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Validation of New Technology Using Legacy Metrics: Examination of SURF-IA Alerting for Runway Incursion Incidents

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Abstract

This study demonstrated an innovative method of utilizing expert raters and actual high-risk incidents to identify shortcomings of using legacy metrics to measure the effectiveness of new technology designed to mitigate hazardous incidents. Expert raters were used to validate the Enhanced Traffic Situational Awareness on the Airport Surface with Indications and Alerts (SURF-IA) model for providing alerts to pilots to reduce the occurrence of pilot deviation type runway incursion incidents categorized as serious (Category A or B) by the legacy FAA/ICAO Runway Incursion Severity Classification (RISC) model. The study concluded that the SURF-IA model did not yield an outcome of a Warning or Caution alert for all pilot deviation type runway incursion incidents classified as serious by the FAA/ICAO RISC model. The different outcomes between the RISC and SURF-IA models may result in misleading information when using the reduction in serious runway incursion incidents as a metric for the benefit of SURF-IA technology.

Keywords: runway incursion, Automatic Dependent Surveillance-Broadcast, Runway Incursion Severity Classification, Enhanced Traffic Situational Awareness on the Airport Surface with Indications and Alerts

Introduction

The Federal Aviation Administration (FAA) forecasts that airport tower operations associated with increased domestic capacity will increase by 23% between FY 2012 and FY 2032, which corresponds to an increased number of runway operations (FAA, 2011a). As a proactive measure for mitigating runway incursions, which have continued to increase both in rate and in number, the FAA is introducing various technologies as part of the Next Generation Air Transportation System (NextGen). NextGen is a series of interlinked programs, systems, and policies that implement advanced technologies

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and capabilities to dramatically change the way the current aviation system is operated. One of those technologies will be Enhanced Traffic Situational Awareness on the Airport Surface with Indications and Alerts (SURF-IA), which alerts pilots of potentially dangerous runway incursions (FAA, 2011b).

Runway incursions are defined as the incorrect presence of an aircraft on a surface designated for takeoff and landing, and are grouped into three types: (a) operational error/deviation/incident (OE/D/I), (b) vehicle-pedestrian deviation (V/PD), and (c) pilot deviation (PD) (FAA, 2009; ICAO, 2007).The proposed metric to measure the benefit of SURF-IA as a runway incursion mitigation strategy will be assessed by the FAA Office of Runway Safety through analysis of statistics for change in the rate of pilot deviation (PD) type runway incursions using the legacy Runway Incursion Severity Calculator criteria (ADS-B, 2011). However, different outcome severities from the RISC and SURF-IA models, when applied to the same runway incursion incident, may result in misleading information when using the reduction in runway incursion incidents classified as *serious* by the RISC model as the metric for assessing the effectiveness and benefit of new SURF-IA technology. The outcome differences may also result in a pilot not receiving a Warning, or Caution *alert*, from the SURF-IA flight deck technology for an event that would be categorized and reportable to the FAA by the RISC model as a *serious* runway incursion.

This paper was adapted from a study by Joslin (2013) that examined the use of legacy metrics from the RISC model to assess the effectiveness and benefits of the SURF-IA model for providing *alerts* to pilots to reduce the occurrence of PD type *serious* (Category A or B) runway incursion incidents. Category A is defined as a serious incident in which a collision was narrowly avoided while Category B is defined as an incident in which separation decreases and there is significant potential for a collision, which may result in time critical corrective/evasive response to avoid a collision. Category A and Category B are considered *serious* incidents (FAA, 2010a).

