

The influence of automation (FD on vs. off) on pilots' skills: an eye-tracking study

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IASS 2019

I. Automation and manual flying

Opinion: Is automation causing manual flying skill degradation?

The Retention of Manual Flying Skills in the Automated Cockpit

SAFO

Safety Alert for Operators

SAFO 17007
DATE: 5/4/17

Flight Standards Service
Washington, DC



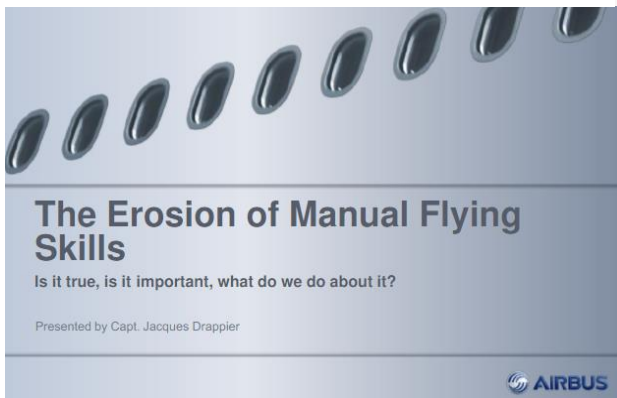
Maintaining Manual Skills

FAA urges airlines to increase opportunities for pilots to fly manually.

by Linda Werfelman | May 26, 2017



Subject: Manual Flight Operations Proficiency



ACCIDENTS AND POOR MANUAL FLYING SKILLS

Flying the Needles: Flight Deck Automation Erodes Fine-Motor Flying Skills Among Airline Pilots.



I. Automation and manual flying

- Concern about **erosion of skills** due to flight deck **automation** (Casner et al., 2014; Skybrary, 2016)
- Long-haul pilots most vulnerable to skill erosion (Haslbeck & Hoermann, 2016)
- Poor manual flying skills = contributive factor of several accidents and incidents (FSF, 2017)
- In daily operations, most of the approaches are flown with automation
→ *Flight Directors (FD) on*



I. Research questions

What is the influence of automation (here: FD on vs. off) on pilots' ...



- A) flight parameter deviations (loc/glide)
- B) input strategies (roll/pitch)
- C) visual pattern (fixations)



II. Method – full-flight simulator study



20 pilots A340 (10 F/O, 10 CPT)

