General Aviation Airport Runway Incursions: A Qualitative Approach to Examining Reasons for, Barriers to Addressing, and Lessons Learned from Airport Managers' First-Hand Experiences

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ABSTRACT

TITLE: General Aviation Airport Runway Incursions:

A Qualitative Approach to Examining Reasons for, Barriers to Addressing, and Lessons Learned from Airport Managers' First-Hand Experiences

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The purpose of the study was manifold: (a) to understand the reasons for runway incursions (RIs) at general aviation (GA) airports, (b) to describe the barriers to addressing runway incursions at GA airports, and (c) to describe the lessons learned from addressing runway incursions at GA airports. This study was based primarily on a phenomenological research design, which led to a set of inductively derived conjectures.

The study's sample consisted of 10 GA airports that had at least 10 times the number of GA operations than the number of air carrier (commercial) operations as reported in the Air Traffic Activity Data System (ATADS) across five Federal Aviation Administration (FAA) regions (Alaskan, Southwest, Northwest Mountain, Southern, and Western Pacific). Using the FAA's Aviation Safety Information Analysis and Sharing (ASIAS) database, it was reported that these 10 GA airports experienced the highest frequency of pilot deviations (PDs), and vehicle/pedestrian deviations (V/PDs) runway incursions events that had occurred over the last 7.5 years (January 1, 2010 through June 30, 2017).

Using the qualitative data analysis software tool, Nvivo©, and Spradley's (1979) approach, the data were organized into three domains, which corresponded to the three research questions (RQs). The results of data analysis led to the development of common themes and patterns (the phenomenological design component), and these common themes and patterns then served as the basis for formulating corresponding conjectures (the first stage of grounded theory design).

The findings suggest that there are numerous reasons that contribute to RIs at GA airports such as compromised situation awareness (SA) and communication, airfield access, resource related issues, and attention to reporting RIs. The barriers faced included airfield infrastructure, and pilot related issues; and the lessons learned were that collaborative communication, and modified physical environments can mitigate the occurrences of RIs. The findings are beneficial to airport managers in that it provided a succinct synthesis of RI mitigation information, for some of which can be implemented in the interim, while providing recommendations for what can be done long term to improve aviation safety.

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List of Abbreviations

A-SMGCS	Advanced Surface Movement Guidance and Control System
AAD	Assistant Airport Director
AD	Airport Director
ADGA	Assistant Director General Aviation
ADS-B	Automatic Dependent Surveillance–Broadcast
AAAE	American Association of Airport Executives
AK	Alaskan
ALPA	Air Line Pilots Association
AM	Airport Manager
AMASS	Airport Movement Area Safety System
AMDB	Airport Mapping Database
ANOVA	Analysis of Variance
AIDS	Accident and Incident Database
AIP	Airport Improvement Program
AOA	Airport Operations Area
AOPA	Aircraft Owners and Pilots Association
AOM	Airport Operations and Maintenance Supervisor
AOM	Airport Operations Manager
ASIAS	Aviation Safety Information Analysis and Sharing
ASDE-3	Airport Surface Detection Equipment Model 3

ASDE-X Airport Surface Detection Equipment Model X

ASRS Aviation Safety Reporting System

ATADS Air Traffic Activity Data System

ATC Air Traffic Control

ATCT Air Traffic Control Tower

ATL Hartsfield-Jackson Atlanta International Airport

ATO Air Traffic Organization

ATP Airline Transport Pilot

ATSB Australian Transportation Safety Bureau

BAMOT Baseline Moving Map Traffic Display Audible Alert and Graphical

BMO Baseline with Moving Map and Own Ship

BMOT Baseline with Moving Map and Own Ship and Traffic Display

CAST Commercial Aviation Safety Team

CPDLC Controller Pilot Data Link Communication

DAO Director Airport Operations

DOT Department of Transportation

DVT Deer Valley Airport

EAA Experimental Aircraft Association

EASA European Aviation Safety Agency

EFB Electronic Flight Bag

EMM Electronic Moving Map

F	Value from ANOVA or Regression Analysis
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FAROS	Final Approach runway Occupancy Signal
FBO	Fuel Base Operations
FIE	Frontiers in Education
FIT	Florida Institute of Technology
FRAM	Functional Resonance Accident Model
FY	Fiscal Year
GA	General Aviation
GC	Ground Control
GPS	Global Positioning System
HF	Human Factors
HUD	Head-up Display
ICAO	International Civil Aviation Organization
IEEE	Institute of Electrical and Electronics Engineers
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
IR	Infrared
IRB	Institutional Review Board
LAHSO	Land and Hold Short Operations

LCGS Low Cost Ground Surveillance System

LOC Locus of Control

M Mean

Mdn Median

N Population size

NAS National Airspace System

NASA National Aeronautics and Space Administration

ND Navigation Display

NM Northwest Mountain

NPIAS National Plan of Integrated Airport Systems

NTSB National Transportation Safety Board

OE Operation Error

OED Operational Error/Deviations

OEP Operational Evolutional Plan

OI Operational Incident

OIG Office of Inspector General

OPS Operations

P1 Participant 1

P2 Participant 2

P3 Participant 3

P4 Participant 4

P5	Participant 5
P6	Participant 6
P7	Participant 7
P8	Participant 8
P9	Participant 9
P10	Participant 10
PAJN	Juneau Alaska International Airport
PD	Pilot Deviation
PEGASAS	Partnership to Enhance General Aviation Safety, Accessibility, and Sustainability
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RI	Runway Incursion
RIIEP	Runway Incursion Information Evaluation Program
RIM	Runway Incursion Mitigation
RIPS	Runway Incursion Prevention Systems
RIPSA	Runway Incursion Prevention Shortfall Analysis
RQ	Research Question
RSA	Runway Safety Area
RSAT	Runway Safety Action Team
RSG	Runway Safety Group

RSO Runway Safety Office

RSP Runway Safety Plan

RWLS Runway Status Light System

RWS Runway Incursion Database

RWY Runway

S Southern

SA Situation Awareness

SD Standard Deviation

SI Surface Incident

SMS Safety Management System

SOP Standard Operating Procedure

STAMP Systems-Theoretic Accident Model and Process

STIS-B Surface Traffic Information Service-Broadcast

SW Southwest

TCAS Traffic Collisions Avoidance System

TOPAZ Traffic Organization and Perturbation Analyzer

TRID Transportation Research Information Database

TSA Transportation Security Administration

Txy Taxiway

U.S. United States

VFR Visual Flight Rules

V/PD Vehicle and Pedestrian Deviation

VMC Visual Meteorological Conditions

WP Western-Pacific

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I would also like to thank my parents who taught me the value of hard-work and a good education; because you can have everything taken from you in life, but no one can ever take your education.

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Dedication

This feat really took the village. I dedicate this academic accomplishment and milestone to my tribe; they kept me going during the most trying of times. It is said that our path is ours alone to walk. With that in mind, this accomplishment is dedicated to the personal faith, courage, and endurance it takes to walk one's path, especially during those moments for which the next step is uncertain. As Henry Ford said: “when everything seems to be going against you, remember that the airplane takes off against the wind, not with it.”

Chapter 1

Introduction

Overview

This chapter provides the reader with an overview of the current study by introducing the background of runway incursions (RIs), which are defined as the incorrect presence of an aircraft, vehicle or person on landing and takeoff areas (see below for formal definition), the problems RIs present, and the necessity for further RI research. The reader is informed about why the emphasis of the study was on general aviation (GA) operations, RI areas that prior research addressed, the gap filled by the current study, and the definitions of key terms that were used. The primary focus of the current study was to understand GA airport managers' perceptions of reasons for, barriers to addressing, and lessons learned from addressing RIs at their airports, and formulate conjectures. A phenomenological design was employed to capture the managers' unique perspectives relative to this phenomenon, and the first stage of grounded theory that involved building—but not testing—theory was used to inductively formulate conjectures from the data. The significance of the study is discussed as it applied to industry, and the chapter concludes with a list of the study's limitations and delimitations.

Background and Purpose

Background. According to the Federal Aviation Administration (FAA) Runway Safety Statistics database, an increase of 299 RIs was reported from 2015

(1,458 RIs) to 2019 (1,757 RIs), and thus far for the first quarter of 2020, 449 RI events have been reported (FAA, 2020). The escalating RI statistics highlight that RI events have been continuously increasing annually since 2015. Two pressing concerns arise from these statistics. First, the increasing rate of the RI events poses an imminent threat to aviation safety. Second, the threat warrants further investigation in order to understand the reasons for, and problems in addressing RI events, and what can be learned from this quandary. The current study addressed this.

What are RIs. The FAA defined RI as "any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and takeoff of aircraft" (FAA, 2015a, p. 1). RIs are classified into three main categories, and are summarized in Table 1.1 below (FAA, 2015a, p.1):

a. Operational Incidents (OI), which is the action of an Air Traffic Controller (ATC) that results in less than required minimum separation between 2 or more aircraft, or between an aircraft and obstacles, (vehicles, equipment, personnel on runways) or clearing an aircraft to take off or land on a closed runway.
b. Pilot Deviation (PD), which is an action of a pilot that violates any Federal Aviation Regulation. For example: a pilot crosses a runway without a clearance while enroute to an airport gate.

c. Vehicle/Pedestrian Deviation (V/PD), which are pedestrians or vehicles entering any portion of the airport movement areas (runways/taxiways) without authorization from air traffic control.

Table 1.1
Three Main Types of Runway Incursions (RIs)

	RI Types	
Operational Incident (OI)	**Pilot Deviation (PD)**	**Vehicle/Pedestrian Deviation (V/PD)**
The action of an Air Traffic Controller (ATC) that results in less than required minimum separation between 2 or more aircraft, or between an aircraft and obstacles, (vehicles, equipment, personnel on runways) or clearing an aircraft to take off or land on a closed runway.	An action of a pilot that violates any Federal Aviation Regulation. For example: a pilot crosses a runway without a clearance while enroute to an airport gate.	Pedestrians or vehicles entering any portion of the airport movement areas (runways/taxiways) without authorization from air traffic control.

The severity of an RI is categorized by an assessment panel that evaluates the severity on a range by letter, and is summarized in Table 1.2 (FAA, 2015b):

a. “A” is an incident in which a collision is narrowly avoided.

b. “B” is an incident in which separation decreases and there is a significant potential for collision, which may result in a time-critical corrective/evasive response to avoid a collision.

c. “C” is an incident characterized by ample time and/or distance to avoid a collision.

d. “D” is an incident that meets the definition of an RI, such as incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and takeoff of aircraft, but with no immediate safety consequences.

Table 1.2

Categories of Increasing Severity of Runway Incursions

D	C	B	A	Accident
Incident that meets the definition of runway incursion such as incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and takeoff of aircraft but with no immediate safety consequences.	An incident characterized by ample time and/or distance to avoid a collision.	An incident in which separation decreases and there is a significant potential for collision, which may result in a time critical corrective/ evasive response to avoid a collision.	A serious incident in which a collision was narrowly avoided.	An incursion that resulted in a collision

Why it is important to study RIs. It is most imperative to study the topic of RIs for two main reasons. First, RIs have been a consistent problem for the aviation safety community from present-day to as far back as the 1977 Tenerife disaster (FAA, 2017; Thomas, 2002). Second, it is evident that the aviation industry has been and will continue to be interested in learning more about RIs and accumulating as much information as possible. As evidenced by, aviation organizations and trade publications have regularly been writing about the topic over the years (ALPA, 2007; AOPA, 1998; Aviation Week and Space Technology, 2015; General Aviation News, 2017; Mid West Flyer, 2016). The articles discussed below illustrate how RIs are a potentially deadly issue and that the frequency of these events keeps increasing.

Consistent RI problems. On March 27, 1977, on the island of Tenerife, two Boeing 747 passenger jets collided on the runway, resulting in the loss of 583 lives, and went down in history as one of the deadliest and most infamous accidents in aviation history. According to the Federal Aviation Administration (2017), the event highlighted just how catastrophic RIs can be and was the impetus for investigations and recommendations into RI mitigations (FAA, 2017). Moreover, Thomas (2002) illustrated just how problematic RIs have been to aviation safety by systematically citing over 15 different major RI events spanning over 2 decades, beginning with Tenerife in 1977 and capping off with a Singapore airlines RI event in 2000. Table 1.3 summarizes these major RI events. A more recent search for RI events in the FAA (2018) Runway Safety database found that from the year 2000 through 2017, there were 436 major Category A and Category B RI events. This is summarized in Table 1.4.

Table 1.3
Summary of Major RI Events from 1977 to 2000

Year	RI Event
1977	Two commercial airliners collided on the runway in Tenerife, killing 583 people.
1983	Two commercial airliners collided on the runway in Madrid, Spain, killing 100 people.
1984	The pilot of a small business jet made an early takeoff to avoid hitting a DC-9 that had taxied onto the runway. The business jet passed just ten feet over the commercial airliner.
1988	The pilot of a small, single engine aircraft was forced to abort a landing at an uncontrolled airport when a construction vehicle pulled onto the runway as the aircraft was descending for its final approach.
1990	Eight people died and 36 were injured when a Boeing 727 and a DC-9, both operated by North-West Airlines, collided on a fog-covered runway in Detroit, Michigan.
1990	One person was killed in Atlanta, Georgia, when a Boeing 727 landed and collided with a small, twin-engine aircraft that had not taxied clear of the runway.
1991	34 people were killed when a Boeing 737 landed and collided with a commuter aircraft stopped on the runway at the Los Angeles International Airport.
1994	The occupants of a small twin-engine aircraft were killed when the aircraft taxied into the path of a DC-9 landing on the same runway in St. Louis, Missouri.
1996	A twin-engine business aircraft taxied onto a runway at an uncontrolled airport in Quincy, Illinois as a commuter aircraft was landing, killing 14 people.
1999	Four separate incidents occurred (two at Chicago O’Hare, one at Los Angeles, one at JFK in New York) in which a commercial airliner on takeoff flew within 300 feet of another commercial airliner that had taxied onto the runway.
1999	Four people were killed when two single-engine private aircraft collided on a runway in Sarasota, Florida.
2000	A Singapore Airlines B-747 took-off at night in a typhoon on a closed runway in Taiwan and collided with construction equipment killing 82 people.

Table 1.4
Tabulation of Major Category A and B RI Events from 2000 to 2017

	Total A and B Runway Incursions	Fiscal Year
	67	2000
	53	2001
	37	2002
	32	2003
	28	2004
	29	2005
	31	2006
	24	2007
	25	2008
	12	2009
	6	2010
	7	2011
	18	2012
	11	2013
	14	2014
	15	2015
	19	2016
	8	2017
Total	436	17 years

Industry interest in RIs. The Air Line Pilot Association (ALPA, 2007) is an airline pilot union that presents its information from the pilots' perspective. ALPA reported that in the United States since 1990, five fatal accidents involving airliners were attributed to RIs; all events were extensively covered by the media, sparking a public debate about aviation safety in the U.S. The most deadly of these occurred in February 1991, at Los Angeles International Airport when a B-737 collided with a turboprop airliner sitting on a runway, killing 34 people. Since 1988, when the FAA began tracking RI statistics at towered airports in the U.S., the evidence has supported that as traffic volume increases so do to RI accidents. From 1988 to 1990, as traffic volume at towered airports in the U.S. increased 4.76%, the RI rate at these airports increased more than 43%. From 1990 to 1993, when traffic volume suddenly decreased 5.34%, the RI rate quickly dropped by 30% (ALPA, 2007).

In their article, ALPA reported on July 23, 2006, a B-747 freighter landing at Chicago O'Hare International Airport rolled through an intersection as a B-737 with 120 passengers and five crewmembers aboard was taking off on the runway. The National Transportation Safety Board (NTSB) later estimated the miss distance at 35 feet. Three days later, a small jet airliner at Los Angeles International Airport taxied into the path of a turboprop airliner, making an intersection takeoff. The turboprop missed the jet by an estimated 150 feet vertically and 50 feet horizontally. Although high-profile accidents as the ones discussed here usually have been the catalyst for change in industry, the aforementioned incidents generally serve as harsh reminders that the potential for a catastrophe is undeniable as air traffic increases (ALPA, 2007).

As a trade publication, ALPA (2007) presents a salient argument for a call to arms to combat this phenomenon. In doing so, ALPA highlights the imminent and consistent threat that RIs pose to aviation safety, despite the mitigations that have already been implemented and those that have not due to political, financial, or technological impediments. Citing U.S. Commercial Aviation Safety Team (CAST), ALPA reported that RIs can be significantly reduced by up to 95% with a combination of technologies that greatly improve the flight crew's situation awareness and provide conflict-alerting capability during ground operations.

According to ALPA (2007), the FAA reported that between fiscal years (FY) 2001 to 2006, 325 incursions have occurred on average annually over each of those 5 years with 2006 experiencing an increase to 330 incursions. At approximately 63 million takeoffs and landings each year, the U.S. stands to experience about five incursions per million operations. The advent of Safety Management Systems (SMS) allowed effective risk management of the air transportation systems and allocation of resources in the appropriate areas. Risk matrices were then developed to evaluate likelihood, severity, and acceptability of risk, which is generally color-coded red (unacceptable), green (acceptable), and yellow (acceptable with mitigation). Currently, the FAA classification of RI is limited by its fault-based approach that ALPA perceives as a hindrance to RI mitigation solutions. The most effective way to reduce safety risk would be to focus on systemic deficiencies that are contributing to these problems as opposed to taking airport or runway-specific approaches.

ALPA (2007) reported that the FAA has an established Hierarchy of Controls that discusses actions that should be taken to deal with various risks. This hierarchy consists of various actions that range from most to least effective, and are as follows:

a) Design the hazard out and modify the system (hardware/software).
b) Deal with systems involving physical hazards and organizational systems.

c) Install physical guards or barriers and reduce exposure to the hazard or reduce the severity of consequences.
d) Issue warnings, advisories, or signals of the hazard.
e) Institute procedural changes to avoid the hazard or reduce likelihood or severity of associated risk.
f) Train pilots and controllers to avoid the hazard or reduce the likelihood of an associated risk.

A steady amount of RI mitigations fall under actions (c), (d), or (e), because those are easier and less expensive to implement when compared to actions (a) and (b).

ALPA (2007) highlighted their contributions to RI mitigation, some of which were adopted by the International Civil Aviation Organization (ICAO). These included new airport signs and paint markings, vehicle driver training programs, pilot training programs, localized RI action teams, SOPs for Ground Operations, (online) pilot education, and Runway Incursion Information Evaluation Program (RIIEP). Notwithstanding the effectiveness of this battery of applicable risk mitigation solutions employed, the rate of RIs has continued to increase, all of which, according to ALPA, can be drastically reduced by up to 95% if CAST's aforementioned recommendations are executed. ALPA concluded by reiterating that RIs is not a new problem, as it has been constant since the inception of the NTSB's Most Wanted list in 1990. The government has allocated invaluable time and resources in an attempt to address this perennial quandary, yet the current level of risk is unacceptable as the likelihood of RIs remain high.

Landsberg, (1998) published an article for Aircraft Owners and Pilot Association (AOPA) regarding the threat and frequency of RI related incidents and accidents. Lansberg, (1998) noted that although GA is demerited as a top RI contributor, air carriers are the usual culprits for RI related accidents, given that GA accounts for the majority of incidents. Lansberg, (1998) surmised that RI contributors include the usual suspects such as poor communication between ATC and pilots, decreased situation awareness, poor or inadequate training, airport vehicle drivers, insufficient or inept airport signage, and unfamiliarity with airport layout.

Following Lansberg, (1998) targeted contributors, ALPA (2007) summarized what it believes to be the top two leading causes of GA RIs: (1) inadequate knowledge or experience with ATC procedures and language, and (2) inadequate knowledge or experience with the airport. With respect to RI mitigation remedies, ALPA reported that rather than imposing more regulation, perhaps it would be more prudent to enforce currently existing regulations relative to specific areas such as pilot flight proficiency in airport and traffic pattern operations, as well as reinforce the value of initial and recurrent training. What is most noteworthy about the ALPA and Lansberg, (1998) articles is that even though they are roughly a decade apart, they highlight that RIs remain a threat to aviation safety almost a decade later.

In contrast to ALPA (2007) and Lansberg, (1998) another trade publication, General Aviation News (2017) interviewed consultants from RS&H—an architecture, engineering, and consulting firm—which conducted a study of 50 RIs that had occurred since 2004 at the Juneau (Alaska) International Airport (PAJN). RS&H concluded that the taxiways did not meet current FAA design standards, which was ultimately the risk factor that could lead to collisions between aircraft. RS&H recommended that the main taxiway be split into two separate, narrower taxiways. In doing so, the pavement width would be reduced, thereby reallocating the signage and lighting closer to the pilot's line of sight. This in turn, would reduce the possibility of pilots experiencing decreased situation awareness. What is noteworthy about this article is that it presents another RI risk factor, namely, dated airport infrastructure, which when compounded by other risk factors such as poor lighting and signage, poses a seriously amplified threat to aviation safety.

The issues and suggested mitigation approaches to addressing RIs offered by the FAA, AOPA (Lansberg, 1998), ALPA, and General Aviation News have been relative to technical or structural RI risk factors. In contrast to this perspective, Schabla (2016), for the MidWest Flyer online newsletter, approached RI mitigation from a human factors perspective by reminding pilots of their duty to the safety of themselves, their passengers, and other aviation personnel who occupy shared space. The article summarized for pilots six concise reminders to avoiding RIs: (a) Actively monitor both ground and tower communications when possible, visualize what you hear over the radio on your airport diagram, and familiarize yourself with electronic flight bags (EFBs) and airport layouts; (b) Keep communication clear and concise, and repeat instructions as needed. Ensure that radios are working properly, and maintain standardized phraseology; (c) Maintain cockpit sterility during taxi, takeoff, and landing operations; (d) Maintain situation awareness and admit when you're lost; (e) Understand airport signs, lights, and markings; and (f) Adhere strictly to procedures and never assume anything regardless of familiarity with the process and airport.

Schabla (2016) did an excellent job of reminding the reader that although airport environs and various technologies play an integral role in RI mitigation, safety starts and ends with the human user maintaining awareness and vigilance. The article also reported that airliners are responsible for fewer RIs than GA even though they are responsible for more flights to/from the nation's busiest airports, and attributed this safety discrepancy to airliners' adherence of stricter procedures and sterile rules compared to the much more laissez-faire nature that is typical of GA. The aforementioned articles reinforced the concern that RIs remain a very real threat to aviation safety.

The past trade articles have demonstrated that RIs in general still remain a problem. However, not all RI types occur equally. According to Croft (2015) for the trade publication, Aviation Week and Space Technology, in 2010, 57% of RIs were attributed to pilot deviations (PDs), 33% were Operational Incidents (OIs), and 10% were Vehicle and Pedestrian Deviations (VP/Ds). By the end of 2014, however, PDs decreased by 39%, OIs increased by 48%, and VP/Ds remained constant. Croft (2015) surmised that the increase in OIs were a direct result of the FAA's Air Traffic Safety Action Program non-punitive provisions, which make controllers more comfortable to report events.

Regarding category types (see Table 1.2), Croft (2015) reported that from 2010 to 2014, the FAA recorded very low numbers of Category A and B incursions but saw the most growth in Category C incursions. Croft (2015) reported there has been some skepticism relative to the process of categorizing incursions because there are three organizations that vote on how an incursion is categorized: Flight Standards, Office of Airports, and Air Traffic Organization. The concern here is that possible discord among these three organizations regarding their each individual categorization of incursions could have an adverse effect on how incursions end up being categorized, and inevitably recorded.

Why focus on GA. Croft (2015) reported that specific to Parts 121 and 135 operations, the decrease in RIs were attributed to the increased focus on effectively implementing risk mitigations such as a combination of procedural, technological, and human factors methods. This was further compounded by the rise in SMS, which provided a non-punitive medium for pilots and controllers to report events, and in exchange, the FAA was able to gather pertinent data and target problem areas. These mitigation actions at Part 121 and 135 operations have reduced RIs. Comparatively, GA airports do not have these same advantages, for which the disparity in these advantages needs to be explored, especially because GA has more flights, and more flights mean more incursions.

Croft (2015) reported that according to FAA records, 35 of the largest U.S. airports were outfitted with Airport Surface Detection Equipment Model X (ASDE-X) and Automatic Dependent Surveillance-Broadcast (ADS-B), which provided controllers with improved situational awareness that has led to a reduction in the number of Category A and B incursions. Furthermore, these technologies also have laid the foundation for other types of anti-incursion technologies such as runway status lights. According to Croft (2015), these could be embedded in the runway, or at runway crossings, that turn red when the runway is occupied, directly alerting pilots of a hazard. Overall, the FAA determined that the technological programs have been successful in reducing RIs, and adding runway status lights will only enhance the success of these technologies. RI mitigations for small airports were not discussed however, and yet again, GA was overlooked.

The articles presented above span roughly over 2 decades, and effectively illustrate that RIs have been a longstanding threat to aviation safety, despite risk mitigations implemented over the years, and still continue to be a risk today. Based on what has been reported over the past 2 decades by the various aviation trade magazines relative to the efforts used to address and mitigate RIs at GA airports, the data shows that the frequency of RIs continues to increase, particularly for PDs and V/PDs. Given this current situation, perhaps this issue should be viewed from readjusted lenses. This is what the current study endeavored to do.

Current RI research. Supplementing the reporting done by the various aviation trade publications, several formal studies have been conducted. Dicus and Tarry (2019) examined different runway safety training methods to see which one was the most effective. In doing so, this will change the way educational content is delivered and how this change in delivery could impact how well pilots learn the material. Metalinos (2018) also looked at training in addition to education and collaboration, and how these can be improved to reduce the occurrence of RIs at airports. Okate (2016) looked beyond training and investigated the role that humans play in RIs, for which these findings could result in the development of RI prevention plans to reduced these occurrences. With all these various RI studies and mitigation recommendations, Byrne (2017) examined whether the FAA 2009 to 2011 Runway Safety Program (RSP) has effectively reduced RIs at the nation's five busiest airports using data from 3 years before and 3 years after the RSP (October 1, 2005 through September 30, 2014).

Bisch, Calabreses, and Donohoe (2016), published a report for the U.S. Department of Transportation (DOT) that presented findings of an RI analysis conducted over the past 11 years. As with most RI investigations, the aim of the findings was to inform the development and deployment of technologies intended to prevent or mitigate future RI occurrences. The focus was on traffic scenarios, locations, and contributing factors for RIs occurring at airports without surface surveillance. In the report, it was postulated that surface surveillance could reduce RIs regardless of other contributing factors because it would improve the ATCs' awareness of the location and movement of ground traffic. This would then allow ATCs to intervene with corrective measures before RIs can occur.

In 2017, Wilt, Browning, Marais, Winter, Wilt, Bhargava, Maharaj, Tamilselvan, and Chaparro (2018) conducted research for an RI report in collaboration with Partnership to Enhance General Aviation Safety, Accessibility, and Sustainability (PEGASAS). The focus of the study was on GA pilots as the cause of RIs, and mitigation recommendations. The comprehensive analysis consisted of a questionnaire, interviews, a review of GA pilot training materials, a review of changes airports made to prevent RIs, a review of the NTSB database, FAA's Accident and Incident database (AIDS), the Aviation Safety Reporting System (ASRS), and the Runway Safety Office RI database (RWS), a review of Part 121 RI prevention strategies, and findings to determine root causes of GA pilot RIs.

Lastly, the most recent RI Safety Plan published by the FAA was the National Runway Safety Plan 2015 to 2017. What is noteworthy about this most recent version of the Runway Safety Plan is that it aligns with the FAA's transition from an event-based safety system to a data-driven integrated risk-based enterprise. This plan acknowledged that there has been a growth over the years in the capability to track aviation industry related data. Now, data such as aircraft performance, radar track, voice tapes, and subjective reporting can be acknowledged and utilized for its ability to provide information that can lead to identifying RI causes and mitigation recommendations. As discussed above, Croft (2015) addressed how each agency framed and interpreted their data, which in turn influenced conjectures made by both the agencies and the cited articles.

As presented in the background section, there are studies that have investigated RIs. However, these have mainly been quantitative in nature, which relied upon archival data to ascertain RI behavior such as frequencies etc. Few studies were qualitative, and focused on the AMs lived experiences of the RI phenomenon. Although these studies have been beneficial to understanding this phenomenon, there is a dearth of studies that provide first-person accounts of AMs who personally experienced RIs. What is missing from current literature is an understanding of the reasons for, barriers to addressing, and lessons learned relative to AMs first-hand experiences with RIs.

Purpose. The purpose of the study was manifold: (a) to understand the reasons for RIs at GA airports, (b) to describe the barriers to addressing RIs at GA airports, and (c) to describe the lessons learned from addressing RIs at GA airports.

The study also aimed to generate a set of conjectures inductively from the data that could then be used as the framework for a potential theoretical model.

Definition of Terms

Key terms and phrases relative to the current study were operationally defined as follows:

1. *Airport/GA manager* is defined as a general moniker used to reference the various positions that airport personnel hold, as different airports may utilize different monikers to address their hierarchy (see Table 4.1 in Chapter 4).
2. *Category A runway incursions* are defined by the FAA (2013, p. 5) as "an incident in which a collision is narrowly avoided." The FAA's definition was applied to the current study.
3. *Category B runway incursions* are defined by the FAA (2013, p. 5) as "an incident in which separation decreases and there is a significant potential for collision, which may result in a time-critical corrective/evasive response to avoid a collision." The FAA's definition was applied to the current study.
4. *Category C runway incursions* are defined by the FAA (2013, p. 5) as "an incident characterized by ample time and/or distance to avoid a collision." The FAA's definition was applied to the current study.
5. *Category D runway incursions* are defined by the FAA (2013, p. 5) as:

> An incident that meets the definition of runway incursion, such as incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and takeoff of aircraft, but with no immediate safety consequences.

The FAA's definition was applied to the current study.

6. *General aviation airport* is defined by the FAA (2017) as "public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings." In the context of the current study, this definition was delimited to one that had at least 10 times the number of GA operations than an air carrier (commercial) operations as reported in the Air Traffic Activity Data System (ATADS, 2017).

7. *General aviation operation* is defined by ICAO as:

> Those flight activities not involving commercial air transportation or aerial work. Similarly, aerial work, for remuneration or for own use, may only be generally defined as operations used for specialized services such as agriculture, construction, photography, surveying, observation and patrol, search and rescue, aerial development, etc. (IAOPA, 2017).

ICAO's definition was applied to the current study.

8. *Pilot deviation* is defined by the FAA (2013, p. 5) as "the action of a pilot that violates any Federal Aviation Regulation (e.g., a pilot crosses a runway without a clearance to do so, while en route to an airport ramp or gate)." The FAA's definition was applied to the current study.

9. *Runway incursion* is defined by ICAO (2007, p.1-1) as: "any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and takeoff of aircraft." ICAO's definition was applied to the current study.
10. *Vehicle/Pedestrian deviation* is defined by the FAA (2013, p. 5) as "pedestrians or vehicles entering any portion of the airport movement areas (runways/taxiways) without authorization from Air Traffic Control." The FAA's definition was applied to the current study.

Research Questions

Research questions. The research questions that guided this study were as follows:

Research question 1. What are the primary reasons for the occurrence of runway incursions at general aviation airports?

Research question 2. What barriers emerge when addressing runway incursions at general aviation airports?

Research question 3. What lessons are learned from addressing runway incursions at general aviation airports?

Study Design

The research design for the current study was qualitative phenomenological coupled with the first stage of grounded theory, which involved formulating conjectures inductively from the data—that is, building a theoretical model—but not testing the model. The study was grounded in the ontological assumption, which embraces the idea that participants are subjected to their individual perception of their reality. The corresponding interpretive framework that best aligned with this study was social constructivism. A central tenet of social constructivism is that individuals' subjective world-view is directly influenced by personal perception, which is flawed because human cognition is imperfect (Ary, Jacobs, & Sorenson, 2010). These research designs were appropriate because I sought to understand the phenomenon of RIs at GA airports as understood from the subjective experiences of airport managers, and subsequently inductively formulate conjectures relative to this phenomenon. Figure 1.1 illustrates the study's design process.

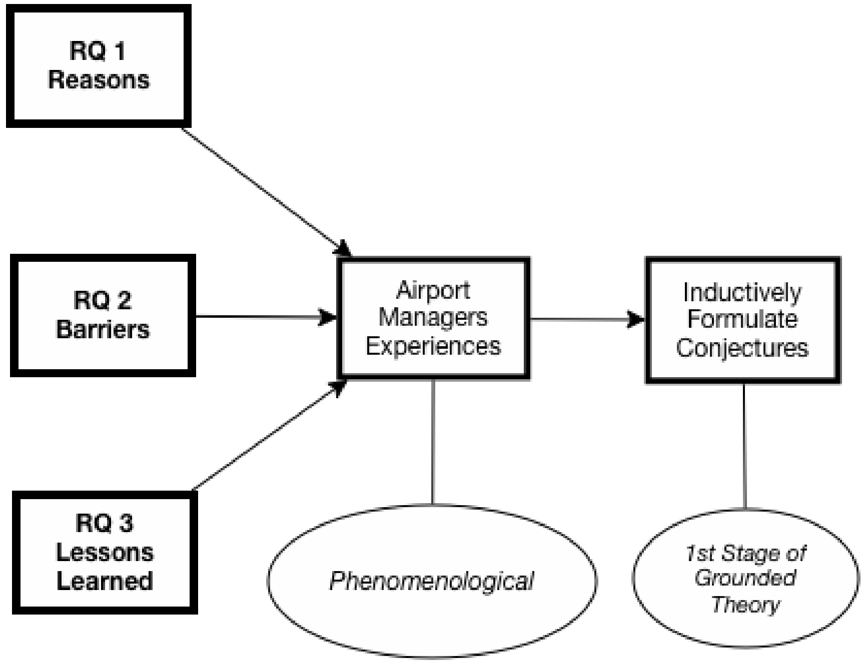

Figure 1.1. **Study design model.**

Significance of the Study

The primary contribution of the current study is that it provides an alternative perspective to examining common issues associated with runway incursions at GA airports. Unlike most of the published research, which focused on quantitative factors that searched for possible causes of runway incursions as a starting point to address them, the current study focused on airport managers who are responsible for the daily operations of their airport. Thus, the significance of the current study is that it tells the airport managers' story as to why they believe RIs occur ("reasons for RIs"), what they perceive are issues that need to be resolved when trying to address them ("barriers to mitigating RIs"), and what they learned from their experiences ("lessons learned"). An added bonus to the current study is that the airport managers' collective stories were then used to develop a set of conjectures that could serve as the basis of a theoretical model. This model could used to help address the problems associated with RIs at GA airports. It also could provide other airport managers with a "heads-up" on what to expect at their airport with respect to understanding the reasons for RIs, possible barriers to mitigating them, and not making the same mistakes when addressing them.

Study Limitations and Delimitations

Limitations. Limitations are conditions, events, or circumstances beyond the control of the researcher that limit the generalizability of the results of a study. In the context of the current study, these limitations are outlined below, and the reader is advised to take these limitations into account when making conclusions or inferences from the result of the study.

1. Sample demographics. I had no control over participants' demographical information that was collected such as years of experience in aviation, professional titles, or FAA regions that data were collected from. As a result, if this study were to be replicated, participants may very well possess different demographical information, which may not yield the same results as the current study.

2. Veracity of participants' responses. The focus of the study was on GA airport RIs as experienced by airport managers. I had no control over how truthful the participants were in their responses to the questionnaire items. This lack of control extended to participants' recall of their experiences, any embellishments they might have made in their responses, and their level of cooperation. As a result, replication studies that are able to confirm the truthfulness of participants' responses—for example through documented evidence—or involve more loquacious participants might yield different results when compared to the current study.

3. FAA regions. The airports that comprised the current study represented five of the nine FAA regions: Alaskan, Northwest Mountain, Southern, Southwest, and Western-Pacific. The regions not represented were Central, Eastern, and Great Lakes. As a result, similar studies that involve airports from different FAA regions might not get the same results.

4. Credibility of current study. A critical component in demonstrating the credibility of a qualitative study is member checking, which involves participants' feedback to ensure that the participants agree with what the researcher has described and interpreted. Although I endeavored to employ member checking in the current study, my attempts via telephone calls and e-mail messages to the airport managers went unanswered. As a result, similar studies that are able to engage in member checking might get different results.

Delimitations. Delimitations are conditions, events, or circumstances that are researcher imposed to ensure that the study is feasible to implement but further limit the generalizability of the results of the study. In the context of the current study, these delimitations are as follows:

1. Data collection instrument. The primary data collection instrument was researcher-prepared and consisted of a set of items that were the result of collaboration between my dissertation committee members and me. Therefore, similar studies that use a different instrument might not get the same results.

2. Data source. The current study relied on a single data source, namely, the researcher-prepared instrument. Therefore, similar studies that use multiple data sources such as email correspondence, text messages, transcripts of telephone calls or field notes, might get different results.

3. Data collection time schedule. Data collection was restricted to a one-time event and was administered via *SurveyMonkey*, an online data collection forum. Therefore, similar studies that use a different data collection protocol might get different results.

4. Sampling strategy. Airport selection was based on searching the FAA's Air Traffic Activity System (ATADS) database for GA airports that experienced the highest frequencies of pilot deviations and vehicle/pedestrian deviations from January 2010 to May 2017. As a result, similar studies that use different search criteria might not get the same results.

5. GA airport. As noted in the definitions section of this Chapter, I delimited the FAA's definition of a GA airport by requiring them to have at least 10 times the number of GA operations than an air carrier (commercial) operations as reported in the Air Traffic Activity Data System (ATADS). Therefore, similar studies that use the FAA's definition without this delimitation, or impose different delimitations, might not get the same results.

6. Database timeframe. The time period used to extract airport data from the FAA ATADS and ASIAS database was January 1, 2010 through June 30, 2017. Therefore, similar studies that use a different time period might not get the same results.

7. Geographical and technological constraints. In conducting the current study, I did not travel to the targeted airports to meet personally with the airport managers and conduct face-to-face interviews. Instead, I relied on telephone calls and email messages to correspond with the participants. As a result, similar studies in which researchers meet personally with their participants or use different distant technologies (e.g., *Skype*) might get different results.

Chapter 2

Review of Related Literature

Introduction

This chapter is organized into three main sections: philosophical underpinnings, literature review, and a summary. The first section discusses the role of philosophy in qualitative studies, required assumptions to ground the study, and frameworks that allow the researcher to understand the participants' experiences. The second section provides a review of literature on runway incursions (RIs), RIs in general aviation (GA), and RI contributing factors, mitigation programs, and safety. The last section summarizes the aforementioned literature review, and discusses the implications as related to the current study.

Philosophical Underpinnings

According to Creswell and Poth (2018, p. 20), the application of philosophy is exemplified by three journal articles they provided. Brown, Sorrell, McClaren, and Creswell, (2006) discussed their use of the phenomenological approach to gain a better understanding of the experiences of patients who were waiting for a liver transplant. Healey (2014) used a qualitative indigenous knowledge approach to understand the rise in sexually transmitted diseases among the Nunavut community when compared to Canadians. Jungnickel (2014) used an ethnographic approach to understand how cycling was used as a tool to gain insight into Australian backyard technologists. All three of these studies reported their philosophical approach.

Creswell and Poth (2018) reported that philosophy plays an integral role in qualitative research. It embodies the beliefs, convictions, or basic ideas that guide human behavior, which collectively guides the research inquiry. Housed under philosophy are assumptions and frameworks. Assumptions require that the study be grounded in philosophy, and frameworks allow for the researcher to understand experiences exclusively from the participants' perspectives based on their subjective reality.