SURF-IA Model

The SURF-IA model was developed by the Radio Technical Commission for Aeronautics (RTCA) and published as Safety, Performance and Interoperability Requirements Document for Enhanced Traffic Situational Awareness on the Airport Surface with Indications and Alerts (SURF-IA)-RTCA/DO-323 (RTCA, 2010). Using Automatic Dependent Surveillance-Broadcast (ADS-B) technology, SURF-IA mitigates runway incursions by enhancing pilot situation awareness of other aircraft through a Cockpit Display of Traffic Information (CDTI). Automatic Dependent Surveillance-Broadcast is the FAA's satellite-based successor to radar. ADS-B makes use of Global Positioning System (GPS) technology to determine and share precise aircraft location information, and streams additional flight information to the flight deck of properly equipped aircraft (FAA, 2012a). The CDTI is enhanced with SURF-IA visual *alerts*, aural *alerts*, and *indications* that highlight traffic and runway status through alphanumeric information and symbology (Figure 1) (Jones & Prinzel, 2006; Jones, Prinzel, Otero, & Barker, 2009; Jones et al., 2010; RTCA, 2010). The SURF-IA logic defined conflicts as any movement between two aircraft that potentially could lead to a high speed collision on the runway surface. The conflict prediction was based on the relative speed and track between the two aircraft unless own-ship was on the surface and the conflicting traffic was airborne on approach, or when own-ship was airborne on approach and the conflicting traffic was intruding on the runway. In both of the latter cases, which involved one aircraft on the surface and one airborne aircraft, the *alert* logic was based on predicted time for the airborne aircraft on approach to reach the runway threshold (RTHRE). A Caution *alert* was issued if the predicted time to conflict was less than 35 seconds. A Warning *alert* was issued if the predicted time to conflict was less than 15 seconds (RTCA, 2010). SURF-IA also provided Runway Status Indications (RSI) and Traffic Indications

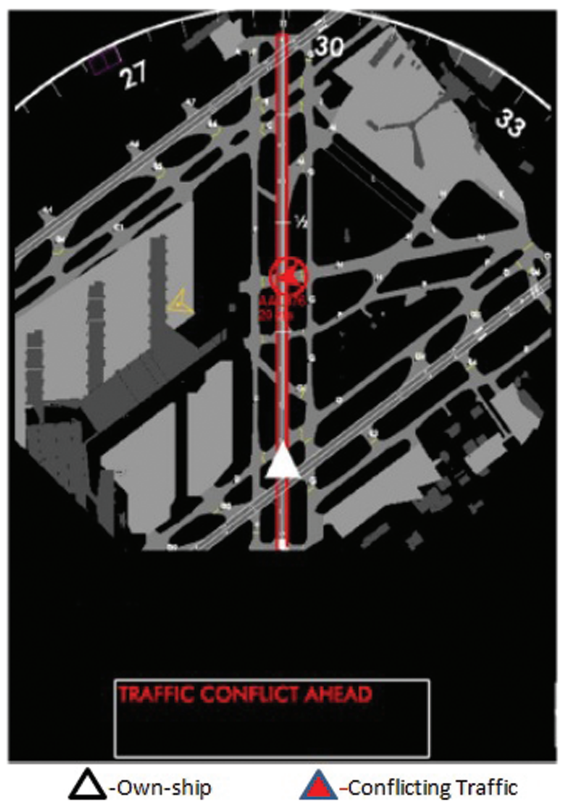

Figure 1. Conceptual cockpit display of a Warning alert from SURF-IA. Adapted from "Safety, Performance and Interoperability Requirements Document for Enhanced Traffic Situational Awareness on the Airport Surface with Indications and Alerts (SURF-IA)," by Radio Technical Commission for Aeronautics (RTCA/DO-323).

(TI) for traffic in normal operational conditions, consisting only of runway and/or traffic highlighting on a CDTI with no aural annunciations. The RSI and TI *indications* were intended to remind the pilot to verify runway status prior to proceeding and to increase the flight crews' situational awareness about particular relevant traffic that could affect runway safety, but did not require any time-critical or immediate action.

Runway Incursion Severity Classification Model

The FAA Office of Runway Safety tracks and classifies runway incursions, and uses a Runway Incursion Severity Classification model as part of its quality management system (QMS) to validate runway incursion severity classifications (FAA, 2006; FAA, 2011a; FAA, 2011b). A computer program, which automated the RISC model, was developed by the FAA and VOLPE National Transportation System Center with the aim of standardizing assessments of runway incursion events among the FAA and ICAO member states (ICAO, 2007). The Runway Incursion Severity Classification calculator classifies the outcome of runway incursions into one of three severity categories: "A", "B", or "C." Category D runway incursions are considered non-conflicting. The primary factors considered in the RISC model were horizontal/vertical proximity of the aircraft and/or vehicle/pedestrian, geometry of the encounter, evasive or corrective action, available reaction time, environmental conditions, and factors that affected system performance such as communication failures/errors (Figure 2).

