Australia Indonesia Partnership
Kemitraan Australia Indonesia

COMMUNICATIONS, NAVIGATION AND SURVEILLANCE

WORKING PAPER FOR WORKING GROUP 3




INDONESIA
INFRASTRUCTURE
INITIATIVE

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This document has been published by the Indonesia Infrastructure Initiative (IndII), an Australian Government funded project designed to promote economic growth in Indonesia by enhancing the relevance, quality and quantum of infrastructure investment.

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Jakarta, 15 October 2010

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ABBREVIATIONS

AAMA	Australian Airspace Monitoring Agency
AFS	Aeronautical Fixed Service
AIM	Aeronautical Information Management
AMC	Airspace Management Cell
AMSS	Aeronautical Mobile-Satellite Service
ATCO	Air Traffic Control Operator
BLU	Public Service Agency
CAA	Civil Aviation Administration
CBT	Computer Based Training
CDM	Collaborative Decision Making
CDR	Conditional Route
CWP	Controller Working Positions
DGAC	Directorate General of Air Communication
D-VOLMET	Digital Meteorological Information for Aircraft in Flight
FDPS	Flight Data Processing System
FMP	Flow Management Position
GANP	Global Air Navigation Plan
GATMOC	Global ATM Operational Concept
GLONASS	Global Orbiting Navigation Satellite System
IAVW	International Airways Volcano Watch
ICVM	ICAO Coordinated Validation Mission Report
KPI	Key Performance Indicators
LoA	Letter of Agreement
LVP	Low Visibility Procedure
METAR	Meteorological Report
NOTAM	Notice to Airmen
OPMET	Operational Meteorological Information
PRM	Precision Runway Monitoring
PRNAV	Precision Area Navigation
R&D	Research and Development
RPL	Repetitive Flight Plan
RMA	Regional Monitoring Agencies
RDPS	Radar Data Processing System
RVSM	Reduced Vertical Separation Minimum
SWIM	System Wide Information Management
TLS	Target Level of Safety
TOC	Table of Contents
VCS	Voice Communication System
VFR	Visual Flight Rules
WAFS	World Area Forecast System
A-SMGCS	Advanced Surface Movement Guidance and Control System
ABAS	Aircraft-Based Augmentation System
ACC	Area Control Centre
ACT	Aviation Consulting Team

ADC	Aerodrome Control
ADS	Automatic Dependent Surveillance
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
AEROTHAI	Aeronautical Radio of Thailand Ltd.
AFTN	Aeronautical Fixed Telecommunication Network
AIDC	ATS Inter-Facility Data Communications
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Services
AMAN	Arrival Manager
AMHS	Aeronautical Message Handling System
ANS	Air Navigation Services
ANSP	Air Navigation Services Provider
AO	Aerodrome Operations
AOM	Airspace Organisation Management
AP1	PT Angkasa Pura 1
AP2	PT Angkasa Pura 2
APAC	Asia Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APP	Approach Centre
APV	Approach with Vertical Guidance
ARINC	Aeronautical Radio, Incorporated
ASM	Airspace Management
ATC	Air Traffic Control
ATCC	Air Traffic Control Centre
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATMSDM	ATM Service Delivery Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSU	Air Traffic Services Unit
AUO	Airspace User Operations
AusAID	Australian Agency for International Development
AWOS	Acquisition Weather Observation Stations
BIS	Boundary Intermediate System
CASR	Civil Aviation Safety Regulations
CATT	Civil Aviation Transportation Team
CDA	Continuous Descent Approaches
CM	Conflict Management
CNS	Communications, Navigation and Surveillance
COTS	Commercial off the shelf
CPDLC	Controller-Pilot Data Link Communications
CTR	Control Zone
CVOR	Conventional VHF Omni-directional Range
D-ATIS	Digital-Automatic Terminal Information Service
DCB	Demand and Capacity Balancing

DFIS	Data Link Flight Information Service
DG	Director General
DGCA	Directorate General of Civil Aviation
DMAN	Departure Manager
DME	Distance Measuring Equipment
DSB	Double SideBand
DVOR	Doppler VHF Omni-directional Range
ES	Extended Squitter
FANS	Future Air Navigation Services
FIR	Flight Information Region
FL	Flight Level
FMS	Flight Management System
FSS	Flight Service Sector
FUA	Flexible Use of Airspace
GBAS	Ground-Based Augmentation System
GNSS	Global Navigation Satellite System
GOLD	Global Operational Data Link Document
GPI	Global Plan Initiative
GPS	Global Positioning System
GRAS	Ground-Based Augmentation System
GW	Gate Way
HF	High Frequency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IndII	Indonesia Infrastructure Initiative
INDOSAT	PT. Indonesian Satellite Corporation
INFOKOM	PT. INFOKOM Elektrindo
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ITU	International Telecommunication Network
JAATS	Jakarta Advanced Air Traffic Control System
LAN/WAN	Local Area Network/Wide Area Network
MAATS	Makassar Advanced Air Traffic Control System
MET	Meteorological Services for Air Navigation
MLAT	Multilateration
MoT	Ministry of Transport
MSAS	Multi-functional Satellite Augmentation System
MSAW	Minimum Safe Altitude Warning
MSSR	Monopulse Surveillance Radar
MTCD	Medium Term Conflict Detection
MWARA	Major World Air Routes Area
Navaids	Navigation aids
NDB	Non Directional Beacon
NM	Nautical Miles
NPA	None Precision Approach

NUC	Navigation Uncertainty Category
PBN	Performance Based Navigation
PSR	Primary Surveillance Radar
RCMS	Remote Control and Monitoring System
RDARA	Regional and Domestic Air Route Area
RNAV	Area Navigation
RNP	Required Navigation Performance
RNP-AR	Required Navigation Performance – Arrivals
RVR	Runway Visual Range
SARPs	Standards and Recommended Practices
SBAS	Satellite-Based Augmentation System
SID	Standard Instrument Departures
SITA	Société Internationale de Télécommunications Aéronautiques
SMEC	Snowy Mountains Engineering Company
SMR	Surface Movement Radar
SMS	Safety Management System
SSP	State Safety Programme
SSR	Secondary Surveillance Radar
STARs	Standard Instrument Arrival
STCA	Short Term Conflict Alert
SUP	Supplement
TCU	Terminal Control Unit
TMA	Terminal Control Area
TS	Traffic Synchronisation
TWR	Tower
UTA	Upper Control Area
VDL	VHF Data Link
VHF	Very High Frequency
VHF-ER	Very High Frequency-Extended Range
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VoIP	Voice over Internet Protocol
VOR	VHF Omni-directional Range
VSAT	Very Small Aperture Terminal
WAM	Wide Area Multilateration
WG	Working Group
WGS-84	World Geodetic System – 1984
WP	Working Paper
WRC	World Radio Communication Conferences

CHAPTER 1: INTRODUCTION

Law no. 1/2009 on Aviation requires that PT Angkasa Pura 1 (AP1), PT Angkasa Pura 2(AP2) and the parts of the Directorate General of Civil Aviation (DGCA) providing Air Navigation Services (ANS) should merge into a single Air Navigation Services Provider (ANSP), with the remaining part of DGCA being maintained as a Regulator. This re-organisation, which must be completed by January 2012, has already begun. A special taskforce has been set up and is being managed by the Director General (DG) of the DGCA.

To save valuable time and resources during the reorganisation process, the following factors should be considered in future Air Traffic Management (ATM) planning and project implementation:

- It is of utmost importance that Indonesia caters for undisturbed and safe domestic and international air traffic in the region and facilitates international transit traffic over Indonesia.
- The Air Traffic Analysis Report (Deliverable 1) shows that there has been a large increase in domestic, international and transit traffic. Implementation of the Association of South East Asian Nations (ASEAN) Open Sky Policy emphasises the need for further ATM development.

The mission of supporting DGCA to develop an updated ATM Master Plan has been contracted to the LFV Aviation Consulting Team (ACT).

The mission includes a transfer of knowledge to DGCA, AP1, and andAP2 staff. Four working groups (WGs) have been established where this staff can participate actively and the knowledge transfer process can be facilitated. Creating WGs for different domains with participation of in-house experts will also facilitate the production of a realistic and acceptable ATM Master Plan, which can later be broken down into specific action plans. The meeting process of the four WGs will result in four Working Papers that will form one of the fundamentals in the development of the final ATM Master Plan.

The ATM Master Plan will try to answer questions such as “What needs to be done?” and “When does it have to be done?” However, it will not answer the question of how things will be done.

LFV ACT is responsible for the WGs

Experts from the following organisations/enterprises/agencies/associations have been invited to participate:

- DGCA/AP1/AP2 experts
- Civil Aviation Transportation Team (CATT)
- International Air Transport Association (IATA)

- Air Services of Australia
- Others

An additional task assigned by the Indonesia Infrastructure Initiative (IndII)/SMEC and agreed by LFV ACT is for each WG results to be put in a Working Paper that will be included in the updated ATM Master Plan.

The four WGs that have been established are:

- WG1 - Air Traffic Flow Management (ATFM)/ Airspace Management (ASM)
- WG2 - Air Traffic Control (ATC)
- WG3 - Communications, Navigation and Surveillance (CNS)
- WG4 - Aeronautical Information Services (AIS)/ Meteorological Services for Air Navigation (MET)/Search and Rescue (SAR)

CHAPTER 2: WORKING GROUP 3 CNS

WG3 - CNS was established to focus on ATM infrastructure needs in the short, medium and long term.

The linked Global Plan Initiatives (GPIs) according to the International Civil Aviation Organisation's (ICAO´s) Global Air Navigation Plan (GANP) (Doc 9750) are GPI nos. 5, 9, 11, 12, 17, 21, 22, and 23.

The WG is required to elaborate on the following work areas:

- Current status and future plans for CNS infrastructure
- Regional Performance Based Navigation (PBN) Implementation Plan
- Short-term budget for CNS maintenance/replacement in Indonesia
- Safety Management System
- Staff situation and recruitment/training processes
- Other relevant issues.

WG3 - CNS is managed by Hans Holkenberg from LFV ACT. WG3 participants are listed in Annex 1.

CHAPTER 3: LINKS TO ICAO AIR NAVIGATION PLAN DOC 9750

The following GPIs are linked to the CNS domain: GPI 5, 9, 11, 12, 17, 21, 22, and 23.

3.1 GPI-17 DATA LINK APPLICATIONS

3.1.1 Scope

Increase the use of data link applications.

Related Operational Concept Components: Demand and Capacity Balancing (DCB), Aerodrome Operations (AO), Traffic Synchronisation (TS), Conflict Management (CM), Airspace User Operations (AUO), ATM Service Delivery Management (ATMSDM).

3.1.2 Description of strategy

The implementation of less complex data link services (e.g. pre-departure clearance, oceanic clearance, Digital-Automatic Terminal Information Service (D-ATIS), automatic position reporting) can bring immediate efficiency benefits to the provision of Air Traffic Services (ATS). Transition to the use of data link communications for more complex safety-related uses that take advantage of a wide variety of Controller-Pilot Data Link Communications (CPDLC) messages, including ATC clearances, is already being successfully implemented. Use of CPDLC and implementation of other data link applications can bring significant advantages over voice communication for both pilots and controllers in terms of workload and safety. In particular, they can provide efficient linkages between ground and airborne systems, improved handling and transfer of data, reduced channel congestion, reduced communication errors, interoperable communication media and reduced workload. The reduction of workload per flight translates into capacity increases and enhanced safety.

Communication data link and data link surveillance technologies and applications should be selected and harmonised for seamless and interoperable global operations. Automatic Dependent Surveillance-Contract (ADS-C), Automatic Dependent Surveillance-Broadcast (ADS-B) and CPDLC are in service in various regions of the world but lack global harmonisation. Current regional initiatives, including utilising unique message subsets and CPDLC procedures, hinder efficient development and acceptance for global aircraft operations. Existing and emerging technologies should be implemented in a harmonised global manner in the near term to support long-term goals. Harmonisation will define global equipage requirements and therefore minimise user investment.

Future Air Navigation Services (FANS)-1/A and Aeronautical Telecommunication Network (ATN) applications support similar functionality, but with different avionics requirements. Many aircrafts operating internationally are equipped with FANS-1/A avionics, initially to take advantage of data link services offered in certain oceanic and remote regions. FANS-1/A equipage on international business aviation aircrafts is underway and expected to increase.

3.1.3 Current situation in Indonesia

The installation of 30 ADS-B ground stations will be finalised this year and the plan is to have them operational in 2012. This will give Indonesia good coverage.

The ATM system in Ujung Pandang has been updated to receive ADS-C/CPDLC (FANS-1/A protocols) messages, which became operational on 23 September 2010.

For Jakarta Area Control Centre (ACC), the plan is to implement ADS-C/CPDLC in a minor back-up system available for some sectors. This will allow for some ADS-C/CPDLC functionality until the ATM system is replaced.

3.1.4 Comments from stakeholders

Comments from CATT:

The ATM Master Plan needs to identify enabling actions that are needed to implement ADS-C, CPDLC and ADS-B.

Comments from IATA:

Within CNS/ATM, reliable communication networks are paramount for effective and timely transmission of data.

In the report, the Consultant may not have assessed the gravity of the situation in terms of data communication within the Indonesian archipelago.

The establishment of a reliable and redundant communication network within the ATS unit in Indonesia is required not only to bring data from point A to point B, but also to enable the transmission of the real-time data required for decision making. A reliable communication network is a key enabler of a modern CNS/ATM infrastructure.

3.2 GPI-22 COMMUNICATION INFRASTRUCTURE

3.2.1 Scope

Evolve the aeronautical mobile and fixed communication infrastructure, supporting voice and data communications, accommodating new functions, and providing adequate capacity and quality of service to meet ATM requirements.

Related Operational Concept Components: AO, TS, CM, and AUO.

3.2.2 Description of strategy

ATM depends extensively and increasingly on the availability of real-time or near real-time, relevant, accurate, accredited and quality-assured information to make informed decisions. The timely availability of appropriate aeronautical mobile and fixed communication capabilities (voice and data) to accommodate ATM requirements, that provide adequate capacity and meet quality of service requirements, is essential. The aeronautical communication network infrastructure should accommodate the growing need for information collection and exchange within a transparent network in which all stakeholders can participate.

The gradual introduction of performance-based Standards and Recommended Practices (SARPs) and system-level and functional requirements will allow the increased use of commercially available voice and data telecommunication technologies and services. In the framework of this strategy, States should, to the maximum extent possible, take advantage of appropriate technologies, services and products offered by the telecommunications industry.

