

Airshow Accidents and Incidents 2018

Des Barker

The tenets expressed in this review are those of the author and addresses a sample of significant accidents and incidents at aerial events worldwide in 2018, both during the actual events and during rehearsals and includes, airshows, air races, flypasts, and air capability demonstrations; in fact, any event at which an aircraft is displayed or rehearses for a public air event in which the flow of the event is jeopardised, or reputational damage could accrue.

Introduction

This report does not seek to pass judgement on the accident other than reporting on information in the public domain in an effort to identify and alert the airshow community to accident trends in airshow safety worldwide. What can be concluded was that airshow 'guardian angels' once again worked overtime in 2018 to reduce the number of fatalities at air events worldwide. Similarly, Air Bosses and Safety Officers were challenged to deal with the unintended consequences of hosting airshows.

Although consensus was reached in 2010 between ICAS, EAC and ASSA that the accident/incident rate had to be arrested, clearly, the objective has not been achieved.

From 2011 to 2014, regulators and the airshow community were patting themselves on the back with statistical evidence of decline being arrested clearly evident. The concern was always "were we seeing a definite decrease worldwide accruing from the contributions of the display pilots, safety

officers, air bosses, airshow organisers and spectators, or was it just a statistical spike?"

Sadly, and at the expense of melodrama, there is nothing new under the sun. Due to the fickleness of man's decision making, highly experienced pilots have in some cases, continued making the same errors in judgement over the past 110 years of airshows?

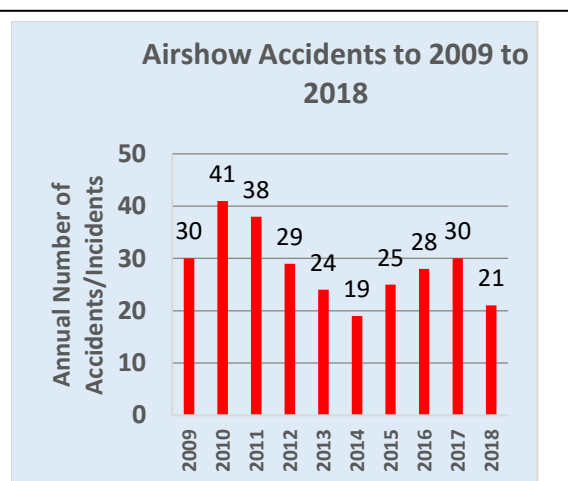
Note, not 'pilot error' but rather 'error of judgement'. The term error has connotations of negligence or incompetence, which is clearly not the case in these accidents. Display pilots do not intentionally have accidents but make their decisions based on the prevailing environmental factors, energy states and attitude of the aircraft in terms of a particular manoeuvre – sadly though, as humans, our ability to continually make consistently accurate decisions within the hazardous low-level display arena, remains questionable.

2018 OVERALL ASSESSMENT

The most significant indicator and highlight in 2018 was zero reportable accidents or incidents in the UK. What was the most probable causes of this 'first ever' achievement?

Opinions differ but is thought that the fallout of the Shoreham Hunter crash in 2015 resulted in a greater awareness of risk and risk management by pilots, air bosses and event organisers which gave new impetus to 'risk aversion' which in turn induced greater oversight by regulators, new regulations and control mechanisms, the creation of the 'Fair System', improving the Just Culture mentality, a greater understanding of the regulations, accreditation of FDD's and documentation and a greater concentration by pilots on display areas, heights and separation distances.

Many argued that the additional restrictions in terms of display areas were more of a distraction and that the new regulations and requirements may have seen some of those less committed to safety, leave the business.



Statistical analysis of airshow accidents over the past 10 years shows a year on year average of 28 accidents per annum? There does not appear to be an ability to reduce the accidents/incidents per annum to zero!

2018 STATISTICAL OVERVIEW

Casualties

A total of 21 accidents and incidents were recorded which resulted in an unacceptable 42 casualties in which 12 pilots lost their lives and 4 pilots were injured. The injury to 5 passengers was a result of 'flipping' in vintage aircraft.

The largest component of injuries resulted from paratroopers in South Africa. Parachutists have been an integral part of airshows from the beginning of airshows and have also paid the ultimate price during public demonstrations of their skills. In 2018, 1 parachutist was killed, but 18 paratroopers were injured, which cast a gloomy picture on the accident statistics.

Fatalities remain untenable and if the airshow community is to continue to exist without regulatory and insurance interventions which would impose additional constraints on the ability to host air events, airshow accidents must decrease. Sponsors are not generally amenable to supporting events in which fatalities occur; not good for their branding at all!

