



ICAO

# INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY



# ICAO Survey on Moving from a Magnetic to a True North Reference System for Heading and Tracking in Aviation Operations

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Procedures Panel

# Introduction

## Background, objectives and methodology of the survey

### Background

- Canada presented a WP at AN-Conf/12 (Nov 2012) and AN-Conf/13 (Oct 2018) and an IP at the HLCC (Oct 2021), to discuss the topic of moving to a true north reference system in air operations.
- At IFPP/15 (March 2022), Canada also presented a WP to the Panel to consider a global switch to true north. The Panel supported the initiative but requested ICAO carry out a survey to investigate the level of support of States and industry for such a proposal.

### Objectives

- Determine the level of support of States and their aviation industry for ICAO to work on moving to true north.
- Identify any concerns or challenges that may need to be addressed for a transition to true north.
- The findings of the survey may be used to aid ICAO in developing any plans and strategies for true north.

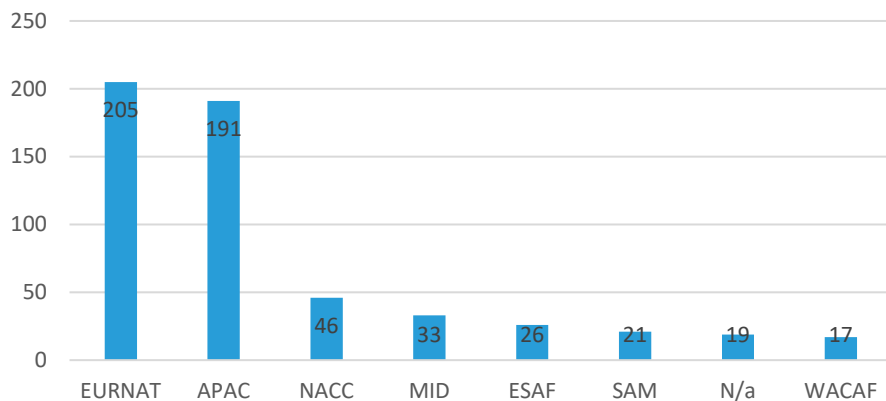
### Methodology

- The survey was conducted online using Microsoft Forms.
- 65 survey questions divided by stakeholders
- The survey link was sent by State Letter (SL AN11/57-22/87) on 21/9/2022.
- A link was provided in the SL to an ICAO website with supporting information related to the topic of true north.
- Two ICAO webinars were conducted to further inform States and industry of all considerations.

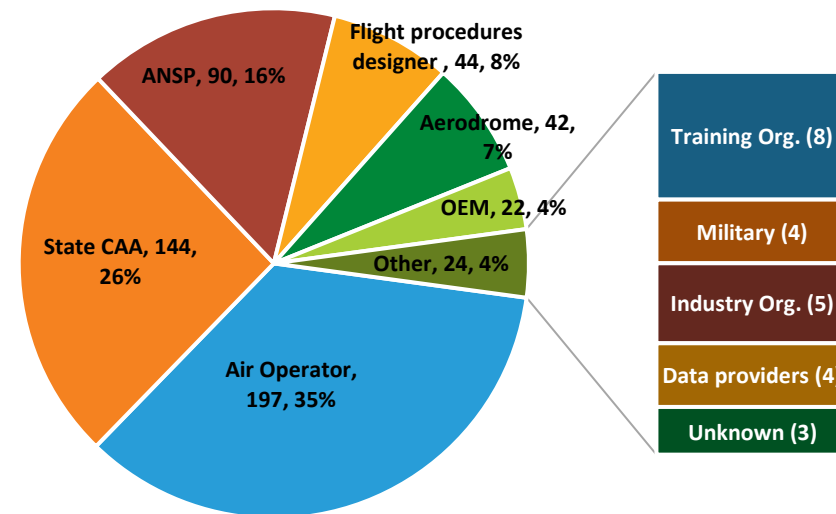
# Respondents

- 564 responses from 103 States during survey period (21/09/2022 – 31/12/2022)
- 37% of responses from EURNAT and 34% from APAC

