

ICAO GANP · ASBU FRAMEWORK

ASBU Elements

With the enablers that unlock each element, and the performance areas and KPIs they are intended to improve.

Training session · Source: ICAO GANP Portal, ASBU Elements



What this session covers

Four questions, answered in order — with worked examples throughout.

01 What an ASBU element is

Its anatomy: purpose, description, maturity, enablers, dependencies and performance impact.

02 How maturity levels work

The five-step ladder from Concept to Mandatory implementation, and what each means for a planner.

03 What enablers are

The concrete regulatory, procedural, technical and training items that must exist before an element can be deployed.

04 How performance is measured

Key Performance Areas (KPAs), focus areas, and the specific KPIs each element is intended to move.

Anatomy of an ASBU element

Every element is documented the same way. Learn the structure once and you can read any element.

01

Main purpose

The operational problem it solves, in one paragraph.

e.g. "To provide airborne collision avoidance as a last resort safety net for pilots."

02

New capabilities

What becomes possible that was not possible before.

e.g. TCAS 7.1 reduces nuisance alerts and improves alerting logic.

03

Description

How it actually works, operationally and technically.

e.g. Interrogate nearby aircraft → threat logic → resolution advisory.

04

Maturity level

How ready the element is to be deployed.

e.g. Concept → Validation → Standardization → Ready → Mandatory.

05

Enablers

What must exist before it can be implemented.

e.g. Certification, procedures, avionics, approvals, training — each with a year.

06

Performance impact

Which KPAs and KPIs it is intended to move.

e.g. Safety, ++, KPI20 and KPI23.

Reading an element code

Every element carries a code. It tells you the thread, the block and the variant — before you read a word of text.

ACAS-B1/1

- **ACAS** Thread — the operational domain
- **B1** Block — the timeline grouping
- **1** Variant — the element within the block

The four threads in this element set

Thread	Domain
ACAS	Airborne collision avoidance systems
ACDM	Airport collaborative decision making
AMET	Aeronautical meteorological information
APTA	Airport accessibility — PBN approaches and procedures

Dependencies and relations — the link types you will see

Evolution

This element is the successor of another

Relation – operational need

Must be in place for this element to operate

Relation – technology need

A technical prerequisite

Relation – information need

A required information feed

Relation – benefit

Not required, but amplifies the benefit

Relation – technology option

One of several valid technical routes

The seven link types, with a real example of each

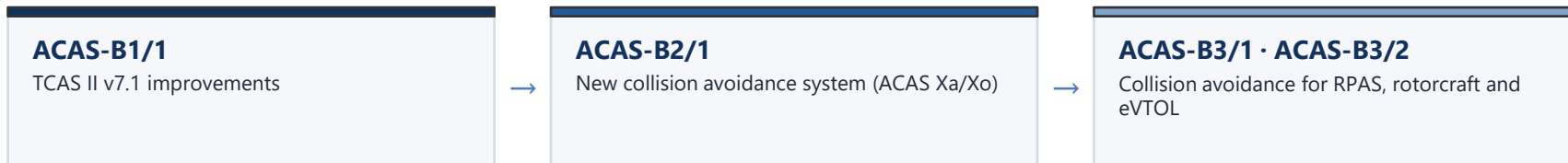
No element stands alone. Every element page lists the other elements it depends on, and how.

Link type	What it means	Real example from this set
Evolution	This element is the successor of an earlier one — same capability, next generation.	ACAS-B2/1 (new collision avoidance system) evolves from ACAS-B1/1.
Relation – operational need	Must already be operating, or this element cannot work at all.	ACDM-B0/2 needs RSEQ-B0/1 Arrival Management and RSEQ-B0/2 Departure Management.
Relation – technology need	A technical prerequisite — the system or infrastructure this one runs on.	ACAS-B1/1 needs ASUR-B0/1 ADS-B.
Relation – information need	A required data feed. Without it the element has nothing to reason on.	ACDM-B0/1 needs AMET-B0/1 and AMET-B0/2 meteorological products.
Relation – operational benefit	Not required, but implementing it makes this element perform better.	ACDM-B0/1 benefits from SURF-B0/2 surface situational awareness.
Relation – information benefit	Optional data that enriches the element's picture.	ACDM-B2/1 benefits from FICE-B2/2 Filing Service.
Relation – technology benefit	Optional technology that raises performance.	ACAS-B3/1 benefits from ASUR-B2/1 evolution of ADS-B and Mode S.

