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Oficina Regional Sudamericana
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(Santiago, Chile, 6 – 8 de mayo de 2009)

Cuestión 2 del Orden del Día: Revisión de la Implantación del Plan Regional de Navegación Aérea

a) Revisión de las mejoras en la ATM Regional

CONCEPTO OPERACIONAL ATM NACIONAL

(Nota presentada por Brasil)

RESUMEN

Esta nota de estudio tiene como objetivo presentar el Concepto Operacional ATM Nacional, documento elaborado por el Departamento de Controle del Espacio Aéreo (DECEA), a fin de establecer un documento de planificación estratégica, orientado a la implantación gradual, coordenada, oportuna y efectiva de los componentes del Concepto Operacional ATM Global.

Referencias:

- Concepto Operacional ATM Global (Doc. 9854); y
- Plan Global de Navegación Aérea (Doc. 9750).

1. Introducción

1.1 Luego del avance en la implantación del Sistema CNS/ATM, logrado por los Estados y Grupos Regionales de Planificación y Implantación, bajo el marco del Plan Mundial de Navegación para los Sistemas CNS/ATM (Doc. 9750), se reconoció que la tecnología no constituía un fin en si misma y que se necesitaba un concepto completo de un sistema ATM mundial integrado, basado en requisitos operacionales claramente establecidos. Ese concepto, a su vez, formaría la base para la implantación coordinada de las tecnologías CNS/ATM basadas también en requisitos claramente establecidos. Para elaborar el concepto, la Comisión de Aeronavegación de la OACI estableció el Grupo de Expertos sobre el Concepto Operacional de Gestión de Tránsito Aéreo (ATMCP).

1.2 El Concepto Operacional ATM Mundial, elaborado por el grupo de expertos arriba mencionado, fue aprobado por la Undécima Conferencia de Navegación Aérea y publicado como el Doc. 9854 AN/458, a través de la recomendación 1/1, que ha indicado lo siguiente:

a) La OACI, los Estados y los grupos regionales de planificación y implantación (PIRG) deberían considerar el concepto como el marco mundial común para guiar la planificación para la implantación de los sistemas ATM y concentrar la labor de desarrollo ATM;

b) El concepto operacional ATM mundial debería ser utilizado como orientación de alto nivel para elaborar disposiciones de la OACI relacionadas con los Sistemas CNS/ATM;

c) Los Estados, con el apoyo de otros miembros de la comunidad ATM, deben emprender la labor de validar los siete componentes del concepto operacional ATM mundial;

d) La OACI, los Estados y los PIRG deberían elaborar estrategias de transición para la implantación de sistemas ATM basados en el concepto operacional ATM Mundial; y

e) La OACI debería alinear su programa técnico para facilitar la labor futura relacionada con el concepto operacional ATM.

1.3 A fin de adecuar la planificación mundial la las conclusiones de la Undécima Conferencia de Navegación Aérea, principalmente con relación al Concepto Operacional ATM Mundial, así como a la Hoja de Ruta de la Industria, la OACI ha desarrollado el nuevo Plan Mundial de Navegación Aérea. Además de incluir el Concepto Operacional ATM Mundial, el Plan Mundial de Navegación Aérea se centra en un conjunto de “Iniciativas del Plan Mundial” (GPI), proporcionando las condiciones necesarias para las implantaciones destinadas a lograr beneficios para la comunidad ATM en el corto y mediano plazo.

2. La Planificación Regional en el contexto del nuevo Plan Global de Navegación Aérea

2.1 La planificación regional siempre se basó en el Plan Regional de Navegación Aérea (Básico y FASID). Sin embargo, después de la publicación del Concepto Operacional ATM Global y del Plan Global de Navegación Aérea, la porción básica del Plan de Navegación Aérea CAR/SAM necesita ser actualizada, teniendo en cuenta que abarca conceptos que ya no se aplican.

2.2 Un intento para actualizar la planificación regional fue presentado a la Quinta Reunión del Subgrupo ATM/CNS, por medio del desarrollo del borrador de un documento denominado Plan de Transición hacia el Concepto Operacional ATM en las Regiones CAR/SAM. Ese Plan ha sido desarrollado teniendo en consideración el Plan Mundial de Navegación Aérea y tenía como objetivo aplicar las Iniciativas del Plan Mundial (GPI), a fin de iniciar la transición hacia el Concepto Operacional ATM.

2.3 Además, este Plan estaba dirigido a establecer una estrategia de implantación destinada a lograr beneficios para la comunidad ATM en el corto y mediano plazo basados en la infraestructura relacionada a la ATM y las capacidades de las aeronaves disponibles y previstas. El documento contenía, aún, detalladamente la infraestructura de Navegación Aérea (CNS, AIM, MET, AGA/AOP) y los Aspectos Institucionales involucrados, necesarios para acompañar dicha evolución.

2.4 El Borrador del Plan de Transición hacia el Concepto Operacional ATM en las Regiones CAR/SAM, que contenía los requerimientos ATM y los capítulos específicos relacionados a la infraestructura de navegación y aspectos institucionales arriba mencionados, debería ser desarrollado por los Subgrupos AGA/AOP, AIM, HRT y MET, por el Comité CNS y por el Grupo de Tarea sobre Aspectos Institucionales. Sin embargo, los diversos órganos auxiliares del GREPECAS no progresaron en el desarrollo del documento.

3. El Concepto Operacional ATM Nacional

3.1 Teniendo en cuenta la necesidad del desarrollo de un documento de planificación estratégica, orientado a la implantación gradual, coordinada, oportuna y efectiva de los componentes del Concepto Operacional ATM Global, el Departamento de Control del Espacio Aéreo (DECEA) ha desarrollado el Concepto Operacional ATM Nacional, basado en el Plan Global de Navegación Aérea, principalmente, en las Iniciativas del Plan Global, así como en los documentos de planificación regionales existentes (Mapa de Ruta PBN CAR/SAM, Concepto Operacional ATFM CAR/SAM, etc.). El Concepto Operacional ATM se adjunta como **Apéndice A** a esta Nota de Estudio (**Inglés solamente**).

3.2 En síntesis, los beneficios que serán obtenidos en el Concepto Operacional ATM Nacional son los siguientes:

a) Asegurar la transición para el Sistema ATM Global;
b) Viabilizar el aumento de la afluencia de tránsito aéreo prevista para Brasil y la Región;
c) Reducir el costo de implantación, operación y mantenimiento de la infraestructura de navegación aérea;
d) Aumentar la disponibilidad, integridad, cobertura y continuidad de los servicios de navegación aérea en Brasil y, en consecuencia, en porciones de las regiones CAR/SAM;
e) Aumentar la eficiencia de las operaciones, con la implantación de rutas directas y de servicios que permitan el cumplimiento de las planificaciones, de acuerdo con los intereses de los operadores; y
f) Atender los niveles requeridos de seguridad operacional.

3.3 Esta concepción considera, inicialmente, el empleo de procedimientos, procesos y capacidades disponibles, evolucionando, en el mediano plazo, para la aplicación de procedimientos, procesos y capacidades emergentes. En el largo plazo, considera la migración para el sistema ATM del "Global Operational ATM Concept".

3.4 Las necesarias actualizaciones serán implementadas la medida que nuevos conceptos y tecnologías sean aprobadas por la OACI y la primera actualización está prevista para ocurrir en 2010, con base en el desarrollo de los programas NextGen y SESAR, y en la experiencia y trabajos desarrollados por la comunidad ATM en Brasil.

3.5 La modernización del Sistema de Control del Espacio Aéreo Brasileño (SISCEAB) ha sido establecida a través de una planificación modular, compuesta por tres fases, debidamente contempladas en la planificación presupuestaria.

a) Fase 1, de corto plazo: hasta 2010;
b) Fase 2, de mediano plazo: de 2011 la 2015; y
c) Fase 3, de largo plazo: de 2016 la 2020.

3.6 Evidentemente, para que tal modernización sea viable y su relación costo-beneficio favorable, es importante considerar como requisito fundamental, que el sistema actual sea una base sólida para recibir y asentar las nuevas funcionalidades, oriundas de la disponibilidad de nuevas tecnologías y del pleno aprovechamiento de los medios ya existentes. De esta forma, buscar una operación eficiente de los sistemas actuales se constituye requisito de la más elevada importancia para que se disfrute de un sistema futuro seguro y eficiente. Los siguientes factores de planificación han sido considerados como fundamentos para el proceso de transición del actual sistema para la capacidad deseada:

a) Atender al nivel de servicios y seguridad requeridos por los usuarios;
b) Implantar la RNAV en todo el espacio aéreo brasileño, en todas las fases de vuelo (ruta, TMA y aproximación) y la RNP, donde sea posible obtener beneficios operacionales, mediante la Navegación Basada en Performance (PBN), con el empleo, entre otros sistemas de navegación, del GPS, del Galileo y del GLONASS;
c) Proveer el nivel de integridad adecuado a las operaciones aéreas, en todas las fases del vuelo;
d) Proveer operaciones “gate to gate” en todo el espacio aéreo brasileño;
e) Proveer vigilancia de las operaciones según los requisitos de ATM;
f) Llevar a cabo la transición para el ambiente ATN, aplicando comunicaciones integradas de dados;
g) Llevar a cabo la transición del AIS para el AIM, con capacidad digital en tiempo real;
h) Minimizar el impacto meteorológico en las actividades aeronáuticas, visando mantener, para IMC, capacidades sistémicas idénticas a las vigentes bajo VMC;
i) Reducir los costos operacionales y los impactos ambientales;