Causal Factors

6 'Flight-Into-Terrain' accidents (29%) occurred which was similar to the historical average of 27%. 5 Loss-of-Control accidents at 24% was greater than the historical average of 18% but a closer investigation of the actual accidents/incidents show three occurred during take-off and landing. A little known fact

The reduction in 'up and away' loss of control accidents was heartening and reversed the trend of 'out of control' manoeuvres which have continued unabated throughout the history of airshow accidents.

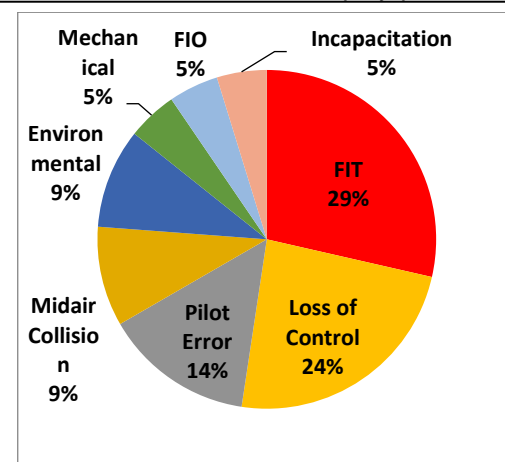
Rather pleasing was that only one mechanical failure was recorded, this against an historical 17% contribution and was mainly attributable to a tyre separating from the wheel rim of a vintage Tigercat landing at Oshkosh.

Another positive attribute was that there were no accidents accruing from tumbling gyroscopic manoeuvres for the second year in succession. Could it be that display pilots now understand that tumbling manoeuvre trajectories and dynamics are not an exact science and that energy management and error budgets for such downline manoeuvres must be more optimistic?

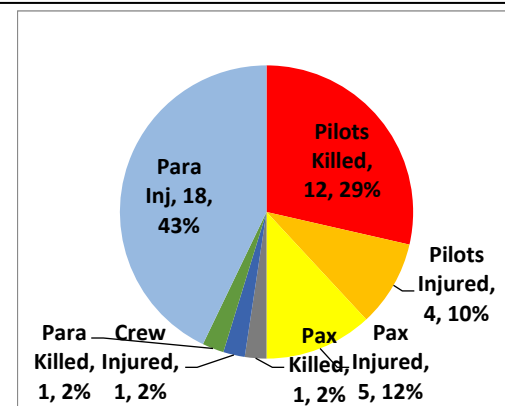
Could it be that display pilots that include high energy tumbling manoeuvres in their routine now understand the inconsistent and unpredictable nature of energy loss and the importance of maintaining situational awareness regarding the aircraft's trajectory; to terminate the manoeuvre at the first sign of the

aircraft's trajectory transitioning to a downward vector - gyroscopic manoeuvres on the downline at low heights at airshows are not for amateurs or for that matter, the professionals either!

The midair collision from mirror formation recovery for the second time in two years indicates that some display pilots do not



Airshow accident and incidents 2018 by Causal Factors.



Categorisation of airshow accident Casualties 2018.

understand that their aircraft do not roll around the inertial axis but around the aerodynamic axis and any burying of the nose without longitudinal separation will most probably result in a midair collision. Another positive aspect for 2018 was that although the 2 midair collisions (9%) was below the historical average of 15%.

Event Categorisation

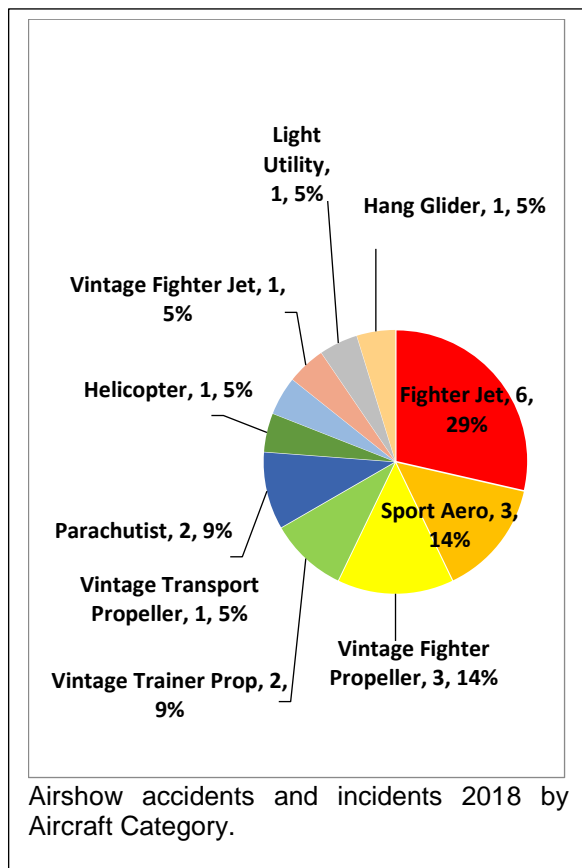
Historically, 77% of accidents and incidents occurred during actual displays versus 23% during practice; 2018 saw a significantly lower percentage at 60%.

