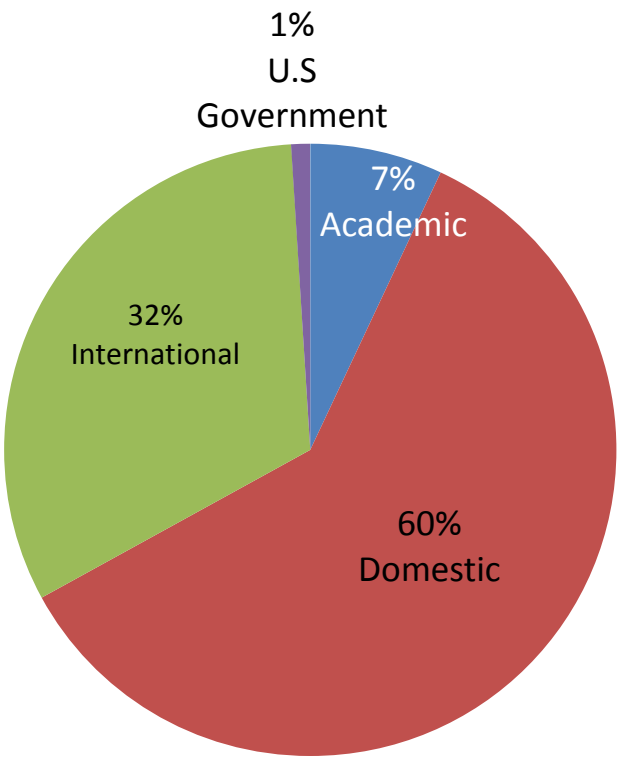
A Partnership for Progress in Mexico

RTCA

THE GOLD STANDARD FOR AVIATION SINCE 1935

RTCA:
A Unique Public-Private Partnership



Founded in 1935
Incorporated in 1991

~ 500 Member Organizations

- Academia
- Airports
- Aviation Service Providers & Regulators
- Government Organizations
  - FAA, DOD, TSA, NASA
- Manufacturers (OEMs and After-Market)
- Operators
  - Airlines, GA, Cargo, DOD
- Suppliers
  - Automation, Infrastructure, Avionics
- Labor
  - Pilots, Controllers, Dispatchers
- R&D Organizations

Goals of Project

OUTPUT

Report: RTCA – Mexico Project:

WHAT and HOW

Report

Mexico Detailed ATM Modernization Implementation Plan Components: 2017-2020

- Modernization Priorities
- Milestones for Government and Industry
- Identification of all critical components and challenges
- Risk Mitigation Strategies
- Commitments

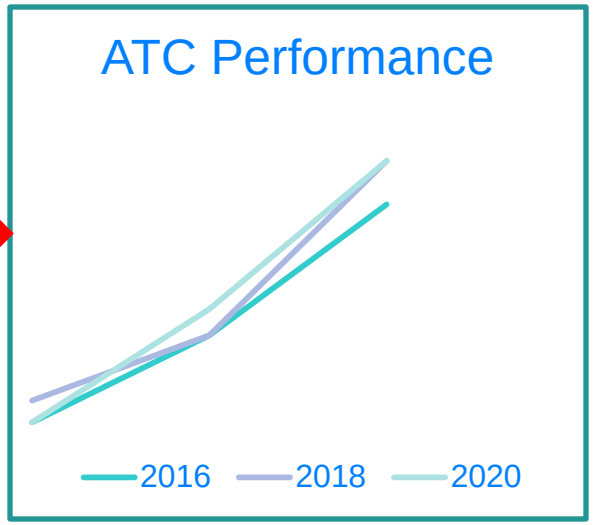
Implementation

DGAC/SENEAM

Program Management

Capabilities Implementation and Deployment

OUTCOMES



- Increased Capacity
- Increased Safety
- Enhanced Environment
- Increased Traffic to Region

Globally Harmonized Locally Tailored

- Requisite Levels Safety and Efficiency
- Seamless Global Air Transportation System
- Timely, Positive Return on Investments

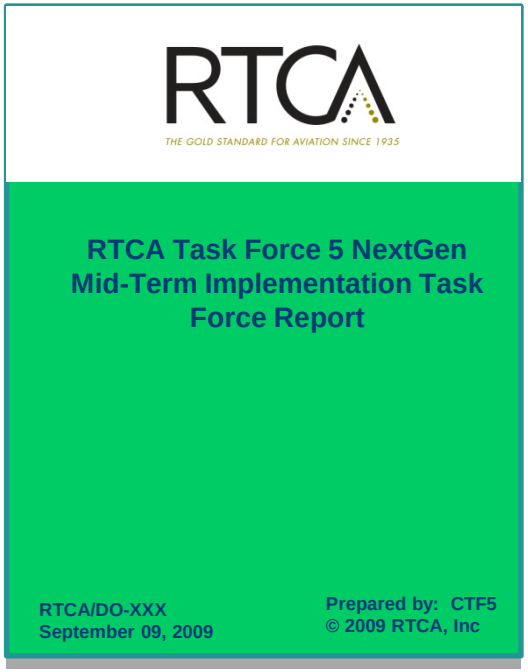
- RTCA Consensus Process Designed to:
  - Adapt solutions to local needs
  - Facilitate harmonization
  - Encourage innovation
  - Expand marketplace of Solutions

Mexico Modernization Project

- Build on Work Already Done by DGAC & SENEAM
  - Plan de Implementación de Navegación Basada en la Performance (PBN) en el Espacio Aeréo de México
  - NAM/CAR Regional Performance-Based Air Navigation Implementation Plan
  - Port of Spain Declaration
  - Based on ICAO ASBUs
- What's New:
  - Leverage RTCA Consensus Process
  - Government and Industry Participation
  - Operational Capability-driven
    - Beyond technology to all components required

