

SMS Best Practice/Good Practice Submission			
State whether this is a Best or Good Practice:		Best Practice	
ANSP	NATS	Date of submission	19/07/2024
Contact Details	Email: Christine.vincent2@nats.co.uk		Tel:
SoE Study Area		6.2 Safety Risk Management	
BP/GP title		Time to Conflict (TTC)	
In use since			
ANSPs using this practice (for BP specifically)			
Key Words			

Details:

Introduction

At NATS, one of our key objectives as listed in our Safety Policy is to minimise our contribution to the risk of an aircraft accident as far as is reasonably practicable. Part of achieving this is measuring that risk. Currently, losses of separation (LOSs) tend to be used as a proxy for mid-air collision risk. For each LOS, a Risk Analysis Tool (RAT) score is determined, which gives a picture of the severity of the event, as applied at NATS.

However, the frequency of LOSs is decreasing. To supplement the RAT measurements, NATS are exploring the benefit of introducing a second, retrospective measure to provide a richer picture of safety. This measure is called Time to Conflict (TTC) and, as described in this submission, is a useful tool in this regard.

What's the Problem?

While the RAT scoring system is a useful tool for measuring the safety risk of aircraft accidents, using LOSs as a proxy for mid-air collisions, there is now a limited amount of information in certain areas of airspace, due to the limited number of LOS events.

The RAT provides a picture of event severity as applied at NATS, but this picture is limited for areas of airspace where the frequency of LOS events is low. To supplement the RAT, TTC has been developed and is currently being explored as a measure to help inform safety where there is a limited number of RAT events, to provide a richer picture of safety in these areas, to generate safety discussions that may not otherwise be undertaken, and, in some cases, to confirm or challenge controllers' perceptions around the safety of a particular piece of airspace.

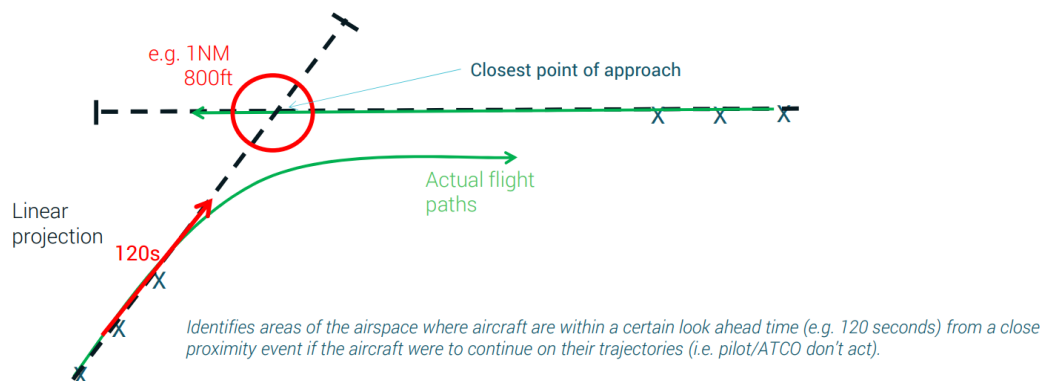
What is TTC and what does it do?

TTC is a tool that has been developed in collaboration with a number of ANSPs. It processes radar data to detect how often aircraft pairs are pointed at each other with only a short period of time before a collision, irrespective of airspace rules, procedures, and the separation standards being applied.

For each detected interaction, the tool calculates a score that represents the safety significance of the interaction based on the aircraft geometries and additional adaptable parameters. The geometric parameters used to determine the significance score are as follows:

- Current position
- Rate of closure
- Time to closest point of approach
- Estimated lateral separation at closest point of approach
- Estimated vertical separation at closest point of approach

The scores are added together after each sweep and a cumulative score is calculated over three sweeps to determine the TTC score.



NATS is employing TTC as a retrospective measure that can be used for post processing. While TTC shows where scenarios are being managed safely, it doesn't consider how good we are at safely managing those scenarios and what tools we have to help with this.

Use Cases

While there are many potential applications of TTC, to date, it is being applied in two specific use cases at NATS: ad-hoc monitoring of specific day-to-day operations, as examined using safety surveys, and Airspace Design implementation.

Safety Surveys

Regarding safety surveys, TTC is being used to target areas of potential concern in the operation where there are limited RAT-based occurrences, in an attempt to uncover the reality of the operation from a safety perspective, whether there is any risk, whether we are comfortable with the level of safety provided in this area, and whether there are any monitoring arrangements needed.

For example, application of TTC was considered particularly beneficial for the Cardiff/Bristol interface, where concerns were raised by General Managers around the interactions of arrivals into Cardiff and Bristol during a specific runway configuration. The aim of the retrospective analysis was to identify potential conflict events that occurred during a specific sample period where one aircraft in a pair is an arrival at Cardiff and the other an arrival at Bristol, under the specified runway configuration.