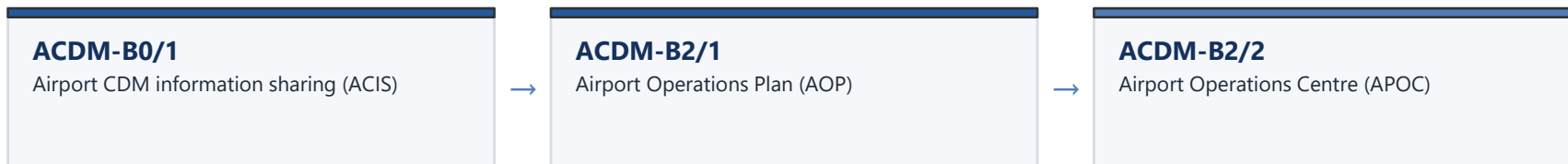
Evolution chains — how elements succeed one another

An evolution link is a roadmap: it tells you what you implement now and what replaces it later.

Airborne collision avoidance (ACAS thread)



Airport collaborative decision making (ACDM thread)



Read a chain left to right before you invest. What you spend on the current step should stay useful, or be a deliberate choice, once the successor arrives.

A worked dependency map: ACDM-B2/1

The Airport Operations Plan — one element, ten links. This is what a real dependency list looks like once you sort it.

Must be in place — blocking	Amplifies the benefit — optional
EVOLUTION ACDM-B0/1 Airport CDM information sharing (ACIS)	BENEFIT ACDM-B2/2 Airport Operations Centre (APOC)
OPERATIONAL NEED ACDM-B0/2 Integration with ATM network function	BENEFIT SURF-B1/1 Visual aids for ground traffic management
OPERATIONAL NEED NOPS-B1/3 Airport–network operations planning	BENEFIT SURF-B4/1 Enhanced vision systems for taxi operations
INFORMATION NEED AMET-B1/1 · B1/2 · B1/3 meteorological information	INFORMATION BENEFIT FICE-B2/2 Filing Service
TECHNOLOGY NEED SWIM-B2/1 Information service provision	INFORMATION BENEFIT FICE-B2/4 Flight Data Request Service

Sort every dependency list into needs and benefits. The needs column sets your sequence and critical path; the benefits column is where extra value appears once the element runs.

"Dependencies and relations" — a published example

Element ACAS-B3/2 — collision avoidance for rotorcraft and eVTOL. This is the published table, unchanged.

ACAS-B3/2 · DEPENDENCIES AND RELATIONS

Type of dependency	ASBU element
Evolution	ACAS-B2/1 — New collision avoidance system
Relation – technology need	ASUR-B0/1 — Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation – technology need	ASUR-B2/1 — Evolution of ADS-B and Mode S
Relation – operational benefit	CSEP-B3/2 — Remain Well Clear (RWC) functionality for UAS/RPAS
Relation – operational benefit	CSEP-B3/4 — Cooperative separation for lowest airspace operations
Relation – operational benefit	CSEP-B3/5 — Cooperative separation for higher airspace operations

How to read it

One evolution link

This element succeeds ACAS-B2/1 — it is the next generation, not a parallel option.

Two technology needs

Both ADS-B elements are prerequisites. Without that surveillance data the system has nothing to work with.