Leveraging Lessons Learned

- NextGen Began as Technology-driven Transformation
- Influenced by Operators, RTCA TF5 Introduced:
  - Operational Capability more than technology
  - Need to close business case
  - Address all components necessary to deliver benefits
  - Stepwise introduction of capabilities
- FAA Plans Embraced TF5 Input
- "Ops Capabilities" Instantiated in ASBUs
- Investment by ANSP, Regulators & Operators



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Deploy “Capabilities” not Technology

TECHNOLOGY	CAPABILITY/BENEFITS
DataComm Network	▲ Efficient weather reroutes ▲ Safety ▲ Efficiency ▲ Productivity
Published PBN routes	▲ Efficient routings
CPDLC in ATC Sys	▲ Safety, Efficiency, Productivity
RNP/PBN Routes	De-conflict traffic to/from Airports ▲ Efficiency, ▼ Environment Impact
ADS-B Infrastructure	▼ A/C separation, ▲ Capacity ▲ Efficient Merging & Spacing

US NextGen TF Output:

Improve Operations Where Biggest Problems Exist

Enhance Access to the NAS

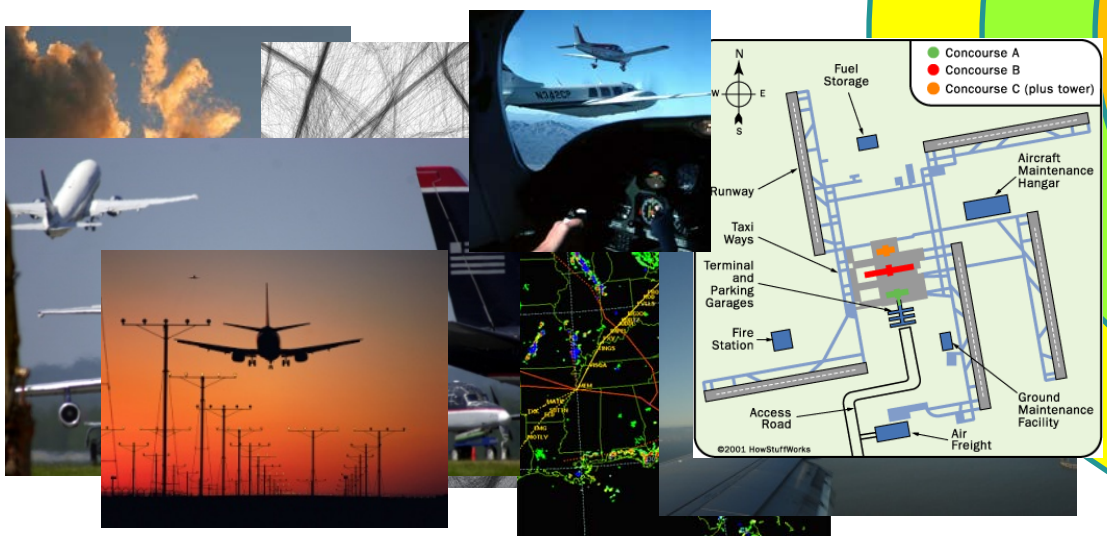
De-conflict Operations at Metroplex Airports

