The 30 June fatal crash of a Nepal Airlines Twin Otter was the only one involving a commercial passenger aircraft in the first six months

BETTER PREPARED

It has been another safer six months to fly. Declining global accident rates, however, raise the prospect of complacency, so safety bodies are encouraging the industry to learn more from incidents where no damage occurred and to be ready to deal with the unexpected

DAVID LEARMOUNT LONDON

The disappearance of Malaysia Airlines flight MH370 has cast a shadow over a set of excellent global airline safety figures for the first half of 2014. Even including MH370, the figures are good, but without it they are exceptional.

MH370 cannot be declared an "accident" at present. The official line is that its loss was probably the result of deliberate action by someone on board. So, while reporting and examining the facts surrounding the missing Boeing 777-200ER, this report will look at this year's statistics to 30 June minus the MH370 figures, just as other incidents involving deliberate or hostile action are excluded.

MH370 disappeared on 8 March. It was last seen on radar over the Andaman Sea, and no

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trace of it or the 239 people on board has been found since, but the Indian Ocean search will resume in August. The details of the event, insofar as they are known, are shown separately (see accidents list under Fatal events: scheduled passenger flights).

REDUCTION

If this event were included as an accident – and if the death of those on board were assumed – a preliminary estimate of airline fatal accidents in the first six months of 2014 shows six, and the total number of resultant deaths is 267. That compares with the previous global best-ever period – January-June 2013 – in which there were nine fatal accidents and 58 fatalities.

If MH370 is omitted, the figures for this year are five fatal accidents and 28 fatalities – almost one-half the previous all-time record. Those figures include all fatal airline accidents involving all types of operations, including pure freight, airline crew base training, and ferry or positioning flights.

The largest passenger aircraft involved in a fatal accident this year to 30 June was a 19-seat Nepal Airlines de Havilland Canada Twin Otter. It was the only commercial transport passenger aircraft fatal accident. The others all involved non-passenger operations (see accident list).

Looking back 40 years at the first half of 1974, there had been 25 fatal airline accidents involving passenger flights in that period, when far fewer flights took place every day.

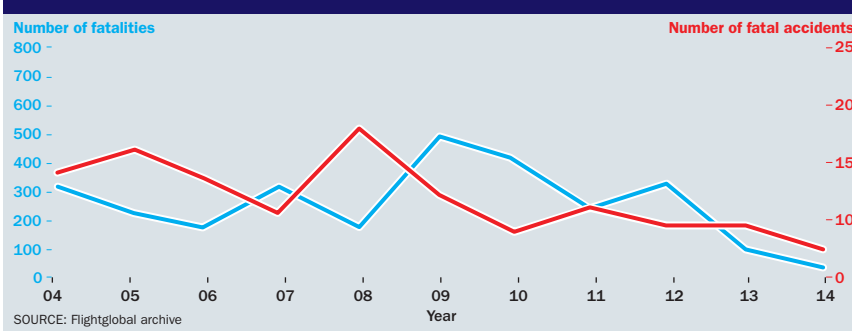
Paul Hayes, safety director at Flightglobal's Ascend consultancy, says aviation is getting so safe now that it is difficult to explain to ordinary travellers just how safe it is. The chances of being on board a fatal flight are so small that the number of noughts between the decimal point and the first positive figure is so massive it feels meaningless.

Applying the airline fatal accident risk that was current in 1950 to the number of flights that take place today, Hayes has deduced that there would be 10 fatal airline accidents per day in which revenue passengers would be killed. The number of deaths that would result annually is more difficult to make meaningful, because it would depend if it were factored for the much greater number of people on each flight today, and the greater distance covered by faster aeroplanes. But he points out that whichever way the figures are factored, the number of passenger deaths annually would be between 50,000 and 200,000.

Aviation is getting so safe now that it is difficult to explain to ordinary travellers just how safe it is

Michel Masson, of the European Aviation Safety Agency's European Human Factors Advisory Group (EHFAG) says EASA has been preparing for some time for the undesirable secondary effect – not a particularly obvious one – of an industry that gets used to having very few fatal accidents. That

FATAL ACCIDENTS AND FATALITIES IN FIRST SIX MONTHS OF EACH YEAR: 2004–14



SOURCE: Flightglobal archive

potential effect is, basically, a lapse into complacency. Since the industry has always used the lessons from accidents to spur it towards higher performance, will airline accountants attempt to reap the safety harvest by reducing investment in things like training and maintenance?