3.7 Las principales iniciativas previstas en la planificación brasileña son las siguientes:

1. Fase 1 – hasta 2010:

a. ATM:
- Implementar herramientas de molde y simulación ATC, visando validar las nuevas estructuras de espacio aéreo;
- Implementar herramientas de cálculo de capacidad ATC y aeroportuaria;
- Implementar herramientas de secuenciación de aproximación y salida;
- Consolidar la capacidad para implementación de medidas ATFM Estratégicas; y
- Implementar el Tratamiento Inicial de Plan de Vuelos.

b. Comunicación:
- Implementar el Sistema de Distribución de Mensajes ATS-AMHS;
- Implementar VDL Modo 2;
- Desarrollar, implementar e implantar una infraestructura de telecomunicaciones (RDCS) que atienda a todo el SISCEAB, con una arquitectura abierta, que pueda absorber todos los servicios actuales y futuros, necesarios al programa de transición CNS/ATM; y
- Estudios y documentación de los requisitos técnicos/operacionales (SICD) para las regiones CAR/SAM, permitiendo una Automatización ATM entre todos los órganos ATC.

c. Navegación:
- Iniciar la implantación de estaciones GBAS CAT I, en aeropuertos cuya demanda operacional lo justifique;
- Implementar RNAV-5, para operaciones en ruta;
- Implementar SID/STAR RNAV-1 en las TMA Brasilia, Recife, Río de Janeiro y Sao Paulo;
- Implementar procedimientos de aproximación RNP APCH y APVBaro/VNAV en los principales aeropuertos que operan IFR;

- Implementar procedimientos de aproximación RNP AR, donde haya beneficios operacionales consistentes;
- Implementar herramienta automática de elaboración de procedimiento de navegación aérea, visando atender a la demanda por nuevos procedimientos, especialmente RNAV y RNP; y
- Adecuar la infraestructura de DME a los requisitos de la OACI para la navegación RNAV (DME/DME) en TMA seleccionadas.

d. Vigilancia:

- Introducir ADS-B en las operaciones “offshore” de la Bacía de Campos (área de explotación de petróleo con intensa actividad aeronáutica) y otros espacios aéreos similares;
- Implantar el servicio ADS-C; y
- Implantar una plataforma de testes para la implementación del ADS-B en el espacio aéreo continental;

2. Fase 2 – 2011 a 2015:

a. ATM:

- Implementar herramientas y adquisición de capacidad para la gestión del espacio aéreo, en tiempo real;
- Implementar nuevas herramientas de automatización ATM: predicción de conflictos; alerta y resolución de conflictos; control de conformidad de trayectoria; integración funcional de los sistemas terrestres con los sistemas de la aeronave, etc.

b. Comunicación:

- Planificar la desactivación gradual del VHF AM, debido a la implementación de los sistemas VDL, considerando, entretanto, la infraestructura de *back-up* necesaria;
- Implementar la Automatización ATM para las Regiones CAR/SAM; y
- Implantar la ATN Nacional;

c. Navegación:

- Implantar GBAS CAT II en aeropuertos seleccionados;
- Iniciar el proceso de desactivación de auxilios a la navegación aérea en tierra, manteniendo solamente la infraestructura de back-up;
- Implementar RNP 2 para operaciones en ruta;
- Implementar SID/STAR RNAV-1 en las otras TMA Brasileñas; y
- Implementar procedimientos de aproximación GLS en los principales aeropuertos brasileños.

d. Vigilancia:

- Implantar cobertura ADS-B en todo el espacio aéreo Brasileño;
- Planificar la interrupción del empleo del Radar Primario para la aviación Civil, donde no haya requisito operacional; y
- Planificar el proceso de desactivación de los “overlap” de cobertura de los radares secundarios para operaciones en ruta (presupone que los usuarios estarán adecuadamente equipados con ADS-B).

3. Fase 3 – 2016 a 2020:

a. ATM:

- Evaluar la implementación de los demás componentes del “Global ATM Operational Concept”; y
- Extender la oferta de servicios a asociados / colaboradores regionales.

b. Comunicación:

- Concluir la implantación de la Red Digital de Comunicación del SISCEAB – RDCS y su integración en las Regiones CAR/SAM, a través de las Redes REDDIG y MEVA II, sirviendo de base para Automatización e Integración ATM en la Región.

c. Navegación:

- Implementar GBAS CAT III en aeropuertos seleccionados;
- Implementar aproximaciones CAT I en los demás aeropuertos brasileños; y
- Dejar la arquitectura de navegación Brasileña disponible para la Región de Sudamérica, visando el desarrollo de una capacidad regional.

d. Vigilancia:

- Iniciar la interrupción del empleo del Radar Primario para la aviación Civil, donde no haya requisito operacional;
- Iniciar el proceso de desactivación de los “overlap” de cobertura de los radares secundarios para operaciones en ruta (presupone que los usuarios estarán adecuadamente equipados con ADS-B);
- Poner los servicios a la disposición de asociados / colaboradores regionales.

4. Principales Proyectos de Implantación

4.1 Navegación Basada en Performance (PBN)

4.1.1 Proyectos de Implantación en las TMA Brasilia/ Recife y Río de Janeiro/Sao Paulo

4.1.1.1 El Plan Nacional de Implantación PBN, solicitado por el GREPECAS, en la conclusión 15/38, esta en proceso de desarrollo por la administración brasileña. Mientras el mencionado plan no es concluido, fue desarrollado el Proyecto de Implantación PBN en las TMA Brasilia y Recife, que se adjunta como **Apéndice B** a esta nota de estudio. Ese proyecto fue basado en el plan de acción aprobado en la Reunión SAM/IG/2. El Proyecto de Implantación PBN en las TMA Río de Janeiro y Sao Paulo esta en fase final de desarrollo, con fecha tentativa de implantación en noviembre de 2010.

4.1.1.2 El objetivo del proyecto de implantación PBN en las TMA Brasilia/Recife, además de la implantación PBN propiamente dicha, tiene como finalidad ganar experiencia en espacios aéreos de menor complejidad, de mediana y baja densidad, caracterizados, respectivamente, por las TMA Brasilia y Recife.

4.1.1.3 El proyecto de implantación en las TMA Río de Janeiro y Sao Paulo tiene como objetivo implantar la PBN en las dos principales TMA Brasileñas, tanto en términos de densidad cuanto de complejidad de espacio aéreo. Además, la pequeña distancia entre las dos TMA (200 NM) y la interrelación de los flujos de transito aéreo entre ellas, tornó necesario que el proyecto de implantación fuera desarrollado en conjunto, para garantizar la armonización de la estructura del espacio aéreo y de procedimientos IFR de las dos TMA.

4.1.2 **Simulación en Tiempo Acelerado**

4.1.2.1 La simulación en tiempo acelerado de las TMA Brasilia y Recife fue iniciado en Diciembre de 2008, con objetivo de buscar la comparación de tres escenarios básicos:

a) Escenario 1 (actual - baseline) – a ser empleado para fines de comparación;
b) Escenario 2 – Con procedimientos SID/STAR más directos posibles.
c) Escenario 3 – Con procedimientos SID/STAR más directos, teniendo en cuenta, también, la necesidad de reducción de la complejidad del espacio aéreo.

4.1.2.2 El escenario 2 tiene como objetivo aumentar la eficiencia del espacio aéreo, con el empleo de SID/STAR más directas posible, enlazando la estructura de ruta directamente a los puntos de aproximación inicial de los procedimientos de aproximación RNP APCH. La estructura del espacio aéreo en ese escenario es altamente compleja, teniendo en cuenta el número significativo de cruces entre trayectorias de salida y llegada. La seguridad del espacio aéreo puede ser garantizada por el establecimiento de altitudes adecuadas en los puntos de cruces entre salidas y llegadas. Se espera que la implantación del concepto de espacio aéreo asociado a ese escenario sea posible en espacios aéreos de baja densidad de transito aéreo, como, por ejemplo, TMA Recife.

4.1.2.3 El escenario 3 tiene también el objetivo de aumentar la eficiencia del espacio aéreo, con el empleo de SID/STAR más directas posibles. Sin embargo, el concepto de espacio aéreo en ese caso busca también reducir la complejidad del espacio aéreo, con miras a aumentar la capacidad ATC de la Dependencia ATC involucrada. Ese escenario fue desarrollado con base en algunas experiencias de la FAA, notadamente en las SID/STAR del Aeropuerto de Atlanta. Se espera que el concepto de espacio aéreo asociado a ese escenario sea viable en espacios aéreos de mediana y alta densidad, como, por ejemplo, TMA Brasilia, Río de Janeiro y Sao Paulo.

4.1.2.4 Algunos ejemplos de los borradores de las SID y STAR asociadas a los escenarios 2 y 3 de las TMA Brasilia y Recife se adjuntan como **Apéndice C** a esta nota de estudio.

4.1.3 **Implantación de Procedimientos de Aproximación RNP APCH con Baro/VNAV, Procedimientos de Aproximación RNAV/ILS y Procedimientos de Salida IFR RNAV (GNSS)**

4.1.3.1 Teniendo en cuenta los beneficios de la implantación anticipada de los procedimientos RNP APCH con Baro/VNAV y RNAV/ILS, así como de Procedimientos de Salida IFR RNAV (GNSS), la administración brasileña desarrolló un proyecto de implantación de esos procedimientos en 28 aeropuertos brasileños, en un plazo de 2 años. Los primeros procedimientos deberán ser publicados en Julio de 2009. Al final de los dos años previstos para la implantación completa, serán desarrollados 256 procedimientos IFR, siendo 76 IAC RNP APCH con Baro/VNAV, 40 IAC RNAV (GNSS)/ILS y 140 SID RNAV (GNSS).

4.1.3.2 Algunos ejemplos de borradores de procedimientos RNP APCH con Baro-VNAV y de procedimientos de salida IFR RNAV (GNSS) se adjuntan como **Apéndice D** a esta nota de estudio.

