767 AEROSPACE METEOROLOGY AND DECISION-MAKING UNDER UNCERTAINTY: DEVELOPMENT OF WEATHER DECISION SUPPORT SYSTEM FOR SOUNDING ROCKET LAUNCH

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ABSTRACT*

In launching sounding rockets, the weather and environmental conditions are crucial. However, the decision-making under weather uncertainty can be a difficult process, have high impact and, in many situations, can compromise all mission rocket launches.

Applied to the sounding rockets launching with microgravity experiment, making operational decisions based on weather conditions is crucial to the success of the mission (Figure 1).

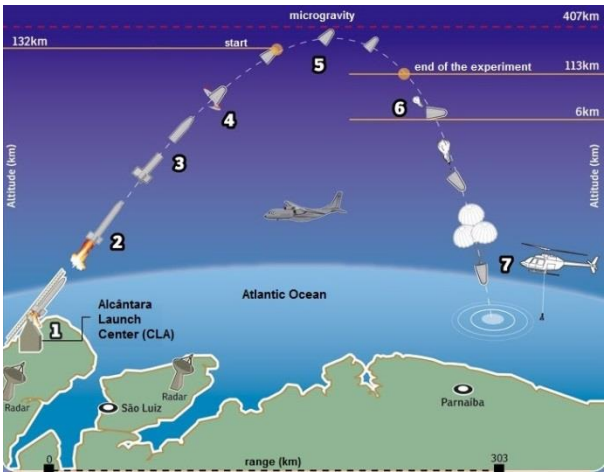

Figure 1: Sounding rockets launching with microgravity experiment and payload recovery.

Numerous papers present methods for decision making under uncertainty. However, incorporating the full problem context along with the climate/weather prediction uncertainty is still a challenge. The chief unaddressed issue is to identify the preferences of the decision makers concerning the weather risk inherent in launching a mission. In other words, the weather forecast is uncertain, and the resulting risk may be interpreted differently by various decision makers in the space center. In this case, to apply the weather forecast as a reliable tool for decision making during the sounding rocket launch, one needs to incorporate the decision maker's preferences on these three quantities:

a) forecast meteorological variable value;
b) lead time of the weather forecast;
c) forecast probability

This paper discusses a method for integrating weather forecast techniques and this subjective decision environment to build a unique index to aid decision-makers during sounding rocket launch in Brazil. As a solution, we propose the development of a new index, the Weather Decision Index (WDI). The WDI transforms the (uncertain) weather forecast into a single index aimed at supporting decision makers with little or no weather expertise.

The systemic view has to combine several methods such as problem structuring, multi-criteria analysis, scenario planning, and analysis of the multiple value dimensions involved mission launch and aerospace meteorology. We apply the WDI in a real decision-making context for a sounding rocket launch at the Brazilian Launching Center.

The WDI is demonstrated to be adequate to represent the decision makers' preferences regarding the handling of uncertainty in weather forecasts. Furthermore, it is possible to identify several applications of WDI, including aeronautical meteorology and disaster risk reduction.

Key-words: *weather index; space program; decision analysis.*

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