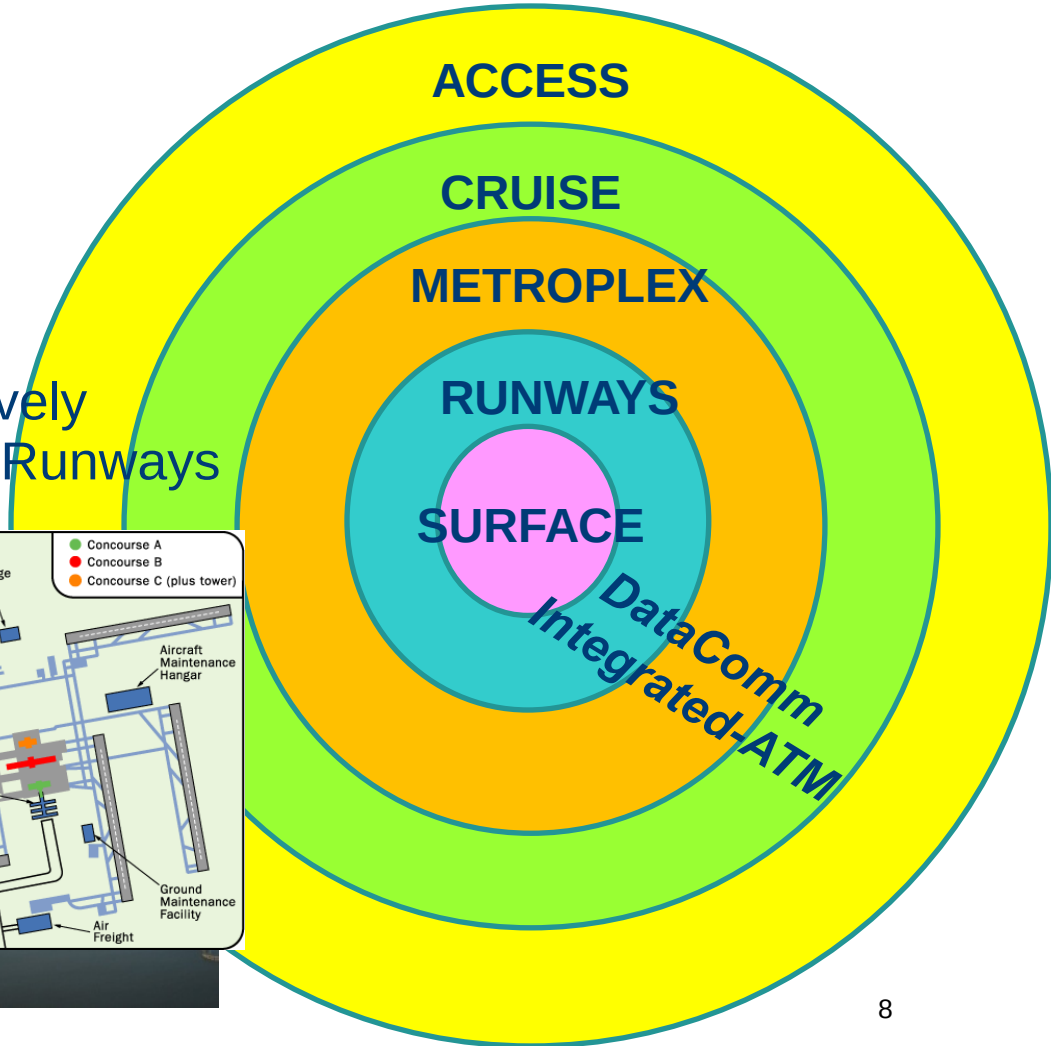
Improve Cruise Efficiency

Improve Surface Operations

- Leverage Current Equipage
- Close Business Case
- Document Commitments
- Plan, Execute & Track Collaboratively

Increase Access to Closely-Spaced Runways





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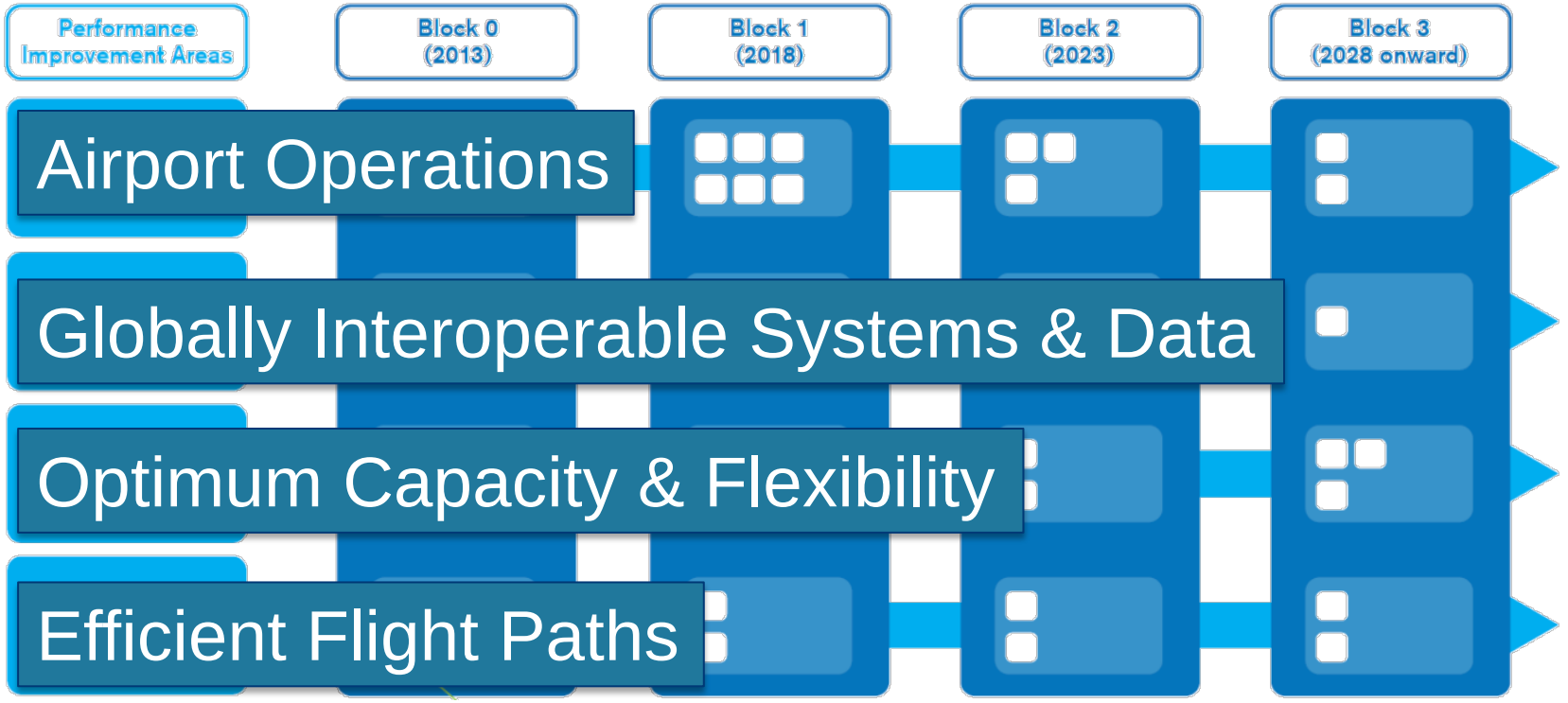
Source: ICAO Briefing

Global Air Navigation Plan (GANP)

Objectives and Priorities



PRIORITIES

- PERFORMANCE BASED NAVIGATION (PBN)
- CONTINUOUS DESCENT AND CLIMB OPERATIONS (CDO/CCO)
- COLLABORATIVE DECISION-MAKING (CDM & A-CDM) & ATFM

Prerequisites for Delivering Benefits

Must address the following elements of each capability:

- Change in roles
- Equipage
- Decision Support Tools
- Policies
- Airspace
- Training
- Automation
- Standards
- Ops Approval; Certification
- Political Risk
- Environmental Issues

For:

- Pilots
- Controllers
- ATC
- TFM
- AOC/FOC

The result becomes basis of integrated implementation plan

Task Force Approach ♦Tailored Solutions

- Your Input Needed to Tailor Solution to Local Needs
- Tools & Information Intended to Aid Experts
- Dashboard & Tools Capture and Display
- Enable Sensitivity Analysis
- Dashboard & Tools Steer Toward Answers
- RTCA Known for Signature Consensus Process
- Starting Point to Help You Prioritize and Make Sound Investments to Meet Your Goals

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Setting Your Priorities

GOALS FOR GANP CAPABILITIES
ACCESS / EQUITY
COST
FLEXIBILITY
PREDICTABILITY
INTEROPERABILITY
SAFETY
ENVIR0NMENT / NOISE
EFFICIENCY
CAPACITY
DELAY

