



| ICAO

CAPACITY & EFFICIENCY

NO COUNTRY LEFT BEHIND



Performance-based Decision-making Method

Olga De Frutos

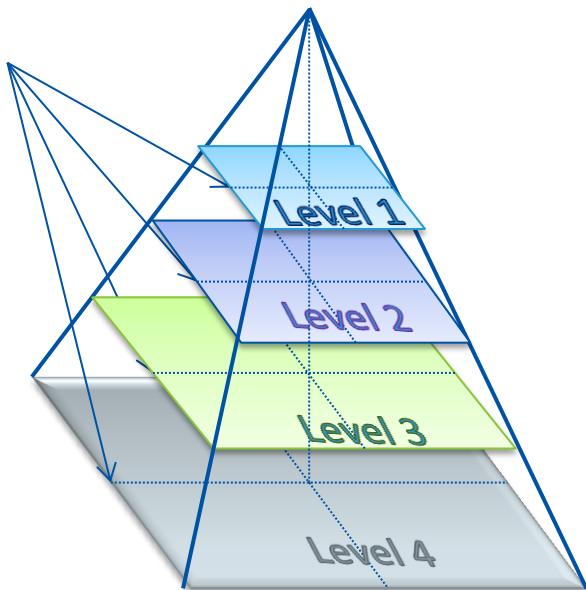
Dakar/18 September 2017



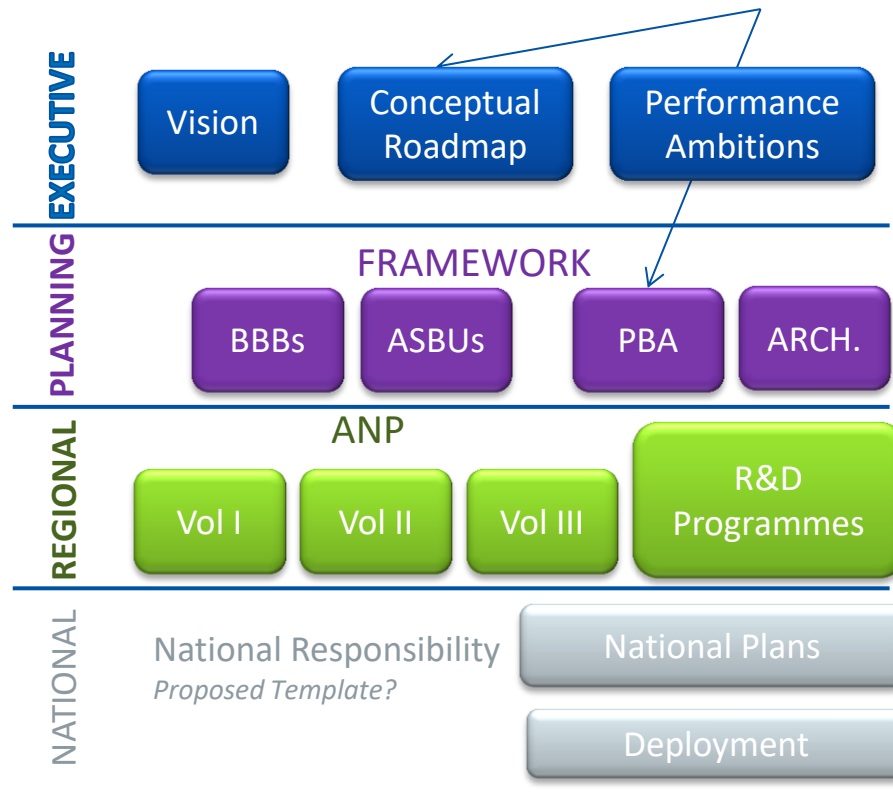


GANP 2019

LAYERS



COMPONENTS



*“Fall in love with the **problem**, not with the solution”*



What this method entails?

“Several procedures for meeting the **expectations of the aviation community** by **enhancing the performance** of the Air Navigation System and **optimizing** allocation and use of the available **resources**”



Principles

- Strong focus on desired/required results
- Reliance on facts and data for decision making
- Collaborative justified decision-making



The way to success

- Commitment
- Agreement on goals
- Organization
- Human resources and knowledge/expertise
- Data collection, processing, storage and reporting;
- Collaboration and coordination; and
- Cost implications



The Method

- STEP 1: Scope, Context & General Ambitions and expectations
- STEP 2: SWOT Analysis/ set objectives
- STEP 3: Set of targets/ Calculation of needs
- STEP 4: Optimum solution identification
- STEP 5: Optimum solution deployment
- STEP 6: Results assessment



