Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

REASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION A06-07

Take-off performance monitoring system

Background

On 14 October 2004, an MK Airlines Limited Boeing 747-244SF (registration 9G-MKJ, serial number 22170) was being operated as a non-scheduled international cargo flight from Halifax, Nova Scotia, to Zaragoza, Spain. At about 0654 coordinated universal time, 0354 Atlantic daylight time, MK Airlines Limited Flight 1602 attempted to take off from Runway 24 at the Halifax International Airport. The aircraft overshot the end of the runway for a distance of 825 feet, became airborne for 325 feet, and then struck an earthen berm. The aircraft's tail section broke away from the fuselage, and the aircraft remained in the air for another 1200 feet before it struck terrain and burst into flames. The aircraft was destroyed by impact forces and a severe post-crash fire. All seven crew members suffered fatal injuries.

In this accident, the take-off was attempted using a thrust setting and take-off speedssignificantly lower than those required to become safely airborne. Once the take-off began, the flight crew did not recognize that the aircraft's performance was significantly less than the scheduled performance until they were beyond the point where the take-off could be safely conducted or safely abandoned.

The Board concluded its investigation and released report A04H0004 on 29 June 2006.

TSB Recommendation A06-07 (June 2006)

Several similar accidents and incidents have shown that there have been other crews throughout the aviation industry that have also not recognized inadequate take-off performance. Some of these occurrences have resulted in substantial aircraft damage and, in several accidents, substantial loss of life. Although several efforts have been undertaken to develop procedural and technical solutions that would alert crews to inadequate aircraft acceleration performance during take-off, these efforts still have not resulted in a reliable methodology or system being introduced and/or installed in transport category aircraft.

Without such a system, there continues to be an unacceptable level of risk to crews and the travelling public.

Therefore, concurrently with the release of its final report, the Board recommended that

> the Department of Transport, in conjunction with the International Civil Aviation Organization, the Federal Aviation Administration, the European Aviation Safety Agency, and other regulatory organizations, establish a requirement for transport category aircraft to be equipped with a take-off performance

> monitoring system that would provide flight crews with an accurate and timely indication of inadequate take-off performance.
>
> **TSB Recommendation A06-07**

Transport Canada's response to Recommendation A06-07 (September 2006)

Transport Canada (TC) agrees that, if a take-off performance monitoring system (TPMS) could be designed to function as intended, it could provide a significant safety benefit. However, TC believes that, in order for civil aviation authorities to establish a requirement for aircraft to be equipped with a TPMS, an acceptable system would have to exist. TC is not aware of any certified system that is available at this time to meet this recommendation.

TC states that it is conceivable that such a system could be designed with current technology. However, a significant effort would be required by private industry and researchers to establish appropriate design criteria, to perform detailed design and system development, and then to conduct significant testing to ensure high reliability before acceptance. In addition, design criteria and standards would also require harmonization with other civil aviation authorities.

TC's letter also states that, at this time, TC cannot establish a requirement for aircraft to be equipped with a TPMS but will revisit this issue when a certifiable product is developed.

TSB assessment of Transport Canada's response to Recommendation A06-07 (December 2006)

Although TC agrees that, if a TPMS could be designed to function as intended, it could provide a significant safety benefit, TC has stated that it will not take any action until a TPMS is developed and certified. In addition, its response makes no mention of any intent to work together with the International Civil Aviation Organization (ICAO) and other regulatory organizations to establish a TPMS requirement. TC's only commitment is to revisit this issue when a certifiable product is developed.

Given that TC has recognized the value of TPMS technology, the Board feels that TC is well positioned to take a leadership role within the industry in advocating for the development and integration of TPMS technology on transport category aircraft.

Because TC's response contains no action or proposed action that will reduce or eliminate the risks associated with this deficiency, the response to Recommendation A06-07 is assessed as **Unsatisfactory**.

Transport Canada's response to Recommendation A06-07 (January 2007)

In its response, TC reiterates its assertion that it cannot establish a requirement for a TPMS because it does not know of any certified system available to the industry. However, TC notes TSB's suggestion that research into TPMS technology would be beneficial and consequently has formed a cross-disciplinary project team to look into this subject. TC describes what work has already been accomplished by the project team and outlines details of its action plan, which includes establishing what remains to be done before a certifiable TPMS could be made available, consulting with industry to gauge their interest in a TPMS solution, and working with industry to bring about a certifiable system. Additionally, TC invites TSB's participation in its preliminary research project team.

TSB reassessment of Transport Canada's response to Recommendation A06-07 (February 2007)

TC's response has outlined an action plan that has not been sufficiently advanced to reduce the risks to transportation safety as described in Recommendation A06-07. However, because the action plan, if fully implemented, could substantially reduce or eliminate the safety deficiency, the response to Recommendation A06-07 is assessed as **Satisfactory Intent**.

Transport Canada's response to Recommendation A06-07 (February 2010)

TC's response advises that the TPMS working group continues and that further funding is required.

TSB reassessment of Transport Canada's response to Recommendation A06-07 (July 2010)

TSB has been briefed on the progress of TC sponsored research in support of the TPMS initiative. Several solutions are being discussed none of which is likely to be pursued without allocation of TC funding.

However, because the action plan, if fully implemented, could substantially reduce or eliminate the safety deficiency, the Board assesses TC's response as **Satisfactory Intent.**

Transport Canada's response to Recommendation A06-07 (January 2011)

In its response, TC advises that a committee examined TPMS system possibilities in this area to no avail. Transport Canada is not aware of any certified system that is available at this time to meet this recommendation. It also indicates that at present, Transport Canada cannot establish a requirement for aircraft to be equipped with a take-off performance monitoring system but will revisit this issue when a certifiable product is developed.

