U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

April 6, 2015

The Honorable John Thune
Chairman, Committee on Commerce,
Science, and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

As required by the FAA Modernization and Reform Act of 2012, H.R. 658 (the Act), Section 307, the Federal Aviation Administration (FAA) is pleased to provide the enclosed report.

Section 307 of the Act requires the FAA to carry out a study to review air carrier data to identify common sources of distraction for the flight crewmembers on the flight deck of a commercial aircraft and to determine the safety impacts of such distractions. This section also requires the FAA to submit a report to Congress on the findings of the study and recommendations regarding how to reduce distractions for flight crewmembers on the flight deck of a commercial aircraft. This report is the FAA's response to that requirement.

We have sent identical letters to Chairman Shuster, Senator Nelson, and Congressman Fazio.

Sincerely,

Michael P. Huerta
Administrator

Enclosure

U.S. Department
of Transportation

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Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

April 6, 2015

The Honorable Bill Nelson
Committee on Commerce,
Science, and Transportation
United States Senate
Washington, DC 20510

Dear Senator Nelson:

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April 6, 2015

The Honorable Bill Shuster
Chairman, Committee on Transportation
and Infrastructure
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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800 Independence Ave., S.W.
Washington, D.C. 20591

April 6, 2015

The Honorable Peter A. DeFazio
Committee on Transportation
and Infrastructure
House of Representatives
Washington, DC 20515

Dear Congressman Fazio:

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Sincerely,

Michael P. Huerta
Administrator

Enclosure

FEDERAL AVIATION
ADMINISTRATION

Report to Congress:
Flight Deck Distractions

FAA Modernization and Reform Act of 2012 (P.L. 112-95) – Section 307

Overview

On February 14, 2012, the President signed Public Law 112–95, the FAA Modernization and Reform Act of 2012. Section 307 requires the Federal Aviation Administration (FAA) to carry out a study to review air carrier data to identify common sources of distraction for the flight crewmembers on the flight deck of a commercial aircraft and to determine the safety impacts of such distractions. This section also requires the FAA to submit a report to Congress on the findings of the study and recommendations regarding how to reduce distractions for flight crewmembers on the flight deck of a commercial aircraft. This report is the FAA's response to that requirement.

The FAA has been studying flight deck distractions continually for the last 20 years and continues to do so as different distractors emerge within the evolving environment of the National Airspace System (NAS). The most common sources of distraction have already been identified, their impacts documented, and safety recommendations issued. Those recommendations have been operationalized and are currently incorporated into the operational, procedural, and training documentation of the manufacturers, air operators, and training centers.

While the national media have covered an increasing number of high-visibility distraction events (e.g., a flight crew on their laptops overflying their destination; a pilot texting during taxi; and in 2013, a fatal helicopter accident involving a pilot who interrupted his preflight operations with multiple texts) the reported base-level of distractions over the last three years has not increased. The distraction events data was tracked and this report is based on three years of data in two key FAA event reporting systems: the Aviation Safety Reporting System (ASRS) for CY 2011-2013, and the Aviation Safety Action Program (ASAP) safety enhancement reporting system, which will be described in detail later in this report, for FY 2011-2013. While significant distraction events are few and far between, they are serious enough to warrant additional research. Accordingly, the FAA initiated a study in April 2013 called "Research to Support the Development of Human Factors Guidelines for Ameliorating the Negative Effects of Surprise, Startle and Distraction on the Flight Deck" to continue the investigation of pilot distraction. This research is in progress.

The FAA will continue to monitor distraction-related safety events through its various safety reporting and investigation systems, as well as conduct continuing research into distractions. In addition to this research, the FAA has also strengthened its regulations concerning distractions on the flight deck, which will be addressed at the conclusion of this paper. The FAA has identified most of the primary distraction issues and implemented safety solutions, however the agency intends to continue progress as further distractions are identified and additional mitigations required.

Background

For most of the last 20 years the FAA has co-sponsored, in partnership with the National Aeronautics and Space Administration (NASA), a wide-ranging research program

focused on exploring interruptions and distractions on the flight deck, and recommending tools and techniques to be used by flight crews to mitigate the effects of these distractions. This effort was led by Dr. Key Dismukes, the Chief Scientist for Aerospace Human Factors in the Human Systems Integration Division of NASA, located at the Ames Research Center in Moffett Field, California, until his retirement in 2010. While other aviation researchers have also made significant contributions to the literature in the field, this joint NASA/FAA effort has been the longest sustained program in the area of distractions on the flight deck. This line of research continues under FAA sponsorship and the leadership of Dr. Florian Jentsch at the Team Training Laboratory at the University of Central Florida in Orlando, Florida.[1]

The recommendations from the ongoing program of research and development have been widely published and distributed. The resultant tools and techniques may be found not only in airline flight and training manuals throughout the world, but in training publications from Boeing, Airbus, and the Flight Safety Foundation as well. While emerging technologies will continue to introduce new distractions onto the flight deck, each with additional nuances, most of the foundational tools for preventing, mitigating, and managing distractions have already been explored, documented, and incorporated into the training programs and standard operating procedures (SOPs) of the air carrier community, in large part based on the NASA/FAA effort. This report introduces this foundational work and also addresses on-going research that should provide additional recommendations for further reducing the risks of flight deck distractions.