The International Civil Aviation Organization (2007) also formalized the use of the Runway Incursion Severity Classification computer program for modeling and standardizing the classification of outcomes from runway incursions to provide consistent ratings by applying the same decision processes used by expert FAA raters. ICAO asserted that, "such consistency is deemed essential for being able to examine trends over time or see the effects of mitigation strategies" (ICAO, 2007, p. H-1).

RISC and SURF-IA Model Comparison

The RISC model was based primarily on *aircraft state*, environmental factors, and non-temporal quantitative factors for closest horizontal or vertical (*overflight*) proximity and could consider air traffic controller (ATC) intervention. The SURF-IA model for *alerts* relied on GPS derived quantitative *aircraft state* factors that considered horizontal and vertical proximity as well as temporal closure considerations. However, the proximity information entered into the RISC model from ATC deviation reports at times was based on subjective observations of incidents with regard to how close two aircraft came to colliding, rather than the precise GPS derived instrument readings for position and time that

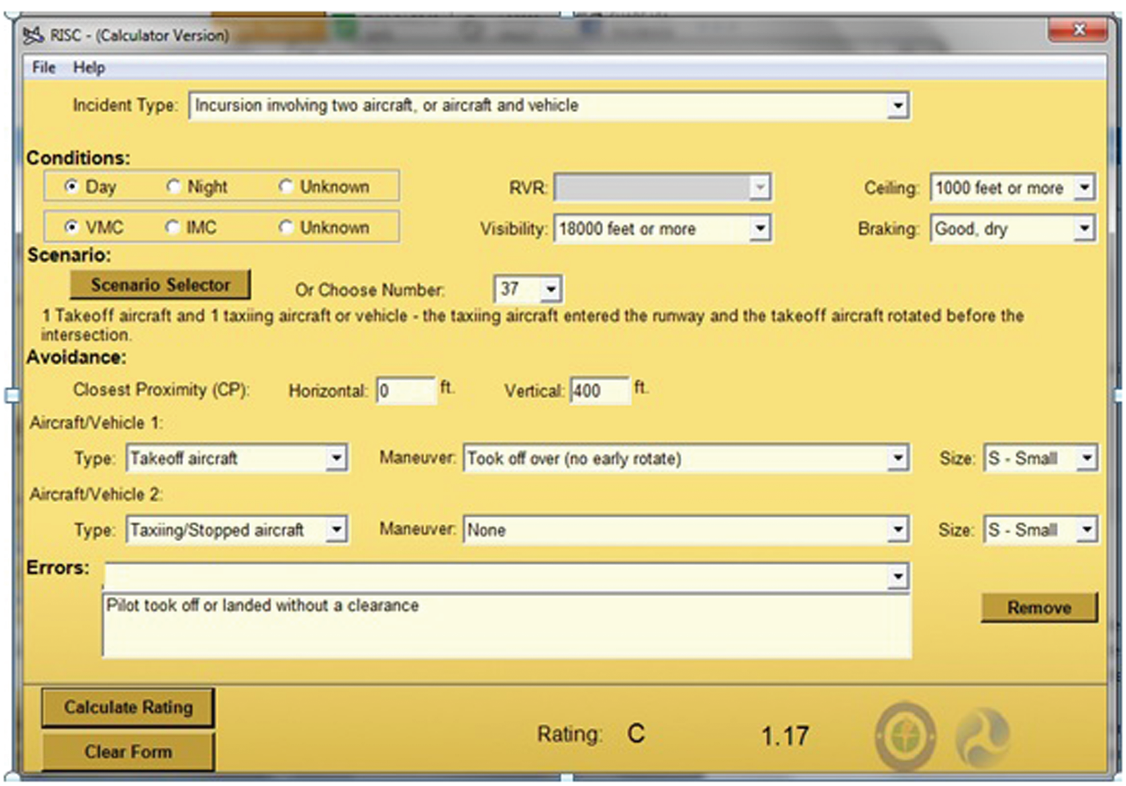

Figure 2. Runway Incursion Severity Classification calculator. Adapted from the "Manual on the Prevention of Runway Incursions," by ICAO, 2007.

