# Session 4

Aeronautical Studies

## Obstacle Limitation Surfaces

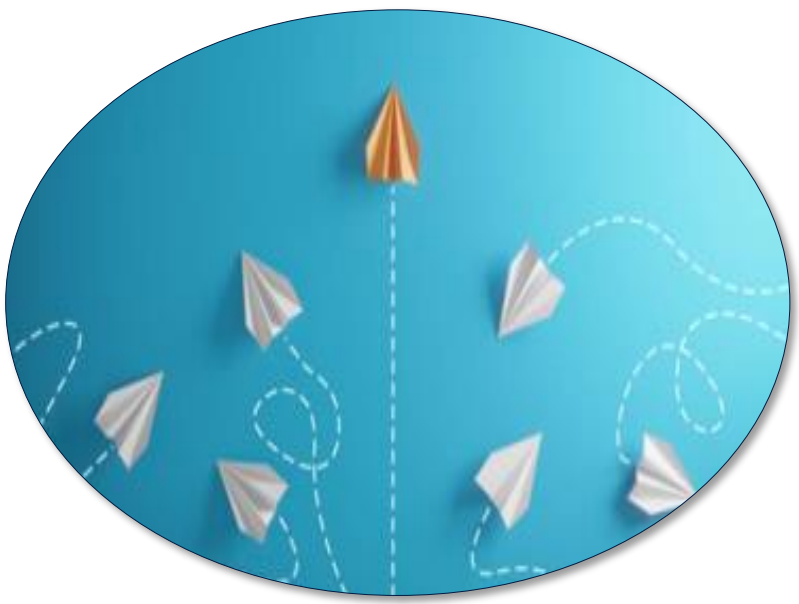
# Objectives

At the end of this module, participants will be able to

- Recognize the need for an aeronautical study.
- Choose data required for the study
- Identify stakeholders involved in the study
- Evaluate the obstacle
- Provide mitigating measures for issues arising from an aeronautical study

# Background

- ICAO Annex 14 and PANS-OPS Doc 8168 reference aeronautical studies.
- Different States follow various practices.
- Absence of a unified approach may lead to inconsistent study results, leaving some aeronautical issues inadequately addressed.



# Background


Since aeronautical studies can ensure safety in aircraft operations, procedures have been incorporated in the **PANS-Aerodromes Doc 9981**, with further guidance in **Airport Services Manual (ASM) Part 6**

The procedures and guidance focus on the **process** - from identification of stakeholders to evaluating the outcome of the study

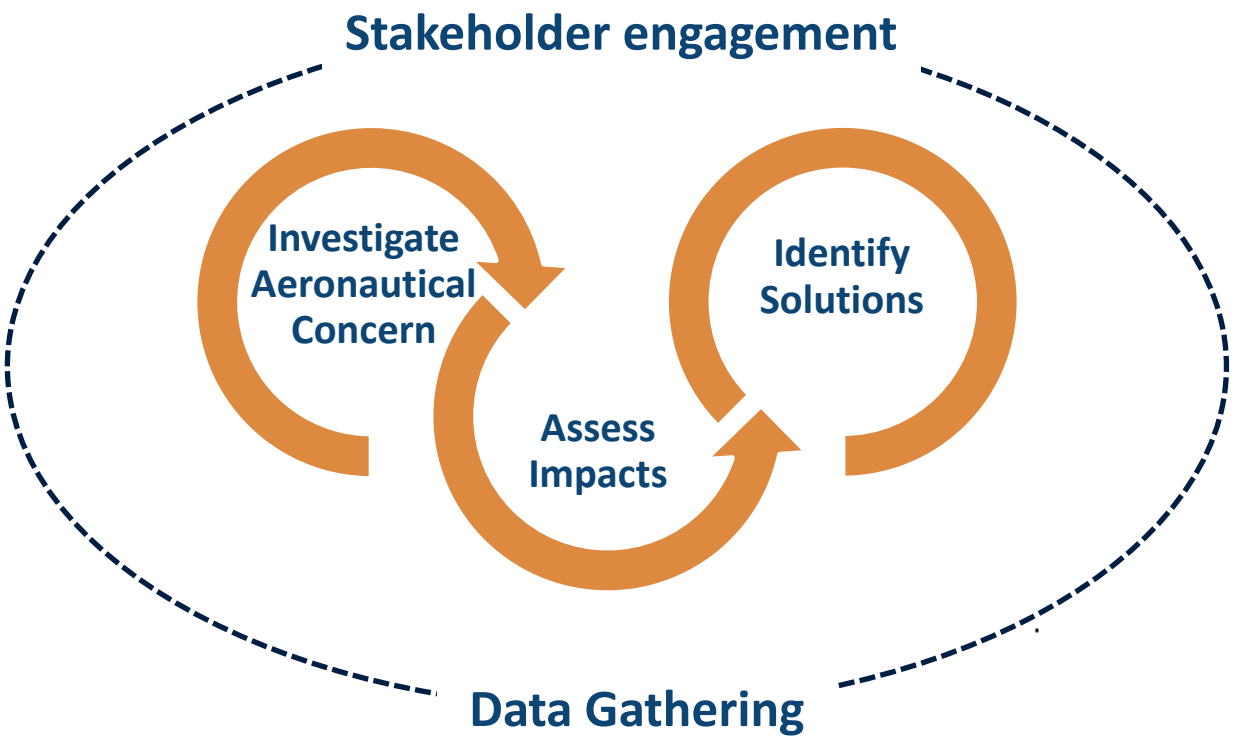
# What is an Aeronautical Study?