Philosophical assumption. Creswell and Poth (2018) presented a total of four philosophical assumptions. The one that best aligns with the current study is the ontological assumption. This embraces the idea that each participant is subjected to his/her individual perception of reality. As a result of this, multiple participants would experience multiple realities differently. This is evidenced through participants' stories. In the context of the current study, airport managers who experienced RIs at GA airports would recall this event based on how they perceived their reality. Therefore, each manager may have a unique perception of how his/her experience unfolded.

Interpretive framework. Creswell (2013, p. 24) discussed several major frameworks. The one that best aligns with the current study is social constructivism. A central tenet of social constructivism is that individuals' subjective world-view is directly influenced by personal perception, which is flawed because human cognition is imperfect. This framework affords the researcher the opportunity to pose open-ended questions, interact with individuals who have experienced a similar phenomenon, focus on details such as setting, interpreting participants' subjective experiences, and acknowledging the researcher's personal biases that may influence the interpretation of the phenomenon (Creswell & Poth, 2018). The selected assumption and framework align with the theoretical grounding discussed, as these theories can be used to explain the stories of airport managers' subjective description of introspection and perception of lived their experiences.

Review of Past Research Studies

This section provides the results of a search completed on the literature as it pertains to the scope of this study. Using key search terms such as "GA airport RIs", and "GA RIs", yielded the forthcoming articles, which included industry (trade) publications, organizational publications, and dissertations that were relative to informing the focus of this current study. Based on what could be ascertained by the articles' information provided, the method and design of some of these studies included quantitative, qualitative, or mixed methodologies.

The increasing risk of RIs. In an article for the Journal of Air law and Commerce, Thomas (2002) addressed the increasing risk of RIs in the U.S., postulating that owing to current RI trends, the most dangerous part of flying could arguably be the time one spends taxiing from the gate to the runway. The goal of his article was to discuss the background of the RI problem in the U.S., and to assess the efforts made by the Federal Aviation Administration (FAA) and other aviation authorities to ensure that aviation safety is paramount. He hooks the reader with two effective quotes from the FAA and the National Transportation Safety Board (NTSB) that drove home the point of how serious of a problem RIs are:

> Taxiing on the airport surface is the most hazardous phase of flight.
> - Jane Garvey, Administrator of the Federal Aviation Administration, Runway Safety National Summit, June 2000.

> When I board an aircraft, I believe that the greatest threat to my life is a collision on the runway.
> - Jim Burnett, Former Chairman, National Transportation Safety Board.

Consistent with how most RI articles begin, in an attempt to highlight the severity and the long withstanding problem of RIs, he referenced the Tenerife accident (1977), then systematically worked his way through the years (2000) citing over 15 different RI related incidents or accidents to further emphasize just how consistent of a problem RI was and still is to aviation safety. This is illustrated in Chapter 1, Table 1.3.

Thomas (2002) goes on to point out that the FAA’s broad definition of what constitutes as an RI (see Chapter 1) is only applicable to those airports that are towered. He posits a two-fold explanation for this, reporting that perhaps (a) the FAA indulges in this limitation owing to the fact that data are easier to collect from controlled airports, and (b) that these controlled airports experience higher air traffic volume, which increases the probability of RI occurrences being more deadly at these airports, thereby validating the necessity to focus on data collected from towered airports. By that same token, Thomas reported that there are many uncontrolled airports that experience RIs that go unaccounted for, as these are usually rural airports with much lower traffic volumes and fewer RI safety facilities. Additionally, he cited an FAA report that indicates that as of the year 2000, there were approximately 459 control towers, which represented over 180,000 airport operations daily. Comparatively, out of the 13,600 airports in the U.S., over 13,100 airports, or 96%, are excluded from the FAA RI statistics. This means that only 4% of all U.S. airports are statistically represented for RIs, which may minimize the magnitude of the danger that RIs pose. To say this differently, based on these statistics alone, it is evident that the general public is largely oblivious to the real dangers they face as they board their flights at airports all over the U.S.

Thomas (2002) reported that the FAA divided RIs into three main categories (a) pilot deviations (PDs), (b) operational errors/deviations (OEDs), and (c) vehicle/pedestrian deviations (V/PDs), and he goes on to operationally define them (see Chapter 1). Thomas also reported that since the FAA began tracking RIs back in 1988, PDs have accounted for 48% of all RIs, with it rising to 60% in recent years; OEDs accounted for 31%; and V/PDs accounted for 21% of all RIs. Thomas goes on to cite the NTSB "Most Wanted" list, reporting that although RIs have consistently been on this list over the past decade, what's disconcerting is that RIs seemed to have disproportionately increased over this period. Moreover, Thomas cited Airplane Owners and Pilots Association (AOPA) who reported that private pilots generally have the least flight experience and they account for 35% of all PDs, when compared to Airline Transport Pilots (ATPs) who generally have the most flight experience, account for 30% of all PDs. When examining flight hours, pilots with more than 10,000 flight hours account for 18% of PDs, compared to pilots with fewer than 300 flight hours who account for 22% of all PDs. Based on these statistics, one can deduce that there is an inverse relationship between number of flight hours and experience relative to number of PD occurrences. Regardless, the takeaway here is that caution should be exercised across all levels of experience.

Pressing on, Thomas (2002) highlighted other potential factors that contribute to RIs such as airport layout, aircraft design, and ATC procedures. Currently, aircraft are being designed to be high-capacity airliners; an increase in passengers as such would make even just one RI catastrophic. Additionally, airport layout can be very disorienting and overwhelming to pilots, especially if other stressful factors such as inclement weather, time of day, and familiarity are thrown into the mix. Addressing taxiway and runway intersections, as well as lighting and signage can significantly curb RI rates. Last, Thomas reported that the ATC procedure known as Land and Hold Short Operations (LAHSO), is an unnecessary risk as it places two opposing aircraft on a collision course with the only safety guarantee being that the pilots of both aircraft successfully execute this procedure.

Thomas (2002) addressed the one of the many failings of the human condition: human error. Thomas reported that technological solutions are incorporated into this vast aviation wheelhouse as a means of acting as a safety net, to fill the safety gaps caused by human error. He broke it down into high and low technology solutions. Under high technology solutions, he discusses two types: (a) radar and satellite surveillance systems, which will detect aircraft and vehicles on the airport surface such as Airport Surface Detection Equipment (ASDE-3/X), Airport Movement Area Safety System (AMASS), and Automatic Dependent Surveillance-Broadcast (ADS-B); (b) loop technology surveillance systems, which is an electrical system that detects presence and size of aircraft. This information is then relayed to air and ground controllers via a computerized system. Under low technology solutions, Thomas discussed three types: (a) airport lighting, (b) airport signage and markings, and (c) airport design, all of which were briefly aforementioned.

Thomas (2002) reported that controller, vehicle operator and pedestrian, and pilot error all need to be reduced. He postulated that this can be achieved through improved training and increased mental alertness, increased situational awareness of airport environment, and increased education programs. One such study on training was conducted by Dicus and Tarry (2019) who designed an experimental study to examine which of three different training methods would be most effective in training pilots: classroom, online, or flight simulation. Although their data were inconclusive, they found that simulator training produced the highest scores. Metallianos (2018) took it one step further investigating how training, as well as education and collaboration can be improved in an attempt to reduce the occurrence RIs. A purposive sample of 12 pilots, air traffic controllers, airport administrators, and ground personnel were interviewed, and the findings yielded five themes: (a) exercising key safety practices, (b) effective communication, (c) a greater focus on scenario-based training, (d) need for greater standardization, and (e) more collaboration and partnership among stakeholders. These findings have multiple applications such as influencing the FAA's resource allocation for runway safety improvement, and improving RI safety training relative to education, training, and collaboration. Okate (2016) went one step further when he developed a three-step framework to mitigate RI events that examined human causal elements, technological assists, and the legal ramifications. His data consisted of the top five busiest airports in Texas. The findings reported that there was not a significant difference between human causal elements and the occurrence of RI events, and that automated technology systems are not reliable in mitigating RI events.

More recently, Bisch, Calabreses, & Donohoe, (2016) published a report for the U.S. Department of Transportation (DOT) that sought to better understand when, how, and why RIs occur in a preventative attempt to better develop and implement runway safety technologies. In doing so, the individual RI needs of each airport could be better ascertained because airport characteristics (size, runway configuration, environment, etc.) and the nature of RIs (number, type, location, etc.) at each airport differ. RI data were collected and analyzed from 440 airports across the U.S. using FAA and NASA databases from 2004 through 2014 that did not have, and were not scheduled to have surface surveillance installed.

Additionally, a subset of 10 airports with the highest RI occurrences was examined and recommended for RI mitigation technology. It is postulated that although it appears as if RIs have been continuously increasing over the years, one could attribute this rising trend to policy change. In 2008, the FAA adopted ICAO RI definition and the Air Traffic Safety Action Program was introduced 2011. These changes could explain the apparent increase in RIs beacuse the dates coincide.

As a result of the timing of this policy change, it is difficult to determine whether there has actually been an increase in RI events, or if it was simply the rate of RI reporting has increased. The findings reported that GA operations accounted for 80% of RI events, and GA PDs were 20 times higher than non-GA operations. Five RI contributing factors were identified: (a) communication, (b) human performance, (c) spatial awareness, (d) equipment, and (e) signs and markings. Furthermore, appropriately designed surveillance systems can improve the controller's situation awareness and aid in their decision-making by providing them with additional information required to prevent RI events.

Thomas (2002) concluded by highlighting the multiple failings of the FAA from the 1980's to 2002 in their repeated attempts to mitigate RIs and implement runway safety initiatives. At the June 2000 safety summit, the FAA selected 10 short-term initiatives to reduce RIs. In October of that same year, the FAA issued a "Blueprint" for runway safety, which included seven long-term initiatives. Despite all these initiatives put forth by the FAA relative to runway safety, based on Thomas' research, he surmised that they are still falling short, which owing to the pandemic that RIs were and still continue to be, he indicates that the multiple failings of the FAA to curb this occurrence is a luxury that the overall safety of the general public cannot afford.

In the context of the current study, in the process of telling their stories, it would be noteworthy to highlight if participants have opinions of any of these FAA runway safety initiatives, and if they have benefitted from them. Additionally, PDs and V/PDs were specifically included in the instrument. Therefore, as described in Chapters' 4 and 5, participants were able to provide valuable insight into the occurrences of these RI types. Also participants provided insight on thoughts on training, education, and collaboration, and the role they play in RI safety mitigation. Last, participants provided insight into their RI needs based on their airport characteristics and nature of RIs.

Airport categories and RI occurrences. Mathew, Major, Hubbard, and Bullock (2017) conducted a correlational study using statistical methods to examine factors that correlate with RIs for different airport categories. They bolstered their need for their study citing previous studies that highlighted RI as an ongoing and prevalent threat to aviation safety. They indicated that their study provided an updated analysis from previous work (Mathew, Major, Hubbard, & Bullock, 2016), incorporating additional 2015 data, additional literature, and addition of a new variable (local time when the incursion took place).

Additionally, Mathew et al. (2017) discussed a multinomial logit model used to examine 8,812 incursions from 2001 to 2010 and found that OI incidents were less likely to result in a more severe incursion at the 35 busiest airports, but more likely to result in severe incursions at other airports. This finding highlighted that incursion characteristics vary depending on airport size. Last, Mathew et al. reported that previous research had focused on factors that increased the likelihood of RIs, but no research had examined the factors that influence the likelihood of an incursion based on the category of airport using a multinomial logit model with random parameters.

Mathew et al. (2017) defined airport categories in accordance with the National Plan of Integrated Airport Systems (NPIAS) definition, which consisted of four categories: (a) large hub, (b) medium hub, (c) small hub, and (d) non-hub. For RI severity categories, they employed the FAA's definition, which consisted of four categories: "A" through "D" with "D" and "C" being less severe, and "B" and "A" being the most severe. Similarly to the current study, Mathew et al. collected their data from the FAA ASIAS system. Their analysis was based on 16,785 observations from 2002 to 2015. Dissimilar to the current study, they had one dependent variable: incursion severity (“A” to “D”); 12 indicator variables: (a) pilot deviation (PD); (b) operational incident (OI); (c) vehicle/pedestrian deviation (VPD); (d) commercial aircraft involved; (e) GA aircraft involved; (f) incident between 2 commercial aircraft; (g) incident between commercial and GA aircraft; (h) incident between two GA aircraft; (i) charter aircraft involved; (j) foreign aircraft involved; (k) incident during months of December, January and February; and (l) during peak operating hours; and one continuous variable: Number of years since 2002.

Using a multinomial logit model, to model RIs for each airport size category, the results indicated that operational incidents (OI) are more likely to occur at large hub airports. In contrast, at GA/non-hub airports, pilot deviations (PD) were significant for less severe incursions (severity” C” and “D”). Only one variable, “number of years since 2002” was found to be significant for all four airport categories; this variable was correlated with severity “A” incursions and indicated a statistically significant reduction in severity “A” incursions, despite an overall 80% increase in incursions between 2002 and 2015.

Mathew et al. (2017) concluded that their findings effectively illustrated that factors contributing to RIs do vary depending on the size of the airport and the severity of the incursions. They reported that when examining the top 50 airports by total incursion, large hubs accounted for 21 airports and GA accounted for 16. All things considered, they postulated that there is no single best solution to prevent RIs across all airports; therefore, the most appropriate countermeasures should vary depending on the airport category.

With Mathew et al. (2017) conclusion in mind, in the context of the current study, the scope of this study is focused on the narrative of airport managers' experiences with RIs specific to GA airports. As they so effectively highlighted in their study, there is no uniform solution to RIs across the aviation industry as a whole, but there are individual solutions that can be customized specific to each airport size category. Conversely, this is an endeavor of the current study; to provide insight into what the participants believe are the causes for RIs at their GA airports. Furthermore, recall that they found that PDs were significant, although for less severe incursions (severity" C" and "D"), at GA/non-hub airports. For the current study, GA airports were also selected based on the number of PDs they had experienced. Participants may be able to address or provide insight into the number of RIs attributed to PDs at GA airports.

RI technologies. Young and Jones (2001) conducted a mixed methods study to examine technological solutions to mitigate runway incursions (RIs). The purpose of their study was to test a concept known as Advanced Surface Movement Guidance and Control System (A-SMGCS). The intent is to prevent RIs and improve operational capability. The authors referred to A-SMGCS as architecture built for pilot usage whereby they identified and combined the technologies that worked best for surface avoidance and detection. They bolstered the need for their study with data from the NTSB, which stated that at the time of this study, the number of incursions had increased significantly by 132% in just under a decade (1993–2000). They also cited the FAA, stating that the administration acknowledged that more advanced detection systems were required in order to quell that staggering numbers of incursions and increase runway safety.

Conversely, according to the FAA, runway incursion numbers continue to escalate due to increased traffic volumes, leading to congested runways, all compounded by poor visibility as a result of deplorable weather and environmental conditions, and time of day. Furthermore, from these statistics, it is estimated that 60% of all runway incursions were caused by pilot deviations, and 20% were caused by operational errors. Consequently, the authors suggested that between these two causes, runway incursions could suffer a great deficit if sufficient situational awareness had been better utilized.

Young and Jones (2001) suggested that in order to improve RI safety, surface movement guidance and control systems must be equipped with two fundamental capabilities: avoidance and detection. They defined avoidance as “the ability of a flight crew to reduce the likelihood of inadvertently entering an active runway” (p. 3). They reported three key pieces of information that pilots require in order to avoid runway incursions: pilot self-awareness of current location, awareness of other traffic location, and ATC directions. Conversely, they defined detection as “ the ability to become aware that an incursion has occurred so that evasive action can be taken, if necessary, to avoid a conflict” (p. 3). Young and Jones reported two main ways for potential incursion detection: visual scans by both pilot and ATC, and actively listening to communications channels. Consequently, they reported three main flaws with these methods: limited visibility due to weather conditions, complexity of airport layout, and radio congestion.

Young and Jones (2001), who are NASA researchers, also highlighted an interesting fact when they discussed the synergistic relationship that has been forged between the FAA and NASA with regards to the role that each institution assumes in their individual approach to assessing their common interest in this problem, which is the threat of runway incursion. Young and Jones pointed out that the FAA’s approach has been focused primarily on improving and modifying airport infrastructure as a means of combating this dilemma. Alternatively, NASA’s focus has been commanded by the need for increased situational awareness in the flight deck. Simply stated, if this quandary were to be assessed in the form of the man-machine relationship, the FAA’s focus is preoccupied with understanding and developing the machine part of the relationship, and NASA is approaching the problem from the human perspective.

Young and Jones (2001) followed up this distinction by discussing the investments that each administration had contributed to troubleshooting this dilemma. The FAA implemented three main mitigation strategies: publication of guidance material for pilots and ATC to increase potential hazard awareness, installation of improved signage and unambiguous markings at airports to simplify navigation, and installation of improved surface lighting systems. From these three mitigation strategies, the authors did highlight that the latter two would only benefit airports where these modifications had already been implemented. In addition to these mitigation strategies, the FAA also invested in the implementation of various technologies, although in a limited capacity. Some of these technologies included, but not limited to, Airport Safety Detection Equipment-3 (ASDE-3/ASDE-X), Airport Movement Area Safety System (AMASS), and Runway Status Light System (RWSL). Alternatively, NASA's investments have focused on flight-deck display concepts. One such display provided flight crews with real-time graphical display indication own-ship position relative to airport taxiways, traffic locations, and taxi route. Another display concept was implemented into the Head-up Display (HUD), which provided flight crews with touchdown and runway exit information regardless of visibility conditions.

Young and Jones (2001) went on to suggest that runway incursion avoidance and detection capabilities can be improved by simply layering these systems based on individual airport requirements and fiscal budget. They referred to this layering as "system architecture" (p. 5), and it consisted of five functional elements: own-ship position awareness, traffic position awareness, route awareness, route deviation detection, and runway incursion detection. The authors indicated that position awareness could be improved through the use of Global Position System (GPS) and Airport Mapping Database (AMDB), which can be supported by HUD's and Navigation Displays (ND's). By implementing these technologies, pilots would be able to determine their position relative to runways and taxiways, know which runway or taxiway they are currently one, and know the name and locations of intersecting runways or taxiways.

Traffic position awareness would allow for both the pilots and ATC to improve traffic SA by having access to graphical displays of airport layout overlaid on current accurate traffic symbols. This would be achieved through the use of an AMDB, or Automatic Dependent Surveillance – Broadcast (ADS-B), or surface radar via Surface Traffic Information Service – Broadcast (STIS-B). Route awareness would allow for taxi routes and routing constraints to be displayed in the flight deck. This is achieved through AMDB, or Controller-Pilot Data Link Communications (CPDLC), which is capable of capturing and transmitting ATC instructions to the flight deck. Route deviation detection is achieved through the use of GPS, AMDB, and CPDLC, which prevents pilot deviations from routes or hold-short locations. This facilitates early pilot deviation detection, which allows for increased recovery time in hazardous situations, and overall decreased runway incursions. Runway incursion detection is achieved through the use of ADS-B, STIS-B, GPS, AMDB, and TCAS. This facilitates accurate traffic reports and detection, which can deter runway incursion by affording the pilots more time to navigate the situation.

Young and Jones (2001) conducted an evaluation of the aforementioned five elements with the addition of a RI detection function with the assistance of the HUD and ND capabilities. These were implemented in a B-757 glass cockpit flight simulation. The airport environment was modeled after the north side of ATL operating at near-peak capacity, which consisted of inter-arrival spacing of three nautical miles between touchdowns and an inter-departure rate of 90 seconds between takeoffs. A total of 432 dichotomous scenarios (takeoff and landing) were completed by 18 active airline pilots and six active ATC's, with a combined average flight experience of 10,600 hours. The takeoff and landing scenario simulated an aircraft taxiing onto the runway or coming in on approach, where the participants were then instructed to abort takeoff or perform a go-around. ATC was favorable to the CPDLC.

The results, though limited in descriptive and inferential statistical information, found that collisions would have resulted in some cases had it not been for the automatic detection systems. Conversely, in other cases it was also reported that strict monitoring of the cockpit display resulted in corrective measures even before the detection system alerted participants. Additionally, data were collected in the form of questionnaires where both pilots and ATCs were unanimous in supporting this technology. Furthermore, pilots supported the use of

Electronic Moving Map's (EMM), HUD's, suggested maneuver guidance following incursion detection, responded favorably to the audible incursion alert, and reported feeling safer having this technology on board. Finally, the data suggested that further investigation is required into automatic onboard detection of RIs.

Although the authors were justifiably strong advocates for the implementation of technological advancements as a means to deter runway incursions, they also acknowledged the inherent flaw of human nature; meaning that humans make for poor monitors and regardless of technological capabilities, and these technological advantages will perpetually suffer from the limitation of human error. Moreover, there were several noteworthy gaps in this study. For example, as mentioned above, the authors did not divulge certain statistical information such as alpha, power, and *F* values. It was also difficult to definitively identify the qualitative design and standards of rigor.

Last, and more specific to the context of the current study, Young and Jones' (2001) study highlight that much focus has been placed on RI technological solutions, and the perceptions of pilots and ATCs. When examined from the context of the current study, Young and Jones administered a questionnaire to pilots and ATCs that provided insight into their experience with RIs, and their perception of effective RI solutions. Similarly, the current study administered a questionnaire where the focus was on airport managers instead, who could provide insight into their RI experiences, their perception of reasons for RIs, problems to addressing RIs, and potential solutions. Shifting the focus from the experiences of pilots and ATCs to airport managers could provide novel insight into this elusive dilemma.

RI Technologies for GA. Jones and Prinzel (2006) conducted a mixed methods study to examine a Runway Incursion Prevention System (RIPS) adapted for GA operations. The purpose of their study was to evaluate the airborne incursion detection algorithms and associated alerting and airport surface display concepts for general aviation operations. They bolstered the need for their study with data from the FAA, citing that between 2001 through 2004, there were approximately 1,395 RIs, with GA accounting for 74% of these incursions. The authors went on to highlight a gap in the current literature reporting that although the FAA implemented a number of initiatives geared toward reducing RIs through a combination of technology, infrastructure, procedural, and training interventions, all these initiatives were still deficient in technology solutions for the aircraft.

Jones and Prinzel (2006) also cited the NTSB, stating that this organization has listed RI on its “Most Wanted” list, specifically advising the FAA to implement technology that “provides a direct warning capability to flight crews” (p. 1). In response to this, NASA developed RIPS for commercial aviation as a means to improve airport safety by providing supplemental surface situation awareness information and guidance cues, and alerts of runway conflicts and route deviations directly to the flight crew. This system was then adapted for GA operations, integrated with NASA's GA synthetic vision system.

A simulation study was conducted to evaluate RIPS for GA operations focusing on analysis of the incursion detection algorithms and display concepts. A cross section of 16 Part 91 GA pilots were recruited with low (< 400 hours) and high (> 400 hours) VFR flight time, and low (< 1,000 hours) and high (> 2,000 hours) IFR flight time. Prior to data collection, participants were exposed to extensive briefing and training as a means to mask the true intent of the experiment. For the purpose of the simulation, pilots were trained to abort if a warning alert was given during departure, to go-around if a warning alert was given on approach, and to stop if a warning alert was given during taxi. They were exposed to a total of five scenarios: arrive/takeoff hold, departure/intersection departure, arrival/departure, departure/departure, and taxi-crossing/departure.

The results indicated that most pilots were capable of successfully assessing incurring traffic by simply looking out the cockpit windows during VMC conditions prior to the incursion alert audible warning. Surface maps with ownship that did not display other traffic were rated as being significantly inferior to a surface map with traffic and/or incursion alerting. This was confirmed using an ANOVA with significant main effects (p <.0001) for display on pilot ratings of situation awareness of where they were located, $F(6, 90) = 143.956$, and where other traffic and hazards were located, $F(6, 90) = 94.899$.

However, the latter (surface map with traffic and/or incursion alerting) was only marginally beneficial, and only effective when alerting was provided. Additionally, pilots reported that the surface map would be significantly more effective if it were located higher on the instrument panel and closer to the pilot's head-up field-of-view. Overall, the results of this study were similar to the Young and Jones (2001) study in that the incursion alerts provided sufficient time to avoid potential incursion conflicts, and departures were generally aborted sooner when alerts were provided. Surface maps with ownship and traffic when combined with audible alerts were considered an optimal incursion prevention display, when compared to audible alerts alone. Over half the pilots expressed a preference for maneuver guidance for conflict resolution combined with incursion alert. Analysis of pilot responses to their perceived safety and runway incursion prevention effectiveness support this conclusion with significant main effects found (i.e., for perceived safety, $F(6, 90) = 857.390$, and runway incursion prevention effectiveness, $F(6, 90) = 188.793$. Overall, pilots felt significantly safer during runway incursion incidents with alerting onboard.

Jones and Prinzel's (2006) study is yet another example of the amount of research that goes into the development of technologies to assist in mitigating RIs and increase overall surface movement safety. Although their study was aimed at understanding which form of technology is the most effective for human use at reducing RIs, and they acknowledged the limitations of the human condition, its glaring deficiency of focusing exclusively on the human experience from the perspective of the human user cannot be ignored. This study just adds to the current literature available in a similar manner of many studies that have come before it and many studies since: that RI is a significant epidemic that is widely acknowledged by major governing boards, all of who are attempting to resolve this issue in a manner specific to their fields, but again, leaving the human scope widely unexplored.

The aforementioned studies are limited to addressing RI solutions from their individual perspective respective to their agencies designated scope of focus. For example, NASA’s interest in RIs has concentrated on cockpit technology, whereas the FAA has focused on ground and ATC technological solutions. This study exercised more autonomy in that it isn’t limited to approach RIs from these overindulged perspectives. In the context of the current study, the focus was to address the gap in literature, which the aforementioned studies have thus far demonstrated the need for phenomenological designs that can provide insight into the RI experience as witnessed by other airport personnel such as managers.

Designing for GA on a budget. Dabipi, Burrows-McElwain, and Hartman (2010), presented a study at the 2010 IEEE Frontiers in Education Conference (FIE), on an undergraduate freshman class project that ran over the course of one academic term. The project served as a collaboration between the Engineering and the Aviation department at a U.S. university. For all intents and purposes, the faculty at the Aviation department served as both the client and academic advisors to the engineering students. The clients requested for a low-cost RI detection system for GA airports to be designed, and it was up to the engineering team to discern the most cost-effective design that fit the needs of the client. The article that appeared in a magazine for undergraduate engineering students' provided rich technical details that went into the design of the product. Based on the information provided, it appears to be the final product that was presented as a continuation of a prior project attempt of the same design over multiple semesters. Furthermore, the manner in which the project was documented leads one to believe that it followed that of a qualitative narrative research design, owing to the detailed log of events that's kept throughout the duration of the project, and the manner in which it is written.

A brief recap illustrated that the authors introduced and justified the need for their project in a similar manner to that of the aforementioned articles; by citing references (FAA) that highlight the continuous problem that RI has been specific to GA safety. Next, they explained the collaboration, the scope of the project, and the class size (nine students) tasked with the project. They go on to highlight the various potential technological solutions that were discussed, and the process of how the final product was delivered. They settled on using an Infrared (IR) beam detection system akin to those commonly used on garage doors. Through a series of trial and error, they finally settled on the design that runs the beams parallel to the runway, which would cover the entire length with one pair of sensors.

Independently of the technical setbacks they experienced, they also documented the arduous process that takes place between client and designer, the many communication failures they experienced as a team, and the overall toll of the waiting period in between each stage of progress. They concluded by acknowledging the negative ramification of the limitations they experienced, which resulted in a theoretical presentation of the design instead of a functional model for the class final presentation. This still illustrated their theoretical knowledge, as financial and time constraints hindered the final product.

In the context of the current study, the setbacks experienced by the team of students, and in the end; the overall negative effect that time and financial constraints had on the successful implementation of a final model, raises a relevant concern about how these exact limitations play out in a real-world environment in terms of how they affect potential solutions, or contribute to safety degradation in GA. As Mathew et al., (2017) pointed out, different airport sizes have different resources made available to them, with GA falling amongst the lowest category. With this in mind, it is plausible that the airport managers' in the current study may provide some insight into this concern, if not altogether address these concerns, and how it is managed in the workplace in the stories that they tell.

Safety assessment models for alert systems. Stroeve, Bakker, and Blom (2007) conducted a study to assess accident-modeling systems that are used to analyze the effectiveness of alert systems in control towers and cockpits. They reported that owing to the complexity of the tasks, human monitoring, and overall performance, a standard model that assesses these alert systems could be rather challenging to determine. The authors made an interesting point when they reported that situation awareness (SA) extends from human cognition to technological cognition, and in order for alert system to be effective, the cognitive state of both agents need to be modified and constantly improve so as to maximize situation awareness and response time.

Stroeve et al. (2007) approached this topic by assessing seven airport operations that lead to RI scenarios: airport layout, weather conditions, human operators, crossing procedure, ATC alerts, cockpit alerts, and communication/navigation/surveillance. Next, they discussed three main types of modeling paradigms needed for risk assessment of complex operations: sequential model, epidemiological model, and systemic accident model. The sequential model describes an accident as the result of a sequence of events that occur in a specific order. Some examples of this model are domino theory, event trees, fault trees and networks models. The epidemiological model describes an accident as the outcome of a combination of factors, such as performance deviations, environmental conditions, barriers and latent conditions. Some examples of this model are the

“Swiss cheese” model and Bayesian belief networks. The systemic accident model considers accidents as emergent phenomena from the performance variability of a system. In this definition, the term “system” refers to a joint cognitive system of human and technical systems interaction (p. 3). In systemic modeling, accident prevention is based on finding dependencies in a socio-technical organization that may lead to functional resonance, and monitoring and controlling such critical dependencies. This model is rooted in cybernetic control theory and chaos theory, but has recently expanded to include Functional Resonance Accident Model (FRAM), Systems-Theoretic Accident Model and Processes (STAMP), and Traffic Organization and Perturbation AnalyZer (TOPAZ).

Sequential and epidemiological models utilize cause-and-effect relationships illustrating the association between failures, errors, and contextual conditions. Moreover, the two most commonly employed accident models used for safety assessment of air traffic are sequential and epidemiological, although these are not without criticism. Contemporary observations indicate that these models inadequately characterize the complexity of socio-technical systems such as humans, groups, technical systems, single/multiple locations, and performance pace. Furthermore, both models are challenged by their ability to represent the large number of interdependencies between organizational entities and its dynamics. Last, both models are stringent on their evaluation of human performance, limiting the role of humans to error making and resolving safety-critical situations.

Stroeve, Bakker, and Blom (2007) continued by proposing the concept of multi-agent situation awareness as key element in systemic accident modeling. The authors define multi-agent situation awareness in three main categories: human cognition, distributed artificial intelligence, and socio-technical organizations. The authors then proceeded to describe how this concept is effectively applied in an accident model of the runway incursion scenario by discussing two models: multi-agent SA accident model, and multi-agent systemic accident model. Next, Stroeve, Bakker, and Blom (2007) illustrated the effectiveness of ATC tower and cockpit runway incursion alert systems by utilizing the Monte Carlo (statistical approximation technique) simulation for the aforementioned accident models.

The results of the Monte Carlo simulations indicated that the runway incursion alert systems might lead to a large reduction in conditional collision risk during reduced visibility conditions. It also indicated that a significant reduction in the conditional risk can still be attained by cockpit alert systems for situations in which the crew of the taxiing aircraft is lost and aware to be taxiing on a normal taxiway rather than a runway crossing. They also deduced that of the aforementioned models, the systemic accident model is the most noteworthy as it is rapidly gaining notoriety as an important appraisal tool for risk assessment.

Although this study adds value to the current knowledge base with regards to effective models for accident risk assessment, it presents a glaring deficiency, which further bolsters the need and value of the current study. Even though

Stroeve, Bakker, and Blom (2007) acknowledge the complexities and importance of cognition at length in their study specific to their models, they failed to assess the effectiveness human-centered models geared toward explaining human behavior and decision-making process in accident risk assessment. The authors cited Hollnagel (citation needed) who argued, “In daily practice, humans do not always work strictly according to rules and procedures, but adapt their performance according to the perceived requirements set by the working context” (p. 4). This epitomizes the need for the current subjective study that aims to understand human experience strictly and unilaterally from the human perspective.

When examined in the context of the current study, this article raises two salient points. First, Stroeve, Bakker, and Blom (2007), assessed seven various airport operations. Although, airport managers’ may not be at the epicenter of all these varying operations, they may be knowledgeable about an overview of the situation. Thus, this study endeavors capitalize on this deficiency by capturing the experiences of airport managers. Second, the authors discuss several risk assessment paradigms. Consequently, although the focus of the current study is not centered around these paradigms, based on the employed study design of the current study, it would be of interest to note if any of the participants describe any of these paradigms in response to the research questions that guided this study.

FAA’s limitations and its effect on runway safety. More recently, Byrne (2017) collected data from the FAA on runway incursions occurring from October

1, 2005 through September 30, 2014 to determine whether the FAA 2009–2011 RSP has effectively reduced runway incursions at the nation's 5 busiest airports using data from 3 years before and 3 years after the RSP. The findings reported that the RSP had made some progress, but it has not effectively reduced runway incursions at the nation's 5 busiest airports. The RSP was effective in decreasing the number of runway incursion caused by air traffic controllers, reduced the overall severity of runway incursions, and positively influenced when, during the phase of flight, most runway incursions happen.

Conversely, back in April 2013, a Ranking Member of the Committee on Transportation and Infrastructure, Subcommittee on Aviation requested that the Office of the Inspector General (OIG) at the U.S. Department of Transportation (DOT) examine the FAA's Runway Safety Program and other actions they were currently employing as a means to improve aviation safety specific to RIs (FAA, 2014). This request was made in light of an increase in RIs from the fiscal years of 2009 – 2013, with the most serious increase in RIs occurring from 2011 – 2013. According to this report, during this timeframe, 12 major RIs occurred in 2009, and 6 major RIs occurred in 2010. RIs increased in severity by more than 57%, with 7 major RIs reported in 2011, a spike of 18 in 2012, and 11 in 2013. When examined by type, PDs accounted for 63% of RIs in 2012, of which GA pilots were responsible for over 80%; and V/PDs accounted for 17% that year. Although 2012 saw an increase in RI events, more than 98% were classified as category "C" and

"D". Overall, RIs saw an increase in occurrence by 30% just from 2011 – 2013 alone, with a total of 954 RIs in 2011, to 1,241 in 2013 (DOT, 2014). With these statistics in mind, the auditors presented two objectives for their FAA RI safety evaluation: (a) progress in implementing initiatives to prevent runway incursions, and (b) effectiveness in reporting and evaluating runway incursions.

Over the course of the audit, they adhered to the typical auditing standards of the Government. The audit was conducted over a 14-month period (May 2013 – July 2014), and included site visits to FAA headquarters, five out of nine FAA Regional offices, and all three Service Area offices. Additionally, the auditors visited 15 ATC towers and their respective airport operators out of 583 towered airports. Their sample was selected based on (a) location, (b) frequency of RIs, and (c) a mix of commercial and GA traffic. Furthermore, they interviewed officials from organizations and air traffic facilities such as AOPA, American Airlines, Delta Airlines, and National Air Traffic Controllers Association, to name a few. Moreover, in an attempt to evaluate the FAA's progress of implementing RI prevention initiatives, they interviewed the Director of FAA's Runway Safety Office to identify FAA's initiatives, and reviewed the criteria that outlined the FAA's goals relative to runway safety improvements.

Next, the auditors determined the status of the initiatives by interviewing the organizations responsible for their implementation: (a) air traffic organization (ATO) safety and technical training, (b) ATO terminal services, (c) flight standards, and (d) office of airports. Additionally, the auditors reviewed actions taken at specific airports relative to identifying initiatives developed through local Runway Safety Action Team (RSAT) meetings, and interviewed local air traffic, airport, and airline personnel. Last, they reviewed the FAA's actions taken relative to its 2007 Call to Action Plan for Runway Safety. When examining the FAA's effectiveness of reporting and evaluating RIs, the auditors reviewed reporting criteria from FAA Orders 7210.633 and 7210.634. Additionally, they interviewed FAA headquarters, industry, and field personnel such as those responsible for reviewing and validating RI reports. Furthermore, they were able to define factors that contributed to the increase in RI occurrences from 2011 – 2012 through interviews with FAA national, regional, and local management officials. Next, they analyzed data that they collected from the 15 air traffic facilities, and the three ATO service areas that they contacted in an attempt to ascertain any other contributing factors. Last, they collected RI data from FAA's national RI database and compared incursion data from 2009 - 2013 to discern RI trends.

In the end, the auditors found that although the FAA had made progress in certain areas by implementing some initiatives to reduce RIs, they also suffered from their limitations in management and their overall organizational structure specific to their Runway Safety Program initiative. For example, initiatives were categorized as (a) short-term actions, (b) mid-term actions, and (c) long-term actions. The auditors found that only eight of these 11 initiatives have been implemented, with one mid-term, and two long-term actions delayed or cancelled. Among those that were delayed or cancelled were the Runway Status Lights System (RWSL), the Moving Map Cockpit Displays, and the “Low-Cost” Ground Surveillance Systems (LCGS). Regarding the deficiencies of the FAA, it was reported that the FAA failed to have a baseline for measuring the number of actual RI events versus an improved reporting process that has lead to increased reporting. Moreover, they do not have an established metric to analyze the effectiveness of safety initiatives that have been implemented. Additionally, the auditors reported that owing to significant management and organizational changes in the Runway Safety Group (RSG), supervisions of safety initiatives have declined considerably. Furthermore, owing to changes in the RSG, local outreach programs have been on a decline. Last, the auditors highlighted that the FAA has failed to update its National Plan for Runway Safety since 2011.

In closing, the auditors made five recommendations to improve the FAA’s implementation of safety initiatives and the reporting of RI events: (a) separate the RSG from mainstream FAA to ensure that oversight and RI investigations and mitigations are exacted effectively, (b) hire a permanent director for the RSG, (c) provide written guidance for Runway Safety Offices on how to conduct effective outreach in resource-constrained environments, (d) update the National Runway Safety Plan, identify all national runway safety-related initiatives, and establish specific and measurable milestones for each initiative, and (e) establish and prioritize a metric that can determine whether RIs are actually increasing, and assess the effectiveness if implemented safety initiatives.

The FAA was given the opportunity to respond to the findings and recommendations made by this audit (FAA, 2014). The FAA's view respective to the audit was that overall they agreed with the recommendations. They expressed their discord relative to certain assertions that were made in the audit, as according to the FAA, was based upon hearsay acquired in interviews. The FAA responded with four points regarding the report: (a) cross-organizational improvements are an ongoing process from the Administrator's Strategic Initiatives to the implementation of an FAA-wide SMS, (b) a permanent Group Manager for Runway Safety was hired, (c) they published the National Runway Safety Plan for 2015-2017, and (d) the National Runway Safety Plan for 2015-2017 includes guidance and strategies on outreach and runway safety activities, toolkits for runway safety program managers, and promotional safety products are made available online for outreach activities.

The FAA 2015-2017 Runway Safety Plan is the most recent plan published by the FAA (FAA, n.d.). In addition to addressing other aviation safety concerns and precautionary measures they seek to implement, GA runway safety is discussed. Yet again, the FAA acknowledged the broad umbrella that covers the various denominations of GA flight activity (from gliders to business jets), and that there is a disparity between GA when compared to commercial aviation. They attribute this disparity to a host of reasons such as the variety of missions flown by GA pilots, the wide range of pilot experience and training, a single pilot's limited cockpit resources and flight support, and less weather-tolerant aircraft. To combat this safety issue, they implemented several programs and initiatives in an attempt to mitigate RI occurrences.

