

# Stephanie Haynes Biography

- Thanks to family tradition, Ms. Haynes grew up with aviation, spending many summers at EAA AirVenture providing weather briefings to pilots. She has over 10 years experience in the aviation weather industry including contracts management, marketing, and sales. She has been a Sales Manager with Vaisala for 6 years, in which role she provides account management for statewide NAVAID programs as well as long-term support contracts for commercial service airports. She received her BA from the University of California at Berkeley and is in process of earning her MBA from the Carlson School of Management.

# Automated Weather Observation System (AWOS)

Stephanie Haynes  
Sales Manager, Vaisala Inc.  
June 23, 2011

**VAISALA**

# Contents

- **Vaisala Introduction**
- **AWOS: Background and Basics**
  - What is it?
  - How do pilots use it?
- **Ann & Robert H. Lurie Children's Hospital of Chicago**
  - AWOS Location
  - Message Corrections
- **Conclusion**



# Vaisala Introduction

- Vaisala is a global leader in environmental and industrial measurement
- We serve customers in meteorology, weather critical operations and controlled environment markets
- The Vaisala Group
  - Employs approximately 1,350 professionals
  - Has nearly 30 offices worldwide
  - Net sales of 253.2 million euros (2010)
  - Products used in over 140 countries
  - A-series shares quoted in NASDAQ OMX Helsinki stock exchange

# Vaisala Office Locations



# Vaisala Business Areas



# NA Airports Segment

- Headquartered in Boulder, CO with offices in Minneapolis and St. Louis
- Specializing in sales, installation, and service of Automated Weather Observation Systems (AWOS):
  - Over 800 AWOS nationwide
  - Nearly 350 AWOS maintenance sites nationwide
- Leading supplier to the FAA
  - Runway Visual Range (RVR)
  - Sensors for the ASOS and FAA AWOS programs
  - National Lightning Detection Network (NLDN) Data
  - Weather radar processors (TDWR Program)

# Contents

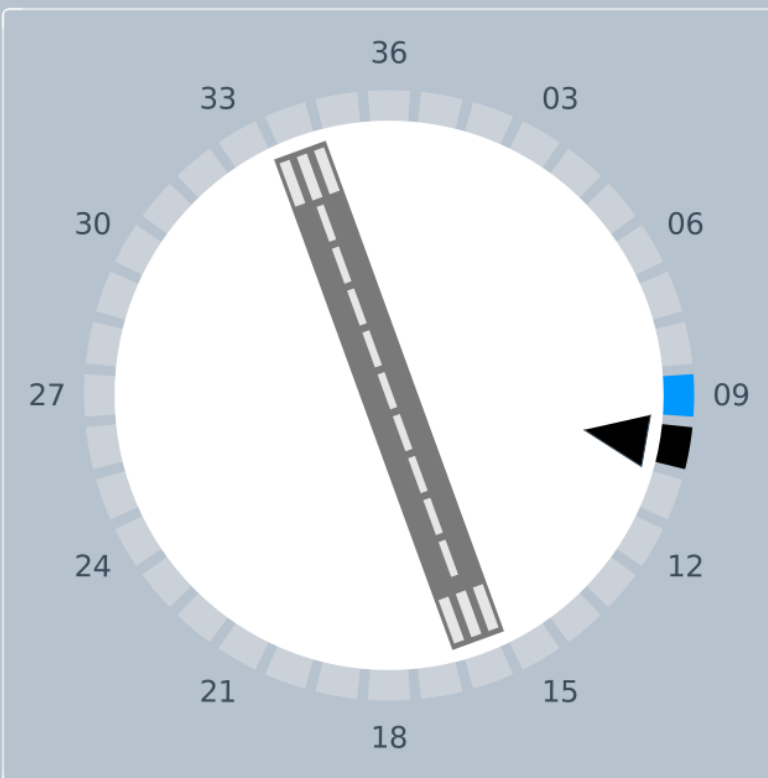
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# AWOS Basics

- FAA-certified automated weather system
- Provides real-time weather information to pilots via telephone, VHF radio, and local display
- Disseminates observations through the national network for public access via the internet
- Primary purpose is to increase situational awareness at takeoff and landing sites
- AWOS III P Measures:
  - Barometric Pressure
  - Temperature & Humidity
  - Wind Speed & Direction
  - Visibility
  - Present Weather
  - Cloud Height & Cover





SGS

2007 AUG 20

19:39Z

TEMP:

18C 64F



DEW PT:

17C 63F



ALTIMETER:

29.83 inHg



VISIBILITY:

10 SM



RUNWAY:

DENSITY ALT:

Wind:

100 DEG 05 KTS



700 Ft Overcast



METAR Message

Remarks

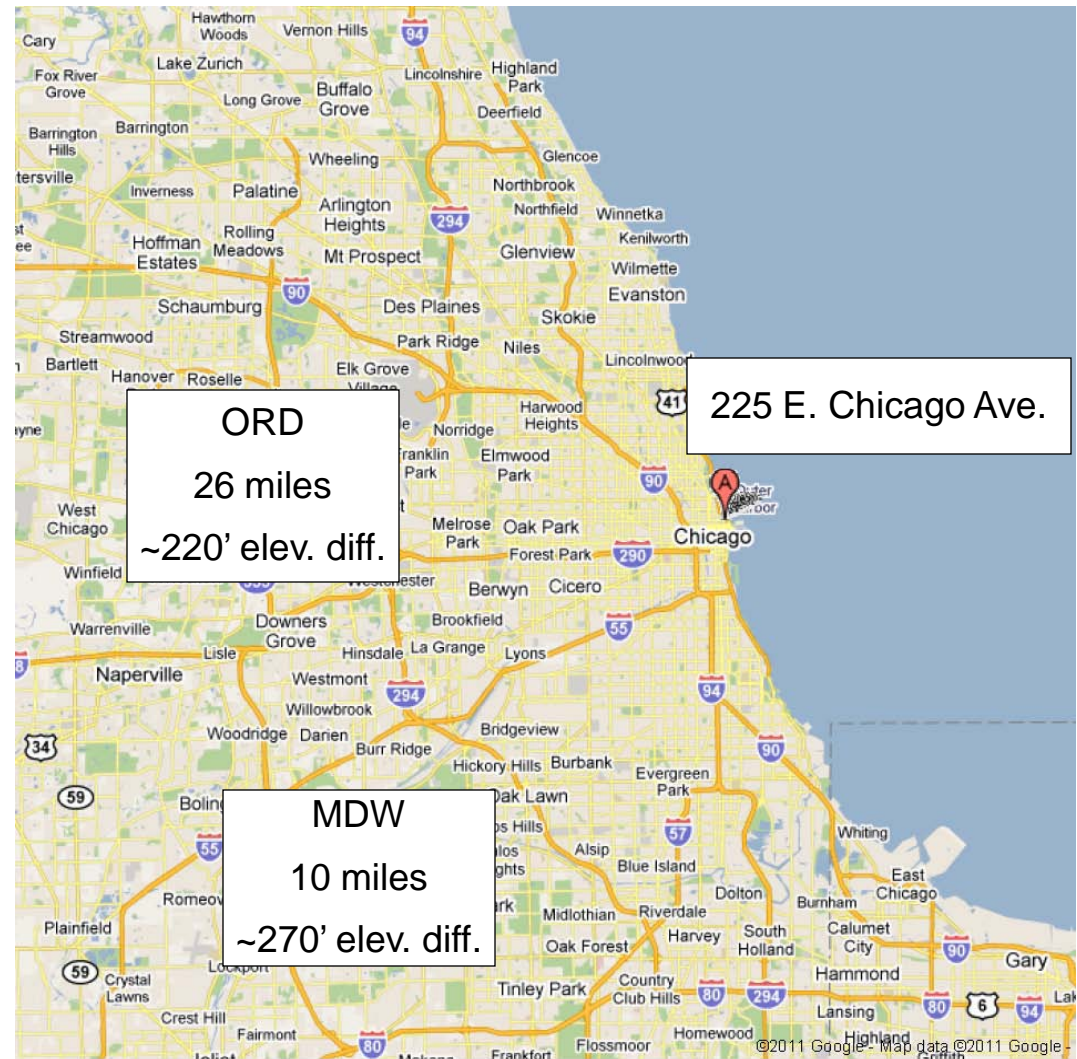
Lightning:

METAR KSGS 201859Z AUTO 09006KT 10SM 0VC007 18/17 A2982 RMK A02 P0001

RWSFC WARNING

# Nearest Observations

- Pilots can access data from other local sites
- ORD & MDW are closest locations
  - Differences in geography and elevation impact sensor readings
  - ASOS only update to the national network 1x per hour



# AWOS Usage

## ■ Barometric Pressure

- The most critical aviation weather parameter
- Used by pilots to calibrate their altimeters based on local conditions

**KORD 200851Z 0000KT 8SM OVC350 20/18 = Temp. 68°F, Dwpt 64.4°F**  
**KORD 200751Z 0000KT 10SM SCT250 21/19 = Temp. 69.8°F, Dwpt 66.2°F**  
**KORD 200651Z 0000KT 9SM FEW030 SCT250 19/18 = Temp. 66.2°F, Dwpt 64.4°F**  
**KORD 200551Z 0000KT 10SM FEW028 SCT250 21/18 = Temp. 69.8°F, Dwpt 64.4°F**  
**KMDW 200851Z 13004KT 10SM FEW140 BKN250 22/20 = Temp. 71.6°F, Dwpt 68°F**  
**KMDW 200751Z 13003KT 10SM FEW140 SCT250 22/20 = Temp. 71.6°F, Dwpt 68°F**  
**KMDW 200651Z 20004KT 10SM FEW250 23/20 = Temp. 73.4°F, Dwpt 68°F**  
**KMDW 200551Z 19005KT 10SM FEW031 SCT250 23/20 = Temp. 73.4°F, 68°F**  
**KORD 151651Z 17017KT 10SM FEW027 = from the S, 20MPH**  
**KORD 151551Z 17010KT 10SM FEW020 = from the S, 12MPH**  
**KORD 151451Z 14009KT 10SM FEW015 = from the SE, 10MPH**  
**KMDW 151651Z 16016G22KT 10SM SCT049 = from SSE, 18MPH, gusts to 25MPH**  
**KMDW 151551Z 16013G19KT 10SM FEW015 = from SSE, 15MPH, gusts to 22MPH**  
**KMDW 151451Z 14012G20KT 10SM FEW012 = from SE, 14MPH, gusts to 23MPH**

# AWOS Usage

**KORD 201251Z 21011KT 6SM**  
**KORD 201239Z 20012KT 8SM**  
**KORD 201151Z 16011KT 7SM**

**KMDW 201251Z 15007KT 3SM**  
**KMDW 201226Z COR 16012KT 2 1/2SM**  
**KMDW 201216Z 15009KT 2SM**  
**KMDW 201151Z 17011KT 3/4SM**

**KORD 192251Z 14005KT 10SM FEW034 SCT055 BKN200 OVC250**  
= Few Clouds at 340', Scattered at 550', Broken at 2,000', Overcast at 2,500'