# What is an aeronautical study?

**Aeronautical study:**

A process of examining an aeronautical concern in order to assess its impact and identify, if need be, possible solutions not adversely affecting the safety and regularity of aircraft operations.

# Elements of an Aeronautical Study



# What are Aeronautical Concerns?

**Objects and / or activities** that could affect

the safety and regularity of air navigation

- Procedures in PANS-Aerodromes Doc 9981 focus on investigating the impact to flight operations and possible solutions to mitigate the impact
- Other aeronautical concerns should also be addressed to ensure a holistic study with appropriate stakeholders

# When to conduct an Aeronautical Study

# Triggers

Penetration of Obstacle Free Surfaces

Penetration of Obstacle Evaluation Surfaces

Objects beyond the OLS that exceeds 100m

States shall clearly **define the conditions** that trigger an aeronautical study

For flight operations and flight procedures, the **conditions are linked to the OLS** established at the aerodrome

# Obstacles beyond OLS

## Anything above 100 meters needs a study.

## Why?

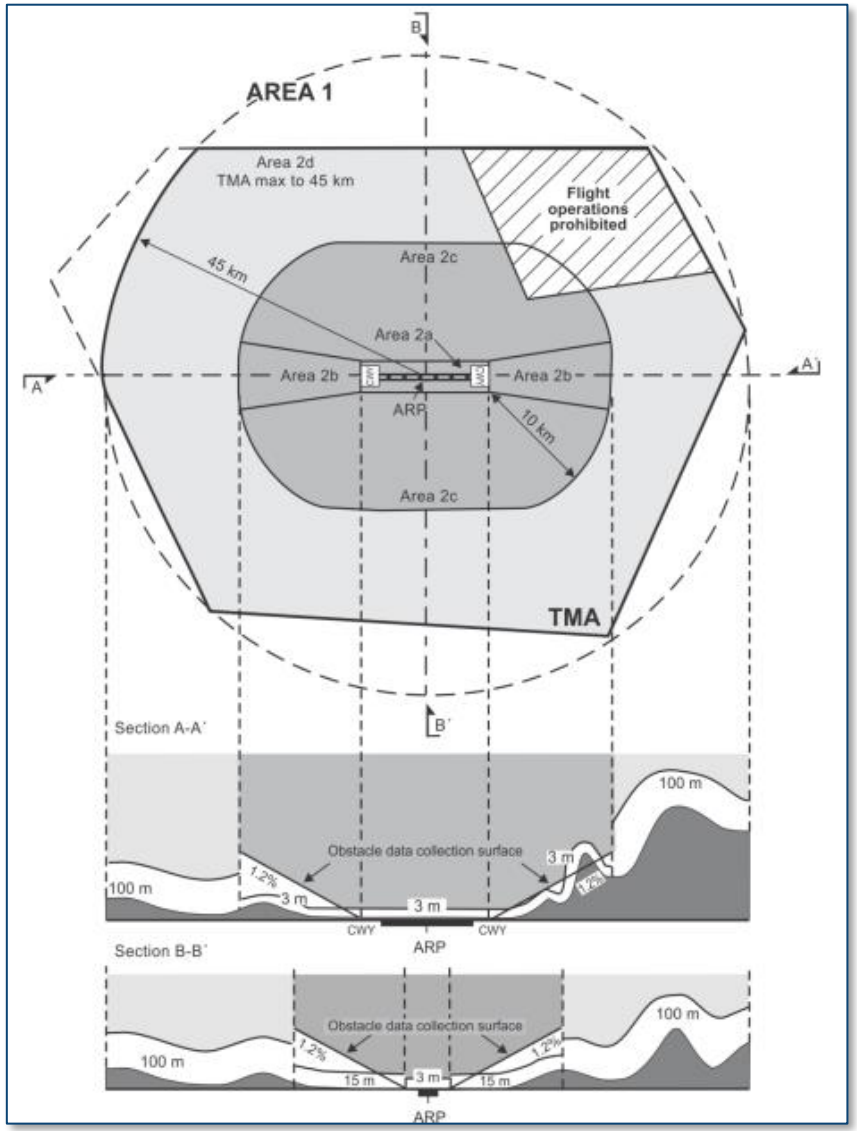
- States should consider the requirement to **analyse potential impact** of all objects which extend to a height of 100 m or more AGL.

