The job of the airline pilot in the early days of civil aviation was one in which character, skill and a dogged ability to stick to the task, under extreme pressure, were tested on an almost daily basis. Weather forecasting was rudimentary, navigation was based on fleeting glimpses of railway lines through ragged cloud and accurate landings on an ability to discern a dim line of gooseneck flares. The aircraft were subject to frequent technical failures and the engines had to be nursed with the sensitivity old stagecoach drivers used in handling an inexperienced team of four. Those who learned their trade during the war came through an even more deadly and unforgiving school. Nowadays, the modern generation of pilots sit in air-conditioned comfort, with reliable engines, navigating errors measured in yards rather than miles on aircraft which can land themselves, smoothly and accurately, in almost impenetrable fog. We are the first generation of pilots who may go through a whole career without having a genuine emergency; many pilots have completed fifteen years flying without having suffered an engine failure. Although this is undoubtedly a blessing, it does beg the question, how will they behave if they are eventually put to the test?

Apart from those who have an innate ability to generate excitement (it is known as lack of airmanship) we tend to be posed our most difficult problems on the simulator. The adrenalin which flows through the veins and the clammy hands which are caused by it, are a pale imitation of the real thing. It is a sham, because the fear which causes it is a fear of appearing a fool, rather than fear for one’s life.

Pilots by nature have to be a fairly self-confident breed and such a charmed life is likely to over-enhance confidence in their own basic flying ability, but most would admit to occasional doubts about how they would behave under extreme stress. They would like to emerge triumphant from a trial but, at the same time, they have no wish to be put to the test. They obviously have great interest in the design faults and mechanical failures which affect airline safety but they are even more interested, in a vicarious sense, in the behaviour of the pilot under stress.

Did he think as quickly and as clearly as in normal circumstances? Did he feel he had plenty of time to make decisions or did time appear to pass quickly? Was the story presented to him by the instrumentation consistent, or confusing? Did he handle the aircraft as well under pressure as he did normally?

Captain Eric Moody, Senior First Officer Roger Greaves and Senior Engineer Officer Barry Townley-Freeman found the answers to these questions, and many more, on the 24th June 1982, when they set out to fly BA 009 from Kuala Lumpur to Perth.

The aircraft was laden with 247 passengers and 91,000 kg of fuel for the flight to Perth, the night was moonless, but clear, and the flying conditions were smooth. The en-route weather forecast was good and the crew expected an uneventful flight lasting 5 hours. The flight crew ate their meal after settling into the cruise at 37,000 ft. This was supplemented by a tray of satay (a specialty of Malayan cookery). The crew had finished their meal by the time the aircraft was south of Jakarta on Airway B69.

Eric Moody had a quick look at the area ahead of the aircraft with the weather radar and picked up nothing more interesting than returns from the surface of the sea. He made his way aft and found that the crew toilet was occupied. He descended the stairs to the first class area and started a conversation with the forward purser Sarah Delane-Lea. Almost immediately he was called to the flight deck by Fiona Wright the Stewardess I. As he climbed the stairs he noticed puffs of ‘smoke’ billowing out from the vents at floor level and a smell which he described as ‘acrid, or ionised electrical’, such as one finds near sparks from electrical machinery. He entered the flight deck to find the windscreens ablaze with what appeared to be the most intense display of St. Elmo’s fire he had ever experienced. Eric strapped himself into his seat and again looked at the weather radar. Nothing of significance was in view, but he was pleased that in his absence, the other two crew members had put on the seat belt signs and the engine igniters.

Roger then pointed out the side windows at the engine intakes which were glowing as if lit from within. The electrical discharges had a stroboscopic effect which gave the illusion that the fans were moving slowly backwards. At the same time the St. Elmo’s fire on the windscreens had given way to a display of what looked like tracer bullets. All this happened so quickly that there was little time for discussion and Eric had been distracted by the display from what he considered to be the most important consideration, the smoke which appeared to have got into the air-conditioning.

Before he could speak Barry called out “Engine failure number 4!” Eric immediately asked for the Engine Fire Drill, and the other two crew members carried it out. Roger believes the crew were helped by the fact that the problem compounded itself gradually. The slow build-up of danger ensured that they were not plunged instantly into an extreme situation. They became more alert and concentrated as the incident became more complex and at no time lost control of their reasoning processes. They were soon
forced to face the full consequences of their problem by the voice of the Flight Engineer.

