

FASID- Chapter XXX

A PERFORMANCE-BASED AIR NAVIGATION SYSTEM

1. INTRODUCTION

1.1 The air navigation system is increasingly being discussed in terms of performance, as the corporatized environment places an increasing pressure on accountability. This chapter examines the need for adopting a performance based approach (PBA) when planning, implementing, operating and monitoring the air navigation systems.

1.2 Performance may be seen from many perspectives. At the highest levels, performance relates to political and socio-economic expectations of society and/or the aviation community. The measures necessary to meet these expectations should govern the design of the system. These general expectations are relative to the effective operation of the air navigation systems and include *safety, security, environment, efficiency, cost-effectiveness, capacity, access and equity, flexibility, predictability, global interoperability and participation* by the entire aviation community.

1.3 These expectations often compete with each other. Some aviation community members (the *Global Air Traffic Management Operational Concept* (Doc 9854) refers) have explicit economic expectations, others efficiency and predictability, while some are concerned with access and equity; and all have safety expectations. For optimum air navigation system performance, each of these sometimes competing expectations needs to be balanced. In an integrated system, changes to one expectation area will likely have an effect on other areas. It is necessary therefore, to assess the whole system effect when planning a change in a specific area. This may require, or lead to, trade-offs in performance. This is generally acceptable with the exception of safety, wherein acceptable levels of safety must be achieved.

2. PERFORMANCE FRAMEWORK

2.1 The notion of a PBA emanated from good industry practices that have emerged over many years. In essence, a Performance Framework is a set of principles, requirements, terminology and describes the building blocks/tools.

2.2 The PBA adheres to the following principles: strong focus on results through adoption of performance objectives and targets; collaborative decision making driven by the results; and reliance on facts and data for decision making. Assessment of achievements is periodically checked through a performance review, which in turn requires adequate performance measurement and data collection capabilities.

2.3 The State or a region that has adopted a PBA, must acknowledge the following requirements: commitment (at the top); agreement on goals (desired results); responsibility (who is accountable); human resources and know-how (culture and skills); data collection, processing, storage and reporting; collaboration and coordination (with other partners) and cost implication (what does it cost).

2.4 The advantages of PBA include: results oriented, transparency and promotion of accountability; shifts from prescribing solutions to specifying desired performance; employs quantitative and qualitative methods; avoids a technology driven approach; helps decision makers to set priorities, makes the most appropriate trade-offs, and allows optimum resource allocation.

2.5 It is essential to use harmonized terminology in applying a PBA to air navigation systems. For performance measurement four basic terms are explained. a) *Performance objective*: Performance Objective is defined in a qualitative way - a desired trend from today's performance (e.g. improvement), within a well specified ATM planning environment. In other words it is a high level statement of outcome that satisfies ATM community expectations. Example: In ASBU approach the module itself becomes performance objective – ASBU B0-15: Improve traffic flow through runway sequencing; b) *Performance target*: An agreed numerical value representing the minimum performance level at which an objective is considered to be 'achieved'. Example: Ten percent increase in the capacity of terminal airspace; c) *Performance Indicator*: It is a measure of progressive achievement of performance objective. Example: Three per cent increase in the capacity of terminal airspace as against the target of ten per cent; and c) *Performance Metric*: The metric is a quantitative measure of system performance – how well the system is functioning. Always indicated in percentage or in number. Example: Number of movements per day per aerodrome; Kilograms of fuel saved per operation; Kilograms of CO2 emissions reduced per operation; Percentage of instrument runway ends having an APV.

3. REGIONAL AND NATIONAL PLANNING FOR AIR NAVIGATION SYSTEMS

3.1 In 2008, all ICAO planning and implementation regional groups (PIRGs), while adopting a regional performance framework, invited States to implement a national performance framework for air navigation systems on the basis of ICAO guidance material and aligned with the regional performance objectives, the regional air navigation plan and the Global ATM Operational Concept. The performance framework was to include identification of national performance objectives taking into consideration user expectations and completion of national performance framework forms. Further to the adoption of performance framework by all PIRGs, the Secretary General, in order to provide more guidance to States, established a series of hands-on workshops for all ICAO Regions.