Defining What is Most Important

Example

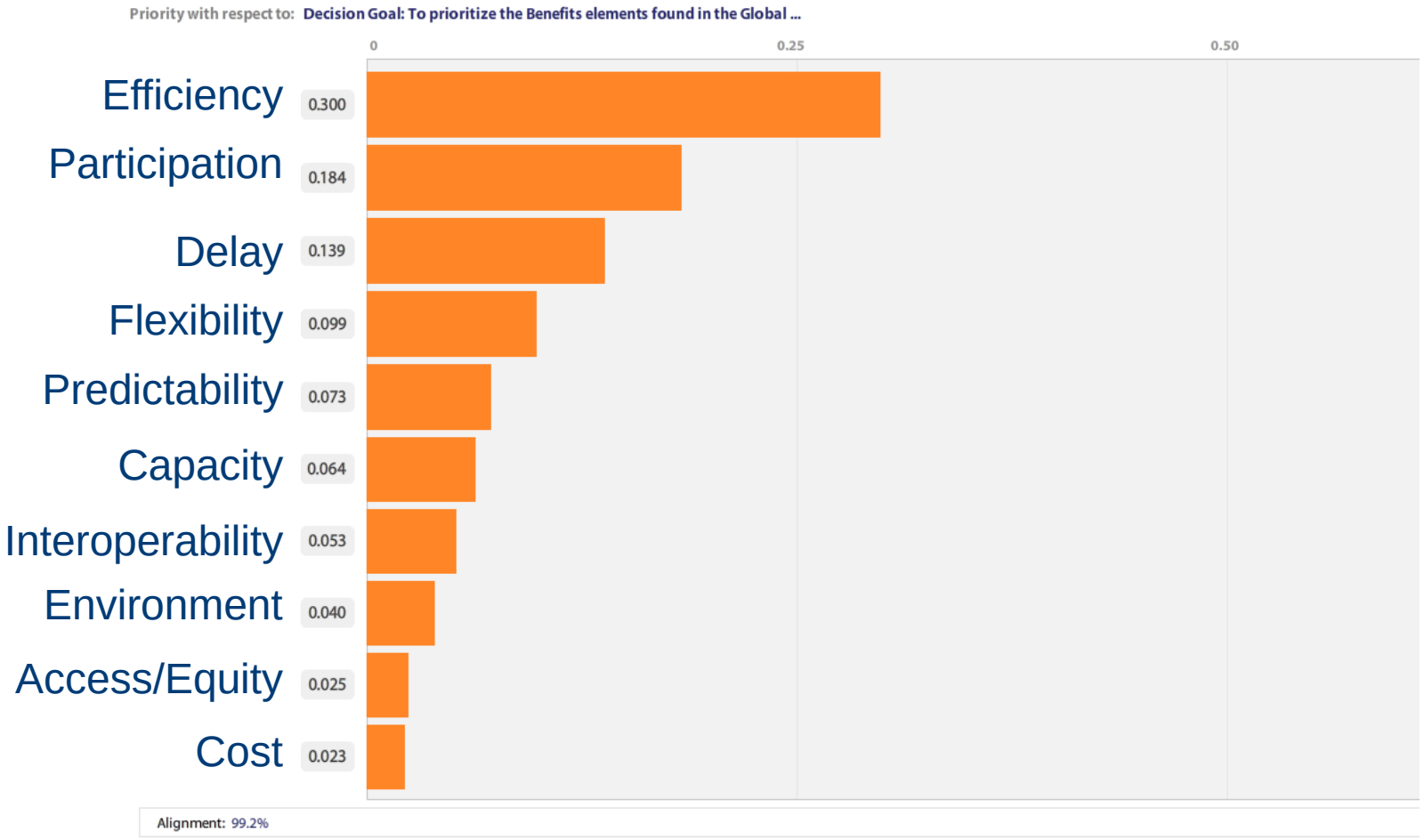
With respect to ASBU module implementation, which is more important?

