Session5
Airline Operations

Airline Operations-A Bit of History

- By the end of 2019 there were **~ 800** worldwide airlines with scheduled flight service throughout the world. This is what is noted in the codes of the ICAO/IATA data bases.
- The **ICAO / airline designator** is a **code** assigned by the International Civil Aviation Organization (**ICAO**) to aircraft operating agencies, aeronautical authorities, and services related to international aviation, each of whom is allocated a three-letter **designator.**
- There are ~ 5,000 airlines with an ICAO/IATA code identified and only 800 currently in service as noted above.
- Complete lists are given in alphabetical sequence by the name of the continent from which they operate.
- Based on reasonable conclusions that means that ~ 4,000 startups are now defunct. (subtracting for mergers and name changes, etc.

- From 2004 to 2020 the number of world wide flights doubled in the world.
- The world's largest airline by fleet size and passengers carried is American Airlines, operating from the United States.
- Airlines by revenue numbers last year were: Delta AL's 45Billion US Dollars; American second & Lufthansa 3rd and also with the highest # of employees.
- Airlines by number of passengers flown: American 1st, followed by Delta, Southwest, United and Ryan Air.
- This year, commercial aircraft will carry *nearly four billion passengers,* according to the International Air Transport Association (IATA), nearly double the number of just 12 years ago, and equivalent to half of the world's population

Take a sneak peek… list of airlines

https://en.wikipedia.org/wiki/List_of_passenger_airlines

Airline Operations-A Bit of History

Current **Major Airlines** in the USA Today

The United States Department of Transportation defines a **major carrier** or **major airline carrier** as a U.S.- based airline that posts more than $1 billion in revenue during a fiscal year.

