munich, 4) Japan's Kansai International, 5) Seoul Incheon, 6) KLIA Kuala Lumpur, 7) Helsinki Vantaa, 8) Zurich, 9 Dubai International, 10) Copenhagen

[13] According to *Airline Business* magazine: "The Airport IT Trends Survey: 2006" available at: http://www.sita.aero/NR/rdonlyres/F5953D0C-D08E-484A-8D34-9E05D2CA4AA3/0/AirportIT_Booklet06.pdf

[14] From Airport Technology : "These are the days" available at www.airport-technology.com/features/features907

Finally, there is the European Commission's **Airport Package** which addresses issues of capacity, efficiency, safety and security in the European airport system.[15] It was developed in the context of previous measures and developments which have seen the liberalization of European air transport, significant growth in air traffic (particularly within Europe itself), and regulatory measures to maintain safety and efficiency, including the development of the **European Aviation Safety Agency** (EASA) and the **Single European Sky** (SES) package to harmonize air traffic management. To address the capacity crunch, the Commission proposes actions in five key areas:

- Make better use of existing airport capacity
- Provide a consistent approach to air safety at airports
- Promote "co-modality" of air and other transport modes
- Improve environmental capacity and planning framework for new airport infrastructure
- Develop and implement technological solutions

Some of the new airport priorities laid down by governments, agencies and associations can be summarized as follows:

1) **Biometrics**: machine-readable passports and their biometrically enabled versions (e-passports) should be available worldwide within the next five years. Home-printed boarding passes can change owners or be altered; thus a secure link must be established between the individual and the document that ensures positive identity verification.

2) **Mobile marketing and web check-in**: Boarding passes will eventually have to be handled by mobile devices. Since these are individually owned, means must be found to improve one-to-one marketing. As with biometrics this will allow airports to increase terminal capacity by reducing the number of check-in desks, while offering passengers more time and freedom to move through the airport consuming more goods and services.

3) **E-ticketing and the bar-coding of boarding passes:** Bar codes have already replaced magnetic strips as a vehicle for data transfer. As of midnight around the world on 31 May 2008, travel agents stopped issuing IATA neutral paper tickets, and the industry is now at 100% ET. This allows bar codes to be printed on almost any paper by almost any home printer, saving the industry $3 billion a year.[16] Furthermore, the switch to electronic tickets will benefit the environment. According to IATA, abolishing paper tickets means that 50,000 fewer trees will need to be felled each year.

4) **Self-service kiosks and common-use kiosks**: Most existing deployments have been dedicated kiosks controlled by the airlines. Check-in desks need to be reduced, allowing passengers to identify and check-in themselves, thus eliminating needless processing and freeing passengers to shop, work or amuse themselves. There is also a trend towards common-use kiosks whereby airlines share infrastructure. This requires a high degree of system flexibility, compatibility and information-sharing.

5) **Tracking through RFID tagging**: Radio-Frequency Identification is now being used for employee identification, but it is already gaining ground with baggage management. Thanks to the lower cost of RFID tags, it will substantially reduce the number of lost, delayed and mishandled bags, and generate substantial savings for the airlines.

6) **100% TCP/IP**: For decades airlines have used separate proprietary data transmission protocols. Today TCP/IP, the Internet Protocol Suite has been adopted as a worldwide standard, enabling new services like IP telephony. In the airport environment, TCP/IP will make it possible for data to be exchanged easily across systems, countries and continents, while allowing for shared use at multiple airport workstations. It will simplify cabling networks and consolidate complex IT operations through Intelligent Infrastructure Management (IIM). It will also be easier to deploy. By allowing video over Internet, TCP/IP will make it possible to replace expensive CCTV surveillance

[15] INTERvistas : "The EU's Airport Package" at http://www.intervistas.com/4/reports/2007-02-06_The_European_Commissions_Airport_Package_Briefing_Note.pdf

[16] Pierre Jeanniot in *Airport Technology* magazine: "Adapting to Survive: An Industry Overview" at: http://www.airport-technology.com/features/feature565

cameras and provide digital images for baggage handling. It also makes it possible to connect actuators (for controlling equipment), cameras and sensors on one integrated network. It can also accommodate handheld, wirelessly connected devices. What has previously blocked TCP/IP adoption were the magnetic strips on boarding passes which require proprietary software (see above). The new bar-coded boarding pass will change all this, and reinforce the trend towards IP convergence.