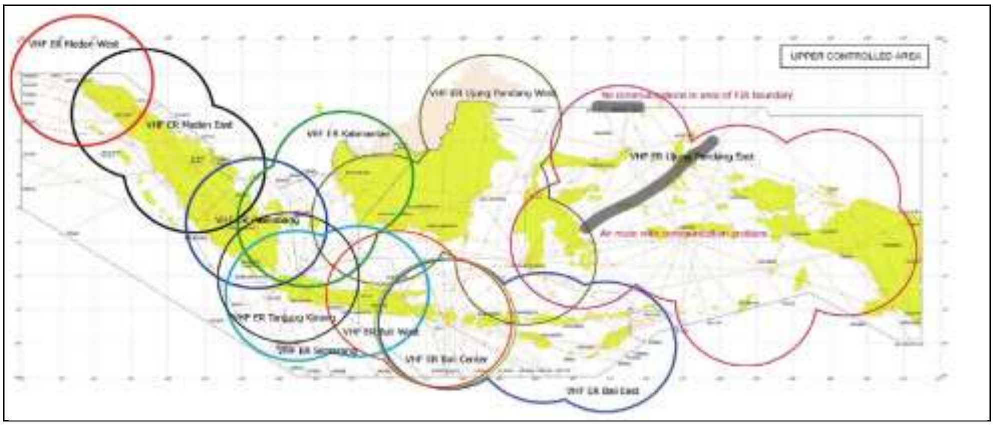
Considering the fundamental role of communications in enabling aviation, the common objective is to seek the most efficient communication network service providing the desired services with the required performance and interoperability required for aviation safety levels at a minimum cost.

3.2.3 Current situation in Indonesia

As regards air to ground voice communications, Very High Frequency (VHF) radio is used for the Control Zone (CTR), Terminal Control Area (TMA) and Aerodrome Control (ADC). VHF radio units are basically located at the airports. The present major issue is the need to replace huge quantities of aging equipment.

VHF air to ground extended range (VHF-ER) is used basically for ATC of the upper control area (UTA) – from flight level 245 (FL 245) to FL 600 in the Indonesian Flight Information Region (FIR), as shown in Figure 1. Only UTA Indian Ocean is served by high frequency (HF) air to ground radio, as the oceanic area is beyond VHF coverage.

Figure 1: VHF-ER coverage



Source: Japan International Cooperation Agency (JICA) Report 2008

HF air to ground radio for upper control area (MWARA) is used for communications beyond VHF-ER coverage in UTA, e.g., UTA Indian Ocean, UTA Ujung Pandang East. It is also a backup communication system for VHF-ER (See Table 1).

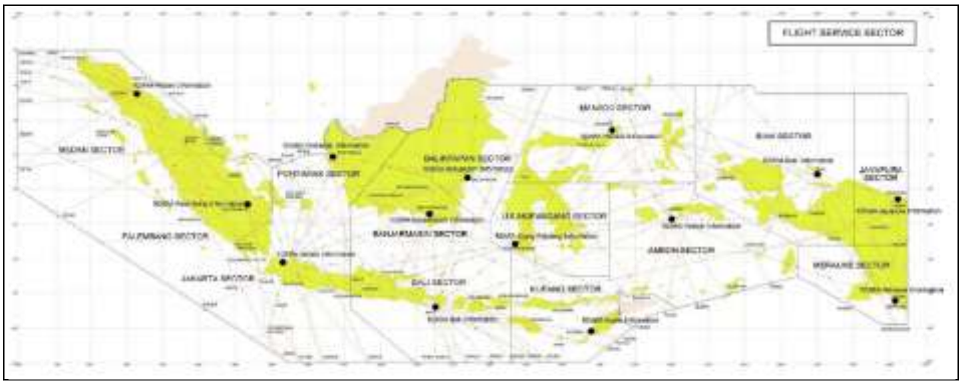
Table 1: HF Air to Ground for Flight Service Sectors

FIR	UTA	HF MWARA	Equipment Sites
Jakarta FIR	Upper control area not covered by VHF-ER	Jakarta Information	Jakarta ACC
Ujung Pandang FIR	Upper control area not covered by VHF-ER	Ujung Pandang Information	Ujung Pandang ACC

Source: DGCA

HF air to ground for Flight Service Sectors (FSS) is used in the uncontrolled airspace from ground to FL 245. The airspace is divided into four FSS in Jakarta FIR, and ten FSS in Ujung Pandang FIR (see Figure 2). HF radio Regional and Domestic Air Route Area (RDARA) is used in these FSS. AP1 plans to merge its 10 sectors into four.

Figure 2: FSS in Indonesia



Source: JICA Report 2008

As regards air to ground data communications, a stand-alone ADS-C/CPDLC (FANS-1/A protocols) system was introduced by Aeronautical Radio, Incorporated (ARINC) in Jakarta ACC. It operated on a trial basis from May to August 2001 and is not in operation now. AP 2 plans to replace the Jakarta Advanced Air Traffic Control System (JAATS) and consolidate ADS-C/CPDLC in the automation system. A minor back-up system produced by local technicians in AP 2 ADS-C/CPDLC is planned to be made available for some sectors.

The Makassar Advanced Air Traffic Control System (MAATS) became operational in July 2005. MAATS has an integrated ADS-C/CPDLC (FANS-1/A) function, and tests and trials have been going on since 2008. DGCA has issued an Aeronautical Information Publication (AIP) Supplement (SUP) so that ADS-C/CPDLC is operational in Ujung Pandang FIR with effect from 23 September 2010.

Ground to ground data communications includes ATS inter-facility data communications (AIDC), Aeronautical fixed telecommunication network (AFTN) and ATN. MAATS is technically ready to implement AIDC with Brisbane Air Traffic Control Centre (ATCC). Brisbane will not, however, be ready to start operational use of AIDC until its software has been updated. The existing JAATS is not ready for AIDC; therefore no trials have been conducted between MAATS and JAATS. At present, messages are exchanged through verbal communication and there is no specific plan to introduce AIDC before the new JAATS is introduced in 2013 (in line with the plan).

For AFTN, there are three communication centres, 20 sub communication centres and 17 tributary stations. AFTN has limitations in terms of character-based data, limited capacity and function, and low transmission rate. ATN is superior in all these respects.

DGCA plans to carry out ATN (ground-to-ground) trials based on a Ministry of Transport (MoT) Decree (KP 218/2004) in order to prepare the ATN concept, transition plan, ATN standard facilities, and Indonesian legal entity requirements. At present, the first ATN router has been introduced in the Jakarta Communication Centre and an Aeronautical message handling system (AMHS) is being procured.

Communications by ANS providers include Very Small Aperture Terminal (VSAT) and VHF Data Link (VDL).

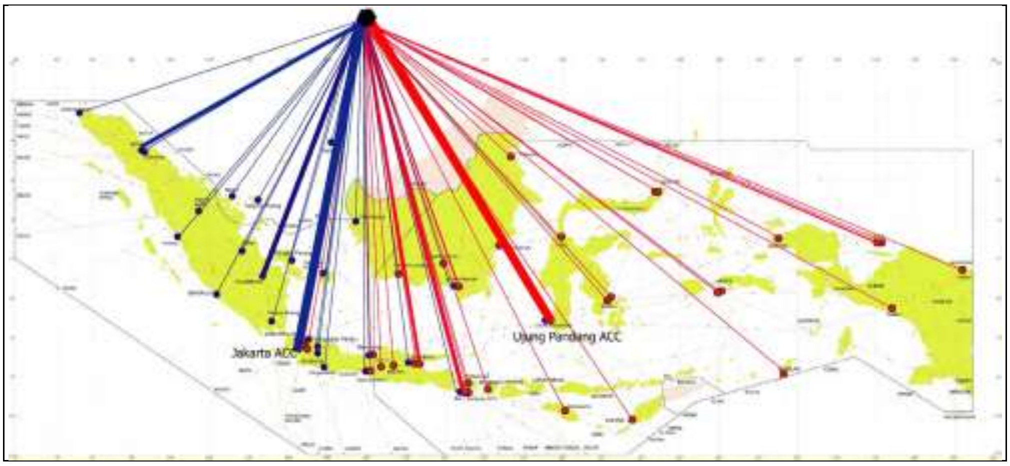
There are nationwide VSAT networks connecting ACCs, airports, remote radar sites, VHF-ER sites, etc. Two private telecommunications companies operate the networks: PT Indonesian Satellite Corporation (INDOSAT) for international links and PT INFOKOM Elektrindo (INFOKOM) for domestic links. AP 1 and AP 2 operate 36 and 37 VSAT terminals respectively. The VSAT configuration is a Standard Instrument Arrival (STAR) network sending data to each VSAT terminal. Makassar is the central uplink site for AP 1 and Jakarta for AP 2.

The following data is transmitted via VSAT:

- ATS direct speech circuit
- AFTN teletype

- Radar data
- VHF-ER
- Other data (ADS-B, etc.).

Figure 3: VSAT Network Aviation Communication in Indonesia



Source: JICA Report 2008

As for VDL, AP 2 and ARINC have jointly installed four ground stations in Medan, Palembang, Jakarta Soekarno-Hatta, and Natuna. These stations are linked by domestic VSAT network and connected with Aeronautical Radio of Thailand Ltd. (AEROTHAI) in Bangkok. As of 2008, Société Internationale de Télécommunications Aéronautiques (SITA) and Garuda had installed 16 remote ground stations for VDL in Indonesia.

3.3 COMMENTS FROM STAKEHOLDERS

Comments from CATT:

The ATM Master Plan needs to be very specific and provide detailed advice on communication projects that are currently planned and identified as needed by IndII. This information should include coverage, redundancy, reliability, volume of data traffic, implications of adopting CPDLC, and any specific communication requirements in the more remote airports and air operations.

Comments from IATA:

AIDC is a standard communication protocol used to exchange ATC information between ATS Units (ATSUs). This information includes notification of flights approaching an FIR boundary, notification of boundary conditions, transfer of control of a flight, and transfer of communications authority for a flight. AIDC greatly reduces the need for voice coordination between ATC facilities, resulting in fewer errors and reduced workload. This is a very efficient way to perform seamless transfer of jurisdiction between FIRs.

In its report, the Consultant correctly states that MAATS is ready to implement AIDC with Brisbane ATCC, but unfortunately AIDC cannot be implemented with Jakarta ATC (JAATS).

It is important to note that Denpasar ATC is also not AIDC-compatible. Therefore, it will not be possible to implement AIDC between Makassar and Denpasar, which are in the same FIR. IATA supports AIDC deployment as the primary means of coordination between ATC facilities, while maintaining the capability for controllers to intervene via voice for non-routine communications.

3.4 GPI-23 AERONAUTICAL RADIO SPECTRUM

3.4.1 Scope

Timely and continuing availability of adequate radio spectrum, on a global basis, to provide viable ANS (CNS).

Related Operational Concept Components: AO, TS, CM, AUO, and ATMSDM.

3.4.2 Description of strategy

States need to address all regulatory aspects on aeronautical matters on the agendas for International Telecommunication Network (ITU) World Radio Communication Conferences (WRC). Particular attention is drawn to the need to maintain the current spectrum allocations to aeronautical services.

The radio spectrum is a scarce natural resource with finite capacity for which demand from all users (aeronautical and non-aeronautical) is constantly increasing. Thus the ICAO strategy on aeronautical radio spectrum aims at long-term protection of adequate aeronautical spectrum for all radio communication, surveillance and radio navigation systems. The process of international coordination taking place in the ITU obliges all spectrum users (i.e., aeronautical and non-aeronautical) to continually defend and justify spectrum requirements. Civil aviation operations are expanding globally, creating pressure on an already stressed aeronautical spectrum with limited availability.

The framework of this initiative involves the support and dissemination by States of the ICAO quantified and qualified policy statements of requirements for aeronautical radio frequency spectrum agendas for ITU WRCs. This is necessary to maintain the current spectrum allocations to aeronautical services and ensure the continuing availability of adequate aeronautical radio spectrum and ultimately the viability of existing and new ANS globally.

3.4.3 Current situation in Indonesia

The Ministry of Communication and Information Technology is responsible for managing radio frequencies in Indonesia. DGCA has been delegated full responsibility for the entire aeronautical spectrum of frequencies, provided they are not for commercial use. The Aviation Law (Law no. 1/2009, Chapter 12, part five) regulates the use of aeronautical frequencies. The ITU WRCs are attended jointly by DGCA and the Ministry of Communication and Information Technology.

3.4.4 Comments from stakeholders

None.

3.5 GPI-5 AREA NAVIGATION (RNAV) AND REQUIRED NAVIGATION PERFORMANCE (RNP) (PBN)

3.5.1 Scope

The incorporation of advanced aircraft navigation capabilities into the air navigation system infrastructure.

Related Operational Concept Components: Airspace Organisation Management (AOM), AO, TS, CM, AUO.

3.5.2 Description of strategy

The implementation of the concept of PBN will lead to increased capacity and enhanced efficiency through reductions in separation minima, bringing benefits to aircraft operators that equip to meet performance requirements. PBN will also improve safety, particularly on approach, through a reduction of controlled flight into terrain.

A significant number of aircrafts are capable of RNAV and RNP. Where warranted, these capabilities should be further exploited to develop more efficient routes and aircraft trajectories that are not directly tied to ground-based navigation aids. Certain RNAV-equipped aircrafts also have a significantly enhanced capability to achieve sequencing requirements for runways, particularly through the use of the “required time of arrival” function within the flight management system (FMS).

The PBN concept, which comprises RNAV and RNP operations, recognises that in designating operations, a clear distinction must be made between aircraft operations that require on-board self-contained performance monitoring and alerting and those that do not.

In accordance with the PBN concept, all phases of flight are addressed including en-route (oceanic/remote and continental), terminal and approach. The concept, its implementation processes, navigation applications, as well as the operational approval and aircraft qualification requirements, are described in the PBN manual that will be published as a new edition of the Manual on RNP (Doc 961 3).

> *"The PBN concept specifies RNAV and RNP system performance requirements in terms of accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of a particular Airspace Concept, when supported by the appropriate navigation infrastructure.*
>
> *"In that context, the PBN concept represents a shift from sensor-based to performance-based navigation. Performance requirements are identified in navigation specifications that also identify the choice of navigation sensors and the equipment that may be used to meet the performance requirements. These navigation specifications are defined in sufficient detail to facilitate global harmonisation by providing specific implementation guidance for States and operators."*
>
> (4.7 Asia/Pacific Regional PBN Implementation Plan, adopted on Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG)/20 2009)

Referring to the same document, ICAO also provides a number of practical examples of tangible benefits derived from PBN implementation, as follows:

- Increased airspace safety through the implementation of continuous and stabilised descent procedures using vertical guidance;
- Provision of runway-aligned final approach path, which may not be possible in conventional navigation;
- Reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel, noise reduction, and enhanced environmental protection;
- Improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimised RNAV or RNP paths;
- Implementation of more precise approach, departure, and arrival paths that will reduce dispersion and foster smoother traffic flows;

- Reduced delays in high-density airspaces and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas;
- Reduced lateral and longitudinal separation between aircrafts to accommodate more traffic;
- Decreased ATC and pilot workload by utilising RNAV/RNP procedures and airborne capability and reduced need for ATC-Pilot communications and radar vectoring;
- Increased predictability of flight paths; and
- Reduced maintenance and flight inspection costs associated with conventional navigation aids.