Could this be that the military adage of "fight like you train" is applied by display pilots. Display like you practice' – anything else is pushing the error budget.

Aircraft Categories

Bearing in mind the reduced participation of military aircraft and the increased number of vintage aircraft at airshows worldwide, vintage aircraft were involved in 33% of the airshow accidents.

What was of concern was the fact that once again vintage aircraft, as was the case in 2011 through 2016, continued to make up the biggest proportion of aircraft types involved in the accidents.



Accidents by Country

21 accidents occurred in 10 different countries but for the first time in many years, the UK recorded zero reportable accidents and incidents, this against the 8 airshow accidents and incidents in 2017,

9 Accidents and incidents occurred in the USA, 3 in South Africa, 2 in Romania and 1 in Canada, Nigerial, New Zealsnd, Indonesia, China, Botswana and 1 in Singapore. Sadly, there are no accurate statistics regarding flying hours flown in practice and during air events against which to make more statistical sense of the accident figures.

¹ Aviation Safety Network, ASN Wikibase Occurrence # 205702, KAI T-50 Golden Eagle, 06 February 2018.

ACCIDENT/INCIDENT OVERVIEW 2018

1. 06 FEBRUARY 2018: KOREAN AEROSPACE INDUSTRIES T-50 GOLDEN EAGLE, ROKAF BLACK EAGLES (CHANGI, SINGAPORE)

Taking off in a three-ship formation as the second section of the ROKAF *Golden Eagles* formation aerobatic team at the bi-annual *Singapore Airshow*, a T-50 Golden Eagle blew a tyre and then flipped over when the aircraft departed the runway during the recovery rollout. Although the aircraft caught fire, the pilot managed to egress with light injuries only, but caused the Air Force to cancel scheduled performances.¹

The Republic of Korea Air Force classified the accident as 'pilot error' due to the pilot having disengaged the nosewheel steering prematurely which led to the jet veering off towards the right side of the runway while accelerating for take off. The proper procedure was to abort the take off, but "the pilot was fixated on the successful completion of the teams' flying display".² Plan continuation bias?³



ROKAF Golden Eagles T-50 rolled over on departing the runway after bursting a tyre during a formation takeoff. (TODAY)

2. 20 MARCH 2018: AMERICAN CHAMPION SUPER DECATHLON DL-30 (JAVA, INDONESIA)

A former Indonesian Air Force pilot, Col H.J. Amir Hamzah HJ Hanafie, was killed when the Decathlon he was flying in preparation for the *Wings Day* ceremony of the Genesa Flying Academy, crashed during an aileron roll. The nose buried at the inverted position and the Decathlon impacted the ground in front of six

² Aerssurance, *Korean T-50 Accident at Singapore Airshow*, 10 November 2018.

³ Yeo Jun-suk, *The Korea Herald, Pilot Error to Blame for Crash of Black Eagles Jet*, 28 March 2018.

aircraft on the flight line and then came to rest inside a hangar.⁴

3. 31 MARCH 2018: YAKOLEV 3 (WANAKA, NEW ZEALAND)

It's amazing how quickly an accident can happen if all actors in the show are not all briefed and understand the shape and size of the airshow. In this case, 'an airshow organizer's nightmare scenario'. 25,000 spectators attending the opening act of the *Warbirds Over Wanaka International Airshow* watched a Yak 3, collide with a 'cherry picker' during the landing roll on the grass strip parallel to the main tarred runway.

The Yak 3 landing from the display lined up all the holes in James Reason's Swiss Cheese model, the first hole starting with the last minute change to the flying programme at *Warbirds Over Wanaka*. A USAF F-16 was supposed to be first up on the programme but bad weather prevented the Fighting Falcon from being able to do so; instead, Mr Arthur Dovey's two synchro Yak 3s which were scheduled for later in the morning, were requested to fill the 'opening slot'.

The next hole in the Swiss Cheese was the two eight tonne 'cherry pickers' parked on the grass adjacent to the runway for a later display that was to consist of a line of balloons at 80 ft stretched between the two cherry pickers. A gaggle of light aircraft fitted with paint ball guns would attempt to shoot at the balloons.