Alaska Airlines

Allegiant Air

American Airlines

Delta Air Lines

Frontier Airlines

Hawaiian Airlines

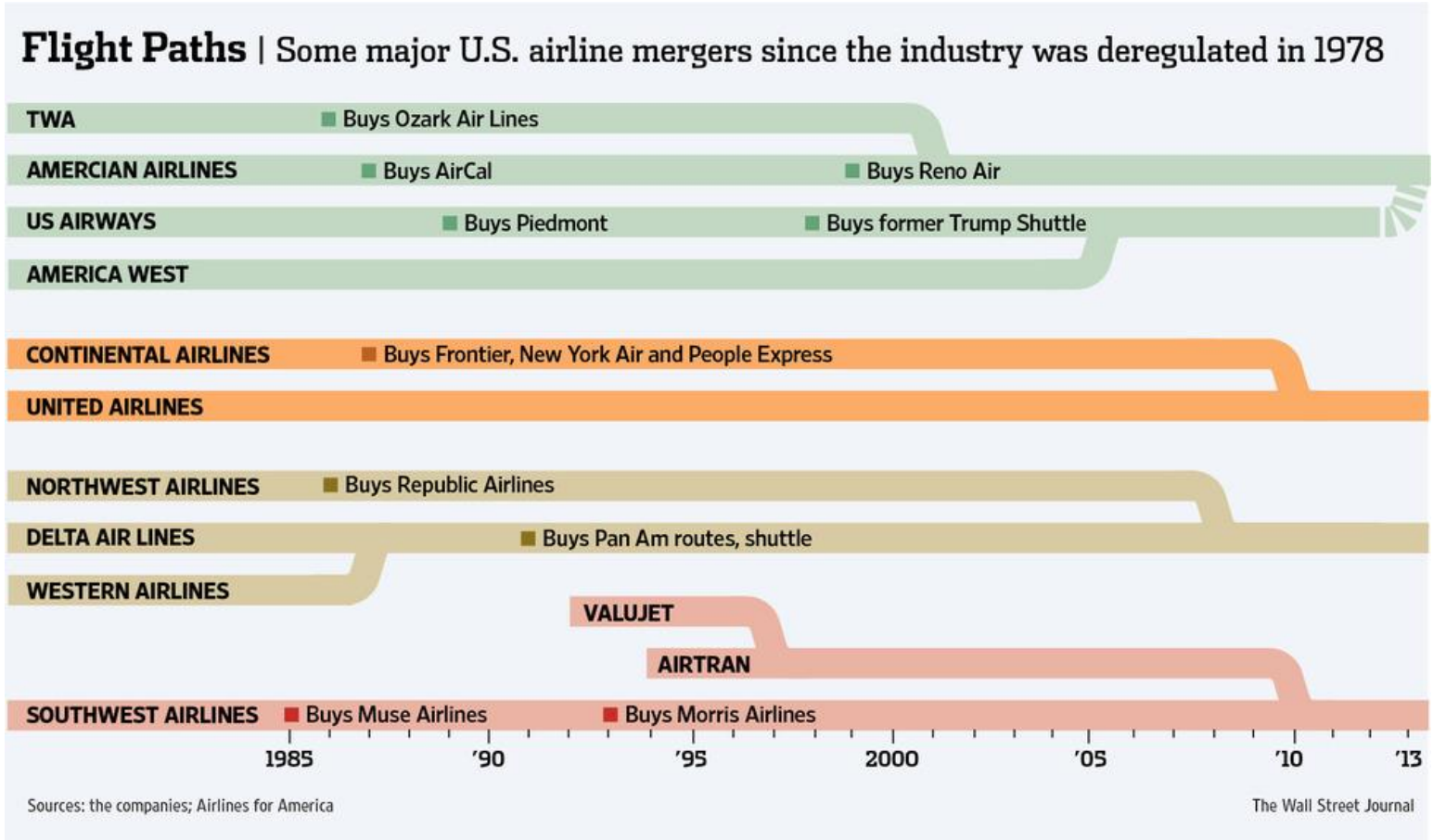
JetBlue

Southwest Airlines

Spirit Airlines

United Airlines

Active Today



This is a risky business – there are way too many A/L's to list that were operating in the US for a while that have disappeared or merged

Airline Operations-

- The much-awaited annual **Airline Excellence Awards** are carried out by **AirlineRatings.com**, which is an aviation safety - and product-rating site based out of Perth, Australia
- To decide who wins, seven editors at the agency consider a dozen key factors including:
  - operational safety
  - passenger reviews
  - profitability
  - investment rating
  - fleet age
  - product offerings such as premium economy on long-haul flights and seating options in other classes
- Air New Zealand's number-one score should come as no surprise, since, aside from last year's loss to **Singapore Airlines**, the carrier has claimed the top spot for six of the past seven years.

1. Air New Zealand
2. Singapore Airlines
3. All Nippon Airways
4. Qantas
5. Cathay Pacific
6. Emirates
7. Virgin Atlantic
8. EVA Air
9. Qatar Airways
10. Virgin Australia
11. Lufthansa
12. Finn-air
13. Japan Airlines
14. KLM
15. Korean Airlines
16. Hawaiian Airlines
17. British Airways
18. Alaska Airlines
19. Delta Air Lines
20. Etihad Airways

Airline Operations-

- **Air New Zealand** is the flag carrier airline of New Zealand
- Based in Auckland, the airline operates scheduled passenger flights to 20 domestic and 32 international destinations in 20 countries, primarily around and within the Pacific Rim
- The airline has been a member of the Star Alliance since 1999.
- Air New Zealand originated in 1940 as Tasman Empire Airways Limited (TEAL), a company operating Trans-Tasman flights between New Zealand and Australia
- **TEAL became wholly owned by the New Zealand government in 1965, whereupon it was renamed Air New Zealand**
- The airline served international routes until 1978, when the government merged it and the domestic New Zealand National Airways Corporation (NAC) into a single airline under the Air New Zealand name.
- Air New Zealand was privatized in 1989, but returned to majority government ownership in *2001* after near bankruptcy due to a failed tie up with Australian carrier Ansett Airlines Of Australia
- In the *2017* financial year Air New Zealand carried 15.95 million passengers
- The current fleet size 116 Airplanes - Government ownership at (53%).
- Air New Zealand's number one score as the worlds best airline should come as no surprise since, aside from last year's loss to Singapore Airlines, the carrier has claimed the top spot for six of the past seven years
- The airline's main hub is Auckland Airport, located in the southern part of the Auckland urban area
- Air New Zealand currently operates a fleet of Airbus A320's, Airbus A320neo family, Boeing 777, and Boeing 787 jet aircraft, as well as a regional fleet of ATR and 72 Bombardier Q300 turboprop aircraft
- Air New Zealand was awarded Airline of the Year in 2010 and 2012 by the *Air Transport World* Global Airline Awards. In 2014, Air New Zealand was ranked the safest airline in the world by JACDEC.

