ACRP Problem No. 12-04-11

Analysis of Aircraft Lateral and Vertical Deviations During Approach and Takeoff

ACRP Staff Comments: No comments offered.

TRB Aviation Group Committees Comments: AIRFIELD AND AIRSPACE CAPACITY AND DELAY CMTE - Recommend. This is a good proposal and is needed research. However, it will likely overlap with ongoing research by FAA Air Traffic Organization/MITRE, which are in the process of updating the CRM.

Review Panel Comments: Not recommended — Who is the audience for this product? Does this affect airport operators? This is an internal FAA/NextGen issue.

AOC Disposition: No funds allocated. No discussion.
I. PROBLEM TITLE
Analysis of Aircraft Lateral and Vertical Deviations During Approach and Takeoff

II. RESEARCH PROBLEM STATEMENT

There is a need to improve and expand the capability of the existing FAA/ICAO Collision Risk Model (CRM) that is used to analyze the presence of obstacles during instrument approaches and missed approaches. The current model is limited because it can only be used to analyze Cat I and Cat II instrument approaches during the non-visual phase, and during missed approaches. While it is possible to use CRM to predict deviations that occur during Cat. I and Cat. II approaches, the model is not applicable to visual, non-precision operations, Cat III or takeoff operations. Moreover, the use of CRM can lead to extrapolations when analyses are focused on obstacles in the immediate vicinity of the runway. Recent advances in sensing technologies now provide newfound opportunities in developing, calibrating and validating new and existing aircraft deviation models, particularly in the areas near the runway that are managed by the airport operator. For example, newer multi-lateration equipment, such as the ASDE-X radar and its associated monitoring devices, are now providing an immense amount of aircraft deviation data in the vicinity of the runway. This wealth of information is not currently tapped and its use can vastly improve the deviation models used in the CRM. Furthermore, aircraft deviation data are constantly being collected at U.S. airports for various aircraft types and this information should be consolidated and used in an integrative manner within the CRM. Recognizing that the aviation industry needs a tool for evaluating the probability of aircraft deviations for the various types of approach available, including non-precision and visual, as well as during takeoff operations and its implementation in the CRM model, this research project aims to develop an updated and expanded Collision Risk Model. This updated and expanded tool will address the risk of collision for different types of aircraft and various meteorological conditions, greatly enhancing the safety of aircraft and airport operations. Moreover it will provide support for risk-based analysis of larger aircraft planned to operate in existing airports when existing standards cannot be met.

III. OBJECTIVE

The objective of this project is to develop an updated and expanded Collision Risk Model. By taking into account of lateral and vertical aircraft deviations from the nominal flight path, the model will be applicable to different approach types, including visual, non-precision and precision, as well as for takeoffs. Prototype software incorporating the models developed in this study should be developed to facilitate analysis and for model validation. Multilateration data used for the model development and algorithm validation must be collected.

IV. RESEARCH PROPOSED

The project involves information gathering that would aid the consultant in recommending a methodology for calculating aircraft horizontal and vertical deviations (to an acceptable level of certainty), thereby allowing an assessment of acceptable collision risks. Some of the tasks envisioned in this project include:

- Review the existing Collision Risk Model structure and methodology and develop an assessment of the model’s capabilities and deficiencies, and outline technical improvements that are desirable to update and improve current CRM capability.
- Consult with FAA to gain an understanding of their efforts to develop the ASAT, including methodology, data sources, expected results and applicability.
- Identify data sources and gather data on aircraft deviations from nominal flight path and categorize by aircraft design group, aircraft performance, weather conditions, day/night conditions, approach/departure and position.
- Formulate an analytical approach to using the gathered data to calculate aircraft deviations from nominal flight path and to determine collision risks to compare with acceptable level criteria used by the industry.
- Update and expand the existing Collision Risk Model (CRM). Define scope of capabilities, algorithm, graphic user interface, inputs, results and presentation of results.
- Develop prototype software incorporating the models developed in the previous task.
• Validate the updated and expanded CRM using an independent data set; data selected for validation shall be complete and comprehensive enough to cover a variety of scenarios.
• Prepare report outlining the research results and basic information about the updated/expanded CRM, including a users’ handbook.

It is assumed the FAA will make available to the researchers the multilateration data that has been collected at various airports. If multilateration data access is not granted, the data may need to be purchased from third parties and the study tasks adjusted to reflect the extra effort. Also, the suggested funding must be increased to accommodate the extra cost, estimated to be $100,000.

V. ESTIMATE OF THE PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding:
Funds: $500,000. Should data need to be acquired from a private vendor, an additional $100,000 should be included in the overall funding amount.
Contract Time: 18-24 months.

VI. URGENCY AND PAYOFF POTENTIAL

This research is considered to be an immediate need, since it addresses the calculation of safety margins of aircraft operations in a manner which is more comprehensive than what existing tools offer. In addition, the updated and expanded CRM is developed from a larger dataset and will include aircrafts currently used by the industry. This allows for more a precise determination of safety level, particularly in the runway vicinity.

VII. RELATED RESEARCH

The FAA is in the process of preparing an updated collision risk model identified as ASAT. This model will potentially address a number of the deficiencies identified in the existing Collision Risk Models (CRM). However, the ASAT Model may not be available for public release. This research will provide a CRM that is publicly available and calibrated to the user level of proficiency.

ACRP 04-09 - Risk Assessment Method to Support Modification of Airfield Separation Standards has been completed recently and identified the deficiencies of the existing CRM. This ACRP will address observed aircraft performance while on approach to or departure from a runway in all meteorological conditions, and will provide a tool for assessing collision risk based on observed aircraft performance.

VIII. PERSON(S) DEVELOPING THE PROBLEM

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IX. PROCESS USED TO DEVELOP PROBLEM STATEMENT
Collaborative effort between individuals listed above.

X. DATE AND SUBMITTED BY

Date: March 4, 2011
Submitted by: Geoffrey Baskir, C.M., AICP, LEED, Member – Airport Aircraft Compatibility Committee (AV 070)

Submit to:

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