- To **align with Annex 15 TOD, Area 1** requirements

- Obstacles on **elevated terrain** such as hills and mountains which are less than 100m AGL should also be considered as they may impact flight procedures.

# Annex 15 TOD requirements

- **Area 1:** Entire territory of State
- **Area 2:** Within the vicinity of the aerodrome



# Other Triggers

Other triggers may also affect the safety and regularity of aircraft operations and should be considered by States

Construction of wind turbines

Building / construction within and near airports impacting CNS

Construction of LNG or power station facility

Installation of solar panels / reflective building facade

Who are the stakeholders?

# Who proposes a study?

Any competent authority or person can be a proponent of an aeronautical study

**States may define the qualifications or competencies of personnel conducting the study**

# Proponents of an Aeronautical Study

More than one proponent may be involved in conducting the study.

These actors are also stakeholders in an aeronautical study

- States
- Airlines / Pilots
- Aerodrome Operators
- Air Navigation Services Providers
- Building Developers or their appointed consultants

# How to conduct an Aeronautical Study

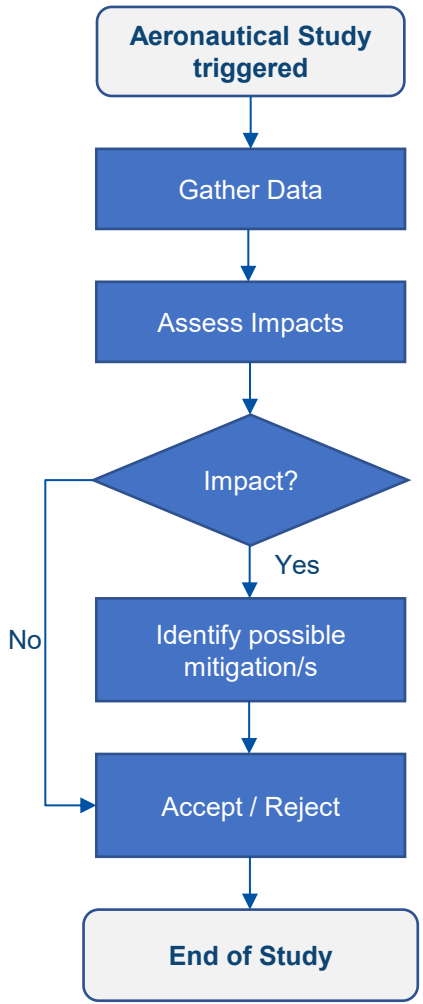
# Methodology

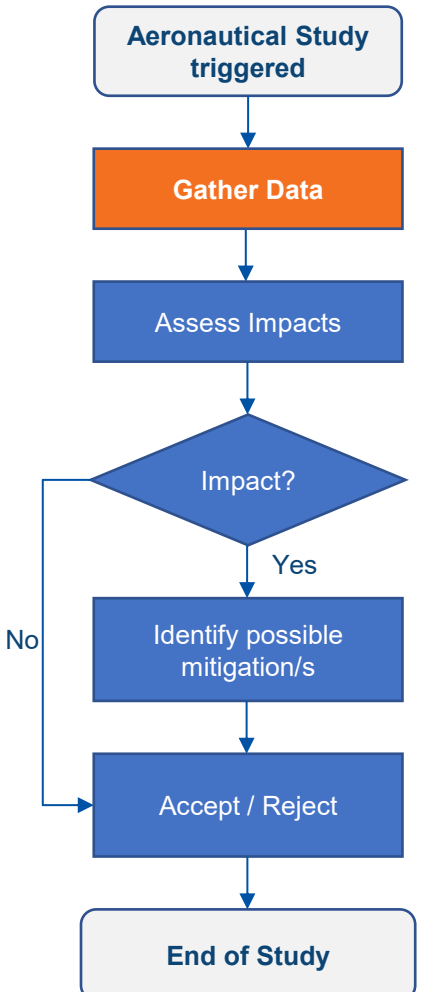
The aeronautical study process includes

1. Data Gathering
2. Impact Assessment
3. Identification of solutions
4. Acceptance or rejection of the study

Process for an

# Aeronautical Study




Aeronautical Study triggered
Gather Data
Assess Impacts
Impact?
Yes
No
Identify possible mitigation/s
Accept / Reject
End of Study

# Gather Data

Essential data to be collected:

- Aerodrome Data
- Type of operations at the aerodrome
- Restrictions at the aerodrome