The original plan was to move the 'cherry pickers' after the paint ball attackers. This was the third hole in the Swiss Cheese model - they were obviously still there because their act in the programme had not yet been performed. Only three holes were needed in the Swiss Cheese model for this accident to occur.

Changing the programme was the easy solution to a programme delay, but no further thought was given to the peripheral 'stage props' in position for the next item on the programme. The Show Director and Safety Officer must have thought that the position of the 'cherry pickers' was fine on the grass because they would have been removed after the paint-ball attackers.

Well, the Yaks did their routine; the first Yak 3 landed on the tarred runway but the second Yak landed on the strip of grass between the main runway and the grass runway and collided with one of the cherry-pickers at approximately 40 mph during the landing run

cutting approximately six feet of the wing clean off while the right undercarriage was ripped off.

Dovey was fortunately not injured but the show was delayed for fifty minutes as the crash debris first had to be cleared from the runway.⁵ The show was apparently to be Mr Dovey's last.

On the day of the crash, the 'cherry pickers' were in the same position they were in at a rehearsal the previous day.

The briefing, according to sources, was that Mr Dovey was to land on the grass runway. However, he chose to land between the runways. Prior to the show, pilots attended a briefing where, it is claimed, their attention was not drawn to the presence of the cherry pickers.

Could this accident have been avoided



The cherry picker into which Arthur Dovey's Yak 3 plane crashed (Stephen Jaquier)



The Yak 3 right hand wing was torn off when it clipped a cherry picker at *Warbirds Over Wanaka*. (Liam Parker)

if there were Air Traffic Control Services available? The contracted organisation did not provide air traffic control services at airshows. Due to their nature, airshows like this are not managed by air traffic control but is overseen by the Airshow Director."

4. 04 APRIL 2018: LOCKHEED MARTIN F-16, USAF THUNDERBIRDS, (NEVADA, USA)

The tragic loss of the USAF *Thunderbirds* No.4, Maj. Stephen Del Bagno led to the cancellation of their pending airshow

⁴ Airshow News, This is Flight, *Decathlon Hits Parked Planes in Fatal Air Display Crash*, 26 March 2018.

⁵ Otago Daily Times, *Plane Crashes at Warbirds Over Wanaka Opening*, 6 April 2018.

the upcoming weekend at March Air Reserve Base.⁶ The Thunderbirds were engaged in a routine training flight at the Nevada Test and Training Range (NTTR) near Creech AFB.

During the High Bomb Burst Rejoin, Del Bagno flew the aircraft for approximately 22 seconds in inverted flight at approximately 5,600 ft agl while sustaining, between -0.5 to -2.06 G's. While at -2.06 G's inverted, he initiated a Split-S. After five seconds in the Split-S, Del Bagno pulled a maximum +8.56 G's and suffered G-induced loss of consciousness (G-LOC).

For approximately the next five seconds, he remained in a state of absolute incapacitation and made no deliberate flight control inputs as the aircraft accelerated toward the ground. Approximately one second prior to ground impact, he began deliberate flight control inputs as he transitioned from absolute to relative incapacitation. The aircraft impacted the ground at 57° degrees nose low with 89° degrees of left bank, fatally injuring Del Bagno on impact, without an ejection attempt.

The Accident Investigation Board found that the cause of the mishap was the pilot's G-LOC during the Split-S portion of the High Bomb Burst Rejoin maneuver. Additionally, two factors substantially contributed to the mishap: (a) the pilot's diminished tolerance to +G's induced by the physiology of the pilot's exposure to negative G's ("Push-Pull Effect") and (b), an associated decrease in the effectiveness of the pilot's Anti-G Straining Maneuver under those conditions.⁷

5. 21 APRIL 2018: MACDONNELL DOUGLAS F-18 USN BLUE ANGELS (FLORIDA, USA)

Unfortunately, sharing the airspace at low level with birds during airshows, will forever continue to remain a real challenge to the safe execution of the display. *Blue Angels* No.5 suffered approximately \$1 million in damage when it ingested a bird into its engine during a performance at the *Vero Beach Air Show*. The pilot landed the plane without incident.

6. 25 APRIL 2018: WELLS EGLIN STARJAMMER (XINHUA, CHINA)

The only aircraft of this type in the world, a Wells Eglin Starjammer, claimed to represent the next generation of aerial entertainment, crashed during a display rehearsal for the *Zhengzhou Air Show 2018* in

the central Chinese city of Zhengzhou, killing the owner and designer and member of the US *Red Eagle Aerobatic Team*, Eglin Wells.

