Sky Diving Wind Tunnel
Power and Drive Train

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2017 – Aerolab proposed a new design for an 8.2 foot diameter flight chamber to Urban Air.

The new design included a single fan powered from a 600 HP, 900 RPM inverted vertical motor that could produce wind speeds up to 157 mph.
OTHER TUNNELS

PROBLEMS

- THE EQUIPMENT PRICE EQUALLED COST OF THE EQUIPMENT
- MOTOR WOULD BE DIFFICULT TO INSTALL, CONNECT AND MAINTAIN.

SOLUTION

ENGINEERING
CRITERIA

- **FUNCTIONAL** - 157 MPH WITH TWO FLYERS
- **SAFE** – NO LATENT SINGLE POINTS OF FAILURE AND MORE
- **RELIABLE** – OPERATE DAILY FOR MANY YEARS
- **SIMPLE** – EASY TO OPERATE
- **SUITABLE** – INSTALL ALMOST ANYWHERE
- **TRANSFERABLE** – DESIGN & PROGRAMS
- **CODE COMPLIANT** – NEC
- **REDUCE EQUIPMENT COST** – NO PROFIT / NO VALUE
SAMPLES OF QUALIFICATIONS

- 1998 – 2002 UNIVERSAL ISLANDS OF ADVENTURE
- 2007 - 2009 BOEING BVWT WIND TUNNEL
- 2008 – NEC ARTICLE 522
- 2009 – 2011 BOEING WHIRL TOWERS
- 2015- 2018 ST LOUIS ARCH TRAMS
CHALLENGE

AFFORDABLE – TO SELL AND OPERATE

- A HORIZONTAL 4 POLE MOTOR COSTS MUCH LESS THAT AN INVERTED 8 POLE MOTOR
- A GEAR BOX MULTIPLIES TORQUE
- FIND A MOTOR AND A GEARBOX THAT HAVE ALREADY BEEN DESIGNED AND ARE NOT CUSTOM
- REDUCE HORSEPOWER TO LOWER OPERATING COSTS
PROJECT REQUIREMENTS

❖ NO MISTAKES – RESPONSIBILITY

✓ VFD AND MOTOR - BOUGHT FROM ABB.
✓ GEARBOX, JACK SHAFTS, COUPLINGS & OTHER PARTS - BOUGHT INDIVIDUALLY.
✓ CUSTOM CONTROL PANEL
✓ BUY SIX OF FIFTY OR SO PARTS – MISTAKES WOULD BE COSTLY
✓ PARTS FROM OVER THE WORLD DO NOT COME TOGETHER UNTIL CONSTRUCTION

❖ COMMISSIONING – ONE TO TWO WEEKS
Necessity is the basis for invention.

Initially developed to reduce cost, Maida Engineering, Inc. developed a patent pending design using:

- an external 500 HP horizontal motor,
- 2.5:1 gearbox,
- Jackshaft with flexible couplings
- Low Harmonic VFD
- Custom Control and Safety Systems
System Development

- The use of a ratio gearbox mechanically multiplies the motor’s output torque.
- Torque is the force of rotation.
- With a 2.5:1 ratio gearbox, an 1,800 RPM motor will run the fan at 720 RPM.

Saved Money and made the Nacelle Smaller

\[
\text{TORQUE} = \frac{5252 \times \text{HP}}{\text{RPM}}
\]
System Development

Simple Solutions
Save Money and Increase Reliability

- Motor runs between 500 RPM and 1800 RPM – Fan runs between 200 RPM and 720 RPM
- 500 RPM and above motor does not need supplemental cooling.
- Air speed at 500 RPM is 40 MPH, not enough to sustain flight.
System Development – Oil Lube Skid

Lubrication

- Motor and coupling use grease
- Gearbox needs cooling and lubrication

CUSTOM DESIGN CAN BE PREFABRICATED

PROVIDES FUNCTIONALITY AND INSTRUMENTATION
GEAR BOX LUBE OIL SYSTEM
FUNCTIONALITY

- System Integration
  - Instruments
  - Control Devices
  - Power Supplies
  - VFD
  - HMI

- Custom Control
  - PLC Base
  - Safety Relays
  - HMI
  - Potentiometer
  - Class 2 Power Supplies
System Development

Control System with PLC, HMI, E-Stop, Safe Torque Off Station, Instruments and on/off Simulator

Located in Philadelphia Office

The Control System, which took months to program, was commissioned in the office prior to January 2019.
Construction
System Development
Details are Important
Details are Important
Details are Important
System Development
System Development
System Development
System Development
Safe Torque Off

- Allows working on mechanical equipment without turning off the VFD
- Used for Inspections
Power and Drive Train
Power and Drive Train
System Development
Interconnection Diagram
Wiring Diagrams are a Trade Secret
Custom Control System
Custom Control System
Custom Control System
Custom Control System
Open to the Public
LOCATIONS

Urban Air Locations:

- **Fort Worth, Texas** - Opened Feb 11, 2019
- **Snellville, GA** – Opened July 4, 2019
- **Katy, TX** – In Construction
- **Woodlands, TX** – In Construction
- **Albuquerque, NM** – In Construction
- **Bee Cave, Tx** – In Construction
THANK YOU