

Case Report

## The Giant hand phenomenon - A Case report

Wg Cdr G Gomez\*

### ABSTRACT

A great number of orientational illusions occur during flight, many of these have been studied in great detail and are well known, both to pilots and aviation medicine specialists. However a case of a lesser known kind of illusion - the Giant Hand phenomenon is described. Though obscure, when it does occur it has sufficient emotional impact and is impressive enough to cause the pilot to report it.

UASM 2001; 45(2) 72 to 75

**KEY WORDS :** Orientational, Illusion, Giant Hand, Phenomenon, Spatial Disorientation

The Giant Hand (GH) phenomenon was first described by Dr PAH King, a pilot and a flight surgeon in 1962. Dr. King relates his own experience which occurred during a night instrument flight in Dec 1959 - while in a left climbing turn, he bent his head down and to the right to find the radio compass audio switch, in so doing he experienced violent vertigo. Thereafter while he attempted to get the wings level he experienced extreme control stiffness and found that even with using both hands and knees he could not move the control column to the right. He felt as though a "giant hand" was thrusting the stick to the left. [1]

In the Indian Air Force, Spatial Disorientation (SD) indoctrination for aircrew was introduced at the Institute of Aerospace Medicine in 1994 [2]. During

the course of this indoctrination the pilots are required to relate in their own words the worst SD incident or experience they have encountered. On analysis of these write-ups an episode of the GH phenomenon afflicting a fighter trainee pilot has come to light.

### The Episode

The trainee pilot of the fighter aircraft, was briefed by his instructor for a dark night trainer check sortie, in which he was to carry out a few

Classified Spl (AvMed) IAM, IAF, Vimanpura,  
Bangalore 560017

turns at 4 km AGL and thereafter asked for a GCA let down. The weather at that time was reported to have clouding between 1-2 km and a lesser amount at medium level.

The pilot states that as he was leveling off and rolling out of a climbing turn he entered cloud. He was on instruments at that time. As he was leveling the aircraft he got distracted by a bright flash of light on one side of the canopy causing him to raise his head and look out in that direction, only to realize that it was the navigation light reflected in the cloud. On getting back on instruments he noticed a 15-20 degree bank on the AGD (attitude indicator). He corrected for the same to wings level. However soon he noticed that the bank was coming on inadvertently and each time it became more and more difficult to achieve wings level attitude. The pilot goes on to explain that finally the muscular effort required seemed to be immense.

At this stage he was asked to descend by the instructor who further queried his handling of the aircraft. It was only on breaking cloud and on visual contact with the flare path did these strong feelings subside and he felt more comfortable. Further to this surprise he found that there was no malfunction of the controls.

#### The Giant Hand phenomenon

Malcolm and Money have described the GH phenomenon in detail [3]. In this a pilot suffering from this effect of SD perceives falsely that the aircraft is not responding properly to control inputs, because every attempt to bring the aircraft to the desired attitude seemingly is resisted by its tendency to fly back to another more stable attitude. A pilot experiencing disorientation about the pitch

axis may feel then airplane subjected to a great force trying to hold the nose down. On the other hand, a pilot experiencing disorientation about the roll axis may feel a force like a giant hand trying to push one wing down and hold it there [3, 4, 5].

Malcolm and Money further in their analysis of GH phenomenon incidents, state that they observed four pre-conditions for this phenomenon to take its effect [3]. These are :-

- (a) A state of anxiety or mental arousal needs to have been prevalent for some minutes prior to the incident.
- (b) The control of the aircraft has involved a motor task of one or both hands.
- (c) Immediately prior to the event the pilot has been distracted from the immediate task of controlling the attitude of the aircraft.
- (d) The resultant gravity has been rotated forward (as during deceleration) or the pilot felt that he was pitched forward as occurs when diving or during some types of cross-coupled head movements.

In this particular episode we find that the young trainee Fighter pilot has had all the preconditions as described by Malcolm and Money viz. :-

- (a) The sortie was at night and involved instrument flying. Further he had entered cloud. For a trainee pilot this is sufficient to raise his arousal level and produce some level of anxiety.
- (b) The pilot reported that he was leveling off and rolling out of a climbing turn. This task would definitely have involved certain amount of motor activity of one or both hands.

(c) Immediately prior the event he was distracted by the flash of light, which made him look out in that direction and taking his attention off from the task of controlling the aircraft.

(d) On leveling off from a climb there has been some amount of deceleration, maybe resulting in a rotation of the gravito-inertial vector, as occurs in the inversion illusion.

Thereafter the pilot reported the classical symptoms of the GH phenomenon wherein he experienced difficulty in controlling the attitude of the aircraft in the roll axis. He had to use considerable muscular effort to keep the aircraft level and prevent the inadvertent bank occurring. His struggle ended only on establishing visual contact with the illuminated flare path.