*ICAO region of respondents*

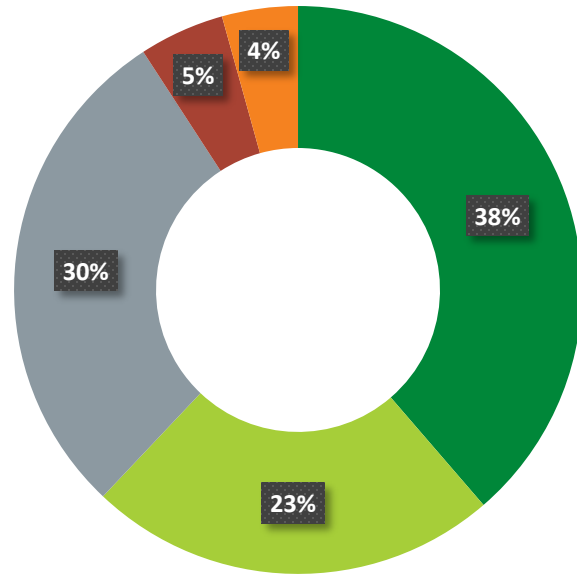


*Distribution of responses by stakeholders*



- Air operators, State CAAs and ANSPs accounted for 77% of respondents

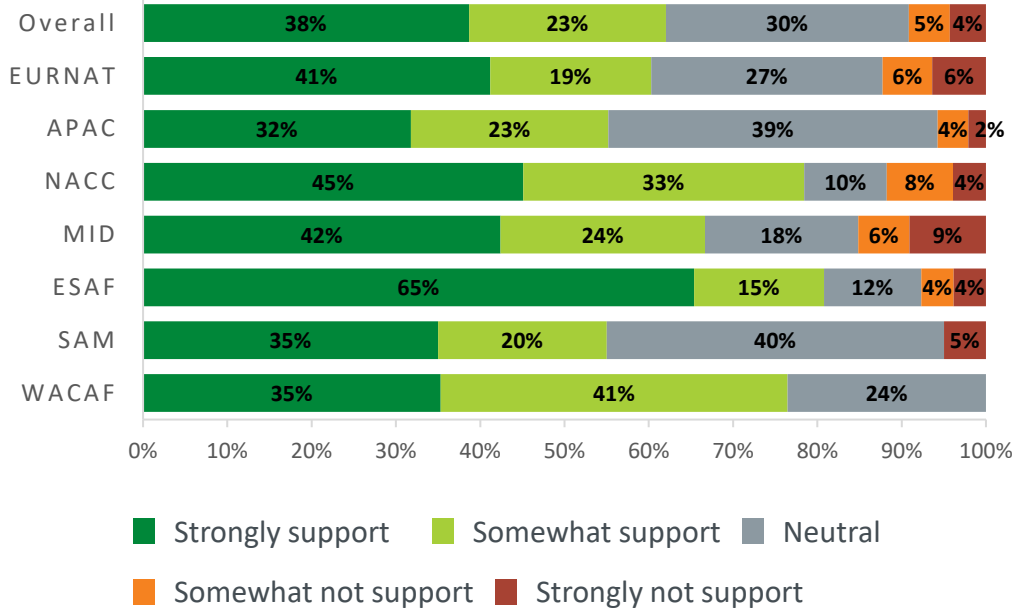
## Level of support for moving to true north



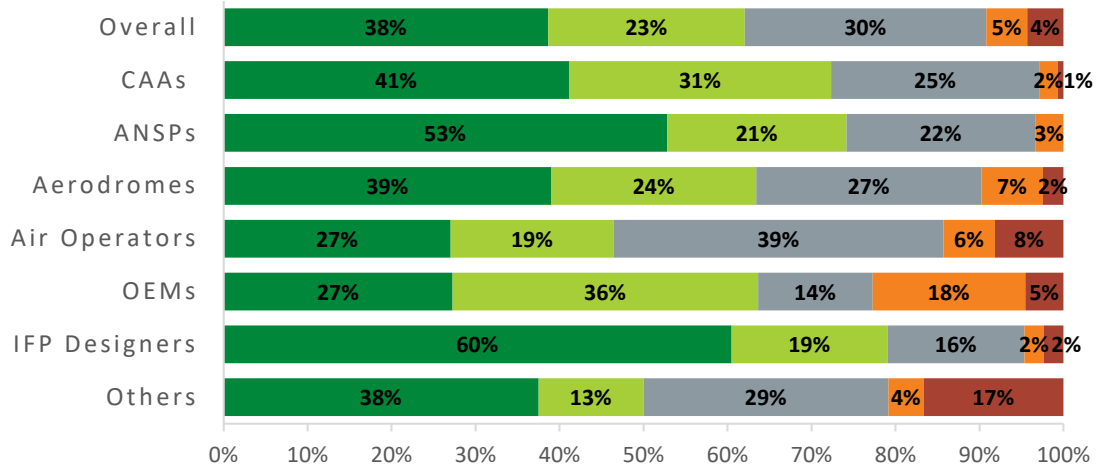
■ Strongly support   ■ Somewhat support   ■ Neutral  
■ Somewhat not support   ■ Strongly not support

