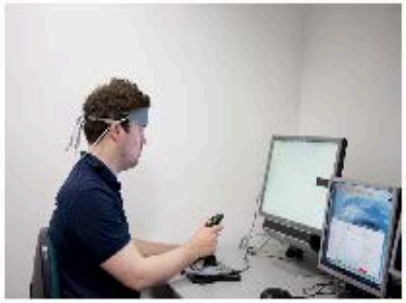
Monitoring GA pilot's eye movements in real flight conditions



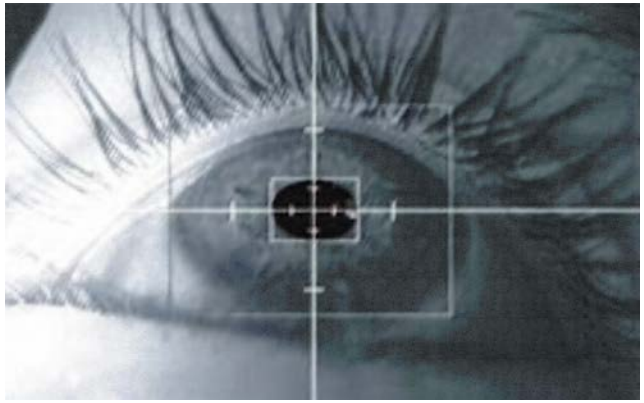
"From laboratory to everyday activity"

AXA Research Fund
Through Research, Protection

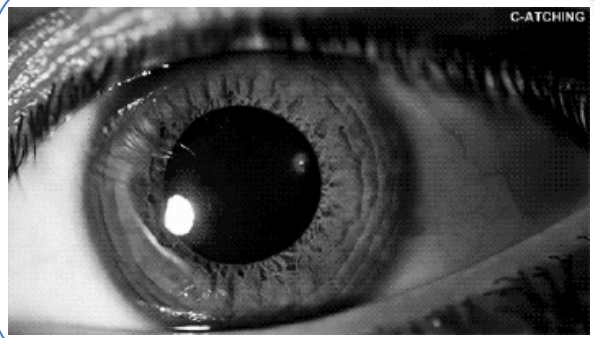
Pr. Frédéric Dehais, Dr. Sebastien Scannella, Thibault Vandebrouck

Attentional processes : a key safety issue

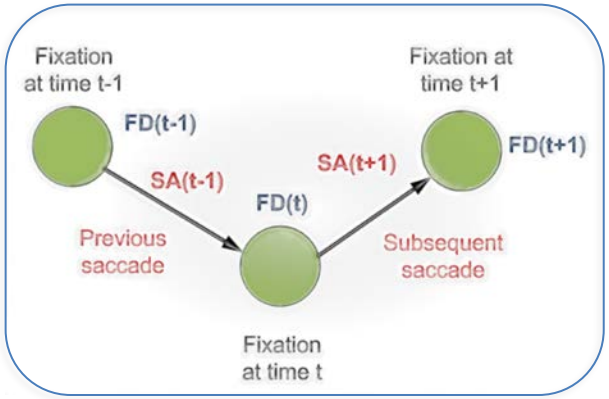
Eye tracking - metrics



Eye tracking – assessing cognitive performance (see [Holmqvist et al, 11])