4.1.3.3 Una de las dificultades ya encontradas en el desarrollo de los nuevos procedimientos IFR son los requerimientos del ítem 5.6.4 del Documento 8168 OPS/611 (PANS-OPS), que se relacionan con la Superficie del Tramo Visual (VSS). Desde 15 de Marzo de 2007, los nuevos procedimientos deberían estar protegidos respecto a obstáculos en el segmento visual, definido por la VSS, o si se penetra la VSS, un procedimiento de aproximación no debería promulgarse sin un estudio aeronáutico. Los procedimientos publicados antes de 15 de marzo de 2007 deberán estar protegidos para la VSS después de la revisión periódica, a más tardar para el 15 de marzo de 2012.

4.1.3.4 La administración brasileña ha realizado un análisis completo de las VSS de los principales aeropuertos brasileños, con miras a identificar la viabilidad de eliminación de los obstáculos que penetran dicha superficie.

4.1.4 **AIC GNSS**

4.1.4.1 Como está previsto en los Planes de Acción PBN para Operaciones En Ruta, TMA y Aproximación, aprobado por las reuniones SAM/IG, la administración ha realizado una evaluación de la reglamentación de aplicación del GNSS como medio de navegación y ha concluido en la necesidad de una completa reformulación, basada en los requerimientos establecidos por el Manual PBN para RNAV-5 (Ruta), RNAV-1 (TMA), RNP APCH y RNP APCH con Baro-VNAV.

4.1.4.2 La versión de la nueva AIC GNSS, en la versión portuguesa e inglés, que fue publicada en 09/04/2009, se adjunta como **Apéndice E** a esta nota de estudio.

4.1.5 **AIC RNAV-5**

4.1.5.1 Conforme previsto en el ítem 7.4 del Plan de Acción RNAV-5, la administración brasileña ha publicado la AIC RNAV-5 en 09/04/2009, conforme está previsto en la Conclusión SAM/IG/2-2. Dicha AIC, en la versión portuguesa e inglés, se adjunta como **Apéndice F**.

4.1.6 **Cambios en los Sistemas Automatizados ATC**

4.1.6.1 La Enmienda No 1 a la 15a Edición del PANS-ATM (Doc 4444), con aplicabilidad del 15 de noviembre de 2012, involucra cambios significativos en la inserción de códigos alfanuméricos relativos a la aprobación RNAV y RNP, fundamentales para la implantación PBN. Considerando las limitaciones actuales del plan de vuelo, la mayoría de esos códigos serán insertados en la casilla 18.

4.1.6.2 La administración brasileña ha iniciado los estudios relativos a los cambios necesarios en los sistemas automatizados ATC, que resultarán en la inserción de caracteres alfanuméricos en las fajas de progreso de vuelo y en los "targets" en la pantalla radar, de acuerdo con las informaciones contenidas en el **Apéndice G** a esta nota de estudio. Los cambios necesarios fueron considerados ya en el nuevo sistema ATC denominado "Sagitario", que será implantado a partir de 2010.

4.2 **Implantación de la Fase 2 del ACC Atlántico**

4.2.1 La implantación de la fase 2 del ACC Atlántico, prevista para Julio de 2009, será caracterizada por la implantación de un nuevo Sistema Automatizado ATC, donde serán insertadas las funcionalidades ADS/CPDLC. Esas funcionalidades permitirán alcanzar los siguientes objetivos en el espacio aéreo oceánico bajo jurisdicción del Brasil:

a) Aumento de la seguridad de las operaciones aéreas;

b) Aumento de la capacidad del espacio aéreo, a través de la reducción de los mínimos de separación entre aeronaves;
c) Aumento de la capacidad ATC;
d) Vuelo de las aeronaves en perfil óptimo de desempeño;
e) Adopción de un sistema de rutas aleatorias y directas; y
f) Atender la demanda proyectada de tránsito aéreo en la FIR Atlántico, notadamente en el corredor EUR/SAM.

4.2.2 El modelo de operación del ACC Atlántico, con el empleo de las funcionalidades ADS/CPDLC y utilización de una sala HF enlazada por comunicaciones de datos con el ACC, propiciará el inicio de la transición de las técnicas de control de tránsito aéreo basadas en comunicación oral entre piloto y controlador para técnicas basadas en comunicaciones vía enlace de datos.

4.3 Implantación de la Fase 2 de los sistemas de apoyo a la decisión del Centro de Gestión de la Navegación Aérea (CGNA)

4.3.1 La implantación de la Fase 2 de los sistemas de apoyo a la decisión permitirá que el CGNA realice con más eficiencia la armonización del flujo de transito aéreo, disponiendo de informaciones de FPL y RPL de manera centralizada, así como las programaciones de los vuelos regulares. La centralización de los planos de vuelo también tornará posible un procesamiento inicial de dichos planes, eliminando más fácilmente las incompatibilidades entre capacidad y demanda que vengan a ser detectadas.

4.3.2 El nuevo sistema dinamizará la consulta a respecto de la operacionalidad de los equipos utilizados por las dependencias ATS, de la infraestructura asociada y de las fechas de restablecimiento de equipos, facilitando la asociación de estas informaciones aquellas relacionadas con fenómenos meteorológicos, detectando de manera oportuna las situaciones que posan afectar la navegación aéreas, permitiendo acciones mitigadoras cada vez más efectivas.

4.3.3 El empleo de ese nuevo sistema posibilitará la evaluación de problemas de incompatibilidad entre capacidad y demanda de forma más eficiente, tanto en las fases estratégica y pré-táctica cuanto en la fase táctica, evitando o minimizando los impactos en el flujo de tránsito aéreo.

4.4 Reestructuración de los Servicios de Navegación Aérea en la Bacía de Campos

4.4.1 Los Servicios de Navegación Aérea en la Bacía de Campos son destinados primariamente al soporte a las operaciones de aeronaves que atienden a la explotación de petróleo en la plataforma continental, ubicada en el nordeste del Estado del Río de Janeiro. La principal demanda esta relacionada al movimiento de transito aéreo en el espacio aéreo oceánico, con origen en los aeródromos de Macaé y Sao Tomé. Esa área es constituida por un espacio aéreo homogéneo, con aeronaves de características similares y una cantidad significativa de transito aéreo en baja altitud.

4.4.2 Desde 05/01/2009, la red de rutas de la TMA Macaé, que atiende al espacio aéreo de las plataformas de explotación de petróleo es basada en el empleo de rutas RNAV (GNSS). Esa estructura de rutas se adjunta como **apéndice H** a esta nota de estudio. A partir del 06 de Mayo de 2009, no serán autorizados vuelos IFR de aeronaves no equipadas con GNSS. La aproximación IFR para las principales plataformas de explotación de petróleo será realiza por medio de procedimientos “Point in Airspace” (PinS), que serán publicados en el tercer trimestre de 2009.

4.4.3 La tecnología de vigilancia ATS a ser implantada en la Bacía de Campos será el ADS-B. La implantación del nuevo sistema automatizado ATC, con capacidad de procesar informaciones del ADS-B y con funcionalidades específicas para el entorno operacional de la Bacía de Campos, así como de las antenas ADS-B necesarias para proporcionar una cobertura de 500 pies en el área de interés, está prevista para Diciembre de 2010.

4.4.4 Se espera que la flota de aeronaves sea equipada gradualmente para operaciones ADS-B. La planificación indica que en Diciembre de 2012 el espacio aéreo de la TMA Macaé será exclusivo para aeronaves equipadas con ADS-B.

4.4.5 El empleo de la ADS-B, la implantación del proyecto de mejoras en las comunicaciones VHF y las herramientas de automatización ATC permitirán la aplicación de la separación horizontal de 5 NM, factor esencial para atender el crecimiento de transito aéreo en la región.

4.4.6 La integración de diferentes sistemas de vigilancia ATS en la Bacía de Campos, tales como ADS-B y Radares Primario y Secundario, permitirá una mejor comprensión de la tecnología ADS-B, viabilizando su aplicación en el espacio aéreo continental.

4.5 Implantación del Sistema AMHS

4.5.1 El AMHS (Air Traffic Services Message Handling System), estandarizado por la OACI, será utilizado para el intercambio de informaciones de emergencia, de seguridad y de regularidad de los vuelos entre los usuarios de la comunidad aeronáutica internacional. Su empleo permitirá la sustitución de la Red de Telecomunicaciones Fijas Aeronáuticas (AFTN), que está en funcionamiento ha varias décadas, pero ya se encuentra técnicamente obsoleta.

4.5.2 El proceso de migración del actual sistema de mensaje (CCAM), que usa la red AFTN como “backbone” ATM, para el nuevo Sistema AMHS, basado en IP, fue iniciado en 2008 y será implantado en 5 fases, desde Junio 2009 hasta Diciembre 2012.

4.5.3 Es Sistema AMHS será implantado en Brasilia y Manaus, permitiendo que un sistema funcione como back-up del otro, conforme puede ser observado en el diagrama abajo.

