Jimisola Laursen & Anders Ludvigsson

An overview of EFB usage in Scandinavia

discrepancies between EASA’s recommendations and operators’ implementation

For the full report: https://lup.lub.lu.se/student-papers/search/publication/8926572

Authors

Jimisola Laursen
❖ First Officer, A320
❖ 3 airlines with EFB
❖ 8 years as an airline pilot CRJ9, B737
❖ Software developer in perf. eng.
❖ MSc in Computer Science
❖ BSc in Aeronautical Sciences

Anders Ludvigsson
❖ Captain, B737
❖ 9 years in Flt Ops admin
❖ 12 years as an airline pilot, MD80
❖ Army officer
❖ BSc in Computer Science
❖ BSc in Aeronautical Sciences
Outline

- Introduction
- Purpose
- Limitations
- Method
  - Survey
- Some interesting facts about EFB usage
- Results and discussion (main findings)
- Conclusions

EFB Admin

The EFB administrator is responsible:

a) for **all the applications installed**, and for providing support to the EFB users on these applications;
b) to check potential **security issues** associated with the application installed;
c) for **hardware and software** configuration management and for ensuring, in particular, that no unauthorised software is installed;
d) for ensuring that **only a valid version** of the application **software** and current **data packages** are installed on the EFB system; and
e) for ensuring the **integrity of the data packages** used by the applications installed.

*AMC 20-25, 7.11*
Introduction

❖ Authors had common perception of:
  ❖ EFB shortcomings
  ❖ Research scarce
  ❖ Rules / recommended best practices not always complied with

Introduction

❖ Searched for available research material
❖ Reached out to FAA + Scandinavian CAAs
  ❖ Confirmed that EFBs are common
    ❖ FAA 66%
    ❖ Scandinavia 78%
❖ Did regulatory overview and background
❖ Had desire to map how the end users perceived the EFB
Purpose

❖ Survey EFB usage
❖ User experience
❖ Identify potential discrepancies from:
  ❖ rules
  ❖ recommended best practices

Limitations

❖ Commercial Air Transport, fixed wing, Air Operator Certificate from DK, NO and SE
❖ User experience
  ❖ General, weight, size, battery
  ❖ Performance calculations
  ❖ Documentation
❖ Excluded:
  ❖ Operational Flight Plan, differences between software / hardware etc.
Method

- Literature study
  - LUBSearch (Google Scholar)
  - Avoiding grey material
  - fatigue AND aviation – 2600
  - efb AND aviation – 9 (20 but 11 non-academic)

Method

- Survey - Quantitative
  - Large population (11 airlines, 500+ respondents)
  - End users
  - Easier to replicate + statistics
  - Based on AMC 20-25
State of the union EFB

I have experience of flight decks without the use of EFBs (Q5)

- Yes: 48% (482)
- No: 52% (520)

All phases of flight

Is the EFB approved for all phases of flight? (Q9)

- No: 48% (486)
- Yes: 52% (520)
Issued – how?

How is the EFB issued? (Q8)

- Issued for each flight period in a bag
- Issued with a check-in and returned at check-out
- Issued personally for each pilot
- Installed in each aircraft

Open / Locked

I'm allowed to use my personally issued EFB for private/non-company use (e.g., installing other apps)? (Q10)

- Yes
- No
- Specified by company
- Install/app
Ergonomics

Do you find the weight, size or installment/stowage of the EFB to limit the way you use it in cockpit? (Q11)

❖ 20 accidents and incidents 1989-2009
❖ Take-off performance calculation and entry errors: A global perspective by the Australian Transport Safety Bureau (ATSB), 2011
❖ A number of case studies
❖ Flight Crew Computer Errors (FMS, EFB) - Case Studies (1st ed) by IATA, 2011

Results / discussion
Results / discussion

Flight Crew Training

Flight crew should be given **specific training** on the use of the EFB system **before** it is operationally used. Training should include at least the following:

a) An overview of the system architecture;
b) Pre-flight checks of the system;
c) Limitations of the system;
d) Specific training on the use of each application and the conditions under which the EFB may and may not be used;
e) Restrictions on the use of the system, including where some or the entire system is not available;

AMC 20-25, 7.13
Flight Crew Training

i) Procedures for normal operations, including cross-checking of data entry and computed information;

ii) Procedures to handle abnormal situations, such as a late runway change or diversion to an alternate aerodrome;

iii) Procedures to handle emergency situations;

iv) Phases of the flight when the EFB system may and may not be used;

v) CRM and human factor considerations on the use of the EFB; and

vi) Additional training for new applications or changes to the hardware configuration.