- Existing obstacle environment and future developments
- Permanency of the obstacle data
- Published flight procedures and future procedures to be implemented
- Track data

**Robustness** of the study outcome depends on the **quantity and quality of data**.

# Gather Data: Qualitative vs Quantitative

Use qualitative assessments where the available **data is limited**.

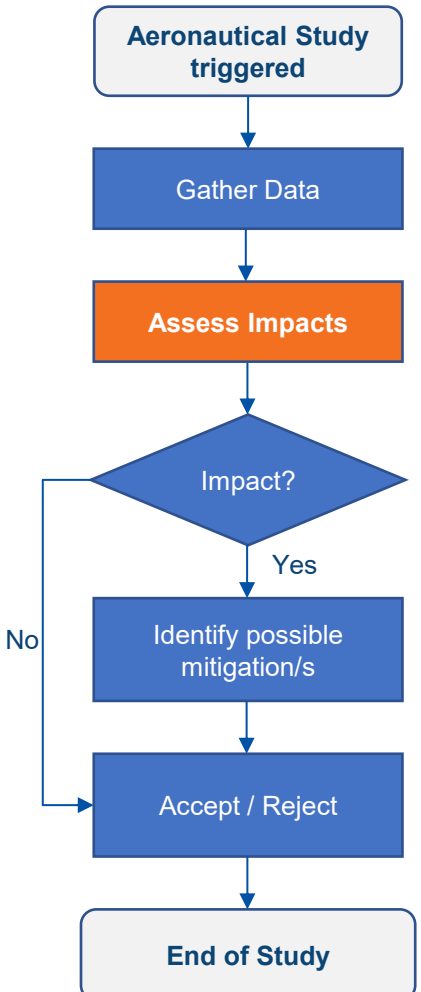
Use **quantitative** methods to evaluate the impact on **OFS**.

*The consequences of incomplete data are more severe for OFS.*

For **OES**, you could use either **quantitative or qualitative** assessments.

# Gather Data: Data Sources

- **AIP**
  - Aerodrome and runway data
  - Aerodrome obstacle charts (Type A & Type B)
- **Inputs from stakeholders** such as ANSPs, aerodrome operators and aircraft operators
  - Instrument flight procedures
  - CNS specification
  - Contingency procedures
  - TOD data sets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# How is impact assessed?

There are several ways to conduct an impact assessment.

For assessment of OFS penetration, a quantitative assessment should be augmented with data obtained through trials and simulation.

For OES penetration, a qualitative assessment may be sufficient.

# Methodology: Quantitative Assessment

Quantitative assessment is the use of available data to **quantify the impact of an object** on flight operations. It relies on

- Historical track data
- Criteria from PANS-OPS
- Current and future runway capacity
- Established or agreed target level of safety

Requires the use of **analytical or simulation tools** such as collision risk modelling.

Additional tool may be required to address other aeronautical concerns (i.e. impact to CNS)

Note: CRM is only used for precision approach.