1st study: Pupillometry



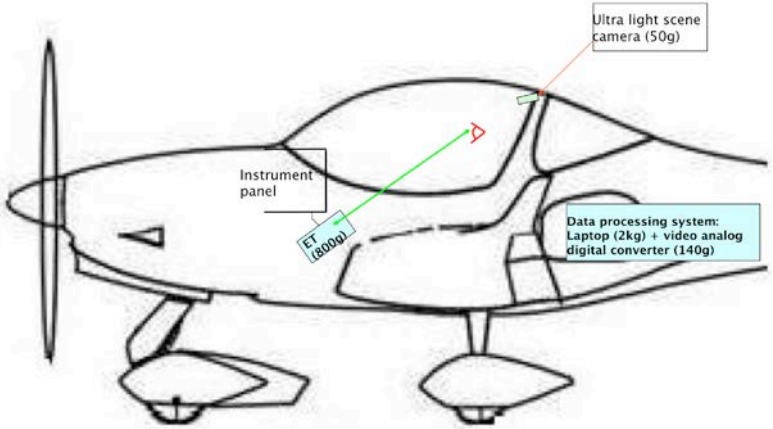
2nd study: Eye movements analysis

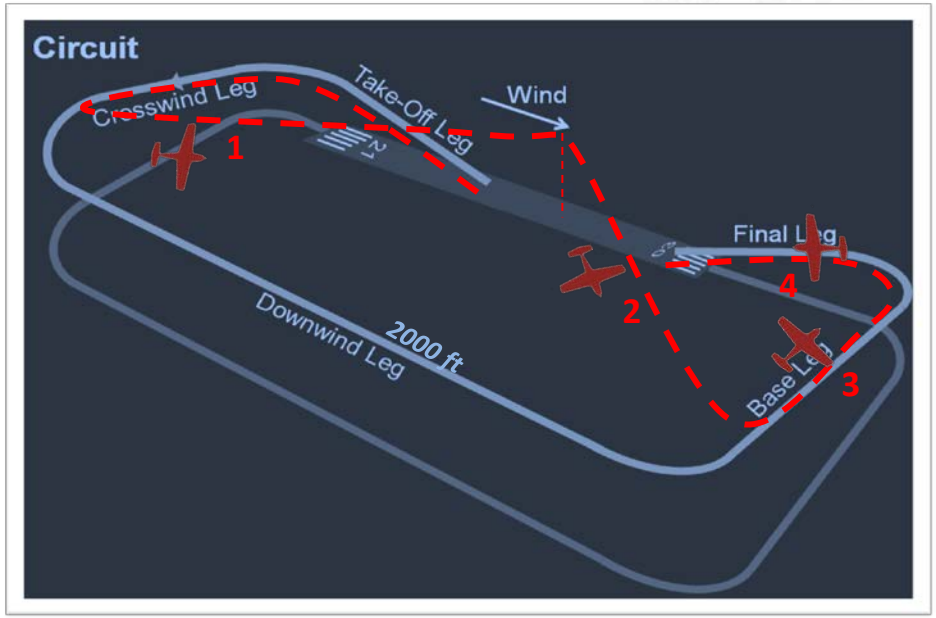
3nd study: AOI-based analysis

1st study: comparing ocular activity during nominal vs. power off approach

Original device: Tobii X50

Embedded device





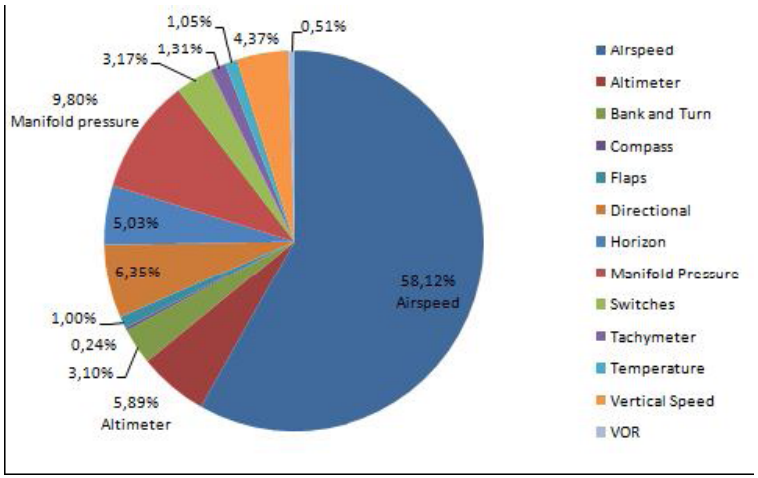
(Permit to fly number 856/2007 – EASA PTF.A07.0232)