- Overall, 61% of respondents either strongly or somewhat support moving to true north
- While 9% either somewhat or strongly do not support moving to true north
- 30% neutral

By ICAO regions



By stakeholder



## Level of support by region and stakeholder

- Regions with strongest level of support – ESAF (80%), NACC (78%) and WACAF (76%)
- MID most response rate not in support with 15%
- State CAAs (72%), ANSPs (74%) and IFPs (79%) with strongest support
- Air operators were most neutral stakeholder with 39%
- OEMs 23% not in support, significantly greater than overall trend of 9% but also above average support (63%) and lowest neutral response (14%)

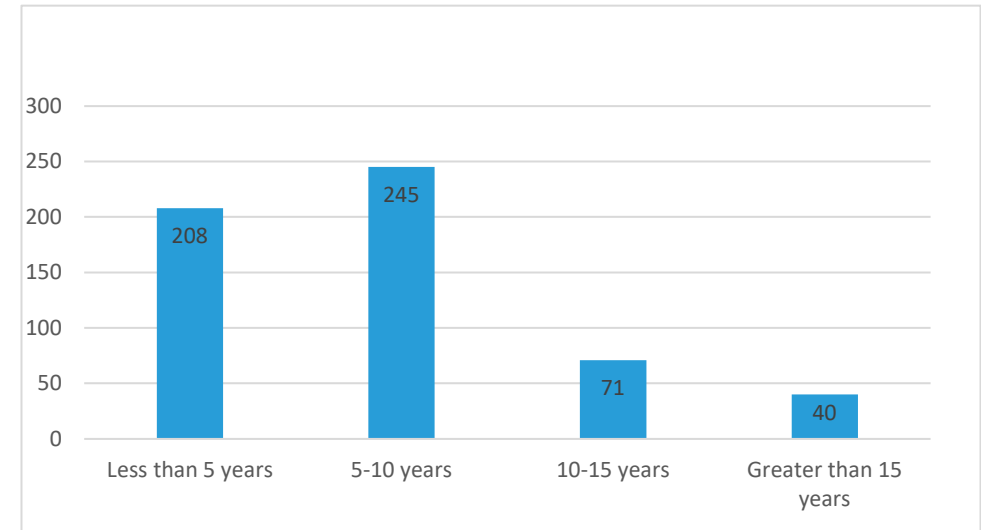
## Estimated timeframe to implement true north

- Majority of respondents indicated 10 years or less to implement true north with 81%
- OEM's were only outlier of overall trend with 32% indicating greater than 15 years

### Heat map of responses by stakeholders

Stakeholders	Less than 5 years	5-10 years	10-15 years	Greater than 15 years
Overall	37%	43%	13%	7%
State CAAs	36%	47%	13%	4%
ANSPs	48%	41%	8%	3%
Aerodrome	45%	38%	12%	5%
Air Operators	32%	43%	16%	9%
OEM	27%	27%	14%	32%
Flight procedures	42%	44%	11%	2%
Others	19%	54%	12%	15%

### Overall responses



# ANSP

## Activities to maintain MAGVAR

- Updating Instrument Approach Procedures 87%
- Updating en-route charts 84%
- Rotating VORs & TACANs 63%
- Maintaining MAGVAR in data systems 61%
- Adjusting runway numbering 54%
- Training personnel 35%
- Updating IRUs & FMS for flight check aircraft 13%

# ANSP

## What activities will change with true north?

- Amend docs, data and systems 57%
- Training personnel 17%
- Easier map/chart development and cost saving 13%
- No impact due to small MAG deviation areas 9%
- Develop transition plan 7%
- Change management / promotion awareness 4%
- Investment for one-time change 2%