7) **Air Traffic Control (ATC) improvements**: IATA is convinced that optimal ATC could reduce the global fuel bill for airlines by 18%. Saving a minute of fuel burn on every flight would save $3.5 billion in operating costs, as well as 4.2 million tons of CO_2 emissions.[17] Air traffic is growing by 4% per annum, and by 2025, 60% of European airports will be congested, and the top 20 airports will be congested for up to six to eight hours a day.[18] To meet this situation, NextGen and the Single European Sky (SES) concepts are also driving several other ATC developments:

   - GPS satellite navigation for air corridor precision, instead of ground radar
   - Integration of Galileo, the European satellite navigation system
   - A "free flight" operating concept that allows pilots to choose their own flight paths
   - Synthetic vision and new avionic tools for safer terminal operations
   - Wake turbulence avoidance systems
   - Improved landing and take-off precision, making it possible to add a 3rd or 4th runway between existing parallel runways
   - Convergence between American and European systems
   - Global Air Traffic Interoperability (GATI)

   According to the SESAR consortium, which is devising a master plan and performance goals for a new European ATM system, an optimized air traffic management will "ultimately be able to handle three times more traffic than today, at a 50% lower ATM cost per flight."[19]

8) **Information integration**: Airports need to operate as a synchronized, coordinated entity. This means that much of what has been mentioned above has to be fully integrated if safety, security, efficiency and cost goals are to be met. Rather than disparate standalone systems with unique interfaces, information is going to have to move between air traffic control, airline systems, airport operators, handling agents, and even cleaning and catering services. According to Urs von Euw, diverse data captured throughout the airport will have to flow, merge, be processed, shared and then acted upon (often automatically) to fully rationalize airport operations:

   > While often done manually today, the introduction of 100% TCP/IP and RFID, automated sensors and actuators could be used to emit constant signals that are transmitted to application systems that could update the status of a flight departure, a passenger, piece of cargo or baggage moving through the system. The knowledge of the whereabouts of time-critical components, such as passengers, staff, vehicles, containers and baggage, is essential to guarantee the punctuality in an airport operation. Moreover, this kind of knowledge is critical in maximizing the utilization of scarce resources (e.g. gate, stands, vehicles, etc.). Improving this process can enhance efficiency and utililization and decrease capital expenditure for expansion projects. At the very least it will lead to a better overview of airport activities and contribute to improved punctuality.[20]

Urs von Euw insists that rather than simply renew maintenance and further integrate expensive, complex and dysfunctional legacy systems, it is time to innovate from top to bottom by creating new cable networks and harnessing the potential of the latest IT technology.

[17] Ibid.,Jeanniot.
[18] Victor Aguado in *Airport Technology:* "League of Nations" at: http://www.airport-technology.com/features/feature909
[19] Roger Cato in *Airport Technology*: "One Step Nearer: Europe's Future ATM System" at: http://www.airport-technology.com/features/feature906
[20] Urs von Euw: "Security, Service and Cost Reduction: A paradigm shift in airport IT applications towards low cost and maximum security" White Paper, available at www.unisys/transportation/insights/white-papers

vii. Why cables are so important

Exceptional growth, privatization and competition have forced airports to take on what were once airline responsibilities: passenger self-service, self-boarding, common-use kiosks, duty-free shops, parking lot security, adjacent hotels, and people movers. All of these things depend on systems and software, which in turn depend on support infrastructures which can carry both energy and information. In other words, the efficient running of modern airports relies on both energy and communications networks which are composed of a tremendous range of cables: from ordinary power outlets for vacuum cleaners to advanced LAN/WAN cables for air traffic and ground control.