GLOBAL FRAMEWORK

REGIONAL FRAMEWORK

LOCAL FRAMEWORK

STEP 1:
SCOPE,
CONTEXT
AND
AMBITIONS

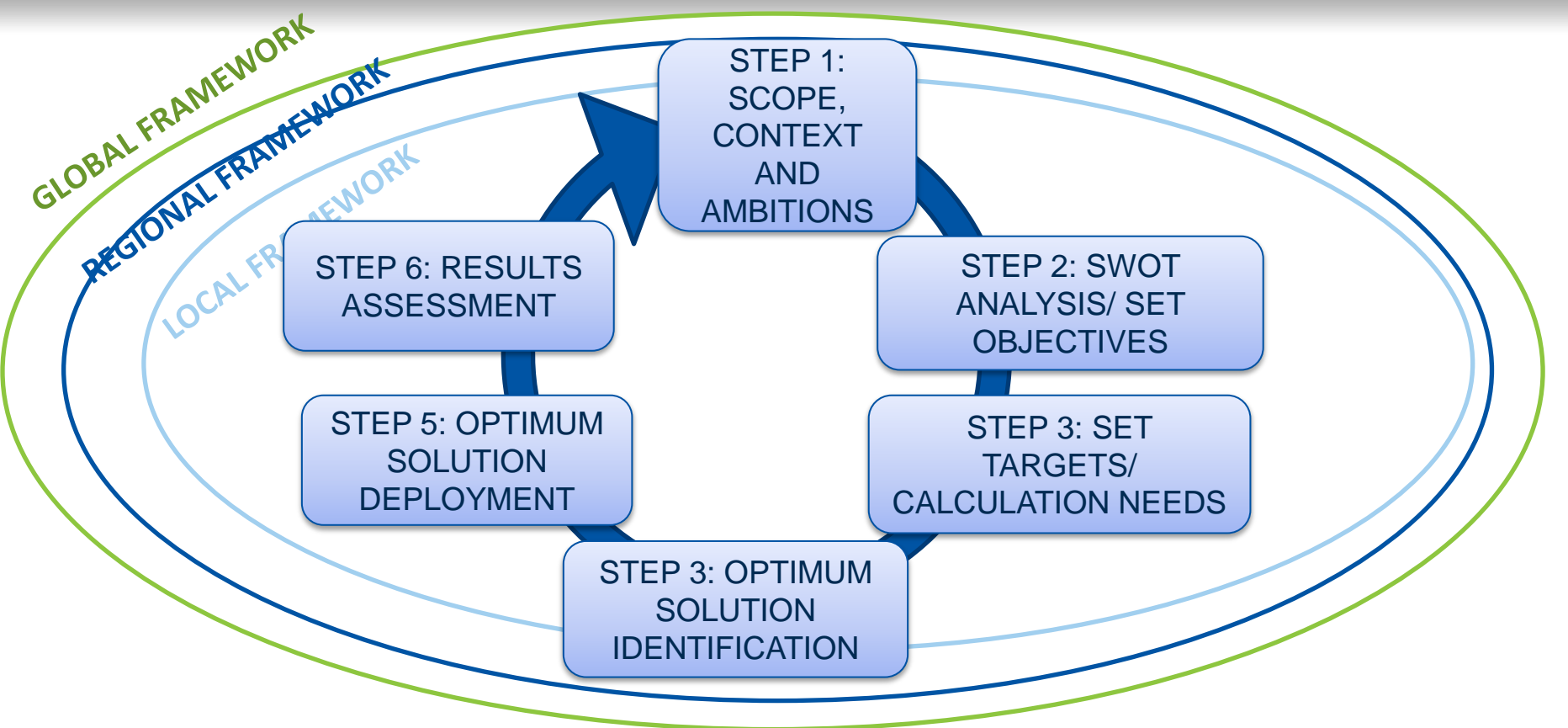
STEP 2: SWOT
ANALYSIS/
SET
OBJECTIVES

STEP 3: SET
TARGETS/
CALCULATION
NEEDS

STEP 3: OPTIMUM
SOLUTION
IDENTIFICATION

STEP 5: OPTIMUM
SOLUTION
DEPLOYMENT

STEP 6: RESULTS
ASSESSMENT





STEP 1: SCOPE, CONTEXT & AMBITIONS

- Context
 - 2019 Global Air Navigation Plan
 - Global Strategic Level: Performance Ambitions
 - Objective
 - ICAO KPAs
 - Design criteria
 - Global Technical Level: Generic Performance Objectives
 - Regional Air Navigation Plan
 - ANP Vol III
 - Specific Performance Objectives based on regional requirements



STEP 1: SCOPE, CONTEXT & AMBITIONS

- Scope

- National Air Navigation Plan

- Performance Targets: who, when and where
 - Make clear assumptions on what is “surrounding” it

- National Development Plan



STEP 2: SWOT Analysis/ set objectives

- Operational analysis (baseline performance)
 - Data collection, process and analyze
 - Monitor current operations
 - KPIs (GANP 2016)
 - Traffic forecast



STEP 2: SWOT Analysis/ set objectives

- **SWOT Analysis**
 - Strengths, Weaknesses, Opportunities and Threats
 - Performance objectives



STEP 2: SWOT Analysis/ set objectives

- National level
 - National Performance Framework
 - Performance Objective
 - High level SWOT analysis
- Local Level
 - KPIs
 - National Performance Framework
 - Specific
 - Detailed SWOT analysis

Example

- o Performance management process.
- o Context:
 - o Global Air Navigation Plan
 - o AFI Regional Air Navigation Plan
 - o Traffic growth, RPAs, airports embed in cities, military activity, weather,...
 - o Multiple neighbors

Example

- o Scope:
 - o FIR, TMAs and airports in AIP.
 - o 25 years (5-year cycle).
 - o Safety, capacity, efficiency, predictability and environment.

Example

o Performance objective:

“To increase capacity along with efficiency and predictability in order to respond to future traffic growth, while ensuring that there are no adverse impacts on safety nor environment.”

Example

- o Operational analysis in FIRs, TMAs and airports within AIP:
 - o Performance baseline
 - o KPI02, KPI13, KPI04, KPI05, KPI08, KPI16, KPI09, KPI10, KPI06, KPI11, KPI01, KPI14, KPI15
 - o SWOT analysis

Example

- o Airport Y:
- o Scope limited to airside of the airport, including TMA. Airport terminal is out of scope.
 - o Performance baseline
 - o KPI02, KPI13, KPI16, KPI09, KPI10, KPI11, KPI01, KPI14, KPI15
 - o Forecast
 - o SWOT analysis

Example

- SWOT analysis:
 - Strengths:
 - manpower
 - Weaknesses:
 - 2 runways separate 300 m → dependent operations
 - HUB operations
 - Separation on final (absolute values and application)
 - Opportunities:
 - New technology and procedures
 - Threats:
 - Weather
 - Topography surrounding airport Y
 - Airport Y physical capacity restriction



STEP 3: TARGETS & NEEDS

- Agree & Prioritize performance objectives
 - Focus area within KPAs
 - Performance objectives
 - Prioritization



STEP 3: TARGETS & NEEDS

- **SMART** Objectives
 - **S**pecific
 - **M**easurable
 - **A**chievable
 - **R**elevant
 - **T**ime-bounded



STEP 3: TARGETS & NEEDS

- **SMART** Objectives

- **Specific**

- **Measurable**

- Achievable

- Relevant

- Time-bounded

PERFORMANCE

INDICATORS → *ICAO KPIs Catalogue*



STEP 3: TARGETS & NEEDS

- **SMART** Objectives

- **S**pecific
- **M**easurable
- **A**chievable
- **R**elevant
- **T**ime-bounded

PERFORMANCE
INDICATORS



VALUE= f(baseline)
SPEED PROGRESS

PERFORMANCE
TARGETS



PERFORMANCE
BASELINE



PERFORMANCE
NEEDS

Example

- o Airport Y
- o Focus area:
 - o Capacity
 - o Airport capacity
 - o Runway capacity
 - o Efficiency
 - o Airport efficiency
 - o Taxi in and out efficiency
- o WHAT?

