Testing Quick Reference Handbooks in Simulators

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1 Context

1.1 Introduction

Context

- Designing Emergency Checklists is difficult
- Procedures in checklists must be tested in simulators [1], which usually means trained pilots test it, as the tests need to work consistently [2] (making sure it's not lengthy, concicse and gets critical procedures) **LF**: Testing for what? What's the baseline? I guess you will need some kind of evidence/argument that demonstrates that with and without the checklist results are markedly different.
- Checklists are usually carried out in high workload environments, especially emergency ones

Problem

- Testing procedures in checklists are often neglected [1]
- There are some checklists that may not be fit for certain scenarios - e.g. ditching (water landing) checklist for US Airways Flight 1549 assumed at least one engine was running [3], but in this scenario, there were none **LF**: What check lists and what scenarios?
- Some checklists may make pilots "stuck" - not widely implemented, could be fixed with "opt out" points. e.g. US Airways 1549, plane below 3000ft, could have skip to later in the checklist to something like turn on APU, otherwise plane will have limited control [3]. **LF**: Yes, or might make them ignore the checklist. What criteria does that?
- Checklists may take too long to carry out - Swissair 111 **LF**: Yes. See Checklist manifesto test

Rationale

- Test checklists in a simulated environment to find flaws in checklist for things like
  - Can be done in an amount of time that will not endanger aircraft
  - Provides reproducible results
  - Procedures will not endanger aircraft or crew further (Crew refering to Checklist Manifesto with the cargo door blowout)

  LF: Again, explain testing against what
- Results in being able to see where to improve checklists

LF: On CL book, Ch1 is about nature of where CL work best; Ch2 explains what a CL is and isn't; Ch3 you can ignore, it talks about checklist for unknown/unexpected scenarios (advanced CL) in building; Ch4 he discussed CL with chefs; Ch5 talks about CL failures and why; **Ch6 is about Boeing's CL**

"factory"; Ch7 and 8 are about applying the CL he came up with, here you get the examples of test/baseline criteria for CL; Ch9 he explains it in his own practice (this is daunting read)!.

1.2 Key Background Sources

Resource	Info
US Airways 1549 NTSB Investigation [3]	**Description:** An investigation on an aircraft that suffered from a dual engine failure from a bird strike forcing the pilots to land on the Hudson River. **Reason:** The investigation found that the QRH was too lengthy and the pilots' used their experience to prioritize essential actions outside the QRH to keep the aircraft in control.
Design Guidance for Emergency and Abnormal Checklists in Aviation [4]	**Description:** Provides the challenges and requirements for designing aviation checklists. It also talks about the problems that are in checklist designing. **Reason:** This will guide for certain aspects to look out for whilst testing checklists, such as if certain actions require waiting, or if it could be completed in a different order.
Designing Flightdeck Procedures [1]	**Description:** Guidance on the process of developing checklists, which includes steps to focus on and how to make a well designed checklist. **Reason:** This report includes steps on testing checklists which is the focus of this project and will provide guidance on how the tests should be carried out.
The Checklist Manifesto [2]	**Description:** Filler **Reason:** Filler

2 Aims and Objectives

Aims

1. Test Checklists
2. Test multiple conditions for that checklist
3. Find problems in the checklist
4. Find how reproducible the checklist is

LF: See above about "testing" what?

