Emergency and unusual situations – whose world view?

We have always known that wise people learn from their mistakes and that all groups of specialists, from medical surgeons to elite athletes, can relate how, when things go wrong, they learn from reviewing the circumstances of their actions...

The grand slalom skier who misreads a turn through a gate and tumbles down the side of the run, the Olympic diver who mis-times their exit from a multiple twisting somersault, and the rally driver who trusts in the friction of their high performance car on a slippery road, all reflect on the moment they lost control. At the point that the pre-programmed motor sequence of these highly skilled actions is being executed, the human has little to do but wait for the outcome. In the examples above, the sequence of motor programmes has been disrupted by inputs which were adaptive: weighting too much on one ski, initiating the twist a nanosecond too soon and compensating for a wet surface too late. What few people realise is that the brain will now have learnt another slightly different sequence from the original motor programme, which it will match to the new context if the same circumstances are encountered. I will return to this later in this paper.

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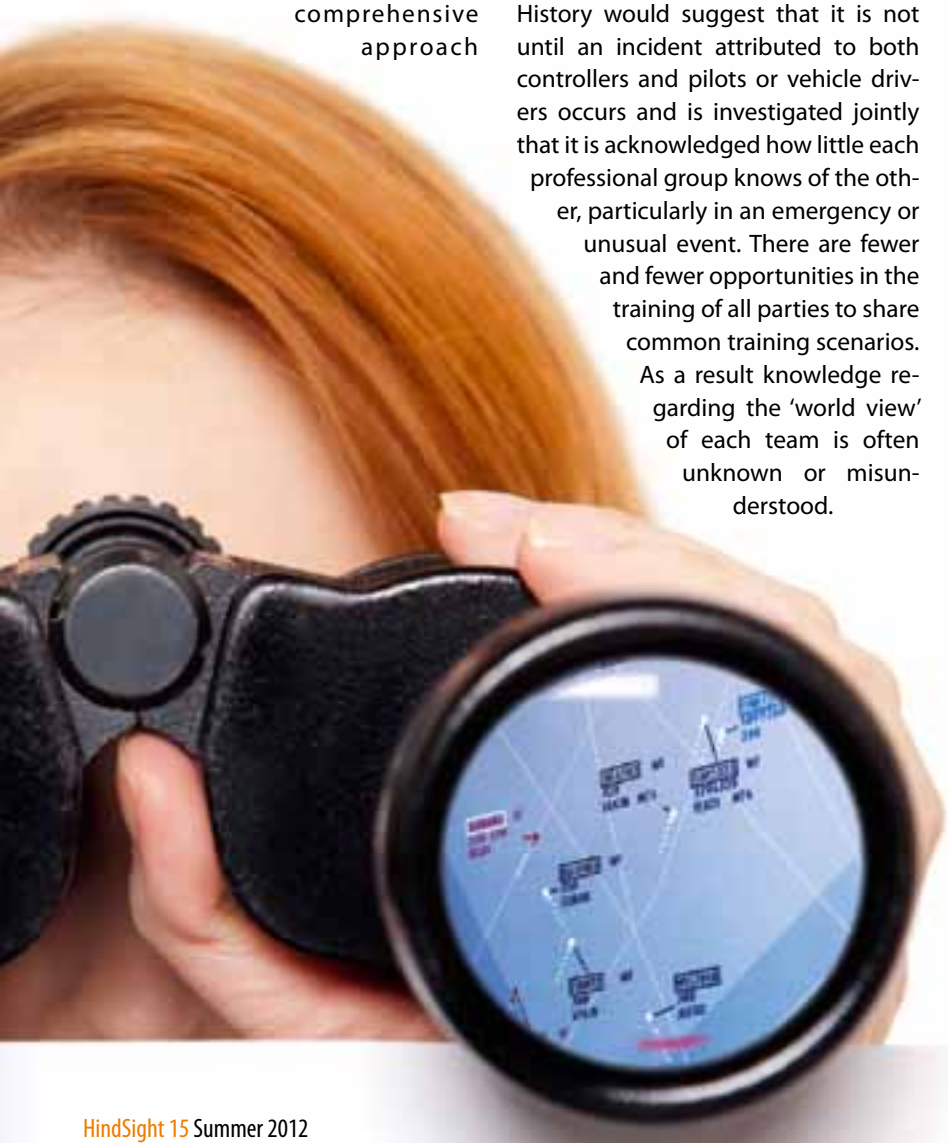
These are all examples of split-second adjustments made when things go wrong, but what of the situations in aviation, with which we are typically more familiar, and in which we often have a slightly longer time frame to recover? Interestingly, humans usually have a similar response to unusual or emergency situations and these follow a set pattern – indeed they can be found in any traumatic response. Firstly we may have a shock or startle reaction. The strength of this will depend on both the individual involved and on how many times they have encountered this situation before. At this point we will suspend belief, for a moment (classically we look to any other person in the direct vicinity for confirmation that what has just been experienced is shared).