After running the TTC analysis, a total of four events of potential interest were identified across the sample period, all of which were classified as 'very low' significance level, but only one of which fit the defined criteria of being an aircraft pair where one is an arrival into Cardiff and one is an arrival into Bristol, while the specified runway configuration is in use. The one event of interest was an interaction in which an arrival into Cardiff and an arrival into Bristol were pointed directly at each other during their approach to the airports. Notably, both aircraft turned before a LOS occurred, but the TTC analysis detected this potential conflict, which could have occurred (but ultimately didn't) if the ATCO or pilot(s) had not acted appropriately.



Because there was a small number of TTC events in the area of interest across the sample period, it was determined that the chance of an occurrence in this area during the specified runway configuration is small. It was also determined that these findings are not indicative of a direct relationship between the runway configuration analysed and the likelihood of TTC events. However, this analysis, combined with previous analysis using different measures, illustrates how the use of TTC can be beneficial in forming a baseline, against which periodic monitoring could indicate any increase in risk over time.

The application of TTC for the scenario described in this safety survey was useful in reassuring the General Managers of both airports around the nature of this type of operation when operating in this specific runway configuration.

Airspace Design

Currently, when airspace design changes are proposed, the method of assuring their safety is largely subjective, being down to simulations and subsequent questionnaires being administered to controllers. There are issues related to this subjectivity, such as safety discussions being dominated by strong voices in the room. By relying on subjective measures, not all safety concerns will be raised, heard, or acted upon.

NATS have is using TTC as a measure in both pre- and post-airspace change implementation to provide a richer, more accurate, and informed picture of the safety of the change.

For example, since the West Airspace design has been implemented, there was 1 LOS, which was attributed to mode switching. This alone does not give an accurate or informed picture of the safety of the change. TTC was applied for the West Airspace change post-implementation as a measure against which to analyse the number of potential conflict events and therefore provide a richer picture of the safety of the airspace change. It is important to note that TTC was not used as a metric against which to influence the design of the change, but to see if the right safety concerns have been highlighted and addressed appropriately.

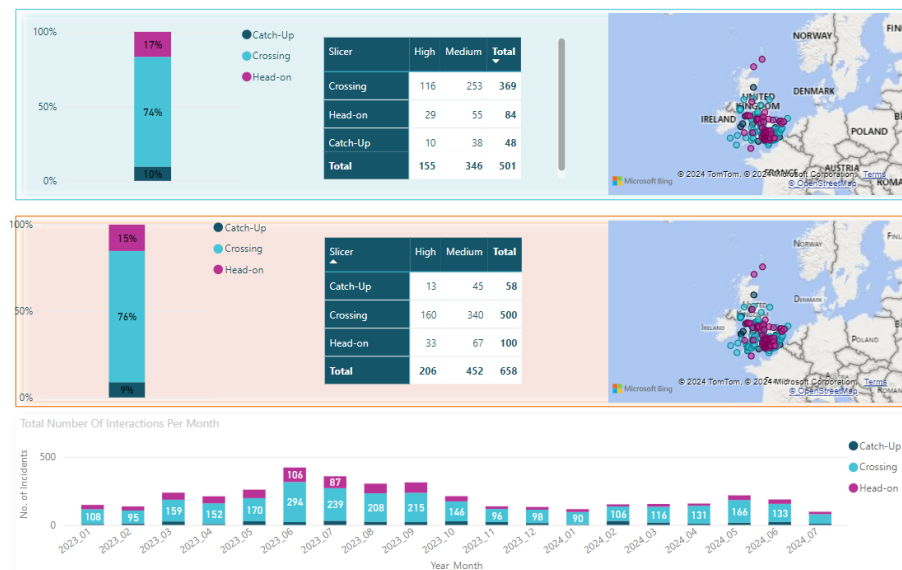
It was found that the use of TTC as a post-implementation measure prompted the right conversations around safety. For instance, if something is detected that is an outlier, conversations could be had around them. It is therefore a useful tool for facilitating safety conversations and showing associated safety, even for those who may not be ATC experts.

Benefits

NATS recognises that the use of TTC provides a richer picture of the safety of a specific area and/or scenario, in addition to what the RAT provides today, as applied by NATS. This is helpful in providing an increased understanding of the safety of the operation from the view of the safety practitioner and as quantitative confirmation in areas or scenarios where controllers know the operation to be safe.

Dashboards have been developed which can be used to view and analyse TTC events in specific pieces of airspace and/or regarding specific scenarios. Screenshots of the dashboards are presented as follows:

Time to Conflict Comparisons



Analytics

Comparison Filter set - 1

Year	6 month period
All	All
Year QQ	Year Month
All	Multiple sele...