Airline Operations - “Top Safety Rated” going into 2020

1. Qantas (Queensland And Northern Territory Aerial Services)

The airline was referred to by Airline Ratings in 2019 as having "amassed an amazing record of firsts in operations and safety and is now accepted as the industry's most experienced airline."

The airline has never had a fatal crash; is the second oldest to initiate revenue service, however, that badge of honor was nearly jeopardized when an Airbus A380 flying from Singapore to Sydney suffered an uncontained engine failure. Some passengers experienced injuries.

2. Air New Zealand

Air New Zealand's long-haul fleet has been engaged in fleet renewal for its long-haul that focuses on the Boeing 787 Dreamliner. In 2018 Boeing reported the aircraft as having no fatal accidents though the aircraft was plagued by initial battery issues.
The airline currently flies the Boeing 787-9 Dreamliner between Auckland and Chicago, the airline's longest and the deepest route into North America from an Oceanic country.

Airline Operations -A look @ Australia & New Zealand to understand the US

- The land mass of Australia and New Zealand (A-NZ) is equal to the US. The population differences are not
  - They are 91% to 9%
- **Qantas, Western Australian** and **ANZ** are three of the worlds oldest airlines; 1920 & 1921 & 1938.
- From 1980 to 1996 the same changes that impacted the US also occurred in A-NZ. It makes studying them easier.
- Defunct means bellied up, went completely bankrupted, i.e. not merged into a different airline
- Defunct in A-NZ is approximately 85 airlines. (way too many to list in the US)
- The largest factors impacting the airlines are:
  - Bad decisions on equipment
  - Load factors
  - Regulation changes
  - De-regulation changes
  - Under capitalization
  - Timing
  - Accidents, etc.
- Current numbers of operating airlines there is 12 via the **ICAO** codes.
- So along with the 85 defunct numbers there were a total of 97 airlines in their history representing an 88% failure rate in the two countries over the past 100 years
- From 1955 to 1997 **Ansett** operated under a major two airline policy with **Trans Australian A/L**. The policy was discontinued, and **Ansett** was merged with **Air New Zealand** in 1996 and was defunct by 2001
- They were for many years the best Domestic A/L to operate in that area
- **Trans Australian Airlines** was operating since 1946
- Deregulation and a policy change occurred and **TAA** was absorbed into **Qantas Airways** in 1992.
- **East West** was also in Receivership in the late 90's due to load factor issues and deregulation

Airline Operations-- Australia & New Zealand a bit of history in the 80's & 90's

- **Qantas** operated **Airbus A300B4** aircraft after its acquisition of **Australian Airlines**
- The **Australian** Government sold the domestic carrier **Australian Airlines** in August 1992
- This provided **Qantas** access to the **Australian** domestic market for the first time in its history
- **Virgin** commenced services on 31 August 2000 as **Virgin Blue**, with two aircraft on a single route
- It suddenly found itself as a major airline in Australia's domestic market after the collapse of **Ansett Airlines** of Australia in September 2001
- The airline has since grown to directly serve 42 cities in Australia, from hubs in Brisbane, Melbourne and Sydney
- **ANZ** continues to be recognized as one of the premiere world- wide airlines

Last QANTAS 747-400 retired after 17 years 4:27 Minutes

https://www.youtube.com/watch?v=s9TvBt9_N_0

Airline Operations-New Airliners-First Delivery Flight

- I was very fortunate to represent **GEA** on the first **GEA** powered **A300B4** wide body domestic airplane for **TAA** in Australia with 7 other company representatives in 1982.
- We started in Toulouse France – to Bahrain for an overnight
- Then on to Delhi, India for a refuel
- Then a night in KL Malaysia and on to Perth for an overnight and finally to Melbourne
- I also represented **GEA** for the second wide body domestic airplane, a **767-200** to **Ansett Airlines** of Australia and **Air New Zealand** and **QANTAS** for the same model **GEA** powered airplane
- There flights were from Seattle to Hawaii to FIJI and on to Australia / New Zealand
- The **Ansett** flight spent a night in Papua, New Guinea