#### Possible mechanism of the GH phenomenon

The actual mechanism by which the GH phenomenon is produced is not clearly understood. [6]. However Malcolm and Money describe a possible mechanism - the condition of anxiety is known to increase the level of activity of the reticular activating system in the mid brain. The rotating gravity vector increases the activity in the Deiter's nucleus. Further the motor task of gripping the control column increases the level of activity in Sherrington's final common pathway in the spinal column. A sudden distraction from the control task possibly releases pyramidal tract control. All these conditions are known to lead to or increase an existing state of spasticity. They therefore, suggest that the GH phenomenon is the result of a postural reflex, an uncontrollable reflex response to the psychological and physiological conditions affecting the pilot prior to and during the incident. The pilot

believes that he is pulling back on the control column when he is actually pushing it [3].

Other workers have simply stated that the cause of the GH phenomenon is conflict between the conscious and the subconscious for control of the aircraft [7,8,9]. To prevail in this conflict between will and skill, the pilot must de-couple voluntary acts from automatic flying behaviour [7]. Dr King describes that he was able to regain control of the aircraft by grasping the stick with his fingertips [1]. Malcolm and Money suggest that the best way to cope with the GH phenomenon is to switch to thumb and forefinger grasp or by pushing the control column in the direction of the pull [3]. Today, the use of thumb and forefinger control is the standard recovery procedure for the GH phenomenon [9].

How does such fingertip control resolve the GH phenomenon? It is seen that Brodrmann's homunculus classically portrays the disproportionate amount of cortical area allotted to motor control of the thumb and the index finger. Moreover this musculature is under more discrete cortical control. This exclusive innervation seems a possible explanation for the enigma whereby the thumb and the index finger grip is able to interrupt the phenomenon. [6]. Other researchers feel that since the GH phenomenon seems to be accompanied by Vestibular generated SD, and that there is a conflict between the conscious and subconscious, it follows that it is the arm and shoulder muscles that are receiving the conflicting inputs. The arm is one of the mechanisms by which we control our orientation through postural reflexes. Thus by using fingers for control, a person bypasses the influence of the subconscious or postural motor reflexes [8,9].

## Operational Significance

The GH phenomenon though not well reported in literature and not well known in flying circles is by no means rare. In a survey conducted in the USAF for the period August 86-July 87, some 15% of pilots reported having experienced the same [6]. In the IAF, Navathe and Singh had carried out an extensive survey of SD incidents and accidents in 1989. However, the GH phenomenon does not find a place in their findings [10]. This case in particular shows, that IAF pilots also experience the GH phenomenon, only it has not been reported. The problem lies with pilots who are unaware of the existence of this GH phenomenon and experience it for the first time. This can lead to surprise, confusion, alarm and even apprehension as pilots are unable to discern the nature of their problem.

The GH phenomenon is a Type III SD [4,5]. A pilot recognizes an unusual attitude, tries to correct, but cannot. As a result, pilots may suspect failure of the aircraft control system. In this light, a pilot's radio transmission that the aircraft controls are malfunctioning should not be taken as conclusive evidence of malfunction of controls, for there is a possibility that this was due to the GH phenomenon [4].

## Conclusion

The GH phenomenon undoubtedly explains why some pilots have been rendered hopelessly confused and ineffectual by SD, even though they knew they were disoriented and should have been able to recover their aircraft. Pilots in the IAF need to be indoctrinated with regards to this phenomenon, so that if and when it occurs in flight it does not surprise or alarm the afflicted pilot. Until the problem and possible mechanism of this phenomenon is properly understood, pilots should be told that the best way to cope with such an occurrence of the Giant Hand is to let go of the stick and to switch to thumb and index finger grasp. Or they could try pushing the controls in the direction of

the perceived pull [1]. Obviously, the manner selected will depend on the particular circumstances in which the pilot finds himself and his aircraft.

## References

1. King PAH. A report of an incident of extreme SD in flight. IAM, Royal Canadian AF, Aeromedical Report 1962, Vol I, 22-8.
2. Gomez G. Spatial Disorientation Training in the Indian Air Force. Paper presented in Ind Soc Aerospace Med Annual Conference 1995.
3. Malcolm R, Money ICE. Two Specific kinds of Disorientation incidents : Jet upset and Giant Hand. In : The Disorientation incident : AGARD CP-95, 1972, Part I : A 10-1 to 10-4.
4. Gillingham KK, Previc FH. Spatial Orientation in Flight. In : Fundamentals of Aerospace Medicine. 2M edition Ed : Dehart RL. Williams & Wilkins, Baltimore USA 1996.
5. Gillingham KK, Previc FH. Spatial Orientation in Flight. AL-TR-1993-0022.
6. Lyons TJ, Simpson CG. The Giant Hand Phenomenon. ASEM 1990; 60:64-6.
7. Slater KR. SD and the Giant Hand Phenomenon. Hygiene Safety 1993; 49:14-6.
8. Monesi FH. An update of findings regarding SD in Flight. A recommendation of underlying mechanisms. In : SD in Flight current problems : AGARD CP-287, 1980:B 2-1 to B 2-6.
9. SD and the Giant Hand Phenomenon. Safety Journal 1995; 34:18-20!
10. Navathe PD, Singh B. Prevalence of SD in IAF aircrew. ASEM 1994; 65:1082-5.