World Airshow Accident/Incident Overview 2015

“A realistic, clear-eyed look at risk management for display flying is a sobering exercise. Emotionally, we all LOVE absolute extreme edge of the envelope flying....right up until the revulsion of impact. Airshow accident statistics are all that remain!” (Maj Gen Scott Hammond, US ANG)

Des Barker

JANUARY 2016
Scope

- Role & Function of Airshow Executive Safety Management
- Display Physiological Environment
- A Statistical Analysis - “The Inconvenient Truth”
- Overview of Airshow Relate Accidents 2015!
WHAT IS THE ROLE AND FUNCTION OF AIRSHOW CONTROLLING BODIES?

Accountable For?

Airshow Safety

Responsible For?

• Visioning – setting safety objectives.
• Imposition and implementation of regulations through the specific country’s regulatory authorities.
• Instilling “SAFETY IS AN ATTITUDE” across the entire airshow population spectrum.
• Fostering of good relations with airshow organisations.
To ensure that the implementation of policies, procedures and equipment utilisation is adequately addressed and that personnel are trained within their areas of expertise.

- Develop and Manage Airshow Safety Strategic Objectives.
- Develop and Manage an Airshow Safety Management System.
- Compliance with Military and Chicago Convention Obligations.
- Monitor regulatory compliance through ICAS/EAC/ASSA appointed officers.
- Practice safety oversight and regulation enforcement through regulatory bodies.
- Ensure Zero Tolerance of poor individual and/or Corporate performance.
The Hostile Low Level Environment

- God did not design man to fly!
- 2 – Dimensional Creatures!

**Human Physiology Challenges**
- Closing Rates 1500 kms/hr
- Extremely High Rates of Descent 300 KTAS vertical
- Normal Acceleration +9g/-6g
- Roll Rates >360deg/sec

**Human Physiology Weaknesses**
- Relatively Low reaction times
- Inability to make quick, consistent and repeatable decisions
- Inability to make good decisions repeatedly under pressure
To review the worldwide airshow accident and incident safety statistics for 2015.
Definition of Airshow Accidents

Longman Family Dictionary
in the context of airshows –
“exhibition” = “a public showing”
and therefore makes all public aviation
events, be they static or flying, an
exhibition of some sort.

In context, this includes rehearsals for:
- Airshows
- Air races
- Flypasts
- Wingwalkers
- Barnstorming/Crazy Flying
There are no new accidents – Just new pilots making old accidents (Hoover)!

- Structural Failure
- Flight Into Terrain
- Mechanical Failure
- Air Races
Lies!

Damned Lies!

Statistics!!!

Benjamin Disraeli - Charles Wentworth Dilke (1843-1911).
"A Few Good Men".

with Tom Cruise, Demi Moore, Jack Nicholson, Kiefer Sutherland, Kevin Bacon. (1991)

Nicholson: "You want answers?!!"

Cruise: "I want the truth!!"

Nicholson:"You can't HANDLE the truth!!"
Sample Size = 278

Statistical Analysis 2015

Annual Airshow Accidents 2015

10 Year Average = 27.8

Airshow Accidents 10 Previous Years

Sample Size = 278
Statistical Analysis 2015

Lviv, Ukraine; Su-27(85/156)

*Osprey (10)
*Tiger Moth (39)
*Reno Air Race P-51 (11/66)

Monster Truck, Mexico

2002: 171
2003: 116
2004: 287
2005: 171
2006: 116
2007: 287
2008: 171
2009: 116
2010: 287
2011: 171
2012: 116
2013: 287
2014: 171
2015: 116

Airshow Accident Casualties 2001

Killed
Injured
Total
Fatalities (1908 to 2015)

1206 vs 1953 = 3159
Airshow Accident Casualties 2015 = 44
Statistical Analysis 2015

Airshow Accident/Incidents Aircraft Categories

Sample Size = 24

Vintage Aircraft = 29%
5th Year
Airshow Accident/incident Causal Factors

### 2012
- **Sample Size = 26**
- **Mech**: 38%
- **Ground Collision**: 15%
- **Midair Collision**: 15%
- **Bird**: 8%
- **Unkown**: 8%
- **Environmental**: 4%
- **Loss of Control**: 15%

### 2013
- **Sample Size = 21**
- **Mech**: 33%
- **FIT**: 24%
- **Para**: 10%
- **Ground Collision**: 15%
- **Environmental**: 9%
- **Truck**: 5%

### 2014
- **Sample Size = 17**
- **Mech**: 29%
- **Loss of Control**: 24%
- **Environmental**: 12%
- **Structural**: 6%
- **Midair Collision**: 6%
- **Pilot Error**: 6%

### 2015
- **Sample Size = 24**
- **Mech**: 25%
- **Loss of Control**: 42%
- **Structural**: 4%
- **Environmental**: 4%
- **Midair Collision**: 25%
- **Mechanical**: 9%
- **FIT**: 6%
Statistical Analysis 2015

Airshow Accident/incident Causal Factors

- **2015**: Sample Size = 24
- **2014**: Sample Size = 17
- **2013**: Sample Size = 21
- **2012**: Sample Size = 26
- **2011**: Sample Size = 34

**Airshow Accident/incident Causal Factors**
Statistical Analysis 2015

Man = 83%

Machine = 13%

Medium = 4%

Sample Size = 24
Statistical Analysis 2015

We do not “train like we fly and fly like we train!!!!