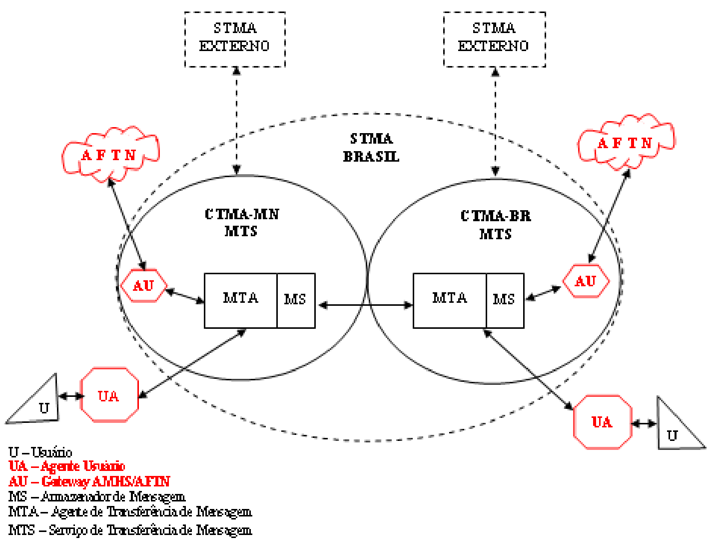

Figura 2.5 – Modelo Funcional do STMA

4.6 Implantación de Estaciones Terrenas GBAS

4.6.1 La implantación de la Estación Terrena del GBAS en el Aeropuerto Internacional Antonio Carlos Jobim, Galeao, en el Rio de Janeiro, en 2010, permitirá el inicio de las aproximaciones de precisión con el empleo del GNSS. En ese sentido, toda la documentación relacionada con la especificación técnica del sistema esta sendo desarrollada. Las aproximaciones frustradas con guía y viabilidad de empleo en aeropuertos adyacentes están siendo reevaluadas, en virtud de problemas de garantía de integridad de estas funcionalidades. La operación será inicialmente basada en el concepto “ILS look alike”, con la posibilidad de inserción de segmentos curvos, por medio del concepto PBN (RNP AR).

4.6.2 La administración brasileña reafirma su comprometimiento con la implantación del GBAS, destacando las siguientes actividades:

a) Envío de los datos GPS/GBAS recolectados desde 2001 hasta 2008 para Honeywell, a fin de desarrollar el Modelo de Riesgo de la Ionosfera (“Iono threat model”) (Abril 2009);
b) Instalación de 4 Sistemas de Inspección en Vuelo UNIFIS3000 con capacidad de inspección GBAS (Mayo 2009);
c) Inicio del proceso de licitación internacional para adquisición de una estación terrena GBAS CAT I (Jul 2009), a fin de posibilitar su empleo operacional antes del próximo período de pico solar.
d) Continuidad de los vuelos de testes de la Estación Prototipo/Teste LAAS/FAA (LTP), instalada en el Aeropuerto Internacional del Río de Janeiro.
e) Continuidad de la recolección de datos para soportar los estudios de la Ionosfera.
f) Participación en el Grupo de Trabajo Internacional GBAS (IGWG).

4.6.3 Es importante resaltar que todos los datos recolectados por la Administración Brasileña, entre 2001 y 2008, están disponibles para estudios relacionados con la Ionosfera, por medio de acuerdo entre las partes interesadas y el DECEA.

5. Acción Sugerida

5.1 Se invita a la reunión a:

a) Considerar la necesidad de actualización de la documentación de planificación regional, basándose en el Concepto Operacional ATM Global y en el Plan de Navegación Aérea Global; y

b) Considerar la necesidad de armonización de la Planificación Regional y el Concepto Operacional ATM Nacional del Brasil.

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APPENDIX A / APENDICE A

MINISTRY OF DEFENSE
AERONAUTICAL COMMAND

AIRSPACE CONTROL

DCA 351-2

BRAZIL ATM CONCEPT OF OPERATIONS

2008

MINISTRY OF DEFENSE

AERONAUTICAL COMMAND

AIRSPACE CONTROL DEPARTMENT - DECEA

AIRSPACE CONTROL

DCA 351-2

BRAZIL ATM CONCEPT OF OPERATIONS

2008

MINISTRY OF DEFENSE

<u>AERONAUTICAL COMMAND</u>

PORTARIA # 299/GC3, 5TH MAY 2008.

Brazil ATM Concept of Operations edition approval

The **Air Force Commander**, in accordance with the inciso XIV of article 23 of the Aeronautical Command Regimental Structure, approved by Decree # 5.196, 26th August 2004, and considering Process # 67050.001449/2008-36, decides:

Art.1st. Approve this DCA 351-2 “Brazil ATM Concept of Operations” edition,

Art. 2nd This document will be valid in its publication data.

Ten Brig Ar (General) JUNITI SAITO

Brazilian Air Force Commander

(Published: BCA # 088, 12th May 2008)

INDEX

PREFACE

In 1991, the 10th ICAO Air Navigation Conference (ANC 10) developed the new CNS/ATM System Concept, after work completed in 1998 by the FANS – Future Air Navigation Committee.

In 1998, after analyzing the revisions of the institutional, legal, economical and technical aspects proposed to the *CNS/ATM System Global Transition Plan* (document developed after the ANC10), the *CNS/ATM System Air Navigation Global Plan,* known as Doc. 9750, was announced.

The aeronautical community has been working to meet the objectives defined in the Global Plan.

After the important evolution in the ANC 10, the 11th Air Navigation Conference, in 2003, considering the progress and difficulties faced by the Implementation and Planning Regional Groups and States, approved the *Global ATM Operational Concept*, with the aim of making it the basic planning reference to conduct the implementation process of an integrated Global ATM.

In November, 2006 the Doc. 9750 New Version, know as ***CNS/ATM System Air Navigation Global Plan***, was approved after being updated with the parameters of the *Global ATM Operational Concept*, providing the aeronautical community with the components and the necessary methodology to allow a strategic plan to meet the world, regional and national objectives.

As its main focus, the Doc. 9750 new version was developed in partnership with the States and Industry, and instead of setting objectives to be reached in all world, in a centered planning, it gives 23 operational initiatives to be considered in the CNS/ATM system planning development and implementation process, aiming at meeting the "performance goals" identified by the regions and states.

Also, environment protection is one of ICAO's strategic goals and it was subject to ample debate during ICAO's 36th Assembly, since it can impact future implementations. Therefore, this is one of the main goals of this concept of operations, that will be accomplished by means of air navigation efficiency improvements, which will result in more rational fuel consumption and, consequently, in less environment-hostile emissions.

In this way, and with the lessons learned from all the DECEA work and the new directions given by the ICAO, the ***Brazil ATM Concept of Operations Plan*** was developed. It was presented to the national aeronautical community, and after important inputs, it became the main planning reference to define the objectives for the CNS/ATM system implementation for the SISCEAB.

1. INTRODUCTION

1.1 PURPOSE

To present the Brazil ATM Concept of Operations plan, including the transition strategy that will bring benefits to the ATM community, in short and medium term, based on the air navigation infrastructure related to ATM (CNS, AIS, MET, etc) and based on the current and future aircraft capacities, and to analyze the aspects that will allow a seamless and secure/safe implementation, with a favorable cost/benefit relation.

1.2 CONCEPTS

The concepts of the terms and expressions with aeronautical use contained in this publication can be found in the Brazilian Air Force Glossary.

1.2.1 DEFINITIONS

a) ATM Community – Set of organizations, agencies or entities that can participate, collaborate and cooperate in the ATM System planning, development, use, regulation, operation and maintenance.

b) Development – Stage in the SISCEAB evolution process where problem analysis, studies, research, tests and evaluations will be performed, aiming at the Concept of Operations plan elaboration and directions for its implementation. These directions will be established by DECEA.

c) Implementation - Stage in the SISCEAB evolution process where all the planning for the project execution, including the scope, implementation justification, expected results, time chart, technical directions, budget, implementation phases and goal definition will be performed. These directions will be established by DECEA.

d) Implantation - Stage in the SISCEAB evolution process where all the investments for the project execution and implementation will be performed, including the work program, technical configuration, basic and executive project, acquisition process, ending with the delivery to the DECEA

e) Air Traffic Management – Generic expression that describes airspace and traffic management in a secure/safe, economic and efficient way, through the CNS/ATM system and seamless services, with contributions from all participants.

f) Human Performance – human capacities and limitations that could implicate the secure/safe and efficient aeronautical operation.

g) Human Factor Principles – Principles applied to the aeronautics systems operation, maintenance, training, specification and certification, aiming at establishing a secure/safe interface between the human being and system components.

h) "Gate-to-Gate" operation – Set of procedures required to meet all the user's needs, including all the aircraft operations, from take-off, flight in TMA, en-route and approach, until its arrival in the final destiny, including the aircraft parking.

i) ATM System – Air traffic management executed through a set of cooperative efforts among human resources, information, technology, facilities and services, supported by communications systems, navigation and surveillance, based in ground and satellite systems and other systems located inside the aircraft.

j) ATS Surveillance service – Service provided using an ATS surveillance system.

l) ATS Surveillance system – Generic term meaning ADS-B, PSR, SSR or any other similar system located in the ground that allows aircraft identification. Note: – A similar system is one that presents, through a comparative evaluation or another methodology, a performance and security/safety level equal to or better than that of a secondary monopulse radar system.