3.5.3 Current situation in Indonesia

PBN implementation in Indonesia can so far only be seen in approximately 15 international ATS routes, with the RNP 10/RNAV 10 criteria as requirements.

Through further implementation of PBN in Indonesia, major cost savings will be possible for the national aviation industry. For airspace users, it will result in shorter trajectories leading to lower fuel consumption and lower greenhouse gas emissions; and for the ATM infrastructure owner less need for investments in costly ground aids and maintenance. The overall capacity will increase when lateral and longitudinal separation is reduced through the higher precision offered by PBN.

The updated ATM Master Plan will address this issue with high priority.

Separation minima for different parts of the Indonesian airspace need to be clarified and approved in conjunction with the PBN implementation.

3.5.4 Comments from stakeholders

Comments from CATT:

The ATM Master Plan should provide specific recommendations and priorities for air routes and airports that would benefit from RNAV and RNP. All enabling activities to implement RNAV and RNP should also be identified.

Comments from IATA:

Navigation Infrastructure (GPI-5, GPI-11, GPI-21)

PBN is a global set of area navigation standards defined by ICAO and based on performance requirements for aircrafts navigating on departure, arrival, approach, or en route. These performance requirements are expressed as navigation specifications in terms of accuracy, integrity, continuity, availability and functionality required for a particular airspace or airport. PBN will eliminate the regional differences of various RNP and RNAV specifications that exist today.

IATA fully supports early implementation of RNAV and RNP based on the ICAO PBN.

IATA also supports the implementation of Approach with Vertical Guidance (APV) for all runways with a Barometric Vertical Navigation (VNAV) used for vertical path guidance during final approach.

During the transition period to PBN, regional specific area navigation requirements should honour PBN approvals that also meet the regional specific criteria.

PBN relies heavily on the use of the Global Navigation Satellite System (GNSS) infrastructure. However, the Consultant's report does not specify if Indonesia recognises GNSS as a radio navigation aid that will allow full exploitation of the global benefits to be gained from RNAV and RNP.

Also, the GNSS and all aircraft navigation and terrain avoidance systems are based solely on World Geodetic System – 1984 (WGS-84). All aircraft systems assume that the latitude and longitude coordinates provided are based on WGS-84. Indonesia's WGS-84 status is somewhat unclear, and the Consultant failed to clarify this.

IATA recommends that the Consultant review and clarify the WGS-84 status, since the implementation and maintenance of WGS-84 coordinates is a paramount priority considering the safety implications.

Finally, Indonesia benefits from an extensive network of ground Navigation aids, providing navigation support all over the country. It is recommended that the Consultant review the use of this equipment and recommends where it should be required as a contingency navigation system for GNSS, in accordance with an agreed airspace concept for the deployment of Distance Measuring Equipment (DME), rather than a full dismantlement of the infrastructure.

Comments from Consultant:

During the Kick-off Meetings, DGCA staff declared that all coordinates in Indonesia were based and calculated according to WGS-84, but that some coordinates still had to be verified in normal routine work (printing error). According to several participants at these meetings, Indonesia was now compliant in respect of WGS-84.

Before any activity is included in the Updated Master Plan, we need clarification on whether the stakeholder's opinion is based on actual information or previous conditions.

3.6 GPI-11 RNP AND RNAV STANDARD INSTRUMENT DEPARTURES (SIDS) AND STANDARD INSTRUMENT ARRIVALS (STARS)

3.6.1 Scope

Optimisation of the TMA through implementation of improved ATS route structures based on RNP and RNAV, connecting the en-route phase of flight with the final approach, based on improved coordination processes.

Related Operational Concept Components: AOM, AO, TS, CM, AUO.

3.6.2 Description of strategy

The implementation of optimised SIDs, STARs, instrument flight procedures, and holding, approach and associated procedures – taking advantage of aircraft navigation capabilities such as RNP and RNAV, as well as ATM decision support systems – will substantially improve capacity and efficiency.

The use of SIDs and STARs will maximise system capacity and predictability while easing the environmental impact, reducing fuel consumption, and reducing ATS coordination. States should take advantage of the performance characteristics that are currently available to design such route structures. Near-term benefits can be achieved by applying RNP 1 and RNAV 2 and 1 criteria to the design of SIDs and STARs that allow optimum spacing between the routes, leading to greater capacity and efficiency benefits.

SIDs and STARs allow the efficient transit of aircrafts from the runway to en-route flight and vice versa, segregation of departing traffic from arriving traffic to provide safe aircraft spacing, maintenance of obstacle clearance requirements, compliance with environmental requirements, and provision of a predictable flight trajectory compatible with aircraft RNAV systems.

3.6.3 Current situation in Indonesia

The following 33 Indonesian airports have a SID/STAR system based on conventional navigational ground aids:

Ambon, Balikpapan, Aceh, Bandung, Banjarmasin, Batam, Bengkulu, Biak, Jakarta Halim, Jakarta Soekarno-Hatta, Jayapura, Hasanudin Makassar, Pekan Baru, Ngurah Rai Bali, Sultan Thaha Jambi, Sam Ratulangi Manado, Kendari, Kupang, Medan, Merauke, Padang, Palangkaraya, Palembang, Pangkalpinang, Pontianak, Semarang, Solo, Sorong, Surabaya, Tanjung Pinang, Ternate, Timika, and Yogyakarta.

No airport yet has a SID/STAR system based on PBN. However, under the plan, the Jakarta and Surabaya airports will establish an RNP 1 SID/STAR system in 2011. Further, with funding from the Boeing Company, Ambon and Manado will establish an RNP arrivals (RNP-AR) system for SID/STAR. This latter project is being coordinated by the airline Lion Air. Both airports are situated in very high-level terrain with complicated approach trajectories, making them generally only available during Visual Meteorological Conditions (VMC) conditions. Installing RNP-AR procedures will allow these airports to also be available during Instrument Meteorological Conditions (IMC) conditions.

The design of major terminal areas in Indonesia is not optimal, considering present and future traffic demands.

Capacity to handle departing/arriving traffic can be increased through proper airspace design for the TMAs. Inbound and outbound airport traffic should be laterally separated where possible to reduce ATC workload, thereby increasing overall capacity. SIDs/STARs based on RNP and RNAV or even Precision Area Navigation (PRNAV) criteria (i.e., RNP5 and RNP1) require the aircraft fleet using the airport to be properly equipped. The higher navigational precision can potentially reduce lateral separation between SID and STAR, saving valuable distance for airspace users. Using SID/STAR reduces radio communication between ATC and the cockpit, thereby reducing workload for both parties.

RNP1 STARs are also a prerequisite for Continuous Descent Approaches (CDA), popularly known as Green Approaches.

Proposed development for the most congested TMAs will be included in the updated Master Plan.

3.6.4 Comments from stakeholders

Comments from CATT:

The amendment of current SIDs and STARs for short-term improvements is supported.

Comments from IATA:

See comments in section 3.5.4.

3.7 GPI-21 NAVIGATION SYSTEMS

3.7.1 Scope

Enable the introduction and evolution of PBN supported by a robust navigation infrastructure providing an accurate, reliable and seamless global positioning capability.

Related Operational Concept Components: AO, TS, CM, and AUO.

3.7.2 Description of strategy

Airspace users need a globally interoperable navigational infrastructure that delivers benefits in safety, efficiency and capacity. Aircraft navigation should be straightforward and conducted to the highest level of accuracy supported by the infrastructure.

To meet those needs, the progressive introduction of PBN must be supported by an appropriate navigation infrastructure consisting of an appropriate combination of GNSS, self-contained navigation systems (inertial navigation systems) and conventional ground-based navigation aids.

GNSS provides standardised positioning information to the aircraft systems to support precise navigation globally. One global navigation system will help support a standardisation of procedures and cockpit displays coupled with a minimum set of avionics, maintenance and training requirements. Thus, the ultimate goal is a transition to GNSS that would eliminate the requirement for ground-based aids, although the vulnerability of GNSS to interference may require the retention of some ground aids in specific areas.

GNSS-centred PBN enables a seamless, harmonised and cost-effective navigational service from departure to final approach that will provide benefits in safety, efficiency and capacity.

GNSS implementation will be carried out in an evolutionary manner, allowing gradual system improvements to be introduced. Near-term applications of GNSS are intended to enable the early introduction of satellite-based area navigation without any infrastructure investment, using the core satellite constellations and integrated multi-sensor airborne systems. The use of these systems already allows for increased reliability of non-precision approach operations at some airports.

Medium/longer-term applications will make use of existing and future satellite navigation systems with some type of augmentation or combination of augmentations required for operation in a particular phase of flight.

GNSS (according to ICAO)

GNSS is a satellite-based navigation system utilising satellite signals – such as the Global Positioning System (GPS) – to provide accurate and reliable position, navigation, and time services to airspace users. In 1996, the ICAO endorsed the development and use of GNSS as a primary source of future navigation for civil aviation. ICAO noted the increased flight safety, route flexibility and operational efficiencies that could be realised from the move to space-based navigation.

GNSS supports both RNAV and RNP operations. Through the use of appropriate GNSS augmentations, GNSS navigation provides sufficient accuracy, integrity, availability and continuity to support en-route, terminal area, and approach operations. Approval of RNP operations with appropriate certified avionics provides on-board performance monitoring and alerting capability, enhancing the integrity of aircraft navigation.

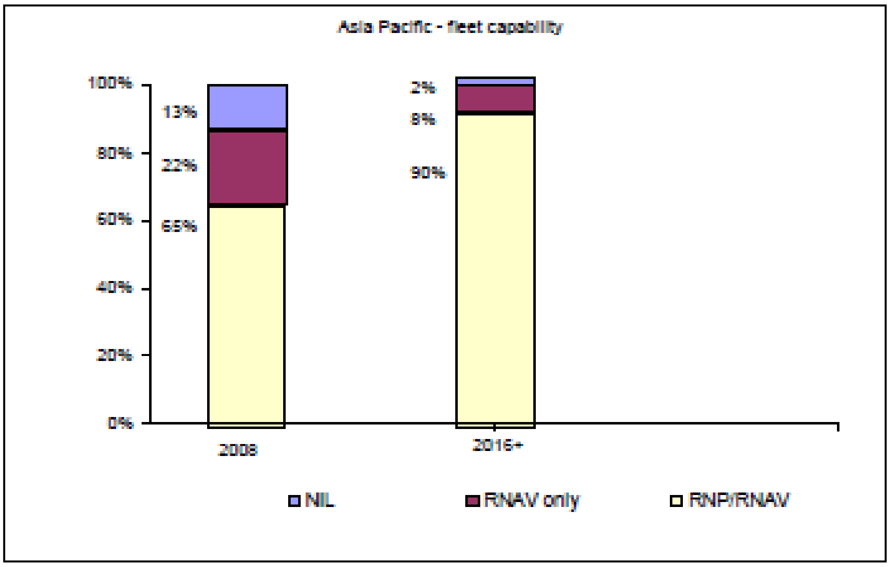
GNSS augmentations include Aircraft-Based Augmentation System (ABAS), Satellite-Based Augmentation System (SBAS), Ground-Based Augmentation System (GBAS), and Ground-based Regional Augmentation System (GRAS).

Aircraft fleet readiness status with respect to RNAV/RNP capabilities in the Asia/Pacific Region

All major commercial aircraft manufacturers have included RNAV capabilities since the 1980's, and commercial aircrafts produced currently incorporate an RNP capability.

An analysis was conducted in March 2008 based on fleet numbers from Ascend Online Fleets database and RNAV/RNP classification by IATA (Figure 4).

Figure 4: Asia Pacific RNAV/RNP fleet capacity



Source: ICAO APAC 2009

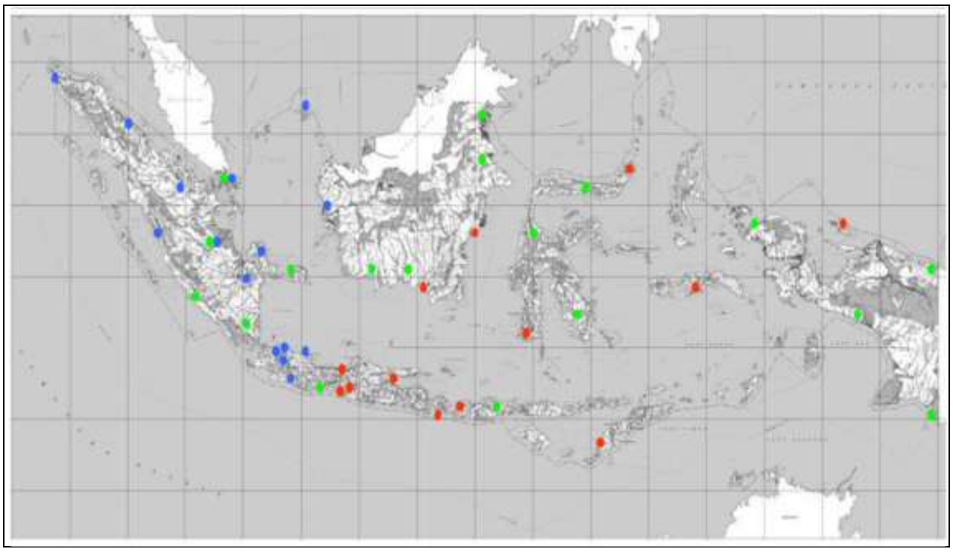
3.7.3 Current situation in Indonesia

Table 2: Navigational Aids in Indonesia

Navigational Aids	Quantities (Units)	Remarks
NDB	183	
DVOR	59	
CVOR	3	
DME	62	

Source: DGCA

Figure 5: VHF Omni-directional Range (VOR) stations in Indonesia



Source: DGCA

Future development targets and need for replacements of ground aids versus the development of PBN in the short, medium and long term will be reflected in the updated Master Plan, with assistance from the counterpart group. However, some doubts have been expressed about the vulnerability of GNSS, which could interfere with the quality of satellite signals and impact navigation capabilities. DGCA is in internal discussions on whether a monitoring tool is needed to measure GNSS signal strength before the PBN implementation plans are finalised for the country.

3.8 GPI-9 SITUATIONAL AWARENESS

3.8.1 Scope

Operational implementation of data link-based surveillance. The implementation of equipment to allow traffic information to be displayed in aircrafts supporting implementation of conflict prediction and collaboration between flight crew and the ATM system. Improve situational awareness in the cockpit by making available electronic terrain and obstacle data of required quality.

Related Operational Concept Components: AO, TS, CM, AUO.

3.8.2 Description of strategy

The further implementation of enhanced surveillance techniques (ADS-C or ADS-B) will allow reductions in separation minima and an enhancement of safety, increase in capacity, and improved flight efficiency, all on a cost-effective basis. These benefits may be achieved by bringing surveillance to areas where there is no primary or secondary radar, when cost-benefit models warrant it. In airspaces where radar is used, enhanced surveillance can bring further reductions in aircraft separation minima and improve, in high traffic density areas, the quality of surveillance information both on the ground and in the air, thereby increasing safety levels. The implementation of sets of quality assured electronic terrain and obstacle data necessary to support the ground proximity warning systems with forward looking terrain avoidance function as well as a minimum safe altitude warning (MSAW) system will benefit safety substantially.

