16.682 The Aerospace Industry

April 13 Class

Special Guests:

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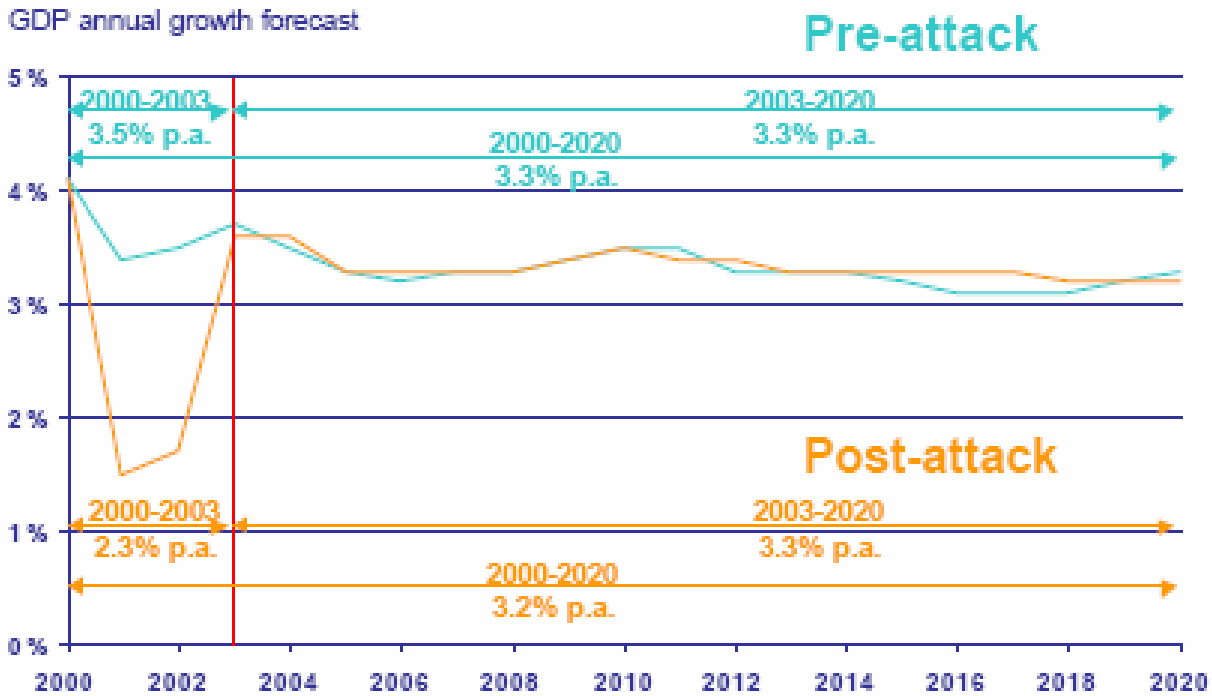
Plan for the Class

3:05-3:10	Announcements and Introductions Write one question about Market Focus on 3X5 card
3:10-3:35	Cargo Aircraft Growth & Lean Thinking
3:35-3:55	Market Focus - Heidi Wood
3:55-4:05	Break
4:05-4:50	Av Week Article Discussions • The US Government should give higher priority to R&D investment in Zero Point Energy than scramjet propulsion. • NASA should use commercial space transportation exclusively
4:50-4:55	Muddy cards
4:55	Adjourn

World GDP growth : deep recession and strong recovery



Courtesy of Daniel Morales. Used with permission.

- Air cargo growth correlates with GDP growth
- World GDP expected to average 3.2% growth per year
- World air cargo traffic expected to grow at 6.4% per year

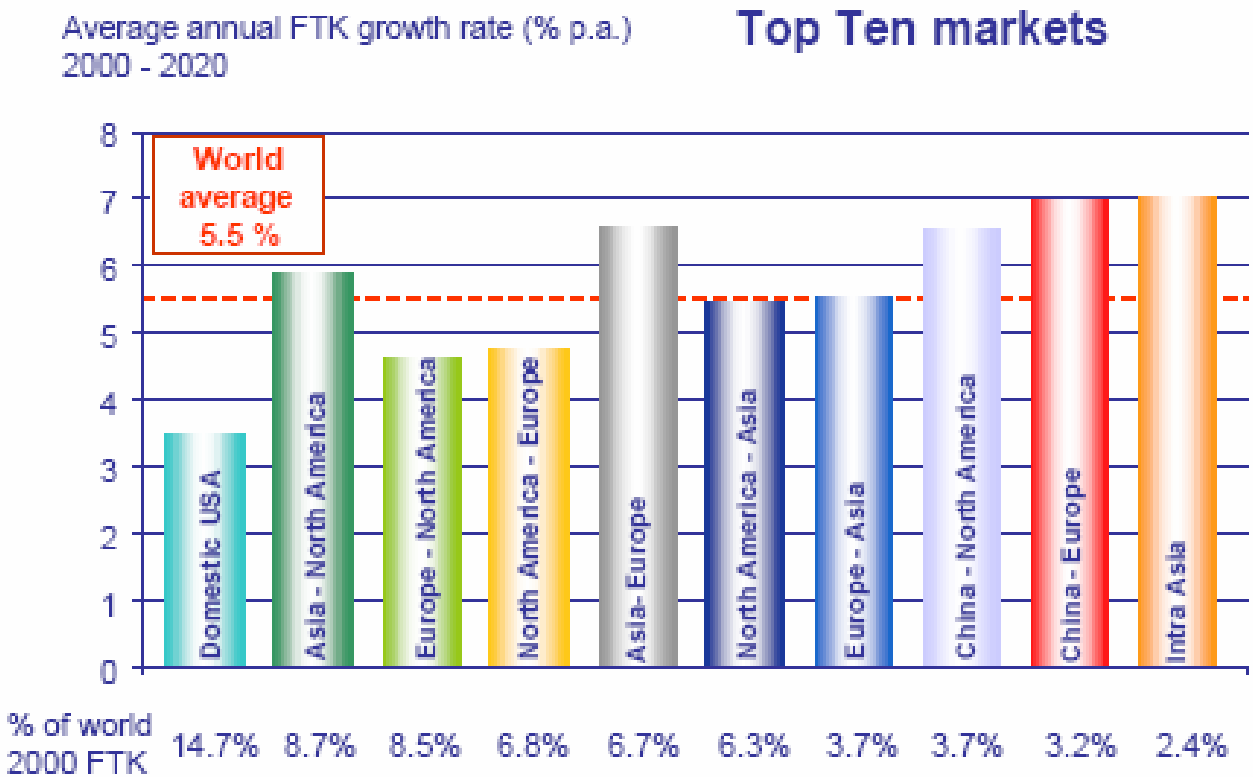
Source: Dan Morales, Commercial Cargo Needs, Market, Metrics, 16.886 presentation, Feb 25, 2004