1.3 ABBREVIATIONS AND ACRONYMS

The abbreviations and acronyms listed can be found in this document, and their meanings are listed below:

ABAS	Aircraft Based Augmentation System
ACARS	Aircraft Communication Addressing and Reporting System
ACAS	Airborne Collision Avoidance System
ACC	Area Control Center
ACP	Aeronautical Communication Panel
ADS	Automatic Dependent Surveillance
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
AFTN	Aeronautical Fixed Telecommunication Network

AIP	Aeronautical Information Publication
AIM	Aeronautical Information Management
AIS	Aeronautical Information Services
AMHS	Air Traffic Services (ATS) Message Handling Services
AMSS	Aeronautical Mobile Satellite Service
AO	Aerodrome Operations
AOM	Airspace Organization and Management
APV	Approach with Vertical Guidance
ASP	Aeronautical Surveillance Panel
ATC	Air Traffic Control
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATMSDM	ATM Service Delivery Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
AUO	Airspace User Operations
BARO	Barometric Vertical Navigation (Baro-VNAV)
BVHF MC CDMA	Broadband VHF Multi-Carrier Code Division Multiple Access
CAR/SAM	Caribbean and South American Region
CAT-I	Category I Precision Approach
CAT-II	Category II Precision Approach
CAT-III	Category III Precision Approach
CCAM	Message Automatic Commutation Center
CFIT	Controlled Flight Into Terrain
CGNA	Air Navigation Management Center
CM	Conflict Management
CNS/ATM	Communications Navigations Surveillance/Air Traffic Management

COFDM Coded Orthogonal Frequency Division Multiplex

CPDLC Controller-Pilot Data Link Communications

CDMA Code Division Multiple Access

DAMA Demand-Assigned Multiple Access

DCB Demand Capacity Balancing

DME Distance Measuring Equipment

E1 European Digitazed Telephone Hierarchy

EAC Restricted Airspace

EGNOS European Geostationary Navigation Overlay Service

FAA Federal Aviation Administration - USA

FANS–1 Future Air Navigation System - 1

FDMA Frequency Division Multiple Access

FIR Flight Information Region

FMS Flight Management System

FR Frame Relay

GAGAN GPS and Geostationary Earth Orbit Augmented Navigation

Galileo Europe’s own global navigation satellite system

GBAS Ground Based Augmentation System

G-GNM Gate-to-Gate Network Management

GLONASS GLObal NAvigation Satellite System - Russia

GNSS Global Navigation Satellite System

GPMS GNSS Performance Monitoring System

GPS Global Positioning System

GRAS Ground Based Regional Augmentation System

GREPECAS Caribbean and South American (CAR/SAM) Regional Planning and Implementation Group

HF High Frequency

HFDL High Frequency Data Link

ICAO International Civil Aviation Organization

IFR Instrument Flight Rules

ILS Instrument Landing System

IMC Instrument Meteorological Conditions

IP Internet Protocol

IRS Inertial Referential System

LAAS Local Area Augmentation System (USA)

LAN Local Area Network

MAN Metropolitan Area Network

MET Meteorology

METAR Aerodrome Routine Meteorological Report

Modes A, C, S Secondary radar transponder Modes

Mode A: provide identification code for the aircraft

Mode C: provide aircraft's pressure altitude

Mode S: provide multiple information formats to a selective interrogation

MPLS Multi Protocol Label Switching

MSAS Multi-functional Satellite Augmentation System - Japan

MSSR Monopulse Secondary Surveillance Radar

MTSAT Multi-functional Transport Satellite (MSAS GEO satellite)

NADIN II National Airspace Data Interchange Network

NAVAID Navigational Aid

NAVP Navigation Panel

NDB Non-Directional radio Beacon

NOTAM Notice to Airmen - A notice distributed by means of telecommunication containing information concerning the establishment condition or change in any aeronautical facility service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operation.

OCP	Obstacle Clearance Panel
PABX	Digital Telephone Central
PAMA	Pre-Assigned Multiple Access
PBN	Performance Based Navigation
PIREP	Pilot Report (Meteorology)
PIRG	Planning and Implementation Regional Groups (ICAO)
QPSK	Quadrature Phase Shift Keying
8PSK	Phase-Shift Keying - 8
RAIM	Receiver Autonomous Integrity Monitoring
RCP	Required Communications Performance
RDCS	SISCEAB Communications Digital Network
RFI	Radio Frequency Interference
RFP	Request For Proposal
RMMS	Remote Maintenance Monitoring System
RNAV	Area Navigation
RNP	Required Navigation Performance
RNP APCH	Approach RNP
RNP AR	Approach RNP, with Authorization
RSP	Required Surveillance Performance
RVSM	Reduced Vertical Separation Minima or Minimum
SASP	Separation and Airspace Safety Panel
SBAS	Satellite Based Augmentation System
SCPC	Single Carrier Per Channel
SID	Standard Instrument Departure
SISCEAB	Brazilian Airspace Control System
SMGCS	Surface Movement Guidance and Control System
SSR	Secondary Surveillance Radar

STAR	Standard Instrument Arrival
TAF	Terminal Aerodrome Forecast
TDMA	Time Division Multiple Access
TMA	Terminal Control Area
TS	Traffic Synchronization
TSO	Technical Standard Order
UAT	Universal Access Transceiver
VDL	VHF Digital Link
VFR	Visual Flights Rules
VHF	Very High Frequency
VOR	VHF Omnidirectional Radio Range
VSAT	Very Small Aperture Terminal
WAAS	Wide Area Augmentation System
WAN	Wide Area Network
WGS-84	World Geodetic System -1984
WiMAX	Worldwide Interoperability for Microwave Access

1.4 SCOPE

The presented plan applies to all organizations and agencies involved in the planned activities.

2. GENERAL PRINCIPLES

2.1 INITIAL TOPICS

2.1.1 The goals of this document are:

a) To meet the ICAO requirements established in the DOC 9854 – Global ATM Operational Concept and in the DOC 9750 – Air Navigation Global Plan; and

b) To develop an ATM Concept of Operations applied to the Brazilian airspace that increases its security/safety and efficiency, and associates its cost to the aeronautical operations.

c) To establish the basis for elaborating the National ATM Implementation Program, that will be constituted by the Global Plan Initiatives (GPI) application projects; in addition, the Program will be harmonized with the documents related to the Aviation Security/Safety Global Plan Initiatives, aiming to meeting the airspace security/safety requirements.

2.1.2 The document is not intended to replace or supersede specific guidance concerning airspace operations. It simply provides a high level definition of the capabilities, infrastructure, and procedures possible with the implementation of the CNS/ATM technologies.

2.1.3 The capacities introduced in this Plan must be validated using the Airspace Modeling, Real Time and Accelerated Time Simulation, Flight Evaluation, to make sure they are attainable. In addition to this document DECEA will develop the following documentation:

a) Implementation Program – This document will define the actions, schedule and priorities to be met by DECEA, aiming to ensure a secure/safe transition during the SISCEAB update, respecting the limits set in ICAO's global and regional plans.

b) Cost/benefit Analysis – This document will define the cost/benefit relation associate to the implementation of each technology envisioned to support future operations in Brazilian Airspace. The projects in the Implementation Program can also be subject to specific cost-benefit analysis, depending on their complexity.

c) Investment Plan – This document will describe a specific acquisition strategy and approach for acquiring the equipment and resources needed to achieve full CNS/ATM capability.

2.1.4 The decision criteria used to develop this document were:

a) Mission success: to what extent the capability improves mission performance for the external and internal customers;

b) Investment return: the capability global value, in economic terms, to the ATM community;

c) Risk: what is the involved risk, in terms of uncertainties and possible consequences; and

d) Strategic alignment: definition of the system capability limit to support the organizational strategic objectives, such as DECEA Global Architecture System and

International Commitments.

2.2 SITUATION SUMMARY

2.2.1 The CNS/ATM concept, developed by the FANS Committee was approved by the ICAO at the 10th ICAO Air Navigation Conference, in September 1991. This Conference recommended to the ICAO the development of a Global Plan, to allow the planning and implementation of the CNS/ATM future systems, through the Implementation and Planning Regional Groups. In this direction, the ICAO developed the Air Navigation Global Plan for the CNS/ATM System, document 9750. In this document, the ICAO recommended that the CNS/ATM system were implemented based in the coordination of the Regional Implementation and Planning Groups (PIRG), although the implementation of CNS/ATM System was a unique responsibility of each State.

2.2.2 In reply to the ICAO Plan, the CAR/SAM Region developed, supported by its PIRG named GREPECAS, a CNS/ATM Regional Plan to help other State-Members to develop their own Implementation Plan, to ensure a seamless and successful transition of these systems.

2.2.3 After the advance in the CNS/ATM System implementation, reached by the States and the Regional Implementation and Planning Groups, it was acknowledged the necessity of a complete concept for the Integrated Global ATM System, based in operational requirements clearly established. This concept would form the foundation for a coordinated implementation of CNS/ATM technology, also based in requirements clearly established.

2.2.4 The Global ATM Operational Concept, developed by the ICAO, in reply to the above-mentioned needs, was approved by the 11th Air Navigation Conference and published as Doc. 9854 AN/458.

2.2.5 It is important to say that the new CNS technologies and the mentioned Global ATM Operational Concept bring important modifications in the traditional form of providing air navigation services. The transition and implementation of a new system, aiming at the operational security/safety and efficiency, require some concern about the human factors.

2.2.6 In order to adjust the world-wide planning to the Global ATM Operational Concept, the ICAO developed the new Air Navigation Global Plan, which gives the necessary conditions for the Implementation to reach the benefits for the ATM community, in short and medium term. In this way, it is essential to have an adequate infrastructure for the ATM, to reach the established operational requirements.

2.2.7 As the Global ATM Operational Concept, the objective of the National ATM is to provide an Air Traffic Management System to the ATM community, during all flights phases, to satisfy the required level of operational security/safety, to be sustainable in relation to the environment, and to satisfy the national requirements for aviation security/safety.

2.3 AIR NAVIGATION SERVICES PLANNING

2.3.1 This Concept of Operations provides a path to a gradual, coordinated, opportune and effective implementation of the Global ATM Operational Concept components, based on the Air Navigation Global Plan and CAR/SAM Regions Planning, and in the Global Plan Initiatives (GPI), that could be implanted in short and medium term.

2.3.2 The National ATM Planning considers the characteristics of the Global ATM Operational Concept components, whose facilities and services make possible its application beyond the national borders. These characteristics make necessary the implementation of multinational facilities and services, in order to prevent duplicity of resources and services for the States.

2.3.3 The institutional aspects related to operation, maintenance, control and property of the CNS/ATM system in the multinational facilities and services must be considered, due the legal, economic, and financial aspects of its implementation.

2.3.4 Considering the aspects mentioned in the previous paragraph, and the necessity to establish an implementation and planning structure of multinational facilities and services, it is observed that there is a tendency to create Regional Multinational Organizations, formed by State groups, that will make sure that the necessary investments for the implementation and maintenance of the air navigation service will be optimized.