M flight hours = 11632, SD = 3685

M age = 49, SD = 8

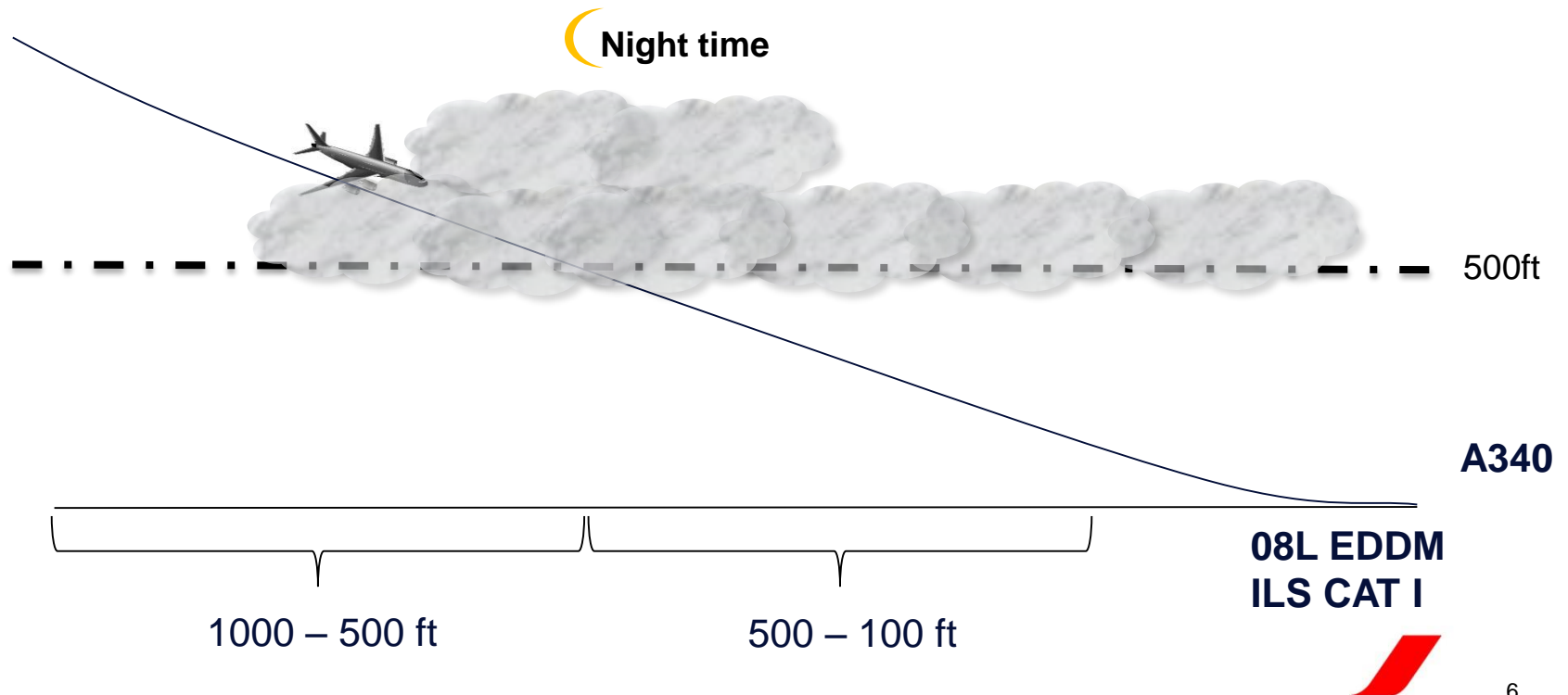


II. Method – scenario

AP OFF, A/THR OFF, **FD OFF**
19 approaches

vs.

AP OFF, A/THR OFF, **FD ON**
19 approaches



II. Method – eye-tracking

- 100 Hz Tobii Pro Glasses 2 wearable eye-trackers
- Tobii I-VT (Fixation) filter (default settings)



