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The Many Parts of an Airport

Weddings, funerals and celebrations: Airports are passageways to life's biggest moments. Along with overstuffed bags, laptops and treasured souvenirs, travelers carry joy and heartache. Next time you are in an airport pause and consider where you are and all that's going on, mostly out of sight to get you where you want to go, safely and efficiently.

An airport operates much like a small city and is responsible for providing services to a variety of users including: passengers, airlines, air freight carriers, private pilots and local transportation services, all who use the airport differently.

Like most hospitals and universities, a modern commercial airport is a campus consisting of many buildings, each with diverse utility needs and use patterns. Air traffic control towers, airfield lighting, baggage handling and screening, terminal security, passenger comfort and safety are critical services not only for the business operations of the airport but also for the security of the community and national aviation system.

Huge Energy and Huge Focus: Airports account for 5% of the aviation sector's global carbon emissions, but that's nothing to sneeze at when you think of their need for vast electrical distribution, emergency backup power generation, chilled water, steam (or hot water), potable water, sewer, natural gas, and incredible heating cooling / circulation capacity.

Most common energy-saving measures are expected in heating, ventilation, and air-conditioning units for incredibly large spaces that have extreme swings in occupancy. But many other energy efficient features are constantly being explored and implemented. From daylighting and LED systems to burgeoning advancements in fuel efficient ground transport and fuel cell powered baggage vehicles, the technologies and processes used in airports boast some of the country's greatest advancements in energy efficiency.

BOSTON: Logan International Airport features roofing materials that reflect the heat of the sun. It has automated and/or self-dimming lights throughout the facility; and restrooms with slow-flowing faucets and waterless urinals. It also installed special controllers on moving walkways reducing the power draw of their electric motors 24 hours a day. Just this feature alone saves of about 60,000 kilowatt hours per year. *The Average annual electricity consumption for a U.S. residential customer is 11,000 kilowatt hours (kWh).*

DALLAS FORT WORTH: (Texas) International Airport has a "continuous commissioning" program, in which the building monitors key areas and equipment for inefficiencies. It senses the weather and occupancy to trigger reprogramming in automation systems – it has saved over \$6 million in energy costs already.

CHATTANOOGA: Tennessee's new energy efficient airport and 9,000 square foot corporate flight center terminal facility includes reserved parking for fuel efficient vehicles – and a 3 million watt solar array that will power the entire airport.

DENVER: This International Airport, known as America's Best Run Airport from Time Magazine, was the first in the United States to implement an ISO 14001 certified environmental system encompassing the entire airport. The air terminal has a state-of-the-art parking "canopy" that is lit by LEDs and features geothermal heating and cooling. To save fuel in its aircraft on the ground, every mainline gate provides parked airplanes with plug-in power and pre-conditioned air so planes can turn off their on-board auxiliary power units. The savings are huge!

MINNEAPOLIS: MSP Internationals 3-megawatt solar installation is now complete on the top deck of two Terminal 1-Lindbergh parking structures. It is estimated that this installation will generate close to 20 percent of the airport's total peak power capacity and it is Minnesota's largest solar generation site. Coupled with a leading, and first-of-its-kind, project that converted more than 7,700 metal halide light fixtures in all four parking ramps to energy saving LED technology, the ramps also provide electric vehicle charging stations (currently 18).

Most progressive airports now promote eco-friendly transportation options to and from the airport, providing ultra modern mass transit hubs, requesting that cab services use hybrid cars, and encouraging travelers to share a cab through a free iPhone app.

Fuel: The airport's fueling system is analogous to a person's circulatory system. Fuel is the lifeblood supplied to aircraft (*a long-haul airliner like a 747 can carry as many as 50,000 gallons of fuel*). This vital need is provided throughout an airport using a fuel storage and hydrant distribution system. Critical to this is the pump pad, the heart of the fuel system. Depending on the size of the airport, the pump pad can be from three to 18 pump-and-motor combinations pumping from several hundred to several thousand gallons per minute (gpm). *The*

pump pad at Los Angeles International Airport, for example, is designed for pumping up to 16,000 gpm.

A major airport design and consultant firm recently completed a design build turnkey upgrade of the 35 year old pump pad at Salt Lake City International Airport, adding pumps and motors. The upgrade — call it a successful quadruple bypass surgery — has reduced the system's energy costs by 30 percent, all done without service interruption.

Airport Control: An airport operations center (AOC) enables total command and control in a single location for airport operators — for their daily work and in times of emergency or irregular operations.

All operations centers share the same fundamental technologies: robust and reliable voice, data and wireless communications; ergonomic workstations for staff; and integrated display systems. AOCs interface with local police, emergency responders, Transportation Safety Administration, and Federal Aviation Administration (FAA). Along with being prepared for irregular operations — spurred by an airfield incident, a snowstorm or even an air show — AOCs can also be "hardened," particularly in areas threatened by potentially catastrophic earthquakes, wind or flooding. Redundant power and communications keeps a center online, even if the building is isolated.

Because AOC work is critical and stressful, larger centers have amenities easy to *live in* during stressful periods; with support spaces, such as canteen areas and sleeping rooms. Some AOCs include a mobile command vehicle linked and able to duplicate AOC functions by reliable communications.

Surveillance cameras can be found anywhere at the airport not only for traveler and personnel safety but also for placing decision makers on site, tremendously boosting situational awareness.