Table 1
Comparison of primary model factors for RISC and SURF-IA

Factors for Model	FAA RISC Model	SURF-IA Alerts Model
Horizontal Separation	√	√
Vertical Separation	√	√
Aircraft Geometry	√	√
Runway Visual Range	√	×
Ceiling/Visibility	√	×
Braking Condition	√	×
Closure Rate	×	√
Day/Night	√	×
VMC/IMC	√	×
Aircraft Size	√	×
Aircraft Maneuver	√	√
Human Errors	√	×
ATC Intervention	√	×
On-Runway Criteria	Hold Short Line	Runway Shoulder
Distance from Runway	<1 mile from runway threshold	≤35 seconds to runway threshold

√ Considered × Not considered.
Note: Adapted from "Safety, performance and interoperability requirements document for enhanced traffic situational awareness on the airport surface with indications and alerts (SURF-IA)," by Radio Technical Commission for Aeronautics (RTCA), 2010, and "A method for rating the severity of runway incursions," by Cardosi, et al., *Proceedings of the USA/Europe 6th Air Traffic Management Research and Development Seminar*, 2005.

were used in SURF-IA (GAO, 2007). An overview of the primary model factors is provided in Table 1.

Other comparisons between SURF-IA *alerting* model and the RISC model for a *serious* (Category A or Category B) classification that could affect the outcomes were as follows:

1) SURF-IA model will *alert* when conflicting aircraft is within 35 seconds of the runway threshold (RTHRE); the RISC model is distance based, not time based.
2) Even when a take-off clearance was cancelled by ATC, SURF-IA will *alert* when conflicting traffic was on the same runway with either aircraft moving at greater than 40 knots with closure. The RISC model accounted for air traffic controller instructions and interventions.
3) SURF-IA will *alert* for any conflicting traffic operating below 1000 feet above the airfield elevation (AFE) with horizontal and/or vertical closure, while the RISC model for a *serious* incident typically requires less than 4000 feet horizontal separation or less than 100 feet vertical *overflight* separation.
4) The SURF-IA model defined an on-runway condition for an aircraft not lined up with the runway as any part of the aircraft inside the runway shoulder. The SURF-IA model also considered an aircraft to have met the on-runway condition when it was approximately lined-up with the runway and was within one runway width of the runway centerline (Figure 3). However, the FAA (2010a) Runway Safety Program and the RISC model defined an on-runway condition to be when any part of the aircraft was inside the runway hold position markings (i.e., hold line). A comparative depiction of the on-runway condition for the SURF-IA model and RISC model is provided in Figure 4 (FAA, 1989, 2010a; RTCA, 2010).

By definition, a runway incursion incident classified as *serious* (Category A or B) required an immediate or time

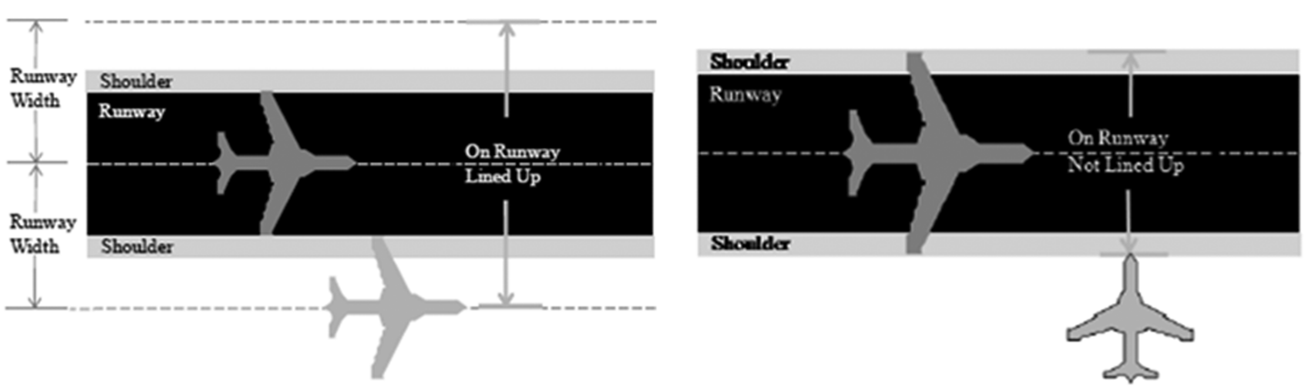

Figure 3. SURF-IA on-runway conditions. Adapted from "Safety, performance and interoperability requirements document for enhanced traffic situational awareness on the airport surface with indications and alerts (SURF-IA)," by RTCA, 2010.