Implementation of surveillance systems for surface movement at aerodromes where weather conditions and capacity warrant will also enhance safety and efficiency while implementation of cockpit display of traffic information and associated procedures will enable pilot participation in the ATM system and improve safety through greater situational awareness.

In remote and oceanic airspace where ADS-C is used, FANS capabilities exist on many air transport aircrafts and could be added to business aircrafts. ADS-B can be used to enhance traffic surveillance in domestic airspace. In this respect, it should be noted that the 1090 Extended Squitter (ES) is available and should be accepted as the global choice for the ADS-B data link.

At terminal areas and at aerodromes surrounded by significant terrain and obstacles, the availability of quality assured terrain and obstacle databases containing digital sets of data representing terrain surface in the form of continuous elevation values and digital sets of obstacle data of features, having vertical significance in relation to adjacent and surrounding features considered hazardous to air navigation, will improve situational awareness and contribute to an overall reduction in the number of accidents related to controlled flight into terrain.

3.8.3 Current situation in Indonesia

Primary and Secondary Surveillance Radar (PSR/SSR)

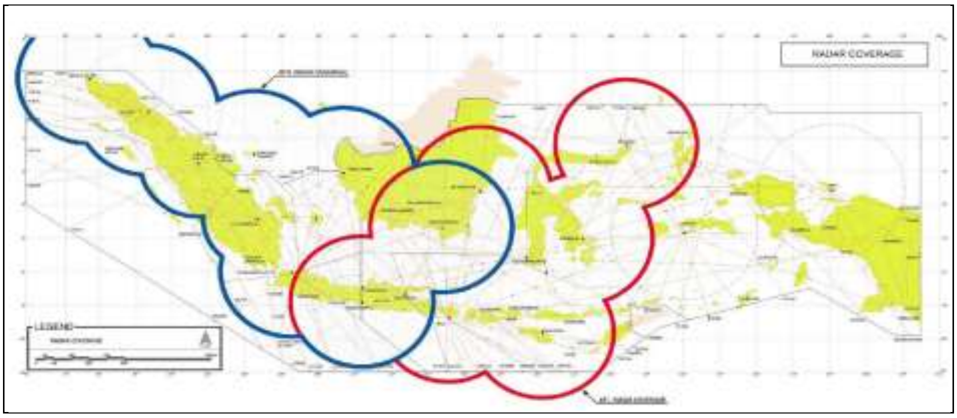
The radar surveillance is made for UTA, CTA and TMA.

Existing Radars

There are currently 13 PSRs, 13 SSRs and 10 Monopulse Surveillance Radars (MSSRs), six of which have Mode S capability. The existing radars, which are mostly installed within airport property, are used for both en-route and terminal radar control. In order to extend en-route radar coverage, a data renewal rate of every five seconds is applied for PSR and SSR. Radar data extracted from PSR/SSR is processed and displayed at approach control at the airport. At the same time, all radar data are transmitted to Jakarta ACC and/or Ujung Pandang ACC, and processed for UTA radar surveillance.

The radar network includes a mixture of radars with varying years of operation and variable quality of radar data (accuracy, integrity, continuity, availability). This may result in duplicated radar target display, and loss of radar target at Jakarta and Ujung Pandang ACCs.

Figure 6: Radar coverage in UTA in Indonesia



Source: JICA Report 2008

ADS-B

There are currently 27 ADS-B ground stations installed in Indonesia, with three more that were planned to be installed during 2010.

There is an immediate need and possibility for ADS-B to be approved for operational use in Ujung Pandang ACC. The need for ADS-B to be implemented in Jakarta ACC is also quite urgent.

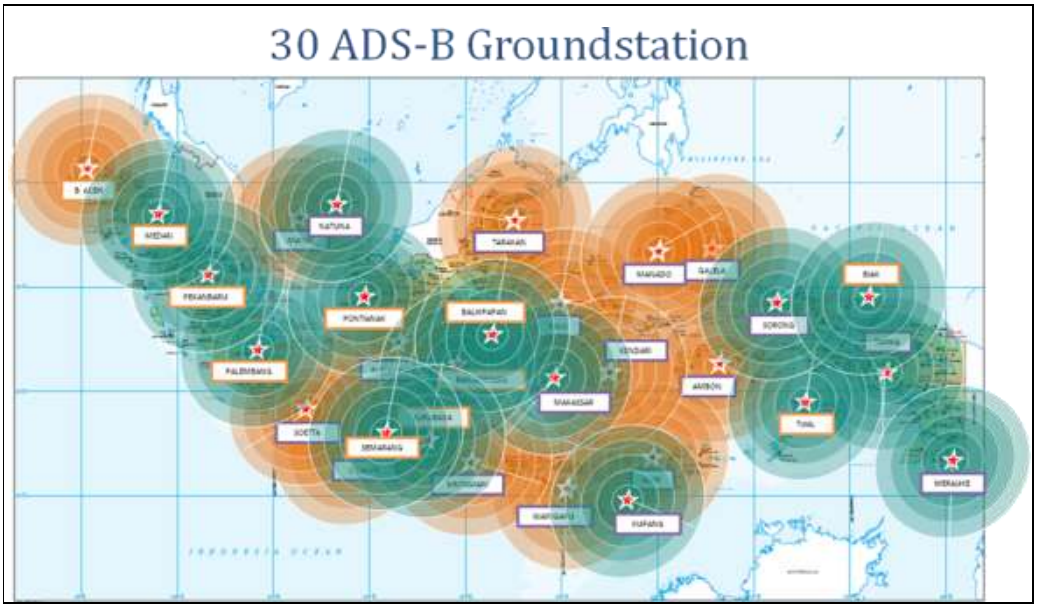
Jakarta Soekarno-Hatta airport needs an Advanced Surface Movement Guidance and Control System (A-SMGCS) installed in order to prevent substantial loss of capacity in poor IMC conditions. This requirement will also be assessed for other major airports.

Multilateration (MLAT)

In an effort to increase efficiency, streamline operations, minimise infrastructure costs and, most importantly, improve safety, many ANSPs are turning away from traditional radars and looking at a different technology – MLAT.

MLAT is an important technology to be considered in developing an ATM Master Plan for future surveillance capabilities in the Indonesian airspace.

Figure 7: ADS-B coverage in UTA in Indonesia



Source: DGCA

3.8.4 Comments from stakeholders

Comments from CATT:

The ATM Master Plan needs to identify surveillance coverage requirements, any gaps in the current coverage, and actions needed to integrate radar data into ACCs. An assessment is needed of the current performance of the existing infrastructure.

3.9 GPI-12 FUNCTIONAL INTEGRATION OF GROUND SYSTEMS WITH AIRBORNE SYSTEMS

3.9.1 Scope

Optimisation of the TMA to provide for more fuel-efficient aircraft operations through FMS-based arrival procedures and functional integration of ground and airborne systems.

Related Operational Concept Components: AOM, AO, TS, CM, and AUO.

3.9.2 Description of strategy

In recent years there have been several efforts to develop flight procedures that provide the most efficient trajectory during an aircraft's approach to the destination aerodrome. These procedures allow an uninterrupted flight trajectory from the top of descent until the aircraft is stabilised for landing. For the purposes of design work, it may be necessary to implement these procedures in phases.

The design of en-route and arrival air routes and associated procedures should facilitate the routine use of CDA procedures. Similarly, the design of departure procedures should facilitate the routine use of unrestricted climb procedures.

To maximise efficiency in TMA airspace, it is critical to take advantage of improved TMA design and make the best use of automation. Therefore, in addition to continuous descent capabilities, aircrafts will increasingly be equipped with time-of-arrival computation. This capability will integrate with ground automation to deliver time of arrival over fixes to assist in the sequencing process, allowing aircrafts to remain closer to their 4-D preferred trajectory.

3.9.3 Current situation in Indonesia

Common reference system is defined in Civil Aviation Safety Regulations (CASR) 170.028.

No trials have been performed in Indonesia with functional integration of airborne and ground systems. Implementation of the Arrival Manager/ Departure Manager (AMAN/DMAN) system in Jakarta TMA would provide the capability to improve efficiency in TMA airspace. More efficient SIDs/STARs will allow for the optimal use of continuous descent and unrestricted climb procedures.

3.9.4 Comments from stakeholders

Comments from CATT:

See comments elsewhere on SIDs, STARs, AMAN and DMAN.

Comments from Consultant:

This is something that could be implemented in the long term.

CHAPTER 4: ATM MASTER PLAN OBJECTIVES

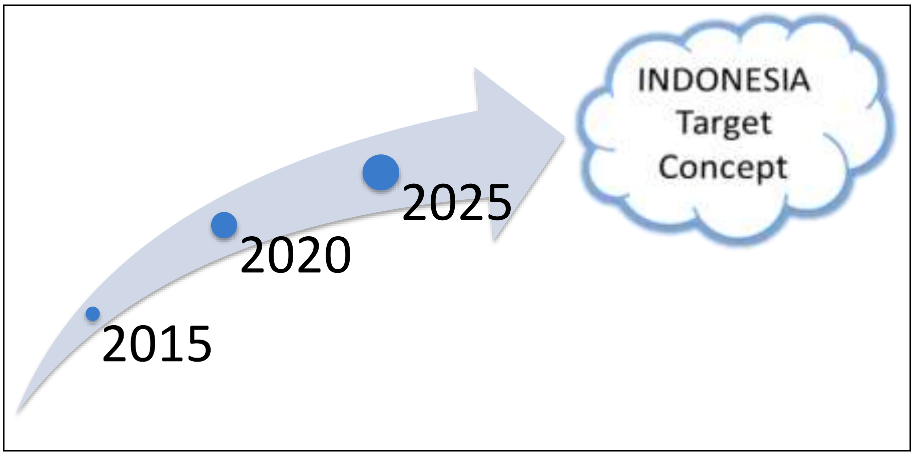
The ATM Master Plan for Indonesia will be a reference document for ATM development over the next 15 years.

The document is based on and developed from the Master Plan issued in 1994 with considerations from the JICA study from 2002-2008 and the new aviation law (Law no. 1/2009 on aviation). The results of this WG will be integrated into the ATM Master Plan.

The ATM Master Plan will be composed of three stages:

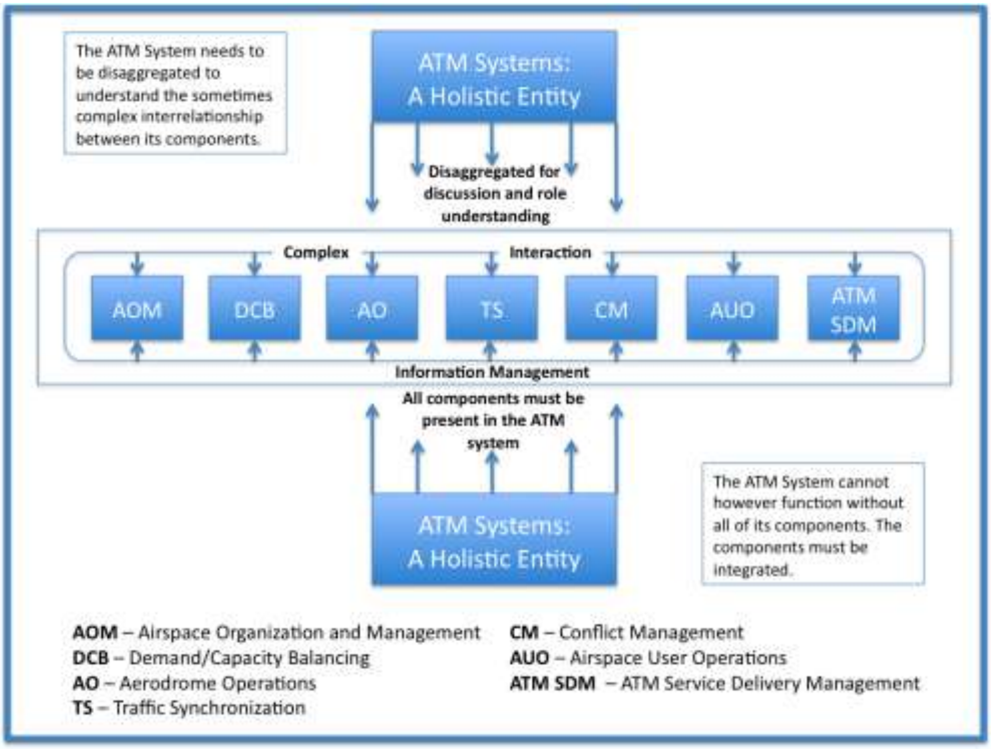
- Short term: up to 2015
- Medium term: from 2016 to 2020
- Long term: from 2021 to 2025 and beyond

Figure 8: ATM Master Plan Milestones



To ensure that a logical approach is applied to the various programs, a number of operational objectives have been defined. Classified according to ICAO doc 9854, there are seven key concept components, as depicted in Figure 9.

Figure 9: ICAO concept components



For each of these key components, relevant high level tasks have been defined. These tasks must be achieved in order to reach the operational ATM objectives.

The three programs (short, medium and long term) have been defined by decomposing the high level tasks into several sub-level tasks that are to be implemented in a timely fashion in order to achieve the global high level objectives.

CHAPTER 5: AIRSPACE ORGANISATION AND MANAGEMENT - AOM

5.1 DESCRIPTION OF CONCEPT

Airspace organisation will establish airspace structures in order to accommodate the different types of air activity, volume of traffic and differing levels of service. ASM is the process by which airspace options are selected and applied to meet the needs of the ATM community.

Key conceptual changes include:

- all airspace will be the concern of ATM and will be a usable resource;
- ASM will be dynamic and flexible;
- any restriction on the use of any particular volume of airspace will be considered transitory;
- all airspace will be managed flexibly. Airspace boundaries will be adjusted to particular traffic flows and should not be constrained by national or facility boundaries.

CHAPTER 6: DEMAND/CAPACITY BALANCING – DCB

6.1 DESCRIPTION OF CONCEPT

DCB will strategically evaluate system-wide traffic flows and aerodrome capacities to allow airspace users to determine when, where and how they operate, while mitigating conflicting needs for airspace and aerodrome capacity. This collaborative process will allow for the efficient management of the air traffic flow through the use of information on system-wide air traffic flows, weather and assets.

Key conceptual changes include:

- through CDM at the strategic stage, assets will be optimised to maximise throughput, thus providing a basis for predictable allocation and scheduling;
- through CDM at the pre-tactical stage, when possible, adjustments will be made to assets, resource allocations, projected trajectories, airspace organisation, and allocation of entry/exit times for aerodromes and airspace volumes to mitigate any imbalance; and
- at the tactical stage, actions will include dynamic adjustments to the organisation of airspace to balance capacity; dynamic changes to the entry/exit times for aerodromes and airspace volumes; and adjustments to the schedule by the users.