To take just one recent example, the new high-bandwidth network backbone at Heathrow's Terminal 5 alone required some 2,500 km of cable, data LAN and security solutions. The advanced IP infrastructure carries voice, data and operational systems, ranging from digitalized images to access control, building management and water control systems.[21]

Energy and information are often imperceptibly interconnected. A new Air Traffic Control system that allows for a new runway to be built between two existing runways requires an energy network to power landing lights; a new baggage handling system means numerous fire-safe control and power supply cables; an expanded terminal requires everything from flat elevator cables to advanced surveillance, telecommunications and fire-fighting resources.

Moreover, as one moves from specific functions and systems to the complete airport environment (which includes the control tower, maintenance hangars and warehouses), the airport begins to resemble an autonomous industrial park; and at its fullest development – what has been called an Airport City or Aerotropolis – accommodates not only passengers and staff, but an entire working population that can run into hundreds of thousands, or even millions of people. An Airport City, like Suvarnabhumi near Bangkok, is a full-grown metropolis built around an airport.

As with industrial buildings, public buildings, offices, residences, and public transport systems, cables are omnipresent in the airport environment assuring high levels of safety, comfort, reliability, and environmental-friendliness. Since 97% of the world's airports now seeing security as a high or medium priority,[22] here, too, cables and cabling solutions have an important role to play.

As a global leader in the infrastructure, industry and buildings, Nexans offers an extensive range of cables and cabling systems, many of them especially designed for the challenging airport market.

[21] Jim Banks in *Airport Technology* magazine, "T5 – We Have the Technology" at http://www.airport-technology.com/features/feature916

[22] See *Airline Business* magazine: "The Airport IT Trends Survey: 2006" available at: http://www.sita.aero/NR/rdonlyres/F5953D0C-D08E-484A-8D34-9E05D2CA4AA3/0/AirportIT_Booklet06.pdf

II. CABLES AT THE CORE OF AIRPORT DEVELOPMENT

Nexans supplies a complete range of cables and accessories for airport infrastructures, from key energy and communication networks to multiple terminals and hangars, control towers and runways. This means that Nexans can provide a complete turnkey cable package for an entire airport, including standard or special cables, connectivity, Intelligent Infrastructure Management (IIM) and active components.

i. Energy networks and building infrastructure

Today's major and international airports are not small, and as been remarked earlier, often outsize giant industrial parks, largely because of the need for long runways which have to be strategically placed, and protected. The modern airport also has to contain enormous hangars, warehouses and other buildings, not least of which is the terminal, or more often the case, multiple terminals.

If we take Munich Airport for example (which ranks number 3 among the world's most popular airports), we learn a number of revealing facts. It occupies 1,500 hectares, or 15 square kilometers of land. Its two parallel runways are 4 kilometers long. The total floor area of its two terminals is 458,000 sqm. The total length of its baggage conveyors for the two terminals is 58 kilometers (handling a total of 33,200 pieces of luggage per hour). Its central area contains an underground S-Bahn rail station on a 46,000 sqm floor area. Its four multi-story and six underground car parks can receive a total of 20,000 visitors.

This kind of complexity and expansiveness, with critical buildings often located kilometers apart, demands secure and efficient energy network to keep all systems up and going.

Airports function as integrated but autonomous industrial units which link up with national grids. That is why it is important that they are compliant with the local standards of national power utilities. They must also be capable of assuming emergency power production immediately in the event of a crisis or blackout. And so, the energy network can range medium and high-voltage cables to assure a steady power supply down to reliable low-voltage cables for runways.

