# Chapter 8 – AIRCREW HANDOUT (EXAMPLE)

## 8.1 INTRODUCTION

Student pilots and experienced pilots as well as aircrew in general are encouraged to read articles covering SD issues in Flight Safety Magazines. Flight safety departments are encouraged to report on SD incidents and accidents on a regular basis in these magazines and on so-called flight safety days.

The availability of Handouts for aircrew after the SD demonstrations makes sense; the completeness of the SD information may vary. We may not expect aircrew to read the very complete book "Spatial Disorientation in Aviation", Eds. Previc FH & Ercoline WR (2004) [26]. The Chapter entitled "Spatial Disorientation: perception in the Aviation Environment" from the Aviation Medicine Handbook written by Braithwaite (2002) [78] provides excellent, more aircrew tailored information and may be read by aircrew.

In the following sections the text and lay-out for a short SD Handout for aircrew is given.

## 8.2 TEXT FOR SD HANDOUT

### 8.2.1 Definitions

Having **Situational Awareness (SA)** means that you:

- Are spatially and geographically oriented;
- Have a good perception and appreciation of your tactical environment; and
- Have a good appreciation of factors that are important in keeping the aircraft (AC) safe from hazardous situations or potentially dangerous flight paths.

Your **Spatial Orientation** is maintained correctly by:

- Integrating the information from your vision and from your vestibular, joint and pressure receptors; and
- Together with information from AC instruments and displays.

You have **Spatial Disorientation (SD)** when:

- You fail to experience correctly the position, motion or attitude of your AC in relation to the surface of the ground or to other AC.

**SD Classification**

SD is usually divided into **"unrecognized SD" (Type I)** or **"recognized SD" (Type II).**

Rarely Type II SD develops into an **"incapacitating SD" (Type III)** associated with a high degree of acute anxiety or fear.

### 8.2.2 Sensory Organs

Your **Sensory organs** are not perfect for flying purposes:

- But your vision is far better than your vestibular organs.

- Erroneous or inadequate information from your sensory organs to your brain gives rise to **an *input error***.

Your **Vision:**

- ***Focal vision*** is used for object and colour recognition and identification (e.g. reading). Information is processed in higher brain levels (time consuming).
- ***Peripheral vision*** is for orientation and movement recognition and night vision. Information is often processed on a subconscious level (time sparing).

Your **Vestibular Apparatus**:

- ***Semicircular canals*** detects angular accelerations as low as 0.5°/s².
- ***Otolith organs*** (saccule and utricle) detect linear accelerations in all directions as low as 0.01G (G=9.81m/s²).

### 8.2.3 Brain Function

Your *Brain* may sometimes not work optimally:

- Reliable sensory or instrument information about AC orientation is foreseen.
- Physical or mental stress as well as complacency give rise to a *central error.*

### 8.2.4 Most Common SDs

**Gravic Illusions:**

- Illusions during a ***stable state of G-forces*** with a false perception of AC attitude.
- Illusions without visual cues are termed ***somatogravic***.
- Illusions with visual cues are termed ***oculogravic.***

*Somatogravic Examples:*

- Coordinated stable turn feels like flying level (no bank).
- Stable acceleration or deceleration feels like climb or descent.

*Oculogravic Examples:*

- Ill-defined horizon fools you to fly with one wing low ("the leans").
- Bad weather w/wo rain, snowfall or different kinds of lights give you a false impression of speed or AC attitude.
- NB: Oculogravic illusions are the most common subset of illusions in flight!.

**Gyral Illusions**:

- Illusions during a ***change of G-forces*** with a false perception of AC turn.
- Illusions without visual cues are termed **somatogyral**.
- Illusions with visual cues are termed **oculogyral**.

*Somatogyral Example:*

- Recovery from a coordinated turn, roll or a spin feels like entering a manoeuvre in the opposite direction.

*Oculogyral Example:*

- AC movements affects the visual perception, giving rise to nystagmic eye movements which gives error in localization and motion of visual targets.