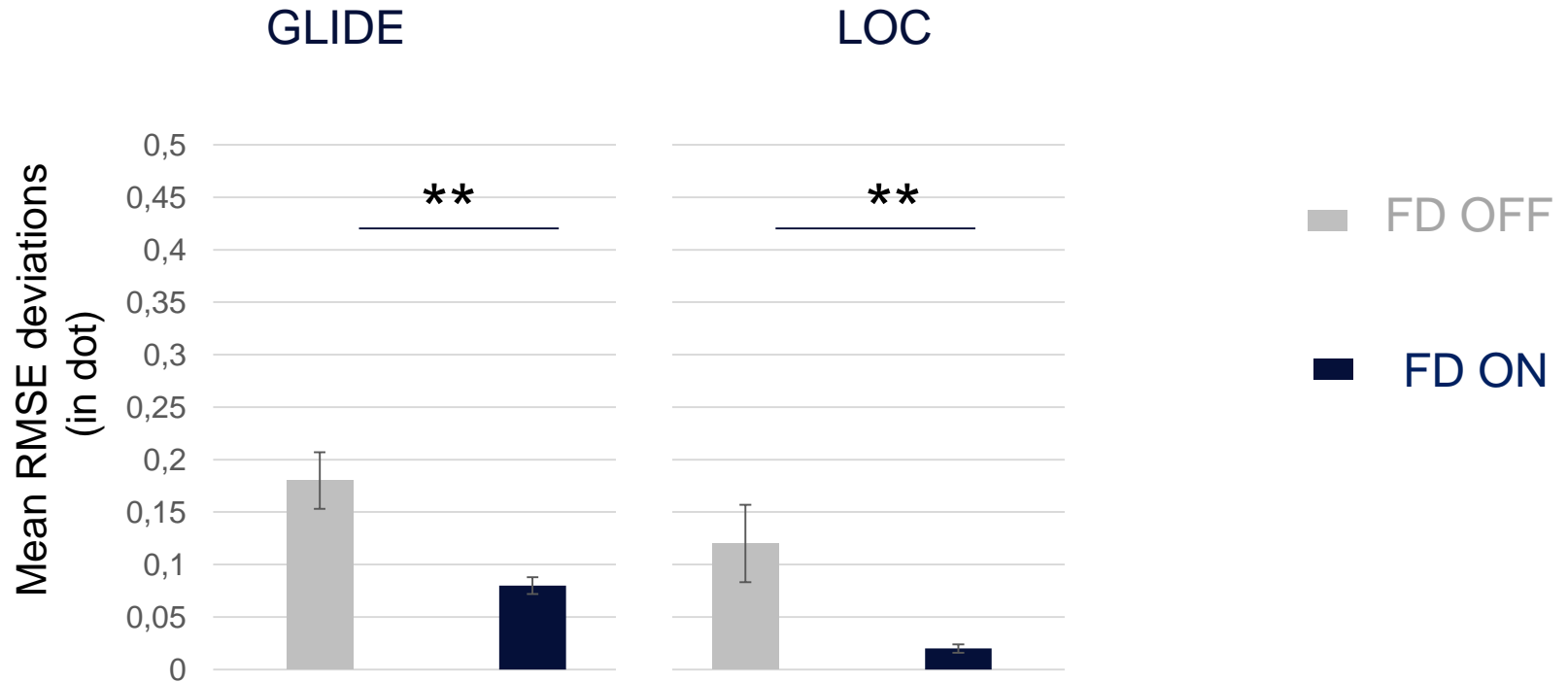
+ Outside world





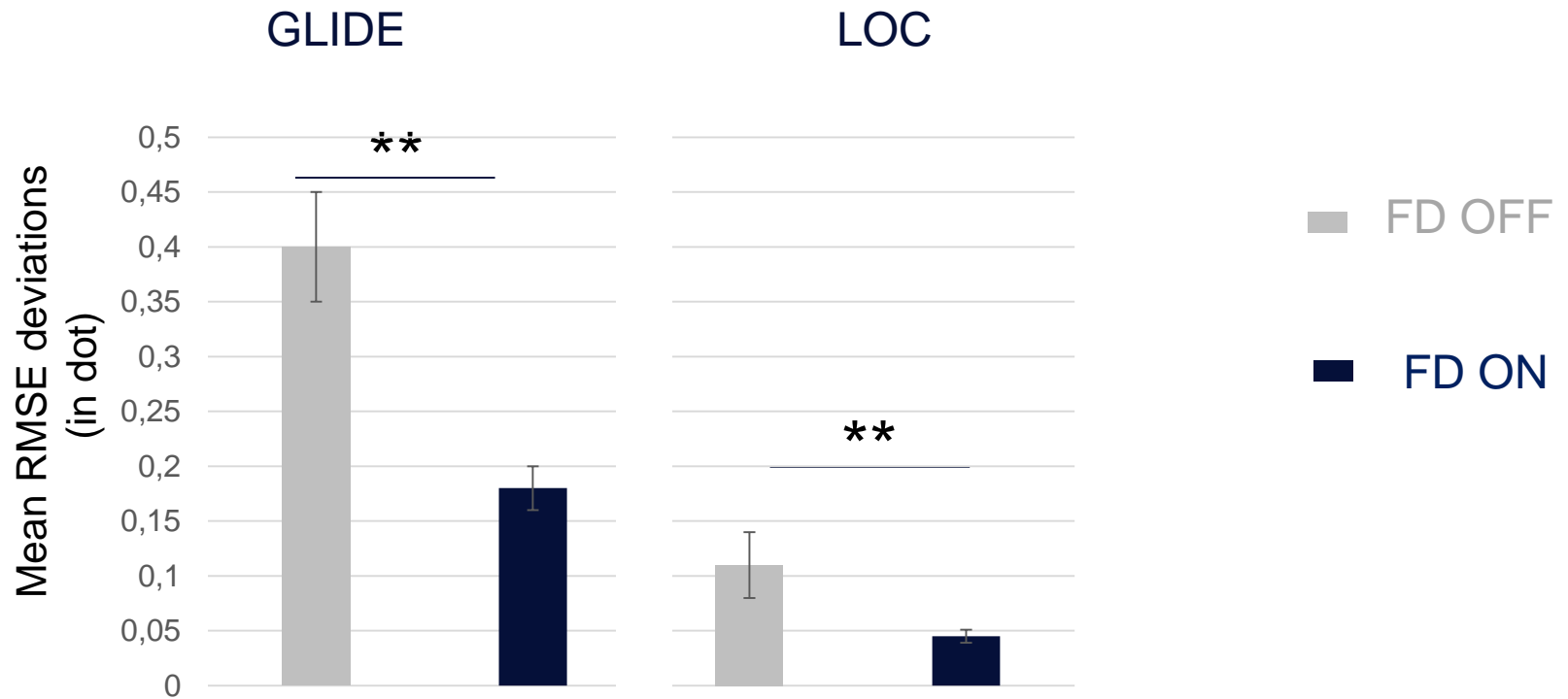
III. Results

