Strengthening Defenses, Barriers, and Controls to Avoid Accidents

Each day, the Air Traffic Organization (ATO) of the Federal Aviation Administration (FAA) guides over 50,000 flights through 30.2 million square miles of domestic and international airspace. The ATO's mission is to ensure that every flight departs and arrives safely. During the 12year period ending in 2015, there have been 50 Air Traffic Management-related fatal accidents in the National Airspace System; only one of those accidents involved a commercial air carrier. In three of the last five years ending in 2015, there were no Air Traffic Management-related fatal accidents. The total volume of air traffic operations for 2015 was 132.1 million flights with Air Traffic Operations only experiencing 19 "high-risk" events reflecting a safe performance rate of 99.99451. The Air Traffic Control (ATC) system in the U.S. is truly an exemplary high reliability organization operating in an extremely high risk environment while experiencing very few events.

ATC maintains a comprehensive Safety Management System (SMS) which received over 15,000 reports in 2015 through its Voluntary Safety Reporting Programs (VSRP) which is the largest of its kind in the world. The reporting system "allows those on the frontlines of safety – such as controllers, technicians, and flight creds – to document incidents, concerns, and potential solutions without the fear of reprisal." The ATO's primary measure of safety-related performance is the System Risk Event Rate or SRER which is a 12-month rolling rate that reflects the frequency of serious airborne losses of separation per 1,000 reported events. In September 2015, the SRER was 2.62 serious losses for every 1,000 reported losses, well below the ATO's target of 20. The ATO assesses safety incidents through their rigorous **Risk Analysis Process (RAP)** whether the event occurred in the air, on an airport surface, or in one of the ATO's technical systems. Assessments are performed by a panel of experts including pilots, controllers, and human factors specialists. Significant hazards include runway incursions, degradation of equipment that could affect the safety of air traffic or flight information services, and loss of separation in the air. The most persistent safety problems reported through the ATO's various voluntary reporting systems were (in order of volume reported): 1) safety culture, 2) a procedural deficiency, 3) equipment design or function, 4) interface with other facilities, 5) compliance with directives, 6) organizational policy, and 7) delegation of work. A significant safety concern and hazard within the National Airspace System is the growing complexity and congestion particularly apparent in the airfield environment.

The ATO has enhanced the system's defenses and controls through its Runway Safety Program to improve runway safety. Strengthening the defenses and controls included:
- Integrating multiple layers of surface surveillance and alerting technology.
- Redesigning problematic runway and taxiway layouts.
- Improving safety aids such as runway lighting and signage.

Over the 10-year period ending in 2015, improvement in the runway-related safety defenses and in the Runway Safety Program overall have resulted in a 44 percent decrease in serious Runway Incursions (incorrect presence of an aircraft, vehicle, or person in a protected area for takeoffs and landings) and prevented damage and injuries from Runway Excursions (when an

aircraft veers off the runway or overruns the runway). ATO's Risk Analysis Process includes an assessment of the severity and likelihood of recurrence of the event as well as an assessment of the National Airspace System's defensive layers and barriers. These defenses and barriers represent "the controllability of the situation." The analysis involves a review of both the systemic factors and human errors that contributed to the event and the likelihood that those factors will align again in the future. **The ATO's barriers "fall into three categories: air traffic control, pilot, and NAS technology infrastructure**. Each category is composed of many discrete barriers designed to prevent a loss of required separation from occurring (termed **resolution barriers)** or prevent a loss of separation from becoming a collision (**recovery barriers**)." (FAA 2016, 9) Examples of ATO technology defenses include alerts, advisories, and surveillance systems; examples of organizational defenses include planning, communications, and supervisory interventions; examples of human (pilot) defenses include situational awareness, execution, and "See and Avoid." Each defense and barrier is scored for effectiveness and the scores allow safety analysts "to inspect the effectiveness of barriers and the factors that influence their performance at different locations and at different levels of specificity. We can identify trends in individual or composite barrier performance, which, in turn, help us understand the conditions that contribute to vulnerabilities or successes."

Sources: Transforming Risk Management, Federal Aviation Administration
        2015 Safety Report, Air Traffic Organization, FAA

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