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Estimation of Reduction in Airspace Capacity due to Convective Weather

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Severe convective weather routinely disrupts normal flow of air traffic in the United States' National Airspace System (NAS). Over the last decade, severe weather has been the most significant cause, accounting for over 70% of air traffic delays in the NAS[1]. Flights incur modification in their nominal routes due to the presence of severe weather, and hence, suffer increased delays. These delays contribute to increased burden on airlines due to extra fuel costs and missed schedules for connecting flights. In this paper, the reduction in air space capacity and the associated air traffic delays due to severe convective weather will be investigated.

Various techniques are available in the literature for grouping objects based on user-defined criteria. A method developed at NASA Ames Research Center for grouping aircraft will be employed to group severe weather regions[2], along with another proximity-based algorithm for creating a network of severe weather polygons. Once this grouping is formed, the demand of air traffic within that region will be assessed. Referencing another day with lesser or no severe weather in that region, a comparison of reduced demand for air traffic within that region can be ascertained. Previously conducted research quantified transient enroute capacity reduction caused by storm blockage. These methods restrict their approach on a specific kind of weather, as well as specific metric for assessing weather impact. The current research is intended to be general in nature and addresses the impact of weather on a range of spatial scales.

Future ATM (Air Traffic Management) Concepts Evaluation Tool (FACET) is an air traffic modeling and simulation environment developed at NASA Ames Research Center[3]. FACET can read and analyze air traffic data in the NAS received from the Federal Aviation Administration's (FAA) Enhanced Traffic Management System (ETMS). In conjunction with air traffic data, FACET can ingest and utilize a variety of severe weather data from different sources, including the Next Generation of Radar (NEXRAD) and the Corridor Integrated Weather System (CIWS) for decision-making purposes[4]. The method of grouping weather cells mentioned above will be implemented in FACET for this study.

Results for the reduction in capacity, as well as incurred delays as correlated with the presence of severe convective weather will be presented. Based on this research, mechanism of arriving at different set of metrics will be proposed for identifying and characterizing air traffic behavior with a given weather data set.

References

[1]Souders, C. G., McGettigan, S., Dash, E. R., and May, J., "Weather Integration Concept of Operations for Transforming the National Airspace System", American Meteorological Society's 12th Aviation, Range and Aviation Meteorology, Atlanta, GA, 2006, 10.2.

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[2]Bilimoria, K., and Lee, H. Q., "Analysis of Aircraft Clusters to Measure Sector-Independent Airspace Congestion," *AIAA 5th Aviation, Technology, Integration, and Operations (ATIO)* Conference, 26-28 September 2005, Arlington, VA.

[4]Bilimoria, K.D., Sridhar, B., Chatterji, G., Sheth, K.S., and Grabbe, S., "FACET: Future ATM Concepts Evaluation Tool," *Air Traffic Control Quarterly*, Vol. 9, No. 1, 2001, pp. 1–20.

[3]Fahey, T. H., Phaneuf, T., Leber, W. S., Huberdeau, M., Morin, D. P., and Sims, D., "Forecasts of Convection for Air Traffic Management Strategic Decision Making: Comparison of User Needs and Available Products", American Meteorological Society's 12th Aviation, Range and Aviation Meteorology, Atlanta, GA, 2006, 2.4.