Access and Equity	OR	Cost

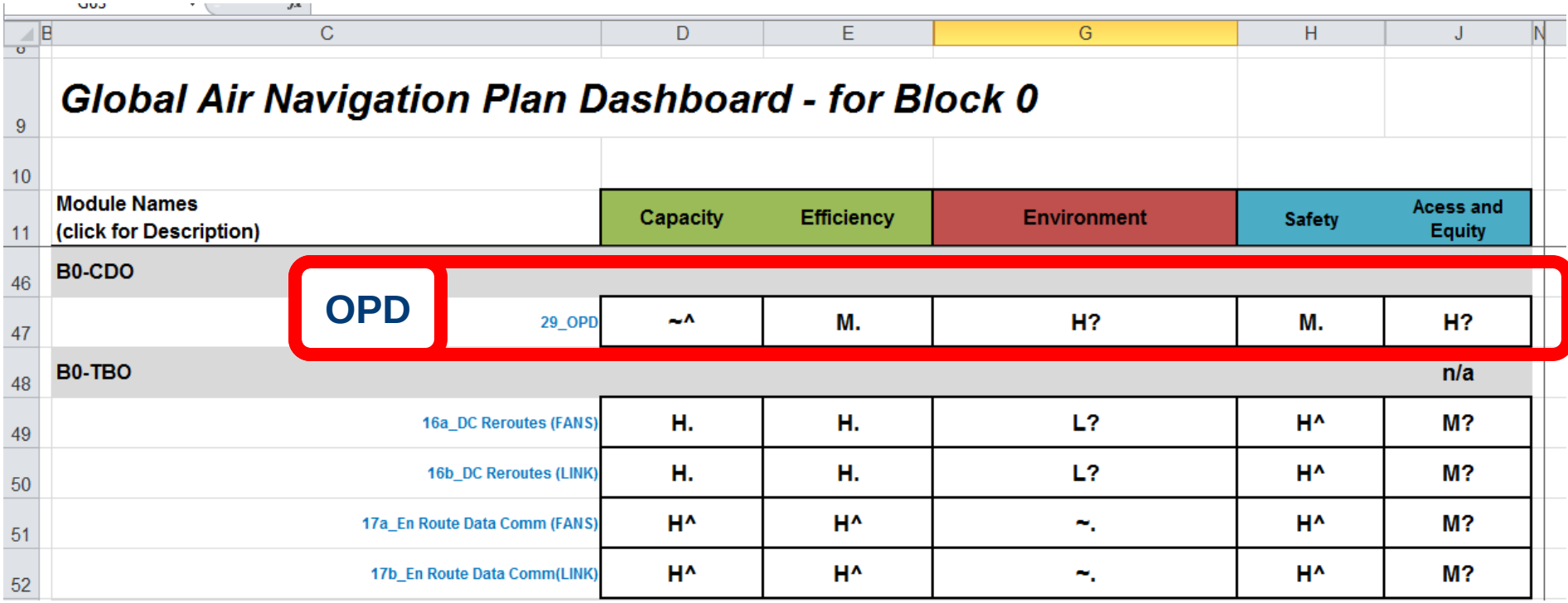
	Extreme		Very Strong		Moderate		Equal		Moderate		Very Strong		Extreme	
Average	8	7	6	5	4	3	**2**	1	2	3	4	5	6	7
Person A	8	7	6	5	**4**	3	2	1	2	3	4	5	6	7
Person B	8	7	6	5	4	3	**2**	1	2	3	4	5	6	7
Person C	8	7	6	5	4	3	**2**	1	2	3	4	5	6	7
Person D	8	7	6	5	4	3	2	1	**2**	**3**	4	5	6	7
~~	8	7	6	5	4	3	2	1	**2**	3	4	5	6	7
Person X	8	7	6	5	4	3	**2**	1	2	3	4	5	6	7

Pair-wise comparisons of decision criteria

Results of Sample Criteria Priorities



Sample Dashboard



Global Air Navigation Plan Dashboard - for Block 0

Module Names (click for Description)	Capacity	Efficiency	Environment	Safety	Acess and Equity
B0-CDO					
29_OPD	~^	M.	H?	M.	H?
B0-TBO					n/a
16a_DC Reroutes (FANS)	H.	H.	L?	H^	M?
16b_DC Reroutes (LINK)	H.	H.	L?	H^	M?
17a_En Route Data Comm (FANS)	H^	H^	~.	H^	M?
17b_En Route Data Comm(LINK)	H^	H^	~.	H^	M?

OPD

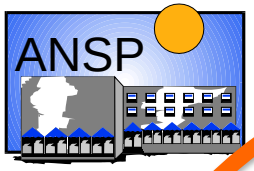
Identify and collect data

Identify KPAs	Collect data to measure KPA metric today (baseline)	Calculate impact of ASBU module on each KPA
Capacity	Ops/Hour	-- Module X impacts -- Increase/ Decrease Ops/Hour by x%
Efficiency	Fuel burnt, Operating time	Increases/Reduces fuel burn by y%
Environment	Noise levels, greenhouse gas emissions	Increases/Reduces fuel burn by z%
Access and Equity	Access to airports and airspace by all stakeholders	Highly/ moderately significant in increasing/decreasing Access
Safety	# of Operational errors by ATC, Pilots Ground personnel, etc. *(Collect data by phases of flight like taxi in, enroute, descent and/or weather conditions like VMC, IMC)*	Highly/ moderately significant in increasing/decreasing errors

Other basic data includes:

Fleet types and counts; Current aircraft equipage: CNS; Airports/runways configuration; Traffic: aircraft and passenger, airports & key city pair flows

Perspectives Vary



$$ Return on Investment

Efficiency

Access

Safety

Capacity

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Stakeholders

Stakeholder Groups	
Academic	Dispatchers
Airframers	General Aviation
Airlines	ICAO
Airports	Military
ANSPs	Other
Associations	Pilots
Aviation Information	Regional Aviation
Business Aviation	Regulatory Organizations
Comm Providers	Standards
Consultants	Training
Controllers	Weather

Next Steps

- ✓ Finalize USTDA Proposal & Gain Official Interest of Mexico for Project
- ✓ Review Mexico's Local Plans & Inputs
- ✓ Identify biggest challenges for Region
- ✓ Framework of Final Product
- ✓ Update Mapping of ASBU B0/B1 Modules to critical elements to ensure benefits
- ✓ Identify stakeholders and solicit TF participation
- ✓ Identify data needs; Commitment to supply
- ✓ Schedule and Resources

TF Steps – From Launch to Plan

Fall 2016

- Kickoff
- Review inputs and assumptions
- Report framework
- Stakeholders on TF
- Data needs, commitments to supply
- Agree on target date for harmonized systems (2020?)

- List of participants
- Data to RTCA
- RTCA analysis

Early 2017

- Kickoff with industry
- Validate SAM PBIP; update as necessary
- Data needs from industry
- Agree on performance metrics

- Industry data to RTCA
- Continued analysis

Spring 2017

- Identify challenges, elements
- Identify locations and capabilities

- …

Summer 2017

- Continue filling in elements

- …

Fall 2017

- Review draft report

- Review and comment on draft report

Spring 2018

- Review all comments and suggested resolutions

- Produce final report

Report Framework and Outline

TF Report

DRAFT

TF Report

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BACKUP

Beyond Single FIR

- Seamless Air Transportation
  - (CNS) Aircraft equipage applicable everywhere
  - Procedures
  - ATC, TFM, CDM automation & decision support tools
- Commonality Across Airports
  - e.g., PBN, OPDs
- Interoperable Flight Plans
  - SWIM