Example

- o Airport Y
- o WHAT?
 - o Objective 1: to increase the airport acceptance rate while maintaining safety
 - o Objective 2: to improve the efficiency of ground operations during heavy traffic time-periods, while maintaining safety and minimizing environmental impact.

Example

- o Airport Y
- o Performance targets
- o Specific and measurable:
 - o Objective 1: KPI09, KPI11
 - o Objective 2: KPI02, KPI13, KPI16

Example

- Airport Y
- KPI09: Airport peak arrival capacity
 - Scheduling parameters for slot controlled airports
 - Airport Acceptance Rates (AAR)

KPI ID	KPI09
KPI Name	Airport peak arrival capacity
Definition	The highest number of landings an airport can accept in a one-hour time frame (also called declared arrival capacity, or airport acceptance rate)
Measurement Units	Number of landings / hour
Variants	None
Operations measured	The capacity declaration of an airport
Object(s) characterized	The KPI is computed for individual airports
Utility of the KPI	This KPI indicates the highest landing rate that an airport will accept, using the most favorable runway configuration under optimum operational conditions. The runways may or may not be the most constraining factor for airport capacity: at some airports the most constraining factor may be the terminal airspace, the taxiways, the number of gates, passenger handling capacity etc. The KPI is typically used for scheduling and ATFM purposes, and to develop capacity investment plans.
Parameters	None
Data requirement	Scheduling parameters for slot controlled airports Airport Acceptance Rates (AAR)
Data feed providers	Airports
Formula / algorithm	At the level of an individual airport: 1. Select highest value from the set of declared arrival capacities 2. Compute the KPI: convert the value to an hourly landing rate, if the declaration is at smaller time intervals
References & examples of use	Comparison of ATM-Related Operational Performance: U.S./Europe (June 2014) CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

Example

- o Airport Y
- o Performance targets
- o Achievable, relevant and time bound
- o KPI09: airport peak arrival capacity
 - o Baseline
 - o Runway system:
 - o Declare capacity of the system runway 40 operations → Airport peak arrival capacity of the system runway: 20 arrivals/hour
 - o Actual throughput: 25 operations
 - o Typical busy hour demand of 50 operations
 - o Two non independent runways separated by 305 m
 - o Operated as a single runway (one runway for departures and one for arrivals)
 - o Traffic growth forecast for the next 25 years: 8%

Example

- o Airport Y
- o KPI09: airport peak arrival capacity
 - o Performance target:
 - o It is decided to adopt the future typical busy hour demand as the capacity target. This results in:
 $50 \times 1.08^{25} = 340$ operations \rightarrow 170 arrivals per hour
 - o The best in class airport peak arrival capacity for two dependent runways is 60 operations, thus the limit of the infrastructure capacity of the airport to accommodate the forecast demand will be reached in 3 years
 - o So the performance target for a short term will be limited by the infrastructure of the runways to 60 operations. A longer term solution, such as the construction of a new airport should be considered.
 - o Airport peak arrival capacity of the system runway: 60 arrivals/hour
 - o Performance needs:
 - o Airport peak arrival capacity of the runway system: $60 - 40 = 20$ arrivals/hour

Example

- o Airport Y
- o KPI11: AIRPORT PEAK CAPACITY UTILIZATION
 - o For each arriving flight:
 - o Actual landing time (ALDT)
 - o Estimated landing time (ELDT) (from flight plan)
 - o For each time interval:
 - o Declared landing capacity of the airport

KPI ID	KPI11
KPI Name	Airport arrival capacity utilization
Definition	Airport arrival throughput (accommodated demand) compared to arrival capacity or demand, whichever is lower
Measurement Units	%
Variants	Variant 1: IFR arrivals only
Operations measured	The number of unaccommodated landings at an airport
Object(s) characterized	The KPI is computed for individual airports
Utility of the KPI	This KPI assesses how effectively arrival capacity is managed by the ANSP. It is a measure of accommodated demand, compared to the available capacity of the airport, irrespective of the delay incurred by arriving traffic. Seen in another way, it captures the “missed” arrival slots. At congested airports, the KPI relates the throughput to the declared capacity. At uncongested airports (or airports without declared capacity) the KPI relates the throughput to the unconstrained demand based on flight plans.
Parameters	Time interval at which to perform the most granular calculations. Recommended value: 15 minutes.
Data requirement	For each arriving flight: <ul style="list-style-type: none"> - Actual landing time (ALDT) - Estimated landing time (ELDT) (from flight plan) For each time interval: <ul style="list-style-type: none"> - Declared landing capacity of the airport
Data feed providers	Airports
Formula / algorithm	For each time interval: <ol style="list-style-type: none"> 1. Compute the throughput: count the number of actual landings based on ALDT 2. Compute the demand: count the number of estimated landings based on ELDT 3a. if demand >= capacity: utilization = throughput / capacity 3b. if demand < capacity: utilization = throughput / demand At aggregated level (longer time periods): <ol style="list-style-type: none"> 4. Compute the KPI: $\text{sum}(\text{utilization} * \text{demand}) / \text{sum}(\text{demand})$
References & examples of use	CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

Example

- o Airport Y
- o KPI11: airport arrival capacity utilization
 - o Baseline
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 - o The best in class airport peak arrival capacity for two dependent runways is 60 operations, thus the limit of the infrastructure capacity of the airport to accommodate the forecast demand will be reached in 3 years
 - o In this case, within in 3 years the capacity is expected to reach the demand and the target in this case will be set in 1, so the throughput to be equal to the demand and the capacity.
 - o Airport arrival capacity utilization of the system runway: 100%
 - o Performance needs:
 - o Airport arrival capacity utilization of the runway system: $1-25/40=0.375= 37.5\%$



STEP 4: IDENTIFICATION OPT. SOLUTION

- Assessment of the SWOT analysis
 - Dominant factors:
main constraints/opportunities
 - selection and prioritization of opportunities and issues