The distraction events referenced earlier, in the overview, demonstrate that distractions are still compromising safety and suggest that additional or alternative risk control measures may be warranted. The latest distraction requiring study is the use of Personal Electronic Devices (PEDs), either during flight (in the case of the overflight), or even prior to flight (in the case of the helicopter accident). The first case is an example of a distraction while the second case is an example of interruption. The NASA/FAA efforts systematically address both distractions and interruptions.

When the FAA introduced the sterile cockpit rule in 1981, which limited non-operational conversations in the cockpit while operating below 10,000 feet, the primary distractor addressed was non-operational conversation among personnel on the flight deck. With the increased use of PEDs, crews are not only interacting with each other but with electronic devices as well. The sterile cockpit rule only addresses in-person conversations with other crewmembers, and not digital conversations via electronic devices. The availability of new technologies now permits the aircrew to have digital conversations and interactions in addition to the traditional distractions generated by the other crewmembers. The FAA has recently responded with a new rule to address this issue, as will be described later in this report.

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[1] Current research is focused on surprise, startle, and distraction, with an added focus on loss of control accidents.

Data Sources and Methods

Congress tasked the FAA to review air carrier safety data to identify common sources of distraction on the flight deck. Because the FAA has been monitoring these trends for a considerable length of time, the primary goal of this latest examination was to focus on new sources of distraction, such as PEDs, which did not exist in the past, were overlooked, or interact with other distractions and interruptions in new ways. The FAA reviewed the last three years of safety data (2011-2013) from two primary pilot reporting systems, ASRS and the ASAP safety enhancement reporting system. Although these systems do contain significant overlap (many ASAP reports are filed with ASRS as well), the two programs together generate over 100,000 totally unique safety event reports each year. This makes them an extremely rich source of current and emerging safety concerns.

The FAA deals with three broad categories of data: reactive (past), proactive (present) and predictive (future). Reactive and proactive data are used to generate predictive data, leaving reactive and proactive databases that can be mined for information. Reactive data consists primarily of incident and accident reports, which are serious safety events that have already occurred. Proactive data consists primarily of pre-cursor events, which are safety violations or safety compromises that did not, or have not yet, resulted in an incident or accident. Over the last decade, as safety has improved, the size and predictive utility of the reactive databases have declined, while the size and predictive utility of the proactive databases have increased significantly. ASRS, ASAP and FOQA (Flight Operational Quality Assurance) are three of the primary proactive databases used by government and industry to maintain safety. This analysis focused on ASRS and ASAP data, as FOQA, which consists of digitized flight recorder data, does not capture the sorts of detailed narratives included in the ASRS and ASAP reports.

Aviation Safety Reporting System (ASRS)

The ASRS program, initiated as a joint FAA/NASA effort in 1976, was the first voluntary safety program initiated by the agency. It is now one of seven voluntary safety programs managed by the Air Transportation Division of the Flight Standards Service, and integrated into the Safety Management Systems (SMSs) of all of the large air carriers in the United States. In addition to ASRS, ASAP and FOQA, there are the following programs: the Internal Evaluation Program (IEP), the Voluntary Disclosure Reporting Program (VDRP), the Advanced Qualification Program (AQP), and Line Operational Safety Audit (LOSA). Of those, the most useful for tracking interruptions and distractions are ASRS and ASAP. The FAA has had mandatory reporting systems, but the ASRS was the first voluntary reporting system.

The ASRS maintains a national safety database (now including over 1,000,000 reports) into which aviation personnel (pilots, flight attendants, dispatchers, maintenance technicians, air traffic controllers and others) submit approximately 90,000 safety event reports per year. NASA analysts prioritize, organize, analyze, and report out on the most significant safety concerns. They issue safety alerts, a safety newsletter, and a safety

magazine; they provide database services, host all of their data on a public website, support the National Transportation Safety Board (NTSB), and host a teleconference with the FAA and other safety organizations (NTSB, Flight Safety Foundation, Boeing, Airbus, etc.) once per month; they also submit all of their data into the FAA's primary safety database, the Aviation Safety Information Analysis and Sharing (ASIAS) system, managed by the Office of Accident Investigation and Prevention (AVP).