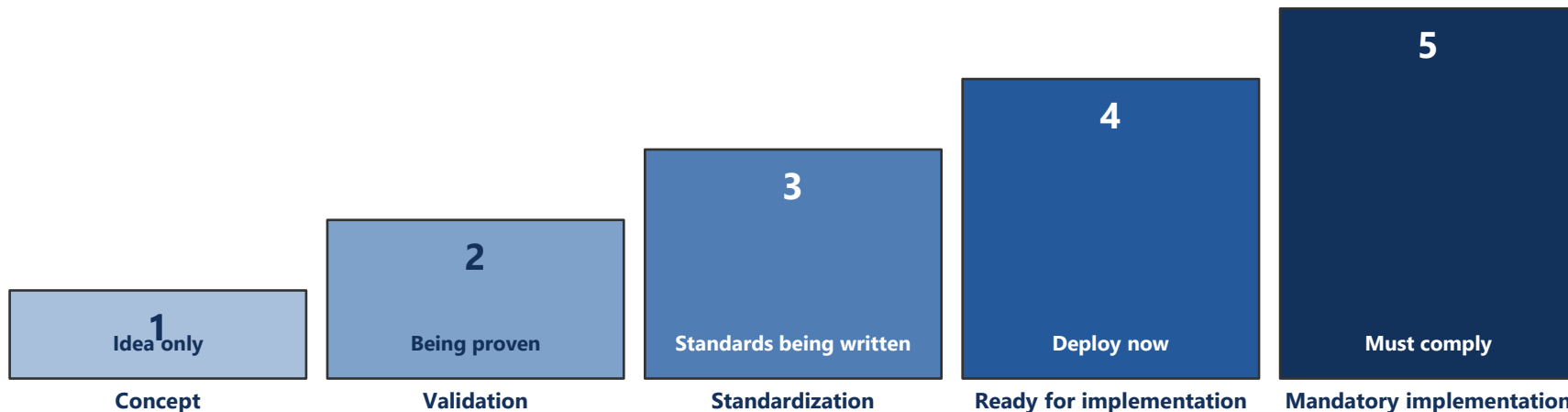
Three operational benefits

The CSEP separation elements are not required, but each one raises the value of implementing this element.

Every ASBU element page carries this same two-column table. Read the dependency type first — it tells you whether the linked element is a prerequisite or an optional amplifier.

The maturity ladder

Maturity answers one question: can a State deploy this element today?



Increasing readiness — and increasing obligation

Why it matters: maturity determines what you do next — monitor it, trial it, prepare for it, budget for it, or comply with it.

What each level means in practice

The same five levels, translated into planning action.

Level	State of the element	What a planner should do	Typical enabler status
1 Concept	Operational concept described; no standards, no validated performance.	Monitor only. Do not plan or budget.	None published.
2 Validation	Concept being proven through trials and prototypes.	Track results. Consider participating in trials.	Draft; being tested.
3 Standardization	SARPs and industry standards actively being developed.	Prepare. Engage in standards work; shape requirements.	In development; target years published.
4 Ready for implementation	Standards published and enablers available. Deployable today.	Plan, budget and implement where the benefit case holds.	Published and available.
5 Mandatory implementation	Required by ICAO provisions.	Comply. This is an obligation, not an option.	Published; compliance dates set.

The one mandatory element: ACAS-B1/1

ACAS improvements — carriage and operation of TCAS II version 7.1. Required by ICAO provisions, not optional.

WHERE IT SITS

Thread ACAS · Block B1 · Airborne Collision Avoidance System

WHY IT IS MANDATORY

Annex 6 and Annex 10 Vol IV require version 7.1; compliance dates are set.