2.3.5 HOMOGENEOUS ATM AREA

2.3.5.1 Homogeneous ATM area is an airspace portion with a common ATM interest, based in similar characteristics of density and air traffic complexity, air navigation system infrastructure requirements, where a detailed planning will foster the application of an interfunctional ATM system. The homogeneous ATM areas can include a specific part from one State or from a group of States, including large parts of continental or oceanic airspace.

2.3.5.2 Based on the Global ATM Operational Concept, the homogeneous ATM areas must be reduced, considering the junction of adjacent areas, in order to guarantee the interoperability and operational integration.

2.3.5.3 In Brazil, the main homogeneous ATM areas are:

a) The oceanic airspace, concentrated in the Atlantic FIR, which have specific ATM requirements, because its low density and air traffic complexity; also, the current available technology demands application of a CNS infrastructure based on satellites, in order to guarantee an adequate air navigation service.

b) The low density and complexity continental airspace located above the Amazon, inside the Amazon FIR, which makes possible the application of specific and differentiated ATM procedures, if compared with the other parts of the national continental airspace; and

c) The average and high density continental airspace, formed by the Brazilian continental airspace part, that keep the regions peculiarities where they are inserted, resulting in the current configuration of the Brasília, Curitiba and Recife FIR.

2.3.6 TRAFFIC MAIN FLOW

2.3.6.1 Air Traffic Main Flow is the concentration of significant volume of air traffic in the same trajectory or in a near flight trajectory. The air traffic flow can cross several homogeneous ATM areas with different characteristics. The main traffic flows must be considered in the airspace structure planning, in order to be prioritized, in terms of route definition and optimized air navigation procedures.

2.3.6.2 In Brazil the main air traffic flows identified are:

a) Rio de Janeiro / São Paulo

b) Rio de Janeiro / Northeast Region / Europe

c) São Paulo / Belo Horizonte / Northeast Region / Europe

d) Buenos Aires / Porto Alegre / Florianópolis / Curitiba / São Paulo

e) São Paulo / Brasília / Manaus / USA

f) Rio de Janeiro / Brasília / USA

2.3.7 The homogeneous ATM areas and the Air Traffic Main Flow are related specially with the airspace en-route. So, improving the capacity and efficiency of the terminal control area (TMA) and the aerodrome, based in a set of initiatives that allow the service continuity, will be the way to obtain a seamless ATM system.

2.3.8 PLANNING METHODOLOGY

2.3.8.1 After the identification of the homogeneous ATM areas, in this case the Brazilian FIR, and the air traffic main flow, it will be essential to define the national airspace user profile, including the aircraft fleet study and its current and future capacities. Also, the analysis of the air traffic increase and the infrastructure related to the ATM will allow the identification of “gaps” in the system performance, and consequently, the choice of the Global Plan Initiatives that are better adjusted to the national airspace specific needs.

2.3.8.2 This planning process will have continuity with the following activities:

a) Analysis of the different options to execute the initiative mentioned;

b) Cost/Benefit analysis for the selected options;

c) Development of the operational concept for each project, stemming from this Concept of Operations, in order to meet every national airspace necessity;

d) Preliminary development of infrastructure requirements associated to the ATM;

e) Elaboration of the Implementation plans specific to each project in this Concept of Operations, observing the necessary conditions to the harmonization of the implementation process between users and service providers.

2.3.8.3 Figure 1 below is an illustration of a planning flow chart:

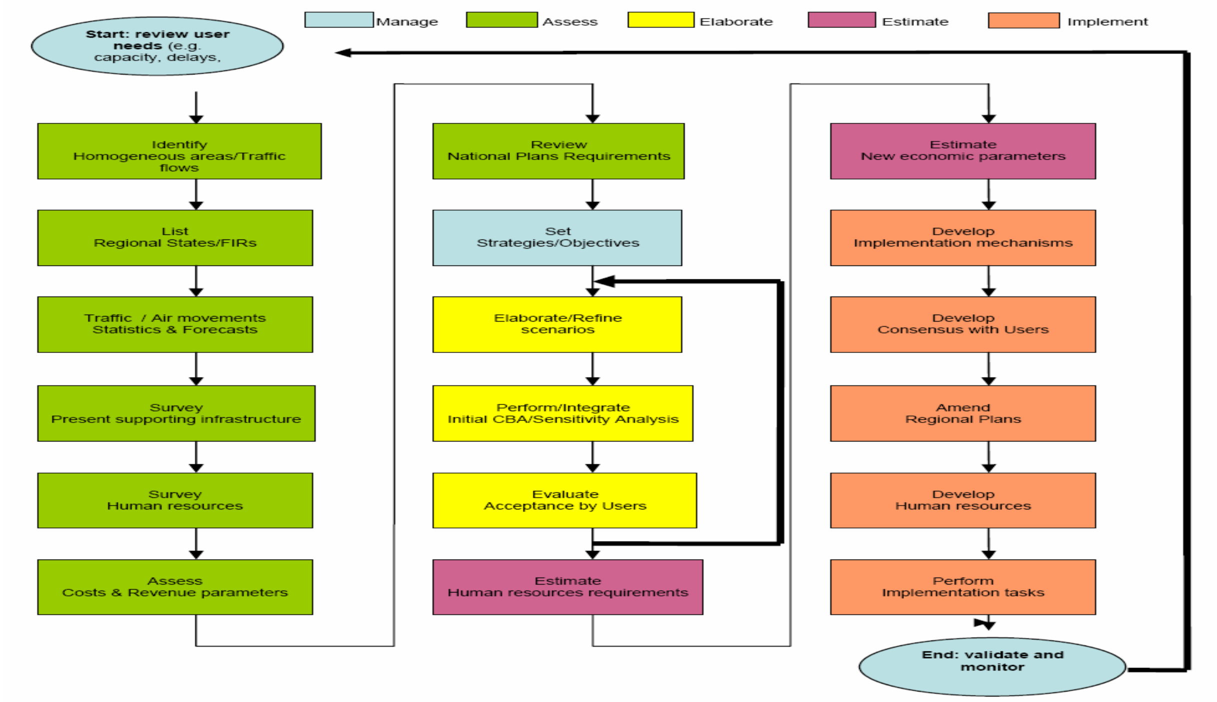

Figure 1 Planning flow chart

2.3.9 EVOLUTION

2.3.9.1 To reach the intended ATM system, several initiatives will be executed, in constant evolution, throughout the years. The set of initiatives that integrate this Concept of Operations have the objective to facilitate and to harmonize the work that has been done, at the regional and national level, and to give the aircraft operators the necessary benefits in short and medium terms.

2.3.9.2 The initiatives presented in this Concept of Operations fulfill the world-wide, regional and nationals objectives, based on the Global ATM operational concept. On this base, the execution and planning activities will begin with the application of available procedures, process and capacities. The evolution will advance, in medium term, to the application of emergent procedures, process and capacities. After that, in a long term, the migration to the ATM system planned in the Global ATM Operational Concept will be made. The figure 2 presents the evolution planned.

2.3.9.3 This Concept of Operations will be updated when new concepts and technologies are approved by ICAO. The first update should be performed in 2010, based on the European and US future air navigation systems implementation programs (SESAR and NextGen), which will be fully applied after 2025, and on Brazilian ATM community experience and performed works.

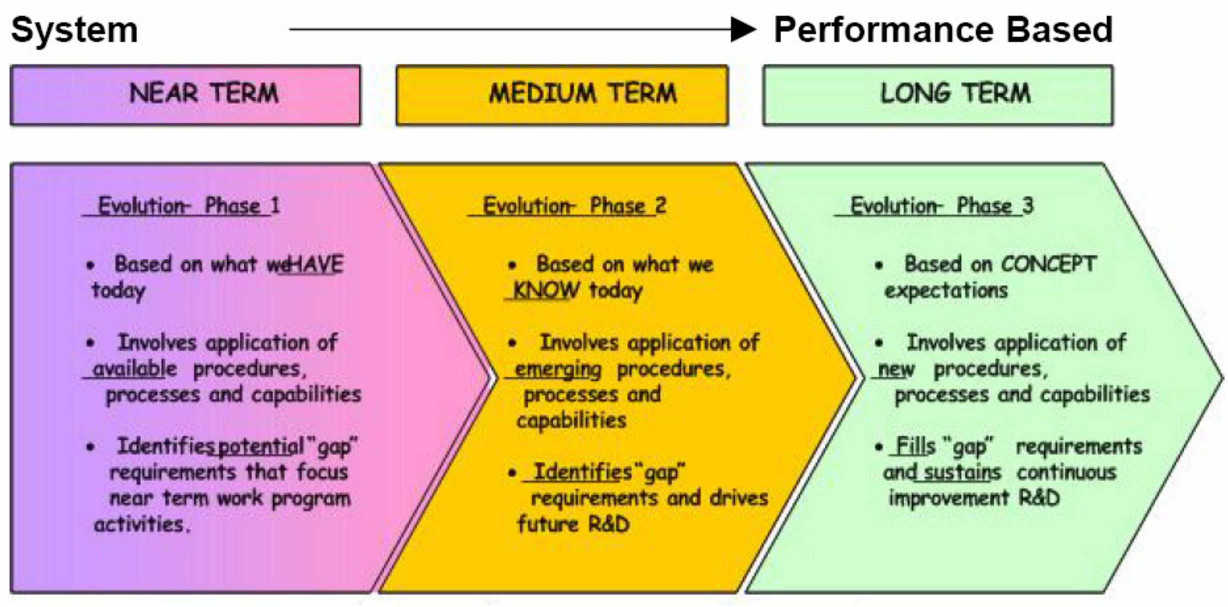

Figure 2 Global Plan Evolution

2.3.10 Global Plan Initiatives (GPI)

2.3.10.1 The table below presents the Global Plan Initiatives (GPI), that can be considered to the ATM system implementation, in short and medium term. In this Concept of Operations, the chosen initiatives will be inserted in specifics chapters, divided in ATM and its related infrastructure (CNS, AIS e MET).