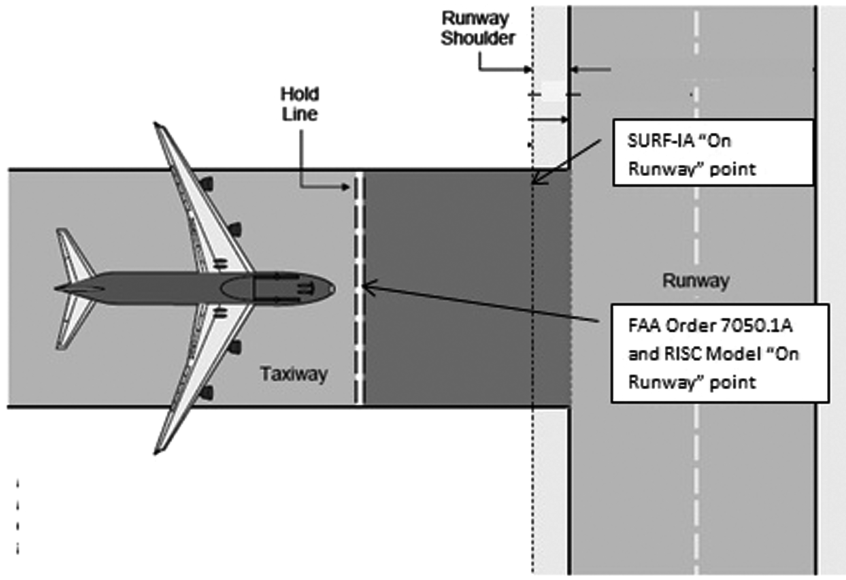

Figure 4. U.S. airport surface geometry on-runway points. Adapted from "Safety, performance and interoperability requirements document for enhanced traffic situational awareness on the airport surface with indications and alerts (SURF-IA)," by RTCA, 2010, "Runway Safety Program," by FAA, 2010a, and"Airport Design," by FAA, 1989.

critical response by the pilot in either aircraft, which is analogous to SURF-IA *alerts* (Warning or Caution) that also require a similar pilot response. The model for SURF-IA used the 14CFR §25.1322 definition of an *alert*, modified to only consider Warnings and Cautions and not Advisories (FAA, 2010b; RTCA, 2010). Hence, a *serious* (Category A or Category B) runway incursion outcome from the RISC model was equivalent, in terms of outcome severity, to a SURF-IA potential *alert* outcome.

Previous SURF-IA Research

The literature review indicated that previous research, simulations, and demonstrations of SURF-IA had all followed the accepted practice of benchmarking performance of conflict alerting algorithms using generic conflict scenario profiles, and not data from specific actual runway incursion incidents (Latimer, 2012). Latimer's (2012) research on creating a conceptual detection and avoidance model recognized the value of using actual incidents to examine outcomes of conflict alerting models and even presented a mix of generic scenarios and actual incidents; however, the study ultimately only utilized the generic scenarios. An analysis by Moertl, Lascara, Higgins, and Baker (2012) to estimate the safety benefits of SURF-IA based on the minimum RTCA (2010) SURF-IA requirement utilized data from a set of 24 historical Category A and Category B runway incursions from FY 2007 of which 12 were PD type. The runway incursions were reconstructed from limited available information, and required detailed assumptions about aircraft movement and timing based on aircraft typical performance characteristics, such as aircraft velocity and distance travelled down the runway during take-off/landing, and aircraft speed and altitude during an approach to a landing. The study considered both *indications* and *alerts*, and used three raters who assessed the effect of SURF-IA on reducing the severity of runway incursion incidents (i.e., Category A to Category B or Category B to Category C); however, no measures of inter-rater reliability were presented and the study utilized the FAA definition of runway incursion prior to it being harmonized with ICAO in 2008. Moertl et al. (2012) concluded that only 33% of the pilot deviation type incidents would have provided either a SURF-IA *alert* or *indication*. Lascara and Moertl (2012) subsequently developed a software tool called the Surface Surveillance Analysis Platform (SSAP) to determine, verify, and validate SURF-IA outputs from historic runway incursions; however, SSAP used outputs different than required by minimally compliant RTCA (2010) SURF-IA technology.

