

Disorientation? Do you mean the leans?

SAFE Europe - Prague

31st March

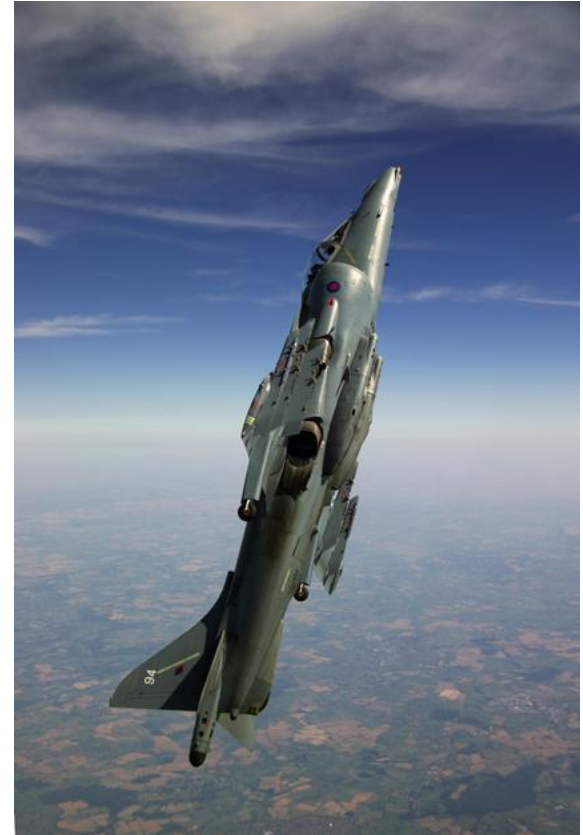
Tracy Grimshaw

Dr Rollin Stott



Contents

- What is Disorientation?
- Description of our disorientation survey tool
- Pilots' reports of disorientation
- Factors contributing to disorientation
- Disorientation training in flight simulators



What is disorientation?

How do you show this picture?

...with the force world upright?



...with the visual world upright?



In manoeuvring flight the visual world and the force world become dissociated.

Common misconceptions about Disorientation

- “Spatial disorientation is all about illusions.”
- “Spatial disorientation occurs because of the deficiencies of the vestibular system. Pilots would be better off without it.”
- “...if only I could understand the cross-coupled illusion.”



Disorientation presents itself to a pilot in one of two ways:

EITHER

1. The pilot becomes confused about the true attitude or position in space of the aircraft, but is aware of it – classed as **Recognised** disorientation.

OR

2. The pilot suddenly becomes aware that the aircraft is not in the attitude or position he/she thought it to be – classed as **Unrecognised** disorientation.

Fundamental premise: if you understand the type of disorientation that pilots are experiencing in-flight you can best target countermeasures.

Understanding disorientation

Previous world-wide disorientation surveys were typically based on ‘tick boxes’ for ‘illusions’ BUT:

- Open to misinterpretation
- Deceptive to call an experience an ‘illusion’ – to the pilot, it is a dangerous reality
- No real handle on the nature of disorientation that pilots are actually experiencing



UK MOD Disorientation Survey tool

- A simple survey tool was designed:
 - Aircrew completed in their own words incidents involving confusion or total unawareness of the true attitude or position of the aircraft
 - This acknowledges the fact that the most dangerous form of disorientation arises insidiously without any experience of an illusion, often as result of loss of situational awareness (SA)
 - Subsequent analysis by Subject Matter Experts (SMEs)
 - Access database developed to act as knowledge store and enable analysis of incidences

2007 Survey front page

ORIENTATION INCIDENT SURVEY

Aircraft continue to be flown into the ground because the pilot thinks it is somewhere else. For every accident of this sort there are likely to have been 20 or so 'might-have-beens'. It is hoped that analysis of these near, or not so near, misses will improve our understanding and help to prevent such accidents.

To this end the Motion group within the Human Protection and Performance Enhancement group, QinetiQ, Farnborough are conducting an incident survey on behalf of the MoD. We would be very grateful if you could provide, in the boxes overleaf, as detailed a description as possible of ANY incidents that occurred in-flight to date during your career in which:

Either:

You became confused about the attitude or position of your aircraft

Or:

You suddenly became aware that the aircraft attitude / position was not what you had expected it to be.

If you have experienced anything of this sort your account of the circumstances in which it occurred and your assessment of why it came about would be most valuable. If there is insufficient space, please use the box on the last page for additional comments, or feel free to attach extra sheets to this document.

Severity

Incident Description

Please use the boxes that follow to describe as fully as you can any incidents you have experienced.

A checklist reminds you to include the conditions of flight at the time (e.g. IMC, night, formation flying) and whether you were using any night vision devices. In addition an indication whether any training received on spatial disorientation was of help in these circumstances would be useful.