**KORD 192151Z 11007KT 10SM FEW032 SCT060 BKN200 OVC250**  
= Few Clouds at 320', Scattered at 600', Broken at 200', Overcast at 2,500'

**KORD 192051Z 10009KT 10SM SCT032 BKN060 BKN200 OVC250**  
= Scattered Clouds at 320', Broken at 600', Broken at 2,000', Overcast at 2,500'

**KMDW 192251Z 20006KT 10SM SCT035 OVC300**  
= Scattered Clouds at 350', Overcast at 3,000'

**KMDW 192151Z 14007KT 10SM SCT034 BKN060 BKN250**  
= Scattered Clouds at 340', Broken at 600', Broken at 2,500'

**KMDW 192051Z 00000KT 10SM BKN035 OVC250**  
= Broken Clouds at 350', Overcast at 2,500'

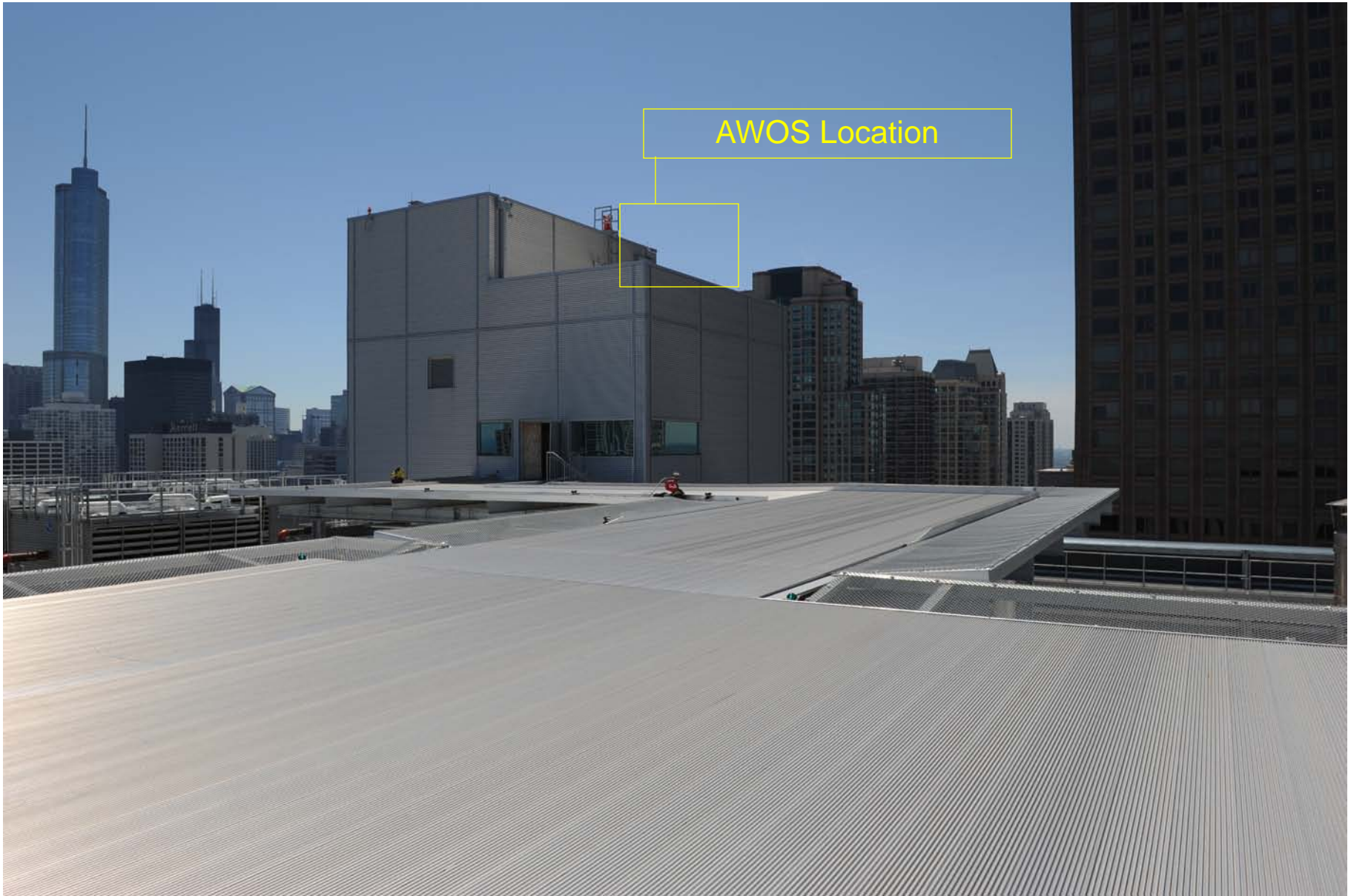
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  - Siting
  - Correcting AWOS Reports
- Conclusion



# Siting

- AWOS location chosen per FAA siting criteria
  - FAA Order 6560.20B
  - Developed to ensure consistent functioning of aviation weather systems
  - “If systems are installed in accordance with this order, there is a high probability that, as far as location is concerned, the systems will be able to provide the usable information desired.”
- Section 2 – Sensor Exposure
- Section 4 – Heliport Siting Criteria



AWOS Location

# Siting

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# Siting

## ■ 2.3 Cloud Height Sensor

- “The sensor should be located as far as practicable from strobe lights and other modulated light sources.”

## ■ 2.4 Visibility Sensor

- “...the receiver will be pointed in a northerly direction.”
- “The sensor should be located as far as practicable from strobe lights and other modulated light sources.”
- “...backscatter-type sensors must have a clear area for 300 feet (90 meters) in the forward (north) octant.”

