



Simulator-based Assessment of Usability of New Flight Reference Cards for Emergency Procedures

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14. ABSTRACT The U.S. Army Aeromedical Research Laboratory (USAARL) evaluated Book 2 of the new Flight Reference Cards (FRCs), an aircrew checklist designed to aid in the management of aircraft malfunctions and emergencies. The primary objective of the testing was to assess the utility and suitability of the new FRCs. The key findings suggest that the FRCs are easy to use, promote crew coordination and teamwork and facilitate fault diagnosis and Emergency Procedure (EP) management, in line with the new Emergency Response Method described in Aircrew Training Manual Task 1070: Respond to Emergencies. In addition, the FRCs do not negatively impact pilot workload or safe handling of the aircraft during an EP. The layout of the FRCs is intuitive and appears to be superior to the Green Checklist, evidenced by the reduced times taken to locate the correct Emergency Procedure cards for the given scenarios. The FRCs are an improved method of conferring emergency information compared to the current checklist and do not present any significant human factors issues.					
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Background

The U.S. Army Aeromedical Research Laboratory (USAARL) implemented a test plan in coordination with the U.S. Army Aviation Center of Excellence (USAACE), Directorate of Evaluation and Standardization (DES), Aviation Missile Command (AMCOM), Systems Readiness Directorate (SRD), and the Aviation Flight Test Directorate (AFTD).

The purpose was to assess the use of novel Flight Reference Cards (FRCs) that were developed to support Army aircrew in an updated approach to Emergency Procedures (EPs). A human factors evaluation was completed to assess the FRCs during EPs across five simulator airframes: AH-64E, AH-64D, CH-47F, UH-60M, UH-60A, and UH-60L. *Although five airframes were assessed, data was collapsed across the three UH-60 and two AH-64 airframes.



Methods

The FRC assessments occurred over two phases. Phase 1 evaluated the human factors elements of the FRCs for each airframe with Standardization and Maintenance Examiner pilots. Phase 2 compared the FRCs to the current Green Book checklist on the human factor elements of interest with minimally experienced pilots.

Methods Continued

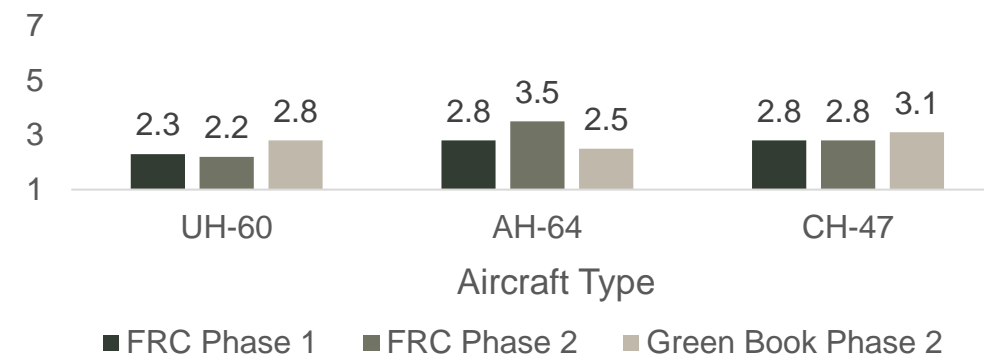
Phase 1: Six experienced aviators performed a series of flights in a simulator where the utility of the FRCs was evaluated (usability, legibility, clarity, ability to maintain appropriate levels of crew coordination, impacts on pilot workload, and time to locate the EP). All participating pilots received training in the emergency response method (ERM) and had a chance to familiarize themselves with the layout and content of the FRCs.

Phase 2: Nine less-experienced pilots were selected to participate in the second phase of the study to capture the effectiveness of the FRCs for the general aviator. Phase 2 used the same procedures as described in phase 1, except pilots performed separate EPs using the current checklist (Green Book) and again using the FRCs.

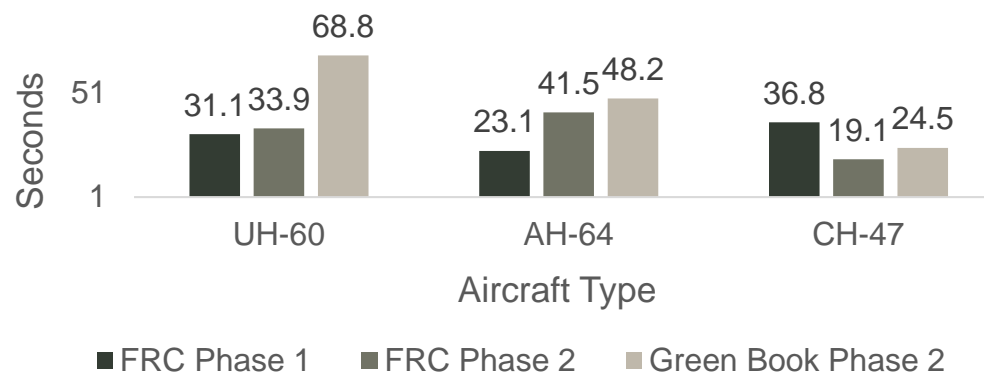
Results

Average Workload Rating

1 (No system demands) - 7 (System unmanageable)



Average Time to Locate EP



Discussion

The purpose of this test was to evaluate the utility and suitability of the new FRCs. The FRCs provide aviators with information to diagnose EPs or malfunctions as well as a set of actions to safely manage the situation. They also support the new approach to EP management by encouraging problem solving in a contextual manner and reducing the use of rote memorization.

Performance

- The FRCs appeared to facilitate accurate and timely identification of EPs and accurate execution of the steps to resolve the EP.
- Across the 287 EPs across the 3 airframes, only 5 mistakes in the execution of the EPs were noted.
- Time to locate an EP in the FRCs was notably quicker than locating the EP in the Green Book Checklist.

Workload

- Subjective workload ratings for FRCs were all within acceptable ranges during day and night flights.
- FRC ratings were generally lower than those for the Green Book Checklist.

Usability

- Study team observers (research pilots and research psychologists) assessed clarity and legibility of the FRCs and the degree to which they facilitated crew communication, teamwork, problem solving, and decision making.
- No major human factors issues were identified during the use of the FRCs.
- Pilots documented subjective usability ratings on a modified version of the Usability Metric for User Experience (UMUX-Lite).
- Subjective ratings indicated that the FRCs are easy to use, do not negatively impact crew coordination or situational awareness, and support EP management.

Conclusions

- The new FRCs were overwhelmingly preferred by the aviators and continue to be improved (e.g., colored tabs, underlined font, simplified procedures).
- Initial data supports the idea that a new approach and FRC will lead to better aviator performance teaching, learning, and performing when emergencies occur.

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