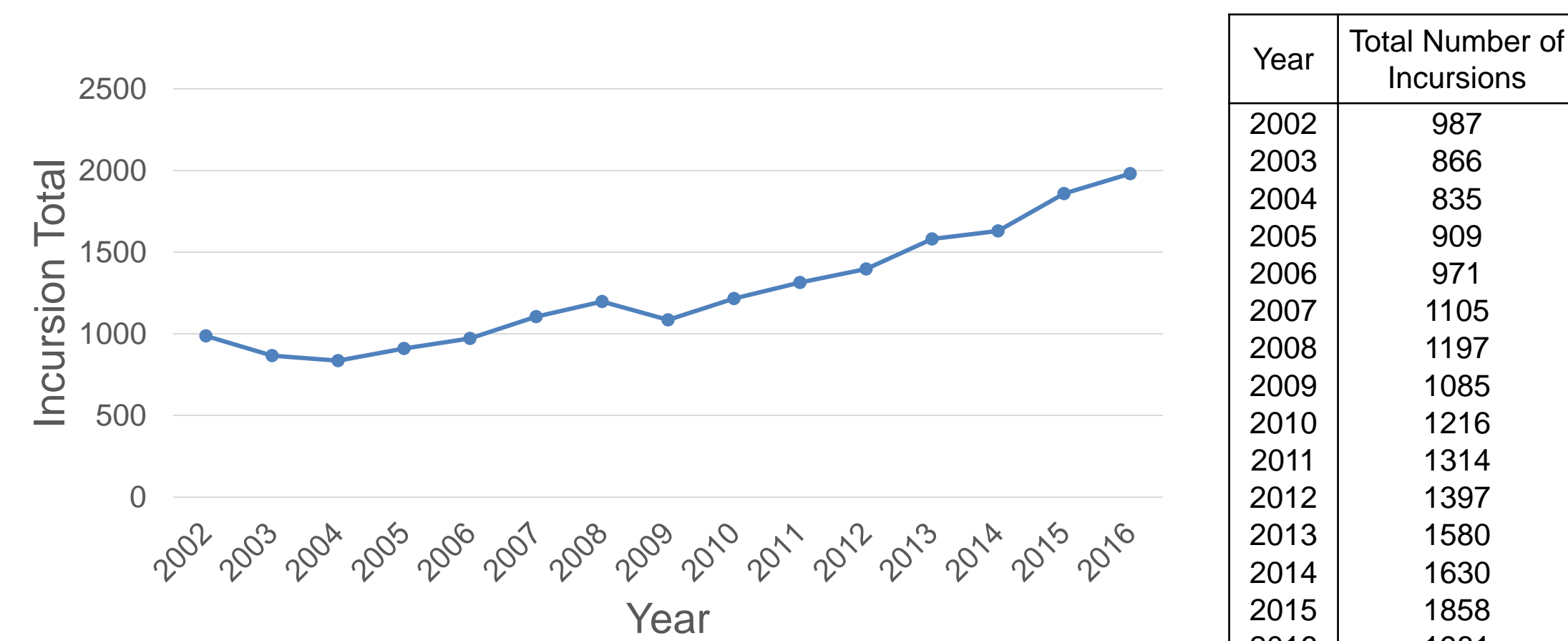


Wesley L. Major, Dr. Sarah M. Hubbard
Purdue University

Introduction

Runway incursions are a threat to runway safety and have been increasing in recent years. Robust visual aids can potentially increase situational awareness and reduce the risk of a runway incursion. Airfield facilities, markings, signage, and intersecting taxiways/runways can be illustrated through the use of 360-degree photographs which will increase familiarity of airfield characteristics and increase safety.