# Correcting AWOS Reports

## ■ 2.6 Voice Programming: Remarks & NOTAM

- A voice-appended remark and/or NOTAM can be entered by authorized weather observers to provide an alternative to entering data using the keyboard because the system can only speak the words in its fixed vocabulary.
- The recorded message does not appear in the METAR or on the display screen. Recorded messages are appended to each voice report. If power is lost, the recorded message is restored
- A recording up to 91 seconds may be made and is stored in battery backed SRAM on the processor module voice card.
- If a weather remark and a NOTAM are to be recorded, the NOTAM message should be prefixed with the word “NOTAM” to distinguish it from weather remarks.
- Voice remarks and/or a NOTAM can be programmed using the AWOS handset (at the ACU or the VDP) or remotely using a dial-up telephone.

# Correcting AWOS Reports

- Watauga Medical Center Heliport, Boone, North Carolina. Automated weather observation. 1636 Zulu. Weather: Wind 120 at 5; Visibility 10; Clear Below 12,000; Temperature 19 Celsius; Dew Point 13; Altimeter 30.06. Remarks: Density Altitude 4,200.
- Altus Quartz Mountain Regional Airport. Automated weather observation. 2050 Zulu. Weather: Wind 240 at 18 gusts 27; Visibility 10; Clear Below 12,000; Temperature 40 Celsius; Dew Point -1; Altimeter 29.52; Remarks: Density Altitude 5,000. Use right-hand traffic for Runway 17. AWOS winds are currently intermittent and unreliable, contact Unicom for wind estimate.



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# Conclusion

- An AWOS provides critical information to pilots
  - Aids in making accurate fly/no-fly decisions
  - Increases safety by improving situational awareness at takeoff and landing
- Having an AWOS on-site increases the accuracy of the information available to pilots
  - Environmental conditions can vary significantly from site to site
  - AWOS observations update every minute
- The AWOS is sited according to FAA guidelines for optimal sensor functioning
- Additional information about site conditions can easily be provided to pilots when necessary

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# Rex J. Alexander

# Biography

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# Rex J. Alexander

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- 30 years in Aviation
- 25 years in Rotary Wing Operations
- 17 years in Air Medical Operations
  - Pilot, Base Manager, Safety Manager & Regional Manager
- Over 5,000 Hours of Helicopter Experience
- Rated and Current Commercial/Instrument Helicopter Pilot Flying EMS
- Licensed Airframe and Powerplant Technician
- BS in Aviation Management from Parks College of Aviation, St. Louis University

# Rex J. Alexander (continued)

## ■ Member of the following:

- National EMS Pilots Association (6 years)
  - Current President (8 months)
- Indiana Association of Air Medical Services (7 years)
  - Former President (5 years)
- Helicopter Association International Heliport Committee (3 years)
- Helicopter Association International Air Medical Committee (1 year)
- National Fire Protection Association NFPA-418 Standards for Heliports Committee (1 year)
- Joint Helicopter Safety Implementation Team Infrastructure Working Group (4 years)
- Industry liaison to the FAA, DOT, NTSB, HLS and TSI

# Review of Illinois DOT Urban Airwake Analysis

Ann & Robert H. Lurie  
Children's Hospital of Chicago



Provided by  
Rex J. Alexander  
June 23, 2011

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# Overview

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# Overview

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- Expert Analysis
  - Overview of IDOT Report
  - Comparison to Expected Flight Operation
- Commitment to Safety
  - Intensive Testing
  - Orientation and Education

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# Expert Analysis

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# Overview of IDOT Report

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- **An outstanding report:**
  - The information provided by both Children’s Memorial’s experts and now the Illinois DOT’s experts has expanded our breadth of knowledge for this location to an unheralded level unmatched by virtually any other location in the world.
  - This has raised the bar of safety to an entirely new level for the rest of the country to emulate.

# Overview of IDOT Report

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*“Airwake turbulence is a common occurrence for **all** operational rotorcraft...”*

# Overview of IDOT Report

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- *“The approach outlined in this report used simulation models to assess airwake effects on helicopter operations, supplemented by experimental data and **conservatism** in application of the models, input parameters, and interpretation of the results.”*
- *“This model formed the basic simulation tool that was exercised for several **worst case**’ wind conditions to understand the limits of airwake effects on helicopter operations.”*

# Overview of IDOT Report

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- *“The [selected] path has more interaction with airwakes due to surrounding buildings [than ‘the most common approach anticipated’] and thus results in a more **conservative analysis.**”*
- *“Upwind conditions for the CFD analysis and airwake simulations were selected to be representative of the more common (based on historical wind data) and **more critical** wind (based on proximity of building airwakes to the helipad site) conditions.”*

# Overview of IDOT Report

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- *“The Bell 206L3... was considered a **conservative** choice for the analysis.”*
- *“The attitude fluctuations and control motions predicted by the flight dynamics model and pilot model tend to be slightly larger than those seen in flight.”*

# Overview of IDOT Report

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- *“Regarding the effects of urban airwake on helicopter operations, simulation results indicate that proposed wind limits for the helicopter (i.e. 25 knot mean winds with a 15 knot gust spread) **are acceptable** although approaching the limits for helicopter operations **based on the representative aircraft** examined in this study.”*

# Overview of IDOT Report

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## Southeast Approach

- *“The gusts over the heliport are relatively benign.”*
- *“There are some low frequency fluctuations in wind speed which are easily compensated for by the pilot.”*
- *“The turbulence does not generate any unusually large attitude disturbances.”*

## Northeast Approach

- *“Disturbances due to urban airwake were not a major factor along the approach path.”*

# Overview of IDOT Report

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- *“Comprehensive simulation analyses did not predict any wind condition that would result in a severe upset of the aircraft or loss of control. As long as the approach is performed by an experienced and attentive pilot a conventional helicopter should have sufficient control margins to perform approach and landing maneuvers.”*

# Overview of IDOT Report

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- Test Aircraft
  - In the testing that was accomplished a light aircraft (Bell 206-L3) was utilized for both the modeling and flight testing.
  - Light, single engine helicopters will not be allowed to operate at this location.