For the energy network Nexans supplies a full range of **high-voltage and medium-voltage XLPE underground cables and joints** for the energy backbone to maintain power for all vital airport applications (radar, control tower, and runway lighting equipment, etc). It also produces a wide range of **medium and low-voltage cables and wires** for general energy supply for lighting, heating, air-conditioning, etc. Special versions include flat cables for modular lighting in corridors and prewired conduits. **Fire-reaction cables** (up to 1kV) prevent fire propagation and reduce smoke emission, while **fire-resistant cables** provide power for alarms, smoke evacuation, lighting, sprinklers and safety lighting systems which continue to operate during a fire. Nexans special **radiant heating cables** provide roof de-icing and subsurface heating for outdoor public areas, including entrances, car ramps and parking areas.

Nexans is currently supplying energy cables to airports around the world, including Madrid Barajas airport and Korea's Incheon airport. Fire-performance cables are used in Barcelona, Charles-de-Gaulle (Paris), Nice and Bâle-Mulhouse airports. Having recently obtained UL certification, Nexans heating cables are not only used in Nordic countries, but also in China and North America to eliminate snow accumulation and ice.

ii. Airfield ground lighting

More and longer runways are of course vital to meet increased traffic and larger aircraft; and so are taxiways with provide a path between runways, ramps, hangars, terminals and other facilities. High-speed or rapid-exit taxiways allow aircraft to leave the runway at higher speeds and vacate the runway for other aircraft. Both surfaces are marked by a complex pattern of lights needed for night landings and for pilot guidance when taxiing. The lighting system is usually controlled by the control tower or a flight service station.

Nexans proposes a complete range of primary and secondary circuit airfield lighting cables.

Primary circuit cables run between the Constant Current Regulators (CCRs) and the transformers which step down voltage to power the individual lights. Carrying 5 kV of power they can run long distances, typically 500 meters, or 1 km and more. Since they must be underground, their sheaths are tough enough to support strain of drawing, and once installed are durable and watertight. These cables are available in several versions, with PVC, PE or XLPE sheaths. They are ideal for ducts, trenches or direct burial.

Located at the lights, themselves, are the **secondary circuit cables** which connect the transformers and the lamps. This is a low-voltage cable (1,000 volts) which can be three core, or twice four cores, or twice six cores. They are relatively short, usually about two or three meters, and are not only flexible but are watertight and can withstand extreme temperatures.

Nexans also produces **remote control cables** for operating the airfield lighting system. They usually run between the control tower and the CCRs.

Nexans has supplied airfield ground lighting cables to many airports and air bases around the world. It supplied 2,700 km of primary circuit cables to Abu Dhabi (UAE), 1,500 km to Jedda (Saudi Arabia), and 1,600 km to Hong Kong (China) International Airports. Secondary circuit cables are widely used in Europe, the Middle East and East-Asia. Nexans is the only cable company manufacturing both primary and secondary circuit cables (in addition to remote control cables) making a full lighting installation possible from a single cable supplier.

iii. Baggage Handling Systems (BHS)

In an airport, a BHS has three main jobs. First, it is used to move bags from the check-in area to the departure gate. Secondly, it moves bags from one gate to another during transfers. And thirdly, it moves bags from the arrival gate to the baggage-claim area. These multiple, interlinking systems are often in underground tunnels and can extend over several kilometers each. Because time is of the essence in busy airports, they can move at high speeds of up to 12 meters per second.

To give an idea of operational complexity, Madrid-Barajas Airport Terminal 4 processes 35 million passengers yearly. Fed by 174 check-in counters, its 97 kilometers driven by 1,400 separate motors of conveyers handles 16,500 bags and suitcases per hour. The system also includes a vast array of sensors, x-rays and automatic sorters, all of which generate a great deal of ambient heat.

To meet the special security requirements of airports, Nexans produces a full range of **flexible halogen-free (HFFR) power and control cables** which can handle temperatures of up to 90°C. In Dubai airport the average operating temperature for the BHS is 50°C. Ability to operate at high temperatures protects this cable from premature aging, while HFFR assures low smoke density and corrosive gases in the event of a fire. Offering the same fire-performance, **flexible halogen-free bus cables** are available in Profibus, Asi Bus, and Hybrid Bus designs for baggage handling, and other applications like security, surveillance, building management, and climate control, etc. The Hybrid Bus combines power conductors and additional bus elements, making it possible to directly power conveyer motors, while accurately controlling RPMs.