The Starjammer incorporated 250+ super-bright LEDs, a 4,000-Watt amplifier and onboard speakers that was optimised for both day and night airshows. For reasons yet unknown, the Starjammer was seen to impact the Shangjie Airport on field from approximately 300 ft agl. There was no collateral damage caused.⁸

7. 27 APRIL 2018: NORTHROP F-5 (GABORONE, BOTSWANA)

A Botswana Defence Force (BDF) pilot lost his life when the F5 Fighter he was flying impacted the Gaborone Golf Course during a rehearsal for the next day's *BDF Day Celebrations*. Eye witnesses reported seeing the Freedom Fighter in an aileron roll but this could not be confirmed.⁹

8. 04 MAY 2018: PARACHUTISTS (PRETORIA, SOUTH AFRICA)

Parachutist displays have been a part of the airshow scene since the first days of aerial events and just as in the case of aircraft accidents, parachuting accidents have blotted the copybook of airshow accident statistics. The annual SAAF Museum Airshow at AFS Zwartkop not only included skydivers, but also a joint Air Capability Demonstration involving a stick of forty-two paratroopers being dropped by a C-130 from a 1,000 ft agl.

The accident occurred during the validation, a day before the airshow where eighteen paratroopers landed outside of the relatively small DZ due to an 8 second delay by the jumpmaster. Some of the paratroopers overshot the DZ and one actually landed on a hangar roof on the other side of the airfield which required his extraction by a 'cherry picker'. Fortunately, most of the injuries were minor although one paratrooper suffered back injuries.

9. 28 MAY 2018: FAIRCHILD PT-23A (KANSAS, USA)

Memorial Day gives US citizens a day to reflect on the heroism of those who gave their life for the freedom of others and country-wide, legendary warbirds participate in ceremonies commemorating the service of American war heroes. However, considering the ages of the vintage aircraft, fuel gauges may not

⁶ Military.com, *F-16 Thunderbirds Pilot Dies In Crash Near Nellis Air Force Base*, 5 April 2018.

⁷ Airshow Stuff, *Air Force Concludes Investigation Into Fatal Crash of Thunderbird #4, Releases Report*, 16 October 2018.

⁸ NTSB Identification: WPR18WA126, *Starjammer*, 25 April 2018.

⁹ Botswana Government Press Release, *BDF BF5 Fighter Aircraft Crash*, 27 April 2018.

necessarily be as accurate as modern fuel gauges.

During a *Memorial Day Flyover* in Wichita, a Fairchild PT-23A belonging to the Commemorative Air Force Jayhawk Wing, was doing flyovers across Kansas cemeteries when it suffered an engine failure. The pilot attempted to restart the engine without success and was forced to conduct an emergency off-field landing near Westport Airport.¹⁰

Before takeoff, after having verified that the fuel tanks were full, the pilot calculated that he should have had 3:15 flying time. The Hobbs indicated 2.9 hours flying time on impact.

The wing of the PT-23A clipped the ground and one pole, but thankfully there was no fire. Both the pilot and a female passenger sustained minor injuries. According to the KHP report, the aircraft ran out of fuel approaching the runway at Westport Airport.¹¹

10. 30 MAY 2018: NORTH AMERICAN HARVARD SNJ, GEICKO SKYTYPERS, (NEW YORK, USA)

One of the Geico Skytypers' SNJ aircraft went down in Melville on Long Island, fatally injuring the pilot, Ken Johansen. *Air Show News* reported that the plane had just departed from Republic Airport in East Farmingdale, the summer home of the *Skytyper Team* between airshows. The team was on a repositioning flight to perform at the NAS *Pax River Air Expo* in Patuxent River, the upcoming weekend. That performance was cancelled.

Skytyper formation was cleared for takeoff. Lead and No.2 got airborne, but No.3 aborted the takeoff due to a misfiring engine. The remainder of the flight appeared uncertain as to what to do next. ATC advised the rest of the formation to takeoff since they were blocking runway 14. No.4 started the takeoff run but then like No.3 also aborted, leaving No.5 and No.6 still on the runway. Finally No.5 and No.6 decided to takeoff to join up with Lead and No.2. It was a fateful decision.

A flight instructor reported that the No.5 airplane initiated a climbing right 180° turn, similar to a chandelle maneuver, to 800 ft agl. He estimated that throughout the turn, the bank angle of the airplane was about 70° to 80° until it reached a height of about 1,200 ft agl. He observed the No.6 airplane conduct the same maneuver, however, at the apex of the turn, the

airplane entered a spin, and remained in a constant rate spin, until it descended into terrain..¹²



Fuel starvation resulted in engine failure of the PT-23. (Jason Tidd)



In 1981, Buchanan was injured in a different hang glider incident that left him paralyzed from the waist down.