TRW

First Twin Wide Body 7:32 Minutes

https://www.youtube.com/watch?v=sulRvRtgIx8

Airline Operations – Every Commercial Airplane is Uniquely Identified

- Article 20 of the **Convention on International Civil Aviation** signed in 1944, states that all aircraft engaged in international air navigation bears its appropriate nationality and registration marks
- Upon registration, the aircraft receives its unique "registration", which must be displayed prominently on the aircraft
- Annex 7 to the **Chicago Convention** describes the definitions, location, and measurement of nationality and registration marks
- The aircraft registration is made up of a prefix selected from the country's call sign prefix allocated by the **International Telecommunication Union** (ITU) (making the registration a quick way of determining the country of origin) and the registration suffix
- Depending on the country of registration, this suffix is a numeric or alphanumeric code, and consists of one to five characters

Air France Airbus A318 displaying registration **F-GUGJ** on the wing undersurface and the last two letters of the registration, GJ, on the nose wheel doors

A **Boeing 787-8** Dreamliner displaying Air India registration **VT-ANG** on the wing undersurface and on the nose wheel doors and on the rear fuselage

U.S . Aircraft carry “N” registration

Airline Operations –Registration Numbers

If you look closely at the rear fuselage of this new **American Airlines Boeing 737 MAX 8**, below the windows and just above the open door of the aft cargo hold, you'll see the registration for this aircraft, **N338RS**

Here's the registration record, indicating that the airliner received an airworthiness certificate November 7, 2018.

Each airliner has its own specific number for also tracking various compliance requirements.

In the US, registration numbers are five alphanumeric characters: One to five numbers (N1 to N2345) One to four numbers followed by one letter (N1234Z): One to three numbers followed by two letters (N123AZ)

Airline Operations- Introducing New Aircraft

- Airlines determine the need for new aircraft which is generally based on competition, aging aircraft or new route structure opportunities
- The Fleet Planning Process:
- Selecting the right aircraft for the markets is vitally important to financial success
- Selection and purchase of new aircraft is usually directed by an airline's top officials, although it involves personnel from many other divisions such as maintenance and engineering, finance, marketing and flight operations
- Numerous factors are considered when planning new aircraft purchases, beginning with the composition of the existing fleet
- Are any potential aircraft purchases related to replacement of existing aircraft or are they intended to drive service growth?
- What are the potential cost impacts on a carrier's fuel and maintenance programs, its crew resources and its training requirements?

- All Considerations:
- Fuel consumption – the largest cost
- Labor Costs – second highest
- Maintenance – Expensive
- Tooling – Includes Airframe and Engines
- Training – Critical
- New Flight Simulators – Expensive
- Line Station additional needs – Costly
- Overhaul up-grade capabilities – Costly
- Operations: Line Stations - Overhaul Facilities
- Newer aircraft are more efficient and cost less to operate however, such productivity gains must be weighed against the cost of acquiring a new aircraft