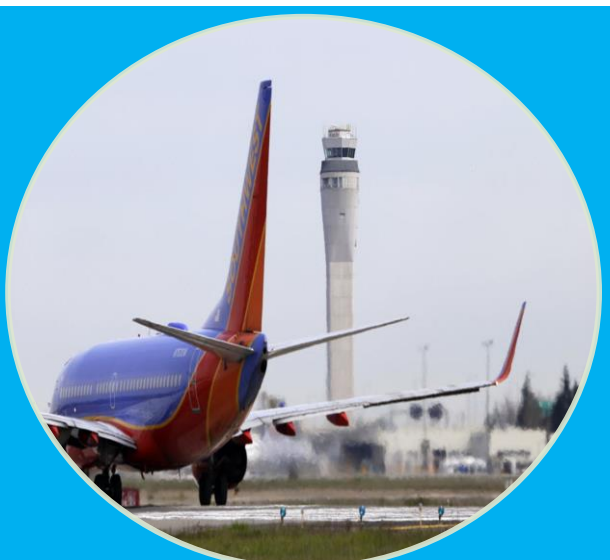
Runway Incursion

The Federal Aviation Administration (FAA) defines a runway incursion 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 take-off of aircraft" (Federal Aviation Administration, 2017c). FAA categorizes incursions based on cause, resulting in the following three incident types:

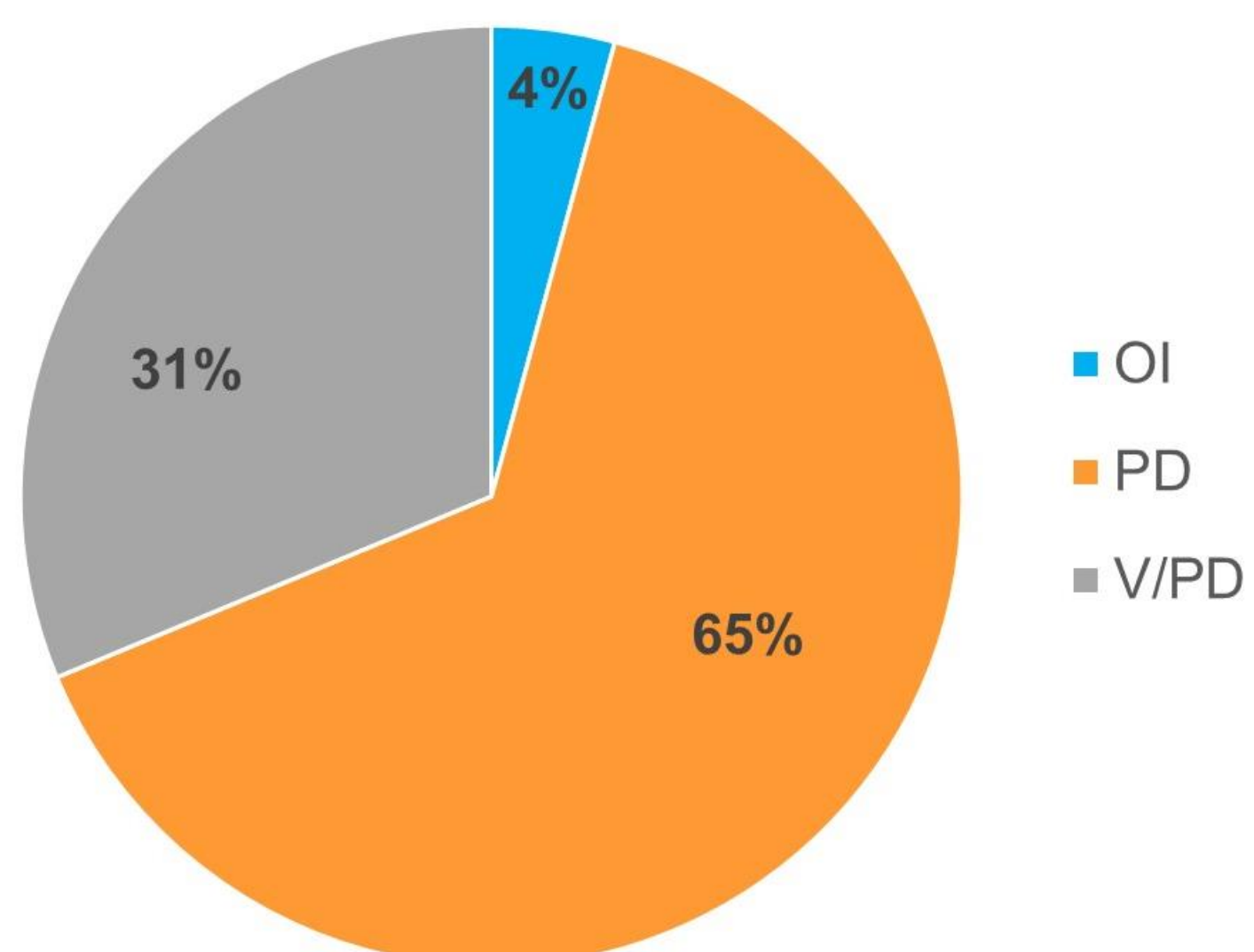
Pilot deviation (PD): runway incursion caused by pilot error that violates any Federal Aviation Regulation, such as entry onto runway without permission.