1st study: video – nominal landing

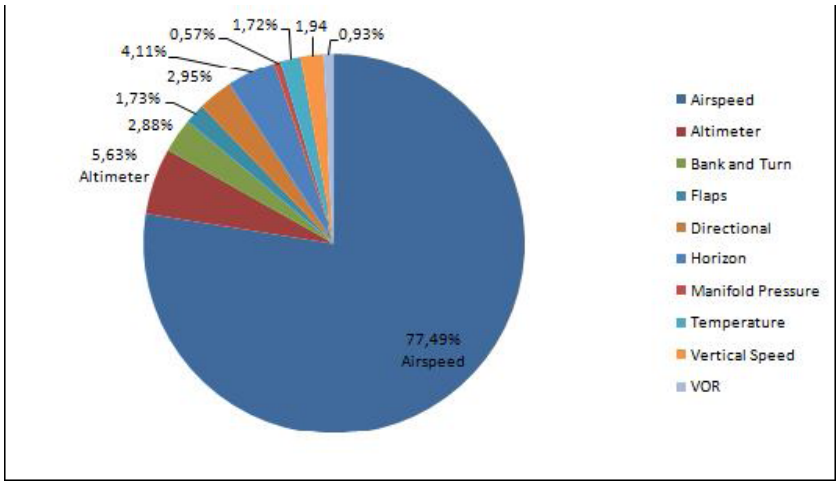
1st study:nominal landing vs power off landing N=6 (5896 flight hours)

