VTOL for the Masses

IPRO 318

Advisor: Prof. Francisco Ruiz

Tom Malewicki
David Ofori-Amoah
Bhuvana Srinivasan
Steven Yap
What is VTOL?

- Vertical Takeoff Landing Aircraft
  - Helicopter
  - Hovercraft
  - Flying Car
- VTOL for the Masses
  - Maneuverability of a helicopter
  - Usability of an automobile
  - Flight stability of a plane
Why VTOL?

- Avoid Traffic Congestion
- Fast, Direct Transportation
- Avoid Lengthy Runways
- More Efficient Long Range Travel
Our Objective

• Other Proposals
  – Skycar
    • Millions of Dollars and Decades of Time
    • No Working Proof of Skycar capability

• Design a VTOL aircraft for civilian use
  – Economic appeal
  – Durability
  – Ease of use
  – Availability
Market Survey

• Revised survey from previous semester
• Students and Staff surveyed
  – $10,000 to $20,000 for the price of the aircraft
  – 150 mile range
  – Majority was confident in safety of product as well its ability to sell
Features of VTOL Aircraft

• Based on a helicopter design
• Wings
• No tail rotor
• 2 counter-rotating rotors
• 2-3 passengers
• Maximum speed of 120mph
X-Plane

- Simulation of model in X-Plane
  - FAA Approved
- Flying VTOL in X-Plane
  - Forward Flight Only
Computer Model

- Testing
  - Wings
  - Rotors
  - Center of Mass

- Finalized prototype design
  - Two intermeshed rotors
  - Large wings
    - Slightly Smaller than the rotors.
Scale Model

- Scale model based on Kyosho Nexus 30 model helicopter
Scale Model Wings

- Generate lift in forward flight and increase stability of aircraft
- Capable of rotation to reduce downwash
- Reduce weight of aircraft on rotor because maximum weight is on the wings (reduce cost of rotor)
- Built using Styrofoam coated with fibre glass and carbon fibre through a vacuum bagging process
Scale Model Power Train

• Function
  – Transmits power from the main shaft to the rotors

• Model is maneuvered by
  – Moving the Rotors
  – Changing the center of mass
Full Scale Prototype - Frame

- Pipe cage model
- Increased strength and reduced weight
- Cromoly 4130, aluminum
- Based on the model of the light-weight Robinson 22 and the Schweizer 300C aircrafts
Full Scale Prototype – Drive Train

- 150 Hp Mazda 13b car engine
- Modified gearing system
- Selected because of relatively easy modification for aircraft use
Budget Research

• To gain financial support for project
• Full Scale Prototype - $10,000
  – Materials needed
  – Supplies and Labor
  – Research and development
• Scale Model - $1,500
  – Model Kit
  – Modifications
  – Testing
Web Page

• Purpose
  – Keep group members up to date
  – Keep public informed

• Features
  – Message board and survey results
  – Project outline
  – Pictures of computer model

• www.iit.edu/~ipro318
Laws and Regulations

- Government Regulations on aircraft
- Noise and air pollution restrictions
- September 11 Impact
  - Air space restrictions
  - Licensing procedures
Future Needs

• Stronger market research
• Keep web page up to date
• Finalize budget and gain financial support
• Computer model research
• Test scale model
• Build full scale prototype
• Research laws and regulations
Conclusion

• Most objectives met
• Optimistic outlook
Thanks To Our Group Members

- Advisor – Professor Francisco Ruiz

Bhuan Agrawal
Jason Allen
Brian Demanett
Robbie Faith
Nekheel Gajjar
Amine Hammouni
Emanuel Idikeo
Josh Jump
Jongwon Kim
Jason Kozmic
Tom Malewicki

Adnan Malik
Loren McDaniel
Dave Muliere
Eskender Mulugeta
Talha Naveed
David Ofori-Amoah
Aidar Omarov
Katin Pandya
Bhuvana Srinivasan
Theron Voran
Steven Yap
Michael Yuan