11. 02 JUNE 2018: HANG GLIDER (IDAHO, USA)

Hang glider pilot Dan Buchanan was killed in a Hang Glider Accident while flying at the *Gunfighter Skies Air and Space Celebration* at Mountain Home Air Force Base. The hang glider was in the process of being towed up by vehicle when it departed controlled flight and descended sharply to impact near the runway. The remainder of Saturday's show was cancelled.¹³

Buchanan flew his first airshow in 1989 and was a popular performer on the airshow circuit, with his daytime and night-time glider routines. Over the years his awards and accolades included the Art Scholl Award for Showmanship, the Bill Barber Award for

¹⁰ NTSB Aviation Accident Report, *Fairchild PT-23A, N64176*, 28 May 2018.

¹¹ World Wings.com, *Priceless Warbird Crashes During Memorial Day Flyover Ceremony – Officials Reveal The Cause*.

¹² NTSB Accident Preliminary Report, *WPR18FA155, North American SJN 2, N62382*, 30 May 2018.

¹³ Airshow Stuff, *Dan Buchanan Killed In Hang Glider Accident At Mountain Home AFB Airshow*, 2 June 2018.

Showmanship and the ICAS Special Achievement Award.

12. 07 JULY 2018: MiG-21 LANCER (BORCEA, ROMANIA)

A Romanian Air Force MiG-21 Lancer R crashed at Base 86, Borcea during the *Borcea Open Day*, killing the pilot, Lt. Cmdr. Florin Rotaru.

The 4,000 spectators watched in horror as the 'Fishbed', doing a low flyby, impacted at a very shallow grazing angle, skidding along the airfield and dragging a fireball along. The public attending the Open Day were evacuated from the airbase and the rest of the flying display, cancelled.¹⁴



The fireball of the MiG-21 following impact with the ground. (Adrian Floroiu)

13. 20 JULY 2018: DE HAVILLAND DH-112 VENOM (WISCONSIN, USA)

"Pilot Killed, Two Others Injured When Rare de Havilland Venom Crashes on Takeoff" was how this accident was described in the media. A Venom, along with a de Havilland Vampire and a rare Gloster Meteor of the World Heritage Air Museum, was to be a featured act commemorating vintage jet and Royal Air Force centennial activities at EAA AirVenture 2018 in Oshkosh.

Pilot Marty Tibbitts was killed when his Venom vintage jet crashed shortly after takeoff from Sheboygan County Memorial Airport on a formation training flight in preparation for the show.

The lead aircraft departed, followed by the Venom about 8 seconds later. About 6 seconds after the Venom lifted off, the left wing rocked downward then upward. Multiple witnesses reported that the aircraft appeared to be sluggish and not climbing and upon reaching 200 ft agl, started descending.

¹⁴ Airshowinfo, *Romanian MiG-21 Crashed During Display*, 7 July 2018.

¹⁵ NTSB WPR18FA200, *De Havilland DH112 Venom, N747J*, 20 July 2018.

The Venom impacted flat vegetated terrain, slid through a barn, seriously injuring two people and killing dozens of livestock and continued another 175 ft before coming to a stop.¹⁵

14. 23 JULY 2018: GRUMMAN F7F TIGERCAT (OSHKOSH, USA)

The No.2 of a two-ship, vintage Tigercat display was in the landing rollout after their display and abeam of show centre at Oshkosh when the left tire suddenly separated from the wheel assembly and 'set sail' parallel to the runway.

In a shower of sparks from the tireless rim, the Tigercat yawed through approximately 90° and was brought to a stop. First responders reacted within seconds. All in all, as the saying goes: "any landing you can walk away from is a good one".¹⁶



Without a tyre on the left wheel assembly, a shower of sparks and smoke kept the spectators mesmerised as to what would happen next. (Live 979)



Without sufficient longitudinal separation, the wingman rolled into Lead during the mirror roll to erect. (Romania, Graphic Animation)

15. 04 AUGUST 2018: STEEN AERO LAB SKYBOLT (SUCEAVA, ROMANIA)

Practicing for an upcoming airshow, two Steen Skybolts vertically separated by approximately 3 metres in mirror formation,

¹⁶ Klassiker der Luftfahrt, *Pilot Rescues Grumman F7F Tigercat*, 25 July 2018.

collided during a rehearsal over the Old Frattudes airfield. Cornel Marinescu, a Romanian aerobatic champion, was killed and Sorin Bochis, severely injured.

