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## **TAKEOFF MISCONFIGURATION**

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Takeoff misconfiguration is a critical safety concern in aviation. It refers to situations where an aircraft takes off with incorrect flap or slat settings, which can significantly affect performance and safety during the initial climb. This may negatively affect the air traffic controller's workload. The Commercial Aviation Safety Team (CAST) chartered the Takeoff Misconfiguration Joint Safety Analysis and Implementation Team (TOMC JSAIT) to:

1. Review the analysis and results from the Aviation Safety Information Analysis and Sharing (ASIAS) program's Aircraft Misconfiguration Directed Study.
2. Identify the occurrence of problems and contributing factors that lead to takeoff misconfiguration events.
3. Recommend mitigations, as appropriate, using the CAST analysis process.

### **There are 3 misconfiguration scenarios:**

1. Attempted takeoff with the flaps in the retracted position;
2. Attempted takeoff with the flaps set to a takeoff position that is different from the setting intended and/or required by performance calculations;
3. Early flap retraction in the first 20 seconds after liftoff, typically before gear retraction.

The TOMC JSAIT conducted its investigation in two stages. During Phase I, the team focused on analyzing and reducing the risk associated with the first scenario, which was identified as the highest risk based on historical data. In Phase II, the team examined the risk related to the second and third scenarios, even though they had not been associated with any recorded accidents in airline operations.

**During Phase I** of its investigation, the TOMC JSAIT expanded on the ASIAS Aircraft Misconfiguration Directed Study findings by analyzing misconfiguration event rates using ASIAS FOQA data and comparing them with air carriers' takeoff configuration policies. Based on this analysis, the team concluded that encouraging air carriers to conduct takeoff configuration checks before taxiing could significantly reduce misconfiguration events.

Additionally, the team examined ASAP flightcrew narrative reports in ASIAS to understand the causes of misconfigurations. These reports highlighted the crucial role of the TCWS in preventing

takeoff with retracted flaps. As the final barrier in the checklist and SOP, the TCWS remains critical in preventing misconfigured takeoffs. Another common mitigation reported by flightcrews was identifying errors during flow checks or routine flight deck scanning.

**During the second phase** of its investigation, the TOMC JSAIT directed its attention to the two remaining scenarios. The team conducted an analysis to evaluate and measure the potential risk associated with each scenario. Subsequently, they scrutinized the events to identify any distinctive issues and factors that could contribute to unacceptable levels of risk. They also assessed whether additional mitigation measures, beyond those identified in Phase I, might be required. Following this review, the team determined that no further mitigation efforts are warranted at this point in time.

**In Phase I, the TOMC JSAIT devised three Safety Enhancements (SEs)** aimed at mitigating the risk of attempted takeoff with flaps set to zero. Upon further analysis in Phase II, it was determined that these SEs were equally applicable to the scenario involving incorrect flap settings during takeoff.

**SE 227** advises air carriers to reassess their current Standard Operating Procedures (SOPs) concerning takeoff configuration in light of this new insight.

**SE 228** urges airplane manufacturers to develop advanced design features that enhance flightcrew awareness of system malfunctions or incomplete/incorrect takeoff configurations before proceeding onto the active runway.

**SE 229** recommends that manufacturers and operators conduct a thorough review of the design and maintenance protocols for Takeoff Configuration Warning Systems (TCWS) to ensure their reliability.

### **Conclusion**

Disrupted take-off configuration, although it can happen from time to time, is not a frequent phenomenon. In most cases, aviation services and crews strictly follow procedures and protocols to ensure take-off safety, which reduces the likelihood of such violations, and usually this is enough not to create an unnecessary burden on the controller. However, during the investigation of incidents and accidents, cases of violation of the take-off configuration are sometimes revealed, which can have serious consequences.

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