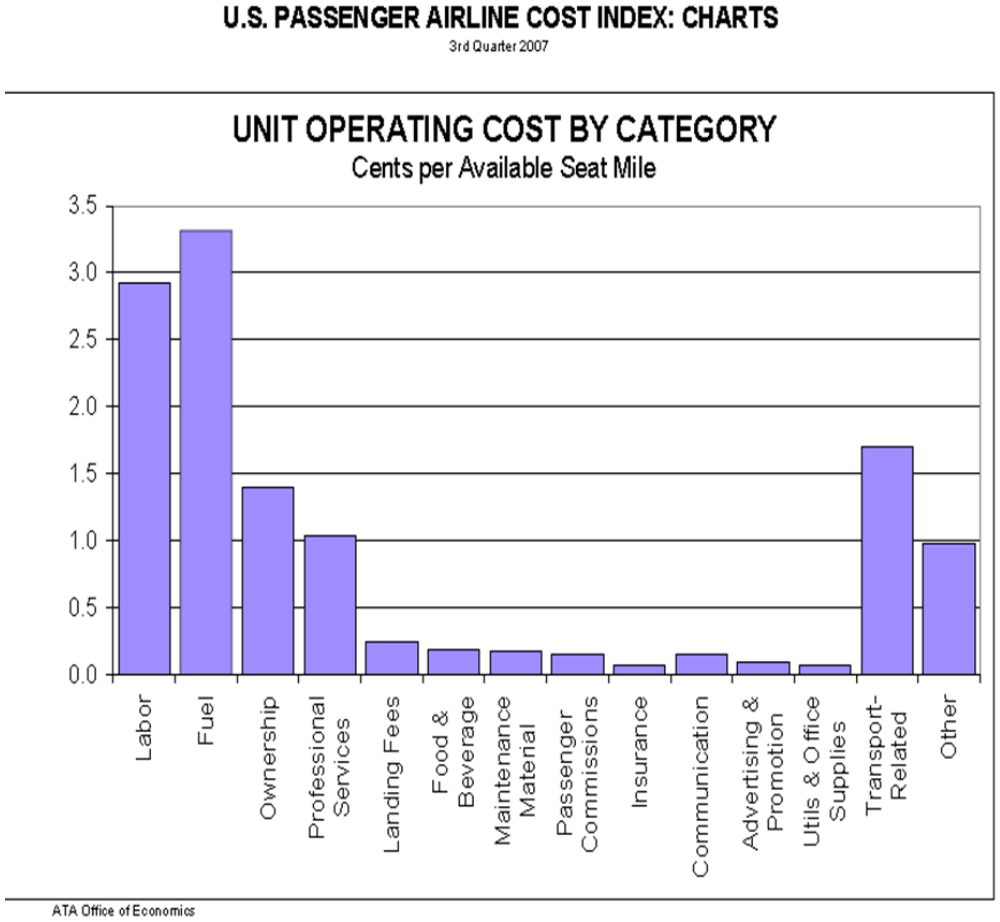
Airline Operations- Aircraft Evaluation & Fleet Planning

- A thorough understanding of aircraft performance, aircraft economics and the lease/finance sector that is essential to the fleet planning decision
- The core revenue/profit contributor for any airline is delivered by operating its aircraft fleet
- Therefore, evaluating, selecting and managing the optimum fleet, matching capacity to demand and making smart purchase/lease decisions are central to an airline's success
- At most airlines, major fleet evaluations take place only once every few years or every decade
- Therefore, the necessary new fleet analysis competencies and processes are often not held in-house, and may not be keeping up with developments within the industry

- Operators must consider many factors when selecting a new or replacement fleet:
- Match capacity to demand
- Optimum number of fleet types
- Fleet commonality
- Aircraft payload range capability
- Aircraft take-off performance
- Relative fuel consumption
- Relative revenue driven by seat count
- Maintenance cost and support capability
- The value of passenger comfort
- Cargo capacity
- Old versus new trade-offs
- Aircraft pricing/lease rates
- Aircraft buy versus lease trade-offs
- Availability and affordability of financing etc.

Airline Operations--Cost Considerations

- Newer aircraft are more efficient and cost less to operate however, such productivity gains must be weighed against the cost of acquiring a new aircraft.
- The **777X** airplane will have price tag of between $390 and $430 Million Dollars
- **737MAX8** will list for approximately $100 Million.
- Can the airline afford to take on more debt?
- What does that do to profits?
- What is the company's credit rating, and what must it pay to borrow money?
- A company's finances play a key role in the fleet planning.
- Since deregulation aircraft leasing has increased, this reduces some of the risks involved in purchasing new technology
    - It also can be a less expensive way to acquire aircraft.



- As shown on the chart **FUEL** is the most significant cost to the airline operators
- Labor is a close second and when added together represent 50% of the total operation costs.