One program implemented to mitigate RIs was an anonymous voluntary reporting program that followed in the foot-steps of a similar program for commercial aviation, which would also similarly rely on the ASIAS database. ASIAS will be used to assist in identifying the risk factors that contribute to serious GA events and accidents, including those on the airport surface. Moreover, this data will be used to develop strategies to further improve GA's safety performance on the ground. Flight Standards is another organization that would review requirements to promote safety-of-flight and airport surface operations. The Office of Airport has also been recruited to aid in the implementation of this most recent FAA safety plan by distributing posters that encourage wildlife hazards to be reported. This most recent safety plan seems to acknowledge the benefits of gathering and analyzing technological data in an attempt to be more proactive and address this safety issue from the offense rather than the defense.

In the context of the current study, the dates used to collect data from the FAA database was January 1, 2010 and June 30, 2017, which picked up in the middle of the timeline for the audit (2009 – 2013). This is noteworthy because it provides an amended timeline snapshot of RI trends from the conclusion of the audit to the conclusion of the current study. Additionally, the audit reviewed number of PDs and V/PDs, reporting PDs as the highest reported RI type. This study also assessed these two RI types. This is noteworthy because the data collected in this study may provide new insight into these RI types. Furthermore, some of the airports that were examined in the audit are included in the current study. Although, these airports cannot be identified by name in the study owing to the confidentiality and anonymity that participants were afforded, the current study may provide insight into RIs experienced at these airports, which could then be broadly addressed by FAA region, thereby still preserving the confidentiality and anonymity of the participants. Last, the audit raised an excellent point about having a metric developed to accurately measure actual RI events, instead of increased reporting owing to improved reporting systems. In the context of the current study, participants may express that they too have also experienced this dilemma, and share their thoughts on this issue.

A systematic literature review case study to investigate RI contributing factors. Wang, Hubbard, and Zakharov (2018) conducted a qualitative case study with the objective of applying an unorthodox process of literature review known as "systematic", when compared to the more commonly utilized conventional style of literature review known as "narrative", to the aviation discipline with the purpose of identifying factors that contribute to RIs. Wang et al. (2018) bolstered the need for their study through the use of prior research from the FAA, who stated that RI remains a constant challenge and main priority of the administration, citing that an average of three RIs events daily occur in the U.S. They went on to highlight that RIs have continuously increased since 2012, with 6,830 RIs occurring between 2012 and 2016 (FAA, 2017).

Data from the FAA (2017) were used to emphasize rates of RI occurrences during this time period, with PDs reporting the highest amount of 61.9%, OIs following behind at 20.2%, and V/PDs rounding it out at 17.5%. Conversely, Wang et al., (2018) employed the exact definitions of a RI, RI severity categories, and RI classifications as aforementioned in Chapter 1 of this current study. Furthermore, they also cited Mathew, Major, Hubbard, and Bullock (2016), who reinforced the importance of a systematic literature review analysis of RI contributing factors as necessary to facilitate mitigation efforts in an attempt to procure and enforce a greater means of RI safety.

Wang et al., (2018) went on to highlight Bettany-Saltikov (2010), who reported that although the application of systematic literature review is fairly novel in the aviation discipline, it has achieved much success in other disciplines, such as the medical field, owing to its history of producing results that foster an environment of improved safety. They posit that the accomplishments of this application is due to its differences when compared to its more utilized counterpart, the narrative literature review; as the former imposes a more rigorous methodology, which lends to more objectivity in an attempt to minimize bias. Although a research question was not explicitly addressed, it was implied that the question the authors' were seeking to answer through the application of the systematic literature review was what correlating factors contributed to a higher incidence of RIs.

The authors go on to explain that a systematic literature review is exactly as its moniker denotes; it's a systematic analysis of previous research examined in methodical manner which allows for the researcher to identify relevant studies, critique, and analyze the data collected from said studies. The objective of this approach is to address the research questions through a process of identification, critical evaluation, and synthesizing the relevant findings of these studies. The central tenets that govern this approach is laid out in six steps: (a) formulating the research question(s) (b) conducting a search for relevant data and identifying the publications (c) define inclusion and exclusion criteria (d) select publications that are relevant to the RQs and data extraction (e) critically evaluate and assess the publications and resulting data quality (f) performing data analysis and combining results.

Wang et al. (2018) adopted the guidelines as outlined by Moher, Liberati, Tetzlaff, Altman, and Prisma Group (2009) for what they referred to as the "Preferred Reporting Items for Systematic Reviews and Meta- Analyses (PRISMA)", which allowed for the authors to conduct a systemic literature review of correlating factors contributing to a higher incidence of RIs. The sample was collected from 22 databases, of which included three key aviation databases: (a) Engineering Village (b) ProQuest Technology Collection (c) Transportation Research Information Database (TRID) Engineering Village. The remaining 19 databases ranged from aviation journals and topics, but yielded scarce aviation related results. Search terms used for these databases consisted of "runway incursion", and "aviation".

The overall search criteria were restricted to articles written in English published post 2007, as this was when the FAA adopted its current definition of RI, identical to that of ICAO; and certain RI events were re-classified by the FAA. Additional search criteria called for original articles published since 2008 in English that yielded a quantitative and/or qualitative assessment, which included content such as: (a) statistics of RIs (b) severity of RIs (c) types of RIs (d) factors that contribute to RIs. Consequently, articles were excluded based on the following criteria: (a) specific methods and technologies to prevent or reduce RIs (b) validation of the new technologies about RIs (c) air traffic safety (d) not peer reviewed. Both the inclusive and exclusive search criteria feasibly aligned with the purpose of the study, and the question the author sought to explore, which was what correlating factors contributed to a higher incidence of RIs.

Within the boundaries of the aforementioned search criteria, a total of 134 articles were retrieved in February 2017. Of the 134 articles, 112 articles (inclusive of 37 duplicate articles) were eliminated by the researchers for various reasons that essentially compromised the authenticity of the purpose of the study and proved to be inept relative to the question that guided the study. The remaining 22 articles were analyzed, and the distribution across database retrieval accounted as follows: six articles from Engineering Village, 2 articles from ProQuest Collection Technology, 9 articles from TRID, and 5 articles from 19 other databases. The final 22 articles selected consisted of six quantitative analyses, ten qualitative analyses, and six mixed-methods analyses. Both the quantitative and the qualitative data analyses yielded six main categories of contributing factors to higher RI incidences listed in order of citation frequency: (a) human factors (b) airport geometry (c) technical factors (d) airport characteristics (e) environmental factors (f) organizational factors.

Wang et al. (2018) found that when both methodologies are compared against each other, qualitative studies were more effective at identifying contributing factors for RIs than quantitative studies, with qualitative identifying four factors from six of the total eight studies, and quantitative lagging behind with four factors from one out of the total 12 studies. The authors lent credence to this finding by reporting that qualitative research focused on complex analysis through gainful employment of the systematic and holistic approach, whereas quantitative restricted its focus to one or two specific contributing factors. Conversely, this also highlights the deficiency of statistical methods specific to the analysis of categorical factors.

The authors concluded their study by reiterating the value of systematic literature review as an evidence-based approach, which facilitates the decision-making process, and made recommendations relative to the six aforementioned RI contributing factors. Relative to human factors, they recommended that both technical and non-technical training should be continuous for pilots, ground operators, and air traffic controllers. This includes honing decision-making and communication skills. Moreover, training should extend to organizational factors, through the support of the FAA and ICAO, to provide support to all matters human factors related. Recommendations for airport geometry, characteristics, and technical factors included airport layout modifications, pilots review of airport geometry before taxiing, controllers notifying pilots about construction in an efficient and timely manner, and ensuring enhanced airport markings to facilitate situation awareness between pilots and ground operators. Recommendations for technology included enhancements for airports and aircrafts respectively, ranging from surface detection equipment (ASDE-X) to enhanced displays in the flight deck that minimizes pilot "head-down" time.

Wang et al. (2018) suggestions for future research included, unsurprisingly, the implementation of systematic literature review on a more frequent and comprehensive level as its pertains to further RI investigation, but also the plethora of aviation topics waiting to be examined and remedied. Moreover, they suggested that studies conducted in other languages be included in future studies. Last, they acknowledged that by limiting their study to peer-reviewed articles, this also failed to account for the valuable publications and research conducted by numerous esteemed agencies such as the FAA and the European Aviation Safety Agency (EASA).

Overall, Wang et al. (2018) composed a very informative and eloquent article. They clearly identified the “case” in their case study, and the methods in which they intended to employ to review and analyze the results of their search criteria, which then lead to the identification of themes, and sound recommendations. Based on the information they provided specific to the search terms and the databases they used, they increased the likelihood of their study being replicable to future researchers. With all this being said, a few deficiencies emerged along the way. First, relative to the four standards of rigor, only two seemed glaringly evident: dependability and confirmability. The authors did a thorough job of informing the reader of the step-by-step process they took, from conception to execution of their study as mentioned above (dependability).

Additionally, attention was paid to confirmability through the systematic literature review method that was employed, as one of the selling points of this method is that it accounts for bias and so forth. Regarding credibility, the argument could be made that based on the information provided that lends itself to dependability, perhaps that same information bolster the credibility of the study. In other words, the authors disclosed their search criteria, databases, and elimination process, based on these factors alone; one can deduce that the researchers' account was accurate. Transferability seemed elusive as no thick description was provided. Furthermore, Wang et al. (2018) did not specify the FAA regions, airport categories (national, local, etc.), or airport operations (towered, non-towered, GA, air carrier, etc.).

In the context of the current study, the aforementioned gaps in Wang et. al. (2018) study were included as criteria for the sample that was used in the current study (i.e. FAA regions, airport categories, and operations). Furthermore, compared to the two standards of rigor that were addressed in Wang et al. (2018) study, the current study accounted for all four standards as discussed further in Chapter 3. Last, and most pressing, was the six themes that emerged from Wang et al. (2018) study. Although the current study did not use the same exact theme terminology, the similarities are almost identical. This is discussed in greater detail in Chapter 4 under the three domains that emerged from each of the three research questions that guided this study.

Airport Managers' perspectives of the challenges related to V/PDs. Mahlman (2019) conducted a qualitative content analysis (approach used as a research strategy to identify airports) and phenomenological (approach used to answer the research questions [RQs]) study with a twofold purpose of describing contributing factors of vehicle and pedestrian deviation (V/PD) runway incursions (RIs) nationally, and describing what mitigation approaches/strategies airport managers recommended or found to be effective. Mahlman (2019) demonstrated the need for the study through a review of the current literature that illustrated a gap in the existing knowledge base that can be remedied by the resulting study. Mahlman highlighted the ever-present problem that RIs still pose to the safety of aviation by citing statistics by the FAA who reported that there have been 1,832 reported runway incursions (RIs) in the United States (U.S.), which is a 25.6% increase from the reported 1,458 RIs reported in 2015 (Mahlman, 2019).

Wilt, Browning, Marais, Winter, Wilt, Bhargava, Maharaj, Tamilselvan, and Chaparro (2017) conducted another similar study that examined GA RIs. This study examined GA RIs root causes at both towered and non-towered airports and made mitigation recommendations. The study evaluated current RI prevention programs, techniques, various educational materials, and RI databases. Additionally, a questionnaire was made available to participants who elected to participate via a link published online in various trade publications and organizations from April 1, 2017 to May 8, 2017. A total of 1,401 respondents provided data. Lastly, a phenomenological design was employed to assess pilots who experienced RIs. From a total of five participants, three participants voluntarily submitted themselves to an interview conducted at the 2016 Experimental Aircraft Association (EAA) AirVenture in Oshkosh from July 25 to July 31, 2016, and two were interviewed via video chat.

The results found that although there is no typical GA pilot or flight that experience RIs, the majority of GA RIs tend to occur during the day in VFR conditions. Moreover, GA pilots of all experience levels need to be cognizant of RI risks as the findings dispelled the notion that inexperienced pilots, instructional flights, and single-pilot operations are the top contributors of PD RIs. Some of the root causes for GA RIs reported related to poor communication between pilots and ATC, human error, and poor situation awareness. Some recommendations that came out of this study were increased training, improved phraseology (towered airports), and the use of 2-way radio requirement for all pilots at the airport.

Mahlman identified four research questions that guided his study: (1) What are the contributing factors of V/PD RIs relative to airport operations? (2) What are the contributing factors of V/PD RIs relative to human factors? (3) What are the contributing factors of V/PD RIs relative to staff/personnel? (4) What mitigation approaches/strategies do airport managers recommend or find to be effective?

The sample for the study consisted of airport executives at 41 airports, who purposively selected and voluntarily participated, with more than 10 V/PD RIs between 2011 – 2016 using the RWS database. Mahlman (2019) reported that the sample was appropriate owing to the aforementioned strategy that was employed to select participants with the purpose of the study in mind. As aforementioned, Mahlman conducted a qualitative content analysis and phenomenological, with the former being used to identify airports that would participate in the study; and the latter being used to answer the RQs that were inductively formulated base don participants' responses. Conversely, this was the evidence provided to substantiate that the study design was appropriate. Furthermore, Mahlman provided a systematic recollection of his methods, which should sufficiently warrant replication.

Mahlman went on to address how he accounted for the four standards of rigor that essentially govern the credence of qualitative designs. Relative to reflexivity, he informed the reader of his professional and academic connections to aviation, and how he implemented bracketing, kept a journal, and had his dissertation committee chair serve as a peer-debriefer to counter any potential biases. In order to account for credibility, he employed the aforementioned tactics in addition to having his dissertation chair independently code the data that he had previously coded. He informed the reader here, that although member-checking would have bolstered the credibility of his study, this was unattainable owing to the anonymous nature of his data collection instrument, which kept the identity of all participants anonymous. Relative to transferability, he accounted for this by including thick descriptors from his participants' responses, which allowed for adequate receiving context by the readers, the aforementioned reflective statement, and disclosing limitations and delimitations. Relative to dependability, this was accounted for through his creation of an audit trail (journal), and intra-rater agreement. Last, confirmability was addressed through the aforementioned measures of his audit trail and reflexivity.

The data were analyzed using Spradley's domain analysis, which categorized the data into common themes and lead to corresponding conjectures. The four themes that emerged were: (a) airport operations, (b) human factors, (c) staff/personnel, and (d) recommended or effective mitigation approaches/strategies. Relative to the findings of Domain 1, Mahlman (2019) concluded that lack of adequate gate controls, and untrained and unauthorized persons gaining access to movement areas are contributing factors to V/PD RIs. Relative to the findings of Domain 2, Mahlman (2019) concluded that personnel distraction, lack of familiarity with airport geography, and inattention to detail are contributing factors to V/PD RIs. Relative to the findings of Domain 3, Mahlman (2019) concluded that lack of recurrent training for existing employees and stakeholders is a contributing factor to V/PD RIs. Relative to the findings of Domain 4, Mahlman (2019) concluded that airport managers had two recommendations: (a) aggressive enforcement capability, and (b) upgrading gate access controls and security.

As aforementioned, Mahlman (2019) bolstered the need for his study by highlighting the deficiencies in past literature, and what his study aims to contribute. He went on to report that his study was seminal in its right owing to the specific focus of his study. Based on these reasons, it can be said that he succeeded in making a credible case for his study. He went on to address the standards of rigor as it best applied to the parameters of his study, approaching all four rigors in a systematic manner, reporting how he gave attention to each. From the reader's point of view, he did a good job at explain each rigor and how it applied to his study, which made it easy to not only follow along in the progression of the study, but also enforced the replicability value of the study. Thick descriptors were employed sufficiently as illustrated in Chapter 4 of his study where he included participants' quotes to support his emerging themes. As a result of this information that was afforded to the reader, one can deduce that his conclusions and conjectures best aligned with the data provided.

Again, from the reader's perspective, it is reasonable to report that Mahlman's (2019) study has credence based on a multitude factors such as the diligence he paid to past research, and the meticulously detail-oriented manner in which he preserved the many components of his study process, namely, the details provided for his data collection and analysis process that ultimately culminated in a set on conjectures and conclusions that is most convincing to the reader.

In the context of the current study, Mahlman's (2019) study faced similar limitations as did the current study. This is said owing to the fact that both studies were completed as partial requirement for a doctoral program, which placed a time constraint on the data collection and analysis period. This begs one to question how the findings would have differed had both studies been allotted more time. Furthermore, both studies faced similar challenges relative to member-checking as both studies employed similar instruments. Owing to the anonymity of which participants completed the instrument on an online forum and submitted sans identifying information, this made it difficult to re-establish contact with participants. As Mahlman (2019) rightfully reported, the inability to member-check does weaken the rigor of the study.

With all of the above being said, there were also similarities in the thematic findings and conclusions of the study (similar to that of Wang et. al. study above), as illustrated in Chapter 4 of the current study. What is most disconcerting amidst all this data research and literature review is that airport managers are aware of the safety deficiencies, its causes and its potential mitigating measures, but inadequate funding seems to be the main culprit at the epicenter of this quagmire. What's even more disconcerting, and creates room for pause, is the notion that the titanic world of aviation can be reduced to a "bottom-line, dollars and sense business", where the profit margins far often eclipse safety precautions, that is, until disaster strikes.

Gap filled by and value of the current study. The current study filled a gap in research in various ways. First, in the current study, data were collected for analysis from a sample of the accessible population (airport managers at GA airports that had the highest frequency of RIs) instead of drawing from pre-existing data. Second, much attention has been paid to RI Categories A and B, and technological and structural RIs mitigation efforts at large airports, but not much was discussed about the GA airport perspective. The current study focused on RI concerns that GA airport managers faced, their perception of this problem, and their mitigation recommendations. The results of the current study could augment previous literature as it is centered upon airport managers' experiences and presents inductively formulated conjectures that were derived from these managers' experiences.

To do this, the current study used a qualitative approach. Qualitative designs, specifically phenomenological, have been used in other fields to tell the stories of the human experience. The benefits extend to the professionals in said fields as well as to the individuals who participate in these types of studies. For example, Brown, Sorrell, McClaren, and Creswell (2006) used a phenomenological design to understand the experiences of patients waiting for a liver transplant. Their results found that professionals addressing certain concerns when interacting with the patients could improve patients' experiences. Moreover, the professionals gained a greater understanding of how to manage the needs of their patients.

In the context of the current study, the contextual data acquired from the study's participants provided an alternative perspective on the reasons for, barriers to addressing, and lessons learned from addressing RIs at GA airports, and presented a set of conjectures that were inductive derived. To understand the value of using a qualitative approach to study this issue, consider the following summary remark from ALPA (2007, p. 2): "… the studies do a good job of explaining what happened but are not always clear as to why." What the current study endeavored to bring to the table was a point of view that has not been explored as heavily when compared to other study methods and designs relative to the field of aviation. The current study aimed to address this concern and gap in the research by examining the perspectives of GA airport managers who have personally lived through RI experiences and can provide unique insight into what they perceive to be the reasons for RIs, problems to addressing RIs, and their lessons learned with respect to mitigating RIs at GA airports.

Summary and Study Implications

Summary. This section summarizes the results of the aforementioned literature, when combined with the ontological assumption, which postulates that that each participant is subjected to their individual perception of their reality, and the social-constructivism framework, which postulates that individuals' subjective world-view is directly influenced by their flawed personal perception, provided guidance relative to how the research questions for this study were framed as illustrated in Figure 1.1 (Chapter 1).

The need for this study was demonstrated via GA RI statistics that resulted from my search of the ASIAS and ATADS database for GA airport RI events. Furthermore, the above literature highlighted gaps that this current study aimed to remedy. The literature cited in this chapter demonstrates the extent to which RIs in GA have been examined and remains a re-occurring problem across the diversified field that collectively sums up the aviation industry. Relative to studies that employed methodology and design, a search on the subject matter yielded the aforementioned quantitative, qualitative, and mixed methods studies (Mathew, Major, Hubbard, & Bullock, 2017; Young & Jones, 2001; Young & Prinzel, 2006; Dabipi, Burrows-McElwain, & Hartman, 2010; Stroeve, Bakker, & Blom, 2007; Wang, Hubbard, & Zakharov, 2018; Mahlman, 2019; Bisch, Calabreses, & Donohoe, 2016; Wilt, Browning, Marais, Winter, Wilt, Bhargava, Maharaj, Tamilselvan, & Chaparro, 2018).

The scope of these studies focused on RIs; RIs specific to GA; types: PDs and V/PDs; severity categories: A – D; contributing factors: airport signage and layout, insufficient training, collaboration, education, poor communication between ground controllers, ATC, and pilots, unfamiliarity with airport layout, and decrease situation awareness; technological solutions: ASDE-3/X, AMASS, ADS-B, and loop technology surveillance systems; and safety programs and initiatives: FAA runway safety plan; to name a few (Thomas, 2002; Dicus & Tarry, 2019; Metallinos, 2018; Okate, 2016; Mathew, Major, Hubbard, & Bullock, 2017; Young & Jones, 2001; Young & Prinzel, 2006; Dabipi, Burrows-McElwain, & Hartman, 2010; Stroeve, Bakker, & Blom, 2007; Byrne, 2017; OIG, 2013; Bisch, Calabreses, & Donohoe, 2016; Wilt, Browning, Marais, Winter, Wilt, Bhargava, Maharaj, Tamilselvan, & Chaparro, 2018). Wang et. al. (2018), and Mahlman (2019) were two pivotal qualitative design studies that through their studies findings, not only highlighted the value of knowledge qualitative studies can provide to the aviation body of knowledge, but resonated with the findings of the current study; identifying similar themes and providing similar recommendations to mitigate RI events and improve aviation safety.

Although these aforementioned studies in their own right bring a significant body of knowledge and value to the field of aviation, they also highlighted a deficiency that could be remedied through the current qualitative phenomenology design: the need to focus on other airport personnel who experience RIs, such as airport managers, and allow them to describe their unique first-hand lived experience using their authentic words, from their point of view. Out of the aforementioned articles, Mahlman (2019) was the only study reviewed that utilized airport managers as a valuable data resource. This is exactly what this study endeavored to do: remedy the deficiencies of the reviewed literature by providing an instrumental platform for participants to relay events as they experienced it. From this type of data, conjectures and recommendations can be made that may be able to provide insight into this phenomenon and improve aviation safety.

Study implications. The implications are reflected in some of those all-encompassing themes that emerged over the course of reviewing the literature, which presented itself repeatedly, some of which were also discussed in the findings of the current study, such as compromised SA and communication, training, inadequate funding, airport geometry and environment modifications, for which conversely lead to similar recommendations for recurrent training, inclusive of SA and communication, increased funding, and improved airport parameter security, to list a few.

Conclusion

In summation, this chapter introduced the reader to the philosophical underpinnings that framed this study. Furthermore, they were exposed to a search of the literature available on the subject matter, and its impact on industry as it stands. This review was assembled into various sections that addressed the ever-present dangers facing modern-day aviation, the implementation of mitigating measures that are in-play, and the gaps in literature that this study addressed. It concluded by discussing the implications of the study.

Chapter 3

Methodology

Population and Sample

Population. The target population for the current study was all GA airports within the United States. According to the FAA (2016), a GA airport is defined as "public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings". The FAA (2016) further classified GA airports under five categories: national, regional, local, basic, and unclassified (see Table 3.1 below). Specific to this study, all 10 participants identified as local GA airports.

Table 3.1
FAA Classified General Aviation Airport Categories

		GA Airport Categories		
National	**Regional**	**Local**	**Basic**	**Unclassified**
Supports the national and state system by providing communities with access to national and international markets in multiple states and throughout the United States.	Supports regional economies by connecting communities to statewide and interstate markets.	Supplements communities by providing access to primarily intrastate and some interstate markets.	Links the community with the national airport system and supports general aviation activities (e.g., emergency services, charter or critical passenger service, cargo operations, flight training and personal flying).	Provides access to the aviation system.

In the context of the current study, a GA airport was delimited to one that had at least 10 times the number of GA operations than an air carrier (commercial) operations as reported in the Air Traffic Activity Data System (ATADS, 2017).

This database contained the official National Airspace System (NAS) air traffic operations data available for public release. For example, Phoenix Deer Valley Airport (DVT) in Arizona had 227 air carrier operations and 967,978 GA operations between January 1, 2010 and June 30, 2017, inclusive, and therefore would be defined as a GA airport for the purpose of this study. On the other hand, Hartsfield-Jackson Atlanta International Airport (ATL) had 5,543,386 air carrier operations and 55,389 GA operations in the same time period and therefore would not be defined as a GA airport. ATADS Airport Operations Standard Report for all 10 participants across the 5 FAA regions that are represented in this study is illustrated in Table 3.2 below. The duplicate regions in the table mean that there were multiple airports from that region, and it represents the statistics of each airport in the sample respective that region (see tables 3.3 and 4.1).

Table 3.2

FAA ATADS GA Airport Operations Standard Report January 1st 2010 to June 30th 2017

Region	Class	Air Carrier Operations	GA Operations
Southwest	Towers with Radar	1,017	598,774
Northwest Mountain	Towers with Radar	408	985,801
Southern	Combined TRACON & Tower with Radar	39,018	1,115,759
Western Pacific	Towers with Radar	227	967,978
Southern	Towers with Radar	414	849,944
Alaskan	Towers with Radar	126	397,989
Western Pacific	Towers with Radar	780	569,525
Southern	Towers with Radar	172	978,482
Western Pacific	Towers with Radar	103	413,212
Western Pacific	Towers with Radar	913	1,154,741

The accessible population was all GA airports within the United States that had experienced a runway incursion that was documented on the Federal Aviation

Administration (FAA) Aviation Safety Information Analysis and Sharing (ASIAS) database. A purposive sample was selected from the ASIAS database to identify GA airports that had experienced the highest frequency of runway incursions across all the major types of incursions (see Table 1.1) - Operation Errors (OEs), Pilot Deviations (PDs), and Vehicle/Pedestrian Deviations (V/PDs) - that have occurred over the last 7.5 years (January 1, 2010 through June 30, 2017, inclusive).

Sample. Eighteen airports that met the definition of GA airport were identified across five FAA regions (Alaskan, Southwest, Northwest Mountain, Southern, and Western Pacific) that experienced the highest frequency of PDs and V/PDs. The unit of sampling was airport managers' at these identified airports. I initiated contact by sending letters in the mail to all 18 respective airport managers of these airports and asked them to complete an online questionnaire that contained interview questions. Please note that in the context of the current study, the term "airport manager" is used loosely as a general moniker to reference the various positions that these airport personnel hold (see Chapter One: Definition of Terms). Of the 18 airport managers' contacted, 10 confirmed their willingness to participate in the study, and 8 expressed interest but declined participation owing to inadequate staffing and increased workload. The final 10 participants, who represent airports across five FAA regions are summarized in Table 3.3 below, and the frequency of their PDs and V/PDs as reported in FAA ASIAS for the last 7.5 years (January 1st 2010 to June 30th 2017) are illustrated in Table 3.4 below.

The initial set of interview questions was developed so participants' responses to the questions would help answer the RQs. The online questionnaire was provided electronically via *SurveyMonkey*. Follow-up questions relative to participants' responses were unsuccessful as multiple attempts were made to contact participants via phone to no avail. Participants had previously requested this method of contact.

Table 3.3
FAA GA Airport Regions Represented

Region	*N*	Percent (Sample)[a]	Percent (Overall)[b]
Alaskan	1	10%	11.1%
Central (IA, KS, MO, NE)	0		0.0%
Eastern (DC, DE, MD, NJ, NY, PA, VA, WV)	0		0.0%
Great Lakes (IL, IN, MI, MN, ND, OH, (SD, WI)	0		0.0%
New England (CT, ME, MA, NH, RI, VT)	0		0.0%
Northwest Mountain (CO, ID, MT, OR, UT, WA, WY)	1	10%	11.1%
Southern (AL, FL, GA, KY, MS, NC, PR, SC, TN, VI)	3	30%	33.3%
Southwest (AR, LA, NM, OK, TX).	1	10%	11.1%
Western-Pacific (AZ, CA, HI, NV, GU, AS, MH)	4	40%	44.4%

Note. [a]Only five of the nine FAA regions were represented in the sample. Therefore, the base is 5. [b]Base is 9.

Table 3.4
FAA ASIAS Report of GA Airports Represented that Experienced Highest Frequency of PDs and V/PDs January 1st 2010 to June 30th 2017

Region	Number of PDs	Number of V/PDs
Southwest	64	32
Northwest Mountain	70	10
Southern	63	5
Western Pacific	120	12
Southern	77	14
Alaskan	55	68
Western Pacific	68	13
Southern	62	10
Western Pacific	83	17
Western Pacific	58	21

Sampling strategy. A nonprobability purposive, and convenience sampling strategy was employed to recruit participants. This sampling strategy was based on my personal judgment and convenience in sample selection. Participants that resulted from the sampling strategy represented a specific group of individuals that I believed to be representative of the target population. In the context of this research setting, the aforementioned selected airports yielded participants who had experienced the phenomenon that is the focus of this study.

According to Ary, Jacobs, and Sorensen (2010), researchers' select purposive samples because "they are believed to be sufficient to provide maximum insight and understanding of what they are studying" (Ary, Jacobs, & Sorensen, 2010, p. 428). Additionally, Ary et.al. (2010) also stated that there are "several variations to purposive sampling, which when combined or mixed within the study can provide triangulation" (Ary, Jacobs, & Sorensen, 2010, p. 429). Accordingly, convenience sampling is one such variation. This sampling strategy allows for samples to be chosen based on availability, time, location, or ease of access. These sampling strategies facilitated the time schedule of the study.

Participants. As mentioned above, purposive sampling was employed to select participants who satisfy the criteria of the study. The convenience sample resulted in the 10 airports with airport managers' that confirmed their willingness to participate in this study. This onto itself proved to be an arduous feat as most of the participants came across as defensive, or not as forthcoming with information they may have viewed as sensitive. Recruiting participants from different airports' who experienced runway incursions, provided a more well-rounded description about this phenomenon. Consequently, the goal was to recruit participants from the airport regions discussed above that would be able to provide robust rich data. Also known as data saturation, this was determined by my discretion based on the quality of participant feedback, which satisfied the purpose of this current study.

Instrumentation

The current study employed one primary data collection instrument. This was the Airport Managers' Interview Protocol. The secondary data collection instrument was supposed to be follow-up calls pending participants' responses to the Interview Protocol. However, the reader is cautioned here that follow-up calls were unsuccessful, which is discussed further in Chapter 4. A brief summary of each instrument follows.

Researcher-constructed questionnaire. A researcher-constructed questionnaire was developed to capture airport managers' first-hand descriptions of their lived experiences of GA airport runway incursions. The questionnaire consisted of 26 items across two sections.

Section A: Interview questions. The first section of the questionnaire consisted of 20 interview items that required participants to self-report specific information about GA airport runway incursions at their respective airports. The items in this section were formatted as (a) open-ended, which allowed participants' to formulate their authentic responses), (b) list-options, which allowed for participants' to make a selection from a provided list of responses that they best identified with, and (c) ranking order, which was also open-ended but allowed participants' to rank the order of their authentic responses. For example, an open-ended item asked participants to describe what they perceived to be the most common reasons for runway incursions at general aviation airports. A list-option item provided a list of possible responses and asked the participant in their opinion, which of the following do they think contributed to this high frequency of runway incursions at their airport? For each reason they selected from the list of possible responses, they were then asked to explain why they believed this to be the case and provide an example. A rank-order item asked participants to list in rank order what they perceived to be the top five reasons for runway incursions at general aviation airports, and to rank their response on a scale where 1 = Most common/important and 5 = Least common/important (see Appendix G).

Section B: Professional demographics. The second section consisted of six demographic items. Participants were asked to self-report specific information about the total number of years overall experience they have working in the aviation profession, the total number of years they have working as an airport executive, the total number of years they have working in their current position, their current professional title/position, if they currently are a member of AAAE, and how many general aviation runway incursions have they experienced during their tenure as an airport executive (see Table 4.1).

Follow-up phone calls. In order to account for the open-endedness of the questionnaire format, pending participants' responses, I planned to discretionarily established contact with participants who were either anemic in their responses, or if further clarification of their responses were needed. Owing to the nature of qualitative studies, which allowed me to both collect and begin data analysis concurrently, as participants submitted their completed questionnaires, I immediately reviewed their responses, and began coding and data analysis. Upon initial contact, participants' had made it known that their preferred method of contact was phone calls, owing to the fact that they may easily overlook an email. Several attempts were made to contact participants to elaborate or clarify their responses, but these attempts were unsuccessful.

Procedures

Research methodology and design. The research methodology of the current study was qualitative, and two designs were employed: (1) Phenomenology and (2) the first stage of Grounded Theory.

Qualitative methodology. The objective of qualitative research is to understand a phenomenon from a descriptive and contextual application, as opposed to a numerically quantifiable variable assessment, which is more akin to quantitative studies. According to Ary, Jacobs, and Sorensen (2010), a qualitative study focuses on context and meaning, occurs in a natural setting, relies on a human instrument to collect descriptive data, and involves an emergent design in which data are examined from an inductive perspective. In the context of the current study, I captured airport managers' perceptions of what they believed to be the root cause(s) of runway incursions, the barriers they had experienced when trying to address runway incursions, and what they perceived to be successful and unsuccessful attempts at reducing runway incursions. Although the current study was not directly conducted at any airport, it still reflected a natural setting in that the airport managers were able to provide their first-hand experiences from working at a specific airport. These first-hand experiences were captured and described via the Airport Managers Interview Protocol.

Phenomenological design. According to Ary et al., (2010, p. 471), "a phenomenological study is designed to describe and interpret an experience by determining the meaning of the experience as perceived by the people who have participated in it." Creswell and Poth later reiterated this concept when they reported "phenomenology emphasizes the common experiences for a number of individuals" (Creswell & Poth, 2018, p. 82). This approach is grounded in the disciplines of Philosophy and Psychology, and posits that there are many ways to interpret a shared experience because individual reality is subjective. The phenomenological approach is unique from other approaches in that subjective experience comprises the epicenter of the inquiry. This approach was appropriate for this study because it aligned with the study's primary purpose. This approach also allowed for participants who had experienced runway incursion events to recall and describe these events from their personal realities. Conversely, a phenomenological design enabled me to use deductive reasoning to report findings, which is further discussed in Chapter four.

First stage of grounded theory design. Recall in Chapter 1, "First stage of grounded theory" was used by this study to address the first step (to formulate conjectures) of a two-part process of a grounded theory design. According to Ary, et.al., (2010, p. 463), grounded theory is rooted in the Sociology discipline and is intended to "inductively build a theory about practice or phenomenon using interviews and observations as the primary data collection tools". Creswell and Poth (2018) later reiterated this concept by reporting that the intent of grounded theory "is to move beyond description and to generate or discover a theory…(that) might help explain practice or provide a framework for further research" (Creswell & Poth, 2018, p. 82). Conversely, by implementing the use of grounded theory, this resulted in method triangulation, which augmented the validity of the study. This design also allowed for inductive reasoning to be implemented, which resulted in a set of conjectures being made upon data analysis.

Researcher's Role

I assumed the role of a nonparticipant. This meant that although I interacted with the participants, it was not to the extent of observing participants in their natural setting, or getting involved with the behaviors and activities of the participants (Ary, Jacobs, & Sorensen, 2010, p. 432). In the context of this research setting, my role of a nonparticipant entailed me establishing contact with the desired groups who had satisfied the aforementioned criteria, and actively reviewing to their responses to the interview questions as they were submitted, which focused on the participant's description of their GARI experience.

Human Subjects Research

Ethical considerations. Ary et al. (2010) discussed four main ethical considerations: (1) kind of information obtained, (2) researcher's relationship to participant, (3) reciprocation, and (4) getting permission to conduct research. They also stated that it is difficult to anticipate which, if any, of these ethical considerations may arise during the course of the study. Regarding the first three ethical considerations and based on the focus on the current study, the nature of the study (dissertation requirement), and the time schedule, I did not foresee any of these being a valid concern for the study. The fourth ethical consideration is discussed under the forthcoming IRB approval section.

Participant confidentiality and anonymity. At the start of data collection, participants were administered a code number that was only known to me (Ary, Jacobs, & Sorensen, 2010). This linked their questionnaire to the data analysis and results process, all while procuring their anonymity. For example, a code number such as "Participant 1" or "P1" was administered to a participant. During the data analysis and results process, I included excerpts from this participant's interview by referring to the participant as “P1”, which maintained participant confidentiality and anonymity from both my dissertation committee members and future readers.

Data etiquette. Once data were collected from participants, to ensure participant confidentiality and anonymity, I solely handled the data. This means that I collected and analyzed all the data. Although my dissertation committee was consulted during the data analysis process, only participant code numbers were used if required to ensure participant confidentiality and anonymity. The data were then only accessible from my password protected personal laptop, which contained the Nvivo© software that was used to analyze the data. No one else had access to my laptop. Upon successful completion of the dissertation defense, the data will be promptly and permanently deleted from my personal laptop.

IRB approval. Regarding the last ethical consideration, foregoing the commencement of the study, Florida Institute of Technology’s (FIT’s) Institutional Review Board (IRB) reviewed the study procedures for approval. I did not anticipate any mental or physical risk to the participants, as they had the option to opt out, or discontinue their participation if they experienced any unease as a result of study participation. The full details of the consent form and the IRB study approval are included in the appendix.

Standards of Qualitative Rigor

In qualitative research, rigor addresses concepts of validity and reliability. These concepts allow for researcher’s to make valid inferences from data, and to ensure data consistency. There are four essential standards of rigor: credibility, transferability, dependability, and confirmability. (Ary, Jacobs, & Sorensen, 2010).

Credibility. This refers to the accuracy or truthfulness of the findings, and was addressed in the current study through consensus, and interpretive adequacy (Ary, Jacobs, & Sorensen, 2010). Consensus was achieved via peer debriefing through my dissertation committee members, a faculty member who had current professional industry experience, and trusted colleagues (Ary et al., 2010, p. 499). Interpretive adequacy was achieved through the use of low-inference descriptors. Using low-inference descriptors allowed me to assimilate participants' direct quotes of their expressed thoughts, feelings, and experiences into the formal composition of the study's results and findings, which vicariously incorporates future readers' into the setting of the study as experienced through me. Attempts to member-check (interpretive adequacy) were unsuccessful. Member checks, which was not successfully executed, is a courtesy that allowed for the participants to provide feedback on the accuracy and interpretation of both their description and experience to ensure that the findings appropriately represent their perception of events. Threats to credibility included researcher bias, which may have resulted from allowing personal attitudes, preferences, and feelings to affect interpretation of data. I controlled for this bias by employing the reflexivity strategy. This strategy allowed me to self-reflect and actively recognized and sought-out my own biases.

Transferability. This refers to the extent to which the findings of the study can be generalized to other contexts or groups, and was addressed in the current study through descriptive adequacy. This involved providing “rich, detailed, thick descriptions of the context” so as to sanction future researchers and readers with enough information to make their own deductions (Ary et al., 2010, p. 501). Threats to transferability included selection effects (the construct being investigated in unique to one group), setting effects (results may be a function of investigation context), and history effects (participants unique historical experiences may influence comparisons). Reactivity was not a significant threat, as data were collected via online questionnaire as opposed to face-to-face interviews. I controlled for this bias by informing the reader of the limitations of the study.

Dependability. This refers to the extent to which a consistent pathway to context variability can be developed and justified. Attention to dependability was addressed in the form of audit trails, and intrarater agreement. Using the code-recode strategy, I coded the data, left the analysis for a period of time, and then returned to recode the data and compared the two sets of coded materials (intrarater greement). I included copies of participant correspondence and any other materials that were used during the study in the appendix, whereby arming future researchers’ and readers’ with the ability to form their own deductions about replicability within the context of the given research setting (audit trails). This should control for this bias.