AMC 20-25, 7.13

Do we need training?

https://www.youtube.com/watch?v=RRy_73vcrMs&t=3s
Training useful?

Would company EFB training (initial and/or recurrent) be useful? (Q23)

- Yes (85.25%)
- No (14.75%)

Assessing correct use?

Is correct use of the EFB assessed during PC/OPC? (Q25)

- Yes (51.72%)
- No (48.28%)
In addition to the provisions of chapter 7.6, specific care is needed regarding the crew procedures concerning performance or mass and balance applications:

1. Crew procedures should ensure that calculations are conducted independently by each crew member before data outputs are accepted for use.

2. Crew procedures should ensure that a formal cross-check is made before data outputs are accepted for use. Such cross-checks should utilise the independent calculations described above, together with the output of the same data from other sources on the aircraft.

3. Crew procedures should ensure that a gross-error check is conducted before data outputs are accepted for use. Such a gross-error check may use either a ‘rule of thumb’ or the output of the same data from other sources on the aircraft.

4. Crew procedures should ensure that, in the event of loss of functionality by an EFB through either the loss of a single application, or the failure of the device hosting the application, an equivalent level of safety can be maintained. Consistency with the EFB Risk Assessment assumptions should be confirmed.

AMC 20-25, F.1.3 Procedures
Data Entry Error and Detection

- Humans have rather high accuracy when inputting data
  - >99.5%
- Significantly lower error detection rate
  - 40-70%  
  *Panko, 2008*

- Swapping between apps?

---

Independent + crosscheck
### Performance calculations

<table>
<thead>
<tr>
<th>Method Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent performance calculations and cross-check of result</td>
<td>64.6%</td>
</tr>
<tr>
<td>FO performs calculation, Captain cross-checks result</td>
<td>15.2%</td>
</tr>
<tr>
<td>PF performs calculation, PNF/PM cross-checks result</td>
<td>13.0%</td>
</tr>
<tr>
<td>PNF/PM performs calculation, PF cross-checks result</td>
<td>4.8%</td>
</tr>
<tr>
<td>Other option</td>
<td>1.5%</td>
</tr>
<tr>
<td>Captain performs calculation, FO cross-checks result</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

### Battery

**I find battery depletion to be a problem during line operation? (Q13)**

- **No**: 112 (21.5%)
- **Yes**: 222 (42.6%)
- **N/A**: 193 (35.0%)
Information distribution

❖ Number of manuals?
❖ Total number of pages?
❖ Channels?

Information overload

❖ EFBs have enabled operators to disseminate information in an unsurpassed way.
❖ Information shall be structured and made available for its users:
  ❖ based on the needs and abilities of the user groups or individuals;
  ❖ not based solely on available software features.
❖ Else there is risk for information overload and adaptation resistance.
❖ Operators have opportunity to improve abilities through training and can limit number of communication channels.
Conclusions

❖ Large majority of the pilots used their EFB for mission critical purposes, e.g. 88% for performance calculations
❖ Yet 77% of the pilots received no training or only initial training
❖ Operators are used to various mandatory recurrent training for their pilots, both theoretical and practical.
❖ It should be standardized to perform EFB training to ensure safe and efficient use.

Conclusions

❖ To perform independent performance calculations with cross check of result is well supported by research.
❖ 35% of the pilots did not follow the recommendations.
❖ Operators are directly responsible and need to ensure recommended best practices are implemented.
All on-board

https://www.youtube.com/watch?v=pQHX-SjgQvQ

Perception of EFB
Questions / thoughts?