PERFORMANCE IMPACT

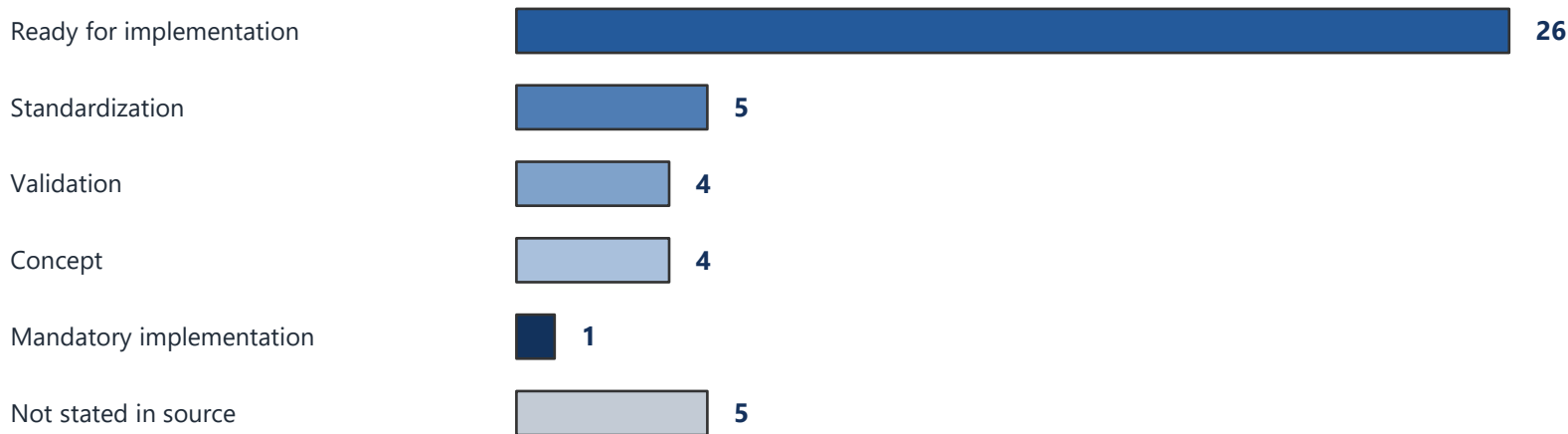
Safety ++ · KPI20 accidents · KPI23 airprox / TCAS alert / loss of separation

What must be in place — the full enabler set

Enabler	Category	Reference	Stakeholder	Year
TCAS II version 7.1 avionics	Avionics	ED-143 / DO-185B	Manufacturer	2008
ACAS procedures and phraseology	Procedures	Doc 4444, Doc 8168, Doc 9863	ANSP, operator	2010
Flight crew and controller training	Training	Doc 9863	Operator	2012
Airworthiness certification	Certification	Annex 6; Annex 10 Vol IV Amdt 85	CAA, manufacturer	2014
Operational approval	Regulation	Annex 6 Part I	CAA	2014
Extended hybrid surveillance (optional)	Avionics	ED-221A / DO-300A Ch.1	Manufacturer	2015

The maturity landscape of this element set

How the 45 element entries in this set are distributed across the ladder.



The headline

The large majority of these elements are already Ready for implementation — the constraint is rarely technology, it is the enablers: regulation, procedures, approvals and training. Only one element in this set is mandatory.

Level 1 — Concept

The operational concept is described, but nothing is validated and no standards exist. These are horizon items.

4 elements

Action: monitor only.

Elements at this level

ACDM-B4/1 Full integration of ACDM and TAM in TBO

AMET-B3/1 Meteorological observations information

AMET-B3/2 Meteorological forecast and warning information

AMET-B3/4 Meteorological information service in SWIM

Concept elements describe where the system is heading, not what you can buy. Use them as long-range architecture guidance — nothing more.

WORKED EXAMPLE

ACDM-B4/1 Full integration of ACDM and TAM in Trajectory Based Operations

WHAT IT IS The end-state for airport collaborative decision making: airport operations fully merged into trajectory based operations across the network.

WHY CONCEPT It depends on a trajectory based operations environment that does not yet exist. There is nothing to certify, procure or train against.