The new system should be able to present predicted sector loads based on flight plan information and possibly other parameters. Ideally, the system support should be able to reflect not only volumes of traffic but also expected complexity. Complexity factors could be expected conflicts, military activity, or weather. The function would support sectorisation and staffing planning for ATC centres, and would give benefits in terms of efficiency and safety.

CHAPTER 7: AERODROME OPERATION – AO

7.1 DESCRIPTION OF CONCEPT

As an integral part of the ATM system, the aerodrome operator must provide the needed ground infrastructure including, inter alia, lighting, taxiways, runways, including exits, and precise surface guidance to improve safety and maximise aerodrome capacity in all weather conditions. The ATM system will enable the efficient use of the capacity of the aerodrome airside infrastructure.

Key conceptual changes include:

- runway occupancy time will be reduced;
- capability will exist to safely manoeuvre in all weather conditions while maintaining capacity;
- precise surface guidance to and from a runway will be required in all conditions; and
- the position (to an appropriate level of accuracy) and intent of all vehicles and aircrafts operating on the movement area will be known and available to the appropriate ATM community members.

AO describes the aerodrome functionality within the ATM system in terms of such factors as information acquisition and delivery, facility access, demand on airspace, and limits on usability. There will be a dependency on landside operations where improvements will be needed to optimise aerodrome capacity (especially relevant if mixed mode operations are applied).

AO will be considered from an en-route to en-route perspective in determining their role within the ATM system.

The principal challenge to aerodrome operators will be to provide sufficient aerodrome capacity, while the challenge to the ATM system will be to ensure that all available capacity is fully and efficiently utilised in a timely manner. AMAN can provide arrival traffic that considers local constraints at the destination airport. More important, however, is coordination between Tower (TWR), Approach Centre (APP) and ACC to create efficient traffic flows.

Where required, runway geometry will permit runway entry and exit at any location along its length, minimising runway occupancy time and reducing holding areas.

Precise surface guidance to and from a runway is preferred in all conditions. The position of all vehicles and aircrafts operating on the movement area will be known and available to the appropriate ATM community members.

Landside activities not directly related to the ATM system will have an impact on AO. These activities include, inter alia, customs, security, baggage handling and fuel supply, and will be optimised through the collaborative exchange of information.

Environmental issues such as noise, gaseous emissions and visual intrusions will be considered in the design, development and operation of aerodromes. Airside operations may be restricted due to environmental constraints and public concern.

Flight parameters will be available to the ATM system, allowing for dynamic spacing and sequencing of departing aircrafts, thereby minimising wake vortex constraints on runway capacity.

Recommendation: To ensure a smooth flow of air traffic into and out of airports, and to optimise capacity and safety efficiently and in an environmentally friendly manner, collaboration is recommended between Indonesian ANSP and Airport Operators (Authorities). The objective should be to link TS activities with AO activities.

7.2 SHORT-TERM PLAN FOR INDONESIAN ATM

The WG proposes to investigate and produce a plan for maintenance and calibration of infrastructure such as Instrument Landing System (ILS).

7.3 MEDIUM-TERM PLAN FOR INDONESIAN ATM

None

7.4 LONG-TERM PLAN FOR INDONESIAN ATM

None

CHAPTER 8: TRAFFIC SYNCHRONISATION – TS

TS refers to the tactical establishment and maintenance of a safe, orderly and efficient flow of air traffic. TS, CM and DCB are interrelated and will become fully integrated, leading to a continuous and organised flow of traffic.

TS encompasses both the ground and airborne part of ATM. It is a flexible mechanism for capacity management that allows reductions in traffic density and adjustments to capacity in response to variations in demand. It uses integrated and automated assistance to arrival and en-route management (AMAN) to ensure optimum traffic flow. The objective is to eliminate choke points and, ultimately, to optimise traffic sequencing to maximise runway throughput.

TS, together with the other ATM components, contribute to the efficient handling of traffic. There is dynamic 4-D trajectory control and negotiated conflict-free trajectories. These techniques reduce the need for traditional path stretching in high traffic density areas, and the associated adverse impact on economy and efficiency.

TS is applicable and can be tailored to all airspace and aerodromes where optimised ordering and sequencing of traffic are critical to accommodate demand.

TS principles include the following:

- the ability to tactically and collaboratively modify sequences to optimise AO, including gate management and/or AUO;
- evolution into 4-D control where a flight is given a time profile to follow in order to optimise throughput; and
- delegation of maintenance of spacing to the flight deck to increase traffic throughput while reducing ground system workload.

The activities discussed above (with the exception of AMAN) are seen as visionary and therefore are considered long-term activities.

8.1 SHORT TERM

The WG believes that an important enabler of increased capacity could be the defined processes. A review of the processes should assess whether a capacity gain can be achieved before a technical solution is investigated.

The information from the arrival management tool (AMAN) should be integrated with the normal display system to provide efficient advisories for the controllers in relevant ACC sectors adjacent to APP sectors, and for the APP sectors for traffic to Soekarno-Hatta and Surabaya airports.

8.2 MEDIUM TERM

Depending on expected traffic development, AMAN should also be considered for the airports in Denpasar, Medan and Makassar.

8.3 LONG TERM

See text on TS earlier in this chapter.

CHAPTER 9: CONFLICT MANAGEMENT – CM

CM consists of three layers:

- Strategic
- Separation provision
- Collision avoidance

9.1 STRATEGIC

Strategic CM consists of organising and managing airspace to reduce conflicts in traffic flows to the extent possible. The capacity of the ATM system should be organised to meet the expected traffic demand. In the rare instances where this is not possible, restrictions should be published in order to avoid overloading the ATM system. TS, being one component of CM, aims at organising and optimising traffic to avoid bunching. The overall aim of strategic CM is to reduce tactical conflicts and indirectly unlock controller workload.

9.2 SEPARATION PROVISION

The second layer of CM is separation provision. This is used to detect deficiencies in strategic planning, and cases where evolving tactical events have not been possible to plan conflict-free. There are four possible stages of a separation provision:

- Conflict detection
- Solution selection[1]
- Implementation
- Monitoring

The ATC system should include support for all four stages. Medium Term Conflict Detection (MTCD) provides a means for resolving system-identified conflicts. The MTCD function provides additional support to the planning function in the detection and analysis of conflicts. The function is highly dependent on accuracy of data, trajectory predictions and conflict parameters. Experience from past implementations indicates an acceptable degree of usability during stable flight conditions. In a dynamic environment, e.g. TMA operations, usability is expected to improve over time. MTCD

[1] The controller will not necessarily select and implement a measure for all conflicts. It is also possible that the conflict will simply be monitored. Unless it deteriorates, no action may be needed.

should also check for Segregated Airspace and provide an improved means for tactical flight planning and for re-routing.

The aim of MTCD is to facilitate a move from the current largely reactive form of ATC to more pro-active control, thereby balancing more evenly the workload of tactical and planning tasks, enhancing sector team efficiency and providing an even safer and better service to airspace users. By maximising the opportunity to pro-actively solve problems during sector planning, it is hoped that tactical workload will be reduced.

9.3 COLLISION AVOIDANCE

The third layer of CM is collision avoidance. The ground system will have a Short Term Conflict Alert (STCA) to inform the controller of the immanent risk of separation infringement.

An STCA is a safety net to warn the controller of any situation where the minimum separation distances between any pair of surveillance tracks is, or is predicted to be within a short time (usually two minutes), violated. By providing a visual alert on the Air Situation Display, the controller can retrieve the alerts in a timely manner to resolve the potentially hazardous situation that has occurred. The system should also potentially support audible alerting.

Note: STCA is mandatory in Europe, and EUROCONTROL has recommended that the following principles be placed at the centre of policy making for STCA use:

- STCA is a safety net; its sole purpose is to enhance safety and its presence is ignored when calculating sector capacity.
- STCA is designed, configured and used to make a significant positive contribution to the effectiveness of separation provision and collision avoidance.

STCA should not be used as a separation tool and this is an important training issue.

9.4 MONITORING

Monitoring is an important part of the controller’s tasks and a modern system can support the controller in this area through:

- Route Adherence Monitoring, which provides support in detecting that an aircraft is no longer following the trajectory expected by the system.

- Clearance Adherence Monitoring, which provides support in detecting that an aircraft is not following the assigned clearance issued by ATC.
- Area Proximity Warning, which provides support in detecting that the aircraft is about to enter a segregated area.
- MSAW, which provides support in detecting that the aircraft is too low in altitude.
- Presentations of FMS data; pilot operations.

9.5 SHORT TERM

STCA and MTCD should be implemented and approved for operational use as soon as practicable in both ACCs.

9.6 MEDIUM TERM

Route Adherence Monitoring, Clearance Adherence Monitoring, Area Proximity Warning and MSAW should be implemented in Jakarta ACC. Safety nets in Ujung Pandang are now being considered for approval for operational use.

9.7 LONG TERM

To be elaborated by the WG

Result: No long-term activities were found by the WG.

CHAPTER 10: AIRSPACE USER OPERATION – AUO

10.1 DESCRIPTION OF CONCEPT

AUO refer to ATM-related aspects of flight operations.

Key conceptual changes include:

- accommodation of mixed capabilities and worldwide implementation needs to be addressed to enhance safety and efficiency;
- relevant ATM data will be fused for an airspace user's general, tactical and strategic situational awareness and CM;
- relevant airspace user operational information will be made available to the ATM system;
- individual aircraft performance, flight conditions, and available ATM resources will allow dynamically-optimised 4-D trajectory planning;
- CDM will ensure that aircraft and airspace user system design impacts on ATM are taken into account in a timely manner; and
- aircrafts should be designed with the ATM system as a key consideration.

The ATM system should accommodate different types of services for diverse user needs. Air transport, military missions, business, private flights and aerial work all have different requirements and planning horizons. The system needs information from the airspace users in order to be efficient, and ATM data is also needed by users to maintain situation awareness.

Individual aircraft performance parameters are important for the optimisation of 4-D trajectory management. In transition to the target ATM concept of the year 2025, providing user-preferred trajectories will increase in importance. Business-oriented operations with growing demand for economic gains are driving expectations from airspace users for clearer ownership of the predicted trajectory. This will require support for planning and execution of user-preferred trajectories and, most importantly, predictable operations.

10.2 SHORT TERM

None.

10.3 MEDIUM TERM

None.

10.4 LONG TERM

Consider implementation, depending on global developments in this area.

CHAPTER 11: ATM SERVICE DELIVERY MANAGEMENT - ATMSDM

11.1 DESCRIPTION OF CONCEPT

ATM SDM operates seamlessly from gate to gate for all phases of flight and across all service providers. The ATM SDM component addresses the balance and consolidation of the decisions of the various other processes/services, as well as the time horizon at which, and the conditions under which, these decisions are made. Flight trajectories, intent and agreements are important components for delivering a balance of decisions.

Key conceptual changes include:

- Services to be delivered by the ATM SDM component will be established on an as-required basis subject to ATM system design. Once established, they will be provided on an on-request basis;
- ATM system design will be determined by CDM and system-wide safety and business cases;
- Services delivered by the ATM SDM component will, through CDM, balance and optimise user-requested trajectories to achieve the ATM community's expectations; and
- Management by trajectory will involve developing an agreement that extends through all physical phases of the flight.

11.2 SHORT TERM

None.

11.3 MEDIUM TERM

Vision: The new ATM system should enable automatic coordination in the future, with the flight plan and surveillance data being shared between ACC and all ATS units in Indonesia.

11.4 LONG TERM

None.

11.5 ATC AUTOMATION SYSTEMS (SYSTEM COORDINATION)

The AIDC standard provides definitions for message exchange between different units that wish to exchange flight plan data information. For sector-to-sector coordination, the entry and exit conditions for flights should be exchanged, and late changes may trigger an update or dialogue about entry/exit conditions. For ACC-to-APP coordination, entry and exit conditions together with expected departure time could be exchanged in order to reduce verbal communication.

Recommendation: The messages defined in the AIDC standard should be available for definitions of data exchange between the system and adjacent centres and units.

11.5.1Short term

- Investigate the possibility of improving exchange coordination information by using Doc 4444 messages.
- Create a taskforce to implement ICAO 2012 flight plan changes.
- Implement AIDC between Ujung Pandang ACC and Brisbane.
- Implement AIDC between Ujung Pandang and Jakarta ACCs as soon as practicable.
- Automatic coordination support between ACC and Main APP units.

11.5.2Medium term

- Automatic coordination support between internal ACC sectors and between ACC sectors and APP sectors.
- Automatic coordination support between ACC and Main APP units.
- Automatic coordination support between ACC and adjacent ACC centres.
- Limited coordination support between ACC and local TWR/APP.

11.5.3Long term

To be elaborated by the WG

Result: No long-term activities were found by the WG.

11.6 CNS GENERAL

The meeting discussed how Indonesian ATM has followed the guidelines in the previous ATM Master Plan. The general conclusion was that while the Master Plan has been implemented in some areas, in many areas it has not.

The meeting also concluded that there is no CNS plan based on the expected operational concept for the future. The responsibility for providing plans for procurement of CNS infrastructure, and the process for maintenance/calibration, also appear to be unclear.

It was concluded that the replacement of old radars is following the replacement plan.

For all new (and old) systems, it is important that operational requirements are properly established. The use of the systems needs to be properly established together with a well-defined maintenance concept. Safety assessments must be integrated and take place during all steps, including specification, operational use and maintenance.

Freight charter and pioneer groups are examples of two user groups that could have specific requirements that need be addressed in the Master Plan.

11.7 COMMUNICATIONS

In all areas in the ATM business using common public solutions (e.g., on the transmission level), there is a general move towards the use of Commercial off the shelf (COTS) Local Area Network/Wide Area Network (LAN/WAN) products for data transport. That also applies to telephony (the trend is for telephony to be a Voice over Internet Protocol (VoIP) solution). However, a transition period is needed for present technology. In other words, compatibility has to be maintained with analogue circuits, digital circuits (type ISDN or equivalent) and VoIP access for at least 5-10 years.

At the other end of the ATM business (operating business-specific solutions – DSB AM VHF radio, Mode 3/C MSSR radar, etc.), there is definitely a slower transition to common public solutions. While there are, of course, COTS solutions (COTS for the ATM business), their evolution is driven by international standardisation, meaning that changes take a long time (backwards compatibility must always be maintained).

The targeted evolution of the communication service for Indonesia should be to provide:

- Increased flexibility in data sharing
- Support for Flexible Use of Airspace (FUA) requirements of cross-border sectors, for example
- Support for new requirements
- During a transition period (medium term), support existing systems until they can use IP-based communication
- Possibility to replace obsolete technology in a safe, economical and timely fashion
- Sound balance between capacity and running costs
- Availability of service (on a functional level)

- Geographical coverage (e.g., possibility to have ANS ATN access in disperse locations, such as CNS sites)
- Support for ANS contingency and service continuity planning
- Information security for operational voice and data used in ATS, MET, AIS and CNS services, and ATFM systems.

