Appendix H

RUNWAY INCURSION SEVERITY CLASSIFICATION (RISC) CALCULATOR

1. The runway incursion severity classification (RISC) calculator is a computer programme that classifies the outcome of runway incursions into one of three severity classifications: “A”, “B”, or “C”. (See Chapter 6, 6.1, for a description of these categories.) The RISC calculator programme does not store any data; it simply provides a quick, easy and standardized way to rate the severity of runway incursions. Experts’ judgements of severity are subject to a variety of factors. Severity judgements can change from person to person and from time to time. The calculator applies the same decision processes used by experts to determine the severity rating. Because the rating (output) is standardized to the input, the ratings are consistent. Such consistency is essential to being able to examine trends over time or see the effects of mitigation strategies. This standardized method for rating the severity of runway incursions can be used to support global sharing and comparison of data by those States that wish to do so.

2. The foundation for the rating is the closest proximity, that is, how close the aircraft came to the other aircraft, vehicle or pedestrian in vertical and horizontal space. Factors that affect the probability of a collision are also included, such as aircraft dimensions and performance characteristics, visibility, the geometry of the conflict, and operator (controller, pilot or vehicle driver) responses.

3. The intent of the rating is to represent the risk incurred; factors such as visibility, available response time, avoidance manoeuvres executed and the conditions under which they were executed allows a characterization of that risk. For example, suppose two aircraft land on intersecting runways and stop 150 m (500 ft) from each other. In unlimited visibility and without severe braking being executed by either pilot, the outcome that the aircraft would come no closer than 150 m (500 ft) has a higher chance of recurring than in reduced visibility (where there is degraded information for all parties) or with extreme avoidance manoeuvres having been executed. Similarly, if the available response time for one of the pilots is extremely short (e.g. less than 5 seconds), then more variability would be expected to be seen in the outcome of the pilot’s responses (and hence, the severity of the outcome) than if the available response time is long. Therefore, each factor that adds to the variability of the outcome of the incursion is considered in the rating and the more conservative rating is applied. This means that each relevant factor has the potential to make the severity rating higher than it would have been if it had been defined solely by the closest proximity. It should be noted that this is not the same as basing the rating on the worst possible, or least credible, outcome of the scenario. The calculator does not rate the severity of the incursion based on everything that could have gone wrong. Rather, the critical sources of variability within the scenario are taken into account, a weight is assigned to each factor (and to each element within the factor) that contributes to the variability, and a rating based on the weight assigned to the factors and the elements within each factor is generated. While it may be helpful to think of the weight as scaling the “severity” level of the factor (for example, a pilot’s acceptance of a clearance intended for another aircraft is more serious than a partially blocked transmission), it actually represents the level of variability that the factor introduces into the severity of the outcome.

4. The model starts with a set of situations or “scenarios” that broadly subsume all types of runway incursions that involve an aircraft and either another aircraft, vehicle or pedestrian. Exceptions are that the calculator cannot accommodate helicopters in the air or other vertical take-off and landing aircraft that are

airborne. Also, the calculator is designed to categorize the severity of conflicts only between two aircraft (or between an aircraft and a vehicle or pedestrian). Therefore, the calculator cannot rate the severity of conflicts that involve more than two aircraft.

5. Runway incursions that involve only a single aircraft are automatically categorized as a “D”. The scenario describes the action of the parties involved in the incursion (landing, taking off, crossed the runway, crossed the hold short line, etc.). Each scenario has a specific set of factors associated with it. The severity rating is based on closest proximity (horizontal and/or vertical) and the set of weighted factors for the particular scenario.

6. Relevant factors can include:

a) visibility;

b) type of aircraft;

c) avoidance manoeuvre executed (whether initiated by the pilot or commanded by the controller):

1) aborted take-off (or cancelled take-off clearance);

2) rotated early to avoid a collision;

3) executed a go-around;

4) applied hard braking; and

5) swerved;

d) runway characteristics and conditions (width, braking action reported); and

e) degree to which the situation was controlled or uncontrolled (e.g. type of pilot/controller errors involved, whether all parties were on the frequency, whether the controller was aware of all of the parties involved).

7. Subsumed within each factor are elements. Elements within the visibility factor are levels of runway visual range, reported ceiling height and visibility, and day or night conditions. Runway characteristic factors include the width of the runway in situations in which an aircraft on the runway conflicts with an aircraft or vehicle approaching it from the side. This factor also includes runway conditions (dry, wet, braking action reported as poor or fair) in scenarios that involve avoidance manoeuvres in which braking action is a relevant factor (e.g. hard braking action reported, aborted take-off). There are several elements within the “controlled/uncontrolled” factor. One element concerns communication issues such as an aircraft not on the correct frequency, a partially or totally blocked transmission, the pilot accepting another aircraft’s clearance, and readback/hearback errors. The other elements map to a lack of awareness on the part of the controller (e.g. the controller forgot about an aircraft) or the pilot (e.g. the pilot landed on the wrong runway).

8. The user of the calculator enters the above information into the appropriate fields and clicks on the “calculate rating” virtual button. The severity rating is then displayed. (A complete user’s manual is provided with the CD.) Within the model, each scenario has a rating table associated with it. These tables specify, for various values of horizontal or vertical proximity, a severity rating for overall best case and worst case, and ratings for each factor at worst case when all other factors are best case. Each individual factor has associated with it a scale from zero to ten. A value of zero means there is no influence of that factor to make the severity of the given incursion greater than what is evident from the closest proximity alone. A value of ten means there is maximum influence of that factor to make the severity of the given incursion greater than what is evident

from the closest proximity alone with other conditions normal. When all factors are ideal, i.e. good visibility, the aircraft are small (and, hence, relatively slow, lightweight and highly manoeuvrable), no pilot-controller communication anomalies, and no avoidance manoeuvres, then all factor values are zero. When this is the case, the severity of the runway incursion is adequately represented by the given closest horizontal or vertical proximity. If, on the other hand, all factor values are tens, then the situation is such that the resulting proximity of aircraft (or aircraft and other object) could easily have been much worse and is represented by a "worst case" severity rating for that scenario at the resulting proximity. The greater each factor rating, the greater the expected variability of closest proximity for recurring runway incursions under the same conditions. A detailed discussion of the mathematics behind the model is available in Sheridan, 2004. (Sheridan, T. (2004), *An Interpolation Method for Rating the Severity of Runway Incursions,* presented at the Symposium on Human Performance, Situation Awareness, and Automation, Daytona Beach, 23–25 March 2004).

9. The United States Federal Aviation Administration (FAA) has compared the results of the ratings generated by the calculator to the ratings of their subject matter experts and, as a result, will be using the calculator in their assessments of the severity of runway incursions.

10. The RISC model can be obtained from the ICAO website at:

www.icao.int/fsix/res_ans.cfm.

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