ENABLER STATUS No published enablers. No target years.

WHAT TO DO Watch it. Let it shape long-term architecture thinking, but keep it out of the investment plan.

Level 2 — Validation

The concept is being proven through trials, prototypes and demonstrations. Performance claims are being tested, not yet standardized.

4 elements

Action: track results; consider joining a trial.

Elements at this level

ACAS-B3/1 New collision avoidance capability as part of a detect and avoid system for RPAS

ACDM-B3/2 Advanced total airport management (TAM)

ACDM-B3/3 Extension of Advanced TAM to integrate AI/ML

ACDM-B3/4 Extension of Advanced TAM to integrate new entrants

Validation is where the evidence is generated. Joining a trial is the cheapest way to influence what the eventual standard will require of you.

WORKED EXAMPLE

ACAS-B3/1 Collision avoidance within a detect and avoid system for RPAS

WHAT IT IS ACAS Xu — a collision avoidance function tailored to remotely piloted aircraft, issuing horizontal turn advisories as well as vertical ones.

WHY VALIDATION Every human factors answer is “yes”: new task, new information, new equipment, new automation. All four need demonstrating.

ENABLERS IN FLIGHT Avionics standards ED-275 / DO-386 (2020); certification SARPs (2022); operational approval (2024); procedures (2026).

WHAT TO DO Follow the trial evidence and the 2022–2026 enabler path.

Level 3 — Standardization

The concept works. SARPs and industry standards are actively being written, and target years are published.

5 elements

Action: prepare; shape the standard.

Elements at this level

ACAS-B3/2 New collision avoidance capability for rotorcraft and UAM / AAM operations

AMET-B1/1 Meteorological observations information

AMET-B1/2 Meteorological forecast and warning information

AMET-B1/3 Climatological and historical meteorological information

AMET-B1/4 Dissemination of meteorological information

Standardization is the last point at which requirements are still negotiable. Once SARPs are published, the cost of change transfers to you.

WORKED EXAMPLE

ACAS-B3/2 Collision avoidance for rotorcraft and UAM / AAM operations

WHAT IT IS Extending the collision avoidance safety net to rotorcraft and eVTOL aircraft, with horizontal as well as vertical resolution advisories.

WHY STANDARDIZATION The underlying logic is proven. What is missing is the agreed standard for this new class of aircraft and operation.

PERFORMANCE Safety — maintain or improve the safety of urban air mobility (+).

WHAT TO DO Engage now. Requirements set at this stage are difficult to change later.

Level 4 — Ready for implementation

Standards are published and enablers are available. These can be deployed today — this is where the benefit is won.

26 elements

Action: plan, budget and implement.

Elements at this level

ACAS-B2/1 New collision avoidance system (ACAS Xa/Xo)

ACDM-B0/1 – B0/2 Airport CDM information sharing; ATM network integration

ACDM-B2/1 – B2/3 Airport Operations Plan, APOC, Total Airport Management

AMET-B0/1 – B0/4 Meteorological products: observations, forecasts, climatology, dissemination

AMET-B2/1 – B2/4 The same information set, delivered through SWIM

APTA-B0/1 – B0/8 PBN approaches, SIDs and STARs, CDO and CCO, performance based minima

APTA-B2/1 – B2/7 Advanced PBN approaches, helicopter operations, advanced CDO

WORKED EXAMPLE

APTA-B0/1 PBN Approaches (with basic capabilities)

WHAT IT IS Instrument approach procedures designed with performance based navigation, independent of ground based navigation aids, with vertical guidance for stabilized approaches.

WHY IT IS READY Every enabler is published and dated 2013 — design criteria, publication rules, crew SOPs, contingency procedures, aircraft eligibility, training and operational authorization.

PERFORMANCE Capacity (++) equip additional runway ends with instrument approaches, and reduce approach minima — both measured by KPI10, airport peak throughput.

WHAT TO DO Build the business case and deploy. Nothing is blocking it.