Within CNS/ATM, reliable communication networks are the corner stone for effective and timely data transmission. One of the most important strategies is to establish a reliable and redundant communication network within the ATS unit in Indonesia. The network also needs to be sufficiently monitored and managed.

HF possibilities should be maintained for oceanic areas, including redundancy for CPDLC.

11.7.1For WG to comment on:

1	Investigate the network used for ADS-B ground stations. Result: A network has been established. This is difficult, since many areas of Indonesia suffer from poor coverage by network operators. Redundancy, monitoring and control all need to be addressed.
2	Any specific communication requirements in the more remote airports and air operations. Improvements have been made to VHF coverage in eastern regions.
3	Status of AMHS needs to be established and any remaining action identified that needs to be included in the Master Plan. Result: Trials are on-going with Singapore. To investigate the need for two AFTN centres and sub centres.
4	The current status of the ATN (ground-to-ground) trials based on MoT Decree (KP218/2004) in order to prepare ATN concept needs to be established, and any remaining action identified that needs to be included in the Master Plan. Result: Tests are ongoing. Results are generally good, but a bandwidth issue needs to be addressed.

To be elaborated by the WG Result: There appears to be no navigation strategy for the coming years.

11.7.2Short term

- Investigation of the best approach for AMHS.
- Implementation of AMHS.

To be elaborated by the WG

Result: See above.

11.7.3Medium term

- Establishment of a reliable and redundant communication network for ATM within Indonesia based on IP sub network technology. This is a key enabler for a modern CNS/ATM infrastructure.

To be elaborated by the WG

Result: See above

11.7.4Long term

To be elaborated by the WG

Result: No long-term activities were found by the WG.

11.8 NAVIGATION

There will be a transition from conventional navigation aids with ground-based equipment to the use of RNAV, where position information is retrieved from ground-based equipment and/or GNSS equipment.

The traditional navigation infrastructure with VOR/DME/ Non Directional Beacon (NDB) will change to new GNSS support capabilities, including Ground-based Augmentation Systems (GBAS) and Satellite-Based Augmentation Systems (SBAS). Limited SBAS benefits are expected in the short term from the MSAS geostationary satellites. A ground-monitoring infrastructure will be needed to realise the full benefits of these systems.

Care must be taken not to dismantle the current VOR/DME/NDB infrastructure until the PBN concept has been fully evaluated and properly implemented in Indonesia.

11.8.1Short term

Current use of ground-based navigation equipment should be reviewed.

A plan for maintenance and calibration of navigation infrastructure equipment should be investigated and produced.

To be elaborated by the WG

Result: There appears to be no communication strategy for coming years.

11.8.2Medium term

- NDB will fade out.
- VOR will fade out.
- Develop regulation for using GBAS.
- GBAS with precision approach category I/II should be applied at the six busiest airports – Soekarno-Hatta, Denpasar, Surabaya, Medan, Balikpapan, and Makassar.

To be elaborated by the WG

Result: See above

11.8.3Long term

- NBD operation no longer protected.
- VOR operation no longer protected.

To be elaborated by the WG

Result: No other long-term activities were found by the WG.

11.9 SURVEILLANCE

Increasing air traffic requires improved capacity utilisation, since the number of movements is expected to grow at 3-5 percent per year. New systems being developed for aircraft onboard equipment, sensors, ground infrastructure, etc. offer potential improvements in safety, efficiency and economy, and should be utilised.

Implementation of new systems must be based on user requirements while respecting legal requirements and provide both cost efficiencies and operational improvements with the same or higher level of safety and availability. Environmental issues must also be taken into account, since they receive increasing attention as demand for airlines and airports increases.

The development of Free Route Airspace and "direct routing" also suggests increasing demand for comprehensive air situation presentation.

MLAT is a key technology to consider in developing the ATM Master Plan with respect to future surveillance capabilities in the Indonesian airspace.

Possible technologies for future air presentation modes are:

- SSR Mode S/EHS
- MLAT
- ADS-B over Mode S
- PSR for major TMA

Declare an objective for surveillance coverage in Indonesia. Discuss and list requirements in the CNS (ATC) team, example:

- Areas and vertical limits where minimum double surveillance coverage is needed.
- Areas where single coverage is acceptable
- Minimum coverage requirement for oceanic areas
- Areas where no surveillance coverage can be accepted
- Propose realistic radar separation minima to be applied in different parts or regions in Indonesia, including both congested and less congested TMAs.

etc.

Result: Not discussed by WG.

There appears to be no surveillance strategy for future years.

11.9.1Short term

Review and engage in sharing of surveillance data between Indonesian ACCs and the military and/or adjacent states.

1	The possibility to deploy MLAT in the ADS-B stations as a backup solution. Result: There is no clear policy on ADS-B installation and use. The operational requirements appear to be missing.
2	To be further elaborated by the WG Result: No further development in the WG.

11.9.2Medium term

Deploy Wide Area Multilateration (WAM) for en-route and TMA airspace, and deploy airport Multilateration (MLAT) as an option to support surveillance function.

To be elaborated by the WG

Result: No additional medium-term activities were found by the WG.

11.9.3Long term

To be elaborated by the WG

Result: No long-term activities were found by the WG.

11.10 INSTITUTIONAL AND ORGANISATIONAL ISSUES

The role of DGCA as a regulator while simultaneously being an ANS provider makes the decision-making process opaque for all ATM partners. A typical case concerns the MAATS – an ATM system assisting Ujung Pandang ACC to provide ANS within its area of responsibility. From a DGCA perspective, this is a State concern, and therefore DGCA has sponsored it. AP1 wanted a technical maintenance agreement with the supplier of the systems, but could not enter into negotiations since the supplier did not own the system. Since DGCA had thought such a contract would be too expensive, this resulted in inefficient maintenance due to lack of expertise.

Table 3: CNS equipment installation plan

No.	Equipment	Status	Location	Year Installed
1	MSSR	New	Sentani – Jayapura	2007
2	PSR	New	Sentani – Jayapura	2008
3	AUTOMATION	New	Sentani – Jayapura	2007
4	DVOR/DME	New	Putusibau	2008
5	DVOR/DME	New	Nunukan	2008
6	DVOR	Replacement	Tarakan	2008
7	DME	Replacement	Tarakan	2009
8	DVOR/DME	New	Kao – Halmahera	2008

No.	Equipment	Status	Location	Year Installed
9	ILS	New	Curug – Tangerang	2009
10	ILS	New	Semarang	2009
11	ILS	New	Gorontalo	2007
12	ILS	Replacement	Batam	2008
13	ILS	Replacement	Sentani – Jayapura	2008
14	DVOR/DME	Replacement	Sentani – Jayapura	2008
15	ILS	New	Timika	2008
16	ILS	New	Kendari	2007
17	MSSR	Replacement	Banda Aceh	2009
18	DVOR	Replacement	Batam	2010
19	PSR	Replacement	Makassar	2008
20	MSSR	Replacement	Surabaya	2009
21	MSSR	Replacement	Surabaya	2009
22	MSSR	Replacement	Balikpapan	2008
23	MSSR	Replacement	Banjarmasin	2008
24	DVOR	Replacement	Cilacap	2007
25	ADS-B	New	Banda Aceh	2008
26	ADS-B	New	Medan	2008
27	ADS-B	New	Palembang	2008
28	ADS-B	New	Pekan Baru	2008
29	ADS-B	New	Jakarta Soekarno-Hatta	2008
30	ADS-B	New	Cilacap	2008
31	ADS-B	New	Pontianak	2008
32	ADS-B	New	Makassar	2008
33	ADS-B	New	Palu	2008

No.	Equipment	Status	Location	Year Installed
34	ADS-B	New	Menado	2009
35	ADS-B	New	Ambon	2009
36	ADS-B	New	Saumlake	2009
37	ADS-B	New	Alor	2009
38	ADS-B	New	Waingapu	2009
39	ADS-B	New	Kupang	2008
40	ADS-B	New	Bali	2008
41	ADS-B	New	Biak	2009
42	ADS-B	New	Sorong	2008
43	ADS-B	New	Merauke	2008
44	ADS-B	New	Timika	2009
45	ADS-B	New	Galela	2008
46	ADS-B	New	Tarakan	2008
47	ADS-B	New	Matak	2009
48	ADS-B	New	Natuna	2009
49	ILS	New	Bengkulu	2008
50	Runway Visual Range (RVR)	New	Palangkaraya	2008
51	ILS	Replacement	Malang (Air Force)	2008
52	ILS	New	Tanjung Pandan	2007
53	DME	Replacement	Batam	2008
54	Acquisition Weather Observation Stations (AWOS)	New	Banda Aceh	2010
55	RVR	New	Timika	2009
56	RVR	New	Kendari	2009
57	RVR	New	Tarakan	2008

No.	Equipment	Status	Location	Year Installed
58	RVR	New	Ternate	2008
59	RVR	New	Palangka Raya	2008
60	RVR	New	Sentani – Jayapura	2008
61	JAATS	Planning Replacement	Jakarta	2011-2013 (Multiyear Project)
62	MAATS	Upgrade	Makassar	2007
63	MSSR	Planning New	Tarakan	2010
64	MSSR	Planning Replacement	Waingapu	2010
65	ADS-B	Planning New	Semarang	2011
66	ADS-B	Planning New	Banjarmasin	2011
67	ADS-B	Planning New	Balikpapan	2011
68	ADS-B DATA SHARING	Planning New	Indonesia and Singapore	2010
69	ADS-B DATA SHARING	New	Indonesia and Australia	2010
70	MSSR	Planning Replacement	Semarang	2010
71	MSSR	Planning Replacement	Palembang	2010

CHAPTER 12: TENTATIVE IMPLEMENTATION SCHEDULE

12.1 COMMUNICATION

12.1.1Short term

- Implement AMHS
- Use CPDLC

12.1.2Medium term

- Establish a reliable and redundant communication network for ATM within Indonesia based on IP sub network technology to support ANS, ATS, MET, AIS and CNS services
- Implement VoIP where applicable

12.1.3Long term

- Change digital VHF transceivers/transmitters
- Phase out HF

12.2 SURVEILLANCE

12.2.1Short term

- Study and implement sharing of surveillance data between Indonesian ACCs and military and adjacent states
- Continue using SSR MODE S/EHS
- PSR for high density TMA
- Use ADS-B for some backup
- Use ADS-C in remote areas

12.2.2Medium term

- Deploy WAM for en-route and TMA airspace
- Deploy airport MLAT as option to support surveillance function

12.2.3Long term

- Phase out conventional radar

12.3 NAVIGATION

12.3.1Short term

- Review current use of ground-based navigation equipment
- Investigate and produce a plan for maintenance and calibration of navigation infrastructure equipment

12.3.2Medium term

- Phase out NDB
- Phase out VOR
- Develop regulation on GBAS use
- Apply GBAS for category-I/II approaches at the busiest airports

12.3.3Long term

- NDB operation no longer protected
- VOR operation no longer protected

ANNEXES

ANNEX 1: KICK-OFF MEETING PARTICIPANTS

Activity number and title:	180, Air Navigation Blueprint	
Title of meeting:	Working Group 3 Kick-off Meeting	Coordinator LFV: Hans Holkenberg
Date and place:	20 August 2010; Air Navigation Directorate Meeting Room	Coordinator WG3: Edison S

No.	Name	Position	Agency	email	phone	f/m
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ANNEX 2: WG MEETING 1 PARTICIPANTS

Activity number and title:	180, Air Navigation Blueprint	
Title of meeting:	Working Group 3: Meeting 1	Coordinator LFV: Hans Holkenberg
Date and place:	21 September 2010; Air Navigation Directorate Meeting Room	Coordinator WG3: Edison S

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ANNEX 3: WG MEETING 2 PARTICIPANTS

Activity number and title:	180, Air Navigation Blueprint	
Title of meeting:	Working Group 3: Meeting 2	Coordinator LFV: Hans Holkenberg
Date and place:	24 September 2010; Air Navigation Directorate Meeting Room	Coordinator WG3: Edison S

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ANNEX 4: MINUTES OF KICK-OFF MEETING

Location: **DGCA Meeting Room, 23rd Floor**

Date: **August 20, 2010**

Briefing points:

1. Mr. Lars explained the purpose of the Master Plan and WG activities in general.

Input from participants:

- Ibu Yudhi requested that the consultant actively seek out data before the WG discussion.
- Ibu Yudhi requested the meeting materials (including inception report) distributed to participants a few days before the meeting.
- DGCA, AP 1 and AP 2 already have their own planning concept. They want to know the concept that will be presented in this Master Plan.
- Pak Edison explained that DGCA has set up a surveillance taskforce. Referring to an earlier workshop, the template for Asia Pacific ADS-B must comply with the standard. He hopes the consultant can provide an appropriate surveillance concept for Indonesia, including future ADS-B location plan.
- AP 1 informed those present that some airports have exceeded their capacity (e.g., Surabaya), so there will be a lot of issues relating to future equipment. Consultant is expected to provide input regarding where, when, and what kind of equipment is needed.
- AP 2 suggested that the consultant visit Soekarno-Hatta airport to understand actual conditions.
- Ibu Yudhi requested the consultant’s recommendation on the best navigation system for Indonesia. This includes the determination of PBN locations, workstation needs, staffing, the JAATS back-up system, and the need for an MASS backup system. Overall, this should be stated in the Master Plan.

Next Steps:

1. WG participants will give comments on the CNS materials provided by the consultant.
2. Comments and any information from participants will be collected by the WG coordinator (Pak Edison) via email.
3. The next meeting will be held on 23 September 2010 with a discussion on incoming comments as its agenda.

ANNEX 5: KICK-OFF MEETING

A kick-off meeting was held on 20 August 2010 at the DGCA premises. The members of the WG were tasked with the following assignments:

- Make a list of items to be considered and included in the update to the ATM Master Plan in the short, medium and long term.
- Try to prioritise the activities proposed in each time period.

The WG results should be presented in a Working Paper (WP), answering the questions in the points above.

The following issues were tabled (see also Annex 4).

During the implementation period of new items, it must be stated that the quality of essential and important existing services must be retained or improved. Before any decision is taken, a budget review must of course take place.

1. Comments on the statements extracted from the report on Indonesian ATM Planning review and point 2.2 below.
   - Comment on questions/statements in boxes in Chapter 11
2. Procedure to attain ADS-B operational approval should initially prioritise Ujung Pandang ACC but this should also be done for Jakarta ACC as soon as practicable. This is a safety and capacity issue and will also benefit the stakeholders' environment and economy. Operational use of already invested money.
3. Installation of CPDLC should be prioritised in Jakarta ACC to support communication and increase safety over oceanic areas. (An interim solution is planned for introduction in late 2010).
4. More to be added by the team, based on their own experience and expectations.