Hangars - Maintaining aircraft: Aircraft hangars, by necessity, are large open buildings and are growing in size to accommodate ever larger aircraft, such as the Airbus A380 (525 passengers) and the Boeing B747-8 (465 passengers) *and those two aircraft manufacturers have even larger derivatives on the drawing board.* To give you an idea for things down the road; Beijing International has recently built hangars approaching a million square feet of space.

The right building shell materials can improve insulating values in any extreme climate, of course, but, also given a hangar's volume, there's no need to heat and cool the upper regions of the hangar to the same comfort levels required at the workstations below. When certain duties, such as vertical stabilizer and rudder work must be completed at higher areas, portable or small supplemental heating and cooling units are used. Nose-in only hangars are also designed with lower roof areas from back at the leading edge of the vertical stabilizer forward to the front hangar wall. Also, today's advanced glass, with high-tech filter coatings along with new technologies in insulated skylights and insulating plastic panel windows, preserve

energy efficiency and reduce lighting loads in the hangar bay.

Hangar doors make an entire wall of the building and present a huge energy-robbing opening. Even when closed, older conventional overlapping door panels are notoriously leaky at the edges. Doors are there to be opened, but new vertical rise fabric doors reduce the opening by being lowered at the tail section of the aircraft reducing the opening height over the wings. In spite of the questionable light weight of these doors, their insulation properties still finds them most prominently used in two extreme climates: the arctic and the desert.

The types and number of fixed maintenance equipment in hangars vary with the type of work performed in each hangar. The modern mandate calls for speedier access to the aircraft with efficiencies that translate directly into the growing need for shorter maintenance check turn times, and provide increased capacity for the hangar throughout its life. Line maintenance equipment must also emphasize speed because aircraft arrive for unscheduled maintenance to correct specific problems and need to be quickly dispatched. *The maximum dwell time is usually overnight.* At the same time, hangars must accommodate heavier maintenance checks that can last for weeks and require nearly constant access to every part of the aircraft.

This need for faster and faster access and the impedance from older floor space gobbling fixed stations make teleplatforms the magic carpets of the aircraft hangar. Mounted on overhead bridge crane systems, these platforms can swiftly travel to any point around any aircraft type for fast, direct and safe maintenance access. Designed to minimize floor area requirement for maneuvering, the newest generation platforms can turn 360 degrees within their own footprints. New mini units, as small as 1 square meter, can deliver a mechanic and his tools up into a wheel well, a lower cargo hold, and other tight areas with ease.

Any hangar requires general power; for tools, equipment, compressed air, water and communications lines, as well as the unique 400 hertz of aircraft power. *(More common 60 hertz American household power limits the RPM of the fastest induction motor to a maximum of 3,600 RPM. The maximum speed of a 400HZ induction motor is 24,000 RPM, approximately seven times faster, with 10 times the power for the same weight and size as a 60HZ motor.)*

These utilities and tools weren't always immediately available to aircraft maintenance personnel, or convenient to aircraft service points. Long cable or hose runs to distant wall-mounted connections created clutter and safety hazards. Now, new designs in utility pits offer multiple utility connections that "pop up" out of the pit to provide connections directly to the many aircraft service points.

New technologies are coming outside the hangar as well. Engine run-up (tests) are a standard requirement for maintenance, repair and overhaul (MRO) operations.

Wall/fence designed jet blast deflectors for these high powered and dangerous run-ups are now installed

near maintenance hangars, eliminating the previous need to tow aircraft over great distances to isolated areas. When these deflectors are combined with acoustical ground enclosures, they reduce the noise impact on the airport and surrounding communities particularly accommodating night testing, when high-power noise is an even more critical issue.

Security: Airports may manage their own police, fire and emergency medical services. As a major international airport with 63 million passengers annually, LAX maintains a highly secure facility. Along with the Los Angeles Airport Police, the Los Angeles Police and Fire Departments are first responders to any emergency and have a force stationed directly at the airport. There are over 1,100 sworn and civilian airport police in addition to the Transportation Security Administration, Federal Bureau of Investigation, Drug Enforcement Administration, US Customs, and Border Control agents monitoring LAX premises twenty-four hours a day.

Oversight: Critical equipment, assets and systems for airports don't always come with a user manual — or at least not anything that could possibly contain all the adjustments, operational requirements, repairs, upgrades and replacements necessary for keeping the myriad parts of an airport running smoothly and safe. Many facilities still lack sufficient information about past and existing conditions and increasingly need mass documenting for recently performed repairs and services as well as for

tracking issues that have arisen in the past, are still ongoing, or remain unresolved. Although most airport facilities are fortunate to have longtime staff with great amounts of institutional knowledge and know-how, as these longtime personnel retire and depart, fulfilling those positions and training replacements with vital information becomes even more critical.

Keep following these articles about aviation and the earth's wild blue yonder. Things are happening and are planned that will astound you.

Interest in a career in aviation has never been more encouraged

Consider this: Major international and local airports are tremendous and a continuously growing “economic engine” for communities, metropolitan regions and the country. Even back in 2011 more than 5 billion passengers flew somewhere in the world, aircraft moved more than 94 million metric tons of cargo worldwide and more than 77 million flights conducted all this activity.

On a national scale, U.S. airports in 2010 produced an annual output of \$1.2 trillion and were responsible for about 8% of the gross domestic product. Between the airport operators, airlines, concessionaires and others, airports directly employed 1.3 million people and supported 10.5 million jobs in the United States, amounting to approximately 7% of all U.S. jobs. Aviation is ever moving, up and up. Get on Board!