Methodology

Video reenactments of nine runway incursion incidents and the associated incident report data from the Aviation Safety Information Analysis and Sharing (ASIAS) system were reviewed by two expert raters. The ASIAS system is an online resource developed by the FAA that enables users to perform integrated queries across multiple databases, search an extensive warehouse of safety data, and display pertinent elements in an array of useful formats. The raters applied the baseline minimally compliant implementation of the RTCA/DO-323 SURF-IA model to determine which incidents would have triggered a SURF-IA Warning or Caution *alert*. The runway incursion incidents were rated on a dichotomous scale that classified the incidents as either SURF-IA *alerting* or SURF-IA *non-alerting*. The analysis focused on whether runway incursion incidents classified with an outcome as *serious* (Category A or B) using the RISC model would trigger a SURF-IA model outcome to display an *alert* (Warning or Caution) to the pilot. The minimum requirements for the SURF-IA alerting model were applied to each incident using the definitions and logic from RTCA/DO-323 (RTCA, 2010). The study did not consider or evaluate the physical location of the SURF-IA annunciation on the CDTI in the pilot's field-of-view, navigational positional accuracy, or aircraft deceleration/braking performance. Hence, the raters only rated whether or not a SURF-IA *alert* would have been triggered, without considering if a runway incursion would have been avoided.

Sources of the Data

The data were derived from two archival sources: (a) ASIAS reports, and (b) FAA runway incursion video reenactments. ASIAS reports of actual runway incursion incidents were already classified as *serious* (Category A or B) by the FAA Office of Runway Safety by applying the legacy Runway Incursion Severity Classification model. These data, posted on the ASIAS on-line database, were extracted and matched with the video reenactments of the incidents that were produced by the FAA Office of Runway Safety, which are periodically posted on the FAA Office of Runway Safety website (http://www.faa.gov/airports/runway_safety/videos/). The FAA video reenactments were developed through precise surveillance data from Airport Surface Detection Equipment, Model X (ASDE-X) and the Performance Data Analysis and Reporting System (PDARS), along with the narrative information from the ASIAS runway incursion reports. The FAA Office of Runway Safety produced reenactment videos of runway incursion incidents that were of high interest to the public, FAA, or the NTSB (R. Motzko, personal communication, July 11, 2012). The database consisted of 58 video reenactments from runway incursion incidents of all types and categories that occurred between CY 2005-CY 2012, of which nine were PD type *serious* (Category A or B) incidents. The sample set consisted of the entire population of *serious* pilot deviation type runway incursion incidents recorded by the FAA Office of Runway Safety in the ASIAS database, for which video reenactments were produced using actual surveillance data from the incidents.

Results

There was 100% agreement between the two raters for the outcomes from the SURF-IA model for the pilot deviation type runway incursion incidents categorized as *serious* (Category A or B) by the RISC model. Both raters agreed that 66.7% of the *serious* incidents would have a SURF-IA outcome of an *alert*, and 33.3% would not have alerted (Table 2, Table 3). The free-form comments provided insight into the explanation for the *aircraft states* for the *serious* incidents that did not provide a SURF-IA *alert* outcome. The factors that precluded a SURF-IA outcome of a Warning or Caution *alert* were: (a) SURF-IA model did not *alert* for a single aircraft wrong runway departure; (b) SURF-IA model did not *alert* for helicopter runway incursions; and (c) SURF-IA model did not *alert* for own-ship entering or crossing the runway and being overflown by another aircraft taking off on the same runway when the aircraft on take-off had already lifted off prior to own-ship entering the runway. All of the aforementioned factors that precluded a SURF-IA outcome of a Warning or Caution *alert* would have been rated as *serious* by the RISC model for the incidents analyzed. A common theme in the raters' qualitative comments was the lack of clear or harmonized definitions for the *aircraft states* used in the models for the SURF-IA technology and the legacy RISC metrics that were used to validate the benefit of the new technology. The *aircraft state* definition mentioned by the raters as being most troublesome was *on-runway*.