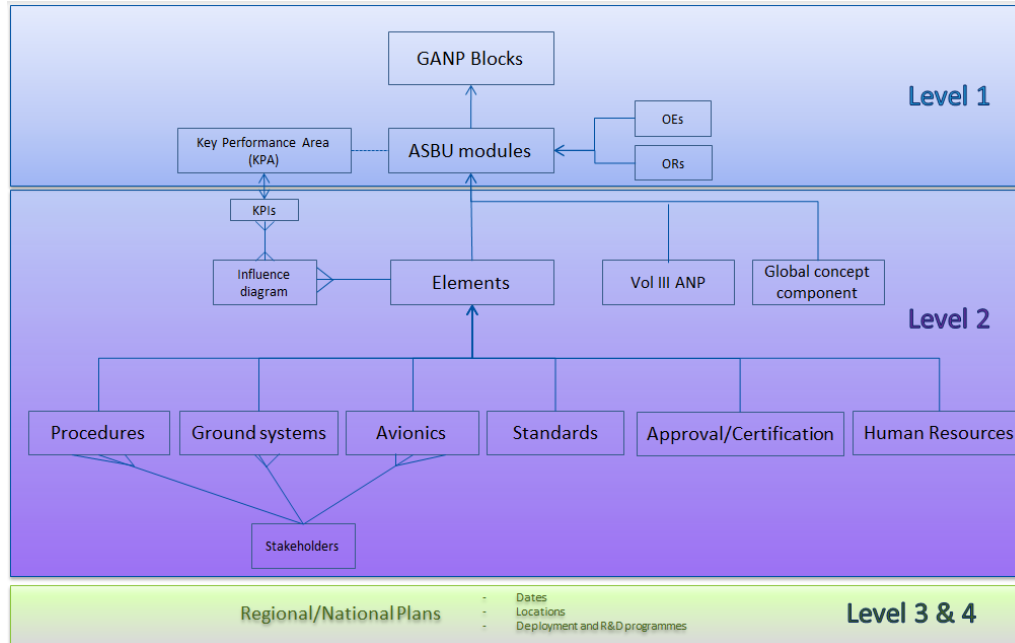
STEP 4: IDENTIFICATION OPT. SOLUTION

- List of options
 - High-level strategy
 - Operational concept
 - Technical enablers
 - Baseline
 - Availability
 - Safety Assessment
 - Human Factors Assessment
 - Assessment of expected performance

ASBU Framework



STEP 4: IDENTIFICATION OPT. SOLUTION





STEP 4: IDENTIFICATION OPT. SOLUTION

- Make decisions
 - Information available
 - Scope
 - Performance objectives and targets
 - Assessment of SWOT analysis
 - List of solutions (ASBUs)
 - Safety Assessment, HP Assessment, CBA and Environment Impact Assessment
 - Single optimum solution or a roadmap of optimum solutions