4. THE PLANNING PROCESS

4.1 The planning process starts by identifying the homogeneous ATM areas, major traffic flows and aerodromes. Then, planners should conduct a survey of the following, as appropriate:

- a) Current and foreseen aircraft population and its capabilities;
- b) Forecasts of average aircraft movements as well as those in peak periods;
- c) Aerodrome characteristics;
- d) Air Navigation infrastructure, including human resource availability;
- e) Civil/military access requirements and consideration of special use airspace (SUA); and
- f) Other requirements.

4.2 An analysis of the data gathered should lead to the identification of "gaps" in performance. Strategies should then be developed to resolve the performance "gaps". During this process, the ASBU modules should be evaluated against the gaps to identify modules that can provide the operational improvements, needed to meet the performance objective(s). This planning process would continue with the development of scenarios for implementation, initial business case analyses on these and the preliminary development of infrastructure support requirements.

4.3 Additional steps would include development of implementation plans and funding profiles, and further review of human resource requirements to support the identified initiatives, followed by further cost-benefit analyses. Finally, national and regional implementation plans would be developed or amended based on the selected ASBU modules. This is an iterative process which may require repetition of several steps until a final choice of initiatives is selected. The planning tools will assist planners in carrying out the above steps. **Figure 1** is an illustration of such a planning flow chart.

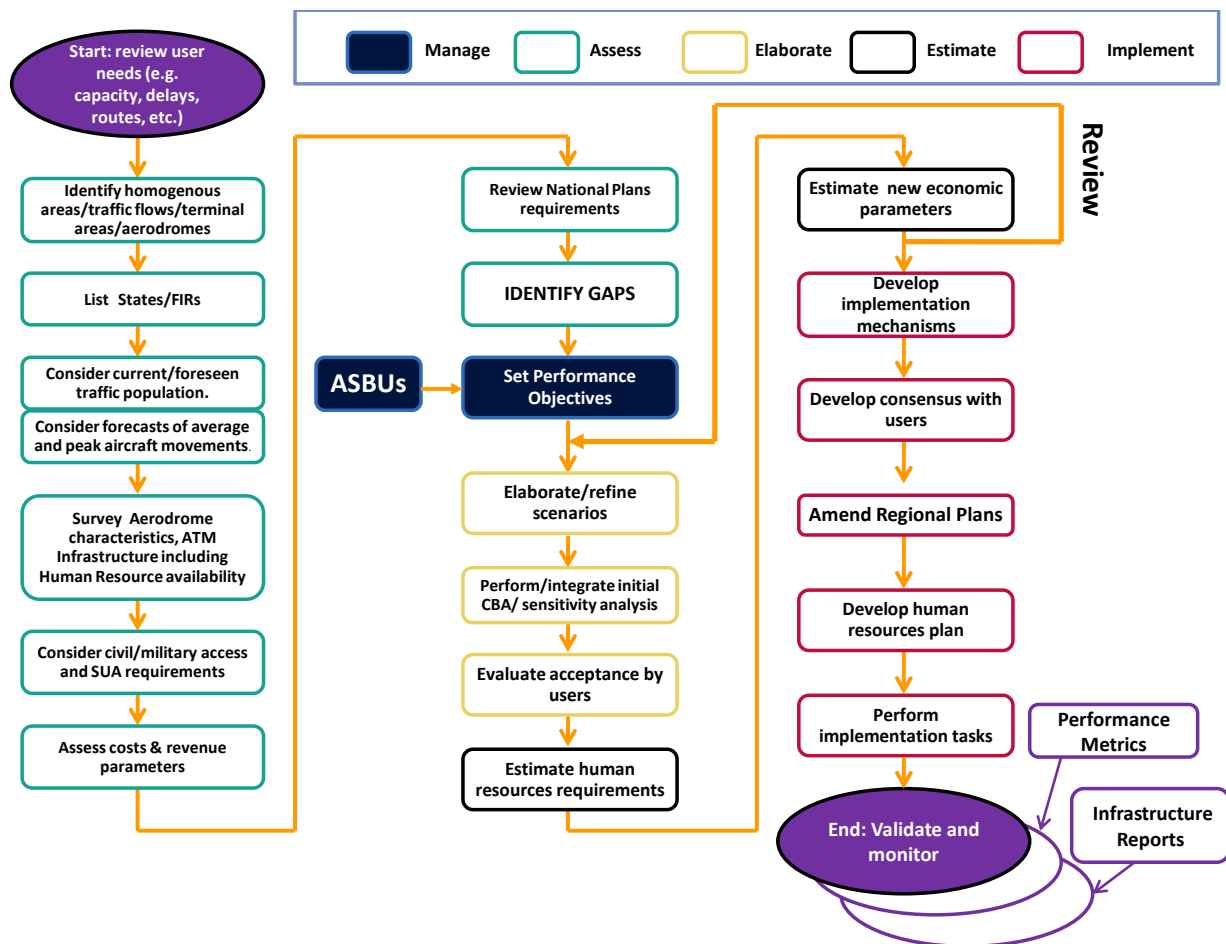


Figure 1 – Flow chart for regional and national Planning for air navigation systems