Aviation Safety Action Program (ASAP)

The ASAP program is effectively an ASRS-type program applied to an individual certificate holder. Pilots, flight attendants, dispatchers, maintenance personnel, and other employees voluntarily report safety events into the program, with the understanding that the FAA will provide enforcement incentives to do so. All reports are reviewed and processed by a three-person Event Review Committee (ERC), consisting of a company representative, an FAA representative, and a representative from the employee bargaining unit (where applicable). This committee will determine which events qualify for inclusion in the program, and for those events that are accepted, they will conduct a root cause analysis, recommend corrective actions, and follow through with all corrective actions until the implementation is complete and considered effective. The ASAP program processes approximately 80,000 safety reports each year.

Approximately 90,000 ASRS reports are submitted each year, of which about 60,000 are "second-hand" certificate-holder-specific ASAP reports that have been co-submitted into both databases. This permits the same safety event to be addressed at both the local level through ASAP and the national level through the ASRS program. This leaves approximately 30,000 reports unique to ASRS and results in a total of about 110,000 unique reports between the two safety datasets annually (due to duplicated data entries).

Trends

At this time, no significant upward trend in distraction events has been observed for the reporting period 2011, 2012 and 2013, nor have new distractions, including PEDs, been noted. Distraction events in the ASRS data were statistically insignificant, while they ran at an even 1% of events per year in the ASAP safety enhancement reporting database. There was no significant reporting of events involving phones or laptops. Note that this dataset is considered proactive, and therefore sensitive to the precursors of future accidents. The FAA will continue to monitor these datasets for trends or new events, especially those related to phones and laptops, in addition to continuing its research program and issue new guidance, as required.

Data Trends – Sources of Distraction

The ASRS archives listed 11 distraction events (statistically insignificant) during the period CY 2011- CY 2013, none involving PEDs. They showed a declining rate of reports over time, with 5 in CY 2011, 4 in CY 2012, and 1 in CY 2013. The ASAP

safety enhancement reports listed 864 events, none involving PEDs. The data show that interaction with other persons is still the most significant source of interruptions and distractions on the flight deck, accounting for 50% of the total. The sources of, or reasons for distraction, were as follows:

Other People	50%	
Passengers		14%
Crewmembers		12%
ATC		8%
Dispatch		6%
Ramp		5%
Gate agent		5%
Other Reasons	50%	
No reason given		20%
Cockpit equipment		12%
Other duties		06%
Self-induced time pressure		04%
Weather		04%
Other traffic		02%
Documentation		02%

Limits on Voluntary Safety Reporting Systems

ASRS and ASAP are both voluntary reporting systems. They do not report every event that may occur, but only the events that individual professionals within the industry elect to report. If pilots report 100 distractions, we know there were a *minimum* of 100 distractions. The FAA does not have absolute figures on the frequency of interruptions and distractions, as there is no mandatory reporting requirement for these items. Although these data programs systematically under-report events, they have been extremely useful in helping gauge the frequency of safety events for many years. The results of significant corrective actions on the part of industry are historically reflected in the variation of these report datasets (such as the decline in distraction events year over year, as noted above).

Flight Deck Distraction Management and Recommendations

Psychologists use the term "prospective memory" to refer to "remembering to remember." How do flight crews put compelling symbolic bookmarks into their brains to remember to pick up where they left off after an interruption or distraction? For example, if a flight crewmember is interrupted in completing a checklist, by a request for an altitude change mandated by air traffic control, and is further interrupted by an urgent call from the cabin crewmembers regarding an unconscious passenger, how does the flight crew member remember to go back to his or her initial task of completing the checklist after responding to the cabin crewmembers and making the requisite altitude change requested by air traffic control? How does the flight crewmember better manage attention paid to activities in a multi-tasking environment with many distractions?

Flight deck distraction management involves three primary activities, or stages:

1. Prevention, involving activities such as checklist discipline and distraction avoidance;
2. Detection, involving activities such as cross-checking; and
3. Recovery, involving activities such as prioritizing (aviate, navigate, and communicate).

Tools and techniques associated with all three phases of distraction management have been developed, tested, and implemented. They are integrated into pilot training and evaluations today but will need to be updated as new technologies bring new interruptions and distractions into the flight deck. The most challenging phase remains recovery, and the FAA applies more resources to this phase than the others for this reason. The FAA's current work with stalls and jet upset research also focuses primarily on recovery. The FAA has also increased research efforts on with the prevention stage.