"There is an unclear trend and correlation between accident scenarios, a risk of complacency, and of safety awareness erosion"

MICHEL MASSON
European human factors advisory group, EASA

Masson points out what happens statistically when policy has to be made using very little accident data. In this situation, he says, "there is an unclear trend and correlation between accident scenarios, a risk of complacency, and of safety awareness erosion". He notes safety agencies have long argued that learning from actual accidents is insufficient, and that "a risk-based approach making use of precursors is needed". This means that incidents that have not culminated in damage because the crew intervened must be recorded and treated – for risk assessment purposes – as the accident they would have become had the crew not intervened – because one day the crew might not.

Masson explains that the European Commercial Aviation Safety Team (ECAST), since 2012, has taken the following policy line: severe incidents must be investigated, the reports published and shared among the community. In Europe, he notes, "this poses a translation challenge". The ECAST also demands that safety assumptions, safety defences and barriers "must be continuously challenged", using selected incidents and a formal process, and an efficient dissemination process must be established.

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MH370 cast a shadow over an exemplary six months for airline safety

CO-ORDINATION

ECAST has also set up a task force looking at high-risk incidents. These do not happen often, but could do. The other area of study is how to prepare crews for unexpected combinations of events that partly result from the complexity of today's airliners. For unique combinations of events, checklists cannot be written nor procedures prepared. This work is performed in co-ordination with the European Network of Analysts, according to Masson.

Among the events so far this year listed in the accidents and incidents summary, high-risk events can be identified even from such a short period. For example, the Etihad Regional, Lion Air, Jet2 and Travel Service Airlines heavy landings are part of a trend the industry is beginning to acknowledge, and there continues to be an undesirable number of long landings and runway overruns/excursions despite industry attempts to raise awareness of the risk. And according to the EHFAG theory that Masson describes, the heavy landings which "merely" damage the gear and buckle the fuselage are risk indicators of a potentially worse outcome. If a landing becomes heavy enough it will eventually be described as a crash. ■

ANALYSIS

AIRLINE ACCIDENT REPORTS PUBLISHED THIS YEAR

AIRLINE ACCIDENT reports, either final or interim, published by investigators during the first six months of 2014:

■ Russian investigators have concluded that an unstable approach at high speed contributed to the fatal 29 December 2012 Red Wings Tupolev Tu-204 overrun at Moscow Vnukovo airport. The aircraft's approach speed, up to 24kt higher than it ought to have been, prolonged the Tu-204's float before it made contact with the runway. This resulted in a reduction in available landing distance, while the soft 1.12g touchdown in a crosswind meant weight-on-wheels switches did not activate, and the spoilers did not deploy and the thrust-reversers would not operate. However, the crew did not wait for confirmation of reverser deployment before engaging high engine power, which instead accelerated the Tu-204 forwards. The report says the crew's failure to engage reverse thrust correctly meant the aircraft did not decelerate and eventually overran the runway, colliding with a highway embankment. Five of the eight occupants of the aircraft, which had been operating a positioning flight, were killed in the crash.

■ Pilot fatigue and demanding airport approaches were examined at a US National Transportation Safety Board (NTSB) hearing into the 14 August 2013 fatal crash of a UPS Airbus A300-600. The aircraft crashed on final approach to Birmingham-Shuttlesworth International airport, Alabama. "We have not identified any anomalies with the airplane, systems, or enhanced ground proximity warning system [EGPWS]," said the NTSB's Daniel Bower. The pilots were carrying out a non-precision localiser/DME approach to the 2,146m-long runway 18 because the main ILS runway was closed. The sky was overcast with calm winds and 16km visibility beneath the 1,000ft cloudbase. At 04:47 local time, the flight crew received a "sink rate" alert from the EGPWS at 235ft above airfield level with a descent rate of 1,536ft/min (7.8 m/s). There is a low hill beneath the final approach path for runway 18, and the decision height for that approach was 500ft AAL, said Bower. The aircraft hit trees and terrain about 1.93km (1.20 miles) from the end of the runway and caught fire. Cockpit voice recorder transcripts show that the pilots mentioned they had been feeling tired on recent trips. Data from the hearing showed that UPS' pilots called in unfit for duty owing to fatigue on 138 occasions in 2013.