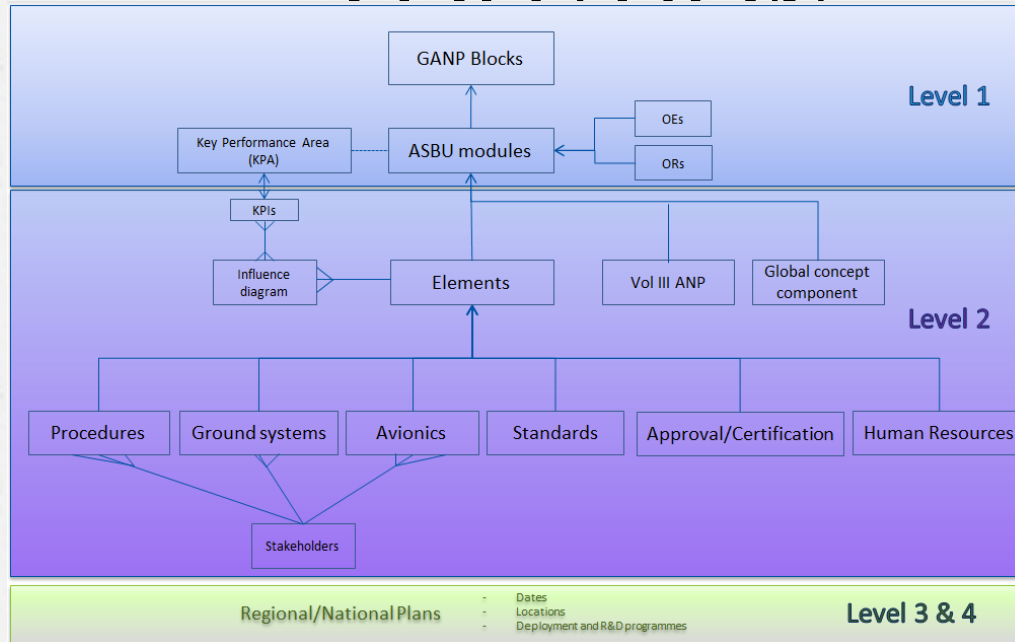
Example

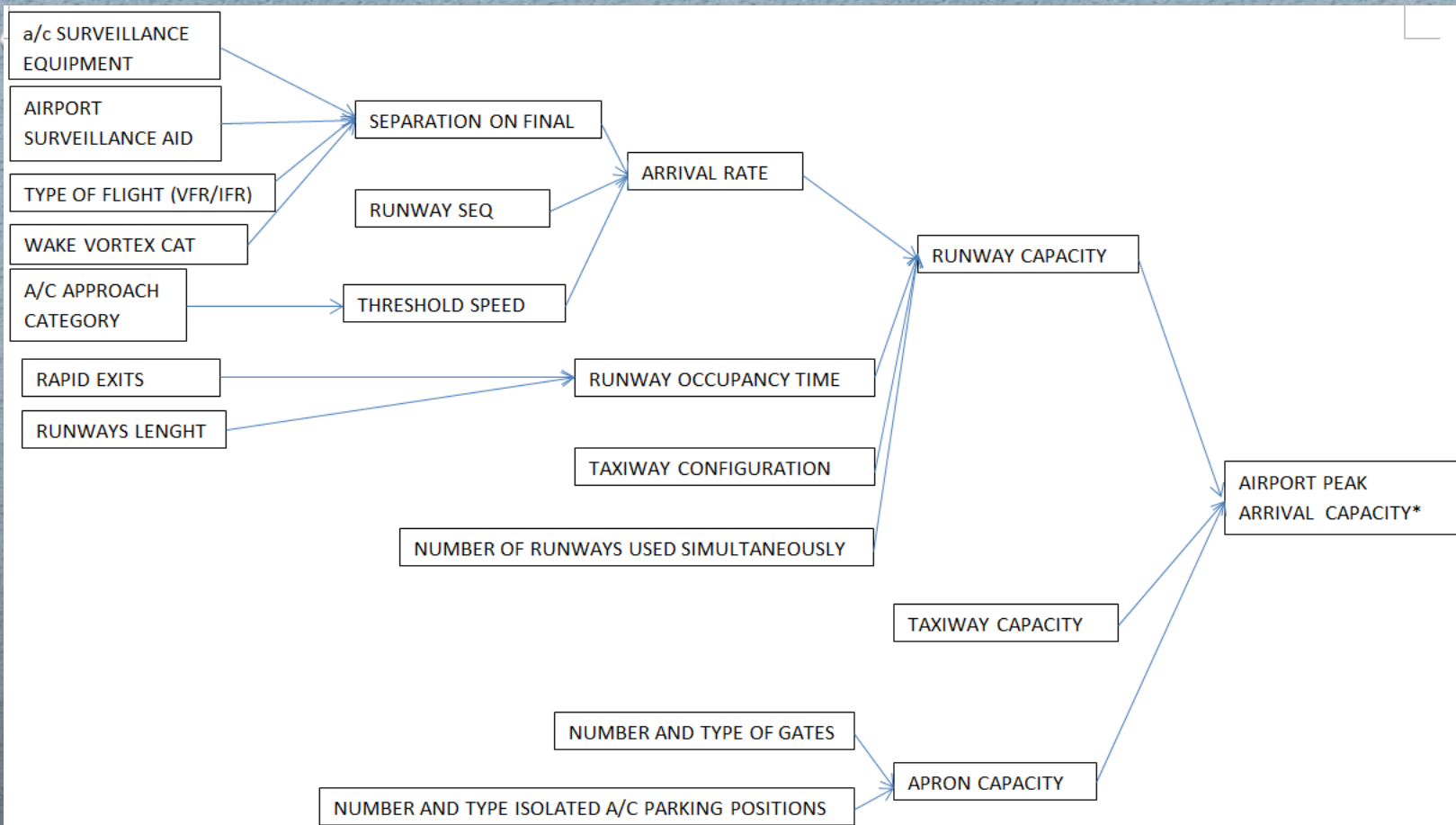
- o Airport Y
- o Airport capacity
 - o KPI09: Airport Peak Arrival Capacity
 - o KPI11: Airport Arrival Capacity Utilization

Example

- SWOT analysis:
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STEP 3: IDENTIFICATION OPT. SOLUTION



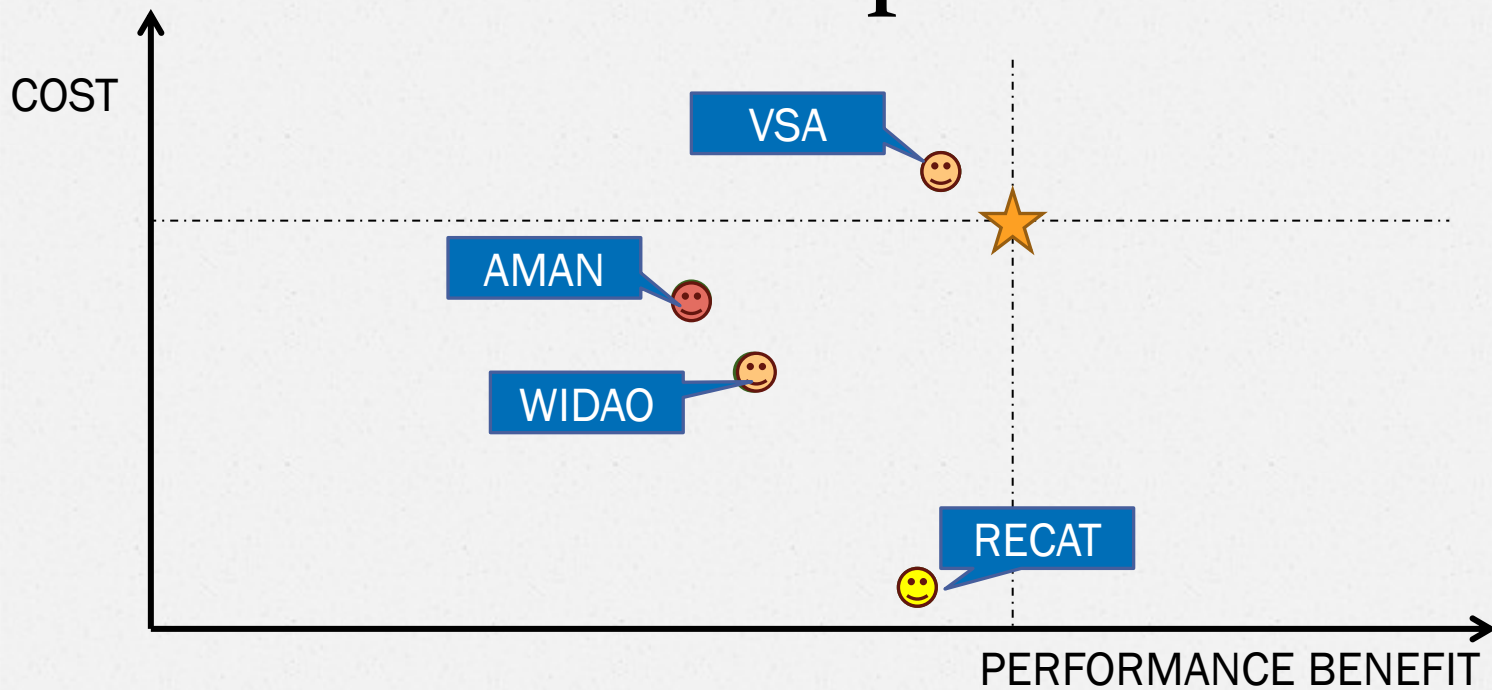


* Airport Peak Arrival Capacity, the highest number of landings an airport can accept in a one-hour time frame (also called declared arrival capacity, or airport acceptance rate).