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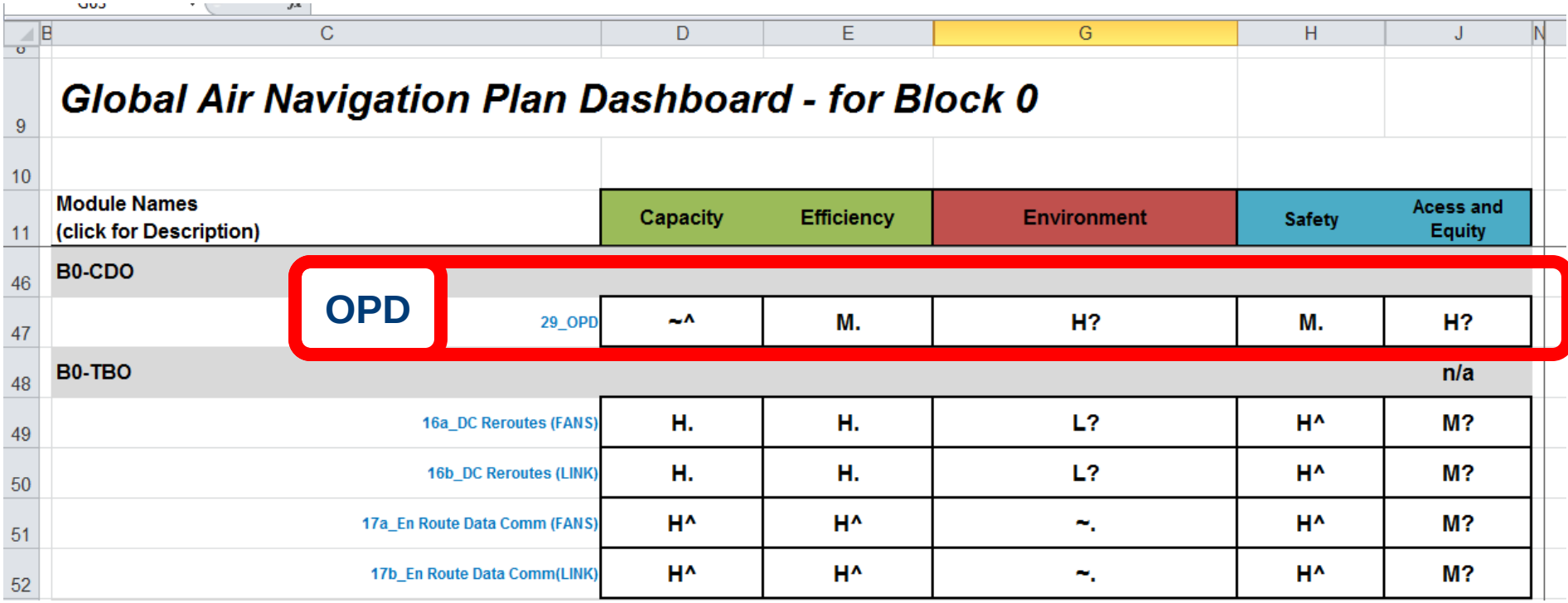
How did 300 People Reach Consensus?

- Everyone's Voice was Heard
- Everyone Agreed on Evaluation Criteria
- Relative Value of All Candidate Capabilities Assessed Using Data-driven Dashboard "Tool"
- Expert Opinion Considered as Necessary
- Not Everyone Got Everything They Wanted

***350** people from **140** organizations identified over **120** possible capabilities, through a consensus process reduced that to a list of **28 capabilities** at specific locations and dates, and produced a report*

Sample Dashboard



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17a_En Route Data Comm (FANS)	H^	H^	~.	H^	M?
17b_En Route Data Comm(LINK)	H^	H^	~.	H^	M?

OPD

Example Dashboard Navigation: Optimal Profile Descents

NextGen Dashboard - for Mid-Term Implementation (9/8/09)						For Legend See "Parameters" Sheet
Capability Name (click for Description)	Timeframe	Benefit	Readiness	Implementation Risk Resolution	Other Consideration Resolution	Assessment Confidence
27_Non-radar GOMEX	2012-2020	H^	M^	M.	M.	Medium
28_Non-radar Low Altitude	2010-2018	H^	L^	L^	M.	High
29_OPD	2010-2012	M.	M^	M.	M^	Medium
30_Q&T Routes	2012-2013	H^	M^	H^	M^	High
32a_RNAV RNP SID & STAR (RNAV only)	2010-2012	H?	M^	M^	M^	Low

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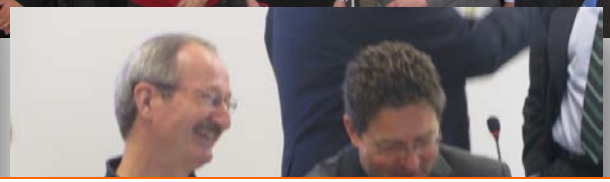

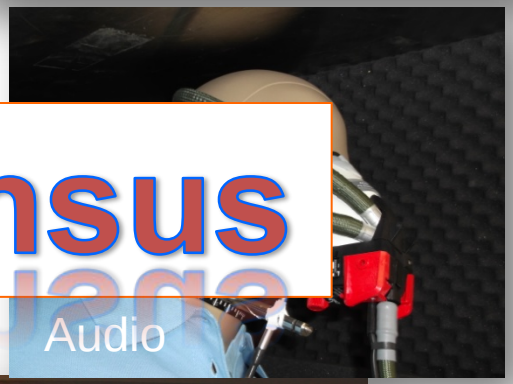

Join the Consensus

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Dashboard Navigation: Capability Description and Link to Unique Capabilities