# Aerodrome

## Activities to maintain MAGVAR

- Updating aerodrome data and documentation 93%
- Maintaining signage and runway numbering 63%
- Training personnel 49%

# Aerodrome

## What activities will change with true north?

- Amend docs, data and systems 59%
- Revise once TN runway markings and signage 49%
- Training personnel 15%
- Update procedures 12%

## Air operator

### Activities to maintain MAGVAR

<input checked="" type="checkbox"/>	Updating FMS	54%
<input checked="" type="checkbox"/>	Annual Compass/AHRU alignment	51%
<input checked="" type="checkbox"/>	Training personnel	41%
<input checked="" type="checkbox"/>	Maintaining operating restrictions and ADs	27%
<input checked="" type="checkbox"/>	Updating IRU MAGVAR tables	16%

## Air operator

### What activities will change with true north?

<input checked="" type="checkbox"/>	Training personnel	69%
<input checked="" type="checkbox"/>	Retrofit aircraft equipment	63%
<input checked="" type="checkbox"/>	IRUs would need to enable the MAG/TRUE functions	44%
<input checked="" type="checkbox"/>	Magnetically Slaved AHRS would have a one-time change	39%

## IFP designers

### Activities to maintain MAGVAR

- Periodically amend instrument flight procedures 98%
- Updating MAGVAR 84%
- Maintaining alignment between aerodrome data and ANSP IFP 79%
- Training personnel 53%

## IFP designers

### What activities will change with true north?

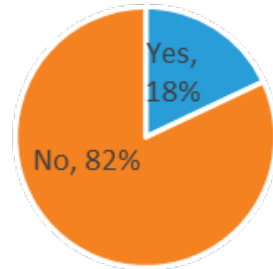
- Simplification of data acquisition 79%
- Ensuring design tools can bypass MAGVAR values 72%
- No need to amend procedures, charts etc. 63%

# OEM

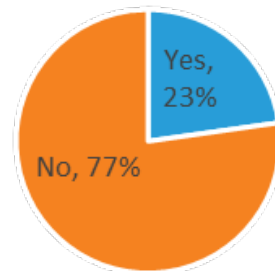
What activities will change with true north?

<input checked="" type="checkbox"/>	<b>Retrofit equipment and certification</b>	<b>86%</b>
<input checked="" type="checkbox"/>	<b>Comprehensive assessment/Transition plan/CONOPS</b>	<b>32%</b>
<input checked="" type="checkbox"/>	<b>Amend manuals &amp; publications</b>	<b>32%</b>
<input checked="" type="checkbox"/>	<b>No need to update MAGVAR</b>	<b>32%</b>
<input checked="" type="checkbox"/>	<b>Training personnel</b>	<b>9%</b>
<input checked="" type="checkbox"/>	<b>Coordinate with suppliers</b>	<b>9%</b>

Already operate in Remote and  
Oceanic Airspace in True?

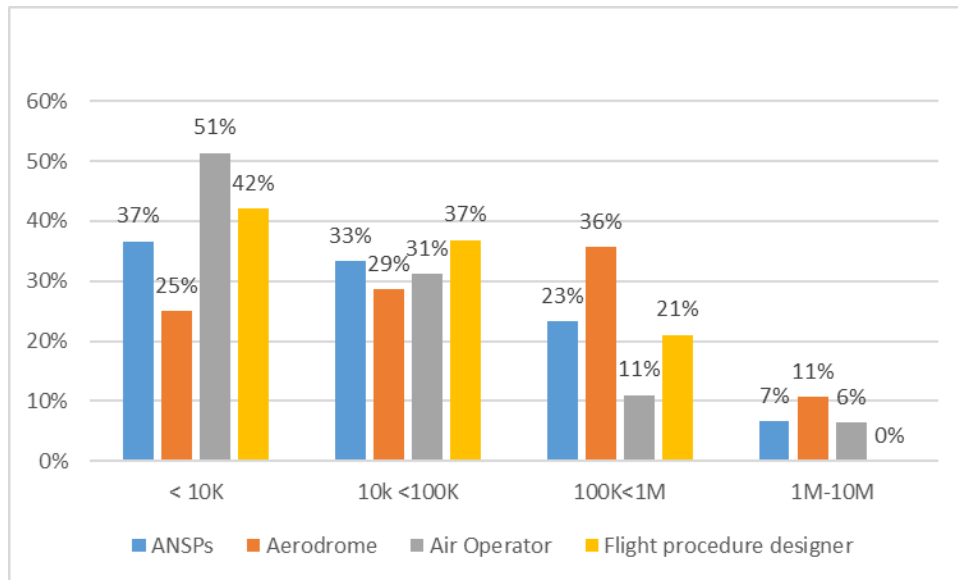


Already operate in Polar areas in  
True?