Comparison Filter set - 2

Year	6 month period
All	All
Year QQ	Year Month
All	Multiple sele...

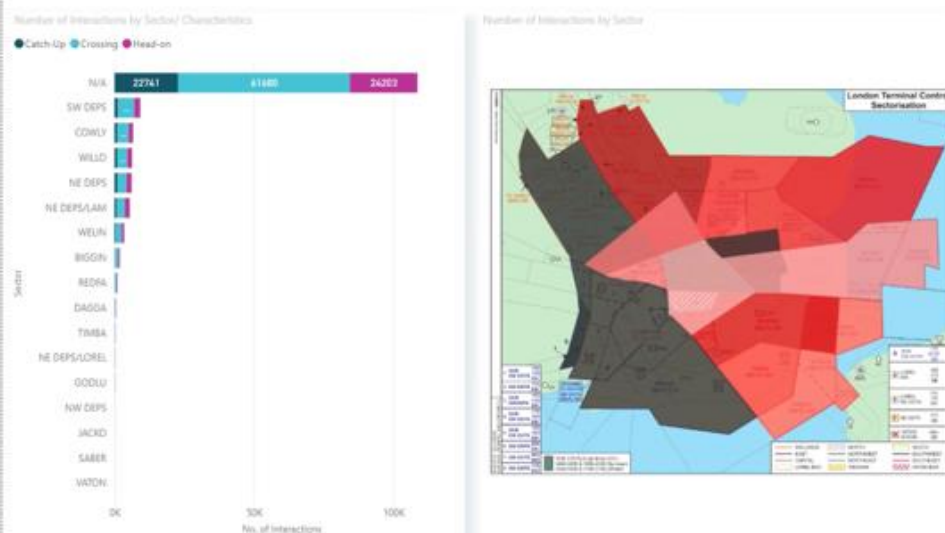
Characteristics

Encounter Type	
Interaction	Commercial - Commercial
Significance Level	Multiple sel...
Sector	All
Watch	All
WatchShiftName	All

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*Use the filters to compare two periods. Select the characteristic to investigate using the legend below.

Heat Sector Map by No. of TTC events



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Analytics

Characteristics	
Encounter Type	
Interaction	All
Significance Level	High
Year	All
Sector	All
Year QQ	All
Year Month	All

Limitations

NATS does not intend TTC to be used as a safety metric. It is a quantitative tool that can be used retrospectively to analyse the frequency and severity of potential conflicts that may not be detected by the RAT scoring system, as applied by NATS. We have faced some pushback from controllers in implementing use of the tool, who tend to think it does not tell them anything they do not already know. However, TTC can be useful in either confirming controllers' suspicions regarding safety which are not supported by the low occurrence of LOS events or for validating the safety of a certain piece of airspace, runway configuration, or other scenario, using quantitative data.

Additionally, the visual representations of TTC analysis can easily be understood by non-ATC experts. This allows TTC analysis to be a useful tool in checking and driving a better understanding of safety in the operation by both safety practitioners and non-ATC experts.

Future Intentions

Moving forward, NATS intends to apply TTC analysis to hazard identification during airspace changes. It is important to note that TTC will not be used as a safety metric in these instances, but as a tool to supplement the existing HAZID process and facilitate richer safety conversations when looking at future airspace designs. It is envisaged that TTC would be used, for example, following a normal HAZID, where TTC would subsequently be run to indicate where there may be areas of interest or concern, or, importantly, where conversations around potential hazards may have been missed.

Additionally, there is an intention to provide TTC analysis to future airspace designs in the long-term. However, it is important that before this is implemented, the existing dashboards will need to be expanded to have a better front-facing user interface that can be readily adapted by safety practitioners to apply TTC analysis to the specific airspace change they are looking to implement.

Conclusion

Currently, RAT scoring is a useful tool for identifying and quantifying LOS events. However, in areas of airspace where LOS frequency is low, there is limited ability to quantitatively analyse the safety of the operation. While not intended as a specific safety metric, TTC is a useful quantitative tool for facilitating safety discussions and identifying potential conflicts which may not be detected by the RAT due to the low frequency of LOS events. It is a powerful tool for retrospective analysis, which can be applied amongst other things to supplement the current hazard identification processes, to examine areas of airspace where there is potential safety concern and to provide insight into the post-implementation safety of airspace design changes.

By submitting this document, your organisation is willing for the proposed Best or Good Practice to be shared with other ANSPs.

For Best Practices, this document should be sent together with the SoE in SMS questionnaire, to: soe_2024@eurocontrol.int **by 30th June 2024 at the latest.**

Submissions for consideration as Good Practices may be sent by the above date. They may also be identified during the survey interview sessions with the assessment team, following which a Good Practice submission document will be requested.