September 26, 2019

Mr. Steve Dickson
Administrator
Federal Aviation Administration
800 Independence Avenue
Washington, DC 20591

The attached letter from the NTSB Chairman provides information about the NTSB's September 19, 2019 report, *Assumptions Used in the Safety Assessment Process and the Effects of Multiple Alerts and Indications on Pilot Performance.* The details of this accident investigation and the resulting safety recommendations may be found in the attached report, which can also be accessed at http://www.ntsb.gov.

The NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives. We would appreciate a response within 90 days of the date of this letter, detailing the actions you have taken or intend to take to implement these recommendations. When replying, please refer to the safety recommendations by number (for example, A-19-10 through - 16). We encourage you to submit your response to ExecutiveSecretariat@ntsb.gov. If your reply exceeds 20 megabytes, including attachments, please e-mail us at the same address for instructions on how to send larger documents. Please do not submit both an electronic copy and a hard copy of the same response.

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National Transportation Safety Board
Washington, DC 20594

Office of the Chairman

September 26, 2019

Mr. Steve Dickson
Administrator
Federal Aviation Administration
800 Independence Avenue
Washington, DC 20591

Dear Mr. Dickson:

This letter provides information about the National Transportation Safety Board's (NTSB) September 19, 2019, report, *Assumptions Used in the Safety Assessment Process and the Effects of Multiple Alerts and Indications on Pilot Performance*. The details of the foreign accident investigations relating to the Boeing 737 MAX and the resulting safety recommendations based on our participation in these investigations may be found in the attached report, which can also be accessed at http://www.ntsb.gov.

As a result of this investigation, we identified the following safety issues:

- The assumptions in Federal Aviation Administration (FAA) guidance for pilot response to flight control failure conditions, such as unintended Maneuvering Characteristics Augmentation System operation, do not adequately consider and account for the impact that multiple flight deck alerts and indications could have on pilots' responses to the hazard
- The need for a standardized methodology and/or tools for manufacturers' use in evaluating and validating assumptions about pilot recognition and response to failure condition(s)
- The need for aircraft systems that can more clearly and concisely inform pilots of the highest priority actions when multiple flight deck alerts and indications are present

Accordingly, the NTSB makes the following safety recommendations to the FAA. Additional information regarding these recommendations can be found on the noted pages of the report.

- Require that Boeing (1) ensure that system safety assessments for the 737 MAX in which it assumed immediate and appropriate pilot corrective actions in response to uncommanded flight control inputs, from systems such as the Maneuvering Characteristics Augmentation System, consider the effect of all possible flight deck alerts and indications on pilot recognition and response; and (2) incorporate design enhancements (including flight deck alerts and indications), pilot procedures, and/or training requirements, where needed, to minimize the potential for and safety impact of pilot actions that are inconsistent with manufacturer assumptions. (A-19-10) (See pages 7-9)

- Require that for all other US type-certificated transport-category airplanes, manufacturers (1) ensure that system safety assessments for which they assumed immediate and appropriate pilot corrective actions in response to uncommanded flight control inputs consider the effect of all possible flight deck alerts and indications on pilot recognition and response; and (2) incorporate design enhancements (including flight deck alerts and indications), pilot procedures, and/or training requirements, where needed, to minimize the potential for and safety impact of pilot actions that are inconsistent with manufacturer assumptions. (A-19-11) (See pages 7-9)

- Notify other international regulators that certify transport-category airplane type designs (for example, the European Union Aviation Safety Agency, Transport Canada, the National Civil Aviation Agency-Brazil, the Civil Aviation Administration of China, and the Russian Federal Air Transport Agency) of Recommendation A-19-11 and encourage them to evaluate its relevance to their processes and address any changes, if applicable. (A-19-12) (See pages 7-9)

- Develop robust tools and methods, with the input of industry and human factors experts, for use in validating assumptions about pilot recognition and response to safety-significant failure conditions as part of the design certification process. (A-19-13) (See pages 9-10)

- Once the tools and methods have been developed as recommended in Recommendation A-19-13, revise existing Federal Aviation Administration (FAA) regulations and guidance to incorporate their use and documentation as part of the design certification process, including re-examining the validity of pilot recognition and response assumptions permitted in existing FAA guidance. (A-19-14) (See pages 9-10)

- Develop design standards, with the input of industry and human factors experts, for aircraft system diagnostic tools that improve the prioritization and clarity of failure indications (direct and indirect) presented to pilots to improve the timeliness and effectiveness of their response. (A-19-15) (See pages 10-11)

- Once the design standards have been developed as recommended in Recommendation A-19-15, require implementation of system diagnostic tools on transport-category aircraft to improve the timeliness and effectiveness of pilots' response when multiple flight deck alerts and indications are present. (A-19-16) (See pages 10-11)

The NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives. We would appreciate a response within 90 days of the date of this letter, detailing the actions you have taken or intend to take to implement these recommendations. When replying, please refer to the safety recommendations by number (Safety Recommendations A-19-10 through -16). We encourage you to submit your response to ExecutiveSecretariat@ntsb.gov. If your reply, including attachments, exceeds 20 megabytes, please e-mail us at the same address for instructions. Please do not submit both an electronic copy and a hard copy of the same response.

Sincerely,

[Original Signed]

Robert L. Sumwalt, III
Chairman