Passing show centre in mirror formation, the higher aircraft flying inverted, rolled left to return to erect flight with insufficient longitudinal separation and on passing through approximately 120°, the right wing tip impacted Lead's left wing. Both aircraft became intertwined and still in contact, plunged to the ground.¹⁷

16. 11 AUGUST 2018: DE HAVILLAND DH89 DRAGON RAPIDE (BRITISH COLUMBIA, CANADA)

Three victims of a crash involving a 1930-era Rapide at Abbotsford Airport were treated and released from hospital while the other two occupants of the vintage biplane, including the pilot, were in a stable condition. The Dragon Rapide 'flipping aviation enthusiasts attending the *Abbotsford International Airshow*, lost control shortly after takeoff after the airshow events had been concluded for the day.



'Flips' for fare paying spectators in vintage aircraft at airshows has long been an airshow event worldwide. (Elya White)

An eye witness reported that the Rapide could be seen rocking from side to side after lift-off before its wing clipped the ground and smashed nose-first into the runway. "It hit hard nose down and I thought, there would be injuries." he said.

As part of the programme, the Rapide was from a museum in the United States and part of a series called "Living History Flights". The museum aircraft offer rides to attendants who are interested in taking rides in vintage aircraft. The final day of the airshow went

¹⁷ Aviation Safety Network, ASN Wikibase Occurrence # 214043, *Steen Aero Lab Skybolt, D-EHHH*, 04 August 2018.

ahead as planned on Sunday, but all "Living History Flights" were obviously cancelled.¹⁸

17. 18 SEPTEMBER 2018: DENEL ORYX (LIMPOPO, SOUTH AFRICA)

The South African Air Force's *Air Power Capability Demonstration* was marred by an Oryx accident during a trooping exercise simulating the combat search and rescue of a downed fighter pilot; fortunately with no injuries other than a broken ankle to one of the SA Army soldiers onboard tasked with providing protection to the S&R team.

In full view of the spectator grandstand of War College and Staff Course learners, foreign attachés, diplomats and politicians, the Oryx, one of a pair, approached at high speed, the pilot, Lt. Col. King, pitched up to decelerate to a 'quick stop', and in the process, the chopper appeared to enter a vortex ring state and just simply drop to the ground, out of control.

The impact with the ground snapped the tail boom off but the troops were able to exit, fortunately there was no fire. The incident overshadowed the annual display of the SAAF's air power capability, timed to coincide with the *Africa Aerospace and Defence (AAD)* exhibition at AFB Waterkloof.

A few holes in James Reasons' Swiss Cheese model lined up. The first hole was the demonstration to the top brass of the military, foreign military attachés and peer group, the second hole, the requirement to demonstrate skills, the third hole, 'hot and high' with a relatively heavy load; with three holes lined up, control of the chopper was lost.



Could the enthusiasm of providing an impressive 'quick stop' to the mainly military spectators have resulted in the chopper entering vortex ring state?

¹⁸ Keremeos Review, 5 Injured in Plane Crash Following Abbotsford International Airshow.

18. 28 SEPTEMBER 2018: CHENGDU F-7Ni (ABUJA, NIGERIA)

Sqn. Ldr. MB Baba-Ari, one of the pilots of a Nigerian Air Force F-7Ni, died after two aircraft rehearsing for the 58th Nigerian Independence Day Military Parade and Fly Past scheduled for 1 October 2018, collided in midair.

Six F-7Ni in VIC formation, three either side of a C-130 transport aircraft, flew by the parade rehearsal. The last aircraft in the right hand VIC was lagging slightly and during the acceleration to close the longitudinal gap that had developed, overshot the station, and with insufficient lateral separation at the join-up, its left wing impacting No.2s right wing. Both aircraft plunged to the ground.

Although three pilots ejected, one died when the pilot impacted the ground.¹⁹ Two other pilots involved in the accident, Sqn. Ldr. Abatuba and Flt. Lt. Ambi, ejected successfully.



The right hand VIC No.3 was lagging and during the acceleration to station, left no lateral separation for the join up resulting in a wing to wing collision.

19. 29 SEPTEMBER 2018: PARACHUTIST (PHALABORWA, SOUTH AFRICA)

A South African Army soldier and team leader of 7 Medical Battalion, Sgt Kabelo Moagi, fell to his death during a fast roping

demonstration from an Oryx helicopter during the *Special Forces Celebrations* while involved with a hot-extraction demonstration.