14 Areas of Interests (AOIs)

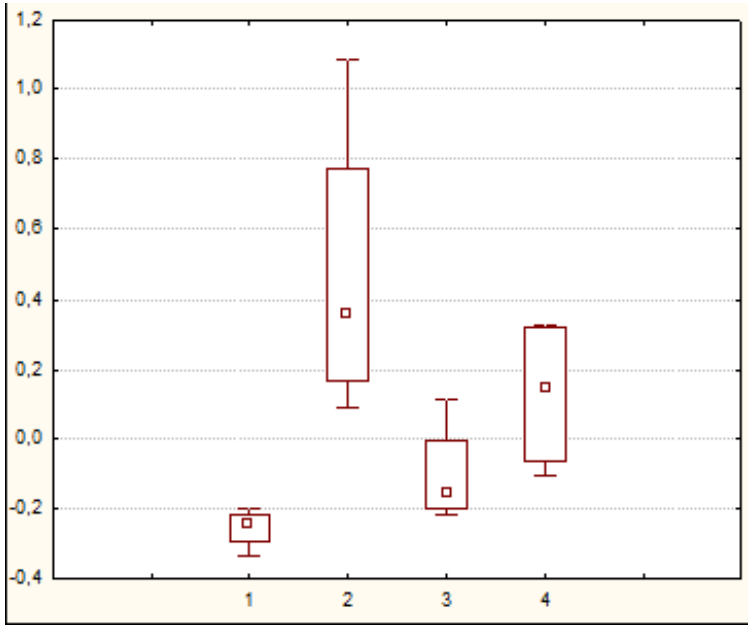
Nominal Landing

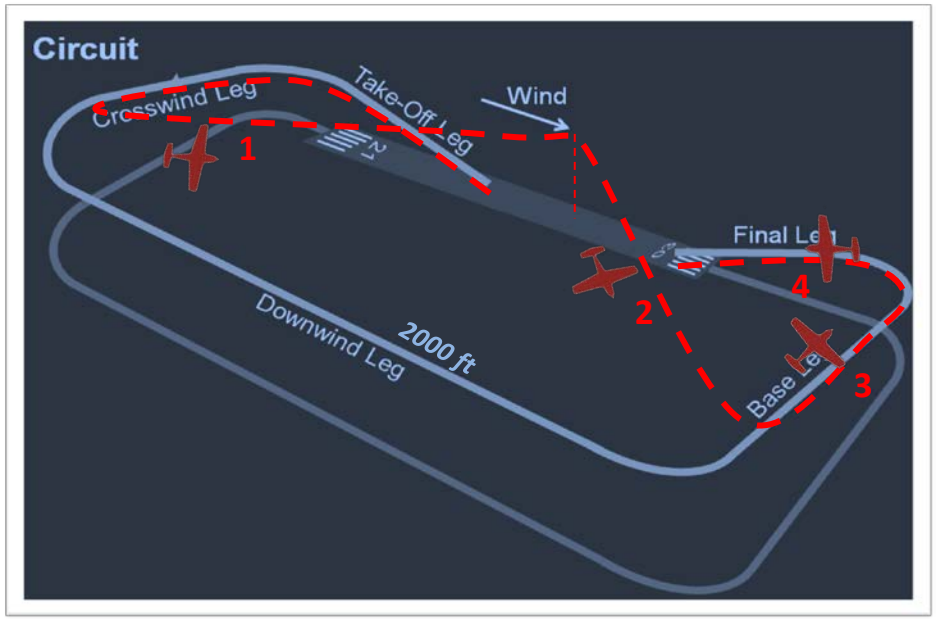


360° power off approach



1st study: pupillometry – 360 power off approach





Gupta et al [00]: pupil size is not affected by illuminance<25Lux

Pupil diameter changes (in mm) during the second flight sequences:

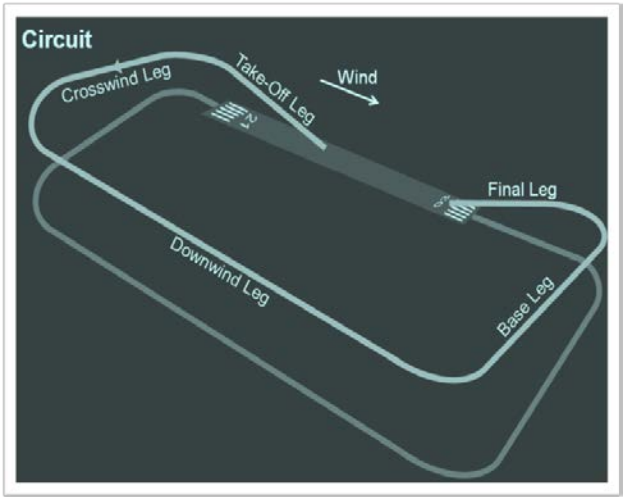
- Before the failure (1), the failure (2), the base leg (3), from the last turn to the final touch (4). (Friedman ANOVA. n=4 ; p=0.001)
- **Strong limitations!!!!: very small sample, 23 factors influence pupil size (vergence, saccades…) [Tryon, 75]**

Dehais, F., Causse, M., & Pastor, J. (2008, March). Embedded eye tracker in a real aircraft: new perspectives on pilot/aircraft interaction monitoring. 3rd ICRAT conference

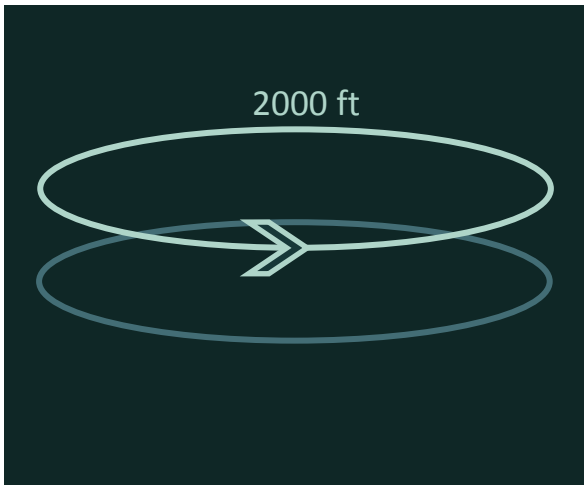
2nd Study: AOI based analysis during traffic pattern and maneuvers

Head mounted eye tracker (Pertech 50Hz)

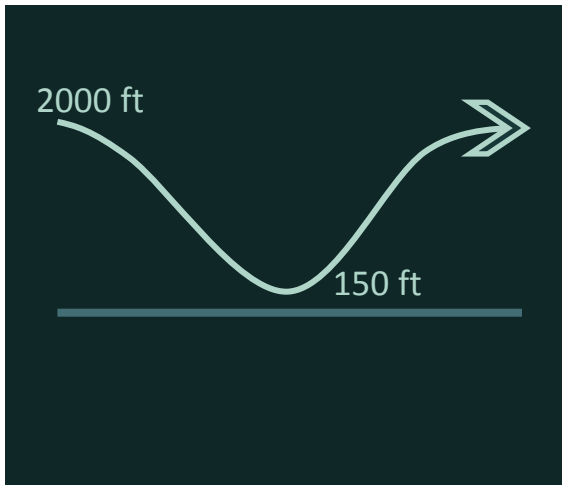
DR400 light aircraft (180 Hp)