Confirmability. This refers to "the extent to which the research is free of bias in the procedures and interpretation of the results" (Ary et al., 2010, p. 504). Attention to confirmability was addressed in the form of the aforementioned reflexivity, peer review, and audit trail, which also controlled for this bias.

Data Analysis

Inductive analysis allowed for data collection and analysis to be completed concurrently (Ary, et.al., 2010, p.425). Conversely, my first step in data analysis was to meticulously review all participant questionnaires that were completed on the SurveyMonkey website to ensure that all questions were answered in its entirety and appropriately.

The second stage involved the qualitative data analysis software tool, Nvivo©. This software enabled me to identify and categorize common themes, trends, and comments. Significant statements or quotes were identified, known as horizontalization, which lead to a development of themes and meanings. Next, a textual description was used to illuminate the participants' experiences, followed by the structural description, which was used to illuminate the context that influenced the experience, how it was experienced, and in what conditions and situations was it experienced. This all culminated in a composite description, which conveyed the overall essence of the phenomenon (Phenomenological analysis).

Once the data were categorized, it was contextualized and discussed relative to each of the three research questions that guided this current study (Ary, et.al., 2010, p.425). Conversely, using Spradley's (1979) approach, the data were organized into three domains, which corresponded to the three RQs. Under each domain, cover terms, and respective included terms if applicable, emerged from the data. Conjectures were inductively formulated from this data (first stage of Grounded Theory). This information was then synthesized into a format of tables that are illustrated in Chapter 4 (see Tables 4.5, 4.6, and 4.7).

The last stage reported descriptive statistics such as calculating measures of central tendency, measures of variability, and measures of position. Following the completion of the three aforementioned data analysis stages, unsuccessful attempts were made to contact the participants to provide feedback on both the accuracy and interpretation of their description of events, as well as the study findings. This is known as member-checking (Ary, et.al., 2010, p.500). Although every attempt was made on my part to execute member-checking, participants did not respond to my correspondence, thus, this was not able to be completed. However, the findings were reported in the study, and the committee was able to review it.

Descriptive statistics. To further inform the context of the research setting, I also reported the following descriptive statistics:

- Mean and standard deviation of participants' total number of years overall experience they have working in the aviation profession.
- Mean and standard deviation of participants' total number of years they have working as an airport executive.

- Mean and standard deviation of participants' total number of years they have working in their current position.
- Summary of participants' current professional title/position.
- Number of participants who are currently members of AAAE.
- Mean and standard deviation of participants' general aviation runway incursions they experienced during their tenure as an airport executive.

Context and Reflexivity

Data collection began on November 29th 2017 and culminated on February 15th, 2018, with a final count of 10 completed questionnaires. This sample size was guided by both the guidelines presented by Ary et.al. (2010, p. 429), and a realistic expectation for the scope of the study. My interest in the selected topic for this study stemmed from my GA specific research experience from past fellowships and grant-funded projects that I had actively participated in, which spanned roughly over a 2-year period, and a combined decade of research experience both in academia and industry. Over the latter part of this period, I had worked on two phenomenological studies that were both completed (or data collected) over the course of one academic semester. It is through these experiences that I felt equipped with the necessary skills required to complete this study.

Outside of my research experience as a student in academia, I am not an active aviation professional as yet. Therefore, I have never held any professional positions such as an airport manager.

Chapter 4

Results

Introduction

This chapter contains a discussion of the results from data analysis and is structured into three sections. The first section presents a summary of the demographic characteristics of the participants who comprised the sample. The second section contains a discussion of the results of data analysis relative to the three research questions that guided the current study. This discussion includes a summary of the salient information that emerged from contextual analysis and provides corresponding conjectures. These conjectures, which are the result of Spradley's (1979) domain analysis classification system, are summarized in tables and may be used to develop a framework and/or guidelines for understanding: (a) reasons for the occurrence of runway incursions, (b) barriers that emerge when addressing incursions, and (c) the lessons learned from addressing runway incursions. The last section of the chapter provides a brief discussion on standards of rigor and what I did and did not do relative to confirming the study's findings.

Profile of Participants

Based on an initial group of 18 potential participants, 10 agreed to participate in the current study. As reported in Table 4.1 and Table 4.2 below, the overall years of experience in aviation for these 10 participants ranged from 8 years to 40 years, the mean was M = 22.4 years (SD = 9.0), and the median was Mdn =

20.5 years. The years of experience as an airport executive ranged from 3 years to 35 years, the mean was *M* = 14.7 years (*SD* = 9.1), and the median was *Mdn* = 14.0 years. The years in current position ranged from 2 years to 17 years, the mean was *M* = 5.7 years (*SD* = 4.6), and the median was *Mdn* = 4.0 years. Lastly, 7 of the 10 participants indicated they were members of AAAE. Based on these results, the airport executives who comprised the sample were considerably diverse with respect to their overall experience in aviation and their airport experiences.

Table 4.1
Summary of Participants' Demographics

	Years Experience in Aviation						
Participant	Overall	As Airport Executive	In Current Position	Title[a]	AAAE Member?	FAA Region[b]	Num of GA RIs
1	40	35	5	AD	Y	AK	41–50
2	30	15	2	AOM	N	S	11–20
3	20	16	3	AM	Y	S	41–50
4	28	20	17	AAD	Y	NM	> 50
5	21	10	5	AM	Y	WP	31–40
6	8	3	2	AOMS	Y	WP	11–20
7	13	5	3		Y	WP	0–10
8	25	10	8	ADGA	N	WP	31–40
9	20	20	9	AD	Y	SW	> 50
10	19	13	3	DAO	N	S	11–20

Note: [a]AD = Airport Director, AOM = Airport Operations Manager, AM = Airport Manager, AAD = Assistant Airport Director, AOMS = Airport Operations and Maintenance Supervisor, ADGA = Assistant Director General Aviation, AD = Airport Director, DAO = Director Airport Operations. Participant 7 did not report his title. [b]AK = Alaskan, S = Southern (AL, FL, GA, KY, MS, NC, PR, SC, TN, VI), NM = Northwest Mountain (CO, ID, MT, OR, UT, WA, WY), WP = Western-Pacific (AZ, CA, HI, NV, GU, AS, MH), SW = Southwest (AR, LA, NM, OK, TX).

Table 4.2
Summary of Participants' Years Experience

Item	*M*	*SD*	*Mdn*	*Range*
Overal1 Years Experience in Aviation	22.4	9.0	20.5	8–40
Years as Airport Executive	14.7	9.1	14.0	3–35
Years in Current Position	5.7	4.6	4.0	2–17

As reported in Tables 4.1 (see above), 4.3, and 4.4 below, and relative to FAA's nine regions, five were represented in the current study: Alaskan, $N = 1$, or 20%; Northwest Mountain, $N = 1$, or 20%; Southern, $N = 3$, or 60%; Southwest, $N = 1$, or 20%; and Western-Pacific, $N = 4$, or 80%. Thus, the sample was most reflective of GA airports in the Western-Pacific region. With respect to the number of runway incursions experienced (Table 4.4), all participants reported having to address at least 11 RIs, and two participants reported addressing more than 50 RIs. Thus, the airport executives who comprised the current study had considerable experience attending to RIs.

Table 4.3
FAA Airport Regions Represented

Region	*N*	Percent (Sample)[a]	Percent (Overall)[b]
Alaskan	1	10%	11.1%
Central (IA, KS, MO, NE)	0		0.0%
Eastern (DC, DE, MD, NJ, NY, PA, VA, WV)	0		0.0%
Great Lakes (IL, IN, MI, MN, ND, OH, (SD, WI)	0		0.0%
New England (CT, ME, MA, NH, RI, VT)	0		0.0%
Northwest Mountain (CO, ID, MT, OR, UT, WA, WY)	1	10%	11.1%
Southern (AL, FL, GA, KY, MS, NC, PR, SC, TN, VI)	3	30%	33.3%
Southwest (AR, LA, NM, OK, TX).	1	10%	11.1%
Western-Pacific (AZ, CA, HI, NV, GU, AS, MH)	4	40%	44.4%

Note. [a]Only five of the nine FAA regions were represented in the sample. Therefore, the base is 5. [b]Base is 9.

Table 4.4
Runway Incursions Experienced

Number of RIs	*f*	Relative *f*
0–10	1	10%
11–20	3	30%
21–30	0	0%
31–40	2	20%
41–50	2	20%
> 50	2	20%

Data Analysis

Overview. As discussed in Chapter 3, both *NVivo*, a qualitative analysis software program, and Spradley's (1979) domains were employed to code and analyze the contextual data. The *NVivo* software uses a format known as "nodes" where data are either classified as a "parent node" or as a "child node." The determination of what got classified as a parent or child node was done at my discretion relative to the sample data. For example, each research question was coded as a parent node, which Spradley (1979) refers to as domains. Within each parent node, common themes were then identified as child nodes, which Spradley refers to as cover terms. In some cases, but not all, these cover terms were further refined into what Spradley calls included terms. A discussion of this coding relative to each research question follows. The reader is cautioned that participants' responses were sparse, which led to a paucity of rich contextual data. Based on my personal correspondence with the participants, I surmise this most likely was due to both the nature of the data collection instrument as well as factors associated with the participants, including their schedules, attitudes, and apathy. Nevertheless, several of the participants' responses to the items on the questionnaire were genuine, insightful, and comprehensive.

Research question 1: What are the primary reasons for RIs at GA airports? The first parent node (domain) corresponded to RQ 1 and was labeled "Primary Reasons for RIs." Based on participants' responses, three cover terms emerged: Pilot Deviation (PD), Vehicle/Pedestrian Deviation (V/PD), and Factors at Participants' Airport. Following is a description of each cover term and corresponding included terms where appropriate.

Pilot deviations. With respect to pilot deviations as a primary reason for runway incursions, participants cited two aspects of PDs: situation awareness and communication.

Situation awareness (SA). One aspect of pilot deviations that participants cited as a primary reason that contributed to PD RIs was situation awareness. Although a majority of participants (6 of 10) identified SA, their responses were terse and anemic, and hence not very informative. For example:

- Lack of situational awareness by pilots and controllers [*sic*] (P3).
- Pilot error—Loss of situational awareness [*sic*] (P4).
- Pilot confusion/distraction/disorientation [*sic*] (P5).
- Lack of familiarity with airport layout; disorientation[*sic*] (P6).
- Pilot situational awareness [*sic*] (P8).

In addition to these meager responses, Participant 9 offered a little more insight: "… for PDs it is often a lack of situational awareness, with training as a contributing factor [*sic*]." Although subsequent attempts were made for further elaboration, none were successful. Nevertheless, these participants all appeared to be saying the same thing, namely, that pilot deviation RIs are a function of pilots' not being sensitive to or cognizant of their surroundings.

Communication. A second aspect of pilot deviations that 3 of the 10 participants cited as a primary reason that contributed to PD RIs was communication. For example:

- Lack of communication between ATCT (Air Traffic Control Tower) and pilots [*sic*] (P2).
- The most common reasons for runway incursions in general is pilot deviations whether it be due to an improper perception of ATC instructions or more simply not receiving the proper instructions prior to movements [*sic*] (P7).
- Expectation bias: Pilots and controllers (and the rest of us for that matter) expect/anticipate an instruction or clearance with a bias based on what we have been given in the past [*sic*] (P10).

The reader will note that the issue of communication as a reason for PDs was not as persuasive as situation awareness. Only 3 of the 10 participants cited the former whereas more than half (6 of 10) cited the latter. Nevertheless, given that these three participants' comments were more substantive, I flagged it as an included term relative to Spradley's (1979) classification.

Vehicle/pedestrian deviations. With respect to vehicle/pedestrian deviations as a primary reason for runway incursions, participants fixated on one aspect of V/PDs: 5 of the 10 participants were very clear in citing airfield access. For example:

- … the lack of security with regard to accessing GA operations areas, compared to Part 139 airports [*sic*] (P2).
- Lack of familiarity with airport layout (and) disorientation [*sic*] (P6).

- For V/PDs, it is most often linked to unauthorized access to the airport movement areas [*sic*] (P9).

Complementing these terse responses, Participants 1 and 7 provided additional details as to what they saw as the primary reason fro V/PDs:

> Lack of strict airfield security, typical GA attitude that strict security is unnecessary, and geographic configuration of many GA airfields (inability to access aircraft w/o ability to drive to A/C, inadequate gate controls, lack of on site control personnel). "Incursions" are not officially Vehicle-Pedestrian-Deviations however, if they're not reported as such as would be the case at ATCT airports [*sic*]. (P1)
>
> The most concerning runway incursions involve V/PDs. These deviations can be rooted back to either a misconception of instructions by ground personnel or persons who enter the airfield by following an authorized individual onto the airfield or by unlawful entry (scaling a fence for instance) [*sic*]. (P7).

Factors at participants' airport. In addition to citing PDs and V/PDs –and their corresponding aspects—as primary reasons for runway incursions, participants also cited factors at their respective airports as reasons for RIs. These factors included resource related issues and the attention given to reporting runway incursions.

Resource related issues. Two resource related issues emerged from participants' responses. The first involved the lack of sufficient funding. For example, Participant 5 indicated that if he had sufficient funding he would be able to direct resources to upgrading the airfield: "(Funding) Would address non-standard conditions/airfield layout associated with age of the airport. Standards changed since layout was created. Many confusing locations on the airfield contribute to disorientation [*sic*].” Participant 9’s comments further augmented those of Participant 5:

> …there was an increase in SI/RI occurrences directly attributable to this project lack of sufficient funding - while the airport has received some funding for measures to reduce SI/RI occurrences, a proposed project to improve perimeter access controls (to reduce V/PD hazards in particular) remains unfunded several years after it was proposed (and supported by FAA Runway Safety) [*sic*]. (P9)

A second resource related issue was personnel, which was primarily reflective of attitudes. Among the various responses provided, Participant 6’s comment seemed to capture the essence of this issue:

> Our airport saw a high frequency of runway incursions in the past due in part to the attitude of airport personnel, specifically that of some airport tenants. V/PDs are the majority of runway incursions that can be avoided by an airport operator. Pilot deviations can sometimes be mitigated by more prevalent markings and signage but not only as many times these are due to misconception of instructions by the pilot. Operational deviations can rarely be controlled by the airport operator. At our airport, we have been working on more campaigns to inform airport tenants and their guests about the dangers of improper entry into the movement area. The goal has been to inform airport tenants about the need to wait for perimeter gates to fully close behind them, escorting personnel on the airport who have not received proper training, and ensuring that our tenants are providing proper training to persons to who they sub-lease. Changing attitudes of persons who utilize the airport have been essential which has been completed in a collaborative

> way with our tenants. The institution of a committee to resolve safety and security related issues (have) helped our airport reduce the frequency of runway incursions (specifically V/PDs) [*sic*]. (P6)

The reader will note that although only 3 of the 10 participants cited resource related issues as one of the factors for runway incursions at their airport, they were much more verbose in their responses than they were when citing PDs and V/PDs as primary reasons for RIs. I surmise that this might be because PDs and V/PDs are self-evident when it comes to reasons for RIs, and there really is not much that can be added. However, when given the opportunity to focus solely on their airport in particular, participants wanted their voice to be heard and hence were more forthcoming in their responses.

Factors that led to additional reporting. Continuing with this observation of participants "finding their voice," the common issue that resulted in the most substantive responses relative to reasons for RIs at participants' airports was related to the attention being given to reporting runway incursions. For example, Participant 3 indicated that he believes the reason for RIs at his airport is because his airport is very active and he has personnel who are sensitive to following FAA protocol for reporting all runway incursions:

> The airport has an FAA control tower that is operated 24/7. The airport is also one of the busiest general aviation airports in the country. Safety is the top priority at the airport and the air traffic controllers are very conscientious about reporting all incursions [*sic*]. (P3)

As the reader will note, Participant 3's response involved two primary issues. The first has to do with how active the airport is, and the second has to do with ensuring that all RIs are reported. With respect to the former, Participant 2 provided additional confirmation:

> I feel there are a couple reasons that together mostly contributed to the increase (in RIs). (First) the Airport operations have dramatically increased since 2010, when the total Airport operations were 189,732. Compared to 2017 where the total operations were 300,307 operations. (Second) the Airport's design, in that standard paths to and from the ramp Taxi-Ways and Run-Ways allowed for a direct path. You were able to move into a safety area without a turn [*sic*]. (P2)

The issue of how busy an airport is also was the sentiment of Participant 10, who reported that his airport "is a training environment for both flight students and controllers. When that environment is coupled with being the 3rd busiest airport in the state based on operations the incursion incident rate goes up [*sic*]."

With respect to reporting all RIs as a reason for the increase in RIs at GA airports, Participant 9 offered the following:

> (There has been a) heightened focus and increased enforcement—I arrived at this airport about the same time as a new FAA Tower Manager; we both took a hard line on reporting every incident regardless of severity and as a result the airport went from having 2–3 reported surface incidents (SIs) and runway incursions (RIs) per year to as many as 25 in one year ... the first step to addressing a problem is to accurately measure it; the second in this case was increased enforcement to reduce the occurrences ... prior to our arrival, the situation was not being addressed (and there was the) timing of

> (a) construction project—in 2013 we had a project to reconstruct the parallel taxiway, which required use of the runway for taxi operations in many phases [*sic*]. (P9)

Continuing along this reporting theme, Participant 1 wrote that he did not think that the FAA database accurately reflected reality, and that the reasons for RIs could be a function of the type of activities at the airport:

> This is a training field. That includes student pilots, flight instructors, AND ATCT Controllers. (The) latter includes their unencumbered ability to see all VDPs…Additionally, XXX has been here since 1930 and is both residentially and geographically encroached. We have apron-edge taxi-lanes that are really ATCT controlled taxiways and many areas on field can only practically be reached by vehicle [*sic*]. (P1)

Once again, there was a clear dichotomy in the substance of participants' responses when citing PDs and V/PDs as reasons for RIs compared to their responses that were focused on their respective airports.

Conjectures relative to RQ 1. As a result of the contextual data analysis relative to the domain of Primary Reasons for Runway Incursions, the following conjectures are offered, which also are summarized in Table 4.5.

1.1 GA airport managers will cite situation awareness relative to pilot deviations as a primary reason for runway incursions. Examples include pilot disorientation, lack of familiarity with airport layout, pilot error, and overall compromised SA by pilots and controllers.

1.2 GA airport managers will cite communication relative to pilot deviations as a primary reason for runway incursions. Examples include improper perception of ATC instruction, failure to receive proper instructions prior to movements, expectation bias, and overall poor communication between pilots and controllers.

1.3 GA airport managers will cite airfield access relative to vehicle/pedestrian deviations as a primary reason for runway incursions. Examples include lack of security, unfamiliarity with airport layout and disorientation, unauthorized and unlawful access to movement areas, and an overall laissez-faire safety attitude by airport personnel.

1.4 GA airport managers will cite resource related issues as a factor at their airport as a primary reason for runway incursions. Examples include insufficient funding to facilitate necessary airfield upgrades, and poor safety attitudes of airport personnel.

1.5 GA airport managers will cite attention to reporting RIs as a factor at their airport as a primary reason for runway incursions, and will include as one such factor. Examples include increased enforcement of runway incursions, and multifunctional use of the airport such as simultaneously accommodating student pilots as well as pilots building flight time.

Table 4.5
GA Manager's Primary Reasons for Runway Incursions

Domain 1	Cover Term[a]	Included Term	Conjectures *With respect to primary reasons for runway incursions: GA airport managers will cite …*
Primary Reasons	PD	Situation Awareness	1.1 situation awareness relative to pilot deviations. Examples include pilot disorientation, lack of familiarity with airport layout, pilot error, and overall compromised SA by pilots and controllers.
		Communication	1.2 communication relative to pilot deviations. Examples include improper perception of ATC instruction, failure to receive proper instructions prior to movements, expectation bias, and overall poor communication between pilots and controllers.
	V/PD	Airfield Access	1.3 airfield access relative to vehicle/pedestrian deviations. Examples include lack of security, unfamiliarity with airport layout and disorientation, unauthorized and unlawful access to movement areas, and an overall laissez-faire safety attitude by airport personnel.
	Factors at Participants' Airport	Resource Related Issues	1.4 resource related issues as a factor at their airport. Examples include insufficient funding to facilitate necessary airfield upgrades, and poor safety attitudes of airport personnel
		Attention to Reporting RIs	1.5 attention to reporting RIs as a factor at their airport. Examples include increased enforcement of runway incursions, and multifunctional use of the airport such as simultaneously accommodating student pilots as well as pilots building flight time.

Note. [a]PD = Pilot Deviation. V/PD = Vehicle/Pedestrian Deviation.

Research question 2: What barriers emerge when addressing RIs at GA airports? The second parent node (domain) corresponded to RQ 2 and was labeled "Barriers to Addressing RIs." Based on participants' responses, two cover terms related to this domain emerged: Airfield Infrastructure and Pilot Related

Issues. Following is a description of each cover term and corresponding included terms where appropriate.

Airfield infrastructure. With respect to airfield infrastructure as a barrier to addressing runway incursions, participants cited three corresponding aspects: funding, physical environment, and accessibility attitudes.

Funding. One factor associated with airfield infrastructure that 2 of the 10 participants cited as a barrier that emerged when addressing RIs was funding. For example, Participant 9 reported, "Funding for improvements (including perimeter fencing, access controls, standardized signs and markings) [*sic*]" are also important factors. Participant 7's response was a bit more informative:

> Funding—it is expensive to place the proper fencing and security barriers at an airport and the tenants do not always want to absorb the cost. Airports would like to place the most sophisticated fencing, gates and security camera's at every possible crevice but airport budgets will not always allow this action [*sic*]. (P7)

The reader should note that these two participants were the only ones who *overtly* cited funding issues. Several other participants also cited funding as a concern, but did so indirectly and this is why: (a) I believed there was enough support for funding issues to be flagged as an included term, and (b) I did not include these other participants' comments in support of this term.

Physical surroundings. A second factor associated with airfield infrastructure that 3 of the 10 participants cited as a barrier that emerged when addressing RIs was the physical surroundings. These participants' responses, though, were very terse and not very insightful. For example, Participant 1 wrote, "Fencing, adequate gate/access controls, [*sic*]" Participant 2 simply wrote "Design, [*sic*]" and Participant 6 wrote "Long processes to correct non-standard layout of airfield surfaces. It takes years to correct geometry related to runway incursions [*sic*]." Although all three participants' responses speak to the issue of the airfield infrastructure's physical environment as a barrier to addressing RIs, the reader is cautioned that in the absence of further elaboration it is difficult to understand exactly the effect the physical environment had on addressing RIs and how to mitigate any corresponding issues. Nevertheless, these comments do offer a small hint of what airport executives could expect to face when trying to address RIs at their airport.

Attitudes towards airport safety and security. A third factor associated with airfield infrastructure was attitudes towards airport safety and security. Although only two participants commented on this, their responses were a bit more substantive and gave a clear indication that people's attitudes about the airfield infrastructure was a concern. For example:

> Tenant attitudes—many tenants understand the need to mitigate RIs and SIs being that an airport perceived as unsafe becomes a marketing and financial

> issue. Some tenants do not understand why they cannot just walk where they want on the airport or drive as they please around the airport without training [*sic*] (P7).
>
> Organizational culture is at the top. There must be a zero-tolerance attitude in place starting with ATC and the airport administration, but extending to tenants and users [*sic*] (P9).

Pilot related issues. A second barrier participants cited that emerges when they address runway incursions was related to pilots. Although 5 of the 10 participants' responses referenced pilots, their comments were unique and hence did not warrant partitioning them into a set of included terms. For example, relative to the Barriers domain, Participant 3 simply wrote "pilot punitive fee, [*sic*]" which is a monetary fine pilots are assessed when they commit any violation that an airport has established to enforce safety regulations, including surface incidents as well as runway incursions. This concern for lack of not being forthcoming was echoed by Participant 10 who wrote "the culture of blame and parties not being open and honest. [*sic*]"

The reader will note that although these two comments were not elaborate, they were consistent with the published literature, which provides support that pilots generally are less likely to report, or be forthcoming about, any safety infractions they either commit or observe. For example, Cleary, Dolbeer, and Wright (2000) indicated a 20% underreporting for bird strikes in the U.S., and the

Australian Transport Safety Bureau (ATSB, 2012) indicated there was as much as a 40% underreporting of aviation wire strikes (e.g., transmission lines, power lines, etc.). More recently, Haslbeck and Schubert (2015) reported that with respect to 35 different contextual areas that were presented to pilots, “underreporting rates are very high, which means a substantial source of uncertainty in airlines’ safety reporting databases, and thus for airlines’ safety management systems” (p. 1). Haslbeck and Schubert also cited several reasons why pilots’ underreport (p. 4): the time needed to prepare a report and upload it into a database, negative feedback by their superior, a lack to initiate change, and a general presumption that any air safety report is meaningless and insignificant.

Independent of fines and punitive action, Participant 4—without further qualification or elaboration—indicated that it was necessary to “(ensure) adequate pilot training. [*sic*]” Consistent with this theme of pilot-related issues, Participant 6 offered “pilot interaction” as a concern when addressing runway incursions. He wrote “Most (pilots) want to be left alone and won’t listen to input. [*sic*]” Lastly, Participant 8 cited “communication [*sic*]” among pilots as his primary concern for addressing runway incursions: “Transient pilots may not know the airport diagram and not follow taxi instructions correctly. [*sic*]”

Conjectures relative to RQ 2. As a result of the contextual data analysis relative to the domain of Barriers to Addressing Runway Incursions, the following conjectures are offered, which also are summarized in Table 4.6.

2.1 GA airport managers will cite funding issues associated with the airfield infrastructure as a barrier to addressing runway incursions. Examples include structural barriers and technological upgrades such as fencing, security barriers, and parameter cameras.

2.2 GA airport managers will cite the airport environment associated with the airfield infrastructure as a barrier to addressing runway incursions. Examples include fencing, adequate gate/access controls, airfield design, and layout.

2.3 GA airport managers will cite attitudes towards airport safety and security associated with the airfield infrastructure as a barrier to addressing runway incursions. Examples include incongruent and dismissive attitudes of airport tenants and personnel relative to safety regulations and organizational culture.

2.4 GA airport managers will cite pilot-related issues as a barrier to addressing runway incursions. Examples include pilots' apprehension to be forthcoming or report infractions, pilot interactions, and poor training and communication.

Table 4.6
Barriers that Emerge when Addressing Runway Incursions at GA Airports

Domain 2	**Cover Term**	**Included Term**	**Conjectures** *With respect to barriers that emerge when addressing runway incursions: GA airport managers will cite …*
Barriers	Airfield Infrastructure	Funding Issues	2.1 funding issues associated with the airfield infrastructure. Examples include structural barriers and technological upgrades such as fencing, security barriers, and parameter cameras.
		Physical Environment	2.2 the airport environment associated with the airfield infrastructure. Examples include fencing, adequate gate/access controls, airfield design, and layout.
		Attitudes towards Airport Safety and Security	2.3 attitudes towards airport safety and security associated with the airfield infrastructure. Examples include incongruent and dismissive attitudes of airport tenants relative to safety regulations, and organizational culture.
	Pilot Related Issues	—	2.4 pilot-related issues. Examples include pilots' apprehension to be forthcoming or report infractions of pilot interactions, and poor training and communication.

Research question 3: What are the lessons learned from addressing runway incursions at GA airports? The third parent node (domain) corresponded to RQ 3 and was labeled "Lessons Learned," and participants' responses were partitioned into two cover terms: Collaborative Communication and Physical Surroundings. Following is a description of each cover term and corresponding included terms where appropriate. As has been typical throughout this chapter, the reader is reminded that most participants' responses were terse and not very informative. Nevertheless, they do provide some insight into the importance of collaborative communication and physical surroundings when addressing measures associated with RI mitigation.

Collaborative communication. The cover term "collaborative communication" referred to communications that involved multiple partners, and had both a positive and negative impact on RI mitigation. As a result, this led to two included terms: presence and absence. With respect to the former, collaborative communication helped promote effective RI mitigation efforts. With respect to the latter, the absence of collaborative communication was viewed as a hindrance to effective RI mitigation efforts. A brief discussion of each follows.

Presence. Participants 1 and 2 simply cited that "better communication [*sic*]" and "open communication [*sic*]" were effective measures for reducing RIs. Unfortunately, these participants did not provide any further elaboration and hence their comments were not useful other than to suggest the role communication has with RI mitigation efforts. Participant 6, however, cited "communication with pilots [*sic*]" as helping reduce RIs and then elaborated further on working with pilots:

> For those pilots who are willing to talk and learn, trainings have been very informative and given increased situational awareness to pilots. I have received several comments from local pilots saying how much more comfortable they are after understanding the reasons behind some of our conditions [*sic*]. (P6)

Participant 7 also elaborated on how collaborative communication promoted effective RI mitigation measures. Instead of pilots, though, which was the case for Participant 6, the targeted airport personnel were airport tenants:

> Tenant and Sub-tenant engagement has been the most effective initiative that we have undertaken. Our executive director advised all of our tenants that if corrective measures were not undertaken immediately that their access to the airfield would be highly restricted. Working with our tenants, we were able to develop collective practices such as limiting what types of vehicles can access the airfield that tenants were able to comply with. Working with our tenants has reinforced the need for training and had made it to a point that they have been involved in the process and that they accept the requirements voluntarily [*sic*]. (P7)

This concept of collaborative communication also extended beyond the airport proper and included local law enforcement. For example, Participant 9 wrote:

> Changing the culture and demonstrating through police enforcement of the rules & regulations (in the municipal ordinance) and increased police presence on the airport that this is a safety issue that we take most seriously ... that has had the greatest effect on reducing/eliminating V/PDs [*sic*]. (P9)

Absence. Some participants also reported that the absence of collaborative communications could make it difficult to reduce or mitigate RIs. For example, Participant 6 indicated that the use of punitive measures does not promote collaborative communications: “Imposing fines just makes people angry and they do not learn from their mistakes. I think this is part of the problem for why pilots do not want to talk or attend trainings. [*sic*]” Participant 7 elaborated further on the use of punitive measures by emphasizing the need for both collaboration and enforcement:

> Verbally telling people about RI initiatives without including stakeholders or without some type of enforcement action (could be counter-productive). Individuals need to know that there are penalties for non-compliance and prior to true engagement with stakeholders the message was not getting completely through [*sic*]. (P7)

Participant 10 reported, “annual RSAT (Runway Safety Action Team) is not always the most transparent and does not always promote dialog. [*sic*]”

Physical environment. In addition to citing collaborative communications as a lesson learned from addressing runway incursions, participants also commented on the physical environment of their respective airports. This was keyed in part by Participant 2’s curt comment, “Airport improvements. [*sic*]” Unlike Participant 2, though, who did not reflect specifically on lessons were learned relative to airport improvements, Participants 4, 5, and 9 were a little bit more verbose (but not by much):

- Participant 4 reported, “Change in airfield pavement areas to reduce confusion and installation of elevated guard lights (has) helped to reduce pilot confusion/loss of situational awareness. [*sic*]”
- Participant 5 reported, “The installation of runway guard lights. This was only accomplished due to a great relationship with the FAA. [*sic*]”
- Participant 9 reported, “The installation of the Runway Guard Lights has probably had the greatest effect on reducing PDs (along with the designation of multiple RI “hot spots” on our Airport Diagram). [*sic*]”

Based on these responses, it appears that the single most effective modification to the physical environment that would help mitigate RIs is giving attention to runway guard lights. This also might be the “airport improvement [*sic*]” to which Participant 2 was referring.

Conjectures relative to RQ 3. As a result of the contextual data analysis relative to the domain of Lessons Learned from Addressing Runway Incursions, the following conjectures are offered, which also are summarized in Table 4.7.

3.1 GA airport managers will cite the presence of collaborative communication with stakeholders as a lesson they learned that could promote effective RI mitigation efforts. Examples include establishing dialogue with pilots, airport tenants, and local law enforcement.

3.2 GA airport managers will cite the lack or absence of collaborative communication with stakeholders as a lesson they learned that could hinder effective RI mitigation efforts. Examples include (a) imposing fines on airport personnel and tenants in the absence of informing stakeholders about the airport's RI safety rules and initiatives, and subsequent punitive retribution for noncompliance, and (b) the failure of RSAT programs to promote transparency and effective dialog.

3.3 GA airport managers will cite making modifications to the physical environment as a lesson they learned that could promote effective RI mitigation efforts. Examples include modifying airfield pavements to reduce confusion and installing runway guard lights.

Table 4.7
Lessons Learned from Addressing Runway Incursions at GA Airports

Domain 3	Cover Terms	Included Terms	Conjectures *With respect to lessons learned from addressing runway incursions: GA airport managers will cite …*
Lessons Learned	Collaborative Communication	Presence	3.1 the presence of collaborative communication with stakeholders as a way to promote effective RI mitigation efforts. Examples include establishing dialogue with pilots, airport tenants, and local law enforcement.
		Absence	3.2 the absence of collaborative communication with stakeholders as a way that could hinder effective RI mitigation efforts. Examples include (a) invoking punitive measures without informing stakeholders about the airport's RI safety rules and initiatives, and subsequent fines for noncompliance, and (b) the failure of RSAT programs to promote transparency and effective dialog.
	Physical Environment	—	3.3 making modifications to the physical environment as an effective measure for mitigating runway incursions. Examples include modifying airfield pavements to reduce confusion and installing runway guard lights.

Confirmation of Results

Overview. Given the nature of the current study, data were collected and analyzed based on my subjective interpretations. In an attempt to mitigate the flaws of researchers who conduct qualitative studies, Ary, Jacobs, and Sorensen (2010) offer several checks and balances that should be undertaken. This concept is known as standards of rigor, and one standard of rigor qualitative researchers most frequently focus on is the concept of credibility, which refers to the truthfulness of the findings. In this section, two methods that I used for enhancing credibility are presented: (a) evidence based on consensus, which is demonstrated through the method of peer debriefing; and (b) evidence based on referential or interpretative adequacy, which employs the strategy of low inference descriptors.

Evidence based on consensus. According to Ary et al. (2010, pp. 498–500), peer debriefing is a strategy in which a researcher provides a colleague or peer with the raw data, descriptions, interpretations, and explanations of the study's findings. These peers then review these documents to determine if the researcher's interpretations and findings are reasonable. For the current study, my peer debriefer was a member of my dissertation committee whose academic experiences included extensive study of qualitative research methodology under the mentorship of a colleague from the University of Florida's qualitative research program as well as conducting and leading qualitative studies.

During this process, my peer debriefer adopted the role of devil's advocate. After reviewing my coding he challenged the manner in which I analyzed the data, my interpretations of the data, and the manner in which I structured the findings. These challenges led to a revision of the research questions, which better reflected the salient information that emerged from participants' comments, and resulted in more cogent interpretations and a more organized presentation of the key findings relative to Spradley's (1979) domain–cover terms–included term classification.

Evidence based on referential or interpretative adequacy. According to Ary et al. (2010, pp. 498–500), using low-inference descriptors such as direct quotes can assist the reader in experiencing the participants' world. In the context of this study, this was achieved by including participants' direct quotes from their responses on the instrument. This thick, rich description allowed me to convey an understanding of the study's context, which allowed the reader to "see" the setting, and understand the various themes that were extracted. This in turn enhanced the overall credibility of the study's findings.

Formal data collection for the current study concluded on February 16, 2018, with a total of 10 participants. However, due to unforeseen circumstances, I did not begin data analysis until several months later. As a result, it was a challenge for me to re-establish contact with all 10 participants for the purpose of member-checking. For example, three participants have since left their positions and are no longer affiliated with the airports selected for this study, and I was unable to secure forwarding contact information for these participants. After multiple attempts to establish contact with the remaining seven participants, none responded. Because these participants are active professionals in their field and had voluntarily participated in the current study, I opted to exercise great caution and respect for their work environment regarding the amount of times I attempted to contact them and stopped after five attempts, the last of which was in January 2019. Therefore, member-checking was not successful. As a result, the credibility of the current study's findings might be problematic and hence is considered a limitation.

Summary

In summation, this chapter provided an overview of the results of this study by discussing the descriptive statistics of the demographic data, contextual analysis, and impending results. Inductive analysis allowed for data collection and analysis to be completed concurrently. Using the qualitative data analysis software tool, Nvivo©, and Spradley's (1979) approach, the data were organized into three domains, which corresponded to the three RQs. The results of data analysis led to the development of common themes and patterns (the phenomenological design component), and these common themes and patterns then served as the basis for formulating corresponding conjectures (the first stage of grounded theory design).

Chapter 5

Conclusions, Implications, and Recommendations

Summary of Study

The purpose of the current study was manifold: (a) to understand the reasons for the occurrence of runway incursions at general aviation (GA) airports, (b) to describe the barriers that emerge when addressing runway incursions at GA airports, and (c) the lessons learned from addressing runway incursions at GA airports. The target population was all GA airports within the United States, and the accessible population was all GA airports within the United States that had experienced a runway incursion, as documented by the Federal Aviation Administration (FAA) Aviation Safety Information Analysis and Sharing (ASIAS) database. The sampling strategy was purposive and data were collected from the airport managers at the targeted airports.

Ten airports—and hence, 10 airport managers—comprised the sample, and the targeted airports represented five of the nine FAA regions: One airport was in the Alaskan region, one airport was in the Northwest Mountain region, three airports were in the Southern region, one airport was in the Southwest region, and four were in the Western-Pacific region. With respect to the airport managers' professional experiences: the mean overall years of aviation experience was M = 22.4 years, the mean years as an airport executive was M = 14.7 years, and the mean years in their current position was M = 5.7 years. Furthermore, 7 of the 10 airport managers reported being active members of AAAE, and all 10 airport managers reported they had experienced multiple RI events. No personological characteristics data such as gender, age, or ethnicity were collected.

The current study used a single, researcher-developed data collection instrument designed to answer the study's three research questions. This instrument was comprised of two sections: Section A contained a 20-item interview protocol, which consisted of open-ended, list-options, and ranking order items that allowed participants to self-report information about their experiences with runway incursions relative to their airports, and Section B consisted of six professional experience questions. I gave attention to the content validity of the instrument by having my committee members review its items. One member of my committee was directly involved in the design of the instrument, and the other members provided constructive feedback as to how to modify the questions to elicit effective and more robust responses from the participants. I also conducted a preliminary study to get feedback about the structure of the items and the estimated time to completion.

To best answer the research questions, the current study was implemented using a qualitative phenomenological design augmented by the first stage of grounded theory design. The designs were appropriate because the purpose of the study was to understand the phenomenon of runway incursions at GA airports as understood from the subjective experiences of airport managers, and subsequently inductively formulate conjectures of this social phenomenon. In the current study, I reviewed participants' stories of their runway incursion experiences via their responses to the items in Section A of the data collection instrument. The results of data analysis led to the development of common themes and patterns (the phenomenological design component), and these common themes and patterns then served as the basis for formulating corresponding conjectures (the first stage of grounded theory design).

The current study also addressed four standards of rigor to promote validity and reliability of the findings: (a) credibility was addressed through consensus (peer debriefing), and interpretive adequacy (low-inference descriptors; recall in Chapter 4 that member checking attempts were unsuccessful); (b) transferability was addressed through descriptive adequacy (the development of a thick description, which is this dissertation); (c) dependability was addressed through audit trails, and intrarater agreement (code-recode strategy), and (d) confirmability was addressed through reflexivity, peer review, and an audit trail. The data collection instrument was administered via *SurveyMonkey*, an online data collection forum, and the data collection period was approximately 3 months, from November 2017 to February 2018.