"Engine failure number 2 . . ."

"Three's gone . . ."

"They've all gone!"

Eric stared at the instrumentation in front of him and refused to accept the full impact of what had been said. "Four engines do not fail", was the refrain which dominated his thinking. He had practised a four engine failure detail on the simulator some months earlier and then, the assumption had been made that all generators would fail, leaving the aircraft on standby electrical power, fed from the aircraft batteries. This would have caused a failure of the co-pilot's instrumentation and much of the cockpit lighting. Yet the instrumentation all appeared to work and the auto-pilot remained in control. The display on the engine instruments was also very confusing as the instruments were a mixture of Smiths and General Electric, some of which froze under power loss and some in which the needles dropped off the scale. There were also some amber lights indicating that engines had exceeded their maximum turbine gas temperatures. While he studied this confusing display, Eric heard Barry suggest that they shut the engines down. At the same time he noticed that the airspeed was decreasing. He put the auto-pilot into a gentle descent and turned to his co-pilot "OK Roger, put out a Mayday".

13.44g "Jakarta, Jakarta, Mayday, Mayday Speedbird 9. We've lost all four engines. We're leaving 370".

Eric then controlled the aircraft using the auto-pilot, while the other two carried out appropriate emergency drills. Both pilots shared the task of moving the engine start levers on different occasions. Because the auto-pilot remained in control, Eric had time to consider the likely cause of such a multiple failure: electrical? (check all circuit breakers); fuel? (turn on all pumps and cross feed cocks); icing? (turn on engine anti-icing). All the crew members, afterwards, felt that checklists, for such extreme emergencies, should contain every item for consideration and not

leaving anything to intuition. Although crew members will always exercise their initiative, it is better that they have trust, that the check list covers everything. The dominant feeling of the crew at this point was the question 'what have we cocked up?'

The first relights were attempted on engines 1, 2 and 3, but Eric decided, with the agreement of the crew, to attempt relights on the number 4 engine along with the others. (The number 4 engine fire handle had been pulled when the fire drill had been carried out).

At 26,000 ft. the cabin pressure warning horn sounded as the cabin climbed through 10,000 ft. The crew started to don their oxygen masks. When Roger removed his mask from the stowage it fell to pieces in his hand. The boy who fit came out of the supply pipe and the tubing disengaged itself from the mask. Eric was presented with an unenviable choice. Should he continue to descend as slowly as possible and have his co-pilot suffer the effects of anoxia, or should he increase the rate of descent until the aircraft was at a more survivable altitude. He chose the latter, and began an emergency descent.

However he decided not to extend the gear, as instructed in the flying manual, because it opened up the possibility of having to ditch the aircraft with gear extended, should it prove impossible to retract them. With hindsight it is now obvious that during gear extension, the hydraulic power from windmilling engines might not be powerful enough to move the gear and the flying controls at the same time. They had previously turned the aircraft on a Northerly heading back towards Jakarta and they decided that with a safety height of 10,500 ft in that area, they would turn back out to sea when the aircraft reached 12,000 ft. At this time the inertial navigation systems were giving a display of gibberish and were no use in fixing their exact position.

When they reached 20,000 ft. Eric retracted the flight spoilers and reduced the rate of descent. Ironically he noticed that Roger had, by then, managed to fit the oxygen mask together (a test of intelligence and manual dexterity while under extreme pressure).

At this point Roger noticed that his airspeed indication showed 320 kts whilst Eric's showed 270 kts. Eric thought that it was worth assuming that the higher figure was correct in case they had been attempting to start the engines while outside the relight envelope. Again they had no luck, although the fuel had been igniting behind the engines and treasuring those passengers with window seats to a view of what appeared to be, four engines on fire. At about that time the cabin reached 14,000 ft. and the passenger oxygen masks were deployed. Eric decided it was time to have a word with them.

"Good evening ladies and gentlemen. This is your Captain speaking. We have a small problem. All four engines have stopped. We are all doing our damndest to get them going again. I trust you are not too much distress."