> **"We have not identified any anomalies with the airplane, systems, or EGPWS"**
>
> **DANIEL BOWER**
> NTSB

■ A short-circuit in a lithium-metal battery probably caused the fire that damaged an Ethiopian Airlines Boeing 787-8 last year, and certification requirements for lithium batteries designed for use in aircraft equipment must be improved, the UK Air Accident Investigation Branch (AAIB) says in a new special bulletin. The fire at London Heathrow airport on 12 July 2013 was probably the result of a botched electrical assembly of the aircraft's emergency locator transmitter (ELT). This led to short-circuiting, causing its battery to overheat and start a process known as thermal runaway, which generates intense heat. The fire spread in the aircraft's rear upper fuselage while the aircraft was empty and unattended until the fire crews arrived, causing extensive damage to the 787's composite materials hull. The AAIB explained this ELT is powered by a five-cell lithium-metal (not lithium-ion) battery, and described what it found: "The internal battery pack had experienced severe disruption, exhibiting evidence of a very high-energy thermal event, consistent with having a thermal runaway. All five cell cases had been breached and burnt material had been ejected into the battery compartment and outside of the ELT case." The AAIB said: "It is recommended that the [US Federal Aviation Administration] develop enhanced certification requirements for the use of lithium-metal batteries in aviation equipment, » to take account of current industry knowledge on the design, operational characteristics and failure modes of lithium-metal batteries."

■ At a June public hearing reviewing evidence on the 6 July 2013 Asiana flight 214 accident at San Francisco international airport, the US NTSB said that crew failures ultimately caused the accident, but systems mode complexities and poor training provision by the airline will probably be ruled to be contributory factors. Carrying out a visual approach to runway 28L in excellent visibility, the aircraft became very low and slow on short final having been fast and high early in the approach. The crew did not realise how low and slow the aircraft was, but noticed in the last few seconds and began to advance the power levers. The lowest airspeed just before the aircraft's tail hit the sea wall well short of the runway threshold was 103kt, and the stickshaker had begun operating. The speed had dropped so low because, although the autothrottle was engaged, the engines had stayed at idle and the crew had not realised this. The crew had retarded the power levers manually to idle earlier in the approach when they were fast and high, and the autothrottle went into "hold" mode when the autopilot was in flight level change mode, a mode in which the autothrottle does not control the speed – attitude does. The crew expected the autothrottle to control their speed but it did not. The hearing was told that the crew did not understand these mode complexities even when they had been informed about them. The NTSB has requested that Boeing improve the description of the system in its flight crew manual, asked the Federal Aviation Administration to review the certification of the system, and said that Asiana must improve its pilot training in automatic systems. ■

> **The crew did not realise how low and slow the aircraft was, but noticed in the last few seconds**

ACCIDENTS AND INCIDENTS JANUARY–JUNE 2014

NOTES ON TABLES

Data comes from *Flight International*'s research in association with Flightglobal advisory service Ascend, which compiles the World Aircraft Accident Summary, among other safety analysis products. Details of non-fatal incidents are not made available officially by authorities in many countries, but *Flight International* continues to list known significant incidents to maximise the availability of relevant information. We accept that the non-fatal listing may be weighted against the airlines of those countries that make safety information more readily available.