# Methodology: Quantitative Assessment

**Examples of quantitative assessment**:

**Collision modelling** where track and obstacle data are used to generate the probability of collision.

**Collision Risk Modelling** to assess impact of objects that are closer to the runway environment

- Collision Risk Modelling (CRM) assesses the risk of aircraft colliding with objects
- Statistical models derive probabilities of aircraft flying on trajectories, including obstacle environments
- CRM can be developed for all flight procedures with prescribed nominal flight tracks

# Methodology: Qualitative Assessment

Qualitative assessments gather additional data when quantitative data is limited.

Qualitative assessments typically refer to trials and simulations, which analyze criteria such as

- visibility of objects in specific weather conditions,
- the ability of pilots to keep certain prescribed flight tracks,

These can be especially useful for the assessment of visual flight operations

# Methodology: Qualitative Assessment

**Scenario for qualitative assessment:**

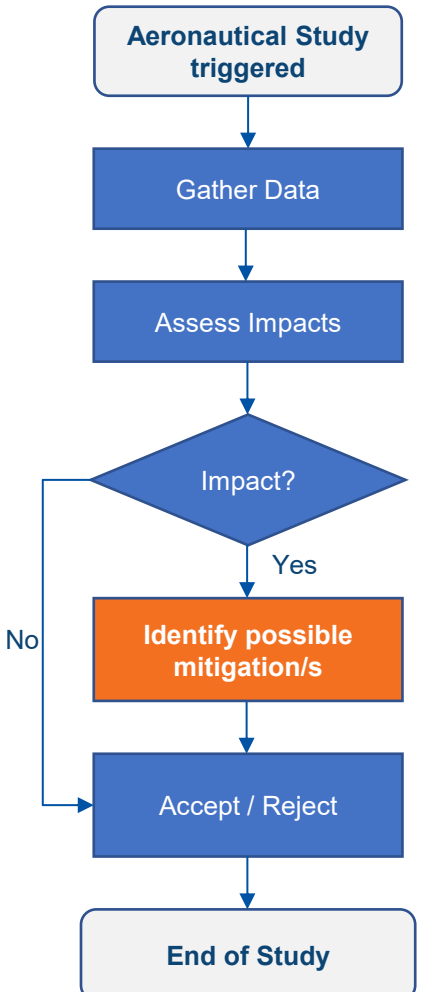
In a visual flight environment where the use of transponder may not be mandatory and aircraft do not operate on the same track alignment, it makes the collection of track data challenging

# Methodology: Qualitative Assessment

To be successful, qualitative assessments requires the involvement of stakeholders

- Stakeholder feedback and experts' opinions are essential for effective qualitative assessments.
- Engagement with affected stakeholders helps identify problems and discuss practical solutions

Simulations could also verify the outcome of the study, such as line-of-sight assessments for air traffic controllers or pilots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# Mitigation Measures: Flight Ops

Possible measures to mitigate the impact on flight operations

- **Adjusting IFPs**
  *Includes adjusting the OCA/H*

- **Suspending or removing** the IFPs.
  *IFPs may be suspended to facilitate temporary construction activities*

- **Limiting operations** on the runway
  *Allowing only take-off operations*

- **Adjusting the track** or prescribed track/s to avoid the obstacles
  *May be adopted for visual operations*