# Overview of IDOT Report

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- Recommendation
  - *“Given modeling uncertainties and approximations, it is recommended that the wind operation limits be initially scaled back (to 20 knots maximum mean wind speed)...”*
  - *“The operational limits of the heliport can be expanded through flight testing...”*

# Overview of IDOT Report

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- **Confirmation of Adopted Standards**

- *“The DOI (U.S. Department of Interior) guidelines advise that **light helicopter** operations be terminated should mean wind speeds exceed 30 knots or the maximum gust spread exceed 15 knots.”*
- Current adopted standards at Children's are a maximum of 25 knots mean wind speeds and 15 knots gust spread for medium helicopters and above.

# Helicopter Approach

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- Unlike an airplane approach a helicopter does not maintain a constant airspeed or descent rate on approach to land. It is a constantly descending/decelerating approach so that the approach terminates at a hover with the rate of descent and groundspeed reaching zero at the same time.

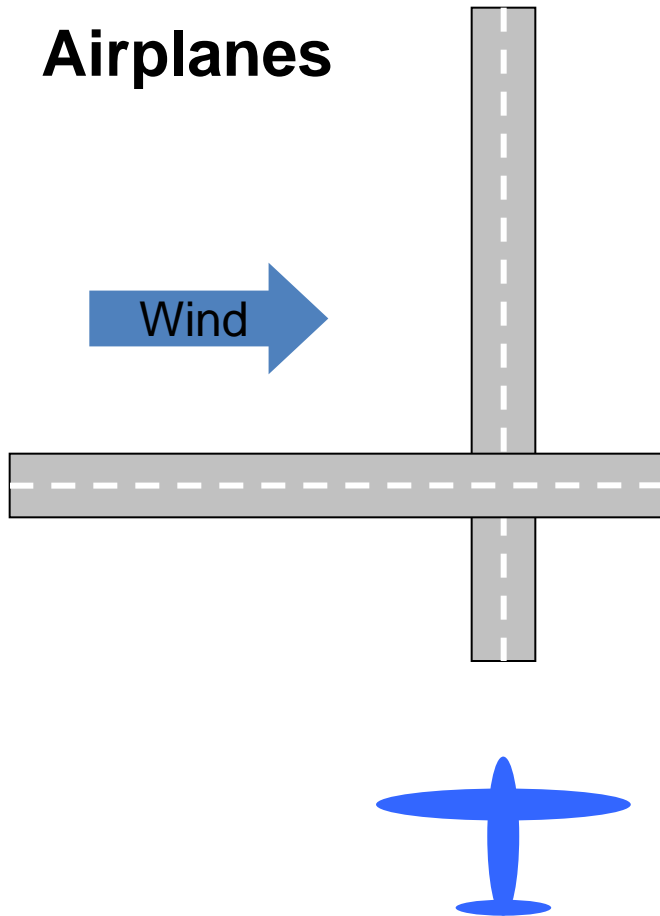
# Crosswind Safety

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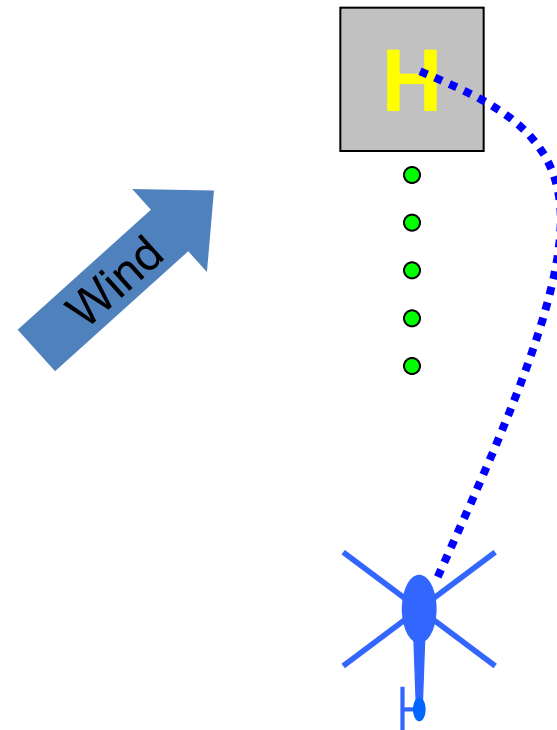
- *“When operating at a heliport, the pilot has more freedom in choosing their approach path and they can choose any final heading alignment. **The pilot can turn into the wind before touchdown.**”*

