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2009

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Maria Espinola da Silva Pacheco Cabral, L., Selma Leal de Oliveira Ribeiro, S., Landau, L., & Gerson, C. (2009). A PC Based Methodology for CRM – Corporate Resource Management Practice Training. *2009 International Symposium on Aviation Psychology*, 342-348.
https://corescholar.libraries.wright.edu/isap_2009/58

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A PC Based Methodology for CRM – Corporate Resource Management Practice Training

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On 2003, the National Civil Aviation Agency (ANAC – Agência Nacional de Aviação Civil) elaborated the Civil Aviation Instruction (IAC - Instrução de Aviação Civil) 060-1002A, reviewed on 2005, about the CRM Training, based on the AC – Advisor Circular 120-51 A-E of FAA - Federal Aviation Administration, aiming at giving a standard direction about the subject for civil aviation organizations. The purpose of the study is to use a PC Based Methodology for the CRM Training / 2nd. Phase - Recurrent Practice and Feedback, in a low cost artificial environment differently from the LOFT – Line Oriented Flight Training, which, besides of being a technical Training, also requires an expensive simulator equipment for it. Although the IAC 060-1002 A was elaborated for civil aviation organizations, military institutions also adopted it, therefore the research was developed into a military institution operating helicopters. Future steps of the Methodology validation need to be further developed.

CRM – Cockpit / Crew / Corporate Resource Management Training, as the names indicate, has passed through an evolution, since its origin after some aviation accident (Portland, Tenerife, Dryden etc.) occurrences, consolidating the comprehension about human error contribution to optimize team human performance, so that the newest generation of CRM, known as TEM - Threat and Error Management, not only emphasizes human errors, but also internal and external threats which may affect flight safety as a final result (CABRAL, 2006).

The study here presented was developed to enable the organizations to implement CRM Training / 2nd. Phase - Recurrent Practice and Feedback, by using computer games, based on some previous experiments (BOWERS, SALAS, PRINT & BRANNICK, 1992), in order to fill up high fidelity flight simulators gap in Brazil, mainly of helicopters, once there is a belief that CRM Recurrent Practice and Feedback Phase ought to be realized in this kind of equipment. This is an inadequate point of view, because, although the CRM Training may be implemented as a behavior training in high fidelity flight simulator environments, at the same time of the LOFT Training (USA, 2003), which is a technical Training, both have different purposes and the second one will never substitute the first one.

This article comments the implementation of CRM Recurrent Practice and Feedback Phase using the Microsoft Flight Simulator Software, demonstrating the facilities of computer games application for the CRM Recurrent Practice and Feedback Phase, as a lower cost and an easier acceptance tool, comparing to high fidelity flight simulators environment (CABRAL, 2006).

CRM Brazilian Regulation

According to Civil Aviation Instruction (IAC - Instrução de Aviação Civil) 060-1002A (BRAZIL, 2006), about CRM - Corporate Resource Management Training, based on the AC – Advisor Circular 120-51 A-E (USA, 2004), it consists of three different phases: Initial Indoctrination / Awareness; Recurrent Practice and Feedback; and Continuing Reinforcement.

The 1st. Phase / Initial Indoctrination / Awareness, based on the organizational diagnosis of the institution, aims at pointing out critical situations concerning teamwork, in order to improve attitude towards team performance; the 2nd. Phase / Recurrent Practice and Feedback requires previous implementation of the Initial Indoctrination / Awareness Phase, aiming at reinforcing team attitude in operational routine and emergencies, in order to achieve a change from individual behavior to team behavior; and the 3th. Phase / Continuing Reinforcement, aims at consolidating the CRM Training into the organization culture.

The aviation accident statistics of the last decades indicates a considerable contribution of human error, what outlines the CRM Training as a valuable tool to optimize team performance and increase safety of aviation operation.

Although the IAC 060-1002 A is proper to guide the CRM implementation in civil aviation organizations, it also is adopted by military institutions. Therefore, this article will present a research (CABRAL, 2006), developed in a military institution which operates helicopters, where it was possible to create a PC Based Methodology for the CRM 2nd. Phase / Recurrent Practice and Feedback, using the Microsoft Flight Simulator Software, in order to optimize the interface between pilots and flight engineers related to teamwork performance.