Sources of Interruptions and Distractions

A 1998 analysis[2] of over 100 ASRS reports documenting memory lapses revealed that in each case, the safety event resulted not from memory overload but from a need to better manage attention paid to activities in a multi-tasking environment. Further studies were conducted[3] which identified four broad categories into which most interruptions and distractions fall:

1. Communications
2. Head down work
3. Scanning for traffic
4. Abnormal or unanticipated situations

As previously mentioned, based on the NASA/FAA effort, most of the foundational tools for preventing, mitigating, and managing distractions have been explored, documented, and incorporated into the training programs and standard operating procedures (SOPs) of the air carrier community. These categories are detailed below and include text from air carrier SOPs as examples of current industry best practices. These SOPs have incorporated the FAA's recommendations with regards to flight deck distractions as our research into, and awareness of flight deck distractions and interruptions have progressed for the past 20 years.

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[2] Dismukes, R.K., Young, G., and Sumwalat, R. (1998). Cockpit interruptions and distractions: effective management requires a careful balancing act. *ASRS Directline*, 10, pp 4-9.

[3] Dismukes, R.K., Loukopolos, L.D., and Kimberly, K.J.M.A. (2001). The challenges of managing concurrent and deferred tasks. Retrieved from Google Scholar: http://scholar.google.co.nz/scholar.

1. Communications

Communications are the most frequent cause of interruptions and distractions, borne out by this most recent data analysis. Most communications are between the captain and first officer; other frequently cited interactions include flight attendants, air traffic controllers, dispatchers, and occasionally jump seat riders. Although most captain-to-first officer communications concern the operation of the flight, the pilots must process, receive, and store information while working through a response, which absorbs a significant amount of flight crew attention. Additionally, non-essential conversation is a recurring issue; it has been cited by the NTSB as a contributing factor in several fatal accidents. However, by regulation, conversation is limited to the discussion of aircraft operations when operating below 10,000 feet.

On February 12, 2014 the FAA published a final rule entitled Prohibition on Personal Use of Electronic Devices on the Flight Deck. This rule prevents crewmembers operating under the authority of 14 CFR Part 121 from using a personal wireless communication device or laptop computer for personal use while at their duty station during aircraft operations.

Current Industry Best Practices

Below are representative countermeasures that air carriers have implemented, based on text excerpted from various SOPs:

- Flight deck communications will be brief, clear and concise.
- Informal conversation should be minimized.
- Sterile flight deck protocols will be observed below 10,000 feet, unless abnormal or emergency situations dictate otherwise.
- Communications should be suspended whenever important flight tasks require the crew's concentration.
- Headsets should be used when operating below 10,000 feet.
- Conversations will be interrupted when more critical flight events are occurring or about to occur.

Head Down Work

Operating the modern flight deck requires considerable head down work, whether programming the flight management system (FMS), reading approach plates, or completing routine paperwork. One pilot observed that "the FMS keypad is a vacuum cleaner that sucks in eyeballs and fingers." Human factors scientists refer to the FMS as "compelling". Head down work diverts the hands and eyes, but more importantly, it diverts the mind. In the early years of the NASA/FAA research program, the topics of study included interruptions, distractions, and "preoccupations." Head down work can easily preoccupy crewmembers if they allow it to do so.

Current Industry Best Practices

Below are representative countermeasures that air carriers have implemented, based on text excerpted from various SOPs:

- The flight crew should consider the level of automation (levels 1-4) when assigning FMS programming or reprogramming duties.
- The flight crew should make every attempt to schedule as much head down work as possible during low workload phases of flight.
- The pilot monitoring should announce to the pilot flying whenever he or she is going head down.
- The flight crew should minimize the time when both crewmembers are heads down.

Scanning for Traffic

Searching for traffic may take the flight crew's attention away from required flight deck tasks or interrupt the crew's plans for otherwise intended actions. Tasks deferred during the traffic scan may not be recalled once the scan is complete.

Current Industry Best Practices

Below are representative countermeasures that air carriers have implemented, based on text excerpted from various SOPs:

- The captain should explicitly state who is flying and who is scanning, to avoid any confusion or duplication of roles.
- When this or any interruption occurs, the crew should follow the Identify-Ask-Decide protocol. This requires the crew to identify that an interruption or distraction has occurred, and ask themselves what task they were performing before the interruption, and decide what actions to perform to get the flight back on track.
- The flight crew should follow a defined decision-making process, such as prioritize (aviate, navigate, communicate and manage aircraft systems), plan (defer non-critical tasks or request more time) and verify (ensure that deferred tasks are performed).