5. PERFORMANCE FRAMEWORK FORM

5.1 The follow-up to performance framework calls for a uniform regional and national monitoring process which would involve implementation of several tasks to achieve the relevant performance objectives. In order to support this process and provide a common approach, a management and report form has been proposed and designated as “Air Navigation Report Form (ANRF)”. A sample

ANRF, which has been standardized and shown here, is applicable to both regional and national planning for air navigation systems. The ANRF will be the basis for performance monitoring of the ASBU implementation at the regional and national levels. The Regional Air Navigation Reports that provide data for shared review will be utilized in developing the annual Global Air Navigation Report. The spirit of such a global review is to assist in understanding which areas requires special attention and effectively improve air navigation performance in the future. This review also provides an opportunity for world civil aviation community to compare the progress across different ICAO regions in the establishment of air navigation infrastructure.

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(This template demonstrates how ANRF to be used.
The data inserted here refers to ASBU B0-05 as an example only)

Regional and National planning for ASBU Modules

REGIONAL/NATIONAL PERFORMANCE OBJECTIVE – B0-05: Improved Flexibility and Efficiency in Descent Profiles (CDO)					
Performance Improvement Area 4: Efficient Flight Path – Through Trajectory-based Operations					
ASBU B0-05: Impact on Main Key Performance Areas (KPA)					
	Access & Equity	Capacity	Efficiency	Environment	Safety
Applicable	N	N	Y	Y	Y
ASBU B0-05: Implementation Progress					
Elements			Implementation Status (Ground and Air)		
1. CDO					
2. PBN STARs					
ASBU B0-05: Implementation Roadblocks/Issues					
Elements	Implementation Area				
	Ground system Implementation	Avionics Implementation	Procedures Availability	Operational Approvals	
1. CDO					
2. PBN STARs					

ASBU B0-05: Performance Monitoring and Measurement (Implementation)	
Elements	Performance Indicators/Supporting Metrics
1. CDO	Indicator: Percentage of international aerodromes/TMAs with CDO implemented Supporting metrics: Number of international aerodromes/TMAs with CDO implemented
2. PBN STARs	Indicator: Percentage of international aerodromes/TMAs with PBN STARs implemented Supporting metrics: Number of international aerodromes/TMAs with PBN STARs implemented

ASBU B0-05: Performance Monitoring and Measurement (Benefits)	
Key Performance Areas	Performance Metrics
Access & Equity	Not applicable
Capacity	Not applicable
Efficiency	Kilograms of fuel saved per flight
Environment	Kilograms of CO ₂ emissions reduced per flight (= KGs fuel saved per flight x 3.157)
Safety	Number of controlled flight into terrain (CFIT) incidents/accidents