The Study

Based on some american previous experiments (BOWERS, SALAS, PRINT & BRANNICK, 1992), this study subsidize a behavioral and not a technical training realized in a low fidelity aviation environment. It was developed a proper Methodology using the Microsoft Flight Simulator Software / 2004, installed in a laptop, with a mouse and a keyboard as devices, for the 2nd. Phase / Recurrent Practice and Feedback.

This research was based on some demands concerning 2nd. Phase / Recurrent Practice and Feedback, such as the lack of: parameters towards internal and external variables; a theoretical base for the CRM concepts; criteria to observe and evaluate team behavior in CRM Recurrent Practice and Feedback Training; systematic procedures to assess the CRM Debriefing. It was considered an occasional sample, which was divided in four groups, each one composed by: a facilitator, a captain, a pilot and a flight engineer. It was required a specific training for the facilitators to apply this Methodology.

The occasional sample of the study sums up 15 participants, who represents 16,67% of the 90 crew members (facilitators, captains, pilots and flight engineers), which can be observed in Figure 1.

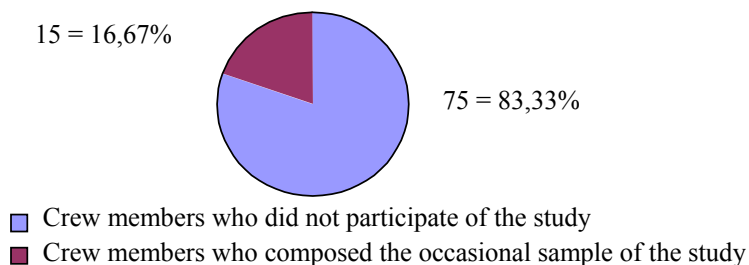


Figure 1: Occasional Sample Percent of the Study

The Methodology

To develop the referred Methodology, some techniques were used, such as: observations, reports and interviews. The result was the implementation of the PC Based Methodology for the CRM 2nd. Phase / Recurrent Practice and Feedback, using the Microsoft Flight Simulator Software. The Methodology application sums up, approximately, five hours, and was divided in three steps, which correspond to the basic moments of the Training - Before Training, During Training and After Training, as follows:

Table 1: *Computer Based Methodology for CRM 2nd. Phase using the Flight Simulator*

Computer-based Methodology for CRM 2 nd . Phase Using the Flight Simulator	TIME ≅ 5 h
<i>Before Training</i>	
Facilitator Checklist / ANNEX I and Briefing about the Training	≅ 10 min
CRM Expectations and its Concepts applications Questionnaire (QE-CRM / ANNEX II)	≅ 30 min
Familiarization on Flight Simulator Main Commands (ANNEX III)	≅ 60 min
CRM Refreshment (CRM Refreshment Parameters / ANNEX IV)	≅ 30 min
<i>During Training</i>	
Facilitator Briefing about the flight	≅ 10 min
Flight operation and Videotape (Internal Variables / ANNEX V, External Variables / ANNEX VI and Script / ANNEX VII)	≅ 60 min
<i>After Training</i>	
Debriefing	≅ 60 min
Training Evaluation (Participant Reaction Questionnaire / ANNEX VIII and Facilitator Reaction Questionnaire / ANNEX IX)	≅ 15 min
Validation after Training (CRM Feedback Form for Training Optimization / ANNEX X)	≅ 30 min

The three phases of the Methodology will be commented bellow:

Before Training

Consists of the following components:

- Facilitator Checklist / ANNEX I – Facilitator tasks and responsibilities guide for each CRM Training step.
- Briefing about the Training – Explanations about the purposes of the Training.
- CRM Expectations Questionnaire / ANNEX II – Assessment of the CRM knowledge and motivation.
- Helicopter Commands Parameters / ANNEX III – Familiarization of the main helicopter commands in Flight Simulator Software.
- CRM Refreshment Parameters / ANNEX IV – Review of the main CRM concepts.