Level 5 — Mandatory implementation

Required by ICAO provisions. Not a choice, and not subject to a local benefit case.

1 element

Action: comply.

Elements at this level

ACAS-B1/1 ACAS Improvements — TCAS version 7.1

Mandatory elements sit outside the benefit case. There is no local cost-benefit decision to make — only a compliance and assurance question.

WORKED EXAMPLE

ACAS-B1/1 ACAS Improvements (TCAS version 7.1)

WHAT IT IS Short-term improvements to airborne collision avoidance: fewer nuisance alerts and corrected alerting logic for geometries implicated in the Überlingen accident.

WHY IT IS MANDATORY It closes a demonstrated safety gap. Requirements sit in ICAO Annex 6 and Annex 10 Volume IV (Amendment 85), so States carry a compliance obligation.

PERFORMANCE Safety (+ +): improve mid-air collision avoidance — KPI20, aircraft accidents, and KPI23, airprox / TCAS alerts / loss of separation / mid-air collisions.

WHAT TO DO Verify fleet compliance and training currency.

What an enabler is

Maturity tells you whether the enablers exist. The enabler list tells you which ones, who owns them, and when.

An ASBU element is a capability. Its enablers are the standards, procedures, equipment, approvals and training that turn that capability into something an operator can legally and safely use.

Every enabler is recorded against six fields

Category

The kind of enabler

e.g. Regulatory provisions

Type

The sub-kind

e.g. Certification

Name

The specific item

e.g. TCAS version 7.1 certification

Description / references

The document that defines it

e.g. ICAO Annex 10 Vol IV, Amdt 85

Stakeholders

Who must deliver it

e.g. CAA; aircraft manufacturer

Year

When it is or was available

e.g. 2014

The practical point: the latest year in the enabler list is the earliest date the element could realistically be deployed.

Enabler categories and types

Five categories recur — each with a different owner, which is why implementation is always multi-stakeholder.

Category	Types seen in this set	Who typically owns it	What it looks like in practice
Regulatory provisions	Certification; Operational approval	CAA; aircraft manufacturer	SARPs published, then a State approval for each operator.
Operational procedures	Operations; Design; Contingency operations	ANSP; aircraft operator	PANS-OPS procedure design, crew SOPs, phraseology, abnormal-event procedures.
Airborne system capability	Aircraft system; Surveillance	Aircraft manufacturer; operator	Avionics built to a EUROCAE / RTCA standard and listed in the flight manual.
Ground system capability	Ground and information systems	ANSP; aerodrome operator	Data sharing platforms, surveillance and meteorological infrastructure.
Training	—	Aircraft operator; ANSP	Crew, controller, procedure designer and airspace planner training.

ACAS-B1/1 — the full enabler set

A mandatory element. Read the year column: the avionics standard came first, the mandate followed six years later.

Category	Type	Enabler	Reference	Stakeholders	Year
Airborne system capability	Aircraft system	TCAS II version 7.1 avionics	EUROCAE ED-143 / RTCA DO-185B	Aircraft manufacturer	2008
Operational procedures	Operations	Procedures for ACAS operation, including phraseology	Doc 4444; Doc 8168; Doc 9863	ANSP; aircraft operator	2010
Training	—	Training for TCAS version 7.1 operations	New resolution advisory wording	Aircraft operator	2012
Regulatory provisions	Certification	TCAS version 7.1 certification	Annex 6; Annex 10 Vol IV (Amdt 85)	CAA; aircraft manufacturer	2014
Regulatory provisions	Operational approval	TCAS II version 7.1 operational approval	Annex 6 Part I	CAA	2014
Airborne system capability	Surveillance	Extended hybrid surveillance avionics (optional)	EUROCAE ED-221A / RTCA DO-300A Ch.1	Aircraft manufacturer	2015

Read it this way: six enablers, four different owners, spread over seven years. One missing enabler blocks the whole element.