AIR NAVIGATION REPORT FORM HOW TO USE - EXPLANATORY NOTES

1. **Air Navigation Report Form (ANRF):** This form provides a standardized approach to implementation monitoring and performance measurement of Aviation System Block Upgrades (ASBU) Modules. The Planning and Implementation Regional Groups (PIRGs) and States could use this report format for their planning, implementation and monitoring framework for ASBU Modules. Also, other reporting formats that provide more details may be used but should contain as a minimum the elements described below. The Reporting and monitoring results will be analysed by ICAO and aviation partners and then utilized in developing the Annual Global Air Navigation Report. The Global Air Navigation Report conclusions will serve as the basis for future policy adjustments aiding safety practicality, affordability and global harmonization, amongst other concerns.
2. **Regional/National Performance objective:** In the ASBU methodology, the performance objective will be the title of the ASBU module itself. Furthermore, indicate alongside corresponding Performance Improvement area (PIA). Consequently, for ASBU Block 0, a total of 18 ANRFs will need to be developed that reflects respective 18 Modules.
3. **Impact on Main Key Performance Areas:** Key to the achievement of a globally interoperable ATM system is a clear statement of the expectations/benefits to the ATM community. The expectations/benefits are referred to eleven Key Performance Areas (KPAs) and are interrelated and cannot be considered in isolation since all are necessary for the achievement of the objectives established for the system as a whole. It should be noted that while safety is the highest priority, the eleven KPAs shown below are in alphabetical order as they would appear in English. They are access/equity; capacity; cost effectiveness; efficiency; environment; flexibility; global interoperability; participation of ATM community; predictability; safety; and security. However, out of these eleven KPAs, for the present, only five have been selected for reporting through ANRF, which are Access & Equity, Capacity, Efficiency, Environment and Safety. The KPAs applicable to respective ASBU module are to be identified by marking Y (Yes) or N (No).
4. **Implementation Progress:** This section indicates status of progress in the implementation of different elements of the ASBU Module for both air and ground segments.
5. **Elements related to ASBU module:** Under this section list elements that are needed to implement the respective ASBU Module. Furthermore, should there be elements that are not reflected in the ASBU Module (example: In ASBU B0-80/Airport CDM, Aerodrome certification and data link applications D-VOLMET, D-ATIS, D-FIS are not included; Similarly in ASBU B0-30/AIM, note that WGS-84 and eTOD are not included) but at the same time if they are closely linked to the module, ANRF should specify those elements. As a part of guidance to PIRGs/States, the FASID (Volume II) of every Regional ANP will have the complete list of all 18 Modules of ASBU Block 0 along with corresponding elements, equipage required on the ground and in the air as well as metrics specific to both implementation and benefits.
6. **Implementation Status (Ground/Air):** Planned implementation date (month/year) and the current status/responsibility for each element are to be reported in this section. Please provide as much details as possible and should cover both avionics and ground systems. If necessary, use additional pages.

7. **Implementation Roadblocks/Issues:** Any problems/issues that are foreseen for the implementation of elements of the Module are to be reported in this section. The purpose of the section is to identify in advance any issues that will delay the implementation and if so, corrective action is to be initiated by the concerned person/entity. The four areas, under which implementation issues, if any, for the ASBU Module to be identified, are as follows:

- Ground System Implementation:
- Avionics Implementation:
- Procedures Availability:
- Operational Approvals:

Should be there no issues to be resolved for the implementation of ASBU Module, indicate as “NIL”.

8. **Performance Monitoring and Measurement:** Performance monitoring and measurement is done through the collection of data for the supporting metrics. In other words, metrics are quantitative measure of system performance – how well the system is functioning. The metrics fulfil three functions. They form a basis for assessing and monitoring the provision of ATM services, they define what ATM services user value and they can provide common criteria for cost benefit analysis for air navigation systems development. The Metrics are of two types:

- A. Implementation Indicators/supporting metrics: This indicator supported by the data collected for the metric reflects the status of implementation of elements of the Module. For example- Percentage of international aerodromes with CDO implemented. This indicator requires data for the metric “number of international aerodromes with CDO”.
- B. Benefit Metrics: This Metric allows to asses benefits accrued as a result of implementation of the module. The benefits or expectations, also known as Key Performance Areas (KPA), are interrelated and cannot be considered in isolation since all are necessary for the achievement of the objectives established for the system as a whole. It should be noted that while safety is the highest priority, the eleven KPAs shown below are in alphabetical order as they would appear in English. They are access/equity; capacity; cost effectiveness; efficiency; environment; flexibility; global interoperability; participation of ATM community; predictability; safety; and security. However, out of these eleven KPAs, for the present, only five have been selected for reporting through ANRF, which are Access & Equity, Capacity, Efficiency, Environment and Safety. It is not necessary that every module contributes to all of the five KPAs. Consequently, a limited number of metrics per type of KPA, serving to measure the module(s)’ implementation benefits, without trying to apportion these benefits between module, have been identified at the end of this table. This approach would facilitate States in collecting data for the chosen metrics.

On the basis of examples of Performance Indicators/supporting Metrics detailed in this document, PIRGs/States to reflect under this section the appropriate metrics that represents the monitoring of respective ASBU Module both in terms of implementation as well as benefits to five KPAs.

The impact on KPAs could be extended to more than five KPAs mentioned above if maturity of the system allows and the process is available within the State to collect the data.