For each description please also fill in the background information section at the top of the box and categorise each incident in accordance with the following criteria:

- | | |
|--------------------|--|
| MINOR | "Trivial"; flight safety was NOT at risk |
| SIGNIFICANT | "Could have been nasty"; flight safety was not at risk, but could have been jeopardised under different conditions. |
| SEVERE | "Lucky to get away with it"; flight safety WAS at risk. |

If you require any additional space please feel free to add further blank sheets of paper to this document.

Example incident report

Incident 1		Background Information:	
Date of incident:	2000	Total hours flown at time of incident:	800
Crew capacity or role:	AC CDR	Hours flown on aircraft type at time of incident:	200
Aircraft type:	GAZ	Severity (tick):	<input type="radio"/> MINOR <input type="radio"/> SIGNIFICANT <input checked="" type="radio"/> SEVERE
Description:			
<p>TX FROM VL TO CULBOOSE WITH 1x PAX IN CABIN. V POOR MET, LOW CLOUD RAIN. INYBRIDGE S. OF DARTMOUTH FORCED DOWN BY WX. FOLLOWING WIPES, OPS OF PAXONS IN CLOUD ∴ COULDN'T COORS (NO U-WIRE XING AVIATION). ABOUT TURNED, PULCHED UP TO IF RECOVER TO EXETER, WHICH WAS CLEAR. IN IF CLIMB, TRIED TO PUT + MAKE RT CALLS TO EXETER. SUDDENLY, COCKPIT TURNED GREEN (IE HEADING RAPIDLY TOWARDS GROUND). PULCHED UP ACCESSORIES + PAID MORE ATTENTION TO IF PUTING. SAFE SEA MADE INTO EXETER. BOUGHT THE WETS + CARDS + APPROXISED TO CREW + PAX FOR BEING A NOBBER. NEARLY SPANDED IN, MY FAULT FOR TRYING TO DO TOO MUCH + NOT LET AD2 EITHER PUT OR MAKE RT CALLS. LEARNED ABOUT PUTING FROM THAT ONE.</p>			

Classification of contributory factors leading to the Incident

- Environmental Factors – Cloud, Night, Featureless terrain, etc
 - Manoeuvre Factors – Low-level abort, Combat, Formation etc
 - Pilot Factors – Distraction, High workload, Fatigue etc
 - Aircraft Factors – NVGs, Display limitations etc
-
- What alerted the pilot to the problem?



Aircraft attitude errors



What height above ground level? How tall are the trees?



Goldfish bowl with sloping cloud tops



Rochester approach - a grass strip, few aids



This approach is too low. How has this happened?

Rochester approach - base leg, 20s before.



The approach has been over a valley. The runway is on higher ground.

Pitch attitude errors



If, when straight and level a pilot is distracted and inadvertently allows the nose of the aircraft to drop, it will accelerate under the influence of gravity, but will feel more nose-up than it really is.



Formation flying

The pilot of this aircraft orientates himself with respect to his leader.

All is well provided...

- he does not lose sight of the lead aircraft in thicker cloud.
- the lead pilot does not become disorientated.

Learning lessons from incidence reports – improving training

- Flight simulators provide the opportunity to learn safety-critical skills in a safe but realistic high-fidelity environment



Incidence reports can
inform scenario-
based simulator
training



Always trust your instruments son.

Providing Disorientation training in UK flight simulators

- Tri-service pilot SD training often focuses on ‘traditional’ illusion-based training e.g. Barany chair
- 5-year work programme – MOD-funded research using rotary wing simulators –
 - RAF Shawbury – Defence Helicopter Training School Griffin simulators
 - 2 independent groups: Experimental (disorientation incidents) and Control
 - Key: students flew themselves into the situation, not aware they were receiving training
 - Training was primarily in the debrief
 - Instructors assessed pilots’ performance
 - Results – the group who had undertaken the SD training in the simulator showed improved situational awareness and crew co-ordination compared to the control group
- The SD training scenarios have now been implemented as a formal part of RAF trainees’ advanced multi-engine training
- Currently trialling refresher disorientation training using RAF Benson flight simulators

Conclusions

- Anonymous Survey
- Outside organisation service mechanism
- Freestyle nature of the report
- Survey invites *all* aircrew to respond to the survey, not just pilots
- By tracking the number and type of SD incidences over several years, patterns and trends can be identified, and potential countermeasures investigated.



Acknowledgements

- Many thanks to aircrew from the RAF, JHC (Joint Helicopter Command) and NAS (Naval Air Squadron), who by completing the SD Survey have furthered UK understanding of spatial disorientation
- Many thanks to the AViate Journal for allowing reproduction of two cartoons here by the artist 'Jake', of DARS (Directorate of Aviation Regulation and Safety)
- Much of this work was carried out jointly with Dr Sharon Holmes
- This research is funded by the UK MOD

QinetiQ

The Global Defence and Security Experts