Once it has been established that something has indeed gone wrong, we attempt to compare the situation with past experiences and start a sequence of pattern matching and decision making. It is at this point that the brain defaults to the situation explained above, and the outcome often relies on the quality of unusual circumstance and emergency training, experience and the ability to accept what the facts of the situation are rather than what we would like them to be.

This final response is a very strongly developed behaviour which promotes survival in extreme situations, but this behaviour often leads us to ignore the unusual facts in favour of disbelief since we want and need a safe outcome.

Knowing how humans respond to unusual or emergency situations has led airline manufacturers to support crews with emergency protocols which support their decision-making and can eliminate failures in a systematic manner. This leads to a more comprehensive approach to tackling these situations and, typically, supports a safe and expeditious outcome. However there will still be examples in which highly trained crews simply don't believe the indications from instruments and tragically their training, as individuals or crews, leads them to disbelieve what is presented to them. In extreme cases they may even ignore the warnings. In the air traffic environment checklists are less evident; however, training in unusual circumstances and emergencies is practiced with regular periodicity.

History would suggest that it is not until an incident attributed to both controllers and pilots or vehicle drivers occurs and is investigated jointly that it is acknowledged how little each professional group knows of the other, particularly in an emergency or unusual event. There are fewer and fewer opportunities in the training of all parties to share common training scenarios. As a result knowledge regarding the 'world view' of each team is often unknown or misunderstood.



But first we need to appreciate the different 'world views'. A controller's responsibility is focussed on separation of individual aircraft (although often they will consider aircraft in pairs or in some cases multiple pairs); however, they have many of these to consider and as such, arguably, their world view is a 'many to one' dynamic. By contrast, pilots are responsible for the safety of their aircraft and as such their flight is associated with a 'one in many' dynamic. Both the controller and the pilot seek the same safe outcome but their perspectives or 'world views' will differ and as such their priorities may be misunderstood, especially in an emergency.

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One way to support a better understanding of these two professional groups is to put them together in a facilitated workshop to explore the issues faced by each team in unusual and emergency situations. At NATS, our considerable experience of Multi-Crew Resource Management workshops[1] has included the following discoveries:

What PILOTS should know about CONTROLLERS:	What CONTROLLERS should know about PILOTS:
■ The priority for controllers is to - communicate - calculate - coordinate	■ The priority for pilots is to - aviate - navigate - communicate
■ Although controllers will probably have more emergencies in their shift cycle than pilots, they remain uncertain if they are not given what they perceive as essential information. Their priority in an emergency is to move any conflict traffic, which means their workload increases in the area of communication and coordination. A good example of these different priorities can be heard in the last R/T exchange from the US Airways A 320 aircraft which ditched in the Hudson River.	■ Many airlines use an emergency acronym to brief flight-deck and cabin crews which helps simplify the communication exchange. One example is the use of a NITS brief which includes – - **N**ature of the problem - **I**ntention - **T**ime needed – to sort out the problem - **S**pecial instructions if required ■ The priority for the pilots, depending on the emergency, is to fly their aircraft and inform their crews about intended decisions. Often ATC is low on their priority in the first minutes of the emergency.
■ Selecting 7700 helps controllers to identify aircraft which need 'special attention' or have an emergency. Controllers will treat all 7700 squawks as needing priority and arrange their traffic accordingly. The other advantage is that the 7700 squawk is also 'seen' on radar by all controllers throughout their airspace, which increases their situation awareness and readiness to assist.	■ At all times, but particularly in an emergency, pilots prefer to be given distance information – in miles, not periods of time – in minutes ■ Pilots have advised that they find it very helpful to receive ATC guidance that is prefixed or suffixed with the statement " when able"
■ Controllers will assume pilots will announce "PAN PAN" for special attention regardless of the outcome. Controllers will assume pilots will announce "MAYDAY MAYDAY" when requiring immediate support. Both 'PAN' and 'MAYDAY' announcements carry almost equal attention and the controllers will allocate a dedicated controller and frequency if required.	■ 'PAN' and 'MAYDAY' does not necessarily mean a pilot needs immediate landing or the nearest airfield. ■ Pilots also advise that in most unusual or emergency situations they prefer to be given airspace to sort themselves out. The only exception is an explosive decompression or smoke/fire in the flight-deck or cabin.

