Aircraft hazard from volcanoes

SIR — Tilling and Lipman[1], in discussing hazards associated with volcanic eruptions, identified action required to reduce the risk to passenger aircraft. Although it is true that technological advances may not provide a panacea for all risks associated with volcanoes, we believe that the risks to jet aircraft that encounter volcanic ash clouds can be reduced considerably by using appropriate on-board technology, an option not discussed by Tilling and Lipman. We have built and tested[2] an airborne infrared device capable of detecting volcanic ash clouds from commercial jet aircraft up to 10 minutes before impact. Airborne trials of the device at the Sakurajima volcano in Japan confirm that this seems a promising approach.

Existing warning systems for aviation rely on a combination of ground-based observers, Earth-observing satellites and a tortuous communications network. Our device would be mounted on board the aircraft, providing instantaneous information to the people who need to know — the pilot and crew. Moreover, the device uses passive infrared radiation and works equally well during the day and night. (The Total Ozone Mapping Spectrometer cannot detect volcanic clouds at night, yet several documented encounters with clouds have occurred at night[3].)

Airborne volcanic substances cause engines to stall; they clog the pitot-static inlets, oil and fuel filters; they abrade the leading edges of the aircraft; they sandblast the cockpit windscreen; and, because of the sulphuric acid content, they cause corrosion to the skin of the aircraft[3]. In many documented cases, the hazard was encountered within 1–3 hours of a volcanic eruption. We believe that with the current and planned suite of Earth-observing satellites coupled with the inevitable problems in communication systems, there will be significant delays in pinpointing hazardous volcanic clouds and relaying the information to aircraft in flight. Our on-board device could provide the solution.

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2. Prata, A. J., Barton, I. J., Johnson, R. W., Kamo, K. & Kingwell, J. *Nature* **354**, 25 (1991).
3. Notes and procedures for Volcanic Ash Observations and Encounters *ICAO Asia/Pacific* (1993).

Colour coded

SIR — With the coming of cheaper colour printing, *Nature* is producing diagrams, such as that showing the species richness of birds in Idaho[1], in colour. Yet possibly 4 per cent of readers are, like me, colour blind, and find many of the colours indistinguishable, particularly reds, greens and browns.

A way of overcoming this difficulty is to use a large field magnifier. Such magnifiers are colour compensated so that, on looking at a flat page, the reds appear to float above the page and, less usefully, the blues are sunk down.

It would also help if *Nature* were to advise authors (1) to code in spectral order and (2) to use blue and yellow for contrast, rather than red and green, where possible.

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Why the gloom?

SIR — There is a lot of gloom in the United Kingdom about the modest numbers of young people choosing to do physics, chemistry and so on. Why the gloom? There is no shortage of professional scientists and engineers. If there were, industry would pay them scarcity salaries. Research dependent on public funding suffers from too many claimants for a portion of the sizeable pie, not too few.

Where there is a real shortage is in able people educated through science (and therefore with sympathy for it) in responsible positions, working as bankers, administrators, politicians, managers and so on. But is our system at school and university geared to teach science in an educational manner? Most of the teaching appears to aim to produce professional scientists by working to overloaded and overspecialized syllabuses.

What is needed is to teach science as a human, social activity, to show how it evolved, to get across its spirit of adventure and its attitude, and to turn out graduates trained in communication skills and in teamwork. These are fundamental to all human activities, science and engineering included. No doubt the volume of science so taught in a given time would be less than now. Those who became professional researchers could make up for this deficiency later. At present many graduates starting on a research career first have to learn painfully to communicate effectively and to work with others.

I trust that more institutions will soon accept the need to teach science and engineering attractively and educationally, and make it known that they do so. They would rapidly reap the benefit by attracting more and better students. Until this happens, they must be prepared to have smaller classes. Keeping up numbers by accepting students of low quality inflicts long-lasting damage on the standing and on the drawing power of science.

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Not so new

SIR — Daedalus (*Nature* **365**, 300; 1993) thinks his "suckercar" is new but in fact it has been built, raced, and twice banned from further racing[1]. The racing community preferred the more euphonious "hoover car".

As in Daedalus's suckercar, real hoover cars used the principle of a hovercraft in reverse. In the Chaparral 2J Can-Am racer, designed by Don Gates, two rear-facing fans were driven by an auxiliary 45 b.h.p. snowmobile engine. They sucked air from a chamber below the car which was sealed from the outside by skirts made of Lexan, a thermoplastic material. This held the car firmly to the ground allowing it to corner much faster than conventional cars. In this car Jackie Stewart made the fastest lap at Watkins Glen in July 1970 and Vic Elford was fastest in practice at several other Can-Am races. Unfortunately the car failed to finish in any race before the system was banned by the Fédération Internationale de l'Automobile (FIA) in December 1970 because it violated rules limiting the use of moving parts in aerofoil systems.

Another hoover car, designed by Gordan Murray, appeared on the Grand Prix circuit in 1978 and was more successful. The Brabham team's BT46, based on the same principle as the 2J but with only one fan, was driven to an easy victory by Nicki Lauda in the Swedish Grand Prix and the result was allowed to stand although this system was also banned by the FIA.

Neither of the hoover cars was tested on vertical or inverted surfaces, as these are not usually a problem on Can-Am or Grand Prix racing circuits. The devices certainly improved cornering speed dramatically, and if the system had come into general use the drivers would probably have needed g-suits to protect them from the centrifugal forces.

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