See also Annex 4: Minutes of WG3 Kick-off Meeting

On Section 12.4: Issues for the WG to consider on the following meetings:

Development of policy for Air Navigation in the MoT strategic plan 2010-14 is defined as follows:

- The procurement and replacement of radar and the use of ADS-B in regions unreachable by radar

What/When?

Currently, each radar station is procured separately. This may lead to a number of different suppliers, which increases the cost of integration, maintenance and spare part.

- The integrated harmonisation of 2 FIR (MAATS and JAATS)

What/When?

Specification of the new MAATS system has started. The project time schedule is unclear. The WG concluded that it was important to have an overall concept and operational definition for Indonesia AOR. The new JAATS should be specified with an overall Indonesia perspective, not just a replacement for the old JAATS for Jakarta FIR.

- Implementation of surveillance technology such as ADS-B and MLAT

What/When?

A report on ADS-B implementation is available.

- Implementation of GNSS augmentation system for terminal/NPA

What/When?

No answer was available from the WG.

- ADS-B data sharing with adjacent countries

What/When?

- AIS system upgrade with 5- to 7-year cycle

What/When?

To be addressed by WG 4.

- Indonesia's AIS system is integrated with the global IAS system, ATS, aerodrome operator, airlines and all users in general

When?

To be addressed in WG 4.

- Independent ADS-B network

When?

No answer was available from the WG.

- Revitalisation of air navigation facilities more than 15 years old

Which/when?

No answer was available from the WG.

- Revitalisation of radar system in Makassar, Balikpapan, Banjarmasin and Surabaya

Which/when?

No answer was available from the WG.

- Formulation of State Safety Programme (SSP)

When?

No answer was available from the WG.

- Implementation of Safety Management System (SMS)

When?

No answer was available from the WG.

ANNEX 6: COMMENTS FROM DGCA (1)

Comments on Draft WP for WG3 CNS:

Chapter 2:

Kick-off Meeting:

1. Please define short term, medium term and long term, because based on your presentation this term is not same as used in the JICA Study. For the list of items, please refer to the JICA Study, chapter 17: CNS/ATM Development by Years 2015 and 2025.

2. Development of policy for air navigation in the MoT strategic plan 2010-2014:
   - *Procurement and replacement of radar and use of ADS-B in regions unreachable by radar:*

     Please refer to the JICA Study, chapter 17: CNS/ATM Development by Years 2015 and 2025. Gradual implementation of ADS-B in Indonesia. ADS-B will be used in the Non Radar Area that is unreachable by radar, and in the Radar Area as backup.
   - *Integrated harmonisation of 2 FIR (MAATS and JAATS):*

     The integrated harmonisation of 2 FIR (MAATS and JAATS) will be planned after renewal of JAATS. Renewal of JAATS is planned for 2011-2013.

     - Old JAATS will be replaced, and we hope will be a ghost in 2013; please give us the phases for this program.
     - In considering the replacement of JAATS, it should be emphasised that this will be a multi-year project that will also require careful consideration of a life extension plan for JAATS; possibility of using MATSC for a level of back-up capability; what common functionality/backup capability is required between new JAATS and MATSC; how the transition will be managed (ghosting, etc.). The new system needs:
       - Backup capability for Ujung Pandang
       - Automated coordination/handover
       - Multi-surveillance processing
       - ADS-C/CPDLC
       - Database management
       - Spares/through life support (not single-year contracts)
       - Agreed reliability, maintainability and integrity parameters
       - Configurable sectors
       - Simulator/training capability
       - Bypass/backup

- Uninterruptible power
- Recording/replay/investigation capability
- Configurable communications switching
- AIDC capability within Indonesia and Adjacent Centre
- Consideration of gate-to-gate profiles is a very long way off for Indonesia
- Slot management could be implemented in the short term (well in advance of AMAN)
- Terminal Control Unit (TCU) concept
- Please define that TCU is suitable for Indonesia, in which location, and with high, medium, and low density traffic

Implementation of surveillance technology such as ADS-B and MLAT:

ADS-B implementation will be gradual; ADS-B will be used for Upper Airspace.

A-SMGCS implementation will use alternative facilities such as Surface Movement Radar (SMR) or MLAT.

Please define busy/complex airspace and airports and then identify services required for traffic in those areas in Indonesia; for example, a recommendation to implement A-SMGCS in Soekarno-Hatta Airport.

ADS-B data sharing with adjacent countries:

DGCA Indonesia and Airservices Australia will implement an Operational Agreement on ADS-B Collaboration for Civil Air Traffic Services in November 2010.

DGCA Indonesia and the Civil Aviation Authority of Singapore will implement an Operational Agreement on ADS-B Collaboration for Civil Air Traffic Services in 2010.

Independent ADS-B network:

Indonesia plans to implement an independent ADS-B network gradually. DGCA Indonesia has already configured the ADS-B network for the eastern and western parts of Indonesia.

Revitalisation of air navigation facilities more than 15 years old:

Please check the JICA Study and MoT Strategic Action 2010-2015.

Revitalisation of radar systems in Makassar, Balikpapan, Banjarmasin and Surabaya:

- The radar systems in Makassar, Balikpapan, Banjarmasin and Surabaya were replaced in 2009.

GPI -17 Data Link Application:

ADS-C/CPDLC implementation in Ujung Pandang needs to be reviewed against the Global Operational Data Link Document (GOLD).

ATN IMPLEMENTATION PLAN

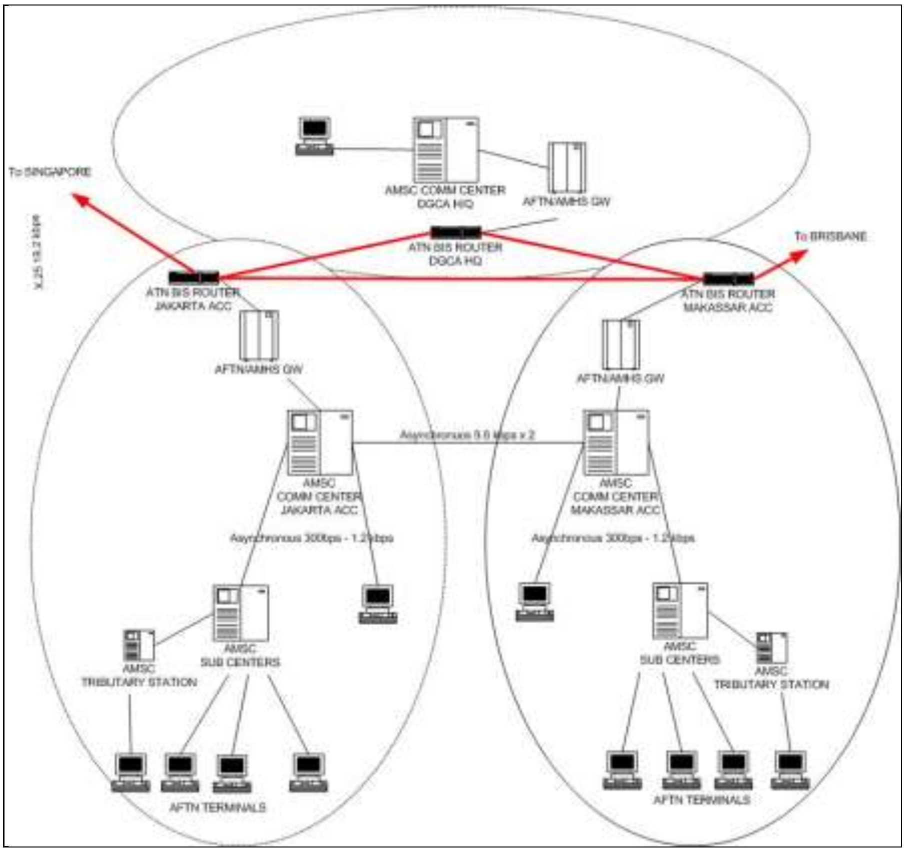
SHORT TERM (… - 2015)

Target Points:

- Indonesia ATN backbone is located at three points: Jakarta, Makassar, and DGCA HQ.
- Indonesia ATN is connected to Singapore via Jakarta and is connected to Brisbane via Makassar.
- ATN is connected to AFTN.

Action Items:

- Establish an interconnection between ATN Boundary Intermediate System (BIS) Router Jakarta and ATN BIS Router Singapore.
- Install and test AFTN/AMHS Gateway (GW) Jakarta with AFTN/AMHS GW Singapore.
- Install ATN BIS Router in Makassar and establish an interconnection to ATN BIS Router Jakarta.
- Install and test AFTN/AMHS GW Makassar with AFTN/AMHS GW Jakarta.
- Install ATN BIS Router at DGCA HQ and establish an interconnection to ATN BIS Router Jakarta and ATN BIS Router Makassar.
- Install and test AFTN/AMHS GW DGCA HQ with AFTN/AMHS GW Jakarta and Makassar.
- Establish an interconnection between ATN BIS Router Makassar and ATN BBIS Router Brisbane.
- Test AFTN/AMHS GW Makassar with AFTN/AMHS GW Brisbane.


To SINGAPORE
X.25 19.2 kbps
AMSC COMM CENTER
DGCA HQ
AFTN/AMHS GW
ATN BIS ROUTER
DGCA HQ
To BRISBANE
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ATN BIS ROUTER
MAKASSAR ACC
AFTN/AMHS GW
AFTN/AMHS GW
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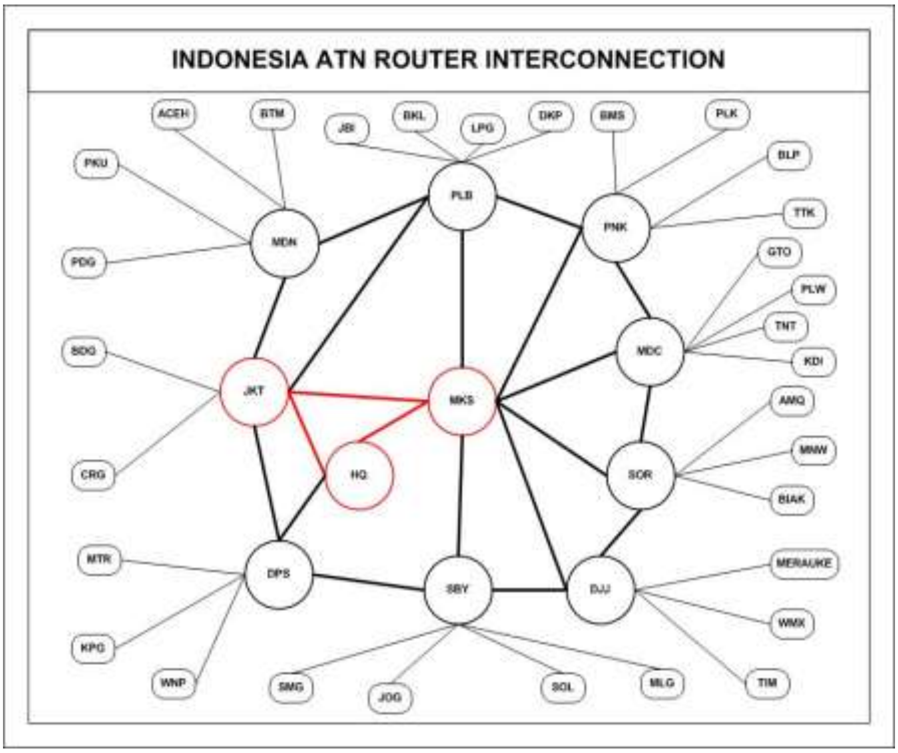
INDONESIA ATN ROUTER INTERCONNECTION
ACEH
BTM
JBI
BKL
LPG
DKP
BMS
PLK
PKU
BLP
PLB
PNK
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GTO
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TNT
MDC
SDG
KDI
JKT
MKS
AMQ
MNW
CRG
HQ
SOR
BIAK
MTR
MERAUKE
DPS
SBY
DJJ
KPG
WMX
WNP
SMG
JOG
SOL
MLG
TIM

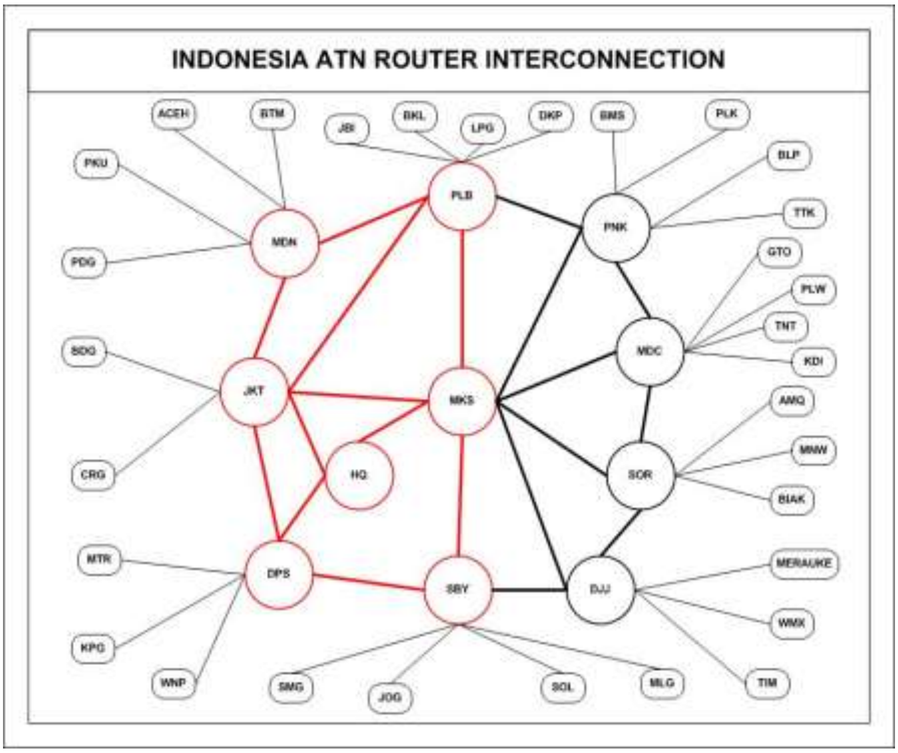
MEDIUM TERM (2016-2020)

Target Point:

- Extension of ATN Indonesia to airports that have operated as a Sub-ACC/TCU.

Action Items:

- Install ATN BIS Router at Denpasar and establish an interconnection to ATN BIS Router Jakarta and ATN BIS Router DGCA HQ.
- Install and test AFTN/AMHS GW Denpasar with AFTN/AMHS GW Jakarta and DGCA HQ.
- Install ATN BIS Router at Medan and establish an interconnection to ATN BIS Router Jakarta.
- Install and test AFTN/AMHS GW Medan with AFTN/AMHS GW Jakarta.
- Install ATN BIS Router in Surabaya and establish an interconnection to ATN Router Denpasar and ATN BIS Router Makassar.
- Install and test AFTN/AMHS GW Surabaya with AFTN/AMHS GW Denpasar and Makassar.
- Install ATN BIS Router at Palembang and establish an interconnection to ATN BIS Router Makassar, ATN BIS Router Jakarta, and ATN Router Medan.
- Install and test AFTN/AMHS GW Palembang with AFTN/AMHS GW Makassar, Jakarta and Medan.
- Test ATN-based AIDC on Indonesia–Singapore, Indonesia–Brisbane, and Jakarta–Makassar connections.