GLOSSARY OF TERMS AND ABBREVIATIONS

AA airfield approach/early descent
AAIB UK Air Accidents Investigation Branch
AAL above airfield level
ACARS automatic communication addressing and reporting system
ADC air-data computer
ADF automatic direction finder
AF air force
AGL above ground level
AMSL above mean sea level
AOA angle of attack
ASI airspeed indicator
ATC air traffic control
C climb
C-B circuit breaker
CFIT controlled flight into terrain
CNK cause not known
CVR cockpit voice recorder
DME distance measuring equipment
ECAM electronic centralised aircraft monitor
EFIS electronic flight-instrument system
EGPWS enhanced ground proximity warning system
EGT exhaust gas temperature
EICAS engine indicating and crew alerting system
ER en route
ETOPS extended-range twin operations
FAA US Federal Aviation Administration
FDR flight data recorder
FL flight level = altitude, in hundreds of feet, with international standard pressure-setting (ISA) of 1013.2mb set on altimeter (eg FL100 – altimeter reading of 10,000ft with ISA set)
FMS flight management system
G on ground
GPU ground power unit
GPWS ground proximity warning system
HP high pressure
IFR instrument flight rules
IMC instrument meteorological conditions
ILS instrument landing system
ISA international standard atmosphere – sea level pressure of 1013.2hPa and standard temperature/pressure lapse rate with altitude
L landing
LP low pressure
MEL minimum equipment list
MTOW maximum take-off weight
NDB non-directional beacon
NTSB US National Transportation Safety Board
PAPI precision approach path indicator
PAX passengers
PF pilot flying
PNF pilot not flying
RA runway/final approach
SID standard instrument departure
TAWS terrain awareness and warning system
TO take-off
TOGA press-button selected take-off/go-around thrust
VASI visual approach slope indicator
VFR visual flight rules
VHF very high frequency
VMC visual meteorological conditions
VOR VHF omni-range navigation beacon
V_1 take-off decision speed

Conversion factors

1nm = 1.85km
1ft = 0.3m
1kt = 1.85km/h

Date	Carrier	Aircraft type/registration	Location	Fatalities (crew/pax)	Total occupants (crew/pax)	Phase
FATAL EVENTS: SCHEDULED PASSENGER FLIGHTS						
8 Mar	**Malaysia Airlines**	**Boeing 777-200ER (9M-MRO)**	Over Malacca Strait	12/227	12/227	ER
The Malaysian authorities believe the circumstances of this flight's disappearance probably suggest deliberate action by a person or persons on board. The aircraft, operating flight MH370 from Kuala Lumpur for Beijing, took off shortly after midnight and climbed to FL350. Over the Gulf of Thailand, just after Kuala Lumpur ATC had handed the aircraft over to Ho Chi Minh ATC and the crew had acknowledged the handover call, the aircraft's transponder stopped operating, so MH370 was no longer visible to ATC on secondary radar. The MH370 crew never contacted HCM. The last automatic ACARS transmission had taken place during the climb. On military primary radar the aircraft was seen to turn west and fly across the Malaysian peninsula, then head northwest over the Malacca Strait before contact was lost. Inmarsat estimates the aircraft, when over the Andaman Sea, turned south towards the open Indian Ocean. This is deduced from automated aircraft responses to "handshake" signals from Inmarsat satellites. The aircraft's "handshake" responses contained no data, but the aircraft's range from the satellite could be deduced each time. These range "pings" each provide a long arc on the globe's surface, somewhere along which the aircraft must be. This happens each time the "handshake" takes place, so together with the primary radar data showing the aircraft's early track and speed, this enables an estimated plot of the aircraft's track to be proposed. The last satellite response received took place shortly after 08:00 Malaysia time, about the time the aircraft would have run out of fuel. Searches have been conducted in the Indian Ocean to the west and northwest of Australia but they found nothing on the surface or the sea bed. The search was suspended in May but will resume in August 2014. The aircraft remains missing and no wreckage has been found. The crew and passengers are missing, presumed dead.						
FATAL ACCIDENTS: REGIONAL AND COMMUTER AIRLINES						
16 Feb	**Nepal Airlines**	**DHC Twin Otter 300 (9N-ABB)**	ER Jumla-Pokhara, Nepal	3/15	3/15	ER
Hit high terrain in cloud and deteriorating weather that included imbedded cumulo-nimbus. The investigators said the accident was caused by a crew loss of situational awareness.						
FATAL ACCIDENTS: NON-PASSENGER FLIGHTS						
18 Jan	**Trans Guyana Airways**	**Cessna Grand Caravan (8R-GHS)**	Mazaruni region, Guyana	2	2	ER
This cargo flight crashed in forest not long after take-off from Olive Creek bound for Imbaimadai. The pilot put out a mayday call stating that the aircraft was going down.						
17 Feb	**Global Air Connection**	**BAe 748-2B (5Y-HAJ)**	Rabkona airport, South Sudan	1	4	L
The aircraft was chartered by the International Organisation for Migration, which reports that the aircraft veered off the runway, across a ditch and one of the wings hit vehicles, causing a fire.						