	Elements Analysis:																
	Change in Roles	Technology/Equipage Required	Technology/Equipage Available?	Decision Support Tools Required	Need Policy	Need Procedures	Implementation Bandwidth	Need Airspace Changes	Standards Required?	Ops Approval Required	Cert Required	Political Risk	Links to Planning Documents	Training	Other Challenges	Environmental	Safety
Pilot/Operator	No role changes.	None	Yes	None	Designed for public use. LOAs should be addressed if OPD benefits are sought.	Yes	Yes	Yes depending on the profile developed and current airspace.	Yes with AC 90-100A	No	No	Environmental. SMS	NGIP	No			
ATC	STAR: No. LOAs would need to be addressed to facilitate. TA: Yes. ATC will need to transmit via datalink. Training in the software would be needed as well.	None. Enhanced TMA operations would assist in spacing/merging prior to TOD	Yes	ATC training on OPD operations to assist understanding of these types of operations in a daily environment to assist in design.	LOAs should be addressed if OPD benefits are sought.	Yes	Yes	Yes depending on the profile developed and current airspace. LOAs should be addressed if OPD benefits are sought.	Yes with AC 90-100A	No	No	Environmental. SMS. LOAs should be addressed if OPD benefits are sought.	NGIP	No		LOAs should be addressed if OPD benefits are sought.	

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29_OPD	2010-2012	M.	M^	M.	M^	Medium
30_Q&T Routes	2012-2013	H^	M^	H^	M^	High
32a_RNAV RNP SID & STAR (RNAV only)	2010-2012	H?	M^	M^	M^	Low

OPD Example: Overall Benefit Scores

<== Return to Top <==

Capability Name (click for Description)	Benefit	Operator					System/Society				General (No		
			Capacity	Efficiency	Predictability	Operator Productivity		ANSP Productivity	Less Enviro Impact	Less Pax Delay		Access	Resource Utilization
18_En route Parallel Offsets	M.	M.	M.	M?	M?	?	L?	~^	~^	L?	M?	~^	L?
19_GBAS TAP	L?	L?	L?	L?	L?	?	L?	~^	L?	~.	L?	L?	~^
20a_GLS	H.	H.	H.	M.	M.	?	M.	L?	~.	M.	M.	M.	?
20ab_GLS	H.	H.	H.	M.	M.	?	M.	L?	~.	M.	M.	M.	?
20b_GLS	H.	H.	H.	M.	M.	?	M.	L?	~.	M.	M.	M.	?
20c_GLS	H.	H.	H.	M.	M.	?	M.	L?	~.	M.	M.	M.	?
21_Integrated Arrival/Departure Airspace (aka Big Airspace)	H^	H^	H^	H^	M?	?	H^	H^	M?	H^	H?	~^	H?
22_LPV	H^	H^	H^	M?	M?	?	M?	~^	M?	?	H^	H^	~^
23_MMS FDMS, Interval Management	H^	L.	L.	L?	L?	?	H^	~.	H^	L?	L^	~.	L?
24_MMS NT TMA RPI	~^	?	~^	~^	~^	?	~^	~^	~^	?	~^	~^	~^
25_Metering, Merging, Spacing Utilizing Required Time of Arrival (RTA)	H^	H^	L.	L?	H^	?	L.	L.	L?	L?	M.	~.	M.
26_MVMC_IMC_CAS	M.	M.	M.	L?	H?	?	M.	~^	M.	?	H?	~^	~^
27_Non-radar GOMEX	H^	H^	H^	H.	H^	?	M?	M?	~^	?	M.	M.	~^
28_Non-radar Low Altitude	H^	H^	1^	H?	M.	?	L?	L?	~^	?	H?	M?	~.
29_OPD	M.	M.	~^	M.	L?	?	H?	L?	H?	M?	M.	H?	~.

OPD: Detailed Assessment Comments

3.1.2	Efficiency		
3.1.2.1	Fuel Use	M.	(-1%-3%):
Different aircraft types vary in fuel savings from 300 – 500lbs per flight. Reference: NWA trials; MITRE analysis for PHX has also analyzed benefits			
3.1.2.2	Block Time Length	L?	(-<.5%):
3.1.2.3	Flight Operating Time	M.	(-4%-7%): Current programs show reduction in flight time of ~2 ½ minutes per flight
3.1.2.4	Taxi Operating Time		

Performance Data - Capacity

- Sub-factor 1: Changes to Airport Visual Operations Throughput - Ops / Hour
- Sub-factor 2: Changes to the Capacity of General Airspace Categories - Ops / Hour
- Sub-factor 3: Changes to the Capacity of Congested Airspace - Ops / Hour
- Sub-factor 4: Changes in Airspace Capacity during Adverse Weather Meteorological Conditions - Ops / Hour
- Sub-factor 5: Changes to Airport Capacity During Adverse Meteorological Conditions - Ops / Hour

H	High Benefit	The increase in throughput is 7 to 10 percent.
M	Medium Benefit	The increase in throughput is 4 to 7 percent.
L	Low Benefit	The increase in throughput is 2 to 4 percent.
~	Negligible Benefit or Not Applicable	The change in throughput is within 2 percent (i.e., (+) or (-)) 2 percent.
N	Minor negative benefit	The reduction in throughput is 2 to 4 percent...
!	Significant negative benefit	The reduction in throughput exceeds 4 percent.

Performance Data - Efficiency

- Sub-factor 1: Fuel Use - Kilograms by phase of flight
- Sub-factor 2: Scheduled Block Time Length – Time by phase of flight (Predictability metric)
- Sub-factor 3: Flight Operating Time – Time by phase of flight
- Sub-factor 4: Taxi Operating Time – Time by phase of flight

		Fuel Use	**Time**
H	High Benefit	The reduction in fuel used is 3 to 10 percent.	The reduction in operating time is 7 to 10 percent.
M	Medium Benefit	The reduction in fuel used is 1 to 3 percent.	The reduction in operating time is 4 to 7 percent.
L	Low Benefit	The reduction in fuel used is 0.3 to 1 percent.	The reduction in operating time is 2 to 4 percent.
~	Negligible Benefit or Not Applicable	The change in fuel used is within (i.e., (+) or (-)) 0.3 percent.	The change in operating time is within (i.e., (+) or (-)) 2 percent.
N	Minor negative benefit	The increase in fuel used is 0.3 to 1 percent.	The increase in operating time is 2 to 4 percent.
!	Significant negative benefit	The increase in fuel used exceeds 1 percent.	The increase in operating time exceeds 4 percent.