Abnormal and Unanticipated Situations

Abnormal and emergency events are rarely encountered in line operations. However, when they do occur, they absorb considerable amounts of crewmember attention. They interrupt normal task flows and require all flight crewmembers to rely on one of their weakest cognitive processes (prospective memory: remembering to remember) to recover normal flight operations once the emergency has been addressed. In addition,

emergencies put psychological stress on crews that can cut down on their mental flexibility, often leading to "tunneling" of attention. For these reasons, abnormal and unanticipated situations are regularly practiced in training.

Current Industry Best Practices

Below are representative countermeasures that air carriers have implemented, based on text excerpted from various SOPs:

- The flight crew should shift tasking to the autopilot to maintain a reasonable workload.
- The pilot flying should place number one priority on flying the aircraft and maintaining the flight path.
- The pilot flying and pilot monitoring roles should be strictly adhered to during abnormal and emergency events.
- The flight crewmembers should pay extra attention to their normal checklists. Checklist usage is normally triggered by events that may not occur, or may not be obvious, when responding to an abnormal or emergency event.

FAA Rulemaking

The first significant rule issued by the FAA specifically addressing interruptions and distractions in the cockpit was published in 1981. The Elimination of Duties and Activities of Flightcrew Members not Required for the Safe Operation of Aircraft rule, nicknamed the "sterile cockpit rule", essentially prohibits the flight crew from engaging in any activities or conversations unrelated to flight operations unless the aircraft is above 10,000 feet.

The FAA also specifies these limits in 14 CFR 121.542 Flight Crewmember Duties. The FAA published that rule to update those limits in response to Public Law 112–95, FAA Modernization and Reform Act of 2012, Section 307. This update includes additional restrictions on the flight crew beyond those of the sterile cockpit rule. The original rule did not apply to all phases of flight, nor did it limit non-operational activities above 10,000 feet. The Probation on Personal Use of Electronic Devices on the Flight Deck rule extends the concept of the sterile cockpit to include (1) interactions with electronic devices as well as non-duty discussions with other crewmembers, and (2) the entire period of time the aircraft is operated, rather than simply at altitudes above 10,000 feet.

Current Research Activities

Because the FAA plans its research programs three years out, the most expeditious way to respond to the congressional call for additional investigation into distractions was to insert it into a related but already on-going research program. The Flight Standards Service is currently conducting a series of studies around loss of control (LOC), one of the leading causes of airline accidents. One important component of the typical LOC

accident is the element of surprise, to include the startle response. The FAA took the startle and surprise thread from the research and added distraction, which is an element of LOC accidents, as well as an area of concern in and of itself. This research now addresses distraction in its broadest definition and does limit its scope to LOC.

The first element of the research is to provide conclusive definitions of the related concepts of startle, surprise, and distraction, which are used somewhat interchangeably in the scientific literature on the psychology of surprise. This will update and expand the previous work on unexpected events and surprise sponsored by the FAA between 2002 and 2006. It will also incorporate relevant results from more recent studies sponsored by NASA and completed in 2009 and 2011. This element of the research will yield a state of the art understanding of the effects of surprise, startle, and distraction on contemporary airline flight operations.

The second element of the research program will apply the findings of the first element to the challenges of training and evaluating the ability of pilots to successfully avoid and/or recover from upsets, stalls, and other LOC scenarios. This was the original goal of the research program into which the distraction research has been incorporated.

The third element of the research program will broaden the earlier work on distraction with a focus on PEDs. While the FAA has already issued a rule limiting the use of PEDs in the aircraft, this research may provide additional recommendations to the FAA and the industry for reducing distractions on the flight deck.

Conclusion

Risk is calculated by multiplying the severity of an outcome by its statistical probability. Based on a review of three years of proactive safety data, the probability of a distraction event is still relatively low. But the severity of such an event can be high, as demonstrated by the recent fatal helicopter accident involving a texting pilot. Distraction is therefore a risk that the FAA will continue to monitor closely, regardless of its frequency. The severity of the event by itself justifies constant monitoring.

Based on the NASA/FAA efforts and recommendations, airlines implemented most of the foundational tools for preventing, mitigating and managing distractions and incorporated these into the training programs and standard operating procedures (SOPs).

In terms of future FAA sponsored research, while the basic toolsets for pilots to counteract interruptions and distractions on the flight deck have been developed, tested, and implemented, new areas of specialization continue to evolve in response to emerging safety trends.

The Prohibition on Personal Use of Electronic Devices on the Flight Deck rule captures what is known to date regarding interruptions and distractions in the cockpit. The FAA will consider future rulemaking as new knowledge emerges.