Summary of Findings

As noted in Chapter 4, *NVivo* was used to code and analyze the contextual data into "parent nodes" or "child nodes," which Spradley (1979) referred to as domains, cover terms, and included terms. The reader will recall that although some participants' responses were sparse, other participants' responses were more informative. The detailed tables respective to each of the individual research questions that followed Spradley's data classification are illustrated in Chapter 4 (Tables 4.5, 4.6, and 4.7). Following is a summary of the salient information that emerged from the data relative to the two research design components.

Summary of the phenomenological results. As noted in Chapter 3, "phenomenology emphasizes the common experiences for a number of individuals" (Creswell & Poth, 2018, p. 82). With respect to the current study, the individuals were airport managers, and the common experiences were related to runway incursions. Following is a summary of the common themes/patterns that emerged from airport managers' experiences relative to the study's research questions.

Research question 1. Research Question 1 corresponded to the domain of "primary reasons for runway incursions." Within this domain, the results of the contextual analysis yielded three cover terms and five included terms: The primary reasons for runway incursions covered: (a) pilot deviations (PD), which included situation awareness and communication issues; (b) vehicle/pedestrian deviations (V/PD), which included access to the airfield; and (c) factors at participants' airports, which included resource related issues and the attention that was given to reporting runway incursions.

Research question 2. Research Question 2 corresponded to the domain of "barriers that emerge when addressing runway incursions at GA airports." Within this domain, the results of the contextual analysis yielded two cover terms and three included terms: The barriers that emerge when addressing runway incursions at GA airports covered: (a) the infrastructure of the airfield, which included funding issues, the airport environment, and tenants' attitudes toward airport safety and security; (b) pilot related issues such as their apprehension to be forthcoming or report infractions of pilot interactions, poor training, and communication

Research question 3. Research Question 3 corresponded to the domain of "lessons learned from addressing runway incursions at GA airports." Within this domain, the results of the contextual analysis yielded two cover terms and two included terms: The lessons learned from addressing runway incursions at GA airports covered: (a) the concept of collaborative communication, and included how the presence of such communications could be beneficial whereas their absence could be a hindrance; and (b) the benefit of making modifications to the physical environment such as modifying airfield pavements to reduce confusion and installing runway guard lights.

Summary of the first stage of grounded theory results. As explained in Chapter 3, the reader will recall that the intent of grounded theory "is to move beyond description and to generate or discover a theory…(that) might help explain practice or provide a framework for further research" (Creswell & Poth, 2018, p.

82). In the context of the current study, a complete grounded theory design was not implemented because the intent of the study was not to generate or discover a theory, but instead to develop a framework for further research. This framework was provided in the form of conjectures, which were grounded in participants' responses. A set of conjectures was developed for each research question and summarized in Tables 4.5, 4.6, and 4.7 in Chapter 4. Following is a brief summary of these conjectures relative to the study's research questions.

Research question 1. For Research Question 1, which corresponded to the primary reasons for runway incursions, the conjectures were made relative to three cover terms and their respective included terms as follows:

Pilot deviations–situation awareness. With respect to pilot deviations that are based on situation awareness, GA managers will cite as primary reasons for runway incursions: disorientation, lack of familiarity with airport layout, pilot error, and overall compromised situation awareness by pilots and controllers.

Pilot deviations–communication issues. With respect to pilot deviations that are based on communication issues, GA managers will cite as primary reasons for runway incursions: improper perceptions of ATC instructions, failure to receive proper instructions prior to movements, expectation bias, and overall poor communication between pilots and controllers.

Vehicle/pedestrian deviations–airfield access. With respect to vehicle/pedestrian deviations that are relative to accessing the airfield, GA managers will cite as primary reasons for runway incursions: lack of security, unfamiliarity with airport layout and disorientation, unauthorized and unlawful access to movement areas, and an overall laissez-faire safety attitude by airport personnel.

Factors at participants' airport–resource related issues. With respect to resource related issues at participants' airports, GA managers will cite as primary reasons for runway incursions: insufficient funding to facilitate necessary airfield upgrades, and poor safety attitudes of airport personnel (at their airport).

Factors at participants' airport–attention to reporting runway incursions. With respect to the attention given to reporting RIs at participants' airports, GA managers will cite as primary reasons for runway incursions: increased enforcement of runway incursions, and multifunctional use of the airport such as simultaneously accommodating student pilots as well as pilots building flight time.

Research question 2. For Research Question 2, which corresponded to the barriers that emerge when addressing runway incursions, the conjectures were made relative to two cover terms and their respective included terms as follows:

Airfield infrastructure–funding issues. With respect to funding issues associated with the airfield infrastructure, GA managers will cite as barriers that emerge when addressing runway incursions: structural and technological upgrades such as fencing, security barriers, and parameter cameras are expensive, especially when one party is expected to absorb all the cost.

Airfield infrastructure–physical environment. With respect to the physical environment of the airfield infrastructure, GA managers will cite as barriers that emerge when addressing runway incursions: inadequate fencing and gate/access controls, and poor airfield design and layout.

Airfield infrastructure–accessibility attitudes. With respect to tenants' attitudes toward accessing the airfield, GA managers will cite as barriers that emerge when addressing runway incursions: the incongruent and dismissive attitudes of airport tenants relative to safety regulations, and organizational culture.

Pilot related issues. With respect to pilot related issues as a barrier to addressing runway incursions, GA managers will cite as barriers that emerge when addressing runway incursions: pilots' apprehension to be forthcoming or report infractions because of possible punitive retribution, pilot interactions, and poor training and communication.

Research question 3. For Research Question 3, which corresponded to the lessons participants learned when trying to address runway incursions, the conjectures were made relative to two cover terms and their respective included terms as follows:

Collaborative communication–presence. With respect to the presence of collaborative communication, GA managers will cite as one of the lessons they learned when addressing runway incursions that collaborative communication promotes effective communication among pilots, airport tenants, and local law enforcement. Through inclusivity, pilots and airport tenants are better educated on runway incursion safety rules as they pertain to the airport, and the ensuing consequences for their actions. Additionally, the increased presence of local law enforcement sends the message that airport managers are serious about the enforcement (and subsequent punitive retribution if necessary) of runway incursion safety rules.

Collaborative communication–absence. With respect to the absence of collaborative communication, GA managers will cite as one of the lessons they learned when addressing runway incursions the absence of collaboration with stakeholders could hinder effective runway incursion mitigation efforts. This could result in pilots and stakeholders being uninformed about the airport's runway incursion safety rules and initiatives, and the subsequent (adverse reaction by pilots to) punitive retribution for noncompliance. Additionally, programs such as RSAT could be viewed as counterproductive because they fail to promote transparency and effective dialog.

Physical surroundings. With respect to lessons learned relative to the physical environment, GA managers will cite that by making modifications to airfield pavements and installing runway guard lights could reduce pilot disorientation.

Conclusions and Inferences

In this section, I review the current study's findings relative to the three research questions presented in Chapter 1. As part of this discussion I present an interpretation of the results in the context of the research setting as well as plausible explanations for the results.

Research question 1: What are the primary reasons for the occurrence of runway incursions at general aviation airports? As reported in Table 4.5 and summarized in the previous section, RQ 1 corresponded to Domain 1 and three primary reasons (cover terms) for the occurrence of runway incursions at GA airports emerged from the data: (a) pilot deviations, which included their situation awareness and communication issues; (b) vehicle/pedestrian deviations, which included access to the airfield; and (c) factors at the participants' respective airports, which included resource related issues as well as the attention that was given to reporting runway incursions. A separate discussion for each cover term follows:

Pilot deviations. A plausible explanation for participants citing pilot deviations as a primary reason for runway incursions at GA airports is related to the training they receive. Unlike the strict and ongoing training requirements of airline transport pilots (ATP), GA pilots are not required to undergo continuous/periodic training once they receive their private pilots license. Therefore, it is reasonable to surmise that participants would cite situation awareness and communication issues associated with pilot deviations as primary sources for runway incursions at GA airports.

Accenting this issue of limited training requirements for GA pilots, it also is reasonable to conclude that GA pilots' skill set is limited and this could negatively impact their communication skills as well as their level of situation awareness. In addition to limited training, GA pilots also generally have limited experience when compared to their more advanced and highly trained ATP counterparts. For example, Thomas (2002) cited an Airplane Owners and Pilots Association (AOPA) report that private pilots generally have the least flight experience and account for 35% of all PDs whereas airline transport pilots generally have the most flight experience and account for 30% of all PDs. This limited experience among GA pilots could impact pilots' situation awareness because of their inability to quickly adapt to unfamiliar airport designs or layouts, and it could impact pilots' communication skills leading to an inability to clarify, confirm, or ask ATC to repeat instructions prior to movement.

Vehicle/pedestrian deviations. A plausible explanation for participants citing vehicle/pedestrian deviations as a primary reason for runway incursions at GA airports is related to insufficient training. Although none of the participants' specifically mentioned this, consider the examples participants gave relative to accessing the airfield: unfamiliarity with airport layout, unauthorized/unlawful access to movement areas, and a laissez-faire safety attitude by airport personnel.

These examples infer a lack of proper training. Thus, it is reasonable to conclude that in the absence of such training, lack of attention to these issues associated with airfield access will contribute to vehicle/pedestrian related runway incursions.

Factors at participants' airport. A common refrain among the participants as to what contributed to runway incursions at their respective airports was a lack of sufficient funding. A plausible explanation for this reason is participants' airports might not be a priority for federal funding as a result of their size, location, or volume of air traffic it handles daily. A second plausible explanation is that the desired upgrades to bring the airport's layout, design, and technological growth up to currently desirable safety standards may be too costly owing to the age of the airport.

The participants also cited as a primary reason for runway incursions at their airport, was the manner in which they reported runway incursions. Although they did not provide specific details, it is reasonable to surmise that this could be a function of several things, including: (a) a change in leadership that brought about a stricter or more lenient approach to reporting runway incursions, or (b) a change in local airport authority policy that protected a violator's anonymity and promoted non-punitive consequences of reporting a runway incursion.

Summarizing. When the findings of Domain 1 are considered collectively, it appears that the reasons for runway incursions occurring at GA airports can be attributed to many aspects across a broad spectrum of an airport's operation. These include: the pilots who fly in and out of these airports, the training and attitudes of the airport personnel (nonpilots) who have access to the airfield, the lack of resources the airport has to help reduce runway incursions, and the extent to which runway incursions are being reported. These findings infer that the reasons for runway incursions occurring at GA airports are grounded in many different factors, and that airport managers at GA airports must give careful attention to these factors when addressing runway incursions.

Research question 2: What barriers emerge when addressing runway incursions at general aviation airports? As reported in Table 4.6 and summarized in the previous section, RQ 2 corresponded to Domain 2 and two barriers (cover terms) emerged from the data when addressing runway incursions at GA airports: (a) airfield infrastructure, which included funding issues, the physical environment, and accessibility attitudes; and (b) pilot related issues, for which no included term emerged. A separate discussion for each cover term follows:

Airfield infrastructure. A plausible explanation for participants citing airfield infrastructure as a barrier that emerges when addressing runway incursions at GA airports is related to the multidimensional aspects of an airport. In the most general sense, airports may be partitioned into two primary areas: landside and airside. The former refers to the unrestricted area accessible to the general public and includes check-in and ticketing desks. The latter refers to the restricted area accessible to airport staff and passengers who have cleared security and includes duty free shops and lounges—it is the “secured” area. This secured area also encompasses the airfield, which includes maintenance and storage buildings, fueling facilities, airport-owned utilities, fencing and gates, drainage, airport vehicles, hangars, airfield lighting and signs, and so forth.

Given this vast real estate and corresponding infrastructure, it is reasonable to surmise that issues such as funding, the physical environment, and accessibility attitudes of airport personnel would emerge as barriers to addressing runway incursions. For example, it takes considerable funding to maintain the airfield and facilitate safety upgrades, and the lack of such funding could become a considerable barrier in any runway mitigation efforts. Insufficient funding could be attributed to various reasons such as: the airport’s inability to generate enough income to qualify for or be prioritized for federal funding due to the size, location, and volume of air traffic it handles daily. On the other hand, although increased funding would facilitate the growth of the airport’s physical environment, for which participants’ also cited, one must consider whether some of these airports even have the physical space to redesign and modify their layout due to zoning concerns and encroaching surroundings such as housing developments or business that have expanded around the airport over time. Furthermore, the timeline for modification projects need to be considered as these activities could result in increased safety concerns in the interim, such as contributing to traffic congestion, or increase vehicles and personnel in certain areas such as taxiways and runways.

In addition to citing funding issues and the physical environment, participants also reported the incongruent and dismissive attitudes of airport tenants relative to airfield accessibility as a barrier that emerges when addressing runway incursions. A plausible explanation for this is related to airport leadership. As noted earlier, the airfield infrastructure requires a sizeable staff, and concomitant to a large staff are the personalities and opinions of airport personnel. Thus, it is reasonable to infer that the absence of strong leadership that consistently adopts, conveys, and enforces a strong safety culture could lead to an attitude problem. The issue of strong leadership becomes even more critical when one considers all aspects of an airport, both airside and landside: Sharing an airport with various tenants who maintain their own fiefdoms makes a uniformed approach to safety very difficult to achieve because of the possible discord that is typically prevalent in an organizational hierarchy. This issue also could be partly attributed to and/or exacerbated by the fact that the FAA and TSA are responsible for various areas of the airside of an airport.

Pilot related issues. A plausible explanation for participants citing pilot related issues as a barrier that emerges when addressing runway incursions at GA airports is related to Domain 1, which focused on primary reasons for runway incursions. The reader will recall that one of the cover terms for Domain 1 was pilot deviations. Thus, it is reasonable to conclude that if participants cite pilot deviations as a primary reason for runway incursions, then they also would cite pilot-related issues as a barrier that emerges when addressing runway incursions.

For example, as noted in Table 4.6, some of the pilot-related issues included pilots' apprehension to be forthcoming or report infractions of pilot interactions, and poor training and communication. With respect to the former, not admitting to or reporting any type of infraction is consistent with human nature and infers an external locus of control (LOC), which refers to

> the degree to which a person perceives that the outcomes of the situations they experience are under their personal control. Individuals with an internal locus of control orientation perceive that they can exert control over the outcome of the situation, while individuals with an external locus of control attribute outcomes to external factors, such as luck or the actions of other persons. (Hunter, 2002, p. 1184)

When examined from this perspective, it makes sense for pilots with an external LOC orientation not to report any infractions because it would mean an admission of guilt and taking personal responsibility for their actions. Doing so also could be a blow to their ego. Thus, by not admitting to or reporting infractions, pilots are able to protect their ego. This also is consistent with what psychologist call self-serving bias (Boyes, 2013, p. 1). Although the current study did not collect any pilot data, these observations nevertheless are reasonable for two reasons. First, Hunter (2002) reported, "pilots become more internally oriented as they grow older, but not as they become more experienced" (p. 1188). This implies that younger pilots, regardless of their aggregated flight hours are more externally oriented. Second, based on FAA data, the mean age of all pilots in 2018 was 44.9n years old, which is still relatively young (FAA, 2019).

With respect to poor training and communication, as noted earlier in Domain 1, GA pilots have fewer rules and regulations to adhere to when compared to their ATP counterparts. As a result, they may be more deficient in training, communication, and flight time experience. Thus, they may be less inclined to actively participate or contribute to the success of safety programs as they may deem such measures as being over-regulated, unnecessarily cautious, or simply an unwanted hindrance. Furthermore, pilots may view punitive retribution as a personal offense to their professionalism, and are therefore less likely to participate, or provide assistance of any type related to safety programs. It is therefore reasonable to conclude that the presence of pilots' dissonance creates a barrier to successfully addressing runway incursions at GA airports.

Summarizing. When the findings of Domain 2 are considered collectively, the barriers that emerge when addressing runway incursions at GA airports are not as widespread as one might think. Only two main barriers emerged: airfield infrastructure, which included a lack of funding for emplacing safety/security upgrades and dealing with the attitudes of airport tenants relative to airfield accessibility, and pilot-related issues as noted above. The reader should not be misled, though, into thinking that these would be relatively easy to address. On the contrary, these findings infer that GA airport managers are faced with two considerable challenges when trying to address runway incursions: (a) securing sufficient funding, which always is an ever-present and ongoing effort, and (b) managing egos and personalities, which might be even more formidable than funding and calls for a herculean endeavor that should include formal training in cognitive psychology.

Research question 3: What lessons were learned from addressing runway incursions at general aviation airports? As reported in Table 4.7, RQ 3 corresponded to Domain 3 and two lessons learned (cover terms) from addressing runway incursions at GA airports emerged from the data: (a) collaborative communication, which included the presence and absence of such communication, and (b) the physical environment, for which no included term emerged from the data. A separate discussion for each cover term follows:

Collaborative communication. The reader will recall from RQ 1, which corresponded to the domain of primary reasons for runway incursions at GA airports, participants cited communication as a primary factor. Following this train of thought, the natural progression comes full circle with participants' citing communication as a lesson learned from addressing runway incursions. For example, according to Rajhans (2012), effective organizational communication is key and relies on “downward and upward communication” (p. 84), or to say it more colloquially, “communication is a two-way street.”

> Effective downward communication allows decisions taken by the management of the organisation to be converted into action by employees, also boosts teamwork, trust, better relations, productivity and fewer chances of rumours and miscommunication. Furthermore, it allows for a consistency of action, and it may stimulate a greater commitment on the part of employees. Upward communication helps managers to understand both business and personal issues that affect employees. In addition, creative suggestions from employees help management in decision making and improvement of the organisation. (Rajhans, 2012, p. 84)

As noted earlier and reported in Table 4.7, the concept of communication emerged as a lesson learned from addressing runway incursions fully qualified as “collaborative communication,” which refers to a process where everyone works together equally toward a common goal(s). Furthermore, based on the contextual data analysis of participants’ responses, collaborative communication included both its presence and absence. A brief discussion of each follows.

The presence of collaborative communication. The primary intent for an organization to engage in collaborative communication is to promote a feeling of worthiness among its employees so they feel that their voices (input) matter. A plausible explanation why airport managers cited the presence of collaborative communication as an effective strategy for addressing runway incursions could be related to their own experiences. For example, over the course of their professional aviation careers, participants presumably attended safety trainings or actively engaged in safety programs that promoted the effectiveness of improved communication among airport personnel as an efficient method to reduce runway incursions. When these past experiences are juxtaposed with runway incursions consistently being targeted by the FAA and NTSB, it is reasonable to surmise that airport managers felt more pressure to promote a collaborative communication agenda at their airport.

A second plausible explanation for airport managers citing the presence of collaborative collaboration as a lesson learned from addressing runway incursions could be pragmatic in nature. For example, the reader will recall from RQ 1 that participants acknowledged communications played a critical role with respect to reasons for pilot deviations. As a result, it is reasonable to surmise that this awareness/acknowledgement could have been the basis for citing communication as a lesson learned. This inference is further supported by the fact that participants indicated that keeping pilots and non-pilot personnel informed of airport rules and regulations, and promoting the presence of law enforcement as a noncompliance deterrent, helped mitigate runway incursions. The reader will note that these actions are consistent with the concept and intention of collaborative communication.

The absence of collaborative communication. Just as the presence of collaborative communication can have a positive impact on mitigating runway incursions, the absence of such communication can have the opposite effect. A plausible explanation why airport managers cited this as a lesson learned could have stemmed from their responses to RQ 2. As explained earlier, an airport is a multifunctional entity that is shared with various tenants who maintain their own fiefdoms. One of the biggest challenges airport managers have is keeping everyone on the same page and trying to manage the different attitudes of the diversified parties involved. For example, pilots may be less inclined to contribute to the safety dialog for a variety of reasons ranging from apathy to hubris. Comparatively, owing to the variety of parties that fall under airport personnel, anarchy or discord may hinder proper communication habits. It also is conceivable that local law enforcement may be understaffed to assist in the necessary capacity, or perhaps have not been informed and invited to provide auxiliary assistance. Although not specifically cited by participants, these examples presumably reflect actual situations that airport mangers have experienced and hence it is reasonable to understand why airport managers would cite the absence of collaborative communication as a lesson learned when addressing runway incursions.

Physical environment. The second cover term that emerged under the domain of lessons learned was the physical environment, which is yet another term that came full circle. The reader will recall from RQ 2 that the physical environment was associated as a barrier that emerged when addressing runway incursions. Thus, a plausible explanation for participants citing the physical environment as a lesson learned stems from their recognition of the need for improvements to the physical environment. As noted by their responses, participants cited two examples of changes they made to the physical environment: They modified the airfield pavements to reduce confusion, and they installed runway guard lights. These modifications presumably increased situation awareness for pilots and airport personnel, and helped reduce confusion about what areas are accessible and assisted in faster orientation of the airport layout. Therefore, it is reasonable to surmise that airport managers observed a reduction in runway incursions as a result of these changes, which led them to citing the physical environment term as a lesson learned when addressing runway incursions.

Summarizing. When the findings of Domain 3 are considered collectively, it appears that the lessons learned from addressing runway incursions at GA airports amount to two common-sense approaches that are related to a single concept—dialogue, which is simply a cooperative two-way conversation. Engaging in two-way conversations that are inclusive of all airport personnel who have a stake or presence in the airport can have a positive impact on the overall safety operations of the airport. Not only can such communication advance a feeling of worthiness among those involved, it also could lead to agreement on effective measures for improving the physical environment. These findings infer that of the various lessons learned by participants from addressing runway incursions, change—both affective and physical—can be steadily implemented in the interim, which can improve runway safety as a whole.

Implications

This sections contains discussions of the implications of the currents study's results and presents them from three aspects: (a) implications relative to theory/philosophy as presented in Chapter 2, (b) implications relative to prior research, and (c) implications for practice.

Implications relative to philosophy. Recall in Chapter 2, Creswell (2013) posited that qualitative research is grounded in the wheelhouse of philosophical underpinnings, which includes assumptions and frameworks. Assumptions ground the study in philosophy, and frameworks assist the researcher in comprehending the participants' subjective experiences. The current study was grounded in ontological assumption and social-constructivism framework. Also, recall that the current study is unique in its qualitative design endeavor in that the majority of the available literature that pertains to the current subject matter has been either limited to journal articles, quantitative studies, or mixed methods studies.

Ontological assumption. According to Creswell (2013), this philosophical assumption embraces the idea that there is no single truth or reality, and hence individuals have differing realities. This implies that each participant would experience his or her own realty differently from other participants. This is evidenced through participants' stories. In the context of the current study, airport managers who experienced RIs discussed their experiences relative to how they perceived their reality. Therefore, managers had a unique perception of how their experience unfolded.

The findings of the current study were consistent with the ontological assumption. All 10 participants recalled details—though some responses were more robust than others—of the RI events they experienced over the course of their professional aviation career relative to the study's three RQs. Further bolstering the cogency of the ontological assumption, as reported in Chapter 4, participants had varying perspectives relative to reasons for RIs, barriers that emerged when addressing RIs, and the lessons learned from addressing RIs. A plausible explanation for the support of this philosophical grounding is that although the airports managed by the current study's 10 participants comprised five FAA regions, and had diverse professional experience, what unified them regardless of distance and airport demographics (size, traffic volume, design, layout, and technological modifications), is their commonality of witnessing RI events over the course of their profession.

Social-constructivism. According to Creswell (2013), this framework posits that individuals' subjective worldview is directly influenced by personal perception, which is flawed because human cognition is imperfect. This framework allowed me to pose open-ended questions to airport managers who had experienced

RI events. Additionally, the questions required participants to focus on the specific details surrounding their runway incursions encounters. This allowed me to interpret participants' subjective experiences within the framework, and also acknowledged how my personal biases could influence the interpretation of this event as told by these airport managers. The findings of the current study are consistent with the framework that guided this study. Although all 10 participants recalled RI events over the course of their professional career, they all expressed very diverse recollections of these events.

Implications relative to prior research. The current study was informed and guided by prior research involving both aviation related studies and articles as discussed in Chapter 2. Following is a brief overview of the prior research and how the findings of the current study compare to those reported in the literature.

The increasing risk of RIs. The findings of the current study were consistent with Thomas (2002) who reported that vehicle/pedestrian deviations (V/PDs), pilot error, and controller error have to be reduced to curb runway incursions. Thomas postulated that this could be achieved through training to improve mental alertness, increased situation awareness, and education programs. Similar to Thomas, participants of the current study also cited situation awareness as a contributing factor, but this was related to pilot deviations and not V/PDs. Furthermore, participants also reported that airport lighting, signage and markings, layout and design—or what Thomas referred to as "low technology solutions"—all contributed to improving SA and overall RI safety. Thomas also reported that general aviation accounted for the majority of RIs, which is yet another sentiment echoed by the current study's participants given that the current study's scope was focused on GA airports. These consistencies between the findings of the current study and what Thomas reported suggests that GA airport managers affected by RIs have not implemented these measures in their attempt to reduce RIs at their airport.

Airport categories and RI occurrences. Mathew, Major, Hubbard, and Bullock (2017) conducted a correlational study and reported that although PDs are highest in GA when compared to other branches of aviation, they are not as deadly as they would be when they do occur in other aviation branches. Additionally, Mathew et al. reported that RI occurrences do vary by airport size and severity of incursion. The findings of the current study were partly consistent with these findings, in that participants indicated that RI reports were influenced by both new leadership, and the functions of their airport (student pilots, flight time building, etc.). Moreover they alluded to the fact that the size of their airport influenced the funding they had available to invest in modifications and training. This suggests that in addition to what Mathew et al. study reported, other factors can explain PDs occurrences, such as increased reporting, a change in leadership, and limited funding that hinders safety modifications.

RI technologies. The type of instrument used in the current study was a questionnaire much like the one Young and Jones (2001) used in their mixed methods study that examined technological solutions for RI mitigation, although very different in content development, and more anemic in the responses. Young and Jones found that technological solutions such as, but not limited to, Airport Safety Detection Equipment-3 (ASDE-3/ASDE-X), Airport Movement Area Safety System (AMASS), Runway Status Light System (RWSL), Global Position System (GPS), Airport Mapping Database (AMDB), Head-Up Displays (HUD's), and Navigation Displays (ND's), are effective RI mitigation measures when successfully implemented. In addition to technological solutions, Young and Jones also discussed the three main RI mitigation strategies implemented by the FAA: (1) publication of guidance material for pilots and ATC to increase potential hazard awareness, (2) installation of improved signage and unambiguous markings at airports to simplify navigation, and (3) installation of improved surface lighting systems. In the context of the current study, participants alluded to the desire for the implementation of the aforementioned technological and strategical mitigations, as illustrated in Domain 1 – Factors at Participants' Airport, Domain 2 – Airfield Infrastructure, and Domain 3 – Physical Environment, for which they perceive will mitigate RI events at their airport (see Chapter 4 for full Domain information).

Last, Young and Jones' study focused on the aforementioned technological solutions that are more prevalent in other branches of aviation such as ATP etc. Owing to the fact that this study focused on GA airports that operated multi-functionally, the type of technology discussed in the article was limited in this arena, as participants sparely addressed the type of technologies that were discussed in the article. Based on the participants' responses, either their airports were not equipped with this technology owing to funding issues, or the participants just failed to mention the technology they had at their airport. This suggests that perhaps some of the airports were too old, too small, or too underfunded to afford the installation of such technologies as discussed above.

RI Technologies for GA. Young and Prinzel (2006) conducted a mixed methods study to examine a Runway Incursion Prevention System (RIPS) adapted for GA operations. They found that the incursion alerts provided sufficient time to avoid potential incursion conflicts, departures were generally aborted sooner when alerts were provided, and overall, pilots felt safer with alerting technologies outfitted in the flight-deck. In the context of the current study, it was found that participants expressed the desire to have more RI mitigation technologies implemented such as RIPS, and the aforementioned technologies from Young and Jones' (2001) study, but were hindered in its acquisition owing to various reasons as illustrated in Domain 1 – Factors at Participants' Airport, Domain 2 – Airfield Infrastructure, and Domain 3 – Physical Environment (see Chapter 4 for full Domain information). Furthermore, participants also expressed that owing to the multifunctional purpose that their individual airports serve, such as flight-time building, and student pilot training, in conjunction with its other air traffic responsibilities, universally implementing some of the technologies as discussed in both Young and Jones' (2001), and Young and Prinzel's (2006) articles at their respective airports will be challenging owing to the multitude of reasons discussed in the aforementioned domains.

Designing for GA safety on a budget. Dabipi, Burrows-McElwain, and Hartman (2010), presented a study on a full academic term undergraduate freshman class project, which was a collaboration between the Engineering and Aviation departments at a U.S. university where the faculty in the Aviation department acted as clients to the engineering students. The clients requested a low cost RI detection system for GA airports. Dabipi et al. who reported that setbacks, time, and financial constraints impeded the successful implementation of the RI detection system. The findings of the current study were consistent with those of Dabipi et al. Participants shared similar sentiments with regards to barriers that emerged when trying to implement safety programs or modifications. For example, participants cited insufficient funding as a resource related issue relative to facilitating necessary airfield upgrades or as a barrier to improving the airfield infrastructure. Participants also identified as part of lessons learned various major setbacks to addressing runway incursions, including the absence of collaborative communication among stakeholders.

Safety assessment models for alert systems. Stroeve, Bakker, and Blom (2007) conducted a study to assess accident-modeling systems that are used to analyze the effectiveness of alert systems in control towers and cockpits. The focus of the modeling systems that were examined by the authors were centered around the extension from the human cognition to the technological cognition, conjecturing that the cognitive state of both agents need to be modified and constantly improved so as to maximize situation awareness and response time, which in turn, produces an effective alert system.

They assessed seven airports and discussed several risk assessment paradigms, of which the three main types were: (1) sequential model, (2) epidemiological model, and (3) systemic accident model. They found that the systemic accident model is the most prominent of the three models as it is a frequented tool for risk assessment appraisal, which postulates that accident prevention is based on finding dependencies in a socio-technical organization that may lead to functional resonance, and monitoring and controlling such critical dependencies. In the context on the current study, the findings did not support or refute any of the paradigms cited by Stroeve et al.

Although these paradigms are informative, the approach of the current study is equally as informative, as the focus of the current study was on airport managers' experience with RIs at GA airports, which proved to be insightful in terms of the unique perspective they offered. This implies that airport managers are an untapped resource that is probably undervalued in terms of assessing possible solutions for RI mitigation. The findings of the current study suggest that airport managers could be a valuable resource.

FAA's limitations and its effect on runway safety. The FAA's RI safety plans and programs were audited in 2014 by the Office of the Inspector General (OIG) at the U.S. Department of Transportation (DOT) to determine if the FAA had made any improvements relative to RI aviation safety in light of an increase in RIs spanning from 2009 – 2013. The audit found that although the FAA implemented some initiatives to reduce RIs, discord in their management and their overall organizational structure specific to their Runway Safety Program initiative proved to be a hindrance to more successful implementations of RI safety measures. There were certain similarities that emerged between the audit timeframe and airport participants. For example, the audit was done 2009 – 2013, and the current study reviewed RI data January 1st 2010 – June 30th 2017.

Additionally, some of the airports that were reviewed in the audit also participated in this study, but shall remain anonymous, as was the agreement with participants. Moreover, the current study looked at PDs and V/PDs, which the OIG audit determined were the top two types of RIs events, with a spike occurring in 2012 as PDs accounted for 63% of RIs that year, of which GA pilots were responsible for over 80%; and V/PDs accounted for 17%. When these statistics are considered in conjunction with the results of the current study's search of the ASIAS database for RI type frequency over the past 7.5 years (January 1st 2010 – June 30th 2017), which also yielded PDs and V/PDs representing the highest frequency of RIs, this suggests that perhaps not enough RI mitigation measures were implemented in the years from the OIG audit to the timeline of this current study as RI events are still occurring at a noticeable rate, especially since there are the same airports in both studies.

A systematic literature review case study to investigate RI contributing factors. Wang, Hubbard, and Zakharov (2018) conducted a qualitative case study, applying the unconventional method of systematic literature review to the aviation discipline with the purpose of identifying factors that contribute to RIs. According to the authors', this method is often utilized in other disciplines, such as the medical field, often yielding fruitful results that are less biased. Owing to the results of this method, the authors' thought it prudent to apply it to a most disconcerting quandary of RIs, which has been, and continues, to plague the safety of the aviation industry. Through a series of databases and clearly defined search criteria, Wang et. al. (2018) found six dominant themes that emerged from the dataset: (1) human factors (2) airport geometry (3) technical factors (4) airport characteristics (5) environmental factors (6) organizational factors.

In the context of the current study, although the monikers of the data were themed differently that those used by Wang et. al. (2018), the similarities of the themes between the datasets are indisputable. For example, one of the themes in Wang et. al. (2018) study is human factors, which covers situation awareness (SA) and communication. In the current study, under Doman 1, both SA and communication are included terms discussed by participants when asked about reasons for RIs. Wang et. al. (2018) other themes of airport geometry and characteristics also emerge in current study's data under Domains 2 and 3, referred to as cover terms "Airfield Infrastructure" and "Physical Environment". Technical factors emerged as "Airfield Infrastructure" in Domain 2, and organizational factors emerged as "Collaborative Communication" in Domain 3.

AMs' perspectives of the challenges related to V/PDs. Mahlman (2019) conducted a qualitative content analysis and phenomenological study with a twofold purpose of describing contributing factors of vehicle and pedestrian deviation (V/PD) runway incursions (RIs) nationally, and describing what mitigation approaches/strategies airport managers recommended or found to be effective. Using Spradley's domain analysis, four themes emerged: (1) airport operations, (2) human factors, (3) staff/personnel, and (4) recommended or effective mitigation approaches/strategies.

Overall, Mahlman (2019) concluded that lack of adequate gate controls, untrained and unauthorized persons gaining access to movement areas, personnel distraction, lack of familiarity with airport geography, inattention to detail, and lack of recurrent training for existing employees and stakeholders are all contributing factors to V/PD RIs based on his participants' responses. Additionally, two recommendations were made: (1) aggressive enforcement capability, and (2) upgrading gate access controls and security.

Similar to the Wang et. al. study above, in the context of the current study, Mahlman's thematic findings that were similar to the thematic findings of the current study. What is interesting to note about the findings of Wang et. al., Mahlman (2019), and the current study, is that relative to RI contributing factors, there are similarities across the findings of all three studies even though Wang et. al. employed a systematic literature review, Mahlman (2019) focused on V/PDs, and current study focused on GA airport RIs.

Implications for aviation practice. The results of the current study have several implications for aviation practice. The first implication is relative to the ontological assumption and social constructivism. The research findings indicated that airport managers are a wealth of knowledge, some more than others, with respect to possessing a great understanding of causes for RIs relative to their airports. This implies that airport managers are an untapped resource of RI information and as a source for identifying potential solutions. This suggests that they should be invited to the table along with pilots and ATC to collectively consolidate their RI knowledge and pose resolutions.

A second implication is relative to reasons for RIs. The research findings indicated that airport managers cited compromised SA and poor communication as contributing factors to RI events attributed to PDs. This implies that pilots might require more consistent training, improved knowledge of airport layout and design, and stronger communication skills. This also suggests that it might be beneficial for airport mangers to offer pilots the opportunity to learn about the idiosyncrasies or unique characteristics, including effective communication measures.

A third implication is relative to V/PD RIs. The research findings indicated that a poorly monitored airfield can lead to more unauthorized access. This was further compounded by the apathetic attitudes of GA personnel, which included various airport tenants and ground personnel. This implies that the combination of insufficient resources to aid in increased parameter vigilance coupled with a poor safety attitude of airport personnel contributes to V/PD RIs. This also suggests that limited finances and poor punitive retribution can exacerbate this problem.

A fourth implication is relative to the airport managers' respective airports. The research findings indicated that insufficient funding to facilitate airfield upgrades for safety purposes as well as an increased attention to reporting RI events contributed to RIs a their airports. This implies that managers know what safety measures need to be enacted, but are limited in their ability to effect these measures because they are confined to work within the constraints of their financial limits. This also implies that a change in leadership or requiring the airport to accommodate additional functions or services could lead to an increase in RI reporting, which in turn could lead to higher runway incursions.

A fifth implication is relative to problems related to addressing RIs. The research findings also indicated that pilots were apprehensive in reporting infractions because of possible punitive retribution, and the managers perceived pilots having an anti-social attitude relative to the collective GA community's RI safety issues. This implies there could be an underlying issue that is causing such disdain by pilots, and that it might be beneficial for airport managers to re-evaluate their policies and interactions with the GA pilot community as they relate to RI safety issues.

A sixth implication is relative to lessons learned for mitigating RIs at GA airports. The research findings indicated that the presence of collaborative communication among key stakeholders such as airport personnel, pilots, and local law enforcement was beneficial and productive. This implies that open, collaborative communication could serve as an effective and low-cost RI deterrent to help improve the overall safety culture at the airport. More succinctly, this finding implies that "teamwork makes the dream work": When an airport works as a unified collective (airport personnel, pilots, and local law enforcement), airport safety could be significantly improved.

The seventh implication is related to the absence of collaborative communication. Based on the lessons learned as articulated by the participants, the findings imply that RI safety measures could be impeded if all stakeholders are uninformed about RI safety rules and the punitive consequences attached for those who fail to comply. In other words, poor, inadequate, or incomplete communication could exacerbate a given situation, which could lead to an increase in RIs.

A final implication is relative to the physical surroundings of the airport. The research findings indicated that modifications to airfield pavements and the installation of runway guard lights led to decreased pilot disorientation and consequently improved SA. This implies that airport layouts that are properly marked reduces the confusion of both pilot and airport personnel with regards to their location relative to where they ought to be, and what parts of the airport are accessible. This suggests that the modification of an airport's physical surroundings is an effective tool that can be utilized to mitigate the occurrences of RIs at that airport.

Generalizability, Limitations, and Delimitations

Generalizability. In qualitative research, generalizability is referred to as transferability. This addresses the extent to which the researcher successfully provides "descriptive adequacy" (thick description or sending context) so future researchers and readers can make the necessary comparison and judgments about similarity (receiving context). In the context of the current study, this was achieved in two ways. First, each stage of the study was documented from inception to completion, and details were discussed across all five chapters. Additionally, auxiliary documentation such as the IRB form, details on how and why the sample was selected, correspondence with participants, and a copy of the instrument, to name a few, were all made available to the reader in the Appendix section. This should provide the reader with sufficient details to make comparisons and judgments about how the study was synthesized and conducted, and allow for the current study to be replicated by future researchers. Second, the instrument was designed to elicit detailed responses from participants. Data analysis was completed, and conjectures were formulated from the rich responses some participants provided, which allowed for their story to be told and their experience documented. In the context of the current study, this was demonstrated in Chapter 4 via excerpts of participants' responses, which were used to provide support for Spradley's terms and cover terms respective to each of the three domains as each emerged from the data analysis.

Study limitations and delimitations. The limitations and delimitations of the current study were presented in Chapter 1. Owing to the fact that the current chapter includes a discussion related to recommendations for future research relative to the study's limitations and delimitations, these limitations/delimitations are replicated in this section for the convenience of the reader.

Limitations. Limitations are conditions, events, or circumstances beyond the control of the researcher that limit the generalizability of the results of the study. In the context of the current study, these limitations are outlined below. Therefore, the reader is advised to take into account these limitations when making conclusions or inferences from the result of the study.

1. Sample demographics. I had no control over the GA airports' demographical information that was collected such as number of PDs and V/PDs events, and the four FAA regions not represented in this study. As a result, if this study were to be replicated with GA airports from the four excluded regions with different numbers of PDs and V/PDs events, this may not yield the same results as the current study.