Date	Carrier	Aircraft type/registration	Location	Fatalities (crew/pax)	Total occupants (crew/pax)	Phase
FATAL ACCIDENTS: NON-PASSENGER FLIGHTS						
8 Apr	**Hageland Aviation Services**	**Cessna Grand Caravan (N126AR)**	50km SE of Bethel, Alaska, USA	2	2	ER
The aircraft entered a steep descent during crew training manoeuvres in good daylight weather and hit the ground.						
8 May	**Aliansa**	**Douglas DC-3 (HK4700)**	North of San Vicente del Caguan, Colombia	5	5	ER
The aircraft was operating a cargo flight from Villavicencio to Florenzia but it came down in high terrain north of San Vicente. Official casualty reports say there were five crew on board, but press reports maintain there were six.						

Date	Carrier	Aircraft type/registration	Location	Injuries (crew/pax)	Total occupants (crew/pax)	Phase
SIGNIFICANT NON-FATAL ACCIDENTS (ALL OPERATIONAL CATEGORIES)						
2 Jan	**NatureAir**	**Bombardier Dash 6 (TI-BFN)**	La Fortuna airport, Costa Rica	-/-	2/?	L
The aircraft overran the runway and the nose gear collapsed.						
5 Jan	**Air India**	**Airbus A320 (VT-ESH)**	Jaipur International airport, India	-/-	5/168	L
Touched down on soft ground to the left of runway 27 in fog with a visibility of about 200m, and received substantial damage when it veered further left and its port wing struck a tree. The aircraft had diverted from Delhi where the visibility precluded landing, and it is understood to have had insufficient fuel on board to divert elsewhere from Jaipur. Runway 27 has a Cat 1 ILS.						
10 Jan	**Carson Air**	**Fairchild Metro (C-FJKK)**	Regina airport, Saskatchewan, Canada	-	2	L
The aircraft touched down about half-way along the runway in poor visibility with a 5kt tailwind and a contaminated surface. It overran the end by about 100m.						
18 Jan	**Aeronaves**	**McDonnell Douglas DC-9F (XA-UGM)**	Plan de Guadelupe airport, Mexico	-	3	L
The aircraft landed at night in poor visibility about two-thirds of the way along the runway and ran off the left side.						
29 Jan	**Air Greenland**	**DHC Dash 8-200 (OY-GRI)**	Ilulissat airport, Greenland	-/3	3/12	L
The crew expected a crosswind on landing, and checked the threshold wind frequently as they carried out their choice of an NDB approach to runway 07. On short final the wind was reported from 140° at 26kt gusting 39kt. On landing the left main gear failed – the investigation later determined it was a stress failure. The aircraft swung left off the runway and down a slope to rocks, and the crew ordered an evacuation.						
1 Feb	**Garuda Indonesia**	**Boeing 737 (PK-GFW)**	Juanda, Surabaya, Indonesia	-/-	6/104	TO
Tread from the aircraft's left outer main gear tyre was shed during the take-off run. At the destination, the crew carried out a fly-by with the gear down in front of the tower to see if damage was visible, then landed on runway 28. During the landing roll the tyre failed, and debris caused major damage to the left spoilers, thrust reverser, wing underside and aft fuselage.						
1 Feb	**Lion Air**	**Boeing 737-900 (PK-LFH)**	Juanda-Surabaya airport, Indonesia	-/5	7/215	L
The aircraft bounced four times during its landing on runway 28, also triggering the tailskid indicator, smashing the nosewheel and bursting a main gear tyre. The final touchdown registered nearly 4g and caused fuselage wrinkling aft of the wing. The surface wind was reported to be 270deg at 16kt						
2 Feb	**East Air**	**Airbus A320 (EY-623)**	Kulyab, Tajikistan	-/-	6/186	L
Inbound from Moscow Domodedovo, the aircraft carried out a daytime approach in heavy snow. It overran the runway end into deep snow and suffered major damage.						
13 Feb	**Jetstar Asia**	**Airbus A320 (9V-JSN)**	ER over Java, Indonesia	-/-	?/?	ER
Unintentionally flew, at night, through volcanic ash cloud downwind of Mount Kelud, sustaining major damage to both engines, but they continued to function. The aircraft landed safely at Jakarta.						