During Training

Presents the following tools:

- Facilitator Briefing – Facilitator explanation about the flight task to the crew members.
- Small paper forms written with the following types of variables:
 - Internal Variables Parameters / ANNEX V – Different combinations of equipment problems, also classified in crescent levels of complexity (low, medium and high), to be chosen to compose the Script.
 - External Variables Combination / ANNEX VI – Different combinations of problems from environment sources, classified in crescent levels of complexity (low, medium and high), to be chosen to compose the Script.
- CRM Script Form/ ANNEX VII – Facilitator guide about the scene description and the parameters of behavior skills (communication / assertiveness, situation awareness, decision making and leadership) assessment.
- Videotape – Record of the whole Training.

After Training

Presents the following tools:

- Debriefing - CRM Video Session conducted by the facilitator, showing the interaction among the participants during the flight experience, emphasizing the behavior skills, based on the CRM concepts.
- Participant Reaction Questionnaire / ANNEX VIII – Assessment of the participant feelings about the Training

right after the Debriefing.

-Facilitator Reaction Questionnaire / ANNEX IX – Assessment of the facilitator feelings about the Training right after the Debriefing.

-CRM Feedback Form for Training Optimization / ANNEX X – To be fulfilled by the facilitator right after the Debriefing and the Facilitator Reaction Questionnaire.

When applying the PC Based Methodology (CABRAL, 2006) for CRM Recurrent Practice and Feedback Training, the sample seemed receptive. During Training, the script was composed by a scene involving an one hour flight, from the City of Taubaté, São Paulo, to the City of São Pedro D’Aldeia, Rio de Janeiro (Brazil), about, approximately, 442 km, in Squirrel Helicopter. During the flight, some variables were introduced, either internal (problems with the equipment) or external (problems in the flight environment) ones, which required of the crew members to make arrangements to find the best alternatives for their resolution.

The variables chosen for the scene that composed the script could not be plotted into the Microsoft Flight Simulator, as first purposed, so they were written in small paper forms to be given to the crew members by the facilitator, once at a time. This procedure turned out to be an effective way of perceiving and managing the problems by the crew members. Also, it was addressed the necessity of classifying the variables in crescent levels of complexity - low, medium and high, so that they could be introduced During Training, according to the facilitator assessment related, not only to the flight evolution, but also to the ability and maturity of each sample to deal with them, based on some parameters of behavior skills, such as: communication / assertiveness, situation awareness, decision making and leadership.

Here are some examples of variables used for the CRM Training: winkle generator lights (internal variable / low complexity), light authority pressure inside the aircraft (external variable / low complexity), phone degradation communication (internal variable / medium complexity), hydraulic failure (internal variable / high complexity) etc.

During Training is considered the most important moment of the 2nd. Phase / Recurrent Practice and Feedback, therefore it must be videotaped and registered by the facilitator in the CRM Script Form / ANNEX VII, to make the participants possible to have a feedback about it, in the Debriefing, After Training.

Results

As part of the study results, some aspects collected from the PC Based Methodology (CABRAL, 2006) tools will be mentioned, as follows:

CRM Expectations Questionnaire:

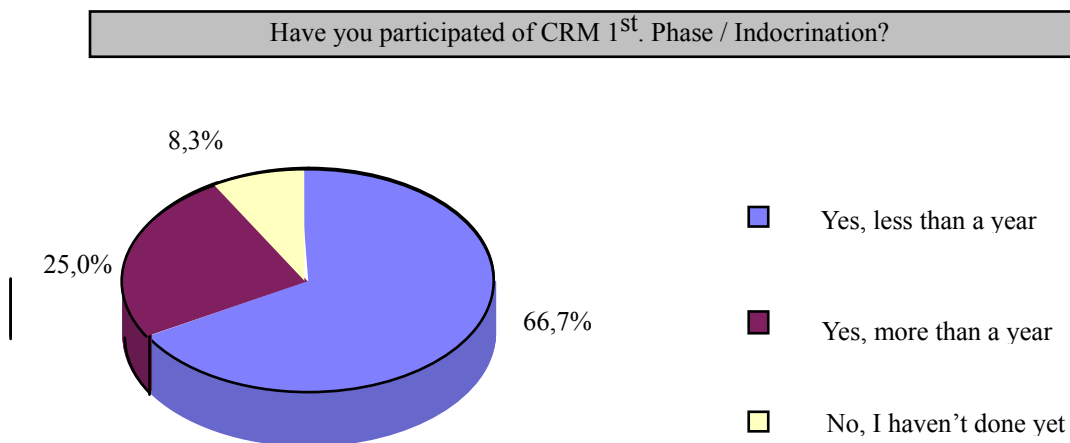


Figure 2: Have you Participated of CRM 1st. Phase / Indocrination?