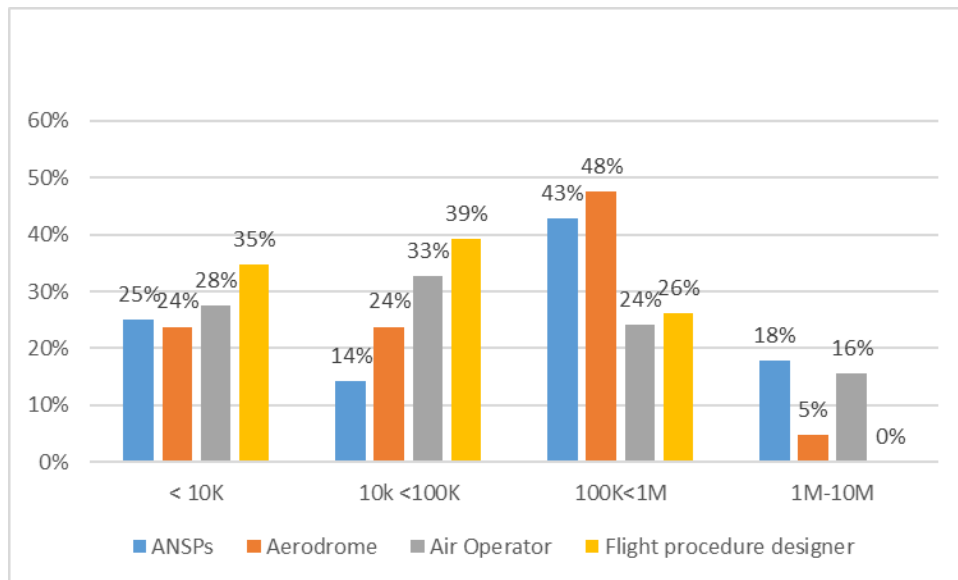


True north operations in  
polar, remote and  
oceanic airspace – all air  
operators

Approximate annual cost to maintain MAGVAR \$USD



Approximate one-time cost to implement true north \$USD



## Cost analysis

- Only received useable cost data from approximately 30% of respondents
- ANSPs and IFP designers predominantly spend less than \$10K
- 36% aerodrome respondents indicated spending between \$100K and \$1M annually
- 33% of air operators and 39% of IFP designers estimated between \$10K and \$100K to implement true north
- ANSPs and aerodromes largely estimated costs between \$100K and \$1M