# Crosswind Operations

**Airplanes**



**Helicopters**



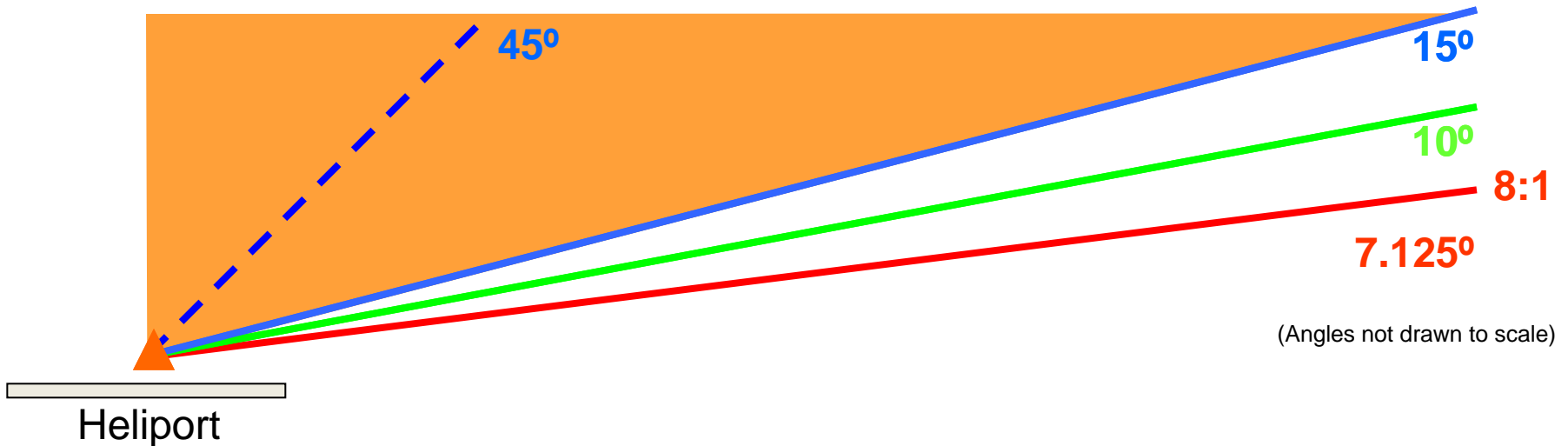
# Approach Paths

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- *“It should be noted that pilots can chose other approach paths to the heliport, and chose alternative glideslopes (i.e. steeper approaches).”*
- Pilots routinely modify their approach and or departure as needed to safely meet the conditions of a specific location.

# Approach Angles

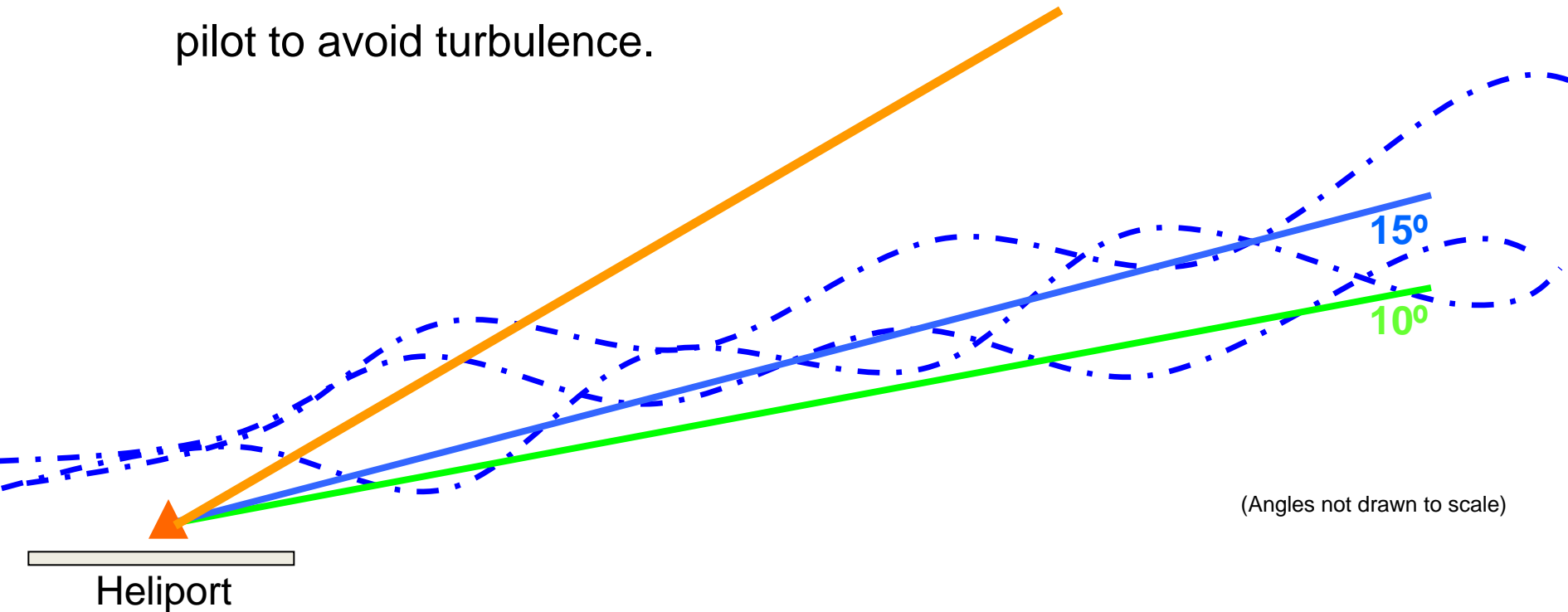
- Approach floor is **8:1** or **7.125 degrees**
- Normal approach **10 degrees**
- Steep approach **15 degrees**
- **Additional usable airspace**