Example

- o Separation on final:
 - o BO WAKE:
 - o RECAT
 - o BO ASEP
 - o VSA
- o Number of runways used simultaneously
 - o BO WAKE
 - o WIDAO
- o Aircraft sequencing
 - o BO RSEQ
 - o AMAN

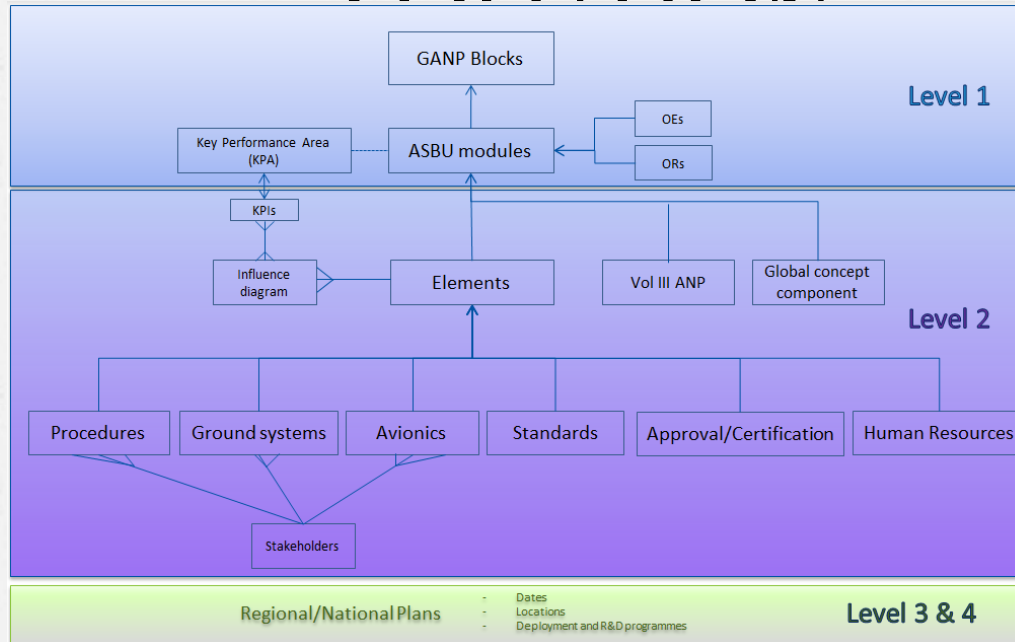
Example



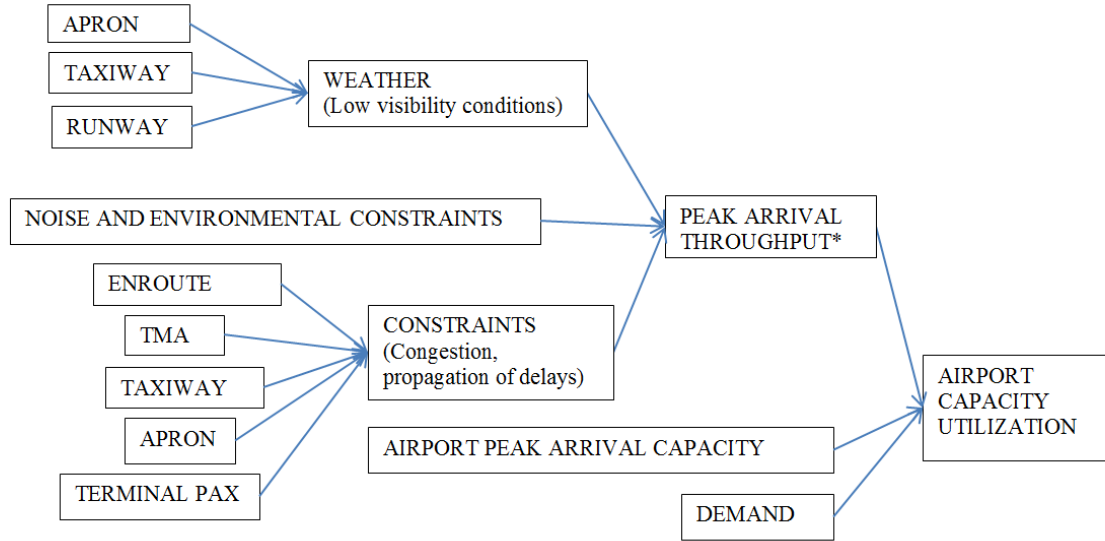
Example

- Associated Safety Assessment
- Associated Human Factors Assessment
- Associated Environmental Impact Assessment

STEP 3: IDENTIFICATION OPT. SOLUTION



Airport Arrival Capacity Utilization, airport arrival throughput (accommodated demand) compared to arrival capacity or demand, whichever is lower.



* The actual number of landings at an airport.

Example

- Weather

- BO APTA:

- GNSS+ BaroVNAV

- GNSS+GBAS

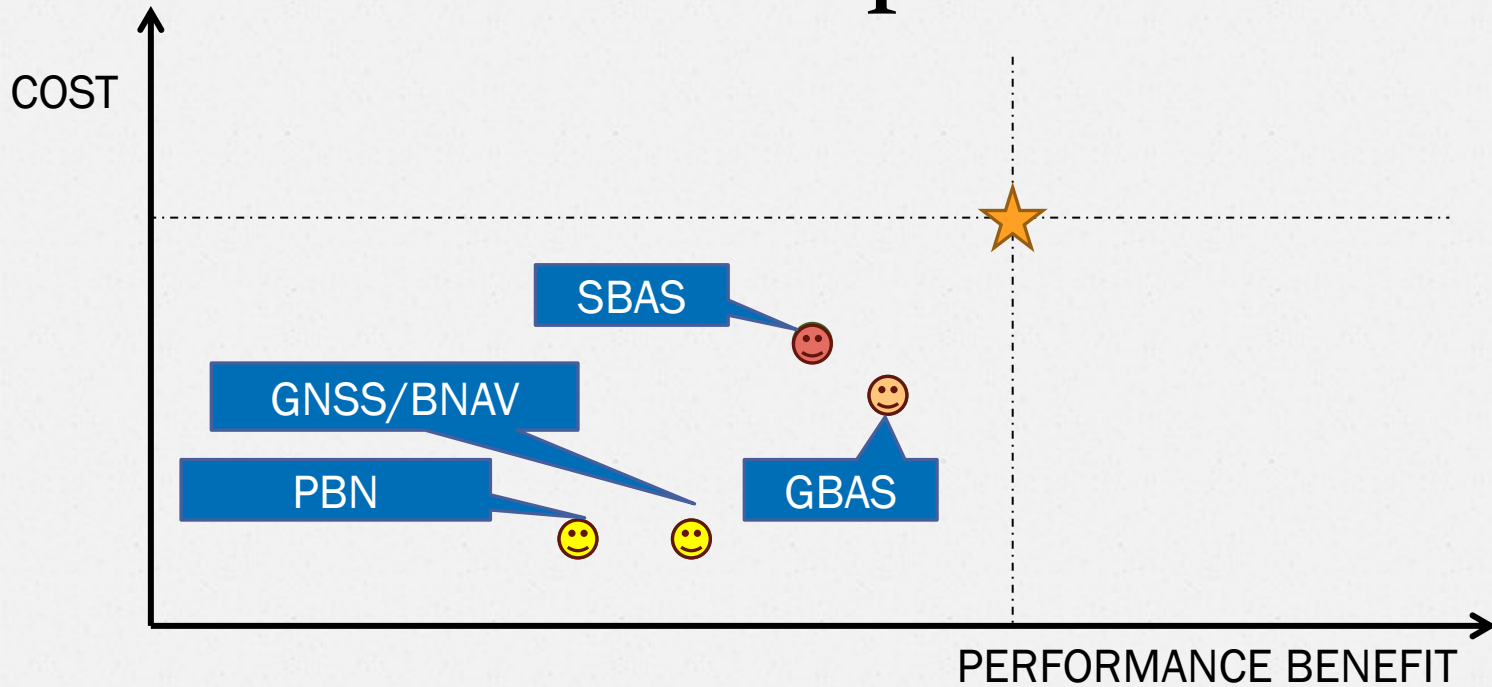
- GNSS+SBAS

- Topography

- BO FRTO

- Airspace design based on PBN

Example



Example

- o Associated Safety Assessment
- o Associated Human Factors Assessment
- o Associated Environmental Impact Assessment



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NO COUNTRY LEFT BEHIND



AID

ICAO AID

Search ICAO

ELEMENT OVERVIEW THREAD OVERVIEW ENABLERS ▾

ELEMENT OVERVIEW

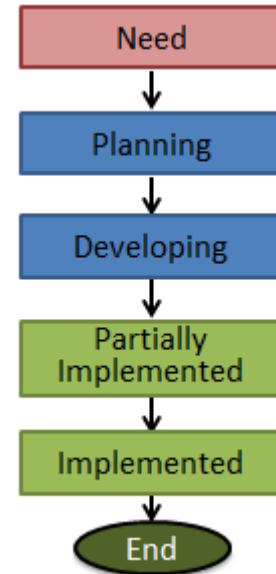
Functional Description
 Enablers
 Deployment Applicability
 Performance Impact Assessment
 ➕ Add Element

WAKE-BO/1	Wake turbulence separation minima based on six aircraft categories		
APTA-BO/1	PBN Approaches (with basic capabilities)		
APTA-BO/2	PBN SID and STAR procedures (with basic capabilities)		
APTA-BO/3	Cat I Precision Approach Procedures		
APTA-BO/4	PBN transitions to/from xLS (with basic capabilities)		



STEP 5: DEPLOYMENT OF THE SOLUTION

- Execution phase
 - Planning
 - Implementation
 - National mechanism for tracking the implementation of the elements
 - Benefits



Example

- o Enablers
- o Responsible stakeholders for implementation
- o Project Management
 - o Monitor Progress on implementation: Mechanism for tracking implementation
- o Deployment packages
 - o Per element
 - o Training, Seminars, WS, TA, SIP,...



STEP 6: ASSESSMENT OF RESULTS

- Continuously assess performance
- Monitor progress of implementation
- Review actually achieved performance
 - Update performance gaps

→ +(Step 1&2)=

PERFORMANCE MONITORING AND REVIEW



STEP 6: ASSESSMENT OF RESULTS

- Tasks in the PMR:
 - Data collection
 - Data publication
 - Data analysis
 - Formulation of conclusions; and
 - Formulation of recommendations.



STEP 6: ASSESSMENT OF RESULTS

- Data collection
 - Automatic Data Collection
 - Manual data reporting (electronic or paper)
- For each KPI:
 - information needs;
 - suppliers of data;
 - information disclosure by data suppliers; and
 - manage the data feeds on an ongoing basis.



STEP 6: ASSESSMENT OF RESULTS

- Data access and publication
 - Audience:
 - Performance specialists
 - Specific data (as much granularity as possible)
 - People with a generally high level interest in ATM performance
 - High-level performance indicator



STEP 6: ASSESSMENT OF RESULTS

- **Data Analysis**

- Quality of the data

- Data analysis

- Big picture

- Cause-effect analysis for results

→ New performance objectives, performance indicators and data needs.