Among the crew members who participated of the study: 66,7% realized CRM / Indocrination Training less than a year; 25% realized more than a year; and 8,3% did not realize it. Although the majority (66,7%) had already be trained on CRM 1st. Phase before, we must advise that it is required its previous implementation for CRM 2nd. Phase, based on a customized culture organizational diagnosis focused to find aviation operational problems

concerning team interaction, which must guide its implementation.

Participant Reaction Questionnaire:

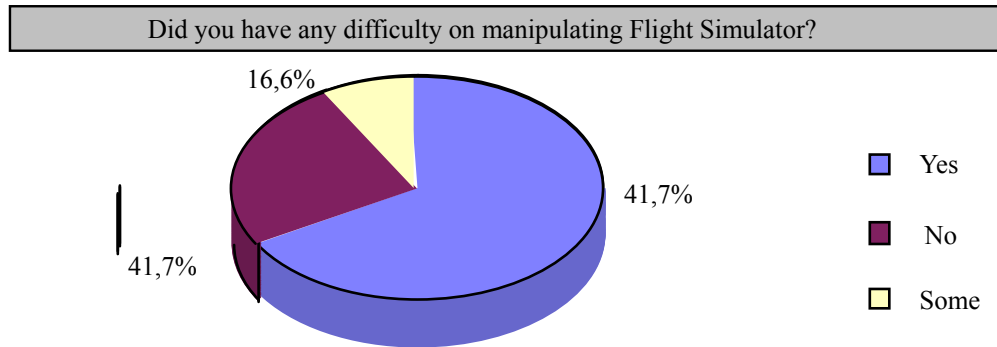


Figure 3: Did You Have any Difficulty on Manipulating Flight Simulator?

Among the participants, half 41,7% had difficulty on manipulating the Flight Simulator, and half 41,7% did not, therefore it was provided the implementation of the Familiarization Flight Before Training / ANNEX III, with the Helicopter Commands Parameters mentioned before.

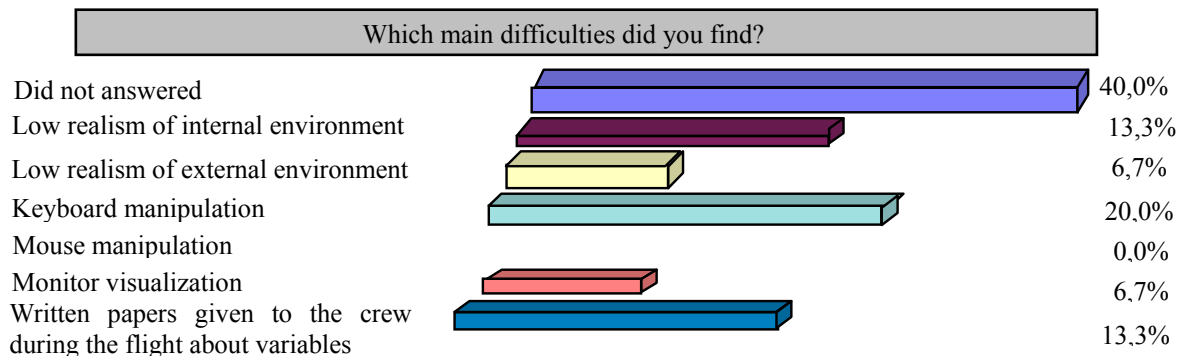


Figure 4: Which Main Difficulties Did you Find?

Although 40,0% of the sample did not answer, among the difficulties presented, 20,0% are related to the keyboard, suggesting to substitute it by a joystick, which constitutes a low cost and a possible initiative.