Airshow Accident/incident Analysis Display vs Practice
Comparative Airshow Accident/incident Analysis - Countries
Comparative Airshow Accident/incident Analysis – Military vs Civilian
<table>
<thead>
<tr>
<th>Ser</th>
<th>Date</th>
<th>Aircraft Type</th>
<th>Category</th>
<th>Accident Category</th>
<th>Fatalities</th>
<th>Eject</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>1</td>
<td>16 Jan 15</td>
<td>Aero Aventura II</td>
<td>Experimental Amphibian</td>
<td>LOC (Fly by)</td>
<td>1 Pilot killed 1 Pax killed</td>
<td>N/A</td>
<td>Airshow</td>
<td>Florida, USA</td>
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<td>2</td>
<td>21 Jan 15</td>
<td>Sud-Aviation Alouette III</td>
<td>Helicopter</td>
<td>Bowing (Pilot Error)</td>
<td>1 Pilot Inj 1 Crew Inj</td>
<td>N/A</td>
<td>Airshow</td>
<td>Saurimo, Angola</td>
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<td>3</td>
<td>19 Feb 15</td>
<td>Zlin 50XL Flying Bulls</td>
<td>Sport Aero</td>
<td>Midair Collision</td>
<td>0</td>
<td>N/A</td>
<td>Airshow</td>
<td>Bangalore, India</td>
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<tr>
<td>4</td>
<td>15 Mar 15</td>
<td>KAI KT-1B Jupiter Aerobatic Team</td>
<td>Trainer Turboprop</td>
<td>Midair Collision (Opposition Pass)</td>
<td>0</td>
<td>2</td>
<td>Display Practice</td>
<td>Langkawi, Malaysia</td>
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<tr>
<td>5</td>
<td>29 Mar 15</td>
<td>Vans RV-8 Team Aerodynamix</td>
<td>Experimental</td>
<td>Midair Collision (Turning)</td>
<td>0</td>
<td>N/A</td>
<td>Airshow</td>
<td>Alabama, USA</td>
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<tr>
<td>6</td>
<td>03 Apr 15</td>
<td>Focke Wulf FW190A</td>
<td>Vintage Fighter Propeller</td>
<td>Mechanical (Brakes) (Landing)</td>
<td>0</td>
<td>N/A</td>
<td>Display Practice</td>
<td>Blenheim, New Zealand</td>
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<td>7</td>
<td>22 Apr 15</td>
<td>Edge 360</td>
<td>Sport Aero</td>
<td>LOC (Lomcevak)</td>
<td>1 Pilot killed</td>
<td>N/A</td>
<td>Display Practice</td>
<td>Buckenham, UK</td>
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<td>8</td>
<td>24 May 15</td>
<td>Hawker Hurricane</td>
<td>Vintage Fighter Propeller</td>
<td>LOC (Landing)</td>
<td>0</td>
<td>N/A</td>
<td>Airshow</td>
<td>La Ferte Alais, France</td>
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<td>9</td>
<td>30 May 15</td>
<td>Stampe SV-4</td>
<td>Vintage Trainer Propeller</td>
<td>LOC</td>
<td>1 Pilot</td>
<td>N/A</td>
<td>Display Practice</td>
<td>Breuil, France</td>
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<td>10</td>
<td>31 May 15</td>
<td>Vans RV-8</td>
<td>Experimental Homebuilt</td>
<td>Midair Collision</td>
<td>1 Pilot</td>
<td>N/A</td>
<td>Airshow</td>
<td>Alba Adriatica, Italy</td>
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<td>11</td>
<td>27 Jun 15</td>
<td>Eurocopter EC 145</td>
<td>Helicopter</td>
<td>Ground Incident (Engine Start)</td>
<td>2 Spectators Inj</td>
<td>N/A</td>
<td>Airshow</td>
<td>Minnesota, USA</td>
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<td>12</td>
<td>27 Jun 15</td>
<td>Christen Pitts S-2B</td>
<td>Sport Aero</td>
<td>LOC (Lomcevak)</td>
<td>1 Pilot killed</td>
<td>N/A</td>
<td>Airshow</td>
<td>Missouri, USA</td>
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<tr>
<td>Ser</td>
<td>Date</td>