COMMON INFORMATION FOR BOTH CREWS/TEAMS:

- At all times, but particularly in an emergency, the 'world view' of the two crews/teams differs. This clearly dictates the priorities of the two parties and therefore the reason these situations can be difficult to manage. In these situations each team can lose overall situation awareness of the other team and this may introduce unwanted communication, and this uncertainty may increase stress for each team.
- In emergency situations, which require an immediate climb/descent, each airline (and often different fleets within the same airline) may fly a profile not anticipated by the controller. Some pilots prefer a straight ahead climb/descent and some prefer a turning descent. What an airline/aircraft type requires and what controllers expect they want, or will do, are often completely different.

1- Multi-Crew Resource Management is a workshop which is facilitated by TRM facilitators together with CRM instructors and focuses on a discussion regarding the interface risks found between pilots and controllers. The participants are made up of a mixture of pilots from different flying disciplines and controllers who also have different controlling experience.

> “Although expert decision makers may make small errors, they generally avoid major mistakes. They seem to have discovered that for many decisions, coming close is often good enough: the key is not to worry about being exactly right, but to avoid making really bad decisions.”

Finally, let us return to the phenomena of motor programmes and the recognition of unusual or emergency situations. The response of the brain, and the consequent behaviour, is always a result of experience and expertise. Once any professional has learned the basic skills, rules and procedures of their work they will have sufficient knowledge to work in a normal situation. However, once an unusual or emergency situation is presented, the person will be limited in their response and also subject to several decision-making, behavioural biases. These include any of the following:

- **Frequency bias:** The risk of an event occurring is almost always over or under evaluated because evaluation is based solely on reference to personal experience;
- **Selectivity bias:** This occurs when, as we select information, our preferences lead to a strong tendency to select a restricted core of facts;
- **Familiarity bias:** This is a tendency to choose the most familiar solution, even if it is not the optimum solution for the situation;
- **Conformity bias:** This happens when we look for results which support our decision rather than information which would contradict it;
- **Group conformity:** This is a bias due to group pressure ‘Group Think’ and/or a tendency to agree with a majority decision.

We can recognise all of these decision-making biases in aviation accident reports both in Europe and beyond. It is therefore essential that all flight crews and teams are exposed not only to ‘normal’ unusual or emergency situations, but also to the recovery from unexpected and unforeseen situations. This has become even more important since both professional groups are increasingly exposed to highly automated systems demanding more monitoring and perhaps less ‘hands-on’ collaborative activity.

As on nearly every manned flight since 1965, lift-off of Apollo 12 went smoothly – but only until seventy-eight seconds after ignition when, unknown to anyone, including the astronauts on board, the booster was struck by lightning. Pete Conrad radioed down the alarming news that the bottom had fallen out of nearly every reading on every electrical system aboard his ship. In the seconds following in which the abort decision would have to be made, John Aaron in Houston took another look at his screen and noticed that the readings on the console were showing about 6 amps, well below what they should have been, but well above the zero that would be expected if the system had truly failed. It had been a few years earlier, when he was monitoring a simulated countdown of another mission, when he had seen a similar pattern as the rocket accidentally tripped the circuit breaker on its telemetry sensors. In a split second, and with conformation from flight command, John Aaron pushed the reset switch and instantly the numbers were restored.

Minutes later Apollo 12 was in Earth’s orbit and went on to complete a successful mission to the moon.

Lovell & Kluger, 1994.