Chapter 14
Operational Decision Making

ABSTRACT

Additional material on decision making in operational systems is presented here. This material would be most useful for researchers engaged in the conceptual design of onboard decision support systems. Decision making is a complex process. Over the years much has been written about decision theory but very little attention has been paid to decision making under increased time compression. Also, additional complexity is introduced by having to deal with large-scale dynamic systems and their attendant trajectory and energy management demands. We discuss DODAR and FORDEC and their limitations. Operational decision making is a risk-driven model that triggers pilots’ responses, actions, and decisions by changing the aircraft’s position within the risk envelope. This material can form the basis of a more complete picture of the state-of-the-art decision theory and what useful aspects and insights we can use operationally.

INTRODUCTION

Why do pilots have to make decisions while they are working in a prescribed environment (with Standard Operating Procedures [SOP], rules, and automation)? What kinds of decisions have to be made? Flying an airliner means encountering adverse conditions that would affect flight safety. These adverse conditions are possible risk factors. As a consequence, each flight personnel becomes a risk manager and is a
central component who plays a vital role in addressing the risk in practical terms. In other words, pilots have to mitigate the risk to maintain the level as low as possible to guarantee safe operations. In managing risk level, pilots analyze situations and environment, generate options, and assess risk status—they make decisions. Every time a change occurs in the plan, a decision should be made to maintain the lowest level of risk.

There are multiple factors affecting safe operations. It is important to clarify and to categorize the risk to make the model operational.

RISK CONTINUUM

A risk is qualified by its likelihood of occurrence and severity of consequence as illustrated in Table 1. Risk is inherent in aviation; we will define a risk continuum from low to moderate then high.

Once these categories are defined, how does the crew deal with this risk continuum?

To have an accurate perception of the risk, pilots should detect any discrepancies with the initial plan and context. Their flight preparation should be pertinent and they should expect a certain context. Being aware and vigilant would allow them to detect any adverse factors. If there is a change in the risk level, flight crews will modify the original mission to contain in a moderate level. If risk rises further, pilots will need the crew, SOP, Air Traffic Control (ATC), and the dispatch to abandon the mission. This is to prevent entering and remaining in high risk situations. Doing this, crews are piloting the risk cursor in a risk envelope. To understanding this concept, we will compare with a flight envelope every pilot and aeronautical engineer knows.

<table>
<thead>
<tr>
<th>Continue with the Mission</th>
<th>Continue with Modification to the Mission</th>
<th>Discontinue the Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>This is normal operations; the initial plan progresses as expected during the flight preparation. No modification is required to the mission. If a change occurs, the level would rise to moderate.</td>
<td>A modification of the mission has to be implemented in order to maintain an acceptable level of risk. This modification would activate flight crews’ vigilance, awareness, and recognition of any other changes in the context. If an additional unexpected event occurs, the level rises to a critical level.</td>
<td>Multiple factors modify the expected and planned context. The mission objectives have to be reconsidered, flight plan needs to be discontinued, and the mission is aborted in order to restore an acceptable level of risk.</td>
</tr>
</tbody>
</table>
Augmentation Systems: The Use of Global Positioning System (GPS) in Aviation
Mohammad S. Sharawi (2012). Technology Engineering and Management in Aviation: Advancements and Discoveries (pp. 283-293).
www.igi-global.com/chapter/augmentation-systems-use-global-positioning/55981?camid=4v1a