## Examples FMS/IRU MAGVAR Updates Costs

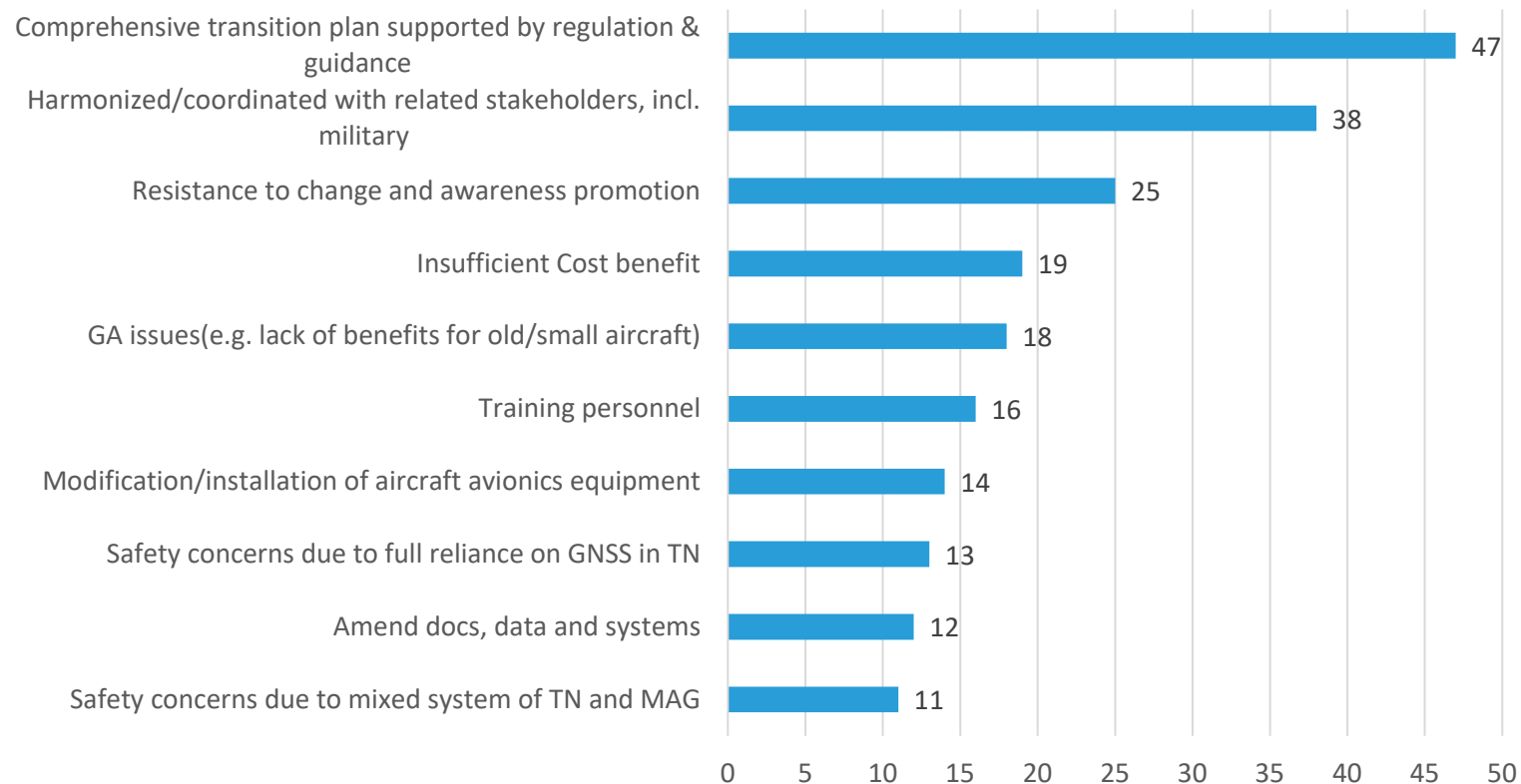
	Fleet size	FMS/IRU cost over 10 years (\$USD)	Cost per aircraft (\$USD over 10 years)
Large scale	900	\$40,300,000	\$47,305
	632	\$27,500,000	\$43,513
Middle scale	300	\$10,600,000	\$35,587
	200	\$8,000,000	\$40,000
Small scale	50	\$1,000,000	\$25,000
	10	\$4,000,000	\$40,000
<b>Average</b>			<b>\$38,567</b>

## Potential transition challenges

Stakeholder	Top potential challenges selected by stakeholder	Response
State CAAs	(1) Managing the one-time implementation cost in my State vs. the ongoing costs over time of managing MAGVAR	57%
	(2) Lack of concept of operations (CONOPS) and Transition Plan unless provided by ICAO	55%
	(3) Potential unmanaged safety risks introduced during the transition to True North	52%
ANSPs	(1) Time frame to safely effect the change	61%
	(2) Lack of CONOPS and Transition Plan unless provided by ICAO	48%
Aerodromes	(1) Lack of financial resources	46%
	(2) The complexity of removing MAGVAR Corrections	44%
Air Operators	(1) Aircraft downtime related to retrofitting aircraft equipment	57%
	(2) Make adjustments required to navigation equipment to adjust for MAGVAR	46%
	(3) Challenges with required equipment in non-IRU-equipped air operators	46%
OEMs	(1) Cost and efforts associated with certifications of modified avionics equipment	59%
	(2) Cost of converting magnetic sense inputs to the AHRU to True North heading outputs	55%
Flight Procedure designers	(1) The ability of data warehouses to manage a large-scale data reference change unless managed appropriately	47%
	(2) Workload management in updating flight procedures for this one-time change vs. continual periodic MAGVAR updates	47%



## Other identified challenges



- The need for a **comprehensive transition plan** was particularly strong among State CAAs and ANSPs
- The biggest additional challenge for aerodromes and IFP designers was related to **amending documents, data and systems**
- **Cost of equipping aircraft** was a big concern for OEMs and air operators