# Turbulence Avoidance

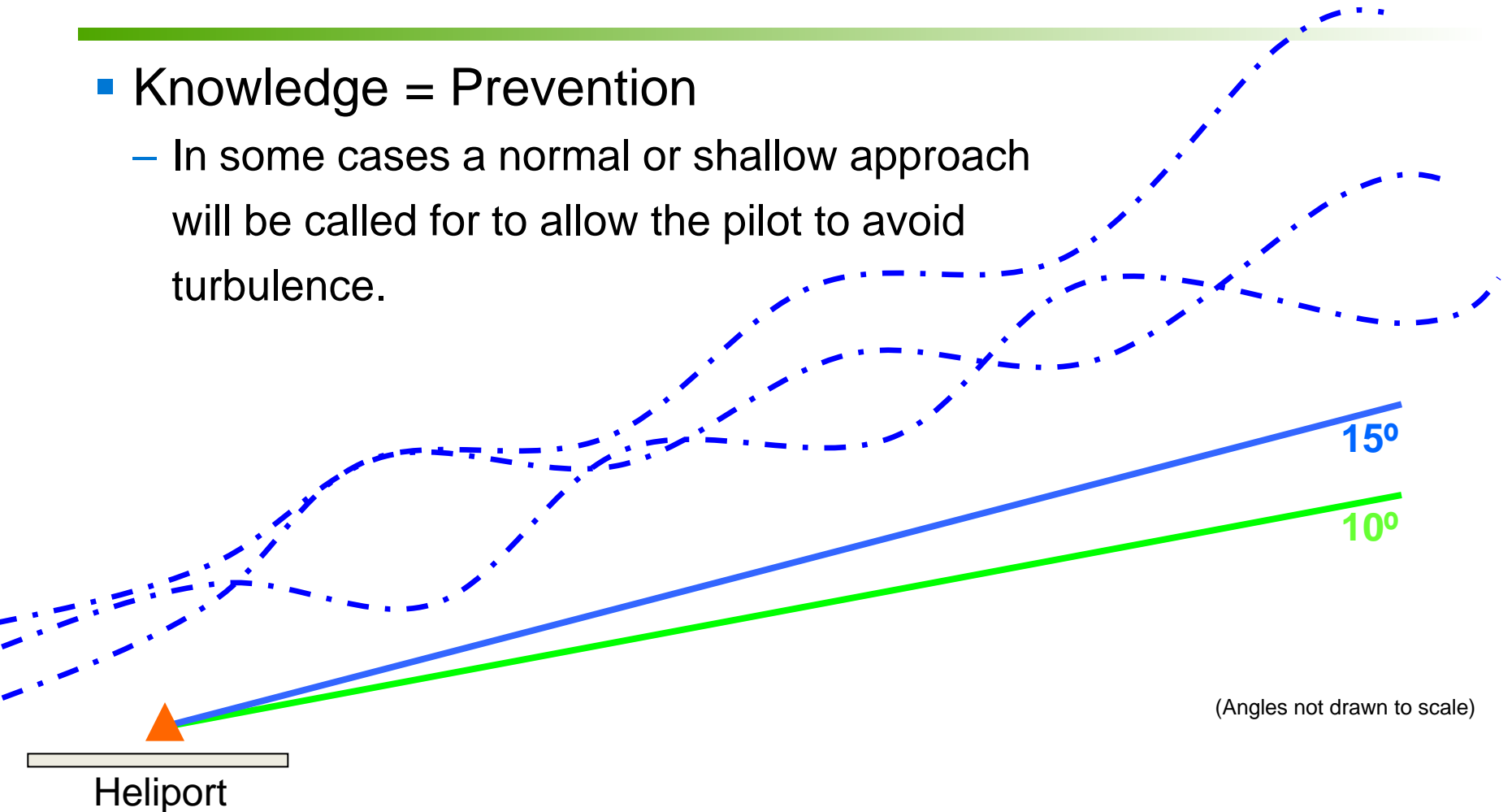
- Knowledge = Prevention

- In some cases a steeper approach may be called for to allow the pilot to avoid turbulence.



# Turbulence Avoidance

- Knowledge = Prevention
  - In some cases a normal or shallow approach will be called for to allow the pilot to avoid turbulence.



# Use of More Robust Helicopters

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- **Bell 206 L3 vs. Design Aircraft**

- *“The aircraft (Bell 206 L3) represents a relatively light aircraft compared to other medical helicopters (making it more susceptible to turbulence).”*