2.3.10.2 The GPI objective is to facilitate the planning process and will not be considered as independent tasks, and in most cases they will be interrelated. In this way, the initiatives must integrate and support each other.

GPI		En-Route	Terminal Area	Aerodrome	Supporting Infrastructure	Related Operational Concept Components
GPI-1	Flexible use of airspace	X	X			AOM, AUO
GPI-2	Reduced Vertical Separation Minima	X				AOM, CM
GPI-3	Harmonization of level systems	X				AOM, CM, AUO
GPI-4	Alignment of upper airspace classifications	X				AOM, CM, AUO
GPI-5	RNAV and RNP (Performance-Based Navigation)	X	X	X		AOM, AO, TS, CM, AUO
GPI-6	Air Traffic Flow Management	X	X	X		AOM, AO, DCB, TS, CM, AUO
GPI-7	Dynamic and Flexible ATS Route Management	X	X			AOM, AUO

GPI		En-Route	Terminal Area	Aerodrome	Supporting Infrastructure	Related Operational Concept Components
GPI-8	Collaborative Airspace Design and Management	X	X			AOM, AUO
GPI-9	Situational Awareness	X	X	X	X	AO, TS, CM, AUO
GPI-10	Terminal Area Design and Management		X			AOM, AO, TS, CM, AUO
GPI-11	RNP and RNAV SIDs and STARs		X			AOM, AO, TS, CM, AUO
GPI-12	Functional integration of ground systems with airborne systems		X		X	AOM, AO, TS, CM, AUO
GPI-13	Aerodrome Design and Management			X		AO, CM, AUO
GPI-14	Runway Operations			X		AO, TS, CM, AUO
GPI-15	Match IMC and VMC Operating Capacity		X	X	X	AO, CM, AUO
GPI-16	Decision Support Systems and Alerting Systems	X	X	X	X	DCB, TS, CM, AUO

GPI		En-Route	Terminal Area	Aerodrome	Supporting Infrastructure	Related Operational Concept Components
GPI-17	Data link applications	X	X	X	X	DCB, AO, TS, CM, AUO, ATMSDM
GPI-18	Aeronautical Information	X	X	X	X	AOM, DCB, AO, TS, CM, AUO, ATMSDM
GPI-19	Meteorological systems	X	X	X	X	AOM, DCB, AO, AUO
GPI-20	WGS-84	X	X	X	X	AO, CM, AUO
GPI-21	Navigation Systems	X	X	X	X	AO, TS, CM, AUO
GPI-22	Communication infrastructure	X	X	X	X	AO, TS, CM, AUO
GPI-23	Aeronautical radio spectrum	X	X	X	X	AO, TS, CM, AUO, ATMSDM

Table 1 Global Plan Initiatives (GPI)

2.4 SISCEAB MODERNIZATION

2.4.1 The SISCEAB modernization will be established by a modular planning with 3 different phases. Each phase will enclose a specific period, considering the system total capacity, and each period will be considered in the budget. These phases are:

a) Phase 1 – Short Term – Today up to 2010

b) Phase 2 – Medium Term – from 2011 up to 2015

c) Phase 3 – Long Term – from 2016 up to 2020

2.4.2 The planning goal is to complete the investment and the implementation of the Brazilian airspace transition in 2020, based in the use of procedures, process and available and emergent capacities. To summarize, the benefits and risks of this implementation are:

a) Benefits:

- To ensure the transition to the Global ATM System;
- To make possible the increase in the air traffic of Brazil and Region, with the additional resources coming from the tourism and from the air transportation industry;
- To reduce the cost of implantation, operation, maintenance and air navigation infrastructure;
- To increase the services availability, integrity, coverage and continuity in Brazil and in the CAR/SAM Region;
- To increase the operational efficiency, with the implementation of direct routes and services that allow the plan execution, according to the operator needs; and
- To ensure the required operational security/safety levels are met.

b) Risks:

- Phased implementation without synchronizing with the demand real growth;
- Difficulties in planning and in budgetary execution;
- Unexpected difficulties with the emergent technologies;
- Unavailability of the required human resources, in adequate quantity and qualification.

2.4.3 For the modernization to be viable and with a balanced cost/efficiency, it is important to consider, as a fundamental requirement, the current system to be a solid base that will receive and support the new features that will be derived from the availability of new technologies and from the full use of existing means. Therefore, striving for an efficient operation of the current systems constitutes a requirement of the utmost importance in order to have a future system that is efficient and secure/safe.

2.5 PLANNING FACTORS

2.5.1 The following planning factors must be considered in the SISCEAB transition process:

a) To meet the required level of security/safety and service for all users

b) To develop the RNAV within Brazilian airspace, in all flight phases (route, TMA, approach) and RNP, where it is possible to have operational benefits, using the Performance Based Navigation (PBN) and navigation systems including, but not limited to, GPS, Galileo and GLONASS;

c) To provide the adequate integrity level to the air operation, in all flight phases;

d) To provide the "gate to gate" operation within Brazilian airspace;

e) To provide the operation surveillance in accordance with the ATM requirements;

f) To make the transition to the ATN environment, applying integrated data communication;

g) To make the transition from ATS to ATM;

h) To make the transition from AIS to AIM, with real time digital capacity;

i) To minimize the meteorological impact in the aeronautical activities with the goal to have, under IMC, system capacities identical to those under VMC;

j) To reduce the operational cost and the environmental impact.

l) To ensure that the Implementation Program establishes the planning for each Project, including the measures required for mitigating or eliminating the assessed risks.

2.6 SERVICE LEVEL

2.6.1 The required services for the airport operation and airspace in Brazil are:

a) Air Traffic Management:

- Air Traffic Service;
- Flow management and aeronautical infrastructure capacity management (ATC and Airport);
- Real time airspace management and organization.

b) Communications:

- En-route – Oceanic airspace:
  1. Basic: Data;
  2. Emergency or non-routine situation: Voice.
- En-route – Continental airspace:
  1. Basic: Data/Voice;
  2. Emergency or non-routine situation: Voice.

- In Terminal Control Area (TMA):
  1. Basic: Data/Voice;
  2. Emergency or non-routine situation: Voice.
- In Aerodrome control:
  1. "Clearance": Data;
  2. Ground: Data/Voice;
  3. Control tower: Voice.

c) Navigation:

- En-route:
  1. Basic: GNSS Services and Inertial System;
  2. Secondary: NAVAIDS based in ground, in the continental airspace, to support contingency procedures.
- In Terminal Control Area (TMA) and Approach phase:
  1. Basic: GNSS Services and Inertial System;
  2. Secondary: NAVAIDS based in ground, in selected airports;
  3. Approach phase: 3-D orientation in all runway ends (Baro-VNAV); 3-D accuracy in selected airports (GBAS), with positive glide path guide.
- Ground navigation (airports):
  1. Basic: GNSS Services in selected airports, with GBAS;
  2. Secondary: Visual references.

d) Surveillance:

- En-route – Oceanic airspace:
  1. Basic: ADS-C;
  2. Emergency or non-routine situation: Voice.
- En-route – Continental airspace:
  1. ADS-B and/or Secondary radar for selected airspace.
- In Terminal Control Area (TMA):
  1. ADS-B and/or Primary/Secondary radar for selected airspace.
- In Aerodrome control:
  1. ADS-B and Multilateration in selected airports;
  2. Voice/Visual for airports with low operational complexity.

e) Aeronautical Information Management (AIM):

- Management of the National Aeronautical Information Database;
- On-line access to AIP, to ROTAER, to land digital data and NOTAM;
- Service to Client by internet;

- Lack of errors in critical and/or essential information;
- AIXM model application;
- Delivery of information in critical situations with priority;
- Real time aeronautical information, through datalink between on-board system and AIS system;
- GNSS Performance Monitoring System (GPMS);
- Information generation and dissemination of NOTAM and Flight Information Service (FIS).

f) Meteorological services:

- TAF, METAR and PIREP:
  1. Basic: Data communication;
  2. Back-up: Vital information by voice.
- En-route prediction:
  1. Basic: Data communication;
  2. Back-up: Voice.

3. AIR TRAFFIC MANAGEMENT

3.1 GENERAL ASPECTS

3.1.1 As the air traffic volume increases in the world, the demands on the air navigation services supplier intensify, and the air traffic management becomes more complex. With the increase in the air traffic density, the amount of flights that cannot have its best flight trajectory will increase, as well as the total system delay (landing and take-off), if the necessary actions to increase the system capacity are not taken. To face this problem, the 11th Conference approved the Global ATM Operational Concept.

3.1.2 The Global ATM Operational Concept resulted in the modification of the ATM traditional division in ATS, ATFM and ASM, initially used for the application of a Global ATM system based in 7 main components: Airspace Organization and Management (AOM), Aerodrome Operations (AO); Demand Capacity Balancing (DCB), Traffic Synchronization (TS), Airspace User Operations (AUO), Conflict Management (CM), and ATM Service Delivery Management (ATMSDM).

3.1.3 The Global ATM Operational Concept presents two essential characteristics, represented by the information management and the collaborative decision, which will decisively influence the concept implementation.

3.1.4 The ATM basis is the global information management, integrated and with guaranteed quality, which will provide essential information for the development of the 7 Global ATM main components.

3.1.5 The concept replaces the unilateral concept of decision, where the user is just a passive part in the process, with a method of collaborative decision making with ample participation of all interested parts, including the operation and planning stages. In this way, it is guaranteed that the flight will be performed close to the best profile, through the negotiation among the ATM community members.

