Pilot Impairment
Medications and Medical Conditions

Nicholas Webster, MD, MPH
Medical Officer
Medications Study Objectives

- Examine among fatally injured pilots
  - Prevalence of positive toxicology tests
  - Trends in positive toxicology tests
  - Comparison to the general population
  - Differences between categories of pilots
Why the Focus on Pilots?

- Fatally injured pilots
  - More than 1,300 drugs and metabolites
- DOT mandatory testing requirements
  - Urine specimen
  - 11 drugs
- Best opportunity to study trends in drug use by transportation operators
Data Sources: 1990-2012

- Bioaeronautical Research Laboratory at Federal Aviation Administration (FAA) Civil Aerospace Medical Institute (CAMI)
  - Toxicology test results database
- NTSB’s Aviation Accident Database
Accident Selection

- **Included**
  - Accidents 1990-2012
  - Flying pilot died

- **Excluded**
  - Pilots in the aircraft but not flying
  - Intentional events
  - Toxicology not performed
Methods

• Metabolites

• Excluded

  • Duplicate results from metabolites or multiple specimens
  • Drug findings in urine only
  • Drugs from postaccident resuscitation
Study Dataset

- 6,677 fatally injured “study pilots”
- 96% general aviation
- Represents 87% of the domestic civil aviation accidents 1990-2012 with a pilot fatality
Demographics

- 98% male
- Ranged from 16 to 92 years old
- Average age increased from 46 to 57 during the study period
Toxicology Findings for All Drugs, 1990-2012

Percent of Study Pilots with Positive Findings

- At Least 1 Positive Drug Finding
- More Than 1 Positive Drug Finding
- More Than 2 Positive Drug Findings

Year:
- 1990
- 1991
- 1992
- 1993
- 1994
- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012

NTSB
Pilot Impairment Safety Seminar October 15, 2016
Medications and Medical Conditions
Definitions

- **Drugs**
  - Over-the-counter
  - Prescription
  - Illicit

- **Controlled substances**
  - DEA defines Schedules I-V
  - Schedule I: no medical use
  - Marijuana Schedule I
Potentially Impairing Drugs

- FDA warnings
  - Sedation
  - Hallucinations
  - Behavior changes
  - Driving or operating machinery
- Controlled substances
  - DEA Schedule II-V
- Illicit drugs
Illicit Drugs

- Schedule I
- Schedule II misuse
  - Cocaine
  - Amphetamine
- Toxicology tests cannot identify non-medical use of other drugs
Drugs Indicating a Potentially Impairing Condition

• Drugs used primarily to treat
  • Psychiatric diseases
  • Severe pain
  • Neurologic diseases
  • Heart rhythm problems
Toxicology Findings by Category, 1990-2012

Percent of Study Pilots with Positive Findings


- Potentially Impairing Drugs
- Potentially Impairing Condition
- Controlled Substances
- Illicit Drugs
Toxicology Findings by Age Group, 1990-2012

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Potentially Impairing Drugs</th>
<th>Potentially Impairing Condition</th>
<th>Controlled Substances</th>
<th>Illicit</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 and under</td>
<td>(n = 1,692)</td>
<td>(n = 1,617)</td>
<td>(n = 1,653)</td>
<td>(n = 1,660)</td>
</tr>
<tr>
<td>+40 to 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+50 to 60</td>
<td>(n = 1,653)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 60</td>
<td>(n = 1,660)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Toxicology Findings by Operation Type, 1990-2012

Percent of Study Pilots with Positive Findings by Category

- Potentially Impairing Drugs
- Potentially Impairing Condition
- Controlled Substances
- Illicit

Part 121 and 135 Air Carriers
- Potentially Impairing Drugs: 15%
- Controlled Substances: 4%
- Illicit: 5%

General Aviation
- Potentially Impairing Condition: 20%
- Controlled Substances: 8%
- Illicit: 6%

(n = 288) (n = 6,389)
Toxicology Findings by Medical, 2005-2012

Percent of Study Pilots with Positive Findings by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>FAA Medical Within Duration of Third Class</th>
<th>Expired / No Medical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potentially Impairing Drugs</td>
<td>(n = 1,676)</td>
<td>(n = 260)</td>
</tr>
<tr>
<td>Controlled Substances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potentially Impairing Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illicit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pilots with Positive Findings

