Intelligent Modeling the Impact of Unpredictable Adverse Weather on ATM Performance

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Motivation

Adverse weather conditions, e.g., thunderstorms or icing, are responsible for
• about 50% of all delays
• more than at least 10% of all accidents and incidents

Example: Flight AF 447 on May 31, 2009

The objective of any future adverse weather solution for aviation is the reduction of delays and the increase of safety. Key elements are:
• Diagnosis & forecast of adverse weather
• Assumption of free-flight 4D trajectories
• Proper treatment of the stochastic nature of weather
• Integration of weather in ATM

Investigation, exploration and development of an adverse weather ATM solution model DIVMET-ATM

Similar tools in US developed at MIT-Lincoln Lab [1] and at NCAR, Boulder [2]. Necessity of these developments results from increased weather related delays.

Note: lack of equivalent tools to support ATM in adverse weather conditions in Europe

Objectives and expected outcomes

Main objectives
• Understanding the interaction of the two complex systems air traffic and adverse weather
• Modeling approach

Development of the DIVMET-ATM model
• Provision of an adverse weather diagnosis and forecast model and its extension to account for the stochastic nature of weather
• Selection of an appropriate global air traffic model
• DIVMET algorithm: circumnavigation of adverse weather

Research topics
• Modeling realistic routes and weather related diversions. Do they match observed ones?
• Effect of increased adverse weather knowledge
• Worst case weather scenarios
• Best ATM strategies to account for the stochastic nature of the problem

Methodology

Development of the DIVMET algorithm
• Simulates the CDM between pilot and ATC
• Proposes a realistic route through a field of adverse weather

Needs
• Transformation of adverse weather into weather objects
• Impenetrable for aircrafts
• Account for motion, decay and generation of weather objects with time
• Validation is planned to be performed by demonstrations together with pilots and controllers

DIVMET-ATM applications
• Optimum routing strategies in unpredictable adverse weather
• Vulnerability of air traffic
• Provide guidance for controllers and pilots to find a safe and efficient route through a field of thunderstorms ahead

References