17 Feb	**Jet2**	**Boeing 737-800 (G-GDFC)**	Funchal airport, Madeira, Portugal	-/-	7/175	L
The aircraft suffered windshear on short final approach to runway 05, owing to a variable crosswind from the left reported at 330° at 14kt gusting to 24kt, caused by the fact that the runway is on the lee side of high ground when the wind is from that direction. The captain persisted with the approach despite the fact that a high sink rate developed just before touchdown, and the aircraft bounced on landing. The aircraft came to a halt safely, but suffered a tail-scrape and some fuselage deformation.						
22 Feb	**Travel Service Airlines**	**Boeing 737-800 (OK-TVT)**	Lajes airport, Azores Islands	-/-	6/164	L
The flight was from Prague, Czech Republic to Montego Bay, Jamaica, with a planned fuel stop at Lajes. The wind at Lajes was strong, gusting and variable with a crosswind from the right. The aircraft encountered severe windshear and turbulence in the last 5nm (9km) of the approach to runway 15. The aircraft touched down hard on the main and nose gear simultaneously, bounced and touched down a second time with a deceleration of 3.5g that caused damage to the undercarriage and fuselage frames.						
25 Feb	**Guicango**	**Embraer Brasilia (D2-FFZ)**	Nr Lukapa airport, Angola	-/-	3/14	ER
A technical issue – thought to be engine problems – developed en route from Luanda to Dundo, forcing the crew to attempt a diversion and emergency landing on runway 18 at Lukapa. The crew lost directional control on the wet runway, veered right and came to rest on rough ground, sustaining substantial damage.						
13 Mar	**US Airways**	**Airbus A320 (N113UW)**	Philadelphia international airport, USA	-/2	5/149	TO
The aircraft was taking off from runway 27L bound for Fort Lauderdale when the crew, immediately after rotate, aborted the take-off because of indications of a No 1 engine fire. The nose gear touched down and collapsed and the aircraft came to a halt partly off the runway. Two passengers were injured in the evacuation.						
11 Apr	**Kenya Airways**	**Embraer 190 (SY-FFC)**	Dar es-Salaam, Tanzania	-/-	6/49	L
The aircraft ran into a heavy rain shower on short final approach to runway 23 and the captain took control from the co-pilot who had lost sight of the runway. On landing the aircraft veered right off the runway before returning to it. The aircraft suffered major damage.						
20 Apr	**Blue Bird Aviation**	**Fokker 50 (5Y-VVJ)**	Guriel landing strip, Somalia	-	3	L
The aircraft landed long and ran off the end of the runway at high speed. The left wing failed and broke away.						
24 Apr	**Wasaya Airways**	**Beechcraft 1900 (C-FWXL)**	Sachigo Lake airport, Ontario, Canada	-/-	2/9	C
The crew heard "wind noise" soon after take-off and suspected a door failure despite getting no warnings. When a crew member went to check it, the main cabin door "popped open" about 25cm and the door warning light came on. The crew elected to turn back and declared an emergency. On approach the door had opened fully, and it separated on landing.						
8 May	**Ariana Afghan Airlines**	**Boeing 737-400 (YA-PIB)**	Kabul international airport, Afghanistan	-/-	5/130	L
The aircraft overran the end of runway 29 by about 300m, destroying the ILS localiser array. The aircraft encountered heavy rain on short final approach and the runway was wet.						
10 May	**IRS Airlines**	**Fokker 100 (5N-SIK)**	Kwasi Posa, Nr Magaria, Nigeria	-/-	2	ER
The aircraft was carrying out a post-maintenance (C-check) ferry flight from Bratislava, Slovakia to Kano, Nigeria. Shortly after waypoint Ganla on airway UA604 the crew reported an unspecified system problem that appears to have affected navigation, because they got lost in a sandstorm. Fearing that they would run out of fuel, the crew force-landed on flat ground, and the right main landing gear and the nosewheel collapsed.						