20. 12 OCTOBER 13, 2018: VANS RV-8 (VIRGINIA, USA)

Redline Air Shows pilot, Jon Thocker was killed following a crash during a night performance at the *Culpeper Air Fest*. *Redline Air Shows* is a dynamic two-ship formation aerobatic team; one of the team's specialties includes night performances with pyrotechnics, which was being showcased at the time of the crash.²⁰

With No. 2 trailing Lead in line astern, the intention was to complete two aileron rolls, but No.2 only completed one and a half rolls before commencing a pull from inverted to impact on-field. The lead pilot said that they had performed in darkness before, but "this one was a little bit on the darker side," so they elected to fly at 700 ft agl instead of their usual 500 ft agl. This accident raised the question in several quarters as to spatial disorientation and the advisability of night formation aerobatics.

Innovation at airshows has always been a commercial requirement aimed at attracting fare paying spectators. Since the early pioneering days of airshows, display pilots have risked their lives to ensure their contracted performance ensures a living wage. Worldwide, there has been an increase in a 'Friday' night airshows with pyrotechnics, flares, lights and sparkles.

However, night formation aerobatics challenges the human physiology significantly, even more so in dark moon conditions. The optical limitations of the 30° foveal view and central blind spot reduces peripheral capacity and presents a limitation to depth perception and estimating closing velocity using only the lights on Lead, especially along the longitudinal axis. The distraction and false information from lights surrounding the airfield may complicate the decision making even further since the sensory cues available are limited.²¹

More of a concern to display pilots should be a visual illusion known as 'black hole effect' which is another inherent risk for night formation aerobatics. Black hole conditions exist on dark nights, usually with no moon or starlight, when there are no ground lights between the aircraft and the ground. The 'black hole illusion', deceives pilots spatial orientation.

Whilst man-made obstacles in the vicinity of an airport such as buildings or towers

¹⁹ Times Live, *Nigerian Military Pilot Dies After Air Display Rehearsal*, 28 September 2018.

²⁰ NTSB Accident Report ERA19FA010, VANS RV-8, N804RL, 12 October 2018.

²¹ D. Henriques email to Des Barker, 13 December 2018.

are normally lit during the hours of darkness, natural obstacles such as hills or trees are not. As a consequence, unless there is exceptional illumination such as a full moon on new snow, natural obstacles will be largely invisible to the pilot during night aerobatics. Without due care, this factor greatly increases the potential of a flight into terrain.

21. 17-NOV-2018: NORTH AMERICAN P-51D (TEXAS, USA)

The P-51 "Pecos Bill" crashed in a parking lot at the Friendship Place Apartments on South Creek Street in Fredericksburg on completion of the *War November WWII Pacific Combat Program* re-enactment of the National Museum of the Pacific.

A witness said that he heard the engine sputtering just before the accident. Both the pilot, Cowden Ward and WW II veteran Vincent Losada, were killed. "Toward the end of the program, the aircraft did a 360-degree flip that looked forced. Then it dropped sharply into a nosedive until it disappeared behind a line of trees and never came back up," said an eye witness.²²

CONCLUSION

Based on statistical evidence, as an international airshow community, we seem rather limited in our ability to reduce airshow accidents and incidents and we have not been able to arrest the decline effectively which raises the question: "can we afford then to just continue and accept an average of 28 accidents/incidents per annum over the past ten years.

We continue to lose approximately 13 display pilots per year on average and have not yet managed to consistently prevent any passenger or spectator deaths or injuries. Once again high profile airshow accidents drew emotional media attention to the hazards which are constant reminders of our all-too-human frailties and of the risks we all take when we step into the cockpit.

It is pointless to introduce additional regulations, there are already enough in place; what is required, however, is to zero in on human factors across the entire airshow community, from first responders, through vendors, safety officers and display pilots alike, through a continuous 'in your face' safety programme, which includes occupational health and safety.

Considering the fact that airshow accidents is a worldwide phenomenon, there is

an urgent need to preach, implement and share the 'airshow gospel' and 'lessons learned' across all countries in an attempt to reduce airshow accidents.

The purpose of this report is not for shock value; it is not to preach. It is so that we all may learn. Airshow flying is hazardous and despite all our preparations, our skills, and our training, something may still go wrong. And if something should go wrong, we only hope that others may learn from our experience, so that it won't happen again. Based on the fickleness of human judgement in the low-level display environment, we need to understand that we are the weakest link in the safety chain."

²² Aviation Safety Network, *Occurrence #218042, North American P-51D Mustang, N4132A, 17 November 20128.*