TSB reassessment of Transport Canada's response to Recommendation A06-07 (March 2011)

In 2007, TC formed a cross-disciplinary project team to look at the issue of TPMS. TC had outlined details of its action plan, which included the following items:

- establishing what remains to be done before a certifiable TPMS could be made available,
- consulting with industry to gauge their interest in a TPMS solution, and
- working with industry to bring about a certifiable system.

By March 2009, the project team had completed a review of the existing TPMS technologies and the final report concluded that research completed over the past few decades has led to advancement in TPMS technology. In addition, a flight research and evaluation project of contemporary TPMS assessment was proposed. This was to visualise the possible operational effectiveness and possible operational limitations of contemporary technology. However since April 2009, no project funding was allocated for this project and progress has come to a standstill.

Of note, with A06-07 the Board had recommended that the Department of Transport work in conjunction with the International Civil Aviation Organization, the Federal Aviation

Administration, the European Aviation Safety Agency, and other regulatory organizations. However, to date no information has been provided by TC to indicate if other agencies had been approached. This is of importance as several similar accidents and incidents have shown that there have been other crews throughout the aviation industry that have also not recognized inadequate take-off performance. Several of those occurrences have occurred since the MK Airlines accident.

The Board is concerned that TC has ended its research into TOPM technology. While the Board understands the complexity associated with such an undertaking, the fact that similar occurrences happen on a regular basis means that a mitigation strategy has to be developed. Because this is a global issue, the Board strongly encourages TC to continue its leadership in TOPM research but to also approach other agencies that could contribute resources.

However, at this date, TC has stopped all work on TPMS technology and will only revisit this issue when a certifiable product is developed. This action plan will not substantially reduce or eliminate the safety deficiency.

Therefore, the Board assesses TC's response as **Unsatisfactory.**

Transport Canada's response to Recommendation A06-07 (May and September 2011)

May 2011 input

No change since January 2011 update.

September 2011 update

No change.

TSB reassessment of Transport Canada's response to Recommendation A06-07 (March 2012)

This reassessment is hindered by the lack of information. The TSB inquired as to whether or not TC had attempted to establish contact or a working group with other agencies as suggested in Recommendation A06-07. This inquiry has remained unanswered.

The response is considered **Unsatisfactory.**

Transport Canada's response to Recommendation A06-07 (December 2012)

While TC is in agreement with the intent of the recommendation, no reliable take-off performance monitoring systems currently exist. TC has determined that the industry is the best place to take the lead to develop a take-off performance monitoring system. TCCA does not intend to require such a system. When a certified take-off performance monitoring system becomes available, TCCA will reassess its position and advise the TSB accordingly.

TSB reassessment of Transport Canada's response to Recommendation A06-07 (March 2013)

The Board is disappointed that TC has ended its research into TOPM technology, decided to forego its leadership role in TOPM research and has delegated to industry the responsibility to decide if and when a TPMS system should be developed. Since the MK Airlines occurrence,

accidents and incidents involving take-off performance issues continue to happen, showing that there are other crews throughout the aviation industry that have also not recognized inadequate take-off performance.

Because TC has stopped all work on TPMS, does not intend to require such a system and is planning to reassess its position only once a certified system becomes available, the Board believes that this action plan will not substantially reduce or eliminate the safety deficiency.

The response is considered **Unsatisfactory.**

TSB review of Recommendation A06-07 deficiency file status (May 2017)

The Board requested that A06-07 be reviewed to determine if the deficiency file status was appropriate. After an initial evaluation, it was determined that the safety deficiency addressed by Recommendation A06-07 still needed to be reassessed.

A request for further information was sent to Transport Canada and a reassessment will be conducted upon receipt of Transport Canada's response.

Therefore, the response to the recommendation remains **Unsatisfactory**.

Consequently, the status of Recommendation A06-07 is changed to **Active.**

Transport Canada's response to Recommendation A06-07 (October 2017)

TC agrees in principle with the recommendation.

No reliable take-off performance monitoring systems currently exist. TC has determined that the industry is best placed to take the lead to develop a take-off performance monitoring system. TC is unable to require a system that does not exist. TC continues to monitor innovation technologies.

TSB reassessment of Transport Canada's response to Recommendation A06-07 (March 2018)

In its response, TC reiterates that, while it agrees in principle with Recommendation A06-07, there are currently no take-off performance monitoring systems (TPMS) that are suitable for use in civil aviation. Moreover, TC believes that the industry would be in a better position to take the lead in the development of such a system.

The Board continues to believe that TPMS can substantially benefit the safety of aircraft equipped with such technology, by providing flight crews with an accurate and timely indication of inadequate take-off performance. Therefore, the Board urges TC to pursue opportunities in take-off performance monitoring research, in conjunction with other regulatory agencies and industry.

As TC does not intend to take any further action regarding TPMS until a suitable system is developed for use in civil aviation, the Board believes that the risks associated with the safety deficiency identified in Recommendation A06-07 remain.

Therefore, the Board considers the response to the recommendation to be **Unsatisfactory.**

Next TSB action

Apart from monitoring the development of innovative technologies regarding TPMS, there are no planned activities to address the risks associated with the safety deficiency identified in Recommendation A06-07. The TSB will continue to monitor advances in TPMS technology that reduce the risk of take-off performance accidents. The TSB will reassess the safety deficiency when warranted.

This deficiency file is **Dormant.**