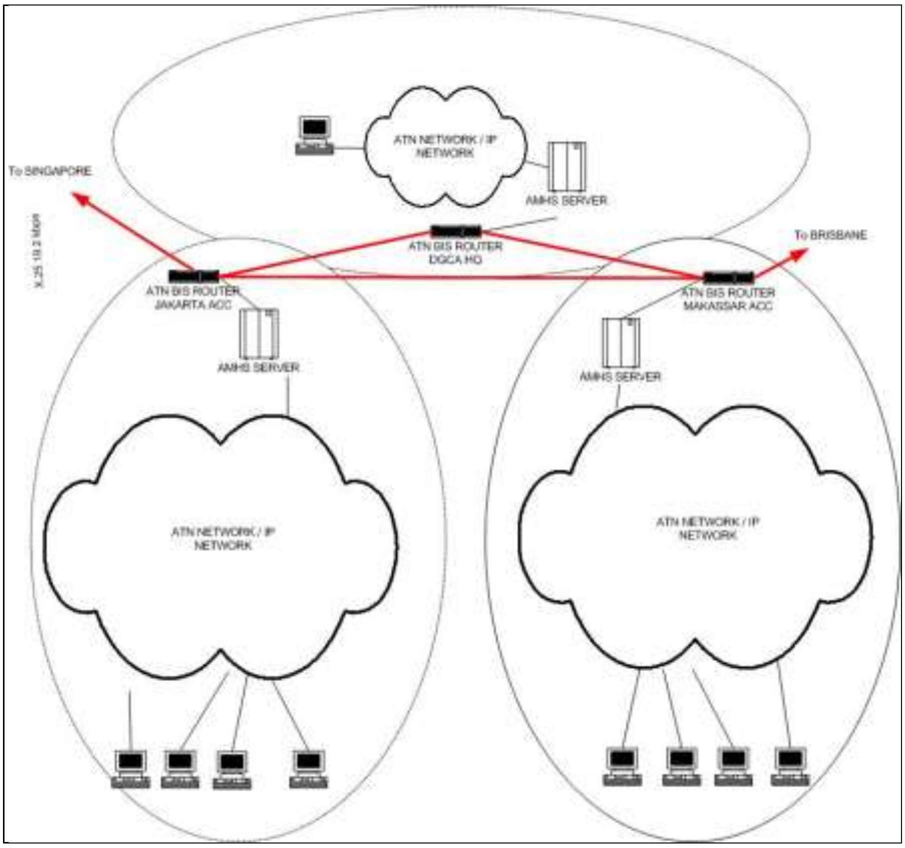
LONG TERM (2021-2025) and beyond

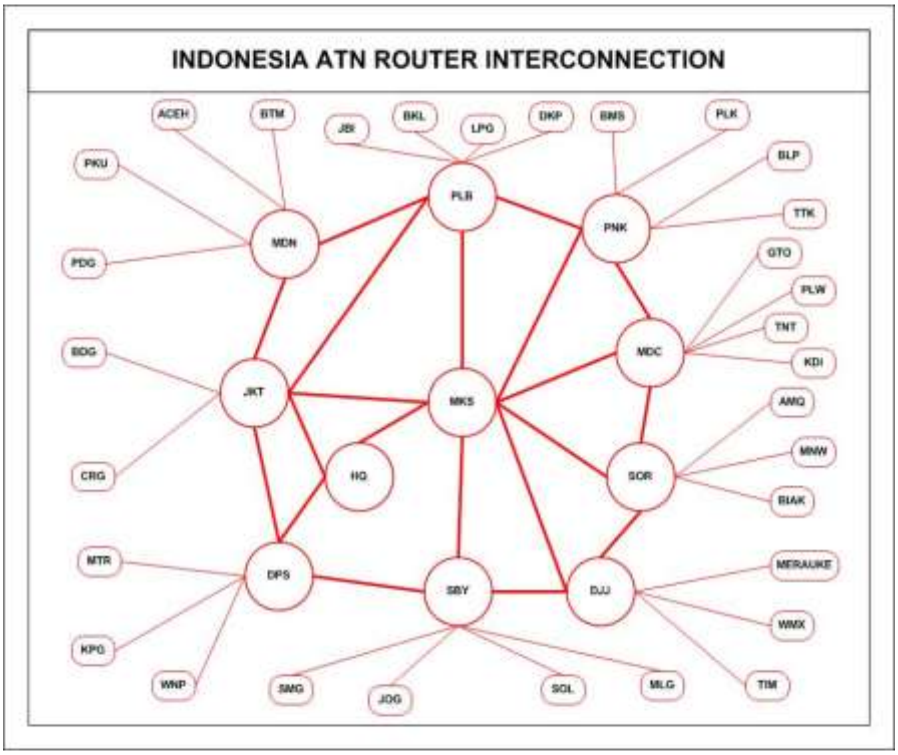
Target Points:

- Full ATN implementation in Indonesia, in three steps:
    1. Complete Indonesia ATN BIS Router backbone.
    2. Full implementation of AFTN/AMHS Gateway in ATN Router Interconnection Indonesia.
    3. Implementation of ATN application in Indonesia.

Action Items:

- Install ATN Router in Pontianak, Manado, Sorong, and Jayapura and establish a connection to other ATN BIS Router (see diagram).
- Install and test AFTN/AMHS GW Pontianak, Manado, Sorong, and Jayapura with other AFTN/AMHS GW (see diagram).
- Test and implement other ATN applications (CM, CPDLC, DFIS, ADS).





GPI-21 Navigation System:

Based on your presentation, NDB and VOR will be phased out in the medium term. In our program, NDB and VOR will be reduced gradually. Please check JICA Study.

Based on Doc 9750 ICAO, the progressive introduction of PBN must be supported by an appropriate navigation infrastructure, etc.

- Please describe the PBN concept for Indonesia and clarify in which locations conventional ground-based navigation aids will support PBN implementation in Indonesia in the short, medium and long term.

Based on your presentation concerning surveillance facilities, please describe in more detail the surveillance concept in the JICA Study.

Indonesia has installed 30 ADS-B ground stations in Indonesia. Please describe ADS-B needs in Papua.

Referring to the JICA Study, please provide more detail on the project cost.

Referring to Doc 9750, please define the strategic initiatives tabled to determine priority ATM programs/projects as the basis for the development of communication, navigation, surveillance and other infrastructure plans. As an example, please see the table below.

Strategic User Preferred Trajectories

Initiative	Element	Operational Requirement			CNS Capability Option			Location
Optimised En-route Operation	Expansion of existing dynamic routing	Service Provider	Airspace User	Aero drome	Service Provider	Airspace User	Aero drome	
		Improved Situation Awareness	Dynamic Routes Optimised		Navigation: Communication: Surveillance:	Navigation: Communication: Surveillance:		

ANNEX 7: COMMENTS FROM DGCA (2)

Chapter 2

Kick-Off Meeting

The discussion of ADS-B is overly simplistic. It is also too specific to focus on one particular kind of surveillance technology. A more valid discussion may be a discussion of what kind of surveillance services are required, and where, which would then lead in to a discussion of what is required to support those services in terms of reliability, availability, aircraft equipage, etc., which would in turn lead to identification of appropriate technology. Known issues with the ADS-B program include:

- A variety of different ground stations, with Remote Control and Monitoring System (RCMS) sourced from only one supplier (i.e. monitoring capability only for a large number of ground stations);
- Single communications links from ground stations to ATC centres (i.e., insufficient redundancy for separation services);
- Lack of regulations governing airborne ADS B equipment (hence no way to address the issue of faulty avionics);
- No procedures for ATCs;
- Use and display of unfiltered ADS B data (including Navigation Uncertainty Category (NUC) =0 data).

MoT Strategic Plan

I have the following comments on the items listed under "Development of policy for Air Navigation in the MoT strategic plan 2010-14":

- *Procurement of radar and ADS-B:* The important question is why? Radar separation is currently not used (at least not consistently).
- *Integrated harmonisation of two FIRs:* what does this mean (all of the following are required)?
  - Backup capability for each FIR?
  - AIDC?
  - Standard procedures?
- *Implementation of surveillance technology:* Rather than focus on technology, Indonesia needs to assess its surveillance standards and requirements (currently many controllers use 10 minutes even within radar coverage, and radar separation standards *vary* from controller to controller – usually 10-20 Nautical Miles (NM)). Once they have determined what standards they will use, the next step should be consideration of what is required to implement those standards (updating or replacing existing radars/ADS-B; installing new sensors where required; ensuring communications infrastructure is adequate to support the chosen standards; implementing monitoring and maintenance programs for the infrastructure, etc.).

- *GNSS augmentation system for terminal/NPA:* Has a need for this really been identified? Any GNSS/PBN programs will need to be preceded by a full overhaul of aeronautical data management.
- *AIS System Upgrade:* AIS needs to be addressed as a matter of urgency, including:
    - Ownership of and responsibility for data;
    - Record-keeping data management;
    - Data publication and dissemination;
    - Processes and procedures for updating data.
- *Integrated AIS system:* This is likely to be a very long-term program.
- *Independent ADS-B network:* The meaning of this is not clear.
- *Revitalisation of facilities:* Rather than "revitalising" all facilities once they reach 15 years, a full review of the on-going need for CNS infrastructure should be undertaken in light of changing traffic levels and aircraft equipage.
- *Revitalisation of radars (Makassar, Balikpapan, Banjarmasin and Surabaya):* These radars have been replaced (although it should be noted that primary and secondary radars were replaced with secondary only radars; primary radar requirements may need to be reconsidered).

Chapter 3

Data link applications

The assessment of the current situation in Indonesia with respect to ADS-C and ADS-B suggests that these programs are both satisfactorily operational (or soon will be). It would be helpful if the ATM Master Plan could include some reference to appropriate commissioning steps or enabling actions for proper implementation of new technology, which may help to avoid partial implementations like the current ADS-B and ADS-C implementations.

For the ADS-B system, the following questions need to be addressed:

- What is the operational concept for the system?
- When will regulations and procedures for ATCs and pilots be developed and published?
- How will the ground stations of three different suppliers be monitored and maintained?
- Are voice and data communications adequate for provision of separation services?
- Will duplicated data communications links be commissioned? If not, how will the "Master" ground station be selected at each site (based on known antenna interference)?
- What filtering of ADS-B data will be used in the ATC automation systems?

- When will aircraft equipage requirements be determined and regulated?

The report also includes an ADS-B "coverage" diagram that does not reflect coverage (which is limited by terrain and antenna location).

Similarly, for ADS-C:

- Is appropriate monitoring in place?
- Has the guidance in the Global Operational Data Link Document (GOLD) been published?
- Have the issues identified during the long trial period been addressed?
- Have procedures for ATCs and pilots been developed and published?
- How was the safety case for 50 NM separation proved?
- Is the planned implementation of ADS-C/CPDLC in the Jakarta FIR safe and reasonable?

Communications infrastructure

This section appears to be a simple list without critical input. The following analysis is required:

- The current situation needs to be accurately described. There is a lot of partially commissioned equipment and infrastructure with little or no monitoring or support program in place.
- Many communications plans have only been partially implemented or are still in the pre-implementation phase.
- Assistance with the prioritisation of the most urgent tasks relating to communications infrastructure is required.

It is not correct that Brisbane is not ready to begin operational use of AIDC messaging with Makassar. The trial has resumed successfully, although with fewer messages than AP 1 would like, in part because the Australian system cannot accept flight plan changes introduced by the MATSC Robot.

Performance Based Navigation (PBN)

This section indicates that PBN implementation will be addressed as a matter of priority in the ATM Master Plan. PBN is critically dependent on accurate, well-managed information. Until aeronautical data ownership and management is addressed for Indonesia, further PBN implementation should not be considered. The ATM Master Plan needs to set out and prioritise enabling activities required prior to further PBN implementation, which must include a complete re-evaluation of WGS-84 compliance (evidence cannot be sourced at the present time).

RNP and RNAV SIDs and STARs

Many SID/STAR issues need to be addressed (and many can be fixed fairly simply, which will have an immediate benefit for pilot/controller workload, rather than going straight to an RNP/RNAV approach). These include:

- Ensuring SIDs and STARs are laterally separated;
- Developing individual arrivals for different runways;
- Introducing feeder fixes to reduce the large number of procedures at each airport (this will also reduce the high reliance on vectoring in the terminal area);
- Ensuring that routes terminate at actual airports (many routes in and out of Jakarta are still associated with the old airport, which closed in the 1980's).

There are numerous references to introduction of RNP AR approaches. In the short/medium term, this should only be done on a very limited trial basis. Data management and aircraft/flight crew qualification are critical and must be treated as such.

Chapter 4

Has any analysis been done of which of the ICAO concept components are most relevant and most urgent for Indonesia? It is doubtful that Indonesia will achieve transition to the full concept in the timeframe of the ATM Master Plan.

Chapter 6: Demand and Capacity Balancing

Is DCB really something that is required in Indonesia, except in its most basic form? The following could be included in any DCB program:

- Addressing AIS;
- Ensuring that all IFR flight plans are properly submitted and accepted by the system;
- Introducing some basic traffic forecasting capability;
- Controlling new entrants to routes and/or airports based on capacity; and
- Establishing slot allocation at busy airports.

Chapter 8: Traffic Synchronisation

The short term objects refer to AMAN. There are no AMAN systems in place in Indonesia. Rather than starting with a specific airport, it would be more helpful to set out the steps to implementation of AMAN and describe the kind of airports at which it may be useful (and the integrity of data inputs required for useful output).

Chapter 9: Conflict Management

It is recommended that Indonesia work towards implementing separation standards prior to other conflict detection. Proper implementation of STCA and other alerts will require full recalibration of radars, improvement of multi-sensor tracking functionality and dissemination of new standards (which must be supported by suitable real-time equipment monitoring).

There is conflict between JAATS replacement (which is often described as short term, despite the 5-7 years it will take for the full replacement program) and other applications described as medium term that should be included in the new system.

Chapter 11: ATM Service Delivery Management

Surveillance

Rather than referring to double surveillance coverage, surveillance needs should be discussed in terms of service continuity and system availability.

This section includes reference to “deploying MLAT in ADS-B ground stations as a backup capability.” This raises a number of questions:

- While the existing ground stations could form part of an MLAT system, the current statement does not make sense;
- What is the backup requirement? Is it a terminal area requirement (MLAT may be a cost-effective solution, depending on terrain and aircraft equipage)? Is it an en-route requirement (ADS-B will be a more cost-effective radar backup)? Is it a backup for aircraft that are not ADS-B equipped?

The purpose of the equipment tables on pages 41-42 is not clear. Does status “REPLACEMENT” indicate that the equipment has been replaced or needs to be replaced?