Spare Part Supply Chain: The case of airlines
CP

◆ CP is a Hong Kong based airline
  – Established in 1946 to fly between HK, Australia, Southeast Asia. Introduced online reservation system

◆ Operational:
  – CP worldwide staff 18528; HK staff 20,050
  – Serves 119 destinations in 38 countries in 2009
  – Length of scheduled route network 481,000 km
  – Number of passengers 24,558,000

◆ Financial
  – Revenue $8,631 M; Profit 605 M in 2009
  – 3rd most profitable airline in the world
  – Major shareholders
    » 42% Swire Pacific Limited
    » 30% Air China Limited
    » 3% CITIC Pacific

◆ Alliance
  – Founding member of OneWorld: American Airlines, British Airways, Cathay Pacific, Iberia, Finnair, Japan Airlines, LAN (Latin American), Mexicana, Malév Hungarian Airlines, Qantas and Royal Jordanian.
Fleet to Maintain

- Fleet as of 2010
  - 12 Boeing 777-300
  - 18 Boeing 777-300ER
  - 5 Boeing 777-200
  - 20 Boeing 747-400
  - 13 Boeing 747-400 BCF
  - 6 Boeing 747-400F
  - 6 Boeing 747-400ERF
  - 11 Airbus A340-300
  - 31 Airbus A330-300
- Total 128 aircrafts
- Average age of 10.8 years

- Fleet on order
  - 12 Boeing 777-300ER
    - Deliver by 2013
  - 10 Boeing 747-8F
    - Deliver over 2010-2012
  - 8 Airbus A330-300

Boeing 777; 2 engines
Airbus 330; 2 engines
Spare Part Classes

- Rotable, engine

- Repairable, fuel pump

- Expendable
  - Integral (close fit, extensive contact), dowel, sleeve
  - Non-integral (loose fit, limited contact), spring, bulb

- Consumable, fabrics

- Expendable-repairable, seat arm

Parts are also grouped according to criticality.
Aviation Spare Parts Supply Chain Management

◆ Procurement
  – Normal replenishment
  – Initial provisioning
  – Special provisioning

◆ Inventory Management
  – Monitor stock turnover
  – Order once reorder point is reached; Ultramain software
  – Against downtime
    » Build safety stock
    » Ship parts via same-day express delivery
    » Borrow it from another airline
    » International Airline Technical Pool, a spare part depository.
    » Borrow from another Cathay aircraft

◆ Repair Management
  – Diagnosis: Technician on the ground takes a video of failed part and its surroundings. Video is emailed to engineers at headquarters and repair shops to quickly identify the problem.
  – CP compiled a database of 300 major aircraft repair shops.
  – Aeroxchange system.

◆ Logistics
  – Individual part shipments to repair house through hubs to reduce lead times
  – Outsourced transport unserviceable spare parts to third party logistics companies
AoG: Airplane on Ground, Costs $60/min.
FoG: Fleet on Ground at Qantas, starting Nov 4, 2010 (loss of $80M)

An en-route engine failure on a flight Singapore -> Sydney leads Qantas to ground its fleet of 6 Airbus A380s.

Both Airbus and Boeing allow airlines to pick engines. Qantas picked **Rolls-Royce Trent 972** for its A380s.

RR Trent 900 has two compressors, a tiled combustor and three types of turbines.

RR produces Trent 900 with partners:
- **Industria de Turbo Propulsores** (turbine)
- **Hamilton Sundstrand** (electronic controls)
- **Avio S.p.A.** (gearbox)
- **Marubeni Corporation** (components)
- **Volvo Aero** (compressor)
- **Goodrich Corporation** (fan casings and sensors)
- **Honeywell** (pneumatics)
What are challenges?

- Infrequent (sporadic) demand, costly downtime
- Accurate demand forecasting

- Spare part obsolescence
- Expensive and complex parts
- Strict quality control standards

- Superior service level
- Low inventory holding cost
How to handle shortages at CP?