Airline Operations-- Cost Considerations

- FAA FAR 121 covers all training programs for airline personnel:
- Pilots must be trained to fly new aircraft.
- Pilot training based on aircraft manufacturers flight test program that determines aircraft flight performance and limitations.
- Training is also required for A&P mechanics and overhaul shop employees.
- In larger airlines most pilot training takes place in simulators that never leave the ground
  - They are very sophisticated and expensive
- Tooling for airframe and engines is very expensive
- Line Stations considerations

https://www.youtube.com/watch?v=cnfoTAxhpzQ
Why A/L's are failing 11:22 Minutes

- **A & P** Aircraft mechanics employed by the **airlines** perform
  - Line maintenance work including routine maintenance, servicing, or emergency repairs at **airline** terminals
  - Major repairs and required scheduled periodic inspections at an **airline's** overhaul base
  - Engine maintenance/refurbishment
- This work by be done by the airline or "farmed out"
- Smaller airlines and low- cost carriers typically farm out aircraft heavy maintenance and engine refurbishment work
  - To larger airlines shops
  - To the engine manufacturer's service organization or an independent specialized engine maintenance company

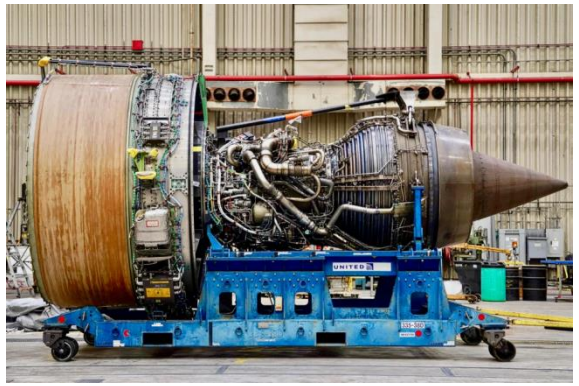
Airline Operations-- Cost Considerations-Engine Selection

- Another cost consideration in most cases is the **Engine Selection** with the addition of new aircraft
- In must cases the choice is **GE Aviation**, **Pratt Whitney** or **Rolls Royce**
- The cost Vs performance is the critical consideration
- Engine manufacturers work hard to “sell” their engine
- They present data to the Airline engineering organization for their engines and aircraft combination showing:
  - Fuel burn
  - Payload/Range data
  - Noise regulation compliance
  - Emission regulation compliance
  - Maintenance costs
  - Reliability
    - Inflight shutdown data (supports ETOPS)
    - Delay and cancellation data
    - Shop visit rate data (flights/flight hours between major engine maintenance)

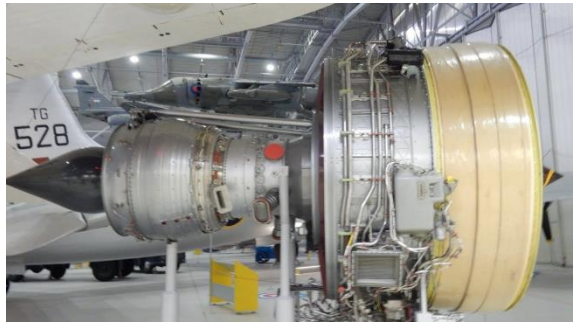
GE90

777 Engines

PW4000



RR Trent 800



Airline Operations-Engine Selection

- There are airframe models where only one engine manufacture is approved, the **737** aircraft is the best example of this
- The **737-100** (first introduction model in the 1970's) and the **737**-**200** aircraft models were only available with **PW JT-8** engines
- All later **737 models** (8 total) starting with the **737-300** series to the latest **737-Max8** aircraft are derivative models powered with CFMI engines

- This commonality helps to reduce operating costs
- An A/L that has benefited greatly from that is **Southwest Airlines** which has an all **737 Boeing** fleet with **CFM56** engines
- Additional cost considerations Vs the economics of advancements in fuel savings, maintenance, etc, is measured carefully as: THE "**TOTAL COST OF OWNWESHIP"**

https://www.youtube.com/watch?v=yR1OBGZevTc&t=26s

Airline decisions – Boeing Vs Airbus – which choice, which airliner? 8:42 Minutes