**The illusions or input errors** outlined above create SD which can be of either Type I or Type II, occasionally also developing into Type III.

**Central errors** create Type I SD and are the most dangerous type of SD since the pilot for different reasons doesn't use given reliable information of AC flight parameters.

Examples:

- Coning of attention or "target fascination";
- Error of expectancy;
- Mental stress;
- Complacency; and
- Environmental factors like hypoxia, high-G or disease.

### 8.2.5 Factors Linked to SD

**Flight Environment**:

- VFR/IFR transition;
- Isolated lights, bad visibility;
- High altitude, low dynamic light flow input (peripheral vision); and
- Featureless terrain (peripheral vision).

**Flight Manoeuvres**:

- Prolonged acceleration/deceleration (-gravic illusions);
- Recovery from prolonged turns (-gyral illusions);
- Subthreshold changes of AC flight parameters; and
- Ascent or descent pressure vertigo.

**AC Factors**:

- Bad instruments (small HUDs, bad location in cockpit);
- Bad symbology;
- View from cockpit (visual frame of reference, "break-off" risk); and
- High manoeuvrability (angular and linear accelerations).

**Aircrew Factors**:

- Flight experience;
- Training in instrument flights;
- Currency of flying;
- Physical health;

- Alcohol and drugs;
- Fatigue or task stress; and
- Cognitive factors like attention, operational qualification, anxiety.

## 8.3 EXAMPLE OF SINGLE SHEET SD HANDOUT

In Figure 8.1 and Figure 8.2 it is shown how this text may be used for a one-sheet handout. Aeromedical Institutes can add their logo and improve the layout to make it acceptable and fancy for the target population.

SD Handout

Definitions

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**SD classification**

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Sensory organs

Your **Sensory organs** are not perfect for flying purposes.

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- Erroneous or inadequate information from your sensory organs to your brain gives rise to **an *input error*.**

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- ***Semicircular canals*** detect angular accelerations as low as 0.5°/s²
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Brain function

Your **Brain** may sometimes not work optimally

- Reliable sensory or instrument information about AC orientation is foreseen
- Physical or mental stress as well as complacency give rise to a **central error**

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Most common SDs

**-gravic illusions**

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- Illusions without visual cues are termed **somatogravic**
- Illusions with visual cues are termed **oculogravic**

*Somatogravic examples:*

- Coordinated stable turn feels like flying level (no bank).
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*Oculogravic examples:*

- Ill-defined horizon fools you to fly with one wing low (e.g. the "leans").
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- NB: Oculogravic illusions are the most common subset of illusions in flight!

**-gyral illusions**

- Illusions during a ***change of G-forces*** with a false perception of AC turn.
- Illusions without visual cues are termed **somatogyral**
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**Figure 8.1: SD Handout Side A.**

SD Handout

*Somatogyral example:*

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*Oculogyral example:*

- AC movements affect the visual perception, giving rise to nystagmic eye movements which gives error in localization and motion of visual targets.

**The illusions or input errors** outlined above create SD which can be of either Type I or Type II, occasionally also developing into Type III.

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- Error of expectancy
- Mental stress
- Complacency
- Environmental factors like hypoxia, high-G or disease

## Factors linked to SD

Flight environment

- VFR/IFR transition
- Isolated lights, bad visibility

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- High altitude, low dynamic light flow input (peripheral vision)
- Featureless terrain (peripheral vision)

Flight manoeuvres

- Prolonged acceleration/deceleration (-gravic illusions)
- Recovery from prolonged turns (-gyral illusions)
- Subthreshold changes of AC flight parameters
- Ascent or descent pressure vertigo

AC factors

- Bad instruments (small HUDs, bad location in cockpit)
- Bad symbology
- View from cockpit (visual frame of reference, "break-off" risk)
- High manoeuvrability (angular and linear accelerations)

Aircrew factors

- Flight experience
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SPATIAL DISORIENTATION HANDOUT

Insert picture here

Aeromedical Institute ……
Address: ……..

For questions and recommendations:
Email: ……..

**Figure 8.2: SD Handout Side B.**