◆ Expensive AOG (Aircraft on Ground) order
  – Locating and securing part
  – Parts are similar; part databases have duplications

◆ Borrowing from another airline
  – Unwillingness to lend
  – Incompatibility of the part

◆ Borrow from another CP aircraft
  – The other aircraft is grounded

◆ Part pools, also see next page
  – Mechanisms to facilitate managing part pool inventories
    » Price of buying from the pool, paid to whom?
Aeorxchange.com: Aviation (parts) supply chain solution

**AeroBuy**: “catalog-based procurement system that facilitates optimum value in the supply chain by connecting buyers and sellers”.
- Portal for acquisition of technical parts from OEMs, surplus suppliers, distributors, airline surplus inventory.
- Search supplier database, view results or pedigree documents and create Request for Quotes (RFQs).
- For normal provisioning.

**AeroAOG**: “solution for managing AOG situations”
- An airline’s loan/borrow/exchange business
- Over 3.6 million unique part numbers stocked at 700+ global stations.
- For special provisioning.

**AeroRepair**: “manages the repair order lifecycle”.
- Search repair capabilities from hundreds of providers by specific location or region.
- Monitor order status, TAT (turnaround time) performance and track delays with exception reporting and status updates.
- For normal/special provisioning.

**AeroComponent**: “manages component support contracts for rotatable parts where fees are based on flight hours and cycles”.
- Manages the entire transaction process from part request to serviceable replacement.
- Tracks actual contract performance levels against targeted service levels.
Outsource procurement of which parts?

Outsource the procurement of the standard parts
Why to use a third party logistics company?

Focus on core business: aviation
Provides technical capability
Extensive network
Policies of Southwest Airlines (SWA)

Keep two spare aircrafts in Dallas to substitute for broken-down aircrafts. SWA is not a part of an airline alliance.

In case of AoG, the entire associated department is dedicated to find a quick solution. The department locates the needed part and if necessary ships it by the first available flight.

Since SWA operates only Boeing 737’s, the inventory of a lot of parts are compatible with the 300, 500 and 700 series. Compatibility reduces the inventory held. Spare part inventory for different series can be pooled.

SWA lends parts and receive parts from other airlines. This practice is quite widespread, but limited by the compatibility of aircraft model.
SWA Policies

It has been observed that spares were bought from other airlines often at exorbitant rates. In other words, the airline that ships the part charges a very high price for the part.

Most of the spare parts shipped from suppliers are shipped by either FedEx, UPS or third party logistics providers.

For spare parts to be shipped to other facilities, use of a third party can be a costly proposition as the airline can more or less ship it for free, unless it is a hazardous material.

The last two pages are based on Tejas Govande’s statements. He is a SCM-MS student at UTD and interns with SWA in Fall 2010. He focuses on spare parts inventory.
Baggage Handling System Service Contractors can Benefit

Several gates at an airport are served by a single baggage handling carousel. Carousel is a part of the baggage handling system (BHS) and it is visible to passengers. If it fails, gates cannot be served and aircraft will be grounded.

A BHS has belts, conveyors, rotating parts, an engine, etc.

Who is in charge of maintaining BHS at an airport?

Airport authority owns and operates BHS but outsources maintenance to a service provider

   DFW port authority owns terminals A, B, C, D, E. BHS in terminal A is produced and installed by Jervis Webb (www.jervisbwebb.com) in 2008 but maintenance service providers are Siemens (www.mobility.siemens.com ➔ Airport Logistics) and JBT AeroTech (www.jbtaerotech.com).

   BHS in Atlanta Airport Terminal T is produced and installed by VanDerLande (www.vanderlande.com) but serviced by ELS (www.elitelineservice.com).

Siemens, JBT AeroTec and ELS have service contracts at airports and they can benefit from AeroAOG solution. Service contractors would like to service BHS without carrying all of the parts in the inventory.
Who else can benefit?

Maritime shipping companies for ship repair.
  Compatibility easier. Standards are not tight.

Power plant operators.
  Generally there is slack capacity.
  Completion of repairs can take days or weeks.
  Some parts are large or on a tower, transportation challenges.
  What if my 50m high GE wind turbine fails?
    Call and wait GE service if you care about your service contract and the associated warranty.
    Can I predict a failure before it happens?
    How to bring the turbine down, repair and bring it up?

Armed forces equipment: Planes, warships, missile launchers, tanks.
  Compatibility is likely but hard to establish.
Who else can benefit?