APTA-B0/1 — a ready-to-implement enabler set

Contrast with the previous slide: every enabler landed in the same year — which is why this is deployable now.

Category	Type	Enabler	Reference	Stakeholders	Year
Operational procedures	Design	PBN approach procedure design and use	Doc 8168 PANS-OPS Vol I & II	ANSP	2013
Operational procedures	Design	Procedure validation, approval and publication	Annex 4; Doc 8071 Vol I; Doc 9906	ANSP; CAA	2013
Operational procedures	Operations	Crew SOPs for PBN approaches	Doc 9613 (PBN Manual)	Aircraft operator	2013
Operational procedures	Contingency operations	Contingency procedures for abnormal events	Doc 9613 (PBN Manual)	Aircraft operator	2013
Airborne system capability	—	Aircraft eligible for the RNP APCH navigation specification	Doc 9613; Aircraft Flight Manual	Aircraft manufacturer; operator	2013
Training	—	Training for crew, controllers, procedure designers and airspace planners	Doc 9613; PANS-OPS Vol II; Doc 9992	ANSP; aircraft operator	2013
Regulatory provisions	Operational approval	Operational authorization for PBN approaches	Doc 9997 (PBN Ops Approval Manual)	CAA; aircraft operator	2013

Note: no new ground infrastructure is required — the enablers are procedural, regulatory and training. That is why PBN scales.

Areas of performance — the KPAs

Every element declares which Key Performance Areas it improves, narrowed to a focus area and an objective.

Safety	Capacity	Efficiency	Predictability
FOCUS AREA Safety nets and operational safety improvements	FOCUS AREA Capacity, throughput and utilization	FOCUS AREA Vertical flight efficiency; flight time and distance	FOCUS AREA Punctuality
EXAMPLE OBJECTIVE Improve mid-air collision avoidance	EXAMPLE OBJECTIVE Equip additional runway ends; reduce approach minima; increase arrival rate	EXAMPLE OBJECTIVE Remove level-offs in climb and descent; reduce taxi-out time	EXAMPLE OBJECTIVE Adhere to scheduled off-block and on-block times
KPI20, KPI23	KPI10, KPI11	KPI17, KPI19, KPI02	KPI01, KPI14, KPI03

Impact notation

+ moderate intended improvement ++ significant intended improvement

Intended performance impact — Safety and Capacity

Every element page states which KPA it improves, by how much, and against which KPI. Grouped here by KPA.

SAFETY			
Focus area: Collision avoidance and separation			
ACAS-B1/1	Improve mid-air collision avoidance (safety net)	++	KPI20 accidents · KPI23 airprox, TCAS alert, loss of separation

CAPACITY			
Focus area: Capacity, throughput and utilization			
APTA-B0/1	Equip additional runway ends with instrument approaches	++	KPI10 Airport peak throughput
APTA-B2/7	Increase airport arrival rate	++	KPI11 Airport throughput efficiency

Reading it in practice

Safety and capacity gains come from different levers. Safety improves through the airborne safety net, which every operator carries — a State-wide, mandatory measure. Capacity improves runway by runway, so the benefit case is local: count the runway ends without instrument approaches, and the peak-hour demand they would serve.

Column key Element · performance objective supported · intended impact (+ moderate, ++ significant) · KPI measured against

Intended performance impact — Efficiency and Predictability

The same reading, applied to the two KPAs where most of this element set delivers its benefit.

EFFICIENCY			
Focus area: Vertical flight efficiency · flight time and distance			
APTA-B0/4	Reduce level-off during descent (continuous descent operations)	++	KPI19 Level-off during descent
APTA-B0/5	Reduce level-off during climb (continuous climb operations)	++	KPI17 Level-off during climb
ACDM-B0/1	Reduce taxi-out additional time	+	KPI02 Taxi-out additional time

PREDICTABILITY			
Focus area: Punctuality			
ACDM-B0/1	Improve departure and arrival punctuality and ATFM slot adherence	+	KPI01 Departure punctuality · KPI14 Arrival punctuality · KPI03 ATFM slot adherence

Reading it in practice

One element can carry more than one KPA — ACDM-B0/1 appears under both. Count every KPA an element touches, not just the headline one.