A) Flightpath deviations between 1000-500 ft



III. Results

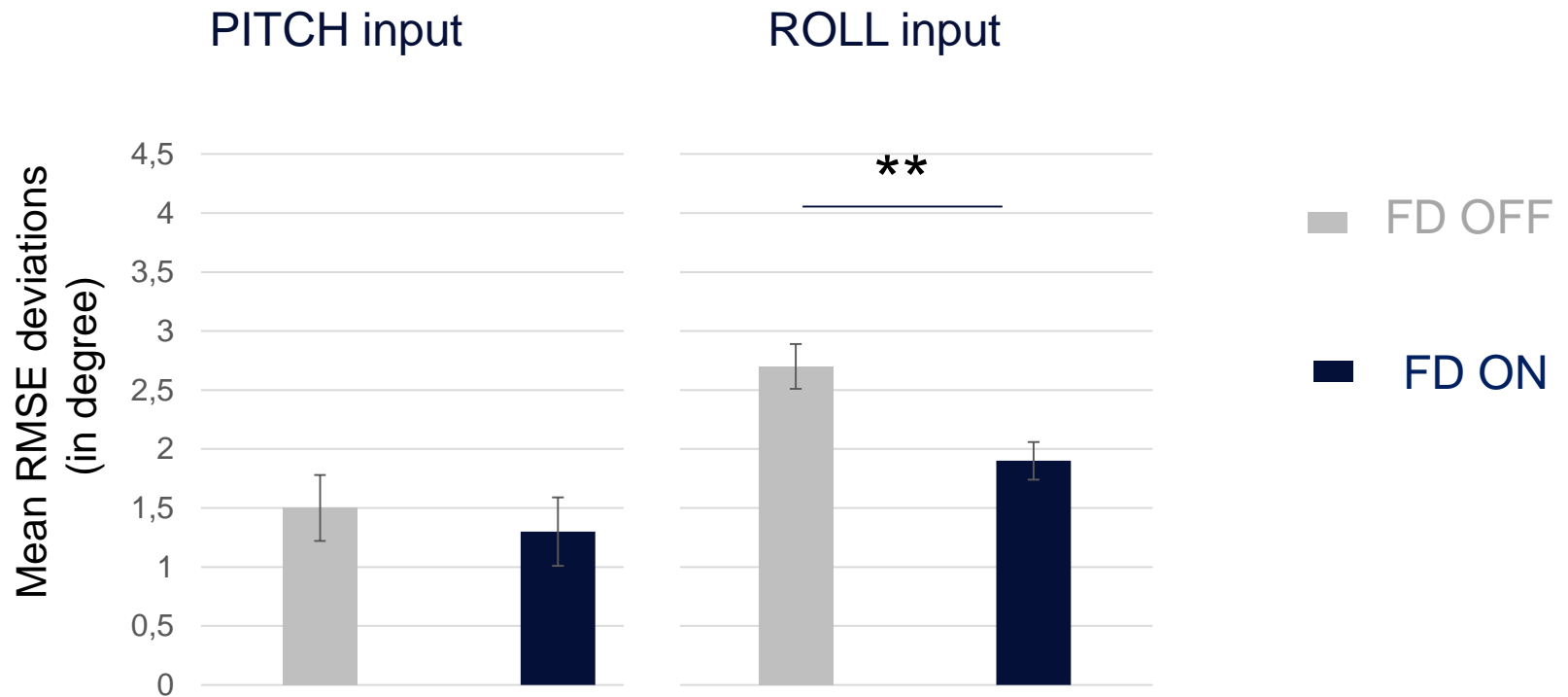
A) Flightpath deviations between 500-100 ft