This study revealed the lack of correspondence between the outcomes from the RISC and SURF-IA models. Expressly, the study revealed that the SURF-IA model did not yield an outcome of a Warning or Caution *alert* for all runway incursion incidents classified as *serious*

Table 2
Own-ship/Traffic pairs from serious (Category A or B) runway incursion incidents assessed by the expert raters as having an alerting SURF-IA outcome

		Own-ship Aircraft State			
		Entering/Crossing Runway (Not Lined Up)	Take-off <80 knots	Approach to Runway (≤3 nm from Runway)	Stopped or Taxiing on Same Runway (Lined Up)
Traffic Aircraft State	Take-off from Same Runway	ASIAS ID 5826 ASIAS ID 7167 ASIAS ID 3374			
	Entering or Crossing Runway (Not Lined Up)		ASIAS ID 8173		
	Stopped or Taxiing on Same Runway (Lined Up)			ASIAS ID 11322	
	Approach to Runway (≤3 nm from Runway)				ASIAS ID 4828

Table 3
Own-ship/Traffic pairs from serious (Category A or B) runway incursion incidents assessed by the expert raters as not having an alerting SURF-IA outcome

ASIAS ID	Own-ship State	Traffic State	Factor
10923	Entering/crossing runway (not lined up)	Take-off from same runway	Traffic lifted off prior to own-ship entering the runway
10675	Entering/crossing runway (not lined up)	After landing roll-out on runway	Own-ship was a helicopter
10969	Take-off <80 knots	Not applicable	Single aircraft wrong runway departure

(Category A or B) by the FAA/ICAO RISC model. There were specific *aircraft states* in the baseline SURF-IA model that precluded an outcome of a Warning or Caution *alert* for runway incursion incidents classified as *serious* (Category A or Category B) by the FAA/ICAO RISC model.

Wrong Runway Departures

A wrong runway departure involving a single aircraft is classified as a *serious* runway incursion by the RISC model if there is a subsequent loss of separation from another aircraft, otherwise they are classified as Category D; however, the SURF-IA model only provides *alerts* for incidents involving two aircraft. Hence, all runway incursion incidents from wrong runway departures, even if the aircraft were SURF-IA equipped, would reflect as an increase in rate and number of runway incursions. The potentially misleading statistical analysis of the benefit of SURF-IA for runway incursion data when not designed to *alert* for wrong runway departures classified as *serious* by the RISC model, was estimated by looking at historical data for the number of wrong runway departures. An FAA (2007) report on U.S. domestic wrong runway departures indicated that from CY 1981-CY 2006 there were 696 incidents or accidents involving wrong runway operations. These data were collected prior to the FAA adopting the ICAO definition of runway incursions that added wrong runway departures. From FY 2008-FY 2013 (January), under the expanded definition of runway incursion, the ASIAS database recorded 23 wrong runway incidents. All of the aforementioned runway incursions, which involved single aircraft wrong runway departures with a subsequent loss of separation from another aircraft, would have been classified by the RISC model as *serious*. However, none would have resulted in a SURF-IA *alerting* outcome because the SURF-IA model does not provide *alerts* for incidents involving one aircraft. Hence, these wrong runway departure incidents would have been interpreted as missed alerts from SURF-IA technology.

Validating Legacy Metrics for New Technology

This study developed a step-by-step methodology that filled the gap for assessing the validity of legacy/traditional metrics for application to new technology (Table 4).

Conclusions

The study revealed that the SURF-IA model did not yield an outcome of a Warning or Caution *alert* for all runway incursion incidents classified as *serious* (Category A or B) by the FAA/ICAO RISC model. There were specific *aircraft states* in the baseline SURF-IA model that precluded an outcome of a Warning or Caution *alert* for runway incursion incidents classified as *serious* (Category A or Category B) by the FAA/ICAO RISC model: (a) wrong runway departures, with a subsequent loss of separation with another aircraft, (b) traffic entering the runway after own-ship lift-off from same runway, and (c) helicopter operations that cross runways at other than established taxiways. The baseline version of SURF-IA was not intended for installation on helicopters; however, an add-on safety analysis may be able to show that helicopters could safely operate SURF-IA (RTCA, 2010).