Performance Data - Environment

- Sub-factor 1: Noise - Population/Land exposed to over 65 DNL, Number of flights under 10000 ft
- Sub-factor 2: Greenhouse Gas Emissions - Co/Co2 ton emission/phase of flight (over and under tropopause) / Operation
- Sub-factor 3: Local Criteria-Pollutant Emissions - Particulate ton/year

		Noise	Greenhouse gas Emissions	Pollutant Emissions
H	High Benefit	3-10% reduction to 65 DNL contour areas or to persons impacted	Reduction in greenhouse gas emissions from 3-10%.	A reduction in particulates from +10-30%
M	Medium Benefit	1-3% reduction to 65 DNL contour area or to persons impacted	Reduction in greenhouse gas emissions from 1 to 3%.	A reduction in particulates from +3-10%
L	Low Benefit			
~	Negligible Benefit or Not Applicable	+/- 0.3 % change to 65 DNL contour area or to persons impacted	No (or negligible) change to greenhouse gas emissions	Neutral: negligible change: +1-3%
N	Minor negative benefit	>0.3% increase to 65 DNL contour area or to persons impacted	An increase in greenhouse gas emissions from 0.3-1%	An increase in particulates
!	Significant negative benefit		An increase in gas emissions over 1%	

Performance Data – Access and Equity

- Sub-factor 1: General Access to airspace or airports
- Sub-factor 2: VFR Access to Services and Airspace
- Sub-factor 3: IFR Access to Services and Airspace
- Sub-factor 4: IFR Access in Low Visibility and Ceiling Conditions
- Sub-factor 5: Equitable Allocation of Limited Service Provider Resources

H	High Benefit	*Significantly* increases access for stakeholder without requiring any new airport infrastructure or aircraft equipage investment.
M	Medium Benefit	*Moderately* increases access from current level for stakeholder with additional airport infrastructure or aircraft equipage investment. Aircraft equipage retrofits and airport infrastructure changes are technically, politically, and financially feasible and scaled to the level of anticipated benefits.
L	Low Benefit	Increases access from current level for stakeholder with additional airport infrastructure or feasible and retrofitable aircraft equipage investment. Aircraft equipage retrofits and airport infrastructure changes are technically, politically, and financially feasible.
~	Negligible Benefit or Not Applicable	Does not reduce access from current level for stakeholder or require any new airport infrastructure or aircraft equipage investment to maintain current access.
N	Minor negative benefit	Requires additional aircraft equipage or additional airport infrastructure to maintain current access. Aircraft equipage retrofits and airport infrastructure changes are technically, politically, and financially feasible stakeholder receives no benefits from this equipage or infrastructure other than maintaining current access.
!	Significant negative benefit	Reduces access from current levels for stakeholder regardless of equipage. Includes cases where mitigating aircraft equipage may be available but not retrofitable or mitigating airport infrastructure changes may not be technically, politically, or financially feasible. Reduction in number of airports with the infrastructure to mitigate the proposed access constraints is a major negative.

Performance Data – Safety

- Sub-factor 1: Reduction in Operational errors (OEs) by Ground Personnel
- Sub-factor 2: Reduction in Pilot Deviations
- Sub-factor 3: Reduction in Flight Crew–Controller Communication Errors
- Sub-factor 4: Reduction in Controller Workload
- Sub-factor 5: Reduction in Flight Crew Workload

		Errors	**Workload**
H	High Benefit	Operational capability decreases the number and severity of controller operational errors by more than 4%.	Operational capability reduces the flight crew workload by more than 20%.
M	Medium Benefit	Operational capability decreases the number and severity of controller operational errors by 3%-4%.	Operational capability reduces the flight crew workload by 10% - 20%.
L	Low Benefit	Operational capability decreases the number and severity of controller operational errors by 2% - 3%.	Operational capability reduces the flight crew workload by 3% - 10%.
~	Negligible Benefit or Not Applicable	Operational capability does not improve the number or reduce the severity of controller operational errors by more than 1%.	Operational capability does not reduce the flight crew workload by more than 3%.

Basic Data – Other

- Fleet types and counts
- Current Aircraft equipage
  - Communications, Navigation, Surveillance
- Airports/runways configuration
- Traffic – aircraft and passenger
  - Airports
  - Key City Pair flows

Task Force: Delivering Operational Capabilities

What, Where, Who, When, Why, How (W5H)

WWW

WHAT Operational Capabilities will be implemented WHERE and by WHOM from now until 2020?

Activities: List of Operational Capabilities with Who, What, Where and equipage needs specified for each operational capability. Prepare consolidated list of similar operational capabilities.

Eval Factors

WHY should the aviation community implement an Operational Capability?

Activities: Define Evaluation Factors for assessing value of Ops Caps (Benefits, Risks, Costs); Define evaluation methodology

Bus Case Parameters

Define parameters that go into building business case for operators;

Elements, Pacing Items

Identify HOW to implement an Operational Capability.

Activities: Specify the elements for each Ops Cap; Define a timed evolution of capability through 2018

Operational Capabilities Assessment SG:

NextGen TF "Editorial Board" assesses Operational Capabilities based on W5H and determines which Operational Capabilities to include in the final plan.

Activities: Take inputs from above and assign "value" for Benefit, Risk and Cost of each capability Use decision lens to gather inputs.

Final Prioritization, Review and Comment, Presentation, and Production

Activities: Evaluate output of above and create final prioritized list

Document equipage strategies for ops capabilities that require new equipage

Document recommendations for follow on tracking of progress toward commitments

IATA INTERNATIONAL AIR TRANSPORT ASSOCIATION

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KEY OBJECTIVES

- Continually improve aviation safety
- Increase value through partnership
- Protect the interests of the industry
- Reduce environmental impact