Column key Element · performance objective supported · intended impact (+ moderate, ++ significant) · KPI measured against

The KPIs referenced by these elements

Ten indicators carry the performance case for this entire element set.

KPI01	Departure punctuality	Predictability	KPI14	Arrival punctuality	Predictability
KPI02	Taxi-out additional time	Efficiency	KPI17	Level-off during climb	Efficiency
KPI03	ATFM slot adherence	Predictability	KPI19	Level-off during descent	Efficiency
KPI10	Airport peak throughput	Capacity	KPI20	Number of aircraft accidents	Safety
KPI11	Airport throughput efficiency	Capacity	KPI23	Airprox / TCAS alerts / loss of separation / near mid-air and mid-air collisions	Safety

Why so few?

A KPI is only listed when the element is expected to move it measurably. A short KPI list is a sign of a focused element, not a weak one — and it tells you exactly which measurement you need in place before you deploy.

From element to KPI — worked mappings

Each row is a real declaration: element → KPA → focus area → objective → impact → KPI.

Element	KPA	Focus area	Performance objective	Impact	KPI
ACAS-B1/1	Safety	Safety nets	Improve mid-air collision avoidance	++	KPI20, KPI23
ACDM-B0/1	Efficiency	Flight time & distance	Reduce taxi-out additional time	+	KPI02
ACDM-B0/1	Predictability	Punctuality	Increase adherence to scheduled off-block time	+	KPI01
ACDM-B0/1	Predictability	Punctuality	Increase adherence to scheduled on-block time	+	KPI14
APTA-B0/1	Capacity	Capacity, throughput & utilization	Equip additional runway ends with instrument approaches	++	KPI10
APTA-B0/4	Efficiency	Vertical flight efficiency	Avoid penalties from a non-optimum top of descent	++	KPI19
APTA-B0/5	Efficiency	Vertical flight efficiency	Reduce altitude constraints (level capping) during climb	++	KPI17
APTA-B2/7	Capacity	Capacity, throughput & utilization	Increase airport arrival rate	++	KPI11

End-to-end example — APTA-B0/4, CDO (Basic)

One element, read completely, using everything covered so far.

01 What it is

Continuous descent operations. Arriving aircraft descend without interruption from the top of descent, so engines are not required to apply power on the way down.

02 New capability

ATC procedures that facilitate an uninterrupted descent, with reduced controller–pilot interaction.

03 Maturity

Ready for implementation. Every enabler is published, so this is deployable today — plan and budget it.

04 Depends on

APTA-B0/2 PBN SIDs and STARs (operational need); AMET-B0/1 and B0/2 meteorological products (information need); RSEQ-B0/3 point merge (benefit).

05 Enablers

Procedure design and publication, crew SOPs, and controller training — procedural rather than infrastructure.

06 Performance

KPA: Efficiency. Focus area: vertical flight efficiency. Impact: ++. Measured by KPI19, level-off during descent.

Five things to take away

- | | | |
|---|---|--|
| 1 | Maturity level is the first field to read. | It tells you whether to monitor, prepare, or deploy — before you read anything else. |
| 2 | Most of this set is already deployable. | 26 of 45 entries are Ready for implementation. The opportunity is available now. |
| 3 | Enablers, not technology, are the constraint. | Regulation, procedures, approvals and training are what gate deployment, and they have different owners. |
| 4 | The latest enabler year is your earliest start date. | Read the year column before you commit to a delivery date. |
| 5 | Every element declares how it will be measured. | KPA, focus area, objective, impact and KPI. Put the measurement in place before you deploy, or you cannot prove the benefit. |