Eric then asked the Cabin Servo Officer to come to the flight deck. He attempted to explain the problem to him while wearing

S.F.O. Roger Greaves, Captain Eric Moody and S.E.O. Barry Townley-Freeman.
his oxygen mask. Graham Skinner could not understand Eric’s words, but he realised that his presence on the flight deck was not helping matters, so he nodded, and returned to his job of helping the passengers.

It was about this point that Eric started to consider the awesome consequences of attempting a deadstick touchdown on the sea at night. His father had taken him, as a child, to fly the pier to watch the flying boats land. He knew that flying boats did not fly at night because of the difficulty of judging height above water. He remembered, with some amusement, a training film made by British Airways which simulated a ditching at sea. The Captain playing the role (no actor) had used the phrase ‘it’s not our day’ in passing the bad news on to the cabin crew. This reverie was interrupted by sounds of jubilation from the other two crew members as number 4 engine started. (This was the engine which had first run down and the success amply repaid Eric’s gamble in trying to start it.) The other three engines started, an almost interminable, 90 seconds later. They were at 12,000 ft.

**13.57z** “Speedbird 9, we’re back in business. All four running, level 12,000.”

They immediately requested a climb to a height which gave them more clearance over the high ground ahead of them and asked for clearance to Jakarta. They climbed to 15,000 ft, and at about this height there was a resumption of the St. Elmo’s Fire. When the throttles were pulled back to level out the Number 2 engine surged continually. It felt as though it would shake the aircraft apart, so it was shut down, but not without great reluctance. At this point Eric suspected that the St. Elmo’s Fire, above 15,000 ft, was somehow connected with the engine problems and concluded that the engines themselves were severely damaged. He decided to descend to get away from the strange atmospheric effects but resolved to leave the throttles in their present position and control the aircraft speed and descent by the use of speedbrakes, flaps and undercarriage. This required a leap of the imagination as up to that point they had strong suspicions that the engines had failed because of an oversight, or an error, by the crew. They were cleared to Jakarta Airport where the weather was fine, with calm wind and good visibility. The only added complication was that glide path information was not available for Runway 24.

**14.21z** “This is Speedbird 9, could you turn runway lights fully up please.”

While the aircraft was on the base log for runway 24 the crew had great difficulty in picking up any lights on the ground and, in particular, in picking out the runway lights. Eventually the runway was spotted to the right of the aircraft out of the co-pilot’s side window. When they lined up with the runway the lights again disappeared and the crew realized that their front windows were almost opaque. The final descent, to touched down, was made using the localiser, to stay on the centreline, and by peering through the outer edge of the left-hand front window, which was still clear. Eric was just able to make out the lights of the VASIs on the left of the runway. The other two crew members called out the radio altitude and DME distance to help in judging the descent. When they were over the runway the whole of the front windows were filled with a diffuse glare of light. This was comforting in that it proclaimed the general proximity of the runway, but the delay before the wheels touched down felt like minutes rather than seconds. The landing itself was smooth, Eric felt that the earth seemed to gather them up; downstairs in the cabin spontaneous cheers and clapping broke out from the passengers.

The crew taxied the aircraft off the runway towards the terminal building. The glare of light from the parking area again filled the front windows with a blinding glare. They decided to call it a day and parked the aircraft.

**14.31z** “Speedbird 9, I can’t see with the light in my eyes. I’ll hold it.”

**Conclusions**

It was two days before the crew got confirmation of the cause of the incident. Barry was convinced that it was caused by an
encounter with volcanic ash when he found his hands and clothes covered in a fine black dust as they waited for steps to be brought to the aircraft. When they got outside they found all the leading edges, engine nacelles and nose cone stripped of paint as if the aircraft had been sandblasted, as indeed in one sense it had. They had flown into the dust cloud from a volcanic eruption from Mount Galunggung which is positioned about 110 miles south east of Jakarta. The plumes of ash started to become visible on satellite weather photographs, after the event.