2. Veracity of participants' responses. The focus of the study was on GA airport RIs as experienced by airport managers. I had no control over how truthful the participants were in their responses to the questionnaire items. This lack of control extended to participants' recall of their experiences, any embellishments they might have made in their responses, and their level of cooperation. As a result, replication studies that are able to confirm the truthfulness of participants' responses—for example through documented evidence—or involve more loquacious participants might yield different results when compared to the current study.

3. FAA regions. The airports that comprised the current study represented five of the nine FAA regions: Alaskan, Northwest Mountain, Southern, Southwest, and Western-Pacific. The regions not represented were Central, Eastern, New England, and Great Lakes. As a result, similar studies that involve airports from different FAA regions might not get the same results.

4. Credibility of current study. A critical component in demonstrating the credibility of a qualitative study is member checking, which involves participants' feedback to ensure that the participants agree with what the researcher has described and interpreted. Although I endeavored to employ member checking in the current study, my attempts via telephone calls and e-mail messages to the airport managers went unanswered. As a result, similar studies that are able to engage in member checking might get different results.

Delimitations. Delimitations are conditions, events, or circumstances that are researcher imposed to ensure that the study is feasible to implement but further limit the generalizability of the results of the study. In the context of the current study, these delimitations are as follows:

1. Data collection instrument. The primary data collection instrument was researcher-prepared and consisted of a set of items that were the result of collaboration between my dissertation committee members and I. Therefore, similar studies that use a different instrument might not get the same results.

2. Data source. The current study relied on a single data source, namely, the researcher-prepared instrument. Therefore, similar studies that use multiple data sources such as email correspondence, text message, transcripts of telephone calls or field notes, might get different results.

3. Data collection time schedule. Data collection was restricted to a one-time event and was administered via *SurveyMonkey*, an online data collection forum. Therefore, similar studies that use a different data collection protocol might get different results.

4. Sampling strategy. Airport selection was based on searching the FAA's Air Traffic Activity System (ATADS) database for GA airports that experienced the highest frequencies of pilot deviations and vehicle/pedestrian deviations from January 2010 to May 2017. As a result, similar studies that use different search criteria might not get the same results.

5. GA airport. As noted in the definitions section of this chapter, I delimited the FAA's definition of a GA airport by requiring them to have at least 10 times the number of GA operations than an air carrier (commercial) operations as reported in the Air Traffic Activity Data System (ATADS). Therefore, similar studies that use the FAA's definition without this delimitation, or impose different delimitations, might not get the same results.

6. Database timeframe. The time period used to extract airport data from the FAA ATADS and ASIAS database was January 1, 2010 through June 30, 2017. Therefore, similar studies that use a different time period might not get the same results.

7. Geographical and technological constraints. In conducting the current study, I did not travel to the targeted airports to meet personally with the airport managers and conduct face-to-face interviews. Instead, I relied on telephone calls and email messages to correspond with the participants. As a result, similar studies in which researchers meet personally with their participants or use different distant technologies (e.g., *Skype*) might get different results.

Recommendations for Future Research and Practice

This section contains a set of recommendations for future research relative to (a) the study's limitations and delimitations, which were replicated from Chapter 1 in the foregoing section, and (b) implications, which were presented earlier in this chapter relative to theory/philosophy, prior research, and practice. Presented in the last section of the chapter is a set of recommendations for practice relative to the study's implications.

Recommendations for future research relative to study limitations. Following is a set of recommendations for future research based on the current study's limitations.

1. GA airport demographical information such as number of PDs and V/PDs, and FAA regions constituted a portion of the data collected. Therefore, a recommendation for future research is to identify and recruit additional GA airports with fewer PDs and V/PDs from the four other regions that were not represented in this study, which may yield different results.
2. The veracity of the information provided by airport manager's could not be verified as they were retold via a questionnaire that was completed at their convenience. Therefore, a recommendation for future research is for researchers to personally administer the study's protocols to airport managers, and verify that they witnessed RI events via reports that were submitted, or documentation that noted the event. Another suggestion specific to the method and design of

the current study would be for researchers to spend an extended amount of time at airports to witness how managers experience and recall RI events.

3. The current study's sample consisted of five of the nine FAA regions. Most of the data were collected from the Western-Pacific (four airports) and the Southern region (three airports). Therefore, a recommendation for future research is to expand the number of FAA regions from five to nine that data is collected from. Another suggestion might be to replicate the study using the same methods and instrumentation applied to different demographics. For example, the study could target personological characteristics such as age, gender, and ethnicity.
4. Owing to circumstances that resided outside of my realm of control, data analysis and the resulting member-checking were delayed. This made it challenging to re-establish communication with the participants. Therefore, a recommendation for future research is to conduct member-checking in quick succession of data collection and analysis.

Recommendations for future research relative to study delimitations. Following is a set of recommendations for future research based on the current study's delimitations.

1. The researcher-developed interview protocol that served as the primary data collection instruction was the only instrument used to collect data for this study.

Therefore, a recommendation for future research is to replicate the study using more than one instrument to either confirm or refute the study's findings.

2. The current study used researcher-developed interview questions. Therefore, a recommendation for future research is to replicate the study using different instruments to either confirm or refute the study's findings.
3. The current study was implemented over a 3-month period between November 2017 to February 2018 via *SurveyMonkey*, an online data collection forum. Therefore, a recommendation for future research is to extend the data collection period to increase the potential of acquiring more participants. Another suggestion might be to administer the data collection instrument in person, conduct a phone interview with participants, or e-mail participants a copy of the instrument and request that upon completion, it's returned to the researcher.
4. The current study utilized the ATADS database, along with a convenience and purposive sampling strategy to obtain its sample. Therefore, a recommendation for future research is to use both a different sampling source and strategy to potentially yield a different sample of participants.
5. The current study delimited the FAA's definition of a GA airport by requiring them to have at least 10 times the number of GA operations than an air carrier (commercial) operations as reported in the Air Traffic Activity Data System (ATADS). Therefore, a recommendation for future studies is to use the FAA's

definition without this delimitation, or impose different delimitations, which may yield different results.

6. The time period used by the current study to extract airport data from the FAA ATADS and ASIAS database was January 1, 2010 through June 30, 2017. Therefore, a recommendation for future studies is to insert a different time period in the database search criteria, which may yield different results.
7. This study was conducted exclusively from central Florida. The inability to travel to all the airports across the five FAA regions included in this study lead to the dependence on technological aids such as teleconferencing, and emails that surely hindered the potential for rich data collection. Therefore a recommendation for future research is to get funding for their study, which could assist in travel expense to allow for face-to-face interviews with participants. This may lead to more robust data, and nullify the technological dependence.

Recommendations for future research relative to implications. A numbered list of recommendations for future research is highlighted below based on the current study's implications relative to theory and prior research.

1. The current study's findings demonstrated that although the method and design employed in this study is currently undervalued and underutilized in aviation research, it yielded valuable data that validates the use for it. Therefore, a recommendation for future research is that more qualitative studies should be

research, it yielded valuable data that validates the use for it. Therefore, a recommendation for future research is that more qualitative studies should be done, as well as phenomenological and grounded theory, as there is much information that can be gathered thought the use of these methods and designs.

2. The current study found that the participants did not discuss the type of technological solutions discussed in the articles reviewed in Chapter 2 (Thomas, 2002; Young and Jones, 2001; Young and Prinzel, 2006; Stroeve, Bakker, and Blom, 2007). Therefore, a recommendation for future research is to investigate airports that actively use some of the aforementioned technological solutions using a qualitative design, if not the same design as this current study.
3. The findings of the current study did not address specifically, the size or the category of the airports relative to data that were collected. Mathew, Major, Hubbard, and Bullock (2017) found that there is a positive relationship between airport categories and RI occurrences. Therefore, a recommendation for future research is to conduct a qualitative study, using perhaps the same design as the current study, but the focus should be on GA airport categories and RI occurrences.
4. Over the duration of the current study, it was found that time and financial constraints impacted the data collection process. Although Dabipi, Burrows-McElwain, and Hartman (2010) reported a classroom project, their findings indicated that these same constraints impeded the delivery of their final

product. Conversely, some participants also discussed the negative ramifications of these said constraints. Therefore, a recommendation for future research is to conduct a similar study using the same method and design as the current study over a longer period of time to see how the data collection may be impacted.

5. GA airport RI events data for this current study were examined from January 1^{st}, 2010 – June 30^{th}, 2017. The FAA OIG audit that reviewed RI events and mitigations was conducted from 2009 – 2013. The findings of the current study resonated with the findings from the audit respective of the disconcerting rate of RIs, with more effective safety measures being left for wanting. Therefore, a recommendation for future research is to examine RIs occurrences, at least, from June 2017 onward to determine the pattern trends, and the implementation (or dis-implementation) RI mitigation measures.
6. Although the design of the current study (phenomenological and the first stage of grounded theory) was different from the case study conducted by Wang, Hubbard, and Zakharov (2018), the findings were similar in the six themes that emerged from their study and the three domains that emerged in the current study. More importantly, they were effective at illustrating the superior utility of a qualitative systematic literature review when compared to the quantitative studies they reviewed. Therefore a recommendation for future research is to conduct a qualitative case study using the systematic literature review as

applied by Wang et. al (2018) to further examine RI contributing factors specifically at GA airports since GA seems to be the major contributor to RI events.

7. Mahlman's study focused on airports across the U.S. with high frequencies of V/PD RIs as reported in the RWS database from 2011 – 2016. His study faced the same time-constraints, limited number of participants, and similar instrument-related limitations as the current study (such as the inability to member-check owing to the anonymity in which the instrument was completed and submitted). Therefore, a recommendation for future research is to collect data over a longer period from a higher number of participants, using an instrument that will allow for them to complete member-checking.

Recommendations for practice relative to implications. Following is a numbered list that describes recommendations for practice that correspond to the study's implications.

1. The current study's findings indicated that compromised SA and poor communication are the primary contributing factors for PD related RI events at GA airports. Therefore, a recommendation for practice is that airport managers should consider implementing SA and communication training for pilots, controllers, and other airport personnel who frequent airport property to improve awareness, orientation, and general knowledge about airport activity.

2. The current study's findings indicated that accessibility to restricted airfield areas was the primary contributing factor for V/PD related RI events at GA airports. Therefore, a recommendation for practice is that airport managers need to either invest or redirect funds for securing airfield access via increased security personnel patrolling the grounds, guarding gate access areas, or installing electronic gated access. This should minimize unauthorized persons from easily accessing restricted areas, and assist authorized personnel in developing a better sense of awareness of where they are accessing. Another recommendation for practice is that all airport personnel (employees, tenants, pilots, and ATC) should be required to wear at all times a form of identification that clearly displays who they are. This should assist all airport personnel in being able to more quickly identify whether such persons should even be on airport property.
3. The current study's findings indicated that airport managers had insufficient funds to facilitate airfield upgrades. Therefore, a recommendation for practice is that airport managers should try to procure alternative means of funding such as securing grants.
4. The current study's findings indicated that airport managers stated that there was an increase in RI reporting at their airport for various reasons such as a change in leadership who took RI reporting more seriously, or that their airport served in a multi-functional capacity, accommodating student pilots or pilots of

varying airmanship experience participating in flight time building. Therefore, a recommendation for practice is that airport managers need to develop some uniformed type of RI reporting that would allow for consistency regardless of change in leadership or airport function.

5. The current study's findings indicated that airport managers found that the apathetic attitudes of both pilots and airport tenants, although for different reasons, made it more onerous to effectively address and remedy RI occurrences at their airport. Therefore, a recommendation for practice is that airport managers need to create an inclusive environment for both pilots and tenants so that they can understand how their attitude impedes RI safety measures, and why airport managers seek to implement certain safety rules, regulations, and the resulting punitive retribution if applicable.
6. The current study's findings indicated that the presence of collaborative communication was an effective measure for mitigating RI occurrences at GA airports. Therefore, in addition to promoting an inclusive environment for all airport personnel, a recommendation for practice is that funding should be allocated for both communication training, as well as educational materials (handbooks, pamphlets etc.), videos, and seminars that educate and teach about effective communication skills. Furthermore, airports should implement effective communication measures, and invest more time and funds in training

and keeping all parties involved updated with airport safety rules and regulations as they modify over time.

7. The current study's findings indicated that the absence of collaborative communication impeded RI safety measures at GA airports. Therefore, as mentioned above, a recommendation for practice is to expose airport personnel to effective communication training.
8. The current study's findings found that specific modifications such as those done to airfield pavements and the installation of runway guard lighting lead to improved SA and decreased pilot disorientation. Therefore, a recommendation for practice is that these two modifications should be the priority when it comes to allocating funds for modification projects.
9. During this study, it was noticed that the FAA RI reporting database does not have a function that automatically triggers a survey for personnel to complete relative to the details of the RI event they experienced. Therefore, a recommendation for practice is that the FAA implements a survey that gets triggered for every RI report, which will then be sent to an independent third party vendor for data analysis.

Summary

In summation, this chapter provided an overview of conclusions, implications, and recommendations for this study. Furthermore, research findings from this study were discussed relative to the limitations and delimitations. Finally, the chapter discussed recommendations for research and practice relative to study limitations and delimitations, future research relative to implications, and practice relative to implications.

References

Air Line Pilots Association International (2007, March). *White paper: Runway incursions: A call for action.* Retrieved December 2017, from http://www3.alpa.org/portals/alpa/runwaysafety/runwayincursionwhitepaper.pdf

Air Traffic Activity Data System (2017). *Airport operations: Standard report.* Retrieved January 2020, from https://aspm.faa.gov/opsnet/sys/opsnet-server-x.asp

Ary, D., Jacobs, L. C., & Sorensen, C. (2010). *Introduction to research in education* (8th ed.). Belmont, CA; Wadsworth, Cengage Learning.

Bettany-Saltikov, J. (2010). Learning how to undertake a systematic review: Part 2. *Nursing Standard, 24*(51), 47-56.

Bisch, A., Calabreses, C., & Donohoe, C. (2016). *Runway safety analysis: Runway incursion characteristics and mitigation recommendations.* U.S. Department of Transportation, Federal Aviation Administration.

Boyes, A. (2013, January). *The self-serving bias: Definition, research, and antidotes: Learn the definition of the self-serving bias and how to overcome it.* Retrieved December 2017, from https://www.psychologytoday.com/us/blog/in-practice/201301/the-self-serving-bias-definition-research-and-antidotes

Brown, J., Sorrell, J. H., McClaren, J., & Creswell, J. W. (2006, February). *Waiting for a liver transplant.* Retrieved February 2020, from https://www.researchgate.net/publication/7452192

Byrne, T. P. (2017). *Reducing runway incursions at the nation's five busiest airports, 2009-2011.* Retrieved December 2017, from https://scholarworks.waldenu.edu/dissertations

Cleary, E. C., Dolbeer, R. A., & Wright, S. E. (2000). *Wildlife strikes to civil aircraft in the United States, 1990-1999*. US Department of Transportation, Federal Aviation Administration. Retrieved September 2019, from https://scholar.google.com/scholar?hl=en&as_sdt=0%2C10&q=cleary%2C+dolbeer+and+wright+2000&btnG=

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd. ed.). Los Angeles, CA: SAGE Publications.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: choosing among five approaches* (4th. ed.).

Croft, J. (2015, March). Commercial aviation headway made curbing airline runway incursions. *Aviation Week & Space Technology.* Retrieved December 2017, from http://aviationweek.com/commercial-aviation/headway-made-curbing-airline-runway-incursions.

Dabipi, I. K., Burrows-McElwain, J. B., & Hartman, C. (2010, October). Low-cost runway incursion detection system for general aviation airports. In *2010 IEEE Frontiers in Education Conference (FIE)* (pp. T1C-1). IEEE.

Dicus, P. & Tarry, S. (2019, August). *Runway safety training methods for runway incursion prevention*. Retrieved February 2020, from https://digitalcommons.unomaha.edu/university_honors_program/43

Federal Aviation Administration (2013a). *Safety briefing November – December 2013*. Retrieved January 2017, from www.faa.gov/news/safety_briefing/2013/media/novdec2013.pdf

Federal Aviation Administration (2013b). *Runway safety report 2011-2012.* Retrieved January 2017, from https://www.faa.gov/airports/runway_safety/publications/media/2012-ajs-475-fy2011-runway-safety-annual-report.pdf

Federal Aviation Administration (2014). *Runway safety program audit report.* Retrieved January 2017, from https://www.oig.dot.gov/sites/default/files/FAA%20Runway%20Safety%20Program%20Audit%20Report%5E9-25-14.pdf

Federal Aviation Administration (2015a, April). *Runway Incursion categories.* Adapted January 2017, from http://www.faa.gov/airports/runway_safety/news/runway_incursions

Federal Aviation Administration (2015b, April). *Runway incursion definition.* Retrieved January 2017, from https://www.faa.gov/airports/runway_safety/news/runway_incursions/

Federal Aviation Administration (n.d.). *2015 – 2017 National runway safety plan*. Retrieved January 2017, from https://www.faa.gov/airports/runway_safety/publications/media/2015_ATO_Safety_National_Runway_Safety_Plan.pdf

Federal Aviation Administration (2016a). *General aviation airport definition.* Retrieved January 2017, from https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/

Federal Aviation Administration (2016b). *General aviation airport categories definition.* Retrieved January 2017, from https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/

Federal Aviation Administration (2017). *Lessons learned from transport airplane accidents.* Retrieved February 2020, from http://lessonslearned.faa.gov/ll_main.cfm?TabID=1&LLID=52&LLTypeID=2

Federal Aviation Administration (2019). U.S. Civil Airmen Statistics. Retrieved February 2020, from https://www.faa.gov/data_research/aviation_data_statistics/civil_airmen_statistics/

General aviation definition. Retrieved January 2017, from http://www.iaopa.eu/what-is-general-aviation

General Aviation News (2017, October). Runway incursion study helps find solutions at PAJN. Retrieved December 2017, from https://generalaviationnews.com/2017/10/08/runway-incursion-study-helps-find-solutions-at-pajn/

Haslbeck, A., Schmidt-Moll, C., & Schubert, E. (2015). Pilots' willingness to report aviation incidents. In *Proceedings of the 18th International Symposium on Aviation Psychology* (pp. 1-5).

Healey, G. (2014). Inuit parent perspectives on sexual health communication with adolescent children in Nunavut: It's kinda hard for me to try to find the words. *International journal of circumpolar health*, *73*(1), 25070.

Hollnagel E. *Barriers and accident prevention*. Ashgate, Hampshire, UK, 2004.

Hunter, D. R. (2002). Development of an aviation safety locus of control scale. *Aviation, Space, and Environmental Medicine*, *73*(12), 1184–1188.

Jones, D. R., & Prinzel, L. J. (2006, October). Runway incursion prevention for general aviation operations. In *25th Digital Avionics Systems Conference, 2006 IEEE/AIAA* (pp. 1-12). IEEE.

Jungnickel, K. (2014). Getting there and back: How ethnographic commuting (by bicycle) shaped a study of Australian backyard technologists. *Qualitative Research, 14*(6), 640-655.

Landsberg, B. (1998, January). Runway incursions: A perfect example of the accident chain. *Aircraft Owners and Pilots Association.* Retrieved December 2017, from https://www.aopa.org/news-and-media/all-news/1998/january/pilot/runway-incursions

Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry*. Thousand Oaks, CA: Sage.

Mahlman, J. A., Jr. (2019, December). *Runway incursions: Examining airport managers' perspectives of the challenges related to vehicle/pedestrian deviation*. Retrieved January 2020, from https://repository.lib.fit.edu/handle/11141/3002

Mathew, J. K., Major, W. L., Hubbard, S. M., & Bullock, D. M. (2016). Statistical modeling of runway incursion. *Proceedings of the Transportation Research Board 95th Annual Meeting*.

Mathew, J. K., Major, W. L., Hubbard, S. M., & Bullock, D. M. (2017). Statistical modeling of runway incursion occurrences in the United States. *Journal of Air Transport Management*, *65*, 54-62.

Marshall, C., & Rossman, G. B. (2014). *Designing qualitative research*. Sage publications.

Metallinos, B. (2018). *Reducing runway incursions: The role of collaboration, education, and training.* Retrieved February 2020, from https://commons.cu-portland.edu/edudissertations/211

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Prisma Group, (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement *PLoS Med, 6*(7). doi: 10.1371/journal.pmed.1000097

Okate, S. I. (2016). *Evaluating the impacts of the internet of things to reduce runway incursions: Understanding the why, how, and when*. Retrieved February 2020, from https://rc.library.uta.edu/uta-ir/handle/10106/26165

Rajhans, K. (2012). Effective organizational communication: A key to employee motivation and performance. *Interscience Management Review*, *2*(2), 81-85.

Runway incursion definition retrieved January 2017, from http://www.icao.int/safety/fsix/Library/Runway%20Incursion%20Manual-final_full_fsix.pdf

Schabla, Z. (2016, October). Best ways to prevent runway incursions. *Midwest Flyer.* Retrieved December 2017, from http://midwestflyer.com/?p=10187

Spradley, J. P. (1979). *The ethnographic review.* New York: Holt, Rinehart, and Winston.

Strauss, A. & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Sage Publications.

Stroeve, S. H., Bakker, G. J., & Blom, H. A. (2007). Safety risk analysis of runway incursion alert systems in the tower and cockpit by multi-agent systemic accident modeling. In *Proceedings of 7th USA/Europe Air Traffic Management R&D Seminar*.

Thomas, K. M. (2002). The increasing risk of runway incursions-the most dangerous part of air travel may be the time spent on the ground. *Journal of Air Law & Commerce*, *67*, 545.

Wang, C., Hubbard, S. M., & Zakharov, W. (2018). Using the systematic literature review in aviation: A case study for runway incursions. *Collegiate Aviation Review International, 36*(2), 33-55. Retrieved January 2020, from http://ojs.library.okstate.edu/osu/index.php/CARI/article/view/7410

Wilt, D. F., Browning M., Marais, K., Winter, S., Wilt, D. W., Bhargava, D., Maharaj, I., Tamilselvan, G., & Chaparro, M. (2018). *PEGASAS P-20 Final report, general aviation runway incursions: Root causes and recommended mitigation methods*. DOT/FAA/TC-18/50.

Wolcott, H. F. (2009). *Writing up qualitative research*. (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Young, S. D., & Jones, D. R. (2001). Runway incursion prevention: A technology solution. *Proceedings of the Flight Safety Foundation Air Safety Seminar, 54,* 1–18.

Appendix A

Interview Protocol

Hello,

You are invited to participate in a research study designed to: (a) understand the reasons for runway incursions at general aviation (GA) airports, (b) describe the barriers to addressing runway incursions at GA airports, and (c) describe the attempts (both successes and failures) made to mitigate runway incursions at GA airports. As part of the study I am requesting that you complete this questionnaire, which contains two parts: (a) a set of interview questions and (b) a set of professional demographic questions. To help accomplish my purpose, I am asking that you provide as much detailed information as possible when responding to the interview questions. Please note that the study is part of a doctoral dissertation research being conducted at Florida Institute of Technology's College of Aeronautics, and has been approved by the university's Institutional Research Board (IRB).

Before clicking on the link to begin responding to the questions, it is important for you to understand the following:

1. Your responses will be treated as strictly confidential and will be accessible only by the research team, which consists of my committee members and me.
2. No identifying information will be collected from your responses.
3. No references will be made in oral or written reports that could connect you in any way to the study.
4. Your participation is completely voluntary and you are not required to participate in the study.
5. If you begin responding to any of the questions and opt not to continue, you may simply close your browser's window to close your session. This action will delete your responses and eliminate you as a participant.
6. By clicking on the link below, you are indicating that you are at least 18 years old and have agreed to voluntarily participate in the study.

7. If you have any questions you may contact me directly (Indira Maharaj: imaharaj2011@my.fit.edu, 407-271-7049) or my major advisor (Dr. John Deaton: jdeaton@fit.edu, 321-674-7474).

Thank you in advance for your time, cooperation, and support.

A. Interview Questions

1. Given your experiences within the aviation profession (and not necessarily as an airport manager), please describe what you perceive to be the most common reasons for runway incursions at general aviation airports.
2. Based on the statistics available from the FAA Runway Incursion Database, the data show that your airport had one of the highest frequencies of runway incursions as defined by ICAO during the period 2010 through June 2017. In your opinion, which of the following do you think contributed to this high frequency of runway incursions at your airport? For each reason you selected, please explain why you believe this to be the case and provide an example.
   (a) Lack of sufficient personnel (human resources)
   (b) Lack of sufficient funding (financial resources)
   (c) Inaccurate, incomplete, or inadequate reporting to the FAA database
   (d) A heightened focus on addressing runway incursions at my airport
   (e) Coincidental timing of airport or runway construction projects at my airport
   (f) Weather related factors
   (g) Attitudes of my airport personnel (affective domain)

(h) Increased enforcement of airport rules and regulations at my airport

(i) Change in airport classification

(j) Other (please identify and discuss any other possible explanations)

3. Please list *in rank order* what you perceive to be the top five reasons for runway incursions at general aviation airports. Please rank these on a scale where 1 = Most common/important and 5 = Least common/important.

4. Do you believe that the data in the FAA Runway Incursion Database accurately reflect the frequency of runway incursions at your airport? If yes, please explain why you believe this to be the case. If no, please explain what makes you believe that data are inaccurate.

5. Based on your overall experiences dealing with runway incursions, why do you think runway incursions occur more frequently with respect to general aviation than with the other branches of aviation?

6. Given your experiences within the aviation profession (and not necessarily as an airport manager), please describe what you perceive to be the most common barriers to addressing runway incursions at general aviation airports.

7. In your opinion, which of the following do you think are barriers to addressing runway incursions at your airport? For each barrier you selected, please explain as thoroughly as possible why you believe this to be the case and provide any examples that could help shed further light on the issue.

(a) Money

(b) Airport personnel, including local and federal employees

(c) Physical surroundings of the airport (e.g., a lack of sufficient space or land)

(d) Politics (e.g., a lack of cooperation between the airport authority and local government)

(e) Airport patrons, including airline passengers, flight crew, etc.

(f) Technological resources, including hardware and software

(g) Lack of proper training

(h) Other (please identify and discuss any other barriers)

8. Please list *in rank order* what you perceive to be the top five barriers to addressing runway incursions at general aviation airports. Please rank these on a scale where 1 = Biggest barrier and 5 = Smallest barrier.

9a. In your opinion, what do you think is currently being done to address runway incursions at GA airports but is not being done adequately in general and at your airport in particular?

9b. What do you think should be done to *improve what currently is being done* and how do you propose this be accomplished at your airport?

10a. In your opinion, what do you think is *not* being done currently to address runway incursions at GA airports that you believe should be done both in general and at your airport in particular?

10b. With respect to what you believe should be done, how would you propose this be accomplished at your airport?

11. Please indicate how your airport handles runway incursions. Please include and describe any related policies, reporting mechanisms, available resources, enforcement activities, personnel training, and so forth.

12. Please describe what actions you have taken in your role as airport manager to help mitigate runway incursions at your airport. Please provide as much detailed information as possible along with any relevant examples.

13. Of the various attempts you have made to address runway incursions at your airport, which do you believe have been the most successful, and to what do you attribute this success?

14. Of the various attempts you have made to address runway incursions at your airport, which do you believe have been the least successful, and to what do you attribute this lack of success?

15. Please give an example of a runway incursion that would be representative of other runway incursions that have occurred at your airport and describe what actions you took immediately following this incursion.

16a. Depending on the type of runway incursion (PD or VPD), please describe what you did to help those individuals whose actions resulted in the runway incursion from committing similar incursions in the future.

16b. To what extent do you think what you did was helpful or beneficial in preventing or mitigating future occurrences?

17. Please describe what you have learned from addressing runway incursions at your airport, and how these experiences have influenced the way in which you will handle subsequent runway incursions.

B. Professional Demographics

1. Please enter the total number of years overall experience you have working in the aviation profession: _______
2. Please enter the total number of years you have working as an airport executive: _______
3. Please enter the total number of years you have working in your current position: _______
4. What is your current professional title/position? ____
5. Are you a currently a member of AAAE? _______ Yes _______ No
6. Approximately how many general aviation runway incursions have you experienced during your tenure as an airport executive? ____________

Thank you for your time and cooperation.

Appendix B

Airport Managers' Mailed Letter Correspondence

<FIT Header>

<Date>
<Airport Manager Name>
<Airport Manager Mailing Address>

Dear Airport Manager's name,

My name is Indira Maharaj and I am a Ph.D. student in Florida Institute of Technology's College of Aeronautics Ph.D. program in Aviation Sciences. I currently am working on my dissertation research, and I am contacting you to request your participation in my study, which involves runway incursions at general aviation (GA) airports.

I am operationally defining a GA airport as a towered airport that had at least 500 times more general aviation operations than air carrier operations between January 2010 and May 2017. According to the FAA's Air Traffic Activity System (ATADS) database, your airport (XXX) had ### air carrier operations vs. ### GA operations during the targeted period and therefore qualifies as a GA airport.

The **purpose of my study**, which is qualitative in nature, is to (a) understand the reasons for runway incursions at GA airports, (b) describe the barriers to addressing runway incursions at GA airports, and (c) describe the attempts (both successes and failures) made to mitigate runway incursions at GA airports. Your airport was selected because it had one of the highest frequencies of pilot and/or vehicle/pedestrian deviation runway incursions during the targeted period based on the FAA's Aviation Safety Information Analysis and Sharing (ASIAS) database

As the manager of XXX, I am **requesting a private interview with you** via telephone or Skype, **or that you complete an online questionnaire** that contains the same interview questions. I also am requesting your assistance in asking other targeted stakeholders such as pilots and/or airport personnel—whom you believe would provide me with rich information relative to the study's scope and objectives—to participate in the study as well. Please be aware that I am committed to ensuring the confidentiality and anonymity of both participants and their data, and my application to FIT's Institutional Review Board (IRB) is currently pending.

I would like to call you next week to discuss my study and your potential participation. Please let me know what day/time work best for you. In the meanwhile if you have any questions or concerns about the nature and procedure of my study, please feel free to contact me at your earliest convenience by email at imaharaj2011@my.fit.edu, or by phone at (407) 271-7049. You also may contact my major advisor, Dr. John Deaton by email at jdeaton@fit.edu, or by phone at (321) 674-7474. Thank you in advance for your time and cooperation.

Respectfully,

Indira Maharaj, M.S.

John Deaton, Ph.D.
Professor

Appendix C

Participant Survey Email Correspondence

<Date>
<Airport Manager Name>
<Airport Manager Mailing Address>

Dear <Airport Manager's Name>,

My name is Indira Maharaj and I am a Ph.D. student in Florida Institute of Technology's College of Aeronautics Ph.D. program in Aviation Sciences. I am currently working on my dissertation research, and I contacted you via mail on September 18th 2017 to request your participation in my study, which involves runway incursions at general aviation (GA) airports. My study has been approved by Florida Institute of Technology's Institutional Review Board (FIT's IRB), which allows me to begin data collection. A copy of my IRB approval is available upon request, and please be aware that I am committed to ensuring the confidentiality and anonymity of both participants and their data.

Per your expressed participation interest, please find below the link that will lead you to my General Aviation Runway Incursion survey posted on SurveyMonkey titled "Airport Managers Interview Protocol". The survey consists of 26 items: 20 "Interview Questions" items and 6 "Professional Demographics" items. Please complete each item fully and to the best of your knowledge. The survey is made available via this medium to afford you the most convenience to respond as your schedule permits. However, it would be greatly appreciated if you could complete the survey within two weeks of receiving the link, as this is a dissertation project that adheres to a scheduled timeline. Please inform me if you require more time to complete the survey.

Please be reminded that the **purpose of my study**, which is qualitative in nature, is to (a) understand the reasons for runway incursions at GA airports, (b) describe the barriers to addressing runway incursions at GA airports, and (c) describe the attempts (both successes and failures) made to mitigate runway incursions at GA airports. Your airport was selected because it had one of the highest frequencies of pilot and/or vehicle/pedestrian deviation runway incursions during the targeted period based on the FAA's Aviation Safety Information Analysis and Sharing (ASIAS) database.

If you have any questions or concerns about the nature and procedure of my study, please feel free to contact me at your earliest convenience by email at imaharaj2011@my.fit.edu, or by phone at (407) 271-7049. You also may contact my major advisor, Dr. John Deaton by email at jdeaton@fit.edu, or by phone at (321) 674-7474. Thank you in advance for your time and cooperation.

Thanking you in advance for your time and accommodation.

Respectfully,
Indira Maharaj, M.S.
https://www.surveymonkey.com/r/Y93DKK6

Appendix D

IRB Form

Institutional Review Board Office
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http://www.fit.edu/research/committees/irb/index.html

Florida Institute of Technology

RESEARCH INVOLVING HUMAN SUBJECTS
Exempt Application

This form shall be used if there is **minimal risk** to human subjects and one or more of the conditions below apply. If there is more than minimal risk associated with the research (none of the conditions below apply) or if the research utilizes a special population (children, prisoners, institutionalized individuals, etc.), please use the full application form found on the IRB website.

You should consult the university's document "Principles, Policy, and Applicability for Research Involving Human Subjects" prior to completion of this form. Copies may be obtained from the Office of Sponsored Programs and on the IRB website.

Name:	Indira Maharaj
Date:	11/14/2017
Academic Unit:	College of Aeronautics
Email:	Imaharaj2011@my.fit.edu

Title of Project: General Aviation Runway Incursion: A Qualitative Approach to Describing General Aviation Pilots' and Airport Personnel First-Hand Experiences.

☐ 1) Research conducted in established or commonly accepted educational settings, involving **normal educational practices**, such as:
a. research on regular and special education instruction strategies, or
b. research on the effectiveness of or the comparison among instruction techniques, curricula, or classroom management methods.

☒ 2) Research involving the use of **educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior** unless:
a. the subjects can be identified, directly or through identifiers linked to the subjects and
b. any disclosure of subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.
Note: This exemption does not apply to survey procedures or interviews involving minors.

☐ 3) Research involving the use of educational tests, survey or interview procedures, or observation of **public behavior** if:
a. the subjects are elected or appointed public officials or candidates for public office or
b. the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

☐ 4) Research involving the **collection or study of existing data, documents, records, or specimens** if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, indirectly or through identifiers linked to the subjects.

☐ 5) Research and demonstration projects that are conducted by or subject to the approval of Department or Agency heads and that are designed to study, evaluate, or otherwise examine:
a. **public benefit or service programs**,
b. procedures for obtaining benefits or services under those programs,
c. possible changes in or alternatives to those programs or procedures, or
d. possible changes in methods or levels of payment for benefits or services under those programs.

☐ 6) **Taste and food quality evaluation** and consumer acceptance studies if:
a. wholesome foods without additives are consumed or
b. food is consumed that contains food ingredients found to be safe by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.

1. **List the objectives of the proposed project.**
   The purpose of this study is manifold: (a) to understand the reasons for runway incursions at general aviation (GA) airports, (b) to describe the barriers to addressing runway incursions at GA airports, and (c) to describe the attempts (both successes and failures) made to mitigate runway incursions at GA airports.
   The primary research questions that will guide the proposed study are:
   RQ1: What are the primary reasons for runway incursions at general aviation airports?
   RQ2: What problems emerge when addressing runway incursions at general aviation airports?
   RQ3: What successes and failures with respect to mitigating runway incursions have been realized at general aviation airports?

2. **Describe the research project design/methodology. Discuss how you will conduct your study, and what measurement instruments you are using. If your project will use a questionnaire or structured interview, attach. Please describe your study in *enough detail* so the IRB can identify what you are doing and why.**

   The primary research methodology of the proposed study will be qualitative, and the design will be phenomenology. The proposed study will initiate contact via email to the respective airport managers of desired general aviation airports that have experienced high volumes of runway incursions as identified through the Federal Aviation Administration (FAA) Aviation Safety Information Analysis and Sharing (ASIAS) database and ask them to complete an online questionnaire that contains questions about general aviation runway incursion respective to their airport. I also will ask the airport managers for their cooperation and assistance in having the other targeted stakeholders (pilots and other airport personnel) who were involved in a runway incursion to complete the online questionnaire. The initial set of questionnaire items will be developed so that participants' responses to the questions will help answer the RQs. The proposed study will use an online questionnaire that will be provided electronically via SurveyMonkey. Any necessary follow-up to the responses I receive from the online questionnaire will be conducted via telephone or e-mail relative to participants describing this first-hand experience. The methodology and contextual rich data analysis are appropriate because I will be understanding and describing general aviation runway incursions from the perspective of the airport personnel and pilots who experienced this lived phenomenon. More concretely, I endeavor to describe general aviation pilots and airport personnel first-hand experiences with runway incursion. I anticipate the data collection will commence by November 2017 and run until rich data saturation is achieved.

3. **Describe the characteristics of the subject population, including number, age, sex, and recruitment strategy (attach actual recruitment email text, recruitment flyers etc).**

   The target population for the proposed study is all GA airports within the United States. The accessible population will be all GA airports within the United States that have experienced a runway incursion that was documented on the Federal Aviation Administration (FAA) Aviation Safety Information Analysis and Sharing (ASIAS) database. A purposive sample will be selected from the ASIAS database to identify GA airports that have experienced the highest frequency of runway incursions across all the major types of incursions—operation based (operation errors [OEs], operation incidents [OIs], and operation deviations [ODs], pilot deviations (PDs), and vehicle/pedestrian deviations (V/PDs)—that have occurred over the last 7 years (January 1, 2010 through June 30, 2017, inclusive). The recruitment strategy will be to contact the respective airport managers of these airports and ask them to complete an online questionnaire that contains questions about general aviation runway incursion respective to their airport. I also will ask the airport managers for their cooperation and assistance in having the other targeted stakeholders (pilots and other airport personnel) who were involved in a runway incursion to complete the online questionnaire. The actual demographics of the sample are unknown at this time, but will be reported after data collection.

4. **Describe any potential risks to the subjects (physical, psychological, social, legal, etc.) and assess their likelihood and seriousness. Research involving children must carefully assess risks and describe the safeguards in place to minimize these risks.**

   There are no known potential risks to the participants, and no children or special populations will be involved.

5. **Describe the procedures you will use to maintain the confidentiality and privacy of your research subjects and project data.**

   As indicated in Item 2, participants will an online questionnaire made available to them to ensure convenience and that they feel comfortable enough to describe their first-hand experience. Additionally, participants will be issued a randomized code number at the commencement of the data collection process to guarantee anonymity. This code number will shield any form of identification, as participants will only be referenced by the code number.

Participants will not be required to provide any self-identifying information, and no participants' names will be collected or identified. Furthermore, the collected data will be contained on my password protected personal laptop, and administrative access to participant data will be restricted to my advisor and I. After the study is completed, I will delete all the collected data from participants.

