

OBJECT ORIENTED APPROACH TOWARDS DESCRIBING OF OPERATIONAL PROCEDURES IN AVIATION

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There are a lot of stakeholders involved in ensuring of aviation safety, thus it is fairly hard to implement all safety requirements into such a complex system. There is a need for a new way in describing of operational procedures, because description in written form is not appropriate anymore. A very appropriate tool for this purpose is UML (Unified Modelling Language), it provides plain and standardized view of the whole system; hence it can help to avoid control lags and dangers resulting from misunderstandings in operational procedures and consequently reduce total operational costs and risk. This work was supported by the Grant Agency of the Czech Technical University in Prague, grant No. SGS10/221/OHK2/2T/16.

Key words: UML modelling, airport security, object-oriented approach, system-approach, operational handbooks and manuals

1 WHY IS MODELING NEEDED?

Currently, the civil aviation represents a significantly extensive, highly specified and quickly-developing branch of human activities. The on-going development concerns all its areas and comprises not only implementation of new or upgraded types of aircrafts, navigation, communication and control systems, but it is also concerned with development considering the airports and procedures of various operational actions. Constant development and large amount of companies and organizations interested in aviation safety are responsible for vast range of changes in the form of regulations, recommendations and standards which necessarily have to be understood and implemented effectively.

Each aviation organization or company deals with the broadcast of important information, changes and recommendations through operational handbooks and manuals. These documents comprise all information in written form only, and the form is, especially when extensive, difficult to understand and not particularly clear. The biggest problem of operational documentation are descriptions of individual operational actions where a particular action is frequently divided into several chapters and sub-chapters without giving any notice to the reader that this particular action

has been discussed beforehand. This results in difficulties when considering correct understanding and clarity within the text. Moreover, the particular actions frequently have large scale of alternative or parallel procedures and they include conditioned behaviour. Apart from dangers resulting from not particularly correct understanding and interpretation of gathered information, the action will plausibly be more time-consuming and this may result in increase of running costs. Various hazards may originate from hidden safety risks as well.

2 MODELING – USAGE

Thus the written form of the documents is not exactly appropriate. What seems to be convenient is to supplement a written description of certain procedures by a graphical model which clearly expresses sequencing of individual procedures, their possible alternatives, how these procedures work and also who is responsible for which procedure. In such situations, it is ideal to use an application of object-oriented approach towards a certain part of flight manual. Moreover, creation of an appropriate graphical model describing operational actions is handy as well.

A model can also find its place in the management area, where it is necessary that the employees working in this field would understand the described procedures utterly. Especially, in the

case of planned optimizing of individual actions or of the entire system to lower its running costs, acceleration and simplification of the procedures, eventually to simplify and streamline the training of employees, the utter knowledge of the procedures is required. A manual supplemented by a schematic graphical model can be used for persons who were not specially trained for operational function.

The modeling language UML seems to be the most convenient for the purposes considering simulation of aviation operational actions. In the case of BPNM, the focus on the business action appears to be the major disadvantage. This focus, different from field concerning modeling, may cause several difficulties. It is also plausible that it would not be able to record modeled procedures in the desired quality.

The usage of agile methods of development appears to be inappropriate as well, since these methods are applied to larger projects and emphasize teamwork. Further significant fact is that the agile methods of development are focused on the software development predominantly and they try to record all the alternatives and circumstances concerned with this development. Exploitation of these advantages would not be possible, as this project represents a project which is not suitable for such methods.

The most appropriate from the types mentioned is the exploitation of simulation language UML, where its universality seems to be the most powerful reason for its usage. The universality is able to record required areas of the system; further on, they enable to create simulations which will regard the system from various perspectives. To support this evidence, the UML language has been used in this field for several years.

3 MODELING OPERATIONAL ACTIONS

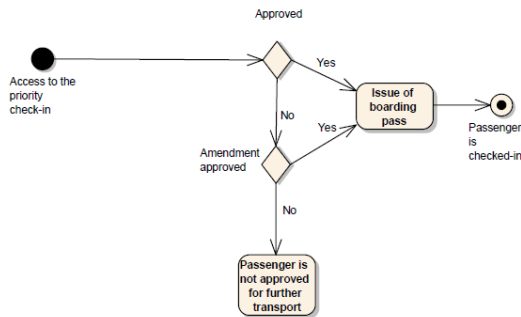
When modelling manual for ground operations GOM, it is necessary to take into consideration the desired goals. The major goals are clearly and comprehensibly displayed procedures related to the departure actions and schematic display of the actions and tasks of the persons included in this procedure. To achieve the goals, it is sufficient to create to basic diagrams from the set of diagram defined in the language UML, concretely the Activity Diagram and the Use Case Diagram.

Sample models do not show all procedures to the tiniest details and some less important steps or alternatives are intentionally omitted or simplified to preserve clarity and transparency.

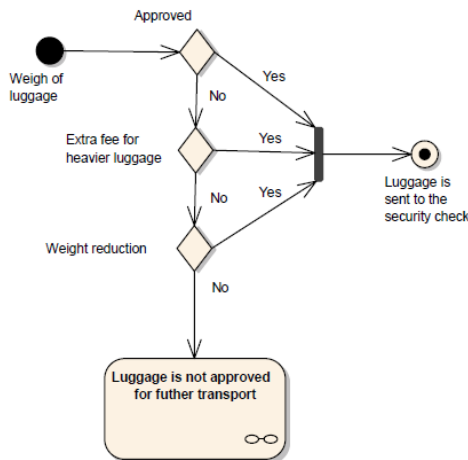
The Activity Diagram will be displayed in several parts due to its size. The diagram is designed into several parts according to who or what enters the procedure. To be more specific, in the case of persons it concerns the passengers checked out trough the Internet, passengers which plan to check out in conventional manner, passengers requiring assistance service and passengers using V.I.P. benefits.

For individual passengers, the model procedure of actions is in the manner, as they follow in the departure procedure. In the case where human beings are not concerned, three inputs are modeled; concretely the input considering luggage, goods or mail. For these variants, the procedure is modeled similarly as in the case of persons. Each model finishes at the moment, when the passengers are boarded and everything is loaded and it is possible to depart.

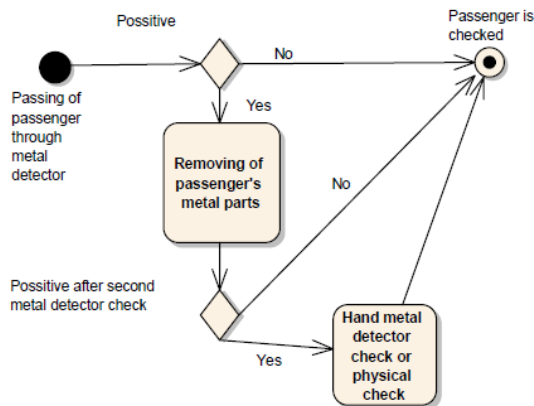
Detail action: Passenger check out



Detail Action: Luggage check out



Detail action: Hand metal detector check



In the case of departure operational actions the Use Case Diagram shows who is responsible for what action in the whole procedure. Actually, the diagram shows the employees or machines on one side, which performs a certain action, and on the other side, different actions which takes place in the framework of the described procedure.

4 CONCLUSION

UML is a very comprehensive and appropriate tool for achieving mentioned goals. It is obvious that activity diagrams and use case diagrams can replace long and incomprehensible written part of operational manuals such as GOM and thus helps to reduce total operational costs and risks.

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