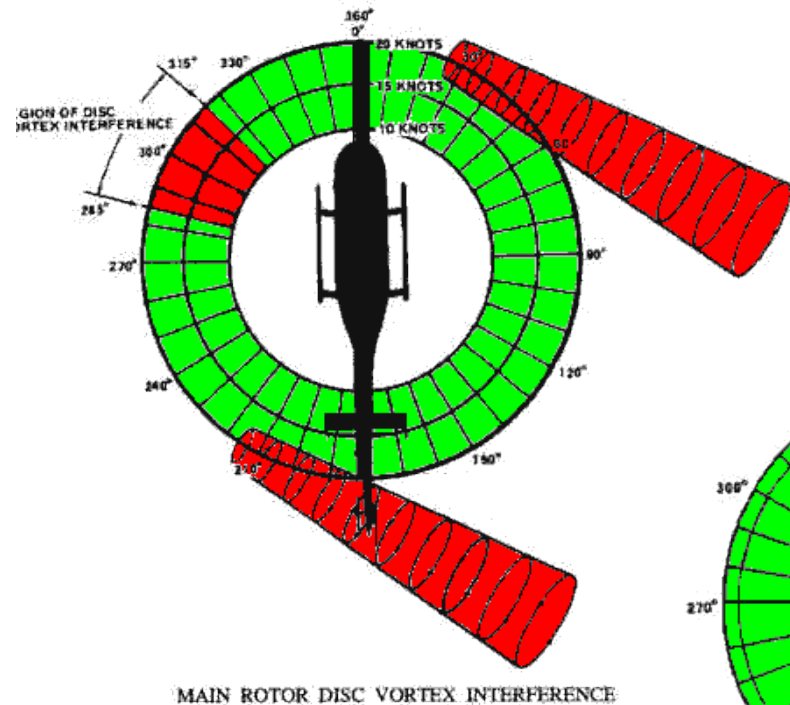
- Light vs. Medium

- Improved Stability

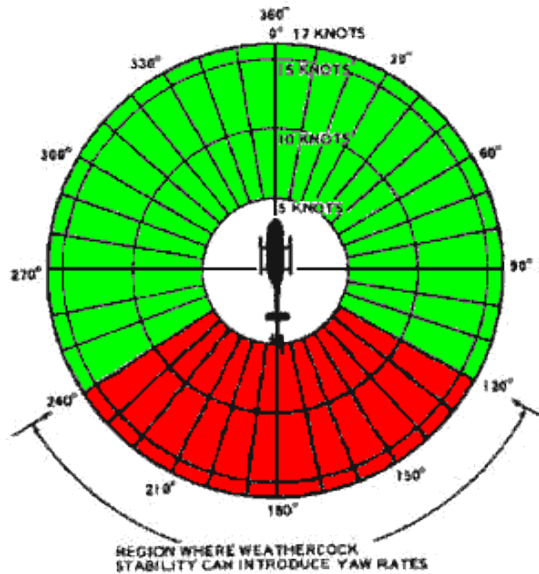
- Twin Engine

- Increased Power Margins
- Redundancy

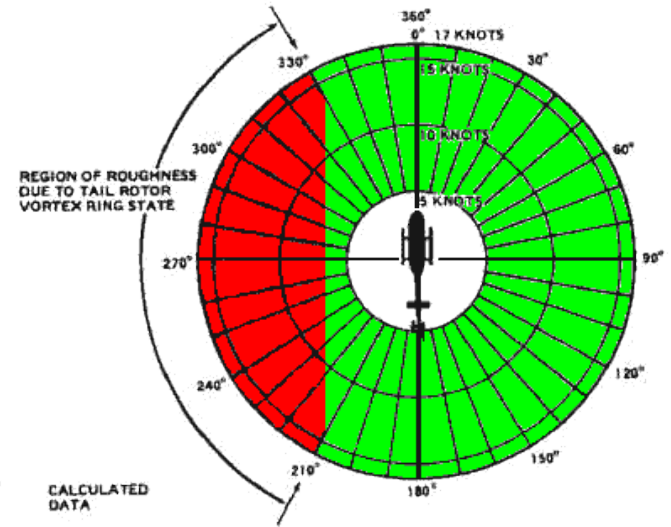
# Known Helicopter Issues Under Known Wind Conditions



**Disk Vortices**



**Weathercock Stability**



**Vortex Ring State**

# Standard Pilot Training

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- All pilots must have gone through Children's Memorial Hospital's heliport training program prior to operations being conducted.
  - The information provided by the Illinois DOT will be incorporated into the training program as well as any continuing evaluation information.

# Use of More Robust Helicopters

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**Bell 206 L3**

**vs.**

**Design Aircraft**  
*(Eurocopter BK-117)*



# Use of More Robust Helicopters

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- **Bell 206 L3 vs. Design Aircraft**

- *“The two-bladed teetering rotor design provides less control authority than more modern (offset hinge or hingeless) rotor systems.”*
- The helicopters that are currently in place that will service this facility are not the two-bladed teetering rotor systems but rather the more stable offset hinge and hingeless designs.

# Piloting Skills

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- At any time the pilot feels that an approach is uncomfortable, incorrect, or potentially dangerous he will abort the approach.
- Federal Aviation Regulation Part 91.3
  - Responsibilities and Authority of the Pilot in Command:
    - *“The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.”*
  - The pilot can always say no.

# Operational Environment

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# Operational Environment

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# Commitment to Safety

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# Intensive Testing

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- Continuous Evaluation and Testing
  - Leveraging technology for safety
    - Every flight will be recorded and evaluated
    - Flight recording equipment
    - Defined parameters
    - Aircraft Simulator Testing and Training Potential
      - *“The modeling approach used in this study (integration of airwake solutions with a flight dynamics model) can be used in high fidelity rotorcraft flight simulators (trainers).”*

# Intensive Testing

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- Time to Develop a Database
  - Three or Four Seasons of Test Flights
  - Rigorous Study and Evaluation
  - Methodical Approach
- Use of Data Collected to Refine Parameters
  - Consider recommendation to lower wind limitations
- Commitment to continue to study and evaluate long into the future

# Standard Pilot Training

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- All Part 135 EMS helicopter pilots receive regular training in and are regularly tested on aerodynamic topics which include but are not limited to:
  - Transverse Flow Effect
  - Ground Effect
  - Effective Translational Lift
  - Retreating Blade Stall
  - Settling With Power
  - Loss of Tail Rotor Effectiveness
  - Vortex Ring State
  - Weathercock Stability
  - Disk Vortices

# Safety Review Program

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- **Review**

- Every flight
- Every turn down
- Every question
- Every issue

- **Involving**

- Transport Teams
- Pilots
- Doctors
- Administration

# Conclusions

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- IDOT'S independent experts conducted a comprehensive study on the impact of the urban wind environment upon helicopters at the landing site.
- IDOT'S analysis utilized a conservative, worst-case scenario to test the outer limits of operations, yet, neither the modeling nor the flight tests predicted any threat to safety.
- CMH has committed to further testing and evaluation prior to conducting any patient transport flights.
- The pilots who will use the helipad will have more sophisticated equipment, and the benefit of additional education, orientation, and training.

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# Thank You