6. **Describe your plan for informed consent (attach proposed form).**

I am requesting a waiver to informed consent because of the potential of losing participants who choose not to sign an informed consent form. Instead, I will provide a "Welcome" page as the first page of the questionnaire that contains the following passage:

You are invited to participate in a research study that seeks to understand general aviation pilots' and airport personnel description of their first-hand experiences with runway incursion. As part of the study, I am asking you to complete this questionnaire, or aforementioned instrument, followed by demographics questions. Before you begin, it's important to understand the following:

1. *There are no perceived risks involved; this study will be used for educational purposes only, as I seek to understand general aviation pilots' and airport personnel describe their first-hand experiences with runway incursion.*
2. *Your responses will be treated as strictly confidential and will be accessible only by the research team.*
3. *Your responses will remain completely anonymous. I will only use data and results from the questionnaire, without including your name.*
4. *Participation in this study is strictly voluntary. You may quit this study at any given time.*
5. *By clicking on the link below, you are indicating that you are at least 18 years old and have agreed to voluntarily participate in the study.*
6. *If you have any questions about this research, please contact Ms. Indira Maharaj at Florida Institute of Technology (imaharaj2011@my.fit.edu) or my advisor, Dr. John Deaton, (jdeaton@fit.edu).*

7. **Discuss the importance of the knowledge that will result from your study and what benefits will accrue to your subjects (if any).**

A literature search using search terms such as "general aviation airport runway incursion" and the more general "general aviation pilot runway incursion" consistently yield no pertinent qualitative design studies. Most of the studies currently available follow a mixed method design, and scarcely expand on rich data collected from qualitative interviews. With that in mind, there are numerous benefits of this study. First, this study may be viewed as seminal and provide valuable insight into this consistent problem owing to the fact no qualitative phenomenological studies were found in the literature search. Second, the results from this study will augment the current knowledge-base. Third, the results could highlight and supplement deficiencies in pre-existing safety measures if the causes of GARI incursion can be identified from the participants' descriptive recollection of the experience. Fourth, the results of this study could highlight potential GARI high-risk areas (hotspots) of airport designs if the participants' are able to recall the exact location of the incursion. This could assist in future airport infrastructural development. Last, the results could assist in the implementation of new programs that could train pilots on how to identify causes and factors that have the potential to result in GARI. The more that is known about this topic, the better the chances will be of combating this dilemma, and keeping general aviation a safe and enjoyable experience for all pilots who share the friendly aerodromes.

8. **Explain how your proposed study meets criteria for exemption from Institutional Review Board review (as outlined on page 1 of this form).**

The proposed study meets the criteria for exemption from the Institutional Review Board review because the research is consistent with Exemption 2, which involves the use of **survey procedures** such that the participants CANNOT be identified, directly or through identifiers linked to the subjects, and any disclosure of participants' responses outside the research could NOT reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation. The study also will not involve children or other special populations.

Signature Assurances

I understand Florida Institute of Technology's policy concerning research involving human subjects and I agree:

1. to accept responsibility for the scientific and ethical conduct of this research study,
2. to obtain prior approval from the Institutional Review Board before amending or altering the research protocol or implementing changes in the approved consent form,
3. to immediately report to the IRB any serious adverse reactions and//or unanticipated effects on subjects which may occur as a result of this study,
4. to complete, on request by the IRB, a Continuation Review Form if the study exceeds its estimated duration.

PI Signature____ Date___________________

Advisor Assurance: If primary investigator is a student
This is to certify that I have reviewed this research protocol and that I attest to the scientific merit of the study, the necessity for the use of human subjects in the study to the student's academic program, and the competency of the student to conduct the project.

Major Advisor____ Date___________________

Major Advisor (print) _____________________________________

Academic Unit Head: It is the PI's responsibility to obtain this signature
This is to certify that I have reviewed this research protocol and that I attest to the scientific merit of this study and the competency of the investigator(s) to conduct the study.

Academic Unit Head_______________________________________ Date___________________

FOR IRB USE ONLY

IRB Approval____ Date___________________
Name

____
IRB #

Florida Tech IRB: November 2005

Appendix E

List of Tables

Table 1.1
Three Main Types of Runway Incursions (RIs)

RI Types		
Operational Incident (OI)	**Pilot Deviation (PD)**	**Vehicle/Pedestrian Deviation (V/PD)**
The action of an Air Traffic Controller (ATC) that results in less than required minimum separation between 2 or more aircraft, or between an aircraft and obstacles, (vehicles, equipment, personnel on runways) or clearing an aircraft to take off or land on a closed runway.	An action of a pilot that violates any Federal Aviation Regulation. For example: a pilot crosses a runway without a clearance while enroute to an airport gate.	Pedestrians or vehicles entering any portion of the airport movement areas (runways/taxiways) without authorization from air traffic control.

Table 1.2
Categories of Increasing Severity of Runway Incursions

D	C	B	A	Accident
Incident that meets the definition of runway incursion such as incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences.	An incident characterized by ample time and/or distance to avoid a collision.	An incident in which separation decreases and there is a significant potential for collision, which may result in a time critical corrective/ evasive response to avoid a collision.	A serious incident in which a collision was narrowly avoided.	An incursion that resulted in a collision

Note: The severity of the RI is categorized on a range by letter as illustrated in Table 1.2 above.

Table 1.3
Summary of Major RI Events from 1977-2000

Year	RI Event
1977	Two commercial airliners collided on the runway in Tenerife, killing 583 people.
1983	Two commercial airliners collided on the runway in Madrid, Spain, killing 100 people.
1984	The pilot of a small business jet made an early takeoff to avoid hitting a DC-9 that had taxied onto the runway. The business jet passed just ten feet over the commercial airliner.
1988	The pilot of a small, single engine aircraft was forced to abort a landing at an uncontrolled airport when a construction vehicle pulled onto the runway as the aircraft was descending for its final approach.
1990	Eight people died and 36 were injured when a Boeing 727 and a DC-9, both operated by North-West Airlines, collided on a fog-covered runway in Detroit, Michigan.
1990	One person was killed in Atlanta, Georgia, when a Boeing 727 landed and collided with a small, twin-engine aircraft that had not taxied clear of the runway.
1991	34 people were killed when a Boeing 737 landed and collided with a commuter aircraft stopped on the runway at the Los Angeles International Airport.
1994	The occupants of a small twin-engine aircraft were killed when the aircraft taxied into the path of a DC-9 landing on the same runway in St. Louis, Missouri.
1996	A twin-engine business aircraft taxied onto a runway at an uncontrolled airport in Quincy, Illinois as a commuter aircraft was landing, killing 14 people.
1999	Four separate incidents occurred (two at Chicago O'Hare, one at Los Angeles, one at JFK in New York) in which a commercial airliner on takeoff flew within 300 feet of another commercial airliner that had taxied onto the runway.
1999	Four people were killed when two single-engine private aircraft collided on a runway in Sarasota, Florida.
2000	A Singapore Airlines B-747 took-off at night in a typhoon on a closed runway in Taiwan and collided with construction equipment killing 82 people.

Table 1.4
Tabulation of Major Category A and B RI Events from 2000 to 2017

	Total A and B Runway Incursions	Fiscal Year
	67	2000
	53	2001
	37	2002
	32	2003
	28	2004
	29	2005
	31	2006
	24	2007
	25	2008
	12	2009
	6	2010
	7	2011
	18	2012
	11	2013
	14	2014
	15	2015
	19	2016
	8	2017
Total	436	17 years

Table 3.1
FAA Classified General Aviation Airport Categories

GA Airport Categories				
National	**Regional**	**Local**	**Basic**	**Unclassified**
Supports the national and state system by providing communities with access to national and international markets in multiple states and throughout the United States.	Supports regional economies by connecting communities to statewide and interstate markets.	Supplements communities by providing access to primarily intrastate and some interstate markets.	Links the community with the national airport system and supports general aviation activities (e.g., emergency services, charter or critical passenger service, cargo operations, flight training and personal flying).	Provides access to the aviation system.

Table 3.2

FAA ATADS GA Airport Operations Standard Report January 1st 2010 to June 30th 2017

Region	Class	Air Carrier Operations	GA Operations
Southwest	Towers with Radar	1,017	598,774
Northwest Mountain	Towers with Radar	408	985,801
Southern	Combined TRACON & Tower with Radar	39,018	1,115,759
Western Pacific	Towers with Radar	227	967,978
Southern	Towers with Radar	414	849,944
Alaskan	Towers with Radar	126	397,989
Western Pacific	Towers with Radar	780	569,525
Southern	Towers with Radar	172	978,482
Western Pacific	Towers with Radar	103	413,212
Western Pacific	Towers with Radar	913	1,154,741

Table 3.3
FAA GA Airport Regions Represented

Region	*N*	Percent (Sample)[a]	Percent (Overall)[b]
Alaskan	1	10%	11.1%
Central (IA, KS, MO, NE)	0		0.0%
Eastern (DC, DE, MD, NJ, NY, PA, VA, WV)	0		0.0%
Great Lakes (IL, IN, MI, MN, ND, OH, (SD, WI)	0		0.0%
New England (CT, ME, MA, NH, RI, VT)	0		0.0%
Northwest Mountain (CO, ID, MT, OR, UT, WA, WY)	1	10%	11.1%
Southern (AL, FL, GA, KY, MS, NC, PR, SC, TN, VI)	3	30%	33.3%
Southwest (AR, LA, NM, OK, TX).	1	10%	11.1%
Western-Pacific (AZ, CA, HI, NV, GU, AS, MH)	4	40%	44.4%

Note. [a]Only five of the nine FAA regions were represented in the sample. Therefore, the base is 5. [b]Base is 9.

Table 3.4
FAA ASIAS Report of GA Airports Represented that Experienced Highest Frequency of PDs and V/PDs January 1st 2010 to June 30th 2017

Region	Number of PDs	Number of V/PDs
Southwest	64	32
Northwest Mountain	70	10
Southern	63	5
Western Pacific	120	12
Southern	77	14
Alaskan	55	68
Western Pacific	68	13
Southern	62	10
Western Pacific	83	17
Western Pacific	58	21

Table 4.1
Summary of Participants' Demographics

Participant	Years Experience in Aviation			Title[a]	AAAE Member?	FAA Region[b]	Num of GA RIs
	Overall	As Airport Executive	In Current Position				
1	40	35	5	AD	Y	AK	41–50
2	30	15	2	AOM	N	S	11–20
3	20	16	3	AM	Y	S	41–50
4	28	20	17	AAD	Y	NM	> 50
5	21	10	5	AM	Y	WP	31–40
6	8	3	2	AOMS	Y	WP	11–20
7	13	5	3		Y	WP	0–10
8	25	10	8	ADGA	N	WP	31–40
9	20	20	9	AD	Y	SW	> 50
10	19	13	3	DAO	N	S	11–20

Note: [a]AD = Airport Director, AOM = Airport Operations Manager, AM = Airport Manager, AAD = Assistant Airport Director, AOMS = Airport Operations and Maintenance Supervisor, ADGA = Assistant Director General Aviation, AD = Airport Director, DAO = Director Airport Operations. Participant 7 did not report his title. [b]AK = Alaskan, S = Southern (AL, FL, GA, KY, MS, NC, PR, SC, TN, VI), NM = Northwest Mountain (CO, ID, MT, OR, UT, WA, WY), WP = Western-Pacific (AZ, CA, HI, NV, GU, AS, MH), SW = Southwest (AR, LA, NM, OK, TX).

Table 4.2
Summary of Participants' Years Experience

Item	*M*	*SD*	*Mdn*	*Range*
Overal1 Years Experience in Aviation	22.4	9.0	20.5	8–40
Years as Airport Executive	14.7	9.1	14.0	3–35
Years in Current Position	5.7	4.6	4.0	2–17

Table 4.3
FAA Airport Regions Represented

Region	*N*	Percent (Sample)[a]	Percent (Overall)[b]
Alaskan	1	10%	11.1%
Central (IA, KS, MO, NE)	0		0.0%
Eastern (DC, DE, MD, NJ, NY, PA, VA, WV)	0		0.0%
Great Lakes (IL, IN, MI, MN, ND, OH, (SD, WI)	0		0.0%
New England (CT, ME, MA, NH, RI, VT)	0		0.0%
Northwest Mountain (CO, ID, MT, OR, UT, WA, WY)	1	10%	11.1%
Southern (AL, FL, GA, KY, MS, NC, PR, SC, TN, VI)	3	30%	33.3%
Southwest (AR, LA, NM, OK, TX).	1	10%	11.1%
Western-Pacific (AZ, CA, HI, NV, GU, AS, MH)	4	40%	44.4%

Note. [a]Only five of the nine FAA regions were represented in the sample. Therefore, the base is 5. [b]Base is 9.

Table 4.4
Runway Incursions Experienced

Number of RIs	*f*	Relative *f*
0–10	1	10%
11–20	3	30%
21–30	0	0%
31–40	2	20%
41–50	2	20%
> 50	2	20%

Table 4.5
GA Manager's Primary Reasons for Runway Incursions

Domain 1	**Cover Term**[a]	**Included Term**	**Conjectures** *With respect to primary reasons for runway incursions: GA airport managers will cite …*
Primary Reasons	PD	Situation Awareness	1.1 situation awareness relative to pilot deviations. Examples include pilot disorientation, lack of familiarity with airport layout, pilot error, and overall compromised SA by pilots and controllers.
		Communication	1.2 communication relative to pilot deviations. Examples include improper perception of ATC instruction, failure to receive proper instructions prior to movements, expectation bias, and overall poor communication between pilots and controllers.
	V/PD	Airfield Access	1.3 airfield access relative to vehicle/pedestrian deviations. Examples include lack of security, unfamiliarity with airport layout and disorientation, unauthorized and unlawful access to movement areas, and an overall laissez-faire safety attitude by airport personnel.
	Factors at Participants' Airport	Resource Related Issues	1.4 resource related issues as a factor at their airport. Examples include insufficient funding to facilitate necessary airfield upgrades, and poor safety attitudes of airport personnel
		Attention to Reporting RIs	1.5 attention to reporting RIs as a factor at their airport. Examples include increased enforcement of runway incursions, and multifunctional use of the airport such as simultaneously accommodating student pilots as well as pilots building flight time.

Note. [a]PD = Pilot Deviation. V/PD = Vehicle/Pedestrian Deviation.

Table 4.6
Barriers that Emerge when Addressing Runway Incursions at GA Airports

Domain 2	**Cover Term**	**Included Term**	**Conjectures** ***With respect to barriers that emerge when addressing runway incursions: GA airport managers will cite …***
Barriers	Airfield Infrastructure	Funding Issues	2.1 funding issues associated with the airfield infrastructure. Examples include structural barriers and technological upgrades such as fencing, security barriers, and parameter cameras.
		Physical Environment	2.2 the airport environment associated with the airfield infrastructure. Examples include fencing, adequate gate/access controls, airfield design, and layout.
		Attitudes towards Airport Safety and Security	2.3 attitudes towards airport safety and security associated with the airfield infrastructure. Examples include incongruent and dismissive attitudes of airport tenants and personnel relative to safety regulations, and organizational culture.
	Pilot Related Issues	—	2.4 pilot-related issues. Examples include pilots' apprehension to be forthcoming or report infractions of pilot interactions, and poor training and communication.

Table 4.7
Lessons Learned from Addressing Runway Incursions at GA Airports

Domain 3	Cover Terms	Included Terms	Conjectures *With respect to lessons learned from addressing runway incursions: GA airport managers will cite …*
Lessons Learned	Collaborative Communication	Presence	3.1 the presence of collaborative communication with stakeholders as a way to promote effective RI mitigation efforts. Examples include establishing dialogue with pilots, airport tenants, and local law enforcement.
		Absence	3.2 the absence of collaborative communication with stakeholders as a way that could hinder effective RI mitigation efforts. Examples include (a) invoking punitive measures without informing stakeholders about the airport's RI safety rules and initiatives, and subsequent fines for noncompliance, and (b) the failure of RSAT programs to promote transparency and effective dialog.
	Physical Environment	—	3.3 making modifications to the physical environment as an effective measure for mitigating runway incursions. Examples include modifying airfield pavements to reduce confusion and installing runway guard lights.

Appendix F

List of Figures

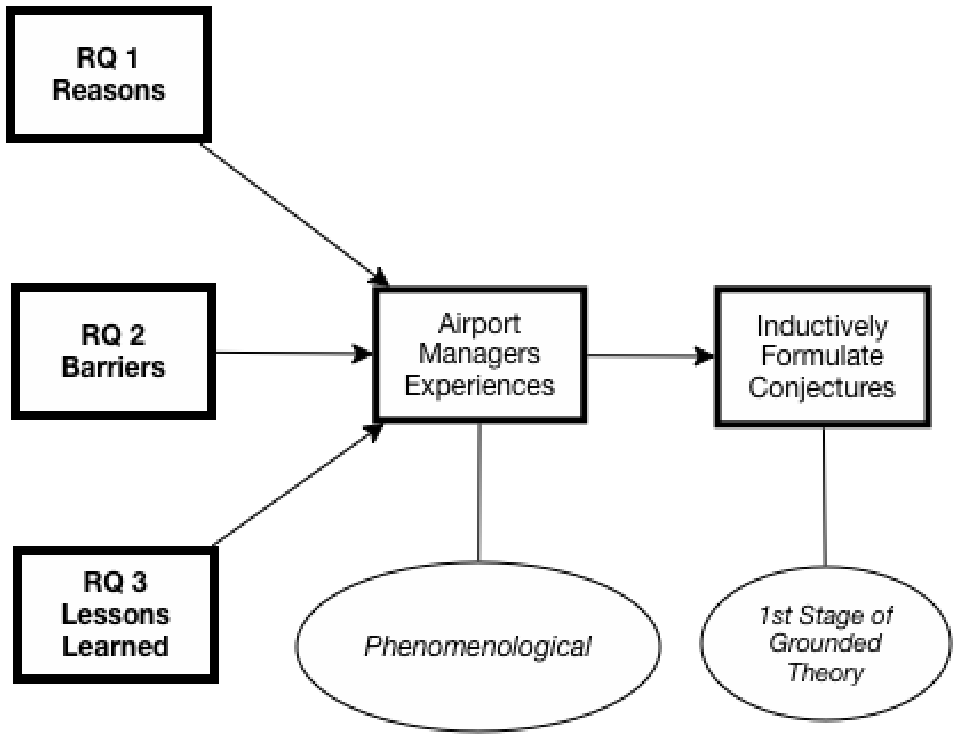


Figure 1.1. **Study design model.**

Appendix G

Raw Data

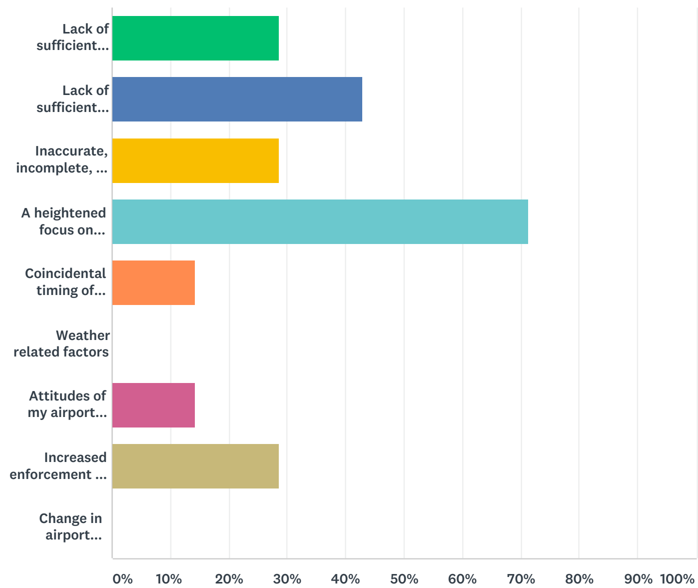
Q1 A1. Given your experiences within the aviation profession (and not necessarily as an airport manager), please describe what you perceive to be the most common reasons for runway incursions at general aviation airports.

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Lack of strict airfield security, typical GA attitude that strict security is unnecessary, and geographic configuration of many GA fields (inability to access aircraft w/o ability to drive to A/C, inadequate gate controls, lack of on site control personnel). 'Incursions' are not officially Vehicle-Pedestrian-Deviations however, if they're not reported as such, as would be the case at ATCT airports.	2/16/2018 9:01 PM
2	Lack of communication, between ATCT (Air Traffic Control Tower) and Pilots. As well as the lack of security with regard to accessing GA operations areas, compared to Part 139 Airports.	2/15/2018 6:13 PM
3	Lack of situational awareness by pilots and controllers	1/28/2018 5:05 PM
4	Pilot Error - Loss of Situational Awareness, Complacency	1/25/2018 12:50 PM
5	Pilot confusion/distraction/disorientation.	12/7/2017 2:34 PM
6	1. Lack of familiarity with airport layout 2. Disorientation	12/7/2017 12:00 PM
7	The most common reasons for runway incursions in general is pilot deviations whether it be due to an improper perception of ATC instructions or more simply not receiving the proper instructions prior to movements. Airport operators strive to ensure that the markings, signage and lighting are correct at intersections and any deviation at a Taxiway/Runway intersection is treated with the highest priority. The most concerning runway incursions involve Vehicular/Pedestrian Deviations (V/PD's). These deviations can be rooted back to ether a misconception of instructions by ground personnel or persons who enter the airfield by following an authorized individual onto the airfield or by unlawful entry (scaling a fence for instance).	12/6/2017 4:53 PM
8	Pilot situational awareness.	12/6/2017 12:45 PM
9	different root causes for pilot deviations (PDs) vs. vehicle/pedestrian deviations (V/PDs) ... for PDs it is often a lack of situational awareness, with training as a contributing factor; for V/PDs, it is most often linked to unauthorized access to the airport Movement Areas	12/5/2017 4:34 PM
10	Expectation bias. Pilots and Controllers (and the rest of us for that matter) expect/anticipate an instruction or clearance with a bias nased on what we have been given in the past.	11/29/2017 6:42 PM

Q2 A2. Based on the statistics available from the FAA Runway Incursion Database, the data show that your airport had one of the highest frequencies of runway incursions as defined by ICAO during the period January 1, 2010 through June 30, 2017. In your opinion, which of the following do you think contributed to this high frequency of runway incursions at your airport? (Check all that apply.)

Answered: 7 Skipped: 3



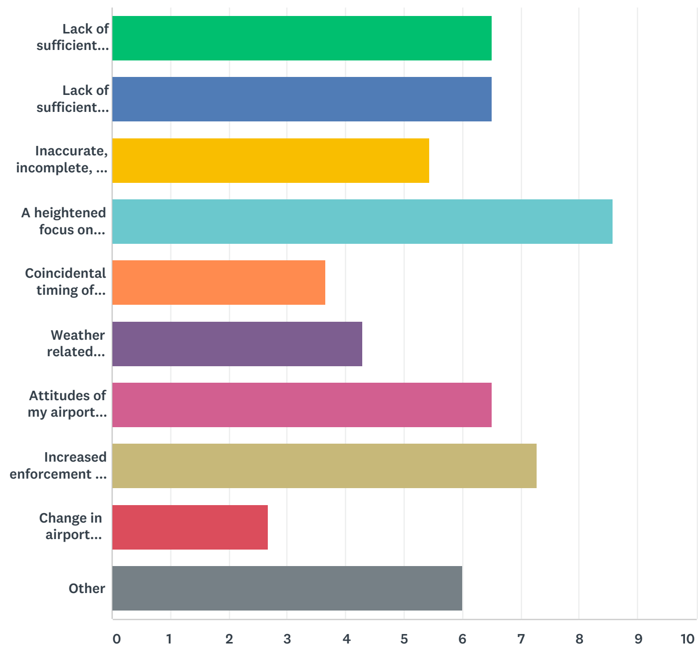
ANSWER CHOICES	RESPONSES	
Lack of sufficient personnel	28.57%	2
Lack of sufficient funding	42.86%	3
Inaccurate, incomplete, or inadequate reporting to the FAA database	28.57%	2
A heightened focus on addressing runway incursions at my airport	71.43%	5
Coincidental timing of airport or runway construction projects at my airport	14.29%	1
Weather related factors	0.00%	0
Attitudes of my airport personnel	14.29%	1
Increased enforcement of airport rules and regulations at my airport	28.57%	2
Change in airport classification	0.00%	0
Total Respondents: 7		

Airport Managers' Interview Protocol

#	FOR EACH REASON YOU SELECTED, PLEASE EXPLAIN WHY YOU BELIEVE THIS TO BE THE CASE AND PROVIDE AN EXAMPLE.	DATE
1	1. We do not have personnel dedicated to patrolling GA areas. 2. FAA data base does not accurately reflect reality. 3. This is a training field. That includes student pilots, flight instructors, AND ATCT Controllers. Latter includes their unencumbered ability to see all VDPs. 4. See #3. Additionally, Merrill Field has been here since 1930 and is both residentially and geographically encroached. We have apron-edge taxi-lanes that are really ATCT controlled taxiways and many areas on field can only practically be reached by vehicle.	2/16/2018 9:01 PM
2	I do not believe any of the above are the reason for the increase in reported incursions at our Airport. I feel there are a couple reasons that together mostly contributed to the increase. 1st, The Airport operations have dramatically increased since 2010, when the total Airport operations were 189,732. Compared to 2017 where the total operations were 300,307 operations. 2nd, The Airports design, in that standard paths to and from the ramp Taxi-Ways and Run-Ways allowed for a direct path. You were able to move into a safety area without a turn.	2/15/2018 6:13 PM
3	The airport has an FAA control tower that is operated 24/7. The airport is also one of the busiest general aviation airports in the country. Safety is the top priority at the airport and the air traffic controllers are very conscientious about reporting all incursions.	1/25/2018 12:50 PM
4	I don't feel that any of these were contributing factors.	12/7/2017 2:34 PM
5	Lack of sufficient funding: Would address non-standard conditions/airfield layout associated with age of the airport. Standards changed since layout was created. Many confusing location on the airfield contribute to disorientation.	12/7/2017 12:00 PM
6	Our airport saw a high frequency of runway incursions in the past due in part to the attitude of airport personnel specifically that of some airport tenants. V/PD's are the majority of runway incursions that can be avoided by an airport operator. Pilot deviations can sometimes be mitigated by more prevalent markings and signage but not only as many times these are due to misconception of instructions by the pilot. Operational deviations can rarely be controlled by the airport operator. At our airport, we have been working on more campaigns to inform airport tenants and their guests about the dangers of improper entry into the movement area. The goal has been to inform airport tenants about the need to wait for perimeter gates to fully close behind them, escorting personnel on the airport who have not received proper training, and ensuring that our tenants are providing proper training to persons to who they sub-lease. Changing attitudes of persons who utilize the airport have been essential which has been completed in a collaborative way with our tenants. The institution of a committee to resolve safety and security related issues has helped our airport reduce the frequency of runway incursions (specifically V/PD's).	12/6/2017 4:53 PM
7	None apply. I believe it was due to changes in FAA ATCT and pilot phraseology coupled with changes in airport geometry.	12/6/2017 12:45 PM
8	heightened focus and increased enforcement - I arrived at this airport about the same time as a new FAA Tower Manager; we both took a hard line on reporting every incident regardless of severity and as a result the airport went from having 2-3 reported surface incidents (SIs) and runway incursions (RIs) per year to as many as 25 in one year ... the first step to addressing a problem is to accurately measure it; the second in this case was increased enforcement to reduce the occurrences ... prior to our arrival, the situation was not being addressed timing of construction project - in 2013 we had a project to reconstruct the parallel taxiway, which required use of the runway for taxi operations in many phases; there was an increase in SI/RI occurrences directly attributable to this project lack of sufficient funding - while the airport has received some funding for measures to reduce SI/RI occurrences, a proposed project to improve perimeter access controls (to reduce V/PD hazards in particular) remains unfunded several years after it was proposed (and supported by FAA Runway Safety)	12/5/2017 4:34 PM
9	DAB is a training environment for both flight students and controllers. When that environment is coupled with being the 3rd busiest airport in the state based on operations the incursion incident rate goes up.	11/29/2017 6:42 PM

Q3 A3. Following is a list of the possible reasons for runway incursions at general aviation airports given in the previous question (A2). Please rank each reason from 1 to 10, with 1 being the most common/important reason and 10 being the least common/important reason so the items appear in ranked order based on what you perceive to be top reasons for runway incursions at general aviation airports.

Answered: 8 Skipped: 2

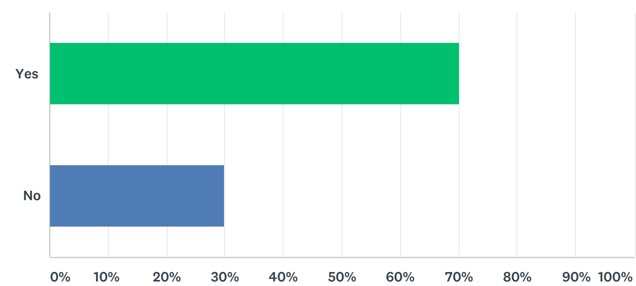


	1	2	3	4	5	6	7	8	9	10	TOTAL	SCOR
Lack of sufficient personnel.	12.50% 1	12.50% 1	12.50% 1	12.50% 1	12.50% 1	12.50% 1	12.50% 1	12.50% 1	0.00% 0	0.00% 0	8	6.5
Lack of sufficient funding.	12.50% 1	25.00% 2	0.00% 0	12.50% 1	12.50% 1	12.50% 1	12.50% 1	0.00% 0	12.50% 1	0.00% 0	8	6.5
Inaccurate, incomplete, or inadequate reporting to the FAA database.	0.00% 0	28.57% 2	0.00% 0	0.00% 0	28.57% 2	0.00% 0	14.29% 1	14.29% 1	0.00% 0	14.29% 1	7	5.4

A heightened focus on addressing runway incursions at my airport.	42.86% 3	0.00% 0	28.57% 2	28.57% 2	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	7	8.5
Coincidental timing of airport or runway construction projects at my airport.	0.00% 0	0.00% 0	0.00% 0	0.00% 0	16.67% 1	33.33% 2	0.00% 0	16.67% 1	16.67% 1	16.67% 1	6	3.6
Weather related factors.	0.00% 0	0.00% 0	14.29% 1	0.00% 0	14.29% 1	14.29% 1	28.57% 2	0.00% 0	14.29% 1	14.29% 1	7	4.2
Attitudes of my airport personnel.	16.67% 1	16.67% 1	16.67% 1	16.67% 1	0.00% 0	0.00% 0	16.67% 1	0.00% 0	0.00% 0	16.67% 1	6	6.5
Increased enforcement of airport rules and regulations at my airport.	0.00% 0	28.57% 2	28.57% 2	28.57% 2	0.00% 0	0.00% 0	0.00% 0	14.29% 1	0.00% 0	0.00% 0	7	7.2
Change in airport classification.	0.00% 0	0.00% 0	0.00% 0	0.00% 0	16.67% 1	0.00% 0	0.00% 0	16.67% 1	50.00% 3	16.67% 1	6	2.6
Other	28.57% 2	0.00% 0	14.29% 1	0.00% 0	0.00% 0	28.57% 2	0.00% 0	14.29% 1	0.00% 0	14.29% 1	7	6.0

Q4 A4. Do you believe that the data in the FAA Runway Incursion Database accurately reflect the frequency of runway incursions at your airport?

Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	70.00%	7
No	30.00%	3
TOTAL		10

#	IF YES, PLEASE EXPLAIN WHY YOU BELIEVE THIS TO BE THE CASE. IF NO, PLEASE EXPLAIN WHAT MAKES YOU BELIEVE THE DATA ARE INACCURATE.	DATE
1	FAA Runway Safety Action Team statistics focus on numeric data w/o tying action to on-the-ground events, so in that sense, it is less than accurate.	2/16/2018 9:01 PM
2	The airport owner and the ATCT (Air Traffic Control Tower) have worked together to address all areas of concern and are thorough when enforcing the rules and regulations of the airport as well as reporting any discrepancies deviations or incursions to the FAA.	2/15/2018 6:13 PM
3	The FAA controllers are very conscientious about reporting all incursions.	1/25/2018 12:50 PM
4	Airport staff reviews incursions with FAA staff annually for the purpose of ensuring accuracy and to learn from them.	12/7/2017 2:34 PM
5	Controllers are very good about reporting incursions and deviations. Airport personnel are also very good about reporting instances that ATC may not witness. However, no way to track the number of incursions PREVENTED by controllers. Controllers prevent at least three times the number of incursions committed.	12/7/2017 12:00 PM
6	The FAA is very diligent in reporting V/PD's at our airport but may be a little less likely to report pilot deviations. The FAA ensures that V/PD's are reported to ensure that security related issues at our airport are addressed and corrected as quickly as possible. When it comes to pilot deviations, sometimes ATC will amend instructions last minute to avoid a PD or sometimes they will simply issue a warning.	12/6/2017 4:53 PM
7	The airport has an FAA ATCT. They have policy in place to ensure all incursions are properly reported.	12/6/2017 12:45 PM
8	Yes, but only beginning since 2007 when my staff and I worked with the FAA air traffic control tower to improve reporting - the policy is that every SI and RI must be reported - and we effectively changed the culture at this airport. Prior to 2007, there was an excessively permissive and cavalier attitude towards RI/SI reporting and mitigation, traceable in large part to an FAA Tower Manager who was not enforcing standards and even went so far as to have a "letter of agreement" in place with a tenant - without knowledge or approval of the airport administration - allowing that tenant to operate on a taxiway in the movement area without contacting Tower for permission.	12/5/2017 4:34 PM

9	As with any data it can fail to capture the entire situation.	11/29/2017 6:42 PM

Q5 A5. Based on your overall experiences dealing with runway incursions, why do you think runway incursions occur more frequently with respect to general aviation than with the other branches of aviation?

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Absolutely. For reasons noted herein. Air carrier (Part 139 certificated) airports are mandated as part of their operating certificate to treat intrusions differently and generally have more generous budgets to do so.	2/16/2018 9:01 PM
2	Large amount of operations in a smaller operation area. Also the fact that GA Airports are not treated with the same heightened security , allows for more traffic in the operations area. Many incursions are due to a contractor or private aircraft owner making a wrong turn.	2/15/2018 6:13 PM
3	Lack of punitive damages.	1/28/2018 5:05 PM
4	Experience level of pilots, overall number of GA operations, mix of traffic, complex airfields	1/25/2018 12:50 PM
5	Lack of pilot proficiency when compared to commercial pilots.	12/7/2017 2:34 PM
6	1. Lack of formal, re-current training 2. Lack of structured standards and consequences 3. Lack of funding or interest to purchase incursion prevention technology	12/7/2017 12:00 PM
7	Yes, with general aviation the pilots tend to have a different attitude, different training level, and the airports tend to have less security related aspects than when other branches of aviation. Professional pilots (i.e. airlines) have rigorous training and more qualification hours where at a GA airport many pilots may only have the basic amount of experience (private pilot) to fly. The attitude level thus with personal travel can be more. At a GA airport, the security requirements are different and many pilots can not understand when stringent requirements are required by the airport operator. Many times push back is received from the tenants and arguments can ensure between some tenants causing issues for the operator.	12/6/2017 4:53 PM
8	Yes, GA pilots are typically less trained, may be more distracted by technology inside the flight deck and their is typically no safety or co-pilot.	12/6/2017 12:45 PM
9	training and professionalism of GA pilots versus that of airline operations, with additional contributions due to lack of conformance to standards at GA airports (in markings, airfield geometry, etc.) often traceable to a lack of funding for improvements	12/5/2017 4:34 PM
10	increased frequency of GA flights and lack of training	11/29/2017 6:42 PM

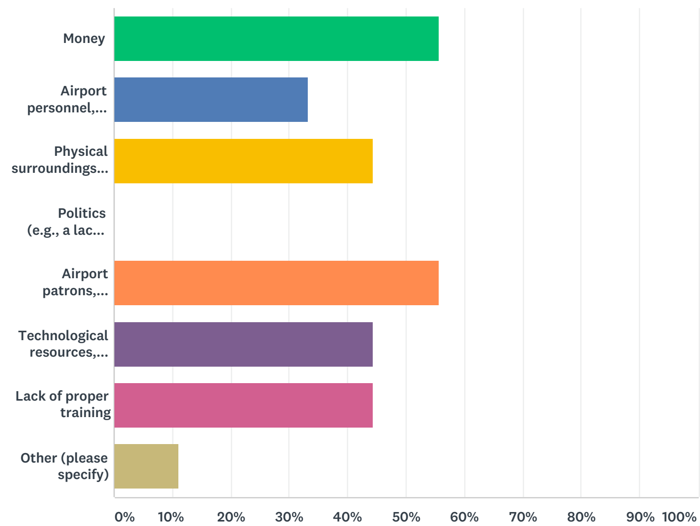
Q6 A6. Given your experiences within the aviation profession (and not necessarily as an airport manager), please describe what you perceive to be the most common barriers to addressing runway incursions at general aviation airports.

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Budgets, staffing levels, fencing, adequate gate /access controls.	2/16/2018 9:01 PM
2	Design, Education and Awareness. In my opinion the FAA and their Partners (The Airport Operators) have made substantial improvements in addressing and correcting run-Way incursions at GA Airports in resent years.	2/15/2018 6:13 PM
3	Pilot punitive fee	1/28/2018 5:05 PM
4	Ensuring adequate pilot training	1/25/2018 12:50 PM
5	Getting the information directly to the individuals who caused them.	12/7/2017 2:34 PM
6	1. Pilot interaction: Most want to be left alone and won't listen to input. 2. Long processes to correct non-standard layout of airfield surfaces. It takes years to correct geometry related to runway incursions.	12/7/2017 12:00 PM
7	Tenant attitudes - many tenants understand the need to mitigate RI's and SI's being that an airport perceived as unsafe becomes a marketing and financial issue. some tenants do not understand why they cannot just walk where they want on the airport or drive as they please around the airport without training. Funding - it is expensive to place the proper fencing and security barriers at an airport and the tenants do not always want to absorb the cost. Airports would like to place the most sophisticated fencing, gates and security camera's at every possible crevice but airport budgets will not always allow this action.	12/6/2017 4:53 PM
8	Communication. Transient pilots may not know the airport diagram and not follow taxi instructions correctly.	12/6/2017 12:45 PM
9	organizational culture is at the top: there must be a zero-tolerance attitude in place starting with ATC and the airport administration, but extending to tenants and users. Training and funding for improvements (including perimeter fencing, access controls, standardized signs and markings) are also important factors.	12/5/2017 4:34 PM
10	the culture of blame and parties not being open and honest	11/29/2017 6:42 PM

Q7 A7. In your opinion, which of the following do you think are barriers to addressing runway incursions at your airport? (Check all that apply.)