Traffic pattern



360 turn

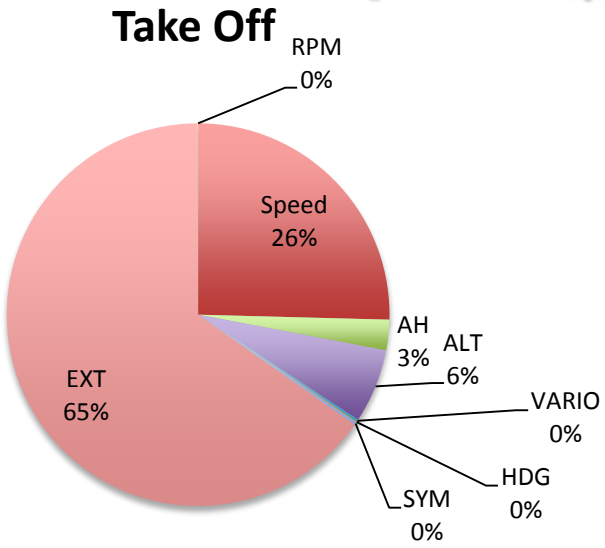


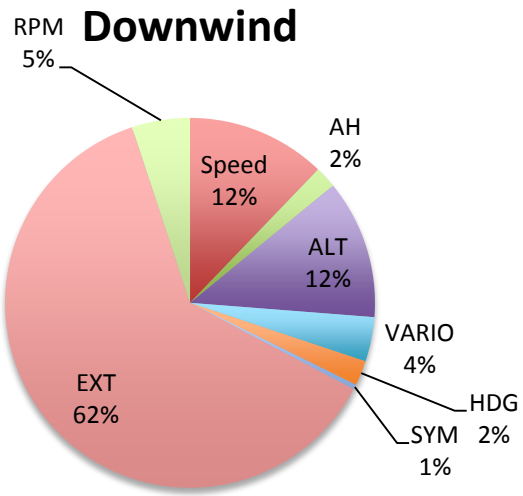
Descend – Climb

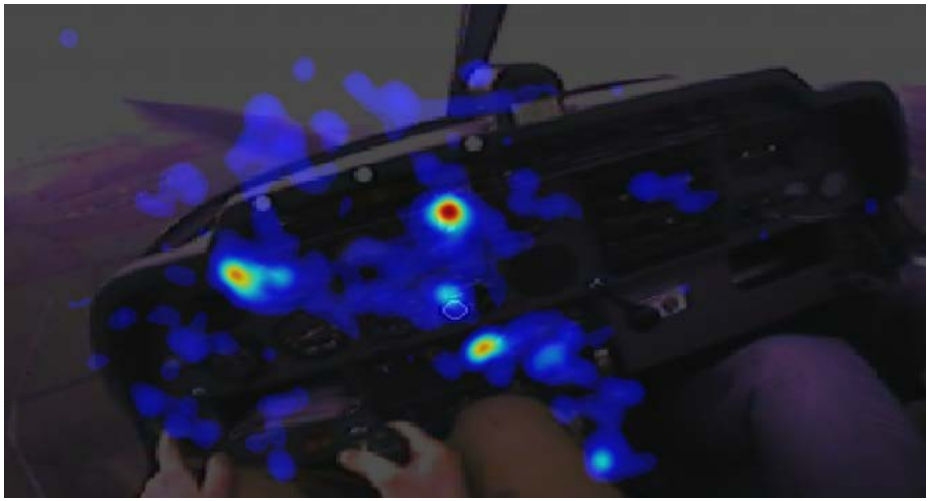
2nd Study: video – take off

2nd Study: Qualitative results

6 pilots (35 years,627 f.h.)