- **Adjusting the OFS slope** may be required for existing immovable objects

- Designing a **specific OES**

# Mitigation Measures: Other concerns

Measures to mitigate the impact for other aeronautical concerns

Treating the surface of building façades

Using solar panels with low reflectance index

Using pan, tilt, zoom (PTZ) cameras in areas where the line of sight is blocked

# Mitigation Measures: Other concerns

Measures to mitigate the impact for other aeronautical concerns

Relocating or introducing additional CNS facilities

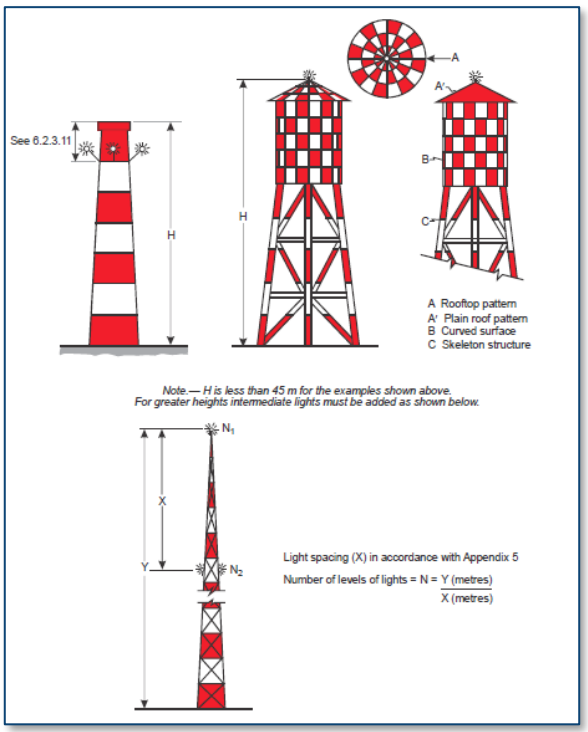
Marking and lighting obstacles

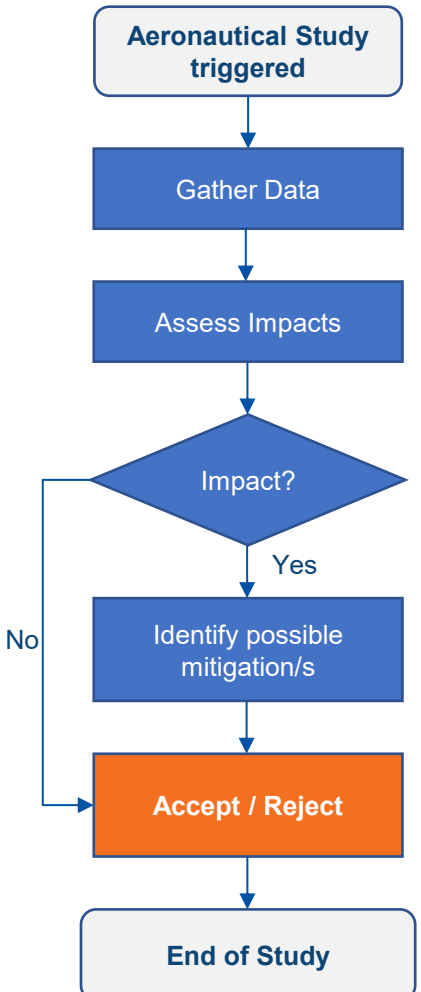
Publishing the obstacle data in the AIP and AIM database

# Mitigation measures:
# Marking and lighting of obstacles

Marking and/or lighting obstacles is intended to reduce hazards to aircraft by indicating the presence of the obstacles.

It does not necessarily reduce operating limitations which may be imposed by an obstacle.

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# Acceptance

**The proponent** will submit the aeronautical study to the State for acceptance once it is completed.

**States or its appointed agency** are responsible in determining the acceptability of an aeronautical study.

On receiving the study report, **verification** should be done to ensure the quality and the robustness of the study

# Acceptance

The verification involves checking if

- All relevant **stakeholders** have been consulted
- The appropriate **method/s** has been used in assessing the impact
- The **current and future operations** at the runway have been considered
- All **aeronautical concerns** in addition to impact to flight operations have been considered and addressed in the study
- The proponent has exhaustively identified all possible **mitigating measures**

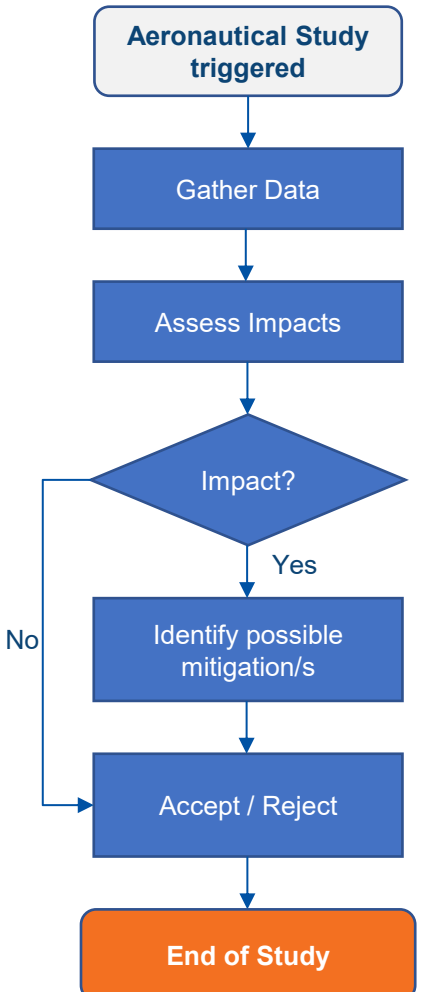
# Acceptance

After verification, States should provide its decision:

**Reject** the report if the impact or the mitigations are assessed to be not acceptable

**Return** the report to the proponent with comments if any part of the study is deemed to be incomplete or if the State requires additional assessment to be conducted

**Accept** the report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# Documentation

As aeronautical study provides a good document trail of assessment and decision made on obstacles, the **report and its outcome** must be properly documented.