III. Results



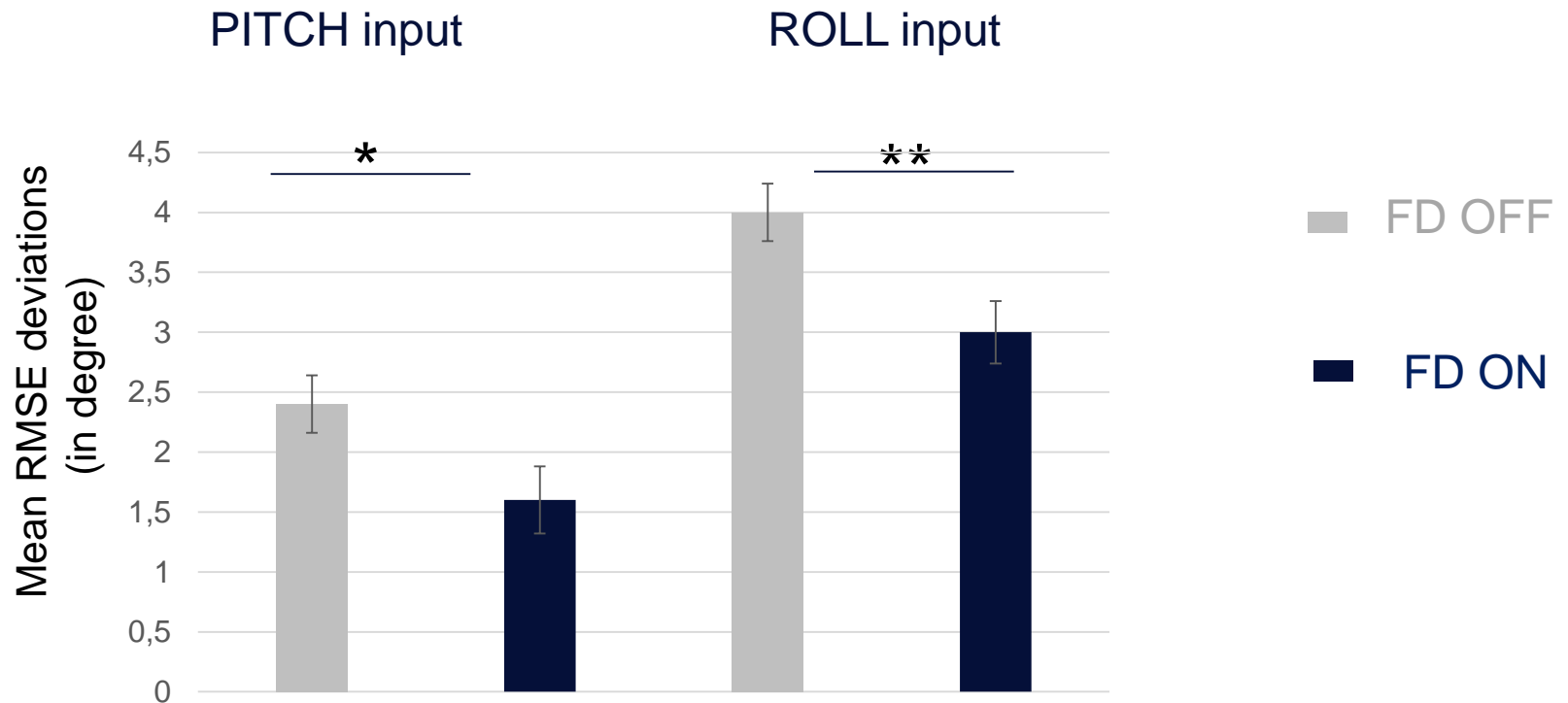
B) Input strategies between 1000-500 ft



III. Results



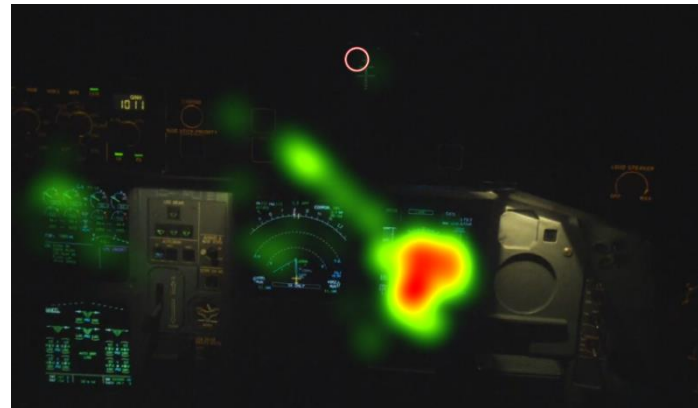
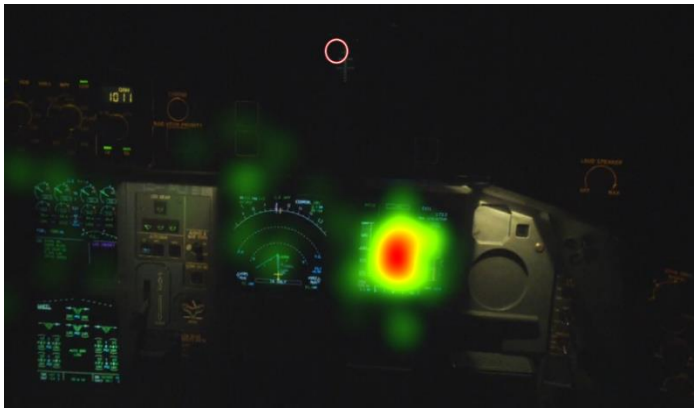
B) Input strategies between 500-100 ft