2nd Study: Qualitative results

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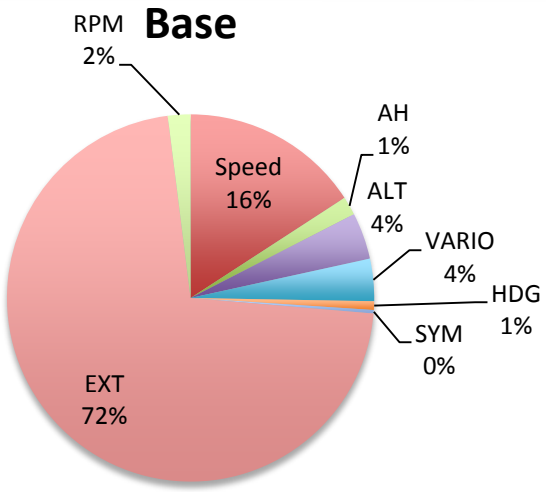

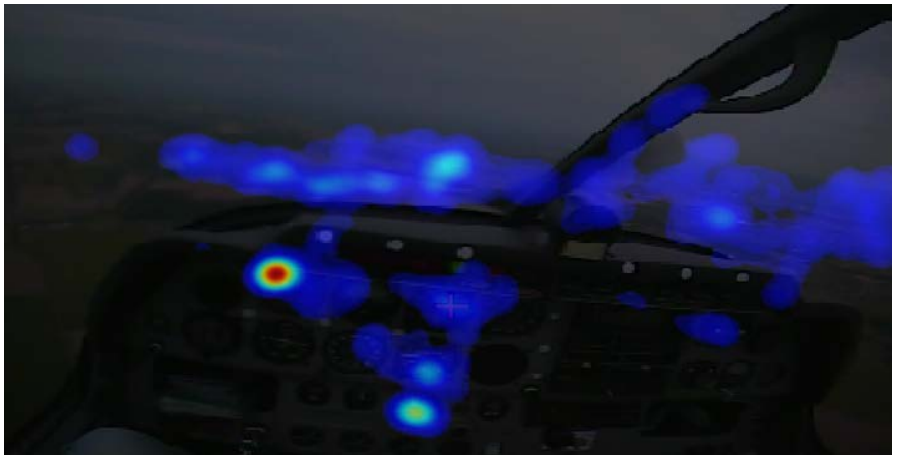

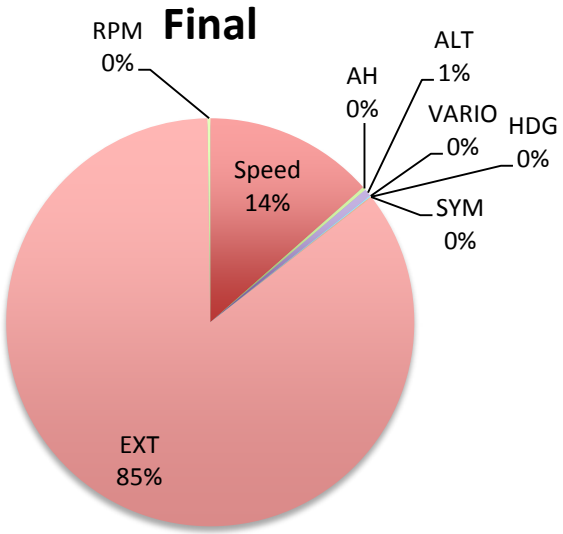

2nd Study: Qualitative results

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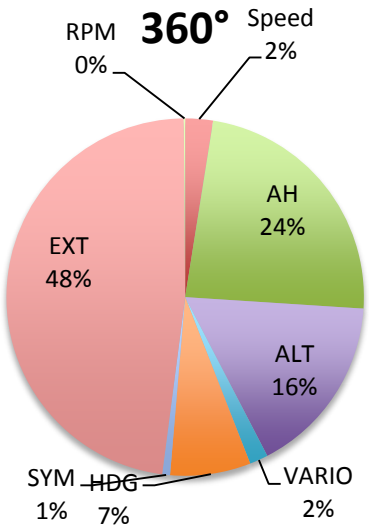
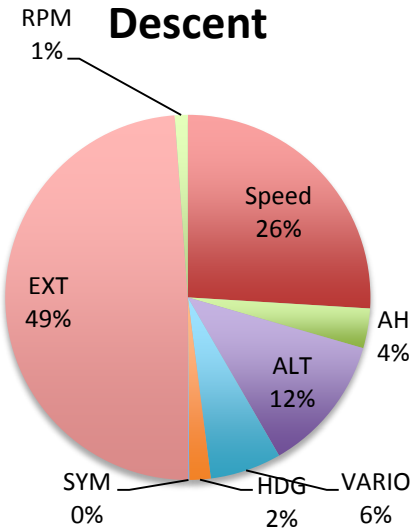
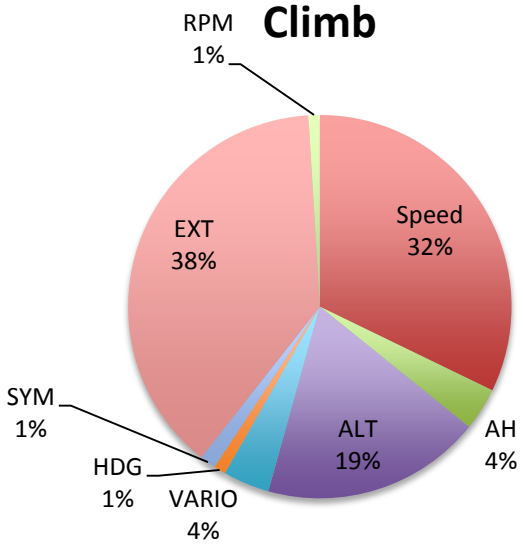


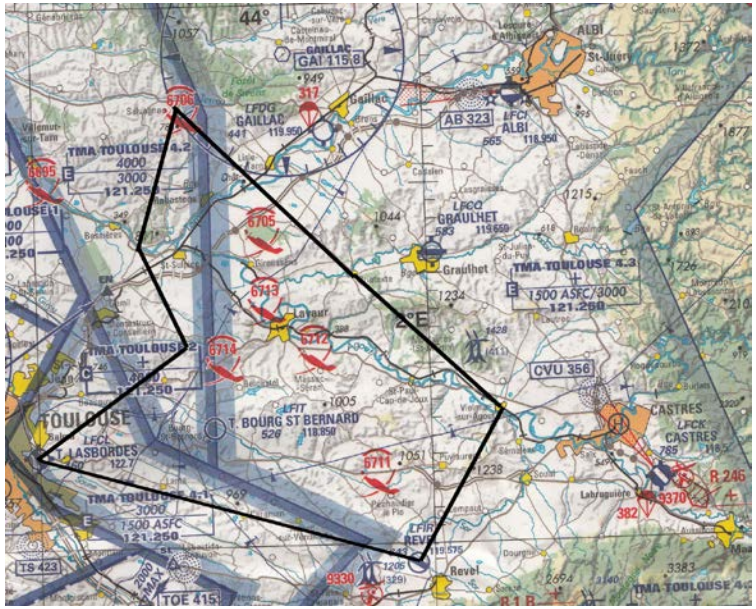




Stall auditory warning plays a key role in LOC scenarios

Pr. Callan – Univ Ozaka

- Inattentional deafness in actual flight:
  - Lasbordes ->Gaillac->Lasbordes
  - EEG (ERPs analysis)
  - 500 auditory alarms
  - Low workload vs High workload
  - 6 pilots (5-20 missed)



Conclusion

- These preliminary results suggest that:
  - VFR pilots generally spend most of the time glancing outside
  - The speed indicator is the most glanced instruments
  - The final is a very demanding phase: attention is highly focused on the speed indicator and mostly on the outside (very few fixations on the vertical speed!)
  - Maneuvers (360, climb, descent): pilots spend 50%-60% of time "head down"! A safety issue?

- Eye tracking offers promising perspectives for training, safety analysis, systems design and certification but there is a need to conduct more studies

Take away message

As a pilot, as flight instructor, or as a cockpit designer :

PAY ATTENTION TO ATTENTIONAL PROCESSES!!