TSB Recommendation A06-07

Take-off performance monitoring system

The Transportation Safety Board of Canada recommends 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.

Air transportation safety investigation report	A04H0004
Date the recommendation was issued	29 June 2006
Date of the latest response	October 2017
Date of the latest assessment	March 2026
Rating of the latest response	Satisfactory in Part
File status	Closed

Summary of the occurrence

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 speeds significantly 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.

Rationale for the recommendation

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.
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> **TSB Recommendation A06-07**

Previous responses and assessments

September 2006: response from Transport Canada

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.

December 2006: TSB assessment of the response (Unsatisfactory)

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**.

January 2007: response from Transport Canada

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.

February 2007: TSB assessment of the response (Satisfactory Intent)

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**.

February 2010: response from Transport Canada

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

July 2010: TSB assessment of the response (Satisfactory Intent)

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.**

January 2011: response from Transport Canada

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.

March 2011: TSB assessment of the response (Unsatisfactory)

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.**

May 2011: response from Transport Canada

No change since January 2011 update.

September 2011: updated response from Transport Canada

No change.

March 2012: TSB assessment of the response (Unsatisfactory)

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.**

December 2012: response from Transport Canada

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.

March 2013: TSB assessment of the response (Unsatisfactory)

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.**

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

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.**

October 2017: response from Transport Canada

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.

March 2018: TSB assessment of the response (Unsatisfactory)

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.**

Latest response and assessment

March 2026: TSB assessment of the overall response (Satisfactory in Part)

Recommendation A06-07 called for Transport Canada (TC) - in conjunction with international regulatory partners, including the International Civil Aviation Organization (ICAO), the U.S.

Federal Aviation Administration (FAA), and the European Union Aviation Safety Agency (EASA) - to establish a requirement for transport category aircraft to be equipped with a take-off performance monitoring system (TOPMS) capable of providing flight crews with an accurate and timely indication of inadequate take-off performance. This recommendation was issued following accidents and incidents in which flight crews did not recognize degraded take-off performance until it was too late to safely take appropriate corrective action.

In its responses, TC has consistently agreed with the intent of the recommendation but emphasized that no reliable or certifiable TOPMS were available and that regulatory authorities could not mandate a system that did not yet exist. Over time, the Board considered TC's responses to be Unsatisfactory, noting that the absence of regulatory leadership and sustained research activity meant that the underlying safety deficiency—flight crews not recognizing inadequate take-off performance in a timely manner—remained. These assessments reflected the reality that, for many years, neither Canada nor its international partners had the technical foundation or certification standards necessary to support implementation.

Since the issuance of the recommendation, the aviation industry has undergone substantial technological and operational evolution. In the absence of TOPMS, risk mitigation has relied on layered defences, including improved performance calculation tools, electronic flight bags, enhanced runway condition reporting initiatives, procedural safeguards, and safety management systems (SMS). These measures have reduced risk but have not eliminated it, particularly in scenarios involving erroneous data entry, incorrect take-off positioning, or degraded acceleration.

Nonetheless, recent international developments indicate that take-off performance monitoring initiatives are underway, but these are still in their infancy. In July 2025, EASA issued Notice of Proposed Amendment (NPA) 2025-01,[1] which proposes to require certain large aeroplanes to be equipped with a TOPMS.

Similarly, the European Organisation for Civil Aircraft Equipment (EUROCAE) Working Group 129 (WG-129), in joint collaboration with RTCA, Inc. (formerly Radio Technical Commission for Aeronautics) Special Committee 244 (SC-244), has produced an internal report identifying current technologies capable of supporting take-off performance awareness and alerting systems (TOPAAS).[2] This work was initiated in response to safety recommendations arising from United Kingdom (UK) Air Accidents Investigation Branch (AAIB) investigations into take-off performance events and highlights that, while enabling technologies now exist, certification remains dependent on the development of modern minimum operational performance standards. As a result, EUROCAE WG-129 and RTCA, Inc. SC-244 are developing a

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1 EASA, NPA 2025-01, Take-off performance parameters and position errors – large aeroplanes (01 July 2025). Available at https://www.easa.europa.eu/en/document-library/notices-of-proposed-amendment/npa-2025-01 (last accessed on 23 April 2026).

2 Special Committee (SC) 244, Terms of Reference, Take-Off Performance Monitoring System, RTCA Paper No. 328-24/PMC-2679 (12 December 2024). Available at https://www.rtca.org/wp-content/uploads/2024/12/SC-244-ToR-Rev1-Approved-2024-12-12.pdf (last accessed on 23 April 2026).

Minimum Operational Performance Standard (MOPS) to define functional and equipment requirements necessary for certification under EASA European Technical Standard Order (ETSO), FAA Technical Standard Order (TSO), and UK TSO frameworks, with a projected publication target in September 2026. Until this standard is finalized and adopted, regulatory authorities remain constrained in their ability to mandate take-off performance monitoring systems.

Recommendation A06-07 was issued nearly 20 years ago, when aircraft systems, on-board data integration, and certification standards were far less advanced than they are today. For nearly two decades, no certifiable systems or harmonized regulatory standards existed to support such a mandate. At that time, real-time take-off performance monitoring technology was not available, and the recommendation looked ahead to a capability that had yet to be developed and that would require coordinated international regulatory action to implement across transport category aircraft.

While the Board continues to recognize the potential safety benefits of take-off performance monitoring systems and notes that early international initiatives are now emerging, the risk associated with the safety deficiency identified in Recommendation A06-07 has not been eliminated.

Therefore, the Board considers the overall response to Recommendation A06-07 to be **Satisfactory in Part**.

File status

Given the age of the recommendation, advancements in supporting technologies and risk mitigation measures, and TC's consistent position, the Board considers that the risk associated with the safety deficiency identified in Recommendation A06-07 has been partially addressed and that further progress is unlikely. While the absence of a certified take-off performance monitoring system means that the risk of undetected inadequate take-off performance has not been eliminated, existing defences reduce its likelihood. Accordingly, the residual risk is considered to be low.

This deficiency file is **Closed**.