## Foreseen benefits

Stakeholder	Top foreseen benefits selected by stakeholder	Response
State CAAs	(1) Less financial and human resources spent on updating related magnetic variation (MAGVAR) tables, aeronautical charts, airports, navigation aids, flight management system (FMS)/inertial reference unit (IRU) tables in state owned aircraft, and other documentation	75%
	(2) Improvements to aviation safety by eliminating errors caused by MAGVAR	71%
ANSPs	(1) After a one-time cost with making the change to True, no future costs related to updating MAGVAR across all ANSP systems or data provided to air operators	80%
	(1) ANSPs can focus on new procedure development instead of issuing corrections for MAGVAR on current procedures (reduced procedure maintenance)	70%
	(1) Improvements to aviation safety by eliminating errors caused by MAGVAR	64%
Aerodromes	(1) Managing the one-time implementation cost in my organization versus the ongoing costs over time of managing MAGVAR	78%
	(1) Improvements to aviation safety by eliminating errors caused by MAGVAR	71%
Air Operators	(1) The elimination of two systems in aviation because All Weather products and charting products (currently produced in TRUE) would match air operations without conversion to MAGVAR values	59%
	(1) Less cost due to elimination of periodical FMC/IRU Epoch updates	54%
	(1) Removal of data discrepancies between aircraft and ATS systems as our future ATC and Air Operations data becomes tightly coupled	53%
OEMs	(1) Simplicity of future avionics design	73%
	(1) Less financial resources spent on updating MAGVAR	55%
IFP designers	(1) Flight procedure service providers can focus on new procedure development instead of corrections for MAGVAR on current procedures (reduced procedure maintenance)	91%
	(1) Simplification of IFP design work with all data suppliers and users on a common heading/track reference system instead of various EPOCH data currently used in different levels of aviation	88%

## Additional foreseen benefits

- Reduced workload and more simplified operations (13 related comments).
- Improved accuracy of navigation systems (7 related comments).
- Long-term cost savings (3 related comments).
- Makes use of today's advanced technology (3 related comments).

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## Key questions identified by the survey

- What timeframe will be needed to transition to true north globally?
- How will global acceptance and a harmonized transition be achieved?
- Should a transition to true north take a phased approach on a regional basis or be done concurrently across States and industry?
- What are the safety risks/hazards associated with a change to true north and how can they be identified and mitigated?
- What is the scope of impact, including equipment changes and operational changes, for general aviation and small aircraft operations?
- What will be the impact on large aircraft systems, equipment and operations?

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# Meetings with Key Stakeholders

## IAOPA

- Discussed key GA related questions to consider for any CONOPS
  - e.g. What will be the cost and effort to replace or retrofit avionics units in GA aircraft that rely on magnetic flux valves?

## General Aviation Manufacturers Association (GAMA)

- Concur with starting to lay the framework now for a future transition to True North
- Concern about inter-dependencies on aircraft systems, which needs to be studied e.g. radar altimetry

## IATA FOG Meeting

- Overall supportive but some uncertainty that it can be done globally across all States in a harmonized way
- Expressed need to properly identify and manage all implementation related risks

## Airlines Electronic Engineering Committee (AEEC)

- Strong support from Airlines representatives for a one-time conversion to true north which would save on turn-around times for MAGVAR updates
- Highlighted importance to understand all issues before committing to true north

# Summary

- Survey results show significant support for true north with 61% of respondents in support, 30% neutral and 9% not in support
- Main benefits include:
  - Long term cost savings
  - Improvements to aviation safety
  - More simplified operations, procedures, charts etc.
- Many implementation related challenges identified:
  - Transition plan supported by SARPs and guidance
  - Harmonized transition and coordination with all relevant stakeholders
  - Resistance to change and awareness promotion
  - Cost benefit inconclusive
- Inconclusive data on the cost benefit, may require further investigation
- A CONOPS and Transition Plan are needed before the full impact on aviation can be assessed