Airline Operations-- Maintenance

- **Light or Line Maintenance:**
- This would typically include Pre-flight checks, Daily checks (before first flight) Fluids, Failure rectification of pilot reports as well as Minor, scheduled maintenance tasks as follows which may include:
- Trouble shooting, Defect rectification, Component replacement, up to and including engines and propellers, with use of external test equipment if required
- Scheduled maintenance and/or checks including visual inspections that will detect obvious failures but do not require extensive in depth inspection
- It may also include internal structure, systems and power-plant items which are visible through quick opening access panels/doors
- Minor repairs and modifications which do not require extensive disassembly and can be accomplished by simple means

- **Base or Heavy Maintenance:**
- Base Maintenance may be referred to as Heavy Maintenance, and consists of tasks that are generally more in-depth and long-lasting, but are performed less frequently
- A Maintenance Repair or Overhaul (MRO) company will need to have large facilities and specialized equipment and staff to undertake base maintenance, and many operators **contract-out** this function
- The different activities may include:
- **C** and **D** Checks for deterioration of the airframe, engines and systems, e.g. corrosion, fatigue
- Removal of defects – implementation of Service Bulletins (SB) and Airworthiness Directives (AD), although this can also be done during Line maintenance
- Technology upgrades
- Cabin reconfiguration, painting etc.

Airline Operations--Airline Jobs

Flight Attendant

- Flight attendants make up almost 20 percent of the 515,000 employees that comprise the aviation workforce

Airline Administrative Support

- Include secretaries, data entry workers, receptionists, communications and PR specialists, and those who work in the human resources department

Operations Agent

- When flights are overbooked agents must rectify the situation in a way that will not negatively impact the schedule

Avionics Technicians

- Avionics technicians specialize in working on the electronics systems of aircraft

Regional Sales Manager

- The airline district sales manager oversees all of a district's reservations and ticket sales offices, and the sales representatives in that district

Flight Dispatchers

- Prepare flight plans, detailed schedule of destinations, layovers, distance, expected fuel consumption, winds aloft, weather, altitude, compass bearing, and alternate airports

Ground / Airport Station Attendant

- They assist passengers in the terminal with general questions regarding directions, terminal services, or arranging wheelchair access

Aviation Meteorologist

- Aviation meteorologists provide weather information to airline flight dispatchers and pilots

Passenger Service Agent

- Passenger service agents are focused on working with passengers – not aircraft
- Their duties include issuing refunds to passengers, computing fares, preparing and selling tickets, collecting charges for excess baggage, checking baggage, and providing travel information

Ramp Planner

- Is responsible for knowing the arrival and departure times for each of the airline's aircraft at that airport
- He or she coordinates a variety of departments or contracted companies that must perform various tasks on the aircraft before it can depart for the next flight—e.g caterer

Airline Operations--Airline Jobs

Reservation Sales Agents

- Provide travel information over the telephone to customers of the airline. Typically, this information includes trip planning, car rentals, seat availability, fare information, schedules, tours, meals, and other information relevant to the customer's flight plans. Although internet reservations have skyrocketed, airlines still utilize reservation sales agents.

Sales Representative

- Airline sales representatives help generate business for the airlines. They promote their airline to businesses.

Crew Schedule Coordinators

- Are responsible for staffing of aircrew and ground support to keep flights on schedule. If weather or mechanical difficulties delay a flight, it is the crew scheduler's responsibility to make sure schedule adjustments are made so that travelers arrive at their destination on time.

Airline Station Agents

- The most important duty of the station agent or district operations manager, is ensuring the overall operations of a given airline at an airport. This encompasses both flight and ground support operations and involves coordinating flight crew, cargo crew, baggage crew, ground crew, and the information that must be communicated among all these teams.

Airline Ticket Agents

- Work at an airline's ticket or baggage counter. They greet customers when they arrive at the airport. They check in luggage and make seat assignments. They also handle airline ticket sales, reservation changes, and provide information on aircraft boarding.