However, most major market forecasters predict that world GDP will make a strong recovery, which will then of course be the impetus for strong recovery in the air cargo market. The predictions for the next twenty years are for world GDP to grow on average 3.2% per year and for world air cargo traffic to grow on average 6.4% per year.

Commercial Drivers for Growth in Air Cargo

- Globalization trends
  - Longer distances between producers and consumers
  - Emerging markets, e.g. China, South America, Africa
- Lean manufacturing
  - Focus on “flow” to eliminate waste, e.g. JIT
  - Faster response to market demands
- Air freight operators looking for new markets
  - Most transoceanic freight shipped by surface
  - Gap in capability- “middle market”
    - Ship is inexpensive but takes 18-30 days
    - Air is expensive but takes only a few days
- Operating economics drive
  - Increased capacity per air freighter
  - Reduced crew and fuel costs

Regional Growth



Source: Dan Morales, Commercial Cargo Needs, Market, Metrics, 16.886 presentation, Feb 25, 2004

- Asia growing fastest; mature markets growing slower
- Air cargo growth (domestic and international) through China airports expected to grow 11.2% per annum for next 20 years

Jiang, et al (MIT ICAT), "Market and Infrastructure Analysis of Future Air Cargo Demand in China"

Now here is a chart of the top ten air freight markets in the next twenty years according to the Global Market Forecast produced by Airbus. As is evident, the fastest growing markets are those linking Asia to other regions as well as Intra Asia whereas the domestic US market and other maturing markets will grow much more slowly.

Responses to Drivers

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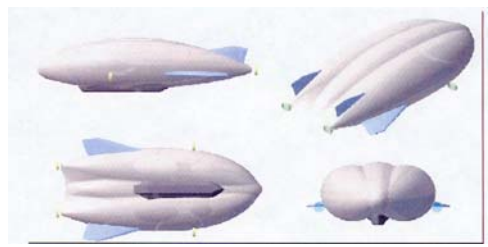
(Image removed due to copyright considerations.)

- Existing technology
  - More wide body aircraft
    - Many converted passenger aircraft
  - Larger aircraft - A380
- Advanced technologies
  - Blended Wing Body
  - Wing in Ground Effect
  - Lighter than air craft
  - Formation flight



The Boeing 747-400SF Program

Discussion points for AvWeek Article

- What units comprise the program core enterprise?
- What organizations comprise the program extended enterprise?
- What other programs within Boeing compete or interact with the 747-400SF?
- What factors would influence a value proposition for converting passenger aircraft to freighters rather than purchasing brand new freighter aircraft models?
- What other Lean Enterprise Value “footprints” do you see in reading these articles?

Points Captured from Class Discussion

The US Government should give higher priority to R&D investment in Zero Point Energy than scramjet propulsion.

- Pros
  - Applications are much larger for ZPE
  - More stakeholders
    - Auto, space,…
  - New energy source to wean us from fossil fuels
- Cons
  - Looking at applied science for scramjets vs science fiction for ZPE
  - Wide variety of applications
    - Military, commercial
    - SSTO
  - Challenge is engineering complexity. Does not need new physics like ZPE
  - Would drive student interest
  - Now have a data point with recent test flight

Points Captured from Class Discussion

NASA should use commercial space transportation exclusively.

- Pros
  - Less time to launch with more providers
  - More options
  - Spread liability
  - Better wages, better engineers
  - Leaner, no bureaucracy
  - More stable industry
  - Allow NASA to focus on R&D
  - Eliminate internal NASA competition
  - Could open new markets
- Cons
  - Is not tailored to NASA's objectives and missions
  - Not human rated
  - If industry goes up, NASA priorities go down
  - If industry goes down, NASA looses launch
  - Loose internal competency
    - What does NASA become