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# How are aeronautical occurrences investigated today?

*¿Cómo se investigan los sucesos aeronáuticos en la actualidad?*

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## Abstract

The National Directorate of Aeronautical Incidents Investigation (DNISAE) developed in June 2022 the 5th Edition of the Civil Aviation Accidents and Incidents Investigation Procedures Manual (MAPRIAAC). The proposed approach goes beyond the technical failure or individual error and focuses on the environment, reconstructs the context of occurrence and searches for the triggering factors.

## Resumen

La Dirección Nacional de Investigación de Sucesos Aeronáuticos (DNISAE) desarrolló en junio de 2022 la 5º Edición del Manual de Procedimientos de Investigación de Accidentes e Incidentes de Aviación Civil (MAPRIAAC). Lo propuesto implica un abordaje que no se queda en la falla técnica o el error individual y pone el foco en el entorno, recompone el contexto de ocurrencia y busca los factores desencadenantes.

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## The investigation process

The Transportation Safety Board (Junta de Seguridad en el Transporte, JST) is the Argentine agency responsible for investigating any aviation event that is deemed to be an accident or incident, including those involving experimental aircraft that have been awarded a Certificate of Airworthiness, by the National Civil Aviation Administration (ANAC, Spanish acronym).

The reactive element of safety management that stands above all others is the examination of aviation accidents and incidents. Active failures and latent circumstances are the two main pillars on which the systemic model put into practice by the JST is founded. In this way, the National Department of Aviation Occurrences Investigation - DNISAE takes into account the analysis of the organizational (OFs) and human factors (HFs) involved in occurrences.

This is why the JST's investigations into air accidents and incidents go beyond simply identifying technical failure or operational error to examine any latent deficiencies in the aviation system that might serve as systemic precursors to further occurrences. To accomplish this, information on HFs and OFs must be gathered and analyzed with the same care and thoroughness as any other conventional area of investigation.

> ***"Any errors or omissions were caused by underlying system issues that ultimately manifested in such ways. So, it is crucial to contextualize the error and comprehend it as a result rather than as a cause."***

"The human element is the most flexible, adaptable, and valuable component of the aviation system, but it is also the most subject to factors that might have a negative impact on its performance", according to the International Civil Aviation Organization's (ICAO) paper 9683.

In aviation, human factors (HFs) are concerned with using what we know about people—their traits, capabilities, and limitations—to design the equipment they use, the settings in which they operate, and the tasks they perform. Operational performance, on the other hand, refers to how people carry out their work and reflects the level of human involvement to a system's performance. People are both a source of risk and a crucial component of identifying and managing all the risks inherent in the aviation system.

In general, the following categories can be used to group the operational performance data that will be gathered as part of an investigation into an air accident or incident:

a. Allowing investigators to create a thorough timeline of all important events leading up to and, if necessary, following the occurrence (this chronology should highlight the actions or omissions of the aviation personnel involved and their potential consequences for the occurrence).

b. Background information on the operation's context enables investigators to analyze in depth the cause of the behavior of the engaged aviation employees.

The JST's method for investigating air accidents and incidents always assumes that any errors or omissions were caused by underlying system issues that ultimately manifested in such ways. So, it is crucial to contextualize the error and comprehend it as a result rather than as a cause.

Furthermore, it is impossible to foresee how certain human behaviors and circumstances will interact with particular elements and features of a working environment. Individual-based mitigation techniques are therefore not thought to be efficient.

The study must go further to explain elements that are remote in time and place from the event in issue, such as unsafe behaviors by frontline personnel or mechanical problems. Despite this, the factors that explain human performance and the occurrence of mechanical failures are typically linked to the workplace environment of frontline operators, the organization in charge of that environment, and even to external factors that have an impact on the organization, such as rules or oversight from the aviation authority, among other things.

An evaluation of the system's defenses at the time the occurrence in study occurred must be included in the analysis of active faults and latent conditions. Each defense must be identified, and its success or failure must be determined. Like this, it is important to evaluate any viable defenses and advocate their use to the relevant agency, natural person, or legal entity in each instance.

## Safety Recommendations (RSO)

The most significant outcome of an investigation is the Safety Recommendations, which aim to ensure that the identified safety flaws are brought to the attention of the relevant agencies and entities to implement the necessary changes and prevent the repetition of similar events. Safety Recommendations offer suggestions to prevent the recurrence of accidents and incidents, which helps to strengthen the national and regional transportation system's defenses.

When the investigation is still in progress or when it is over, as part of the Final Safety Report, the JST may issue Safety Recommendations. When it is determined that there are one or more factors that could jeopardize safety and against which the current defenses are not fully effective, the formulation of a Safety Recommendation during the investigation process will be justified. It is then imperative to communicate this officially and immediately to whoever oversees taking the necessary action.

A Safety Recommendation must persuade the reader to take safety precautions in order to reduce the hazards discovered during the investigation. The accomplishment of this objective can be facilitated through communication that is concise, clear, and well-organized. The following qualities must be included in a properly constructed Safety Recommendation:

- Clearly state who the recipient is
- Addressed to the most qualified organization to implement change
- Be justified and pertinent
- Be timely and attainable
- Display verified and accurate information
- Avoid the use of abstract language
- Make a direct and explicit connection to a fact that affects safety
- Be founded on the development or strengthening of safety defenses
- Be free of presumptions and value judgments
- Be cautious not to overprescribe
- Do not limit the margin of action of the recipient
- Focus on the expected result
- Be measurable and traceable for its follow-up

Safety recommendations developed by the DNISAE are composed of two sections:

a. A summary of the safety issue that was found, along with conditions that could endanger safety, any defenses flaws, and lingering risk (or negative effects) of inaction.

b. The suggested safety measures (risk management alternatives), along with the anticipated outcomes.

The recipient responsible for carrying out most safety recommendations will be an Argentine public or private organization, such as the civil aviation authority, the air service operator, the aircraft manufacturer, the supplier of air traffic services, or the airport operator.

However, the JST may communicate safety recommendations to recipients in other sovereign states, always through the appropriate Accident Investigation Authorities. For its part, ICAO will be the recipient responsible for implementing recommendations that relate only to standards and recommended practices.

The DNISAE issued 352 Safety Recommendation between 2015 and 2021. Data analysis reveals that with 64 % of the targets, ANAC was the primary target of air mode safety recommendations. 8.5 % of this mode's safety recommendations went to aircraft owners, while 7.5 % went to operators (commercial carriers). As opposed to this, 4.5 % of businesses offer services (ramp, air navigation, meteorology, etc.). The final 4 % went to federations, (groups that unite general and commercial aviation operations).

The DNISAE and the Safety Recommendations Monitoring Area work together to evaluate the closure of an aeronautical safety recommendation. The JST determines whether the recommendation's goal has been achieved fully, partially, or otherwise based on the responses received. Both the safety recommendations that were closed as having been completed and those that had an alternate risk mitigation action applied are regarded as satisfactory.

The JST received 80 % of successfully submitted responses in 2021. The more the agency's recommendations that receive a satisfactory response, the greater the contribution been made to increase safety. To make increasingly specific and practical recommendations that will effectively help to strengthen the defenses of our transportation system is the enormous task that lies ahead for the investigation of aeronautical incidents.