The engines were the worst affected parts of the aircraft with the turbine blades having the most damage. The tips of the blades were worn away where they were blasted by the ash at high speed. The material of the ash was mostly silicate particles with a mean diameter of .075 mm. Apart from wearing away the high speed parts of the engine the "silicicous" nature of the material sintered in contact with the hot metal fusing itself to the blades. This is what happens inside steel furnaces. The changes in blade shape and size had serious effects on the efficiency of the engines with the number 4 engine (significantly the engine which ran down first) being the least damaged. Ash was also found in the pitot tubes which had caused the differing airspeed readings. In October 1984 ICAO issued a special report on the dangers of volcanic ash to aircraft, where it was pointed out that the incident on the 24th June 1982 was the ninth eruption of Mount Galunggung that year. The report found that prevention was better than cure, but suggested that any pilot who encountered such a problem should, altitude permitting, reduce thrust to zero, descend and leave the area as soon as possible. Consideration should be given to turning off engines and restarting them when clear of the ash and inside the reignt envelope of the aircraft.

What Can be Learnt from the Behaviour of the Crew?

It would be comforting to think that this was an average crew and that a similar outcome would have resulted had others been flying the aircraft. If this be the case then British Aviation is indeed blessed with the standards of their pilots and flight engineers. If they were unexceptional crew members then it is obvious that they behaved in an exceptional way. They exhibited a quality which is described, best, by a word which is much loved by football managers, and the word is 'bottle'. This describes a sort of courage which is not of the gung-ho variety but the sort which causes someone to persist in an enthusiastic and inspiring manner when the odds for success look slim. Barry said that, bad the aircraft landed in the sea, he would have still been trying to start engines as the fuselage touched the water. This is the sort of professionalism which passengers deserve to get from their flight crew.

Barry felt, very strongly, that check lists, which have to be used in such extreme emergencies, should contain every item of relevance to that emergency (perhaps in an expanded form in the Flying Manual) and suggests that the crew should read out, from the checklist, the items which are meant to be 'memory items'. When there are three concurrent drills to be carried out while one is "thinking through treacle", close adherence to a comprehensive checklist is the only way to guard against error.

Their efforts were successful because:

i) One pilot ensured that while check-lists were being completed, the aircraft attitude and speed were always monitored (somebody minded the shop),

ii) the emergency was managed in a rational and safe manner,

(iii) the emergency check-lists were fully utilised,

(iv) they continued to try to start the engines even though for 13 minutes there was no visible reward for their efforts,

(v) they used the auto-pilot to reduce work load so that, at least, one member of the crew could detach himself from the check-list and try and reason his way to a solution,

(vi) where necessary they made bold decisions: trying to start No. 4 engine and refusing to climb back into the cloud of ash, and

(vii) they made full use of each crew member, aircraft system and landing aid, to ensure a safe landing.

This was an exercise in crisis management, the sort of thing which NATO spends much of its time studying. Any Captain finding himself in such an extreme situation must ensure that, at any particular moment, he clearly identifies the aspect of the problem which is most relevant to the safety of the aircraft and attempts to solve it. He must be able to delegate some responsibilities, and clear-minded enough to ignore those problems which are not an immediate danger to the aircraft. These priorities will change as time goes on so the pilot must guard against tunnel vision. This is an aspect of aviation which is not studied widely, although, in recent years, there have been five occasions when multi-engined aircraft lost all engine power. The most amazing aspect of these incidents is that there has been no loss of life in any of them.

Postscript

Afterwards the crew were amazed to see the way the event captured the imagination of the world. Their own reactions were mixed, some feeling a sort of delayed action euphoria, while others felt very lucky to be alive. They all felt that after similar incidents, crews should not be allowed back to their jobs until normality returns. Eric found himself both lauded and hounded by the press of the world, often being asked questions which were both silly and uninformed. Always he was being asked for quotes. “Give us a quote about what it was like to land on a dark night with no forward vision” he was once asked. “It was a bit like negotiating one’s way up a badger’s arse” said Eric not because of any great knowledge of brock bums (presumably the Arctonyx Collaris, or the Sumatran badger) but because it is how a dark night is described in his beloved Hampshire. Eric was pleased with his quote and disappointed when it was never used, even when he changed badger for possum (Didelphis Masaplaisia) in Australia. We have much pleasure in including the quote in the LOG, long renowned for its fearless misuse of the English language.

Jack Diamond

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