Where confined space and high density buildings do not pose a risk, **flexible PVC control and power cables** can provide an economical solution for some airports. And increasingly, Nexans' **plastic optical fiber cables** offer exceptional data capacity, small bending radius, and high mechanical strength in vibrating environments.

Nexans has supplied BHS cables for several world-class airports, including Sheremetyevo near Moscow, Madrid-Barajas in Spain, Dubai Airport, Changi Airport in Singapore, Kuala Lumpur in Malaysia, and Tan Son Nhat in Vietnam. As a supplier to Siemens for the Beijing airport project, Nexans supplied control and bus cables, along with 80 km of plastic optical fiber to take advantage of the latest baggage handling technologies.

iv. Communication networks

Airports share many of the same security, safety and service concerns as other large building complexes which receive and serve a large public: like campuses, corporate offices, large department stores and train stations. For communication networks, a widespread university campus might be the best analogy; however, busy terminals, high-tech control towers and maintenance hangars (which resemble small factories and R&D centers) each present their own unique challenges.

► Today's best terminals have shown that the traveling experience can have important added value, through new shopping opportunities, restaurants, entertainment, playgrounds for children, religious services, medical care, conference rooms, temporary offices, and wireless local area networks for mobile business people. Self-service facilities, E-ticketing, surveillance and security are areas within terminals that rely heavily on sophisticated communication networks. Cargo hubs have a similar set of special communication needs to keep goods tracked, safe and moving.

► Control towers are the very heart of an Air Traffic Control (ATC) system, which includes Terminal Radar Control (TRACON), and Air Route Traffic Control Centers (ARTCC), and they typically contain a sophisticated mix of data and communications equipment: radios for communication with aircraft, advanced local and international telephone capability, computerized systems for ATC, weather monitoring, etc. As mentioned in section vi. 7) on page 9 above, improving ATC often requires a serious upgrading of the control tower (including TRACON and ARTCC) cabling infrastructure to handle more voice and data information, more quickly and efficiently.

►Finally, aircraft maintenance hangars are mini-factories that unite more skills and functions than the average industrial plant. Here, engineers, technical writers, quality control inspectors, avionics technicians, sheet-metal works and airframe and power plant mechanics require a complex mix of laboratories, support shops, tooling facilities, and warehouses for spare parts. Pilot training and flight simulators are also often housed within the same complex. All of this requires an array of cables and cabling solutions that equals, if not surpasses, the airport terminal, itself.

To meet this triple communications challenge, Nexans provides not only cables and accessories, but a complete, integrated set of systems, equipment, and support software.

Nexans supplies complete **LAN/WAN cabling systems**: fiber for both backbones and horizontal cabling; and copper solutions, from Category 5e to Category 6a and 7a for horizontal cabling. Because of the need for long runways and strategically-placed buildings, airport "campus" requirements are best met with combined fiber and copper. Nexans multimode and singlemode **optical fiber cables and interconnecting components** can be used as backbones for Voice-Data-Image (VDI) and control applications within all-digital networks of modern airports based on Internet Protocol convergence. Fiber eliminates Electromagnetic Interference (EMI) in dense and "electrically polluted" environments.

To complement this are **active equipment, networking systems, and accessories:** this includes intelligent switches and converters for cable ducts, workstations and outside applications. Fast Ethernet and Gigabit Ethernet capacity are available for both fiber and copper-based infrastructures. Active networking helps airports meet their TCP/IP priority (see vii, 6) on page 9 above) for applications throughout the terminal and elsewhere, including e-ticketing, electronic boarding pass, web and mobile check-in, information systems, access control, etc.