States or aerodrome operator may consider **publishing** these studies.

As with safety assessments, the proposed mitigations in the study must be **reviewed** to ensure they remain valid.

# Shielding principles

Shielding is a situation where a new obstacle is assessed through the aeronautical study to be acceptable *without the need for additional mitigation*.

**Rationale:**

The obstacle is located within the shadow of an existing, immovable obstacle.

However, before using shielding, the appropriate authority should conduct quantitative or qualitative analysis to prevent from allowing objects being introduced based on shielding that could have an unacceptable impact to aircraft operations.

# Shielding principles

To define areas where shielding can be applied, it is important to:

- Conduct an aeronautical study using quantitative methodology. Such studies must be data driven and consider all current and planned operations at the aerodrome.

- Ensure that the areas must be regularly reviewed, through an aeronautical study, to ensure its applicability.

# Shielding principles

Shielding is a situation where a new obstacle is assessed through the aeronautical study to be acceptable *without the need for additional mitigation*.

**Caution:**

Shielding should be approached with caution, and the circumstances where shielding may be applied subject to specific considerations. The permanent obstacles should be a permanent physical thing, with long lasting structures and towers considered as semi-permanent obstacles.

States should define circumstances where shielding may be considered, and when shielding should not be applied

# Managing the number of aeronautical studies

Given the new OLS concept, States may see an increase in aeronautical studies.

To reduce the number of aeronautical studies, consider the following options:

- **Adapt the OES** to reflect the maximum height the appropriate authority are prepared to allow. In this situation, the OES will be treated like an OFS
- For objects beyond the OLS, the appropriate authority may **define a higher height threshold beyond 100m**. This approach should only be adopted if the necessary aeronautical study has been conducted to determine the height threshold
- Through a quantitative aeronautical study, **define areas where shielding may be applied**

# Summary

- Penetrations of OFS and OES must be assessed through an aeronautical study.
- Objects that are 100m and above may be potential obstacles and should be assessed.
- Apart from flight operations, there are other aeronautical concerns that must be addressed in an aeronautical study.

Continued…

# Summary

- The Aeronautical study process and importance of stakeholder engagement
- Aeronautical study proponent can be any competent authority or entity.
- Two possible methodologies for impact assessment are qualitative and quantitative.
- Different mitigations are available to manage the impact.
- When the study is submitted to the States for review, the possible outcomes are acceptance, review and rejection.

# Obstacle Limitation Surfaces

## Goal

This course will allow regulators, aerodrome operators, flight procedure designers, town planners and other stakeholders to develop the competencies to comply with the updated provisions related to obstacle limitation surfaces in accordance with Annex 14, Vol 1 and PANS-Aerodromes (Doc 9981).

## Learning Objectives

Upon successful completion of this course, participants will be able to:

- Identify the changes in the OLS concept
- Identify the implications of aircraft performance in OLS
- Evaluate the requirements of specific surfaces in aerodromes
- Carry out obstacle evaluation and control through an aeronautical study

## Course Info

**Language:** English

**Delivery Mode:** Instructor-Led

**Duration:** 4 Days / 24 Hours

**Level:** Technical

## Structure

- **Module 0**: Introduction
- **Module 1**: Evolution of the OLS Concept
- **Module 2**: Why Aircraft Performance Matters for OLS
- **Module 3**: Tailoring of OLS: Part 1
- **Module 4**: Tailoring of OLS: Part 2
- **Module 5**: Obstacle Evaluation and Control through an Aeronautical Study

## Primary Target Population

- The primary target audience comprises:
- Civil Aviation Authorities (CAAs): Responsible for integrating the new OLS proposals into national regulations and conducting oversight activities to ensure compliance.
- Aerodrome Operators: Charged with implementing the new OLS framework to enhance flight safety and maintain aerodrome usability.