STEP 6: ASSESSMENT OF RESULTS

- Formulation of conclusions
 - Performance objectives
- Formulation of recommendations
 - ATM community expectations

Example

- o Data collection at a national level
- o Report annual performance data to the PIRGs Objective: Monitor improvement performance of the system
 - o Tool: ANRF/ Dashboards
 - o ICAO to publish Air Navigation Report based on this data
 - o ICAO to review global performance objectives base on the results
- o Cycle to start again



GLOBAL FRAMEWORK

REGIONAL FRAMEWORK

LOCAL FRAMEWORK

STEP 1:
SCOPE,
CONTEXT
AND
AMBITIONS

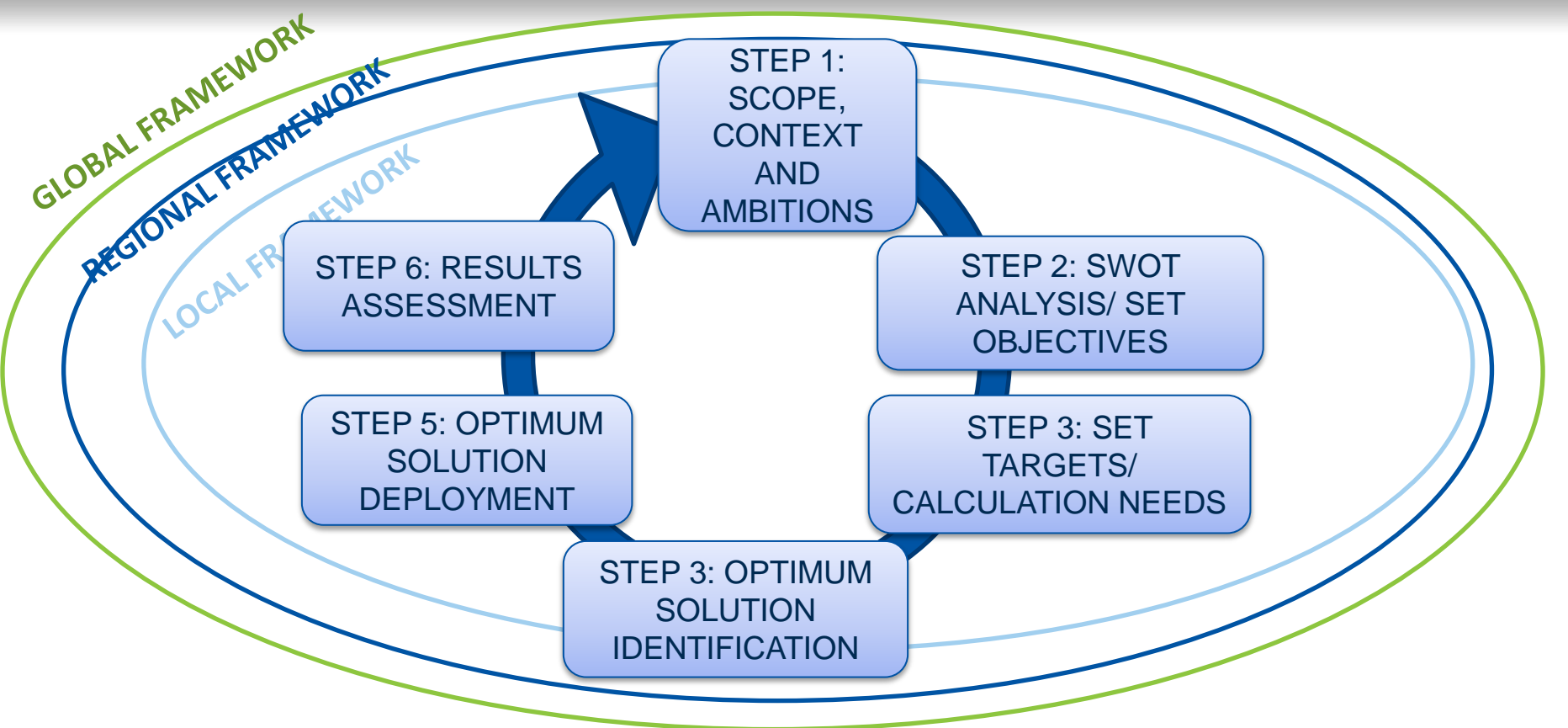
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SOLUTION
DEPLOYMENT

STEP 6: RESULTS
ASSESSMENT





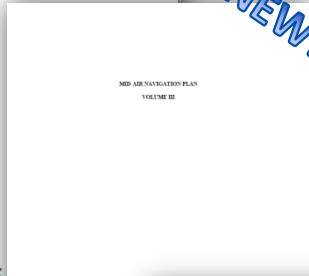
GLOBAL LEVEL FALL 2016

GANP Fourth



CAPACITY AND EFFICIENCY

- Performance Improvement Areas
- Airport operations
- Globally interoperable systems and data
- Optimum capacity and flexible flights
- Efficient flight paths



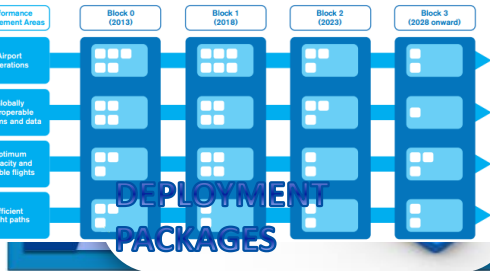
NEW!

A-PAINT ASBUs Performance Assessment Interactive Tool

STATE LEVEL Global Air Navigation

PERFORMANCE ANALYSIS: Do I WILL have a need?

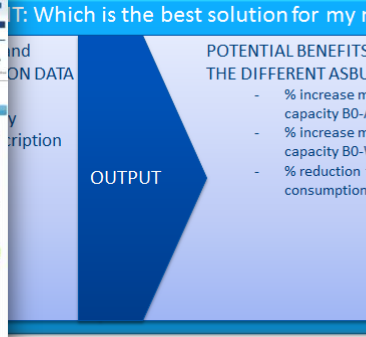
GANP Fourth Edition Aviation System Block Upgrade Methodology



PERFORMANCE
capacity
efficiency
environment
flexibility
predictability

REGIONAL LEVEL DEC 2015

Air Navigation Plans (Current)



Ikits Training Seminars Workshops ...

IMPLEMENTATION



ICAO

CAPACITY & EFFICIENCY

NO COUNTRY LEFT BEHIND



ICAO

North American
Central American
and Caribbean
(NACC) Office
Mexico City

South American
(SAM) Office
Lima

ICAO
Headquarters
Montréal

Western and
Central African
(WACAF) Office
Dakar

European and
North Atlantic
(EUR/NAT) Office
Paris

Middle East
(MID) Office
Cairo

Eastern and
Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Sub-office
Beijing

Asia and Pacific
(APAC) Office
Bangkok



THANK YOU