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<td>Accident Category</td>
<td>Fatalities</td>
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<td>Event</td>
<td>Location</td>
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<tr>
<td>13</td>
<td>01 Aug 15</td>
<td>Folland Gnat Display Team</td>
<td>Vintage Fighter Jet</td>
<td>LOC?</td>
<td>1 Pilot killed</td>
<td>N/A</td>
<td>Airshow</td>
<td>Cheshire, UK</td>
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<tr>
<td>14</td>
<td>02 Aug 15</td>
<td>Mil Mi-28N Night Hunter Berkuty Golden Eagles</td>
<td>Helicopter</td>
<td>Mechanical (Pitch-up)</td>
<td>1 Pilot killed 1 Pilot Inj</td>
<td>N/A</td>
<td>Airshow</td>
<td>Ryasan, Russia</td>
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<td>15</td>
<td>16 Aug 15</td>
<td>Van's RV-8 Redline Team</td>
<td>Experimental</td>
<td>Pilot Error (Taxying)</td>
<td>0</td>
<td>N/A</td>
<td>Airshow</td>
<td>New Jersey, USA</td>
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<td>16</td>
<td>16 Aug 15</td>
<td>Golden Knights</td>
<td>Parachutist</td>
<td>Midair Collision</td>
<td>1 Para killed 1 Para Inj</td>
<td>N/A</td>
<td>Airshow</td>
<td>Chicago, USA</td>
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<tr>
<td>17</td>
<td>22 Aug 15</td>
<td>Hawker Hunter</td>
<td>Vintage Trainer Jet</td>
<td>FIT (Loop)</td>
<td>1 Pilot Inj 1 Pilot killed 16 Public Inj</td>
<td>No</td>
<td>Airshow</td>
<td>Shoreham, UK</td>
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<tr>
<td>18</td>
<td>23 Aug 15</td>
<td>Comco Ikarus Grasshoppers</td>
<td>Experimental</td>
<td>Midair Collision</td>
<td>1 Pilot Killed</td>
<td>N/A</td>
<td>Airshow</td>
<td>Dittingen, Switzerland</td>
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<tr>
<td>19</td>
<td>28 Aug 15</td>
<td>Giles G-202</td>
<td>Sport Aero</td>
<td>Structural Failure (Lomcevak)</td>
<td>1 Pilot Killed</td>
<td>N/A</td>
<td>Display Practice</td>
<td>New York, USA</td>
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<tr>
<td>20</td>
<td>29 Aug 15</td>
<td>replica Spitfire</td>
<td>Experimental</td>
<td>LOC (Takeoff)</td>
<td>0</td>
<td>N/A</td>
<td>Airshow</td>
<td>Brisbane, Australia</td>
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<tr>
<td>21</td>
<td>30 Aug 15</td>
<td>Pitts Special S-2B</td>
<td>Sport Aero</td>
<td>Tumble</td>
<td>1 Pilot Killed</td>
<td>N/A</td>
<td>Airshow</td>
<td>Friesach, Austria</td>
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<tr>
<td>22</td>
<td>12 Sep 15</td>
<td>Aerovodochody L-39 Albatros</td>
<td>Vintage Trainer Jet</td>
<td>LOC?</td>
<td>1 Pilot Killed</td>
<td>N/A</td>
<td>Airshow</td>
<td>Tennessee, USA</td>
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<tr>
<td>23</td>
<td>31 Oct 15</td>
<td>Slick 540</td>
<td>Sport Aero</td>
<td>LOC (Avalanche)</td>
<td>1 Pilot Killed</td>
<td>N/A</td>
<td>Airshow</td>
<td>San Salvador, Brazil</td>
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<tr>
<td>24</td>
<td>19 Dec 15</td>
<td>T-50 Golden Eagle</td>
<td>Trainer Jet</td>
<td>FIT (Downline Rolls)</td>
<td>2 Pilot Killed</td>
<td>No</td>
<td>Airshow</td>
<td>Yogyakarta, Indonesia</td>
</tr>
</tbody>
</table>
“But remember please, the law by which we live,
We are not built to comprehend a lie,
We can neither love, nor pity, nor forgive,
If you make a slip in handling us, you die”