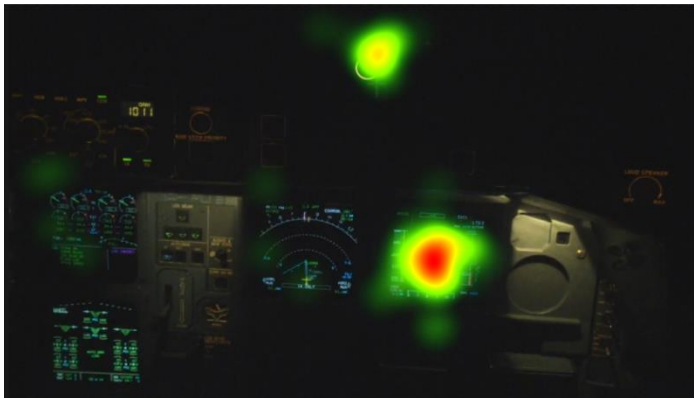
III. Results

FD ON

FD OFF



1000-500 ft



500-100 ft



III. Results



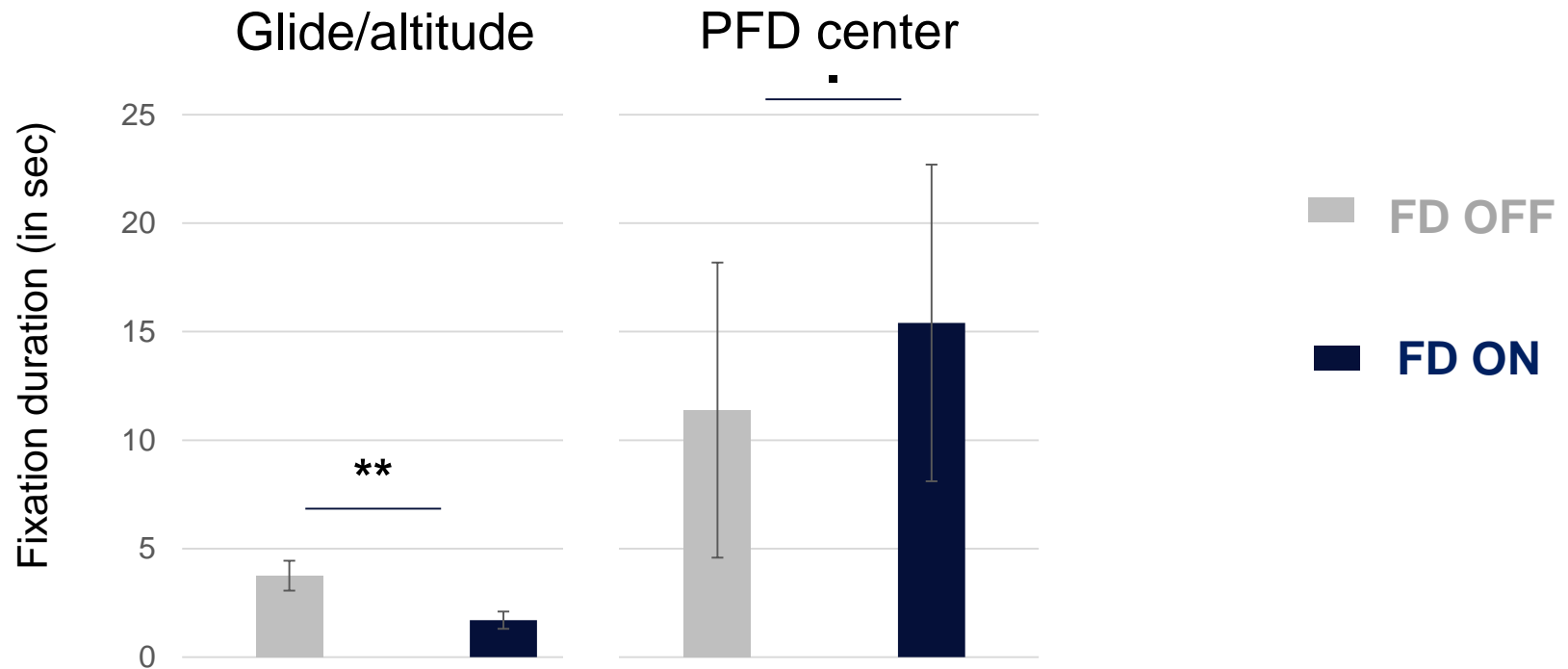
C) Fixations between 1000-500 ft