Airline Flight Instructors

- Provide recurrent training for the airline's pilots. Airline flight instructors may be senior pilots who fly for the airline

Aviation Attorneys

- Specialize in aviation-related cases in commercial or general aviation for individuals, government agencies, or companies. Aviation attorneys represent airlines and/or the government. Some aviation attorneys work for the FAA, while others may be on staff or on retainer by large corporations who own aircraft or deal with airlines

Airline Operations-Scheduling Flights-A Complex Task

- A few of the factors that must be considered are:
- Number of passengers expected for each flight
- Aircraft type
  - Passenger capacity, range
- How much time will the aircraft be on the ground at each airport-turn around time
  - Passenger unloading /loading
  - Time to unload/load baggage
  - Any freight on flight
  - Fueling
  - Catering loading
  - Cleaning
- Gate availability
- When must the aircraft be scheduled to a maintenance base ?
- How long will the maintenance work take ?
- Over night location
- Tomorrow's first destination
- The schedulers must integrate flight and cabin crew availability at each destination
- Consider maximum allowed times for flight crews
- Arrival times of connecting flights
- Departure times of connecting flights
- Time for connecting passengers to go from one gate/terminal to another
- Seasonal variation in passenger demand
- Minimize long flights having more than one plane change
- Airport noise restrictions-curfews
- Computer programs are used to develop flight schedules

Airline Operations-Business Model-Low Cost Carrier

Low Cost Carrier (LCC) Business Model	
Simple Product	• Catering on demand for extra payment • Planes with narrow seating and only a single class • No seat assignment • No frequent flyer programmes
Positioning	• Non-business passengers, especially leisure traffic and price-conscious business passengers • Short-haul point to point traffic with high frequencies • Aggressive marketing • Secondary airports • Competition with all transport carriers
Low Operating Costs	• Low wages • Low airport fees • Low costs for maintenance, cockpit training and standby crews due to homogeneous fleet • High resource productivity • Short ground waits due to simple boarding processes • No air freight, no hub services, short cleaning times, and high percentage of online sales

Low Cost Carriers-U.S.

Airline Operations—Food Service

- Specialized airline food service companies provide snacks, and complete meals to airlines
- Meals are usually prepared on the ground before takeoff
- The food and drinks are served by airline cabin crew members
- Quality of the food and its service can be a differentiating factor for the airline
- The type of food varies depending upon the airline company and class of travel
- First class and business class meals and service are superior to coach class meals and service-but a higher ticket price

Airline Operations—Ticket Sales

- Since the middle of the 20th century, airlines have developed automated reservation systems to sell tickets and store information
- With the internet, airline reservation systems have been opened up for direct public access -- you can choose whether to make a reservation with the airline, via a travel agent or independently through an online interface
- The first automated airline booking system was introduced in 1946 by American Airline
- By 1964, the Semi-Automatic Business Research System (**SABRE**) developed by IBM for use by American Airlines was the world's largest system for data processing
- From the 1960s onward, the major U.S. airlines developed their own automated booking systems
- American Airlines and SABRE separated in 2000
- **SABRE** is also used by online travel consolidators
- Other systems are Abacus, Shares and Travelport
- These booking systems can also handle reservations for hotels, rental cars and cruises in addition to airline tickets
- Airline reservation systems include flight schedules, fare tariffs, ticket records and passenger reservations
- The reservation system can harvest data such as expected aircraft load to help with pre-flight calculations including fuel requirements
- Different airline reservation systems can share information about the same passengers and flights, when multiple airlines operate the same route using **code-sharing**
    - This means tickets may be sold by one airline although the flight is operated by a partner airline

Airline Operations—Fees

- **Landing charges**: Based on the aircraft weight formula
- The maximum certificated take-off weight as indicated in the certificate of airworthiness
- **Parking and hangar charges**: Charges associated with use of parking, hangar and long-term storage of aircraft, maximum permissible take-off weight and/or aircraft dimensions (area occupied) and length of stay
- Any period of free parking time for aircraft immediately following landing should be determined locally by considering aircraft scheduling, space availability and other pertinent factors
- **Other charges**:
  - Passenger service charges
  - Security charges
  - Noise-related charges
  - Emissions-related aircraft charges
- Ticket prices must cover all these fees plus Expenses

Next Session
Aircraft Maintenance and Airports