Rudyard Kipling
“Secret of the Machines”
Midair Collision

19 February 2015
Zlin 50XL
‘Flying Bulls’
Bangalore, India
Midair Collision

23 August 2015
Grasshoppers
Comco Ikarus
Dittingen,
Switzerland
15 March 2015
KAI KT-1B Woongbi
‘Jupiter Aerobatic Team’
Langkawi, Malaysia
31 May 2015
Vans RV8/RV7
‘QBR Team’
Alba Adriatica,
Italy

Midair Collision: Mirror
29 March 2015
Team Aerodynamix
RV 6/RV 8
Alabama, USA

Midair Collision
Loss of Control – FlyBy

16 January 2015
Aero Aventura II Amphibian
Florida, USA
Loss of Control: Spin

30 May 2015
Stampe SV-4
Breuil
France
Loss of Control: Tumble

30 August 2015
Pitts Special
Friesach,
Austria
Loss of Control: Tumble

27 June 2015
Christen Pitts S-2B
Missouri
USA
Loss of Control: Gyroscopic

31 October 2015
Slick 540
San Salvador,
Brazil
Loss of Control: Downline

Downline Hazards

- Gravity,
- High energy loss.
- Highly angular rates,
- High vertical inertia.
- Low aerodynamic power.
- Energy management.

ENERGY GATE + SIGHT PICTURE DECISION CRITICAL

Total Energy $E = \text{Potential Energy} + \text{Kinetic Energy}$

$$\Sigma E = hp + \frac{1}{2}MV^2$$

$$\frac{dE}{dt} = \frac{dhp}{dt} + \frac{1}{2} M \frac{d}{dt} v^2$$

= rate of climb + momentum (mv)

22 April 2015,
Edge 360,
Old Buckenham,
UK
Loss of Control: Takeoff

29 August 2015
Spitfire Replica
Brisbane, Australia
Loss of Control: Landing

24 May 2015
Hawker Hurricane
Dijon
France
Flight Into Terrain: Downline Rolls

19 December 2015
T-50 Golden Eagle, Yogyakarta, Indonesia

Detik-detik Saat Pesawat TNI T-50 Jatuh
22 August 2015
Hawker Hunter T7,
Shoreham,
United Kingdom

Flight Into Terrain: Loop
Flight Into Terrain: Parachutist

16 August 2015
"Golden Knights"
Chicago, USA
Mechanical Failure: Brakes

03 April 2015
Flugwerke Focke Wulf FW190A
Blenheim, New Zealand
Mechanical Failure: Engine

28 August 2015
MiL Mi-28 Night Hunter
*Berkuty Golden Eagles*
Ryasan,
Russia
Structural Failure: Composites

28 August 2015
Giles G-202
New York, USA
Environmental: Spectators

27 June 2015
Eurocopter EC145
Minnesota, USA
Pilot Error: Handling

21 January 2015
Sud Aviation SA-316B
Alouette III
Saurimo, Angola
Pilot Error - Taxying

16 August 2015
Vans RV8
New Jersey
USA
The Rogue

Rookie  
Willing to Learn

Rising Star
Accolades
Rising Ego
Respect

Falling Star
Disregard for personal safety
Arrogance
Aggressiveness
Continuous Affirmation

Rogue
Split Trajectory
Regulation Transgression

The path from Rookie to Rogue is marked by a split trajectory, indicating a transition from respect and willingness to learn to disregard for personal safety, arrogance, and aggressiveness. The journey is characterized by a rise in ego and accolades, followed by a fall, leading to the rogue state.
Conclusions 2015

Highlights: None - Lousy year.

Lowlights:

• Average 27.8 accidents/annum untenable - 83% MAN!!!!!
• Passenger killed on demonstration flight?????
• 11 Public killed/16 Public Injured!!!!!
• Vintage aircraft losses 29% - remains highest/5\textsuperscript{th} year in row.
• Loss of control inordinately high 42%.
• Black August 2015/9 Airshow accidents.
• Energy loss in a tumble/spin clearly problematical: investigate scientifically to provide quantitative planning information to the display pilot.
• The question of composites integrity a challenge for material sciences.
• Interrogate the psychological aspects of decision making.
• Skill of formation aerobatics pilots in some case, questionable.

‘quick wins’ for airshow organisers, safety officers and display pilots can ultimately contribute to driving an agenda for zero airshow accidents per annum.
2015

EXECUTIVE SAFETY MANAGEMENT SCORECARD

- 24 Airshow Accidents & Incidents
- 28 Aircraft
- 11 Pilots killed
- 3 Pilots injured
- 1 Crew member injured
- 1 Parachutist killed.
- 1 Passenger Killed
- 11 Public killed
- 16 Public injured

TOTAL = 44 killed/injured!!

The world airshow community is left with the unsolved problems that unites all of us, “don’t hit the ground”.

It’s not how you manage the ‘Known Unknowns’ of your sequence, but rather how you manage the ‘Unknown Unknowns’.

(Apologies to Raymond Poole)
“I have learned that carelessness and overconfidence are usually far more dangerous than deliberately accepted risks.”

(Wilbur Wright 1900 in a letter to his father)