III. Results



C) Fixations between 1000-500 ft



III. Results



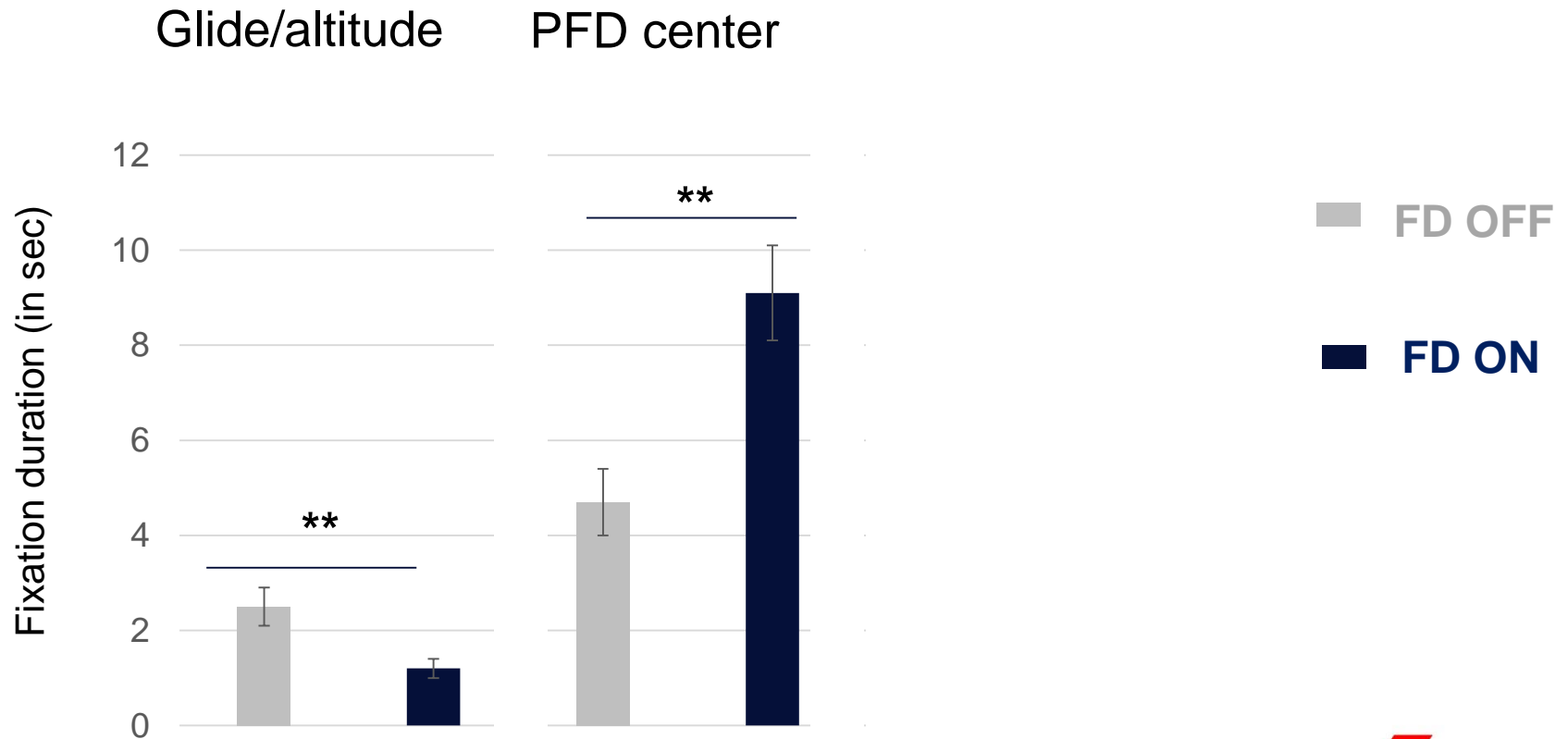
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III. Results