Operational incident (OI): runway incursion caused by air traffic controller (ATC) error that violates the required minimum separation between two or more aircraft or between an aircraft and an obstacle.



Vehicle/pedestrian deviation (V/PD): runway incursion caused by unauthorized entry of vehicles or pedestrians onto the airport movement areas, such as ground vehicle entry onto runway without ATC authorization.



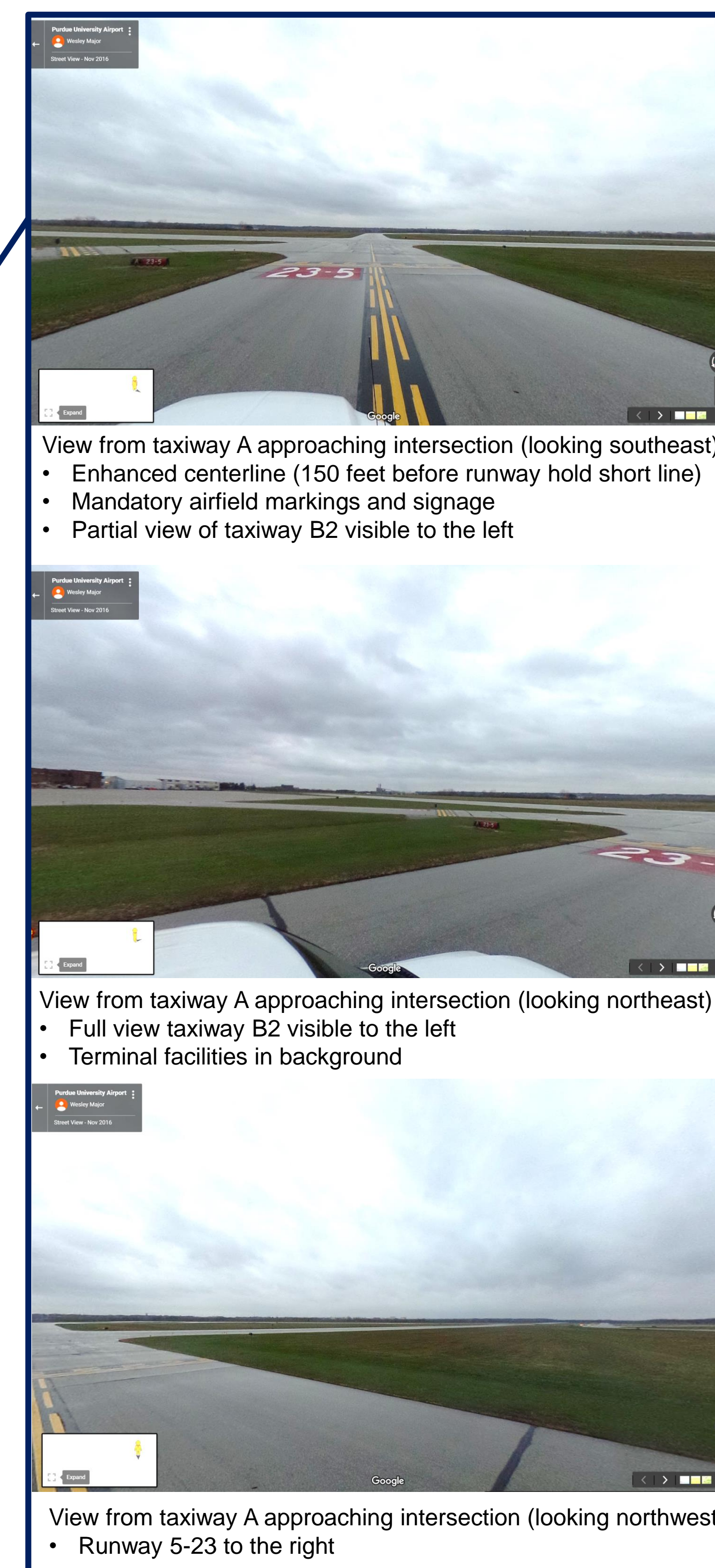
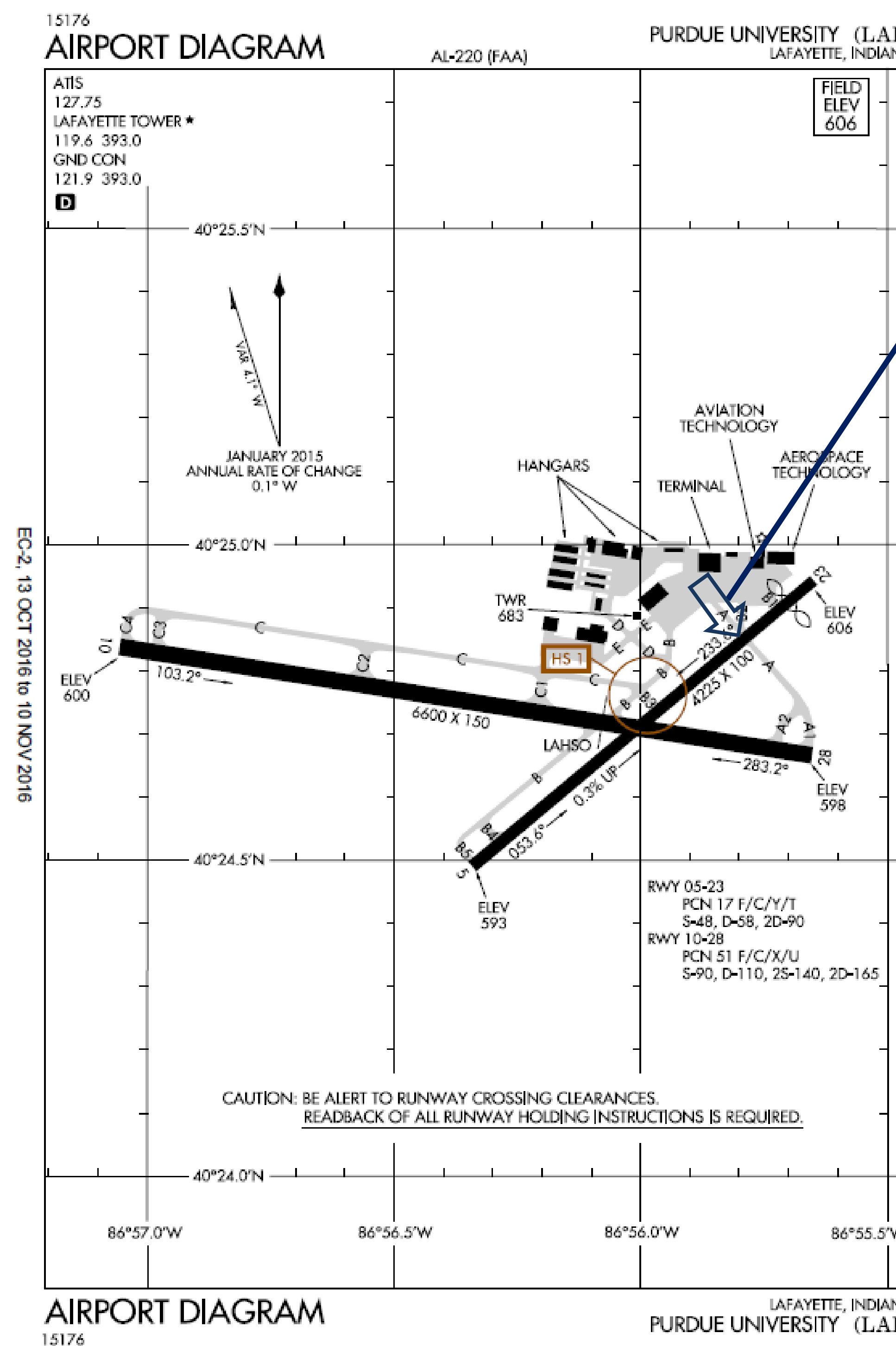
Since October 2001, there have been 6,288 runway incursions at general aviation (GA) airports, with a majority of these incursions classified as PD or V/PD (Federal Aviation Administration, 2017b). Nearly two-thirds of GA incursions are a result of pilot error.