- Potentially Impairing Drugs
- Controlled Substances
- Potentially Impairing Condition
- Illicit
Impairment and the Probable Cause

• Medical condition or drug with potential to cause impairment
• Impaired decision-making or behavior not reasonably predicted by skill and experience
• Associated with accident circumstances
NTSB Identification: ERA13LA076

- 14 CFR Part 91: General Aviation
- Accident occurred Sunday, December 02, 2012 in Collegedale, TN
- Aircraft: CASSUTT SPORT RACER, registration: N9CA
- Injuries: 1 Fatal.
Flight

• Local VMC flight ~1600 to practice takeoffs and landings
• Wind 170 at 9 knots, 10 miles visibility, broken clouds at 5,500 feet and 25,000 feet, temp 21 C, dew point 9
• Departed runway 21- no further contact - ALNOT
Accident Location

Wreckage located December 4, 2012
\(\frac{1}{4}\) mile north of the FGU runway 21 threshold
Accident site
Pilot

- 82 year-old private pilot
  - airplane single engine land rating
  - 400 total flight hours in 2004
  - Deferred class 3 medical certificate April 2004
    - Severe coronary artery disease
Autopsy

- Cause of death – Multiple blunt force injuries
- Manner – accident
- Severe coronary artery disease
  - Significantly enlarged heart
  - 90-percent occlusion of the left anterior descending, circumflex, and right main arteries
  - Complete occlusion of the three bypass vessels
Toxicology

- Carvedilol and losartan
  - Blood pressure/cardiovascular medications,
- Fluoxetine and its metabolite, norfluoxetine
  - AKA – Prozac an anti-depressant
- Dextromethorphan
  - Cough medication
- Warfarin
  - AKA Coumadin – an anticoagulant
Toxicology

- **Promethazine** – above therapeutic level in blood
  - AKA Phenergan a sedating anti-nausea medication
- **Diphenhydramine** – therapeutic levels in blood
  - AKA Benadryl a sedating allergy medication
  - AKA Sominex a non-prescription sleep aid
- **Combination**
  - increased drowsiness, confusion, and memory problems.
- **WARNINGS**
  - “may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery).”
Summary

- Pilot likely had necessary skill and experience to safely complete flight
- No preexisting mechanical issues identified
- Combination - two sedating medications
  - Degrade ability to safely fly the airplane
  - Severe Heart disease
  - High risk for a sudden cardiac arrhythmia
Probable Cause

• Impact with trees and terrain during the landing approach likely due to the physiological incapacitation of the pilot
Most Common Drugs

- Sedating antihistamines
  - Most common category

- Diphenhydramine
  - Most common individual drug
  - Most common potentially impairing drug
### Drug Facts

**Active ingredient (in each capsule)**
- Diphenhydramine HCl 25 mg

**Purpose**
- Antihistamine

**Uses**
- temporarily relieves these symptoms due to hay fever or other upper respiratory allergies:
  - runny nose
  - sneezing
  - itchy, watery eyes
  - itching of the nose or throat
- temporarily relieves these symptoms due to the common cold:
  - runny nose
  - sneezing

**Warnings**

**Do not use** with any other product containing diphenhydramine, even one used on skin.

**Ask a doctor before use if you have**
- a breathing problem such as emphysema or chronic bronchitis
- glaucoma
- trouble urinating due to an enlarged prostate gland

**Ask a doctor or pharmacist before use if you are**
- taking sedatives or tranquilizers

**When using this product**
- marked drowsiness may occur
- avoid alcoholic drinks
- alcohol, sedatives, and tranquilizers may increase drowsiness
- be careful when driving a motor vehicle or operating machinery
- excitement may occur, especially in children

**If pregnant or breast-feeding, ask a health professional before use.**

Keep out of reach of children. In case of overdose, get medical help or contact a Poison Control Center right away.
(1-800-222-1222)