Answered: 9 Skipped: 1



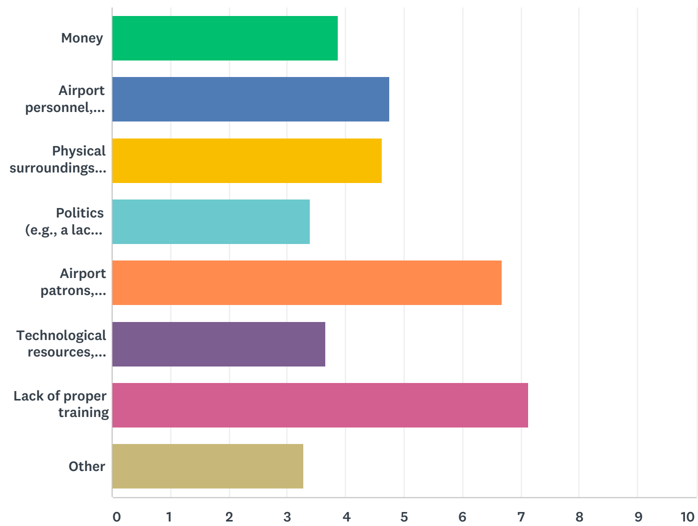
ANSWER CHOICES	RESPONSES	
Money	55.56%	5
Airport personnel, including local and federal employees	33.33%	3
Physical surroundings of the airport (e.g., a lack of sufficient space or land)	44.44%	4
Politics (e.g., a lack of cooperation between the airport authority and local government)	0.00%	0
Airport patrons, including airline passengers, flight crew, etc.	55.56%	5
Technological resources, including hardware and software	44.44%	4
Lack of proper training	44.44%	4
Other (please specify)	11.11%	1
Total Respondents: 9		

#	FOR EACH BARRIER YOU SELECTED, PLEASE EXPLAIN WHY YOU BELIEVE THIS TO BE THE CASE AND PROVIDE ANY EXAMPLES THAT COULD HELP SHED FURTHER LIGHT ON THE ISSUE.	DATE
1	1. Money, not enough. 2. Not enough personnel. 3. Geographic constraints as noted herein. 4. Non Part 139 airports - including Merrill Field - are not eligible for Security Camera funding.	2/16/2018 9:01 PM
2	GA Airports must tighten their security and vetting of anyone requesting access to operations areas. Most incursions happen when the responsible party didn't know they were in the wrong. Different agency's e.g., Police responding to an Alert gaining access to the operations area not knowing the Regulations.	2/15/2018 6:13 PM
3	The need for constant training.	1/28/2018 5:05 PM

4	I don't feel that there are any barriers to addressing runway incursions.	12/7/2017 2:34 PM
5	Money: Not enough to address what needs to be addressed. This is also political depending on local, state, and federal government situation at the time. Patron: Again, lack of desire to acquire skills or technology. Also difficulty in providing training. Many are reluctant to participate. Technology: Too expensive for private/recreational pilots	12/7/2017 12:00 PM
6	Money - As previously stated, lack of funds requires airports to implement security related enhancements based upon a cost/benefit analysis. Personnel - At times communications between local and federal personnel make it hard to mitigate V/PD's. At our particular airport, a V/PD has attributed to a federal agency even though the individual had attended appropriate training. Physical surroundings - our airports is land congested but is also known to have a large homeless population in the surrounding area. The homeless population has at time become a factor for both SI's and RI's. Airport Patrons - Visitors in the past have been a factor for runway incursions. In one particular incident, three representatives for a special event doing a site visit (one of whom was a certified pilot) crossed a taxiway and a runway during the visit. Other personnel who have been allowed access to the airport but then left monitored have in several circumstances proceeded across a taxiway and a runway. Technology - additional cameras and monitoring systems would be helpful in not only identifying threats before they occur but in the investigation following an event. Persons who are caught on camera are much more likely to be held fully accountable than those who can create reasonable doubt.	12/6/2017 4:53 PM
7	Pilots not following best practices. Studying airport diagram, using proper phraseology and not mintaining situational awareness.	12/6/2017 12:45 PM
8	Physical surroundings: Less-than-standard separation between the runway and the parallel taxiway (separation is 300 feet, standard is 400 feet) results in holding positions right at the edge of the parallel taxiway, which is a significant contributing factor to PD incidents. There is no way to fix this; the airport does not have land available to move either the taxiway or the runway to create standard separation. The airport is an urban Reliever, with dense development all around. Technological resources and money: the airport needs better access controls (card reader in/out coupled with video surveillance) on its perimeter gates and has had a request pending for AIP funding for years, but a lack of sufficient State and Federal funding for airport improvements has resulted in the project going unfunded, with no prospect of change in the next 2-4 years. Training is occasionally a factor in pilot deviations; we have a lot of flight training including international students whose first language is not English. In addition, transient pilots not familiar with the airport's constrained geometry (the sub-standard runway-taxiway separation in particular) do not expect the holding positions so close to the edge of the parallel taxiway and may inadvertently cross (in spite of the Runway Guard Lights at every intersection).	12/5/2017 4:34 PM
9	DAB is unique in our layout and runway crossings. Heavy training environment is a major contributor.	11/29/2017 6:42 PM

Q8 A8. Following is a list of the barriers to addressing runway incursions at general aviation airports from the previous question (A7). Please rank each barrier from 1 to 8, with 1 being the biggest/most important barrier and 8 being the weakest/least important barrier so the items appear in ranked order based on what you perceive to be biggest barriers to addressing runway incursions at GA airports.

Answered: 9 Skipped: 1



	1	2	3	4	5	6	7	8	TOTAL	SCORE
Money	0.00% 0	0.00% 0	25.00% 2	12.50% 1	25.00% 2	12.50% 1	12.50% 1	12.50% 1	8	3.88
Airport personnel, including local and federal employees	12.50% 1	12.50% 1	0.00% 0	37.50% 3	12.50% 1	12.50% 1	0.00% 0	12.50% 1	8	4.75
Physical surroundings of the airport (e.g., a lack of sufficient space or land)	0.00% 0	0.00% 0	50.00% 4	0.00% 0	12.50% 1	37.50% 3	0.00% 0	0.00% 0	8	4.63
Politics (e.g., a lack of cooperation between the airport authority and local government)	0.00% 0	0.00% 0	12.50% 1	12.50% 1	12.50% 1	25.00% 2	37.50% 3	0.00% 0	8	3.38
Airport patrons, including airline passengers, flight crew, etc.	33.33% 3	44.44% 4	0.00% 0	11.11% 1	0.00% 0	11.11% 1	0.00% 0	0.00% 0	9	6.67
Technological resources, including hardware and software	0.00% 0	0.00% 0	0.00% 0	33.33% 3	33.33% 3	0.00% 0	33.33% 3	0.00% 0	9	3.67

Lack of proper training	37.50% 3	37.50% 3	25.00% 2	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	8	7.13
Other	14.29% 1	14.29% 1	0.00% 0	0.00% 0	14.29% 1	0.00% 0	0.00% 0	57.14% 4	7	3.29

Q9 A9a. In your opinion, what do you think is currently being done to address runway incursions at GA airports but is not being done adequately in general and at your airport in particular?

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	As noted above.	2/16/2018 9:01 PM
2	We are currently addressing our runway incursions by adding a new Taxi-Way and Run up area as well as eliminating direct paths to restricted movement areas. With the attention given to my airport over the past couple years as well as the pending improvements already approved I do not believe there are any inadequacies.	2/15/2018 6:13 PM
3	N/A	1/28/2018 5:05 PM
4	Proper pilot training	1/25/2018 12:50 PM
5	Nothing. I believe that we are doing more than most other GA airports.	12/7/2017 2:34 PM
6	Construction: Time for planning and funding makes catching up nearly impossible.	12/7/2017 12:00 PM
7	Excluding unauthorized personnel and training: GA airports notoriously have less stringent security requirements than their counterparts. Most GA airports do not have gates monitored by ether personnel or cameras and leave it up to individual tenants to ensure that the perimeter gates close appropriately behind them. Training is a time consuming venture for airport operators and depending on the requirements of the particular airport may be directly controlled by the airport operator or be required to be complied with by the individual tenants. Airports in general have to ensure that persons are held accountable for persons who leave perimeter gates partially open and unattended as well as ensuring that security and operational related training is properly completed by all persons with access to the AOA.	12/6/2017 4:53 PM
8	Pilot training.	12/6/2017 12:45 PM
9	FAA is doing very little to address the issue at airports that are not certificated under FAR Part 139 beyond working with the few airports that are taking the issue seriously and diligently reporting all occurrences. FAA is also working to develop low-cost technology to help address the issue at Relievers and National/Regional category GA airports, but that is years away from being fielded and funding will still be an issue. GA airports (mine in particular) are not receiving the appropriate priority for AIP funding for projects that would mitigate the issues (perimeter access controls, in our case).	12/5/2017 4:34 PM
10	Runway status lights.	11/29/2017 6:42 PM

Q10 A9b. What do you think should be done to improve what currently is being done and how do you propose this be accomplished at your airport?

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Even more emphasis re ongoing education and reinforcement to ALL tenants.	2/16/2018 9:01 PM
2	We should follow the path we are on and continue to work together, e.g., FAA, ATCT and Airport Authority.	2/15/2018 6:13 PM
3	N/A	1/28/2018 5:05 PM
4	Increase pilot training requirements in regards to incursion education and prevention.	1/25/2018 12:50 PM
5	Quicker reporting from ATC to airport administration. We have been collaborating on a more refined communication strategy.	12/7/2017 2:34 PM
6	Increased coordination between FAA or State DOT for project planning and funding. Possibly add more than one project per year to catch up on project backlog.	12/7/2017 12:00 PM
7	Training and preventing unauthorized access to sensitive areas of an airport. At our airport, we have instituted many security initiatives but ensuring that all individuals who access the airfield receive proper training has been a major issue for us.	12/6/2017 4:53 PM
8	Pilots need to be trained and held accountable for incursions.	12/6/2017 12:45 PM
9	Congress needs to pass an FAA reauthorization bill including an increase in the PFC cap for air carrier airports, while maintaining or increasing AIP funding that could be focused on funding projects at small hub / non-hub, and busy GA airports. We know how to fix the problems - especially at my airport, where we have had two AIP-funded studies of the issues - but we have not been able to get the funding to pay for the needed physical improvements. If someone were to die as a result, we could probably get the funding ... but death or injury is what we work very hard every day to prevent.	12/5/2017 4:34 PM
10	Increased interaction between ATC and flight schools	11/29/2017 6:42 PM

Q11 A10a. In your opinion, what do you think is not being done currently to address runway incursions at GA airports that you believe should be done both in general and at your airport in particular?

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Not enough education and emphasis on need for.	2/16/2018 9:01 PM
2	We should follow the path we are on and continue to work together, e.g., FAA, ATCT and Airport Authority.	2/15/2018 6:13 PM
3	N/A	1/28/2018 5:05 PM
4	There is not enough training and education being done with pilots on incursion prevention.	1/25/2018 12:50 PM
5	Nothing. I believe we're doing all that we can.	12/7/2017 2:34 PM
6	Increased training opportunities for general aviation pilots.	12/7/2017 12:00 PM
7	Public Outreach - Unfortunately the general public does not understand the sensitivity of an airport and public outreach regarding some of the safety concerns may be helpful. General Aviation airports are more likely to have more types of groups trying to get on the airport to ether look around or cross the airfield because it is easier.	12/6/2017 4:53 PM
8	More focus needs to be placed on pilot training during ground operations.	12/6/2017 12:45 PM
9	My airport was visited TWICE by the FAA Regional Administrator - with the implied threat of withdrawing AIP funding - in connection with the high numbers of RI/SI events we were reporting ... but FAA saw that we were doing everything reasonably possible to address the issues. In short, there isn't anything we aren't doing that we should be doing. With respect to other GA airports, there is a lot of variation but the key factor is how seriously airport administration (and ATC) treats the issue and what steps they take to implement a strong safety culture at their airports. Attitude of the people running the show is key.	12/5/2017 4:34 PM
10	more RSAT meetings to address incursions	11/29/2017 6:42 PM

Q12 A10b. With respect to what you believe should be done from the previous question (A10a), how would you propose this be accomplished at your airport?

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	We have recurrent meetings w/ all airport users, quarterly newsletters, website, FaceBook posting. during which these issues are addressed.	2/16/2018 9:01 PM
2	We should follow the path we are on and continue to work together, e.g., FAA, ATCT and Airport Authority.	2/15/2018 6:13 PM
3	N/A	1/28/2018 5:05 PM
4	The training should be an FAA requirement for all pilots. However, specialized training could be provided for users of specific airports that have high incursion rates.	1/25/2018 12:50 PM
5	NA	12/7/2017 2:34 PM
6	FAA to sponsor multiple trainings at each airport to provide general and airport specific trainings for pilots.	12/7/2017 12:00 PM
7	Through our Public Relations group. This could happen through a twitter message or other means but also becomes problematic. An airport may want to get out to the public that the movement area can be dangerous but can also feed public fears and cause issues with certain groups thinking that the airport is an unsafe place overall.	12/6/2017 4:53 PM
8	This is being addressed at my airport through pilot briefings and working with the local flight schools. More effort needs to be applied nationwide.	12/6/2017 12:45 PM
9	We did it 10 years ago ... changed the attitude and the culture and now RIs are relatively rare here.	12/5/2017 4:34 PM
10	FAA mandated triggering event meetings with stake holders following every incursion (ie, similar to the Wildlife Hazard Working Group meeting following a major bird strike.)	11/29/2017 6:42 PM

Q13 A11. Please indicate how your airport handles runway incursions. Please include and describe any related policies, reporting mechanisms, available resources, enforcement activities, personnel training, and so forth.

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	We are an FAA ATCT airport. FAA writes incursions up, they're reported to us (as airport operator), we investigate, write explanation to regional FAA airports inspectors, correct deficiencies if found.	2/16/2018 9:01 PM
2	Report incursion to the FAA, ATCT and Airport Authority, Identify the cause, e.g., operator error, ATCT error or poor design (As is the case here, mentioned in previous questions/Answers). Address the error and correct whether it be Training, Communication or design.	2/15/2018 6:13 PM
3	Arrests, punitive fines, training, suspension of privileges	1/28/2018 5:05 PM
4	An annual Runway Safety Action Team meeting is held annually to review and discuss incursions that were incurred in the previous year. Action items are developed and implemented in order to reduce future incursions. Follow up is performed by the airport on all V/PD incursions and surface incidents. Action may include revoking ramp action privileges, requiring additional training or termination from employment.	1/25/2018 12:50 PM
5	ATC reports the incident to airport administration. Together, we evaluate to determine trends, hotspots, & learning opportunities. We then evaluate the need for airport improvements.	12/7/2017 2:34 PM
6	The airport really has no control over OIs and PDs. We are responsible for conducting investigations and enforcement/training for VPDs. However, we assist ATC with coordination and information as necessary for all runway incursions. We have also developed an airfield familiarization packet which describes problem areas and hot spots at our airport. However, this does not help a transient pilot who does not prepare for their trip.	12/7/2017 12:00 PM
7	If a runway incursion occurs, depending on the parties that are involved will dictate which procedures are utilized. If it is a PD or OI, the respective FAA divisions will conduct the investigations. If it is a V/PD, the airport will receive a letter of investigation from the FAA while the airport simultaneously investigates the RI. We will hold a hearing for the responsible parties. If it is found that violations affect the particular lease agreement, our properties group will further investigate the occurrence. Many times retraining is conducted for the responsible parties which may include the red leasehold lines and or driver's training. Additionally, if a facility is found at a leasehold to be insufficient, the corrective actions may include physical barriers that the leaseholder needs to erect. This was the case in a recent RI where the leaseholder erected barriers to surrounding a problematic area isolating people from directly driving onto the AOA from a parking area. All persons with access to our airfield are trained to contact Airport Operations or Airport Police with any suspicious activities.	12/6/2017 4:53 PM
8	FAA will interview the pilot after the incursion. Information will be provided to the airport for discussion. FAA has conducted workout sessions with the airport to modify aircraft layout.	12/6/2017 12:45 PM
9	The overwhelming majority of RI and SI events are reported by ATC, which then notifies airport administration. Our staff investigates every V/PD incident (PDs are within the purview of FSDO, not the airport) and takes appropriate remedial actions. Local police can issue citations when appropriate. The airport has a robust airfield access and driver training program, required for all persons who access any common-use area inside the airport perimeter fence.	12/5/2017 4:34 PM
10	Airfield tours to ATC and flight schools; Tower tours for flight students, observation flights for ATC; weekly safety meetings; frequent RSAT meetings rather than just the required annual	11/29/2017 6:42 PM

Q14 A12. Please describe what actions you have taken in your role as airport manager to help mitigate runway incursions at your airport. Please provide as much detailed information as possible along with any relevant examples.

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	I have implemented airport mgr-airport tenant and airport user meetings at every airport I have been at. Initially they are just bitch sessions from the users/tenants to airport mgt, but after a period of months they become useful tools for improved communications - and I recurrently, regularly emphasize incursion prevention.	2/16/2018 9:01 PM
2	Daily briefings with staff to be aware and diligent when in the operations area to help stop incursions before they happen, as well as weekly communications between the airport authority employees and manager and the ATCT employees and manager in an effort to improve communication and awareness. Monthly safety meetings with airport authority, ATCT and airport users to discuss concerns and encourage open communication. We do not want a student pilot to have an incurious because they were not sure and were afraid to ask the controler	2/15/2018 6:13 PM
3	Updating signage/markings and provide recurrent training.	1/28/2018 5:05 PM
4	Numerous airfield changes have been implemented including additional signage at all entrances to the movement areas, addition of elevated guard lights at all hold lines, removal of pavement in confusing areas, re-alignment of taxiway connectors, painting "TAXIWAY" on Taxiway B, adding non-movement area markings at the edge of all movement areas, purchase of a vehicle tracking system for snow equipment, formalized driving training program for airport personnel, production of a video for tenants driving on the ramps, formalized/active training program with off airport emergency responder's.	1/25/2018 12:50 PM
5	In the process of evaluating runway incursions and identifying trends, we identified several hotspots on the airport. We then coordinated with the FAA to secure grant funding to install elevated runway guard lights at those runway intersections.	12/7/2017 2:34 PM
6	Currently part of the FAA RIM study as part of our Master Plan. This project is being completed in two phases. The first is a detailed analysis of hot spots and all hot spots have been planned to be corrected in future projects. The second phase is a complete look at the airfield for non-standard or confusion area that contribute to runway incursions. These findings will then be programmed in for correction through construction or enhanced surface guidance.	12/7/2017 12:00 PM
7	While having zero V/PDs per year is the ultimate goal, there is significant potential for them to occur due to the large number of based aircraft, operations and tenants on the airfield. The airport is frequented by a variety of clients, contractors, vendors and other visitors who must also conform to airport safety and security standards. Ensuring that persons who drive on the airfield are properly trained is key to preventing V/PDs. We have instituted a Motor Vehicle Operating Permit (MVOP) Program requires applicants to complete training and pass an exam before receiving authorization to drive on the airfield. Airport tenants, operators and users are required to demonstrate knowledge of Rules and Regulations pertaining to vehicle and pedestrian access onto runways and taxiways. In August 2014, the Safety and Security Airfield Enforcement Program (VSAFE) was enacted to help reduce V/PDs. Violations result in citations and hearings, and can cause revocation of a repeat violator’s MVOP. Later that year, also implemented a “Do Not Cross the Red Line” awareness campaign to prevent unauthorized vehicles and pedestrians from crossing red leasehold lines without permission. In 2016, a more comprehensive V/PD Action Plan that included extensive outreach to the aviation community, additional tenant workshops and production of a training video was executed. As a result, the total number of citations issued in 2016 decreased by 28 percent from 2015. We have a strong record of utilizing a proactive and collaborative approach to preventing V/PDs, making it the responsibility of the entire airport community to protect safety and security. Discussions with major tenants are currently underway regarding implementation of airport-specific best practices, which may include a monetary fine system and technological solutions such as camera surveillance systems. We also exploring the feasibility of enacting a City Ordinance to impose mandatory sanctions for violations of established rules and regulations, ranging from financial penalties to cancellation of a lease agreement.	12/6/2017 4:53 PM

8	Completely redesigned areas of the airport to increase pilot situational awareness. Created a pilot briefing with the FAA. Hand out pilot briefings to all transient pilots. Worked directly with flight schools to modify training at the airport to address specific concerns.	12/6/2017 12:45 PM
9	I have been here 10 years and this has been a priority since I first arrived. The first step was to measure the problem, i.e., report every single occurrence and then identify causes through investigations of each incident. Airport rules & regulations were written into the municipal code, making them enforceable by local police (we had no effective mechanisms for enforcement prior to that happening). We changed the culture of tenants on the airport and made it clear that RI/SI events are a hazard for all of us and they would not be tolerated. We strengthened procedures to control access to the AOA; we now have a police sergeant assigned to the airport who offices with airport administration and serves as liaison with the police department to assist with all airport-related policing issues. We have a robust training program that is required for all personnel who desire to have access inside the airport perimeter fence; escorts are required for people who have not gone through the training, and the requirement is enforceable by the local police. We have improved gates, fencing, and signage on both the fences and at the non-movement area boundaries to alert airport users of requirements. We have produced educational materials and distributed those to FBOs, flight schools, etc. We requested additional funding in a runway improvement project to install runway guard lights at every runway-taxiway intersection; that was approved and the RGLs have greatly reduced the incidence of pilot deviation RIs. We are currently in the process of reviewing and updating our airport rules & regulations and the corresponding municipal ordinance to make adjustments that we have found (through experience) to be helpful. We had an AIP-funded access controls study in 2013 that made recommendations for improvements - needed to help us reduce and prevent V/PDs - but other than the low-cost recommendations (which were implemented immediately) we have been unable to secure funding (AIP grants) for the other recommended improvements, specifically the access control improvements (card readers and cameras). We participated in an AIP-funded Runway Incursion Mitigation (RIM) study that resulted in additional suggestions for addressing the RI risk ... which again have yet to be funded. (It seems we can get studies funded, but we can't get funding to make the actual physical improvements recommended in those studies.) We have expressed to FAA our interest and willingness to participate in their RIPSA (Runway Incursion Prevention Shortfall Analysis) technology demonstration program (which has yet to be started, as far as I am aware). We have worked closely with FAA's ATC personnel on these issues and have supported FAAST Team efforts in this area as well. Whatever we can think to do, we have done, but it is an ongoing effort.	12/5/2017 4:34 PM
10	try to foster a safe environment. Declared a war on runway incursions.	11/29/2017 6:42 PM

Q15 A13. Of the various attempts you have made to address runway incursions at your airport, which do you believe have been the most successful, and to what do you attribute this success?

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Better communication and emphasizing that FAA AIP grants have strings attached that dictate (and to which the airport sponsor has agreed) the sponsor will operate the airport in a 'safe manner.' In FAA view, high numbers of VPDs equate to unsafe airport operation, which in turn can jeopardize AIP funding. AIP funded improvements impact ALL users and NOBODY wants that jeopardized. I tie the two together, w/ specific airfield improvement examples.	2/16/2018 9:01 PM
2	Airport improvements and open communication	2/15/2018 6:13 PM
3	Training and security access training	1/28/2018 5:05 PM
4	Change in airfield pavement areas to reduce confusion and installation of elevated guard lights. Has helped to reduce pilot confusion/loss of situational awareness.	1/25/2018 12:50 PM
5	The installation of runway guard lights. This was only accomplished due to a great relationship with the FAA.	12/7/2017 2:34 PM
6	Communication with pilots. For those pilots who are willing to talk and learn, trainings have been very informative and given increased situational awareness to pilots. I have received several comments from local pilots saying how much more comfortable they are after understanding the reasons behind some of our conditions.	12/7/2017 12:00 PM
7	Tenant and Sub-tenant engagement has been the most effective initiative that we have undertaken. Our executive director advised all of our tenants that if corrective measures were not undertaken immediately that their access to the airfield would be highly restricted. Working with our tenants, we were able to develop collective practices such as limiting what types of vehicles can access the airfield that tenants were able to comply with. Working with our tenants has reinforced the need for training and had made it to a point that they have been involved in the process and that they accept the requirements voluntarily.	12/6/2017 4:53 PM
8	Having the FAA ATCT be more aware of common pilot errors and encourage them to improve communication.	12/6/2017 12:45 PM
9	Changing the culture and demonstrating through police enforcement of the rules & regulations (in the municipal ordinance) and increased police presence on the airport that this is a safety issue that we take most seriously ... that has had the greatest effect on reducing/eliminating V/PDs. The installation of the Runway Guard Lights has probably had the greatest effect on reducing PDs (along with the designation of multiple RI "hot spots" on our Airport Diagram).	12/5/2017 4:34 PM
10	tours between flight schools, airport and ATC to give perspective.	11/29/2017 6:42 PM

Q16 A14. Of the various attempts you have made to address runway incursions at your airport, which do you believe have been the least successful, and to what do you attribute this lack of success?

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Nicely asking w/o any consequences for failure to comply.	2/16/2018 9:01 PM
2	We should follow the path we are on and continue to work together, e.g., FAA, ATCT and Airport Authority.	2/15/2018 6:13 PM
3	N/A	1/28/2018 5:05 PM
4	Training video for equipment operators operating on non-movement areas. This has typically not been a problem area for the airport and the video is meant to be preventative.	1/25/2018 12:50 PM
5	I have no examples of this.	12/7/2017 2:34 PM
6	Fines. Imposing fines just makes people angry and they do not learn from their mistakes. I think this is part of the problem for why pilots do not want to talk or attend trainings.	12/7/2017 12:00 PM
7	Verbally telling people about RI initiatives without including stakeholders or without some type of enforcement action. Individuals need to know that there are penalties for non-compliance and prior to true engagement with stakeholders the message was not getting completely through.	12/6/2017 4:53 PM
8	Pilot training and awareness of the airport diagram.	12/6/2017 12:45 PM
9	Trying to get funding for improved airport access controls has not been successful at all; we have reduced the RI/SI numbers - nearly eliminated these incidents - through other means, but the risk remains from the lack of stronger controls on airfield access. We are relying on policy, procedures, and people ... and we need more help on the physical technology improvements.	12/5/2017 4:34 PM
10	annual RSAT is not always the most transparent and does not always promote dialog.	11/29/2017 6:42 PM

Q17 A15. Please give an example of a runway incursion that would be representative of other runway incursions that have occurred at your airport and describe what actions you took immediately following this incursion.

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	See Q11. VPDs getting onto the field through open gates.	2/16/2018 9:01 PM
2	We had outside police officers respond to an alert, upon arriving to one of the security gates that access the AOA the officers asked an airport tenant to open the gate. Once in the AOA they proceeded to cross two live runways and several Taxi-Ways in rout to the accident site. There were a total of 6 incursions. We have now advised all tenants not to open the gates as well as identified a specified gate for emergency access advising the local authorities of the access point and AOA restrictions. (No More Assumptions)	2/15/2018 6:13 PM
3	Unauthorized vehicle access to AOA. Notify police. investigate how individual gained access to airfield.	1/28/2018 5:05 PM
4	Aircraft landing on the wrong runway. FAA air traffic personnel are supposed to advise the airport authority of the incursion then a SSR (system safety review) meeting is held to discuss the details of the incident and determine what actions could be taken to prevent the situation from occuring again in the future.	1/25/2018 12:50 PM
5	A representative incursion would be ATC issuing a "hold short" instruction to a pilot, the pilot correctly reading it back to ATC, but then proceeding out onto the runway anyway. The airport hasn't taken action on this type of incursion.	12/7/2017 2:34 PM
6	Direct ramp access to a runway. The pilot did not take the turn that was instructed and incurred the runway. This occurred at a well known hot spot. We coordinated an investigation with tower and documented for project support. This location is scheduled to be corrected in Fall 2019. Until then these incursions will continue to occur.	12/7/2017 12:00 PM
7	One RI that we have had involved an individual who entered a perimeter gate via piggybacking and then proceed onto a tenant leasehold, past a taxiway, onto a runway and drove in a 360 degree circle prior prior to proceeding onto another taxiway and being intercepted by Airport Operations. This person had no knowledge of an airport or any of our facilities and was allowed to enter through a perimeter gate without being challenged. The individual who entered the gate was given a code by another party for the particular perimeter gate but was not provided proper training. Since the person who entered was not given proper training, the person who followed them through the gate was not reported to airport operations or police. The parties were later found through video evidence at the leasehold and were brought into a hearing with airport operations. The airport cited the master tenant in the incident since they were ultimately responsible for their perimeter gate. Corrective actions were required including barricades for their parking lot with airfield access as well as increased record retention for training.	12/6/2017 4:53 PM
8	Pilot failing to hold short of a runway after asking for permission to take off on a concurrent runway. Asking for permission to depart runway 12R however failing to hold short of runway 7.	12/6/2017 12:45 PM

9	Maintenance Manager and I were doing a drive-around on the airport early one afternoon; I observed a vacuum truck (used for pumping out portable toilets) traveling west on a taxilane in the non-movement area, but heading towards the movement area. The truck turned onto the taxiway (in the movement area) with no radio call to Ground; we immediately alerted ground, who confirmed that they were not in contact with the vehicle. We requested ATC to call the police, which they did. Meanwhile, the truck continued from the taxiway onto the runway and proceeded ~2,000 feet down the runway before turning off on another taxiway, where the truck was met by our airport vehicle and two police vehicles. The truck driver was detained and cited for the runway incursion; airport immediately began an investigation to determine how and where the truck had gained access to the AOA, first by interviewing the driver. It was determined that the driver had opened a section of construction fence that was securing a hangar construction project at one of the FBOs; the driver had attempted to cross the airport to get to two port-o-lets on the west side of the field that the driver believed needed service. The FBO was not at fault; because the driver dismantled a section of construction fence to gain access to the AOA, the driver was additionally charged with criminal trespass (a Class B misdemeanor). Fortunately, the closest aircraft was 4 miles out on approach to the runway, so this was a Category D RI.	12/5/2017 4:34 PM
10	FBO towed a aircraft onto an open runway during the Daytona 500. Airport levied a fine, a meeting was held to debrief the incident. Procedures were implemented to prevent incident in the future.	11/29/2017 6:42 PM

Q18 A16a. Depending on the type of runway incursion (PD or VPD), please describe what you did to help those individuals whose actions resulted in the runway incursion from committing similar incursions in the future.

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Strong emphasis on Police enforcement of trespass citations. We have not had any repeat violators.	2/16/2018 9:01 PM
2	More training and better communication	2/15/2018 6:13 PM
3	Required recurrent training be performed prior to be authorized to operate on airfield	1/28/2018 5:05 PM
4	With V/PD's additional training is provided to those involved. When appropriate, revocation of ramp access or termination of employment may be used.	1/25/2018 12:50 PM
5	For PDs, we often partner with the FAA in safety seminars to discuss unique areas of the airport and to learn from other incursions. For VPDs, we suspend airfield driving privileges for up to 30 days & require the driver to undergo additional airfield drivers training.	12/7/2017 2:34 PM
6	FSDO FAAST team conducted training for the pilot. ATC conducted interviews and trainings. No penalties were assessed.	12/7/2017 12:00 PM
7	Individuals who commit V/PD RI's or SI's are required to undergo training depending on the details of the particular incidence. They will have their driving privileges suspended for a period of time following the incident and any further incidents may lead to them permanently losing their driving privileges.	12/6/2017 4:53 PM
8	In the case of VPD the operator was fined and lost all driving privileges until retrained. In the case of an employee of the airport the individual was given progressive discipline. In the case of pilots no actions were taken by the FAA.	12/6/2017 12:45 PM
9	The driver was cited and (we believe) fired. We had suspected the FBO of negligence in enabling the incursion, but that proved not to be the case; they had secured the AOA from their construction site as required.	12/5/2017 4:34 PM
10	Verbal and physical escort by Operations onto a closed surface prior to FBO parking on surface.	11/29/2017 6:42 PM

Q19 A16b. To what extent do you think what you did was helpful or beneficial in preventing or mitigating future occurrences?

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	See Q15 above.	2/16/2018 9:01 PM
2	We have had 0 incursions in almost 2 years.	2/15/2018 6:13 PM
3	N/A	1/28/2018 5:05 PM
4	The additional training for VPD's has been very beneficial.	1/25/2018 12:50 PM
5	Very beneficial.	12/7/2017 2:34 PM
6	Not at all. The physical layout needs to be changed.	12/7/2017 12:00 PM
7	Very effectively, we have not had any persons recommit V/PD's and we use each as a learning tool for all of our master tenants.	12/6/2017 4:53 PM
8	Their has to be accountability and a penalty attached to all infractions.	12/6/2017 12:45 PM
9	This was the type of event that is very difficult to prevent or predict; perhaps in that regard it is not such a good example, but it did stand out in my mind.	12/5/2017 4:34 PM
10	Very beneficial we have not has a repeat.	11/29/2017 6:42 PM

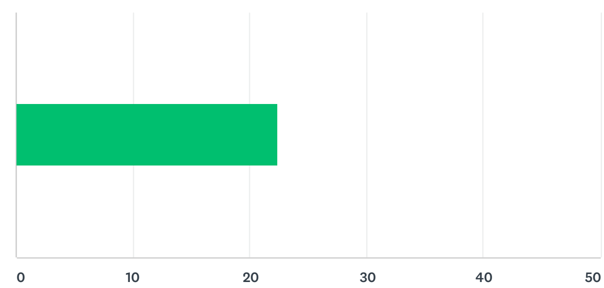
Q20 A17. Please describe what you have learned from addressing runway incursions at your airport, and how these experiences have influenced the way in which you will handle subsequent runway incursions.

Answered: 10 Skipped: 0

#	RESPONSES	DATE
1	Behavior rewarded is repeated. Adverse behavior w/o consequence is also repeated.	2/16/2018 9:01 PM
2	It's important to approach each incident on its own merits and be open minded. Too often we are looking for someone to blame instead of a solution, It's important that together we work towards better training and an open line of communication.	2/15/2018 6:13 PM
3	Continue current procedures	1/28/2018 5:05 PM
4	Great effort and expense has gone into preventing runway incursions at our airport. The incursions that still occur are typically PD that are a result of loss of situational awareness or complacency that tie into human factors. Additional training needs to be focused on this area in order to further reduce incursions.	1/25/2018 12:50 PM
5	I have learned to look for trends. No matter how much training and outreach we do, there are still pilots who didn't receive the information.	12/7/2017 2:34 PM
6	hierarchy of controls need to be adhered to. Administrative and procedural controls are not enough, and technology is too expensive or not required in general aviation. Engineering controls is the most effective way to mitigate risk, and construction projects can eliminate options for pilots at complex intersections to where a runway is not even accessible at that point.	12/7/2017 12:00 PM
7	We have learned that training is essential for ensuring that persons stay clear of the movement areas. We always focus on training in order to make sure persons know where they can and cannot go.	12/6/2017 4:53 PM
8	All policy and procedures must be clear and direct. You cannot assume that the operator will take if upon themselves to ensure the incursions do not happen.	12/6/2017 12:45 PM
9	It is important to investigate incursions to determine how they occurred, what were the causal and contributing factors. Once these causal and contributing factors are identified, mitigating action can be taken ... which is key. It is essential to understand what happened in order to develop and implement strategies to prevent future occurrences.	12/5/2017 4:34 PM
10	be honest, transparent and open about correcting situations. Do not create a culture of blame.	11/29/2017 6:42 PM

Q21 B1. Please indicate the total number of years of overall experience you have working in the aviation profession.

Answered: 10 Skipped: 0

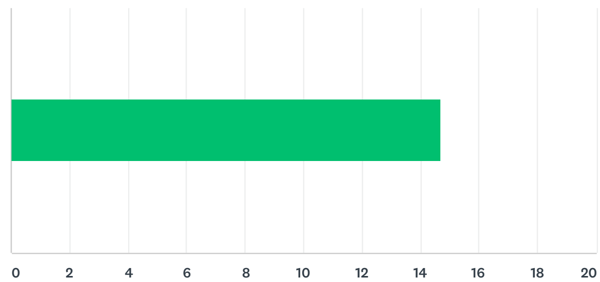


ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	22	224	10
Total Respondents: 10			

#		DATE
1	40	2/16/2018 9:02 PM
2	30	2/15/2018 6:15 PM
3	20	1/28/2018 5:07 PM
4	28	1/25/2018 12:52 PM
5	21	12/7/2017 2:36 PM
6	8	12/7/2017 12:02 PM
7	13	12/6/2017 4:54 PM
8	25	12/6/2017 12:46 PM
9	20	12/5/2017 4:36 PM
10	19	11/29/2017 6:43 PM

Q22 B2. Please indicate the total number of years you have been working as an airport executive.

Answered: 10 Skipped: 0

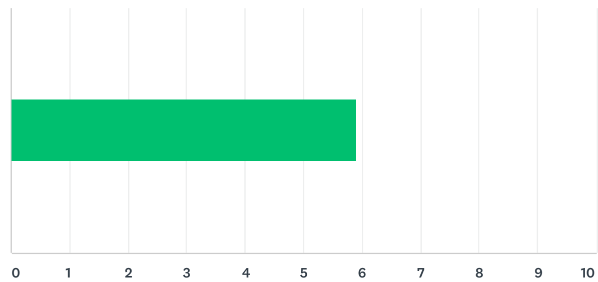


ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	15	147	10
Total Respondents: 10			

#		DATE
1	35	2/16/2018 9:02 PM
2	15	2/15/2018 6:15 PM
3	16	1/28/2018 5:07 PM
4	20	1/25/2018 12:52 PM
5	10	12/7/2017 2:36 PM
6	3	12/7/2017 12:02 PM
7	5	12/6/2017 4:54 PM
8	10	12/6/2017 12:46 PM
9	20	12/5/2017 4:36 PM
10	13	11/29/2017 6:43 PM

Q23 B3. Please indicate the total number of years you have been working in your current position.

Answered: 10   Skipped: 0



ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	6	59	10
Total Respondents: 10			

#		DATE
1	5	2/16/2018 9:02 PM
2	2	2/15/2018 6:15 PM
3	3	1/28/2018 5:07 PM
4	17	1/25/2018 12:52 PM
5	5	12/7/2017 2:36 PM
6	2	12/7/2017 12:02 PM
7	3	12/6/2017 4:54 PM
8	10	12/6/2017 12:46 PM
9	9	12/5/2017 4:36 PM
10	3	11/29/2017 6:43 PM

Q24 B4. What is your current professional title/position?

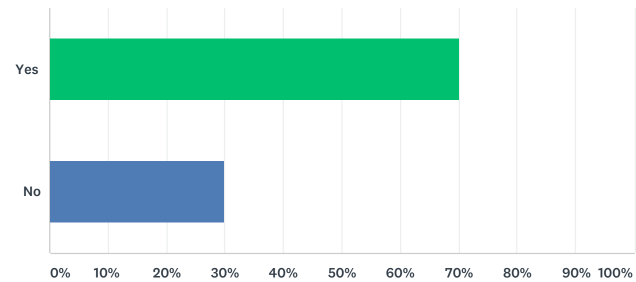
Answered: 9 Skipped: 1

#	RESPONSES	DATE
1	Airport Director	2/16/2018 9:02 PM
2	Airport Operations Manager	2/15/2018 6:15 PM
3	Airport Manager	1/28/2018 5:07 PM
4	Assistant Airport Director (COO)	1/25/2018 12:52 PM
5	Airport Manager	12/7/2017 2:36 PM
6	Airport Operations & Maintenance Supervisor	12/7/2017 12:02 PM
7	Assistant Director General Aviation	12/6/2017 12:46 PM
8	Airport Director	12/5/2017 4:36 PM
9	Director of Airport Operations	11/29/2017 6:43 PM

Airport Managers' Interview Protocol

Q25 B5. Are you a currently a member of AAAE?

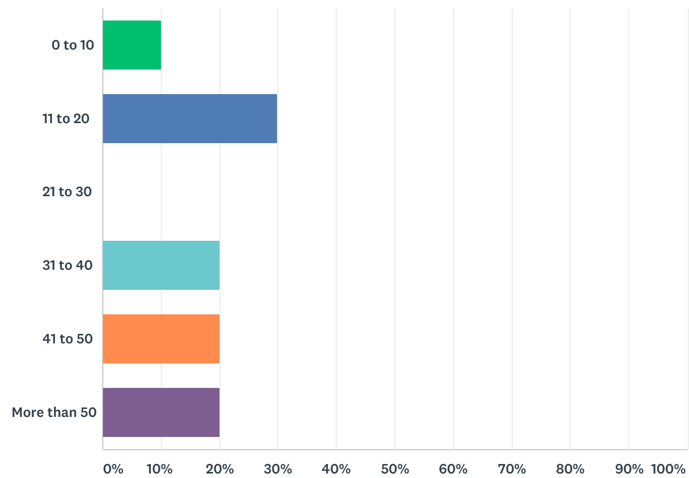
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	70.00%	7
No	30.00%	3
TOTAL		10

Q26 B6. Approximately how many general aviation runway incursions have you experienced during your tenure as an airport executive?

Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
0 to 10	10.00%	1
11 to 20	30.00%	3
21 to 30	0.00%	0
31 to 40	20.00%	2
41 to 50	20.00%	2
More than 50	20.00%	2
TOTAL		10