Facilitator Reaction Questionnaire:

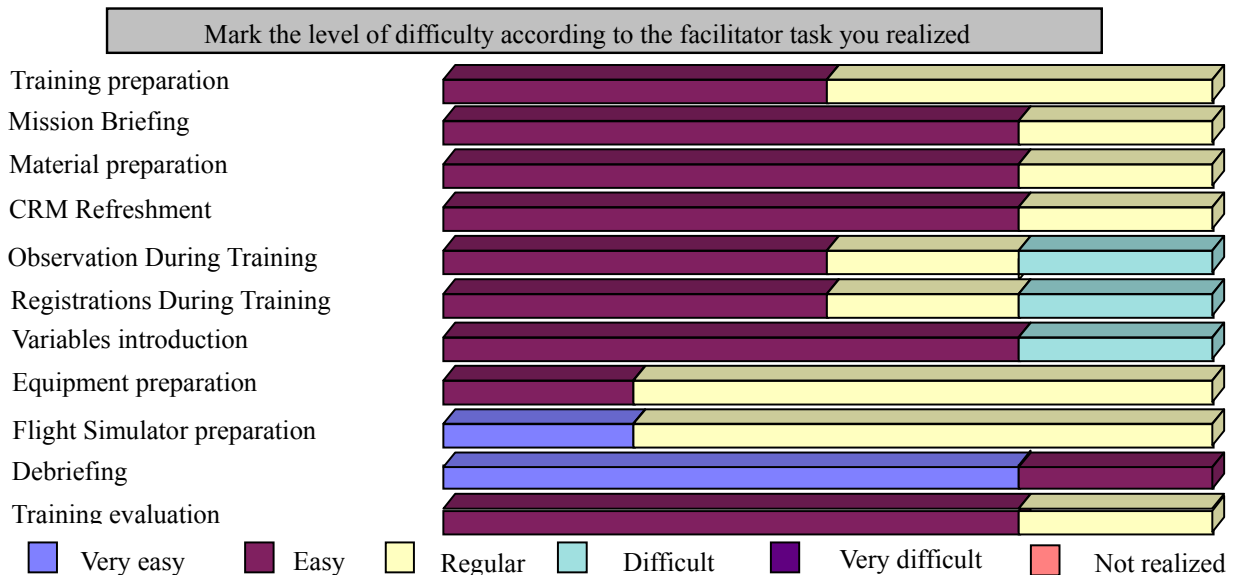


Figure 5: Mark the Level of Difficulty According to the Facilitator Task you Realized

No task was considered very difficult or not realized, but three of them were considered difficult by a minority: observation and registration During Training, and variables introduction. It indicates a high level of requirement for the facilitator During Training, which requires a specific training to prepare the facilitator for an adequate performance. Besides, the facilitator has, also, to plan, create and update continuously Before Training, based on the PC Methodology After Training, which reinforce the need of the facilitator training.

It is appropriate to mention that here was illustrated a summary of the whole research, which may be consulted and deepened by researchers (CABRAL, 2006).

Conclusion

The PC Methodology for CRM 2nd. Phase / Recurrent Practice and Feedback showed a high level of acceptance among the study sample, but it would be better to adopt the use of a joystick for the helicopter controls instead of a keyboard, which is, also, a low cost solution.

The study results were presented not only to the sample, but also to some organization managers, who decided to adopt the PC Based Methodology (CABRAL, 2006) using the Microsoft Flight Simulator Software for CRM Recurrent Practice and Feedback Training.

At the beginning, the idea was to focus the CRM 2nd. Phase / Recurrent Practice and Feedback, only to helicopter flight operations in Microsoft Flight Simulator, based on the script involving the scene once planned, but, when the Methodology was concluded, it revealed that it can also be developed for other types of aircrafts, if the necessary adaptations be implemented.

The main benefit of this PC Methodology is to offer a low cost and an accessible computer game as a resource to implement the CRM Training, in place of an expensive simulator environment, as usual, although it may also be used in this kind of equipment. Future steps of the research may include the Methodology (CABRAL, 2006) validation in military and civil aviation environments and in other types of aircrafts.

The study also shows the need for each organization to elaborate an internal instruction for the CRM Program and to use the Methodology results as an instrument of culture organizational diagnosis for an annual review of CRM 1st. Phase / Indocrination.

Finally, it must be emphasized the need to adapt the Methodology to the use of appropriate games involving other aeronautic segments, besides aviation crews, such as air navigation and maintenance, considering the contribution of professional interculture to operational safety.

Acknowledgments

We're very grateful for all the efforts and contribution of the Aviation Command of Brazilian Army, which made possible the development of this study.

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