### Directions

- take every 4 to 6 hours
- do not take more than 6 doses in 24 hours

<table>
<thead>
<tr>
<th>Adults and children 12 years and over</th>
<th>1 to 2 capsules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children 6 to under 12 years</td>
<td>1 capsule</td>
</tr>
<tr>
<td>Children under 6 years</td>
<td>do not use this product in children under 6 years of age</td>
</tr>
</tbody>
</table>

### Other information

- store at 59° to 77°F in a dry place. Protect from heat, humidity, and light.
- do not use if carton is open or blister unit is broken

See side panel for lot number and expiration date.
Prevention

- READ - ASK
- FAA Medications and Flying Brochure
  - [https://www.faa.gov/pilots/safety/pilotsafetybrochures/](https://www.faa.gov/pilots/safety/pilotsafetybrochures/)
- FAA Do Not Issue - Do Not Fly
  - [https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/pharm/dni_dnf/](https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/pharm/dni_dnf/)
- AOPA member’s web site
- Other resources
Medication Advice (FAA)

- Rule of 5
- $5 \times$ the maximum dosing interval
- If the dosing interval is every 6 to 8 hours then $5 \times 8 = 40$ hours after last dose.
Accident – NTSB # WPR14FA078

- Fresno California
- December 26, 2013 at 1821
- Cessna 172K
- Dark night with haze

Example of 1970 Cessna 172 K
Accident Sequence

- 3 attempts to land on runway 30/12 at Fresno Chandler Executive (FCH)

Pass 1
Pass 2
Pass 3

60 foot tree damage at 40 feet

Crash Site
Accident Site Opposite Direction

2 FATAL
72-Year-Old Male Private Pilot

- 1,459.34 total hours, 25.3 at night
- FAA Medical Certification Exam – May 2013
  - No reported medications or medical conditions
  - No abnormalities recorded by examiner
  - DVA
    - Uncorrected 20/20 R,L,B
    - NVA corrected 20/25 R,L,B
  - Issued a Class 3 Medical Certificate
    - must possess glasses for near vision
Pilot Personal Records

- 5 optometry visits over 3 years
  - Primary complaint – halos around stars
  - Optometry Exam:
    - 5/10 - OD: NS Trace, OS NS1+
    - 9/11 - OD: NS1+, OS NS1+
    - 7/12 - OD: NS1+, OS NS1+
    - 8/13 - OD: NS1+, OS NS1+
    - 11/13 - OD: NS1+, OS NS1+, bilat floaters, right vitreous opacity, CDVA 20/20 OU
  - No other ocular disease recorded
- No other contributory natural diseases
Autopsy and Toxicology

- No impairing natural diseases, medications, or toxins identified
Investigation

• 3 weeks prior to accident
  • Difficulty taxiing at home field at night
  • Unable to locate taxiway
    • Witness illuminated taxiway with truck headlights
  • No problems identified with airport lighting
    • Other pilots had no problems taxiing at night
Discussion

- No mechanical or operational issues
- Pilot passed med cert exams
- Demonstrated no difficulty flying during the day
- Cataracts
  - Induced glare and diminished nighttime visual acuity
  - Impaired ability to safely control the airplane at night
NTSB Probable Cause

- The pilot’s failure to maintain adequate clearance from trees while on approach, which subsequently led to a loss of airplane control.
- Also causal was the pilot’s continued operation of the airplane at night with a diagnosed medical condition that degraded his night vision.
Cataract Risk

- By age 65 ≈20% and by 70 ≈50% of Americans affected
- ≈60,000 active pilots over 65
  - ≈12,000 or 4% of pilot population at risk for cataracts
- Risk of progression and vision impairment
- Possibly flight safety hazard (especially at night)
- Surgery effective at eliminating hazard
Pilot Specific Cataract Risk Guidance

• At the time of the investigation
  • No guidance for aviation medical examiners
  • No readily accessible pilot guidance
Recommendations

• Federal Aviation Administration
  • AME education - risks cataracts may pose to flight safety including a discussion of degraded vision at night; and referral of pilots with cataracts to eye care professionals
  • Pilot education on risk and need to communicate with eye care professionals

• Aircraft Owners and Pilots Association
  • Pilot education on risk and need to communicate with eye care professionals
QUESTIONS
&
SUGGESTIONS