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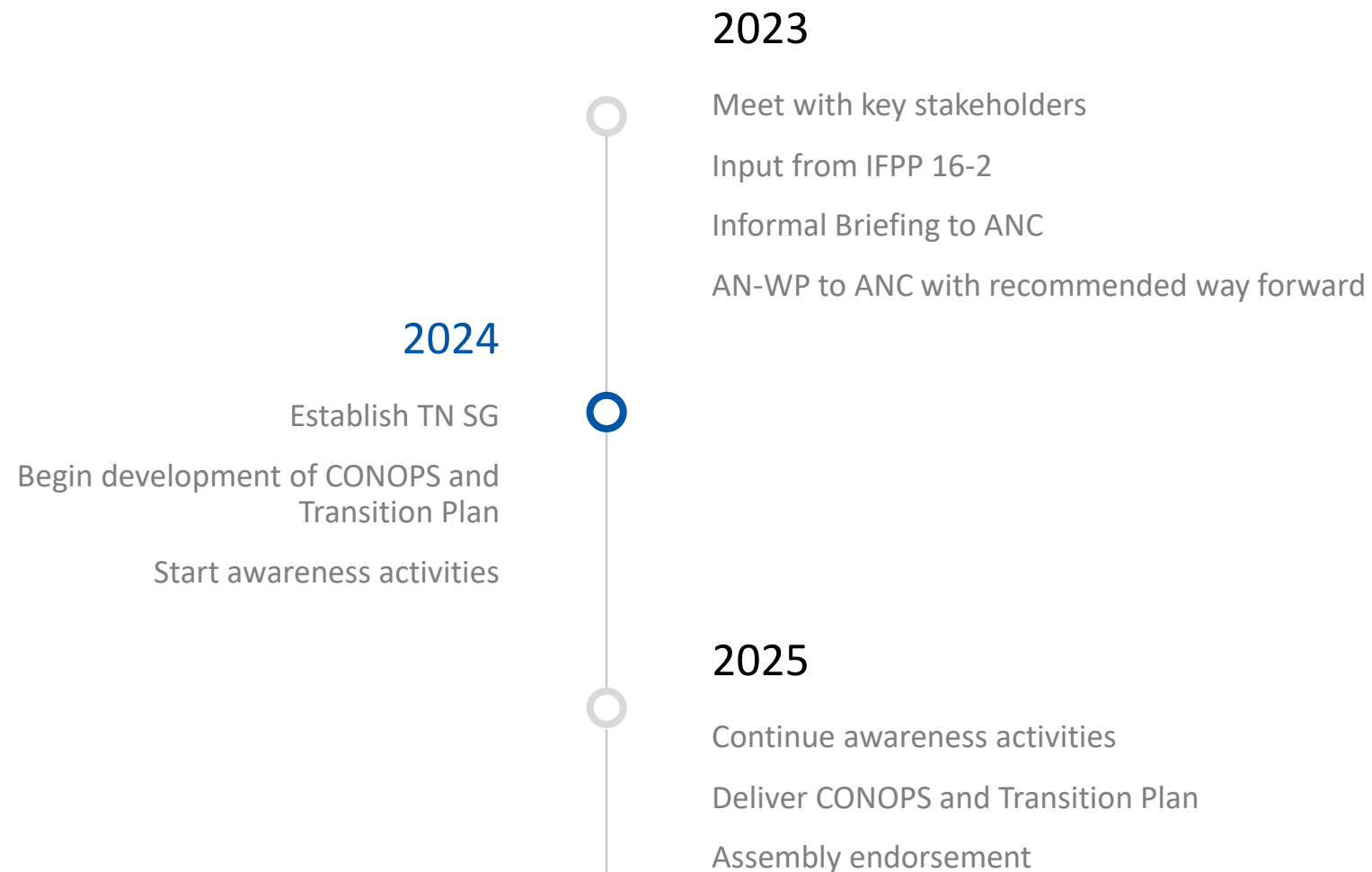
## Next steps

Where do we go from here?

The Secretariat is recommending to establish an inter-disciplinary group (e.g. study group) to support implementation planning

- Development of a global CONOPS and transition plan
  - Development of strategies for implementing true north
  - Analyzing the potential safety risks and identifying mitigations
  - Identify ANC Panels that will be impacted and propose appropriate tasks accordingly
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- SARPs and PANS proposal for amendments should be led by ICAO Panels in accordance with the CONOPS and associated job card
  - Continue awareness activities (webinars, symposia, workshops etc.)
  - AN-WP to ANC 2023 Fall Session recommending the above

# Preliminary Timeline







Thank You!