In FY 2012 there were 10 *serious* (Category A or B) pilot deviation type runway incursions, which was a tenfold increase over the one (1) runway incursion of this type and category reported in FY 2011. This study used four of the ten incidents recorded in FY 2012, of which three were rated as *non-alerting* by the SURF-IA model. If this study had assumed that all aircraft involved in the FY 2012 incidents had SURF-IA equipment installed, and then used the change in PD type runway incursions classified as *serious* by the RISC model as a metric to assess the effectiveness and benefit of SURF-IA, at least three of the ten FY 2012 incidents would not have provided a SURF-IA alert. Hence, the FY 2012 runway incident data would have been misleading by indicating that the SURF-IA model was at best only 70% effective and beneficial in providing an *alert* to mitigate the hazard from runway incursion incidents classified as *serious* by the legacy RISC model metric. The aforementioned different outcome severities from the RISC and SURF-IA models may result in misleading information when using the reduction in *serious* runway incursion incidents, classified by the RISC model, as a metric for the benefit of SURF-IA technology.

This study demonstrated an innovative method of utilizing expert raters and actual high-risk incidents to identify the shortcomings of using legacy metrics to measure the effectiveness of new technology designed to mitigate hazardous incidents. The expansion of the methodology used in this study to other areas lies in first identifying the

Table 4
Step-by-step methodology for validating metrics for new technology

1	Determine the intended function of the new technology. For this study, the intended function of the new technology was the reduction in serious runway incursions.
2	Identify the model for the traditional or legacy metric used to measure the outcome from the intended function of the new technology. For this study, the RISC model was the legacy metric used for categorizing the severity of runway incursions.
3	Identify the model for the new technology (e.g., SURF-IA).
4	Identify the limitations of the technical capabilities of the new technology (e.g., SURF-IA model will not alert for single aircraft wrong runway departures).
5	Identify any differences in definitions between the models (e.g., on-runway condition was defined differently in the RISC model versus the SURF-IA model).
6	Identify expert raters in the field of the new technology.
7	Gather archival data from actual cases of interest that have already been classified by the legacy/traditional metric. For this study the cases of interest were pilot deviation type runway incursion incidents classified as serious (Category A or B) by the RISC model.
8	Select a sufficient number of cases of interest to establish a statistically significant sample size.
9	Have the expert raters apply the model for the new technology (e.g., SURF-IA) to the cases of interest, and determine the outcome from the new technology (e.g., alerting or non-alerting).
10	Gather qualitative comments from the raters to: • explain why or how they determined their rating • provide lessons learned • identify which cases were most troublesome • recommend modifications to the model(s)
11	Calculate the inter-rater reliability, and descriptive statistics (e.g., percentage agreement, counts).
12	Identify the cases and conditions where the outcome from the metric used to measures the benefit of the new technology does not match the outcome from the new technology, as assessed by the expert raters. The cases identified in this study were those where the SURF-IA model did not yield an outcome of a Warning or Caution alert for runway incursion incidents classified as serious (Category A or B) by the RISC model.
13	Identify modifications to the model(s) that would harmonize the metrics with the outcome of the new technology.

known limitations and capabilities in the actual design of any new technology and then using expert raters to see if, and how, the outcomes from legacy metrics were affected. If the model differences yield outcomes that do not match, the design of the new technology and/or the design of the metric for measuring the benefit of the new technology may need adjustment. The overall implication from this study is that the implementation of new technology demands a concurrent validation of the metrics used to assess its effectiveness. The methodology is generalizable and can be applied to other high-risk areas, such as medicine, nuclear power plants, and other modes of transportation.

Recommendations

Prior to the certification of SURF-IA for use on aircraft, it is recommended that further study with a larger number of runway incursion incidents classified as *serious* (Category A or B) by the RISC model is conducted to identify other *aircraft states* and associated factors that do not trigger a SURF-IA *alerting* outcome. It is also recommended that prior to using the ASIAS runway incursion data as a metric for the benefit of SURF-IA, the FAA develop a process for identifying and tracking ASIAS reported *serious* runway incursion incidents which are known not to trigger an *alerting* outcome in the baseline SURF-IA. Data from the runway incursion incidents involving runway *aircraft states* not designed to trigger an *alert* by the baseline SURF-IA model should not be considered when assessing the effectiveness and benefit of the new SURF-IA technology for reducing runway incursion incidents. However, consideration should be made to harmonize the technology (SURF-IA) and the metric (RISC) used to assess its effectiveness by either improving the SURF-IA model technical capabilities to accommodate all possible *aircraft states* that the RISC model would classify as *serious* (Category A or B) runway incursion incidents, or modifying the RISC model to match SURF-IA criteria.

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