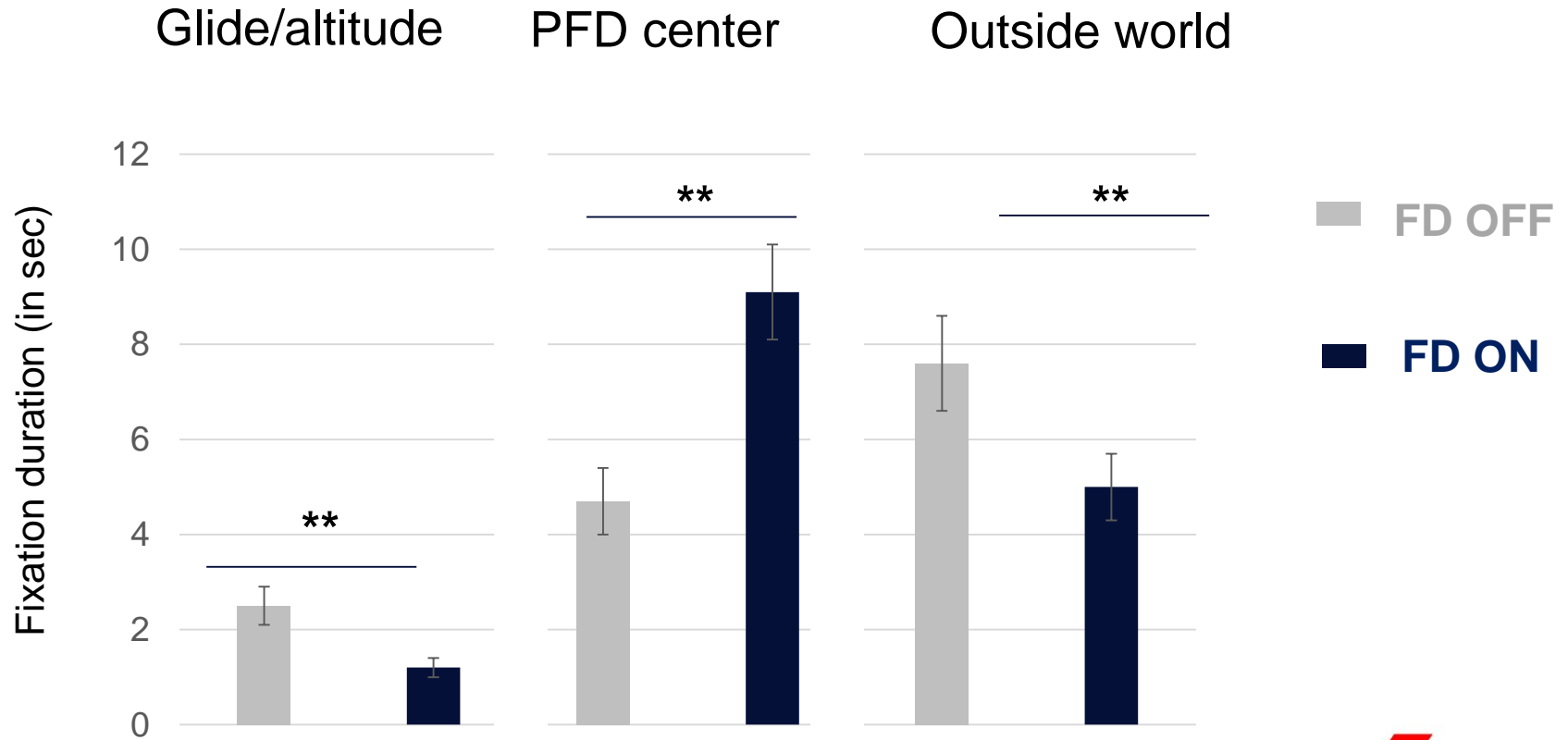
C) Fixations between 500-100 ft



III. Results



C) Fixations between 500-100 ft



IV. Discussion (*ongoing work*)

- The flight directors improved the precision of the approaches.
- The flight directors reduced the sidestick inputs.
- The flight directors changed the visual pattern, with more fixations on the PFD center and less fixations on the glide/altitude and the outside world.

→ **Strong differences in hand-eye skills**



V. A case study

Influence of non-adequate FDs on basic skills

Human-machine interaction



V. A case study





V. A case study



V. A case study



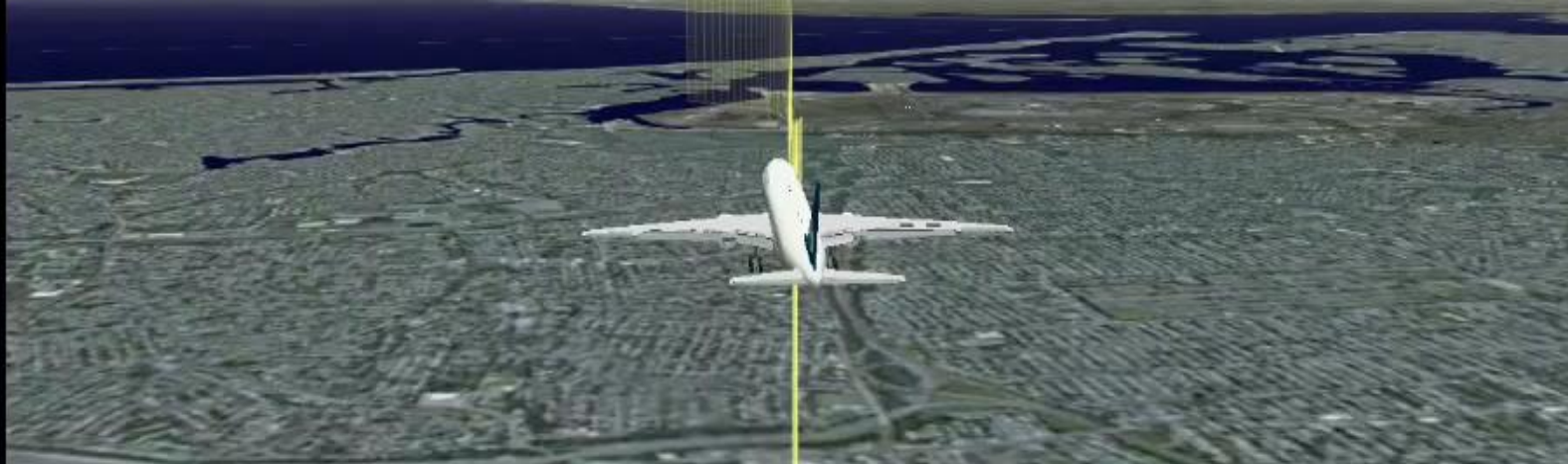


V. A case study



V. A case study





CONCLUSIONS

In line with:

- EASA / Manual Flight Training and Operations / Safety Information Bulletin 2013-05
- FAA / Manual Flight Operations Proficiency / SAFO 17007

→ Propose an AeroSafety World article concerning the study's main findings

The use of automation (here: FD on vs. off) significantly changes pilots' behavioral and visual strategies. These differences reflect distinct habits.

Manual flying "FD on" is flying with automation and cannot replace manual flying "FD off" in order to maintain or acquire basic pilot skills.

→ Convene a group of experts around the world to participate in a tabletop exercise to take the understanding of next steps to a new level (rethink philosophy, policy, and training for authorities and operators)

72nd annual

INTERNATIONAL AIR SAFETY SUMMIT

IASS 2019

Thank you for your attention!



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