V-22 OSPREY

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Brian Bourgeois
Kyle Papso
Billy Gifford
Seung Ri Park
Dan Gessner
OUTLINE

• History/Development (Porter)
• Design (Brian)
• Mechanical Engineering Application (Big Dan)
• Mishaps to Success (Seung Ri)
• Tactical Application (Billy)
• Commercial Application (Kyle)
HISTORY/DEVELOPMENT

Porter Nelson
HISTORY/DEVELOPMENT

• Osprey came about from the DoD’s Joint Service Vertical takeoff/landing experimental aircraft program that began in 1981.

• Program was in response to the failed Iran Hostage Rescue Mission of 1980.

• Bell Boeing was awarded the preliminary design contract in 1983.
HISTORY/DEVELOPMENT CONT.

- Work was split evenly between the companies.
HISTORY/DEVELOPMENT CONT.

- Much controversy has surrounded the V-22 Osprey.
- The project is expected to cost $54+ billion once it is complete.
- Cited by some as unsafe and impractical.
- Regardless, the govt. and military continue to back the program with full rate production being approved in 2005.
- Even though it is considered unsafe by some, the USMC says the aircraft is one of if not the safest aircraft in their inventory.
DESIGN FEATURES

Brian Bourgeois
DESIGN FEATURES

- 1st production tiltrotor a/c
  - Categorized by FAA as Powered Lift a/c

- V/STOL

- Transition to fixed wing w/ rotating nacelles

- Driveshaft connects both engines in case of failure

- Tiltwing vs. Tiltrotor
  - Tiltrotor better for STOVL
DESIGN FEATURES CONT.

- Glass cockpit
- Triple redundancy in flight controls
- Nacelles can rotate from 0° to 97.5°
- Swash plate at rotor hubs
  - Controls rotorhead in helo mode
- Not capable of autorotation
  - Transition to fix wing mode
MECHANICAL ENGINEERING APPLICATION

“Big” Dan Gessner
POWERTRAIN

- Turboprop
  - Low speed efficiency
  - Low exhaust thrust
  - V-22 central gear box
- Turbofan
  - High speed efficiency
- Turbojet
  - High exhaust thrust

http://www.grc.nasa.gov/WWW/K-12/airplane/Animation/turbtyp/etpr.html

MATERIALS AND STOWABILITY

- Composites
  - Make up 43%
  - Graphite fiber material in wings and fuselage

- Storage
  - Efficient stowability
  - 90 seconds

MISHAP TO SUCCESS

Seung Ri Park
INITIAL PROBLEMS

- Four major crashes
  - Mechanical failure (1992, 2000)
  - Vortex Ring State (2000, 2010)
- Crash in April 2000 was the worst killing 19 on board
VORTEX RING STATE

- Problem in helicopters and Osprey
- Rotors decent into the turbulent air
VORTEX RING STATE

- Flight Control System
  - Uncommanded Roll
- Center of gravity
- Having two engines
OTHER ISSUES

• High Downwash Velocity
• Need both engines to hover
• Engine failure during vertical landing
• Autorotation
## COST AND PERFORMANCE

<table>
<thead>
<tr>
<th></th>
<th>CV-22 Osprey</th>
<th>Sikorsky CH-35E</th>
<th>C-130</th>
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<tbody>
<tr>
<td>Cost ($ million)</td>
<td>67</td>
<td>40</td>
<td>60</td>
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<tr>
<td>Internal Capacity (lb)</td>
<td>20,000</td>
<td>30,000</td>
<td>42,000</td>
</tr>
<tr>
<td>External Capacity (lb)</td>
<td>15,000</td>
<td>32,000</td>
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<tr>
<td>Cruise Speed (knots)</td>
<td>241</td>
<td>150</td>
<td>320</td>
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<tr>
<td>Range (mi)</td>
<td>1,011</td>
<td>621</td>
<td>2,360</td>
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</table>
RECENT SUCCESS

• Better warning system
  • Slower than 40 knots
  • Descend faster than 2,200 ft per minute
  • Needed 2000 ft of altitude to recover without danger
• Marines passed 100,000 flight hours in Afghanistan
• Marines have given good reviews for the aircraft
• Funding is still uncertain
TACTICAL APPLICATIONS

- Advantage because of vertical insertion with speed
- “Get in, get out”
- Speed helps to avoid RPG’s
- Compact storage so that it can fit on a carrier
- Best for transportation
- Can go pretty much anywhere
- Can “sneak” behind enemy lines
TACTICAL MISSIONS

- April 13, 2007 – Marine Corps sent 10 V-22 aircrafts into Iraq for the Osprey’s first combat deployment.
- Osprey has provided support in Iraq, logging 2000 flight hours over 3 months.
- Used primarily in western Iraq for routine cargo and troop movement.
- Also used for riskier “aero-scout” missions.
TACTICAL MISSIONS

• A Government Accountability Office study reported that in January 2009, the Marines had 12 V-22’s operating in Iraq, completing all their missions.

• They concluded that the “deployments confirmed that the V-22’s enhanced speed and range enable personnel and internal cargo to be transported faster and farther than is possible with the legacy helicopters it is replacing.”
TACTICAL MISSIONS

• December 2009 – Osprey saw its first offensive combat mission.

• Osprey assisted in inserting 1,000 Marines and 150 Afghan troops into Helmand Province in southern Afghanistan to disrupt communication and supple lines of the Taliban.
COMMERCIAL/ NON-COMBAT APPLICATIONS

Kyle Papso
HUMANITARIAN AID

- 2010 Haiti Earthquake
- Operation Unified Response
- First Humanitarian Mission
- One day: Deployed three 10 man team, conducted surveillance, and transport supplies
PRESIDENTIAL PROTECTION

- V-22 Osprey is now part of HMX-1 (Marine One)
- Replace Sea-Stallion Heavy Lift Copters (1960’s)
- Save time and security
- Landing concerns
COMMERCIAL TILT ROTOR AIRCRAFTS

- AW609 (AgustaWestland)
- Twice as fast, twice the range of helicopters
- Helipads at corporate offices, isolated oil fields, small airports not designed for jets
- $8-10 million, 2016
QUESTIONS?
REFERENCES

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