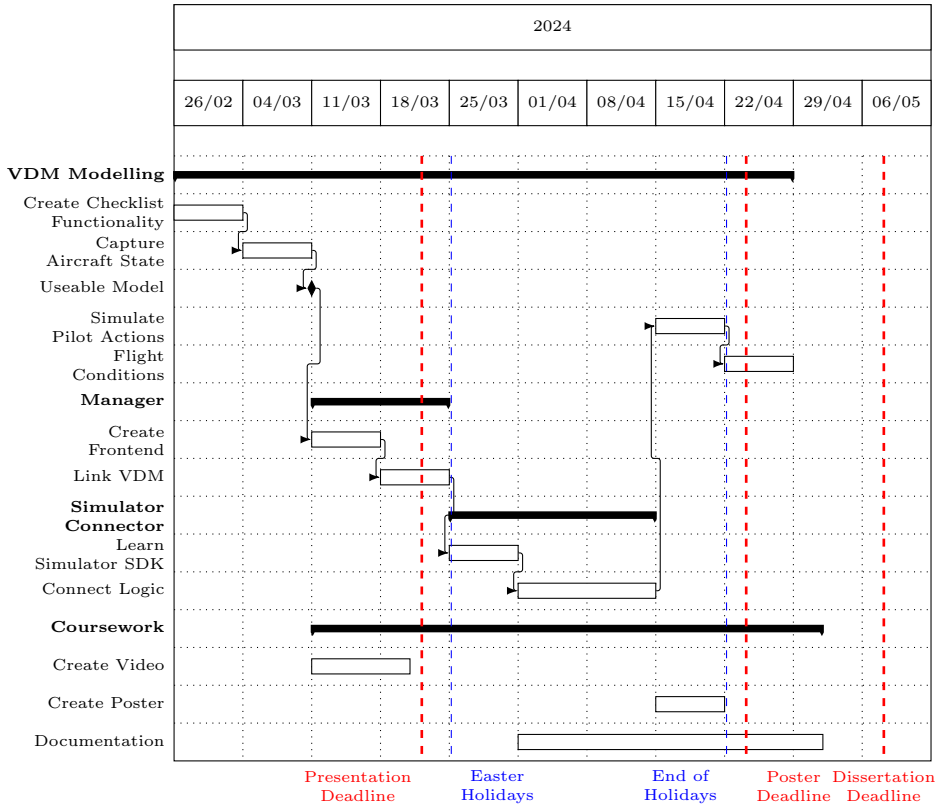
Objectives

1. Checklist Manager
   (a) Input a checklist
   (b) Add conditions to test

2. Checklist Testing Logic
   (a) Capture state of aircraft
   (b) Simulate a pilot's actions
   (c) Simulate delay in actions **LF**:
   (d) Ensure consistency of checklist logic
3. Simulator connector
   (a) Connect to the flight simulator
   (b) Set up conditions for flight
   (c) Monitor and take Logic's actions

3 Planning

3.1 Diagrammatic Work Plan



3.2 Brief Explanation

- Pretty much put how long each part of objectives should take.
- The deadlines for the Presentation, Poster, Dissertation will be done at the same time as the programming

- The work during the Easter Holidays is there with the expectation of taking a bit of a break, but to not lose momentum once the holidays are over.
- All the items on the gantt chart are more so the worst case scenario for how long each item will take
- The last part of VDM modelling is just in case I run out of time, and they aren't the most important

3.3 Risks

- Time management - that's why the last part of modelling is done after the simulator connector as it's not essential, can be done manually
- Simulator not being good enough?
- Simulator could be too complex to be able to link with model.

4 Ethics

4.1 Ethics Checklist

My project:

1. Will *not* involve working with **animals** or users/staff/premises of the **NHS**
2. Will be carried out **within the UK or European Economic Area**
3. Will *not* have any impact on the **environment**
4. Will *not* work with populations who do *not* have **capacity to consent**
5. Will *not* involve work with **human tissues**
6. Will *not* involve work with **vulnerable groups** (Children/Learning disabled/Mental health issues, etc.)
7. Will *not* involve any *potentially* **sensitive topics** (Examples include but are not exclusive to body image; relationships; protected characteristics; sexual behaviours; substance use; political views; distressing images, etc.)
8. Will *not* involve the collection of any identifiable personal data

4.2 Ethical Considerations

This project will involve referencing previous aviation accidents which had deaths involved, however, I will make sure to be respectful towards everyone involved in those accidents.

This project will also not involve the use of any users, so no data collection considerations will need to be taken into account for.

5 References

[1] Immanuel Barshi, Robert Mauro, Asaf Degani, et al. *Designing Flightdeck Procedures*. eng. Ames Research Center, Nov. 2016. URL: https://ntrs.nasa.gov/citations/20160013263.

[2] Atul Gawande. *The Checklist Manifesto: How To Get Things Right*. Main Edition. Profile Books, July 2010. ISBN: 9781846683145.

[3] National Tranportation Safety Board. *Loss of Thrust in Both Engines After Encountering a Flock of Birds and Subsequent Ditching on the Hudson River*. Technical Report PB2010-910403. May 2010. URL: https://www.ntsb.gov/investigations/Pages/DCA09MA026.aspx.

[4] Barbara Burian. "Design Guidance for Emergency and Abnormal Checklists in Aviation". In: *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 50 (Oct. 2006). DOI: 10.1177/154193120605000123.