Innovative Airport Visual Aids

The proposed tool suggested in this research leverages technology to supplement and augment existing airfield diagrams and increase situational awareness for pilots and ground operations workers. Traditionally, airport diagrams are used to familiarize pilots and other personnel with an airport's layout and geometry. While these diagrams meet basic needs and provide one frame of reference, they do not provide pilots and airport ground crews with a visual representation of each airfield's unique characteristics. Creating a more robust visual aid will fill this gap and potentially improve airport safety and training.



Google Maps image kit with Ricoh Theta S camera



Scan here to see the Street View of Purdue University Airport

Uses and Benefits of the Enhanced Airport Diagram

Enhanced airport diagrams can be used by aviation stakeholders for a wide range of applications. Student pilots, current pilots, ground personnel, and emergency teams could all benefit from such a tool. Most importantly, this tool can be used to illustrate hot spots and other potentially confusing areas on the airfield.



Airport Ground Crew



Pilots and Student Pilots



Emergency Teams

Literature Review

Airport diagrams fill a critical need for pilots as they plan their trip and upon approach to an airport. Many pilots and ground vehicle operators would benefit from a more robust depiction of airport facilities from the perspective of the ground. Dublin International Airport was the first airport to address this need with the creation of a Google Street View perspective for their airfield. Vincent Harrison, Dublin Airport managing director, said, "These images



Dublin International Airport in Google Maps and Street View

will help the airport's Airside Safety Training department, as they will become an essential piece of the training suite in educating and familiarizing all airport employees" (Kennedy, 2016). The advent of virtual globe software, such as Google Street View, allows users to navigate and explore areas in three dimensions. This is very useful since virtual globes can be used by educators to help students think spatially by investigating processes and places (Schultz, Kerski, and Patterson, 2008). The information gathered through maps (2D) and actual navigation (i.e., Google Street View) is different. From a map, people acquire survey knowledge; from navigation, people acquire procedural knowledge of the routes connecting diverse locations (Thorndyke & Hayes-Roth, 1982). The proposed photos also convey landmarks, which are often a key element in navigation (Raubal & Winter, 2002; Snowdon & Kray, 2009).



It makes sense to bring all available modern tools to pre-flight planning.

Conclusion

Aviation safety is paramount, and the increase in runway incursions has prompted the FAA to create programs specifically to reduce incursions. This research sets forth a low cost method to familiarize airport users with the airfield, which will contribute to enhanced situational awareness and support a reduction in runway incursions. A Google Street View style map of the airfield increases situational awareness, one of the risk factors identified by the Runway Incursion Mitigation program, and results in a more robust visual aid, providing aviation stakeholders an accurate representation of the airfield procedures and conditions from a ground-based perspective, which has the potential to increasing safety and training efficiency.

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