Because transparency, preventative action and problem-solving are essential for network managers, Nexans has developed **Intelligent Infrastructure Management (IIM)**. This support software enhances visibility of airport networks by automatically mapping, locating, reporting and alerting on any event. Information from the network layer provides 100% accurate records of cable routing, connectivity, device identification, status, and location, etc.

Bus, Batibus and Profibus cables provide signal transmission for controlling measurement and industrial applications in the maintenance hangar workshops, and for controlling runway lights, radar, and weather detection devices in the control tower. They are also used for building management: from security and lighting to indoor climate control.

Finally, Nexans' **Voice-Data-Image, Closed-Circuit TV, and Voice-Over-Internet-Protocol cables** are increasingly being integrated on one platform to assure all surveillance and access functions so essential to airport security. A fiber link (sometimes with coaxial cables) handles multiple cameras where distance is a factor.

Note that all of the above cables offer fire-performance characteristics to protect people, materials and equipment in the event of fire.

Nexans solutions allow large hubs to operate over longer distances and at higher data speeds. Incheon International Airport in Korea and Changi in Singapore both use our cables and systems, as well as JFK's Jet Blue terminal and Phoenix Arizona's Sky Harbor International. Several TCP/IP applications have been realized at Cologne-Bonn Airport in Germany. However, a wide range of Nexans airport terminal cables are being used around the world: in Barcelona airport, Charles-de-Gaulle in Paris, Halifax International (Canada), Madrid, Dubai, Beijing, Hong Kong, Singapore, Frankfurt, Munich, Düsseldorf.

v. Bridge cabling systems

Static and mobile bridges (between aircraft and the passenger gates) require reliable control and energy cables. Nexans cables meet national standards, a wide voltage range and extreme temperature criteria.

Nexans offers a full range of bridge cables according to VDE, CC (Chinese), CSA, UL, and HAR (European Harmonization) standards, one of the few manufacturers to do so. These cables operate safely in the hottest and coldest climates.

vi. Aircraft ground power cabling systems

The apron is the part of the aerodrome set aside for loading, unloading or maintaining aircraft. A common problem at airports is that all airplanes on the ground use their APU (Auxiliary Power Unit) to generate electricity. An APU consumes 400 to 700 liters of jet fuel per hour each. To cut noise and pollution it is essential to provide an adequate ground support system providing 400 Hz electric power.

Nexans manufactures two types of cables to hand off power to aircraft while parked: unshielded and shielded PVC cables which are in fixed installations in ducts running between the terminal building and the gate or ground socket; and shorter cables, with a rubber PUR outer sheath, which can connect via the bridge, mobile tenders or service vehicles.

Nexans cables meet the strictest civil aviation standards for ground power supply.

vii. Airport Cities: the ultimate challenge

The areas above represent the core activities of airports, and are a mere sampling given the technological complexity of the airport environment. However, it is no exaggeration to say that Airport Cities (Aerotropolises) are in fact full-blown urban agglomerations, especially when considering that Amsterdam employs 58,000 people on the airport grounds, and that Bangkok's Suvarnabhumi will be the core of an encircling city of 3 million inhabitants, largely living off airport activities.

To serve the extended Airport City environment requires an even larger range of Nexans products and activities, as expressed in its corporate statement: "With energy as the basis of its development, Nexans is a global player in the infrastructure, industry and building markets. As a worldwide leader in the cable industry it offers an extensive range of cables and cabling systems which make life more livable, travel safer and work more efficient."

Nexans addresses a series of market segments: from energy, transport and telecom networks to shipbuilding, oil & gas, automotives, electronics, aeronautics, material handling and automation. In other words, whether it is basic infrastructure, specific industries, or residential, public or industrial buildings, Nexans has appropriate and complete solutions to meet the ultimate airport challenge.[23]

[23] To obtain further information about our global offer, we invite readers to consult marcom.info@nexans.com or to visit the Nexans website: www.nexans.com