3.1.6 The implementation of the ATM operational concept components will allow sufficient capacity to satisfy the increasing demand, bringing benefits as more efficient flight profiles and improvements in the operational security/safety. However, the new technologies potential to reduce the service cost to the users and to the air navigation service supplier, makes necessary to establish clear operational requirements, object of this document, which must be validated by a cost/benefit analysis.

3.1.7 Considering the ATM operational concept benefits, it will be necessary to make the decisions in the right moment, so that its implementation will provide the required increase in the system capacity, in order to prevent undesired gaps in air traffic services. As the ATM operational concept elements go beyond the States border, it will require cooperation in a regional and world–wide level.

3.1.8 The airspace structure will not be limited by the airspace traditional divisions. The planning will be coordinated among adjacent areas, aiming at a continuous airspace, seamless to the users. The airspace must be free of operational discontinuities and incoherence, and must be organized to meet the needs of the airspace users.

3.1.9 The transition between areas must be clear to the users. The planning and implementation of the ATM operational concept components must include its impacts and requirements, in terms of human factors.

3.1.10 The Brazilian ATM evolution will be carefully planned, in order to prevent the performance degradation of the current system. In this way, it is necessary that the transition ensure the desired security/safety levels, at least equal to the current level, in a gradual evolution to the improvement in the air operations efficiency. During the transition phase the CNS avionics on board aircraft will only be mandated when there are clearly established operational requirements.

3.2 ATM GLOBAL OPERATIONAL CONCEPT COMPONENTS

3.2.1 AIRSPACE ORGANIZATION AND MANAGEMENT

3.2.1.1 It substitutes the old “Airspace Management” (ASM), including the tactical phase of airspace flexible utilization and the airspace organization in the strategic phase, and procedures and rules in which the airspace is structured to accommodate different types of activities and air traffic volume.

3.2.1.2 The airspace will be globally organized, and the air traffic will not be affected by national borders or by FIR and/or control sector limits. These limits will be transparent for the airspace users (“seamless airspace”). It is important to remember that the airspace globalization must not affect the sovereignty of the involved States.

3.2.2 AERODROME OPERATIONS

3.2.2.1 The ATM Global Operational Concept considers the aerodrome operations as an integrated part of the ATM system. The aerodrome operator must provide the ground infrastructure, including: take-off and landing runway, taxiing path, lights, surface movement precision guides, etc. These operations must have as main objectives the security/safety improvement and the capacity maximization, in any meteorological conditions. The ATM system must give the necessary conditions for the efficient use of the aerodrome capacity.

3.2.2.2 This component of the operational concept will remove any inefficiency in the previous concept, as it promotes the interrelationship between the aerodrome operation and the airspace operation, to guarantee the necessary capacity to meet the user needs

3.2.2.3 Although the Global ATM Operational Concept has focused in the “air” side of the airports and has made only reference to the “ground” side, the experience acquired during the process of capacity analysis presents that the “ground” side is as important as the “air” side. Capacity problems related to the check-in, departure and arrival waiting rooms, luggage inspection; immigration control, custom house and others have a fundamental role in the ATM system

3.2.3 DEMAND CAPACITY BALANCING

This component replaces the Air Traffic Flow Management (ATFM). The main reason for this change was that the balance between capacity and demand does not need to be done imposing restrictions to the air traffic demand, but could be implemented through the increase in the ATC and/or airport capacity. The European concept, for example, was modified for Air Traffic Capacity and Flow Management, more adaptable to the Brazilian characteristics.

3.2.4 TRAFFIC SYNCHRONIZATION

This component was established to guarantee an adequate "gate to gate" air traffic flow, through the use of automatic tools, that will indicate the optimum air traffic control sequence to the gates for the approach and landing, for the take-off and en-route. The traffic synchronization will be directly related to the capacity and demand balance, and to the conflict management, to guarantee a continuous and organized traffic flow, implying in the system and the controllers preparation for the use of the aircrafts navigation capacity in 4D.

3.2.5 AIRSPACE USER OPERATIONS

Airspace User Operations refers to the ATM aspects of flights operations. This component was established to indicate that all airspace users must be considered in Global ATM, including unmanned aircraft. The information proceeding from the user about their flights and the predicted changes will be a key element in the integrity of ATM components, such as: Airspace Organization and Management, Aerodrome Operations, Traffic Synchronization and Capacity and Demand Balance.

3.2.6 CONFLICT MANAGEMENT

3.2.6.1 The separation concept will be extended with the application of the Conflict Management component. The separation will be executed between the aircraft and the potential risks. The considered risks will be: another aircraft, the terrain, the meteorology, the turbulence map, incompatible activity in the airspace, vehicles in the surface and other obstacle located in the surface or in the maneuvering area. It can be observed that the separation concept is extended, including other risks beyond the traditional ones, as "another aircraft" and obstacles.

3.2.6.2 The conflict management will be executed in three main aspects:

a) Strategic conflict management;
b) Provision for detection and separation; and
c) Conflict resolution.

3.2.6.3 Normally the conflicts will be detected and decided in the ground, before the take-off, through the conflict strategic management, considering the planned profile of the flight.

3.2.6.4 The separation provision will be the conflict management tactical phase, and will guarantee the separation of the aircraft from the risks associated to its actual flight profile. In this phase, the necessary ATM automation will be applied, through adequate tools, aiming at the "alert", the "resolution" and the "conflict prediction".

3.2.6.5 The conflict detection and resolution in flight will be done through existing systems on board, similar to the ACAS.

3.2.7 ATM SERVICE DELIVERY MANAGEMENT

3.2.7.1 This component replaces the traditional Flight Plan filing, and suggests that a service delivery based in the components previously presented will correspond to the service request. To make this service possible, an interaction system between the user and ATM service provider will be developed, in which will be possible to establish an agreement, through a collaborative decision system, to make possible a flight profile close to the ideal.

3.2.7.2 It is important to say that after the agreement between the user and ATM service provider, a formal air traffic authorization will be necessary and must be complete, including all "gate to gate" flight phases.

3.3 PERFORMANCE-BASED AIR TRAFFIC MANAGEMENT

3.3.1 Performance-Based Air Traffic Management is based on the assumption that the ATM Community expectations can be best served by quantifying its needs. A set of performance goals and objectives that can justify, objectively, the projects that aim to improve the performance of the air traffic management system will be established.

3.3.2 In order to apply the performance-based ATM, it will be necessary to establish mechanisms for evaluating and measuring the performance goals. Figure 3 illustrates the process for transforming the expectations of the ATM Community into objectives and goals. The following Key Performance Areas (KPA) have to be taken into account when elaborating this process:

a) Access and equity;

b) Capacity;

c) Cost-effectiveness;

d) Efficiency;

e) Environment protection;

f) Flexibility;

g) Global interoperability;

h) ATM Community participation;

i) Previsibility;

j) Operational safety;

l) Aviation security.

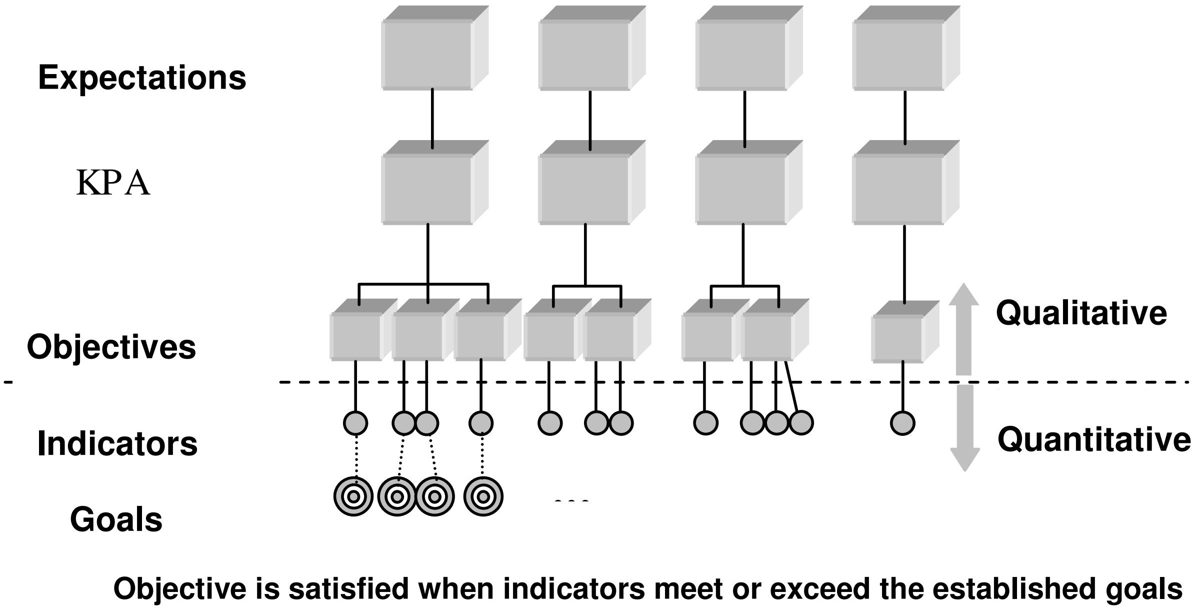

Figure 3 ATM Community Expectations Quantification Process

3.3.3 The KPA provide a general guidance for the classification of the performance improvement needs that will be met by establishing specific performance objectives that are adapted to the specific needs of each Region/State. The scope of these objectives will have to be precisely established, in order to enable their expression in events and quantities, including a desired tendency for the performance indicator (e.g.: reducing the ATM cost per km).

3.3.4 The performance objectives have to be expressed in qualitative terms, which will occur in the definition of the goals to be met. A typical example for a performance objective is "timely arrival improvement," which can be one of the objectives for the "Efficiency" KPA.

3.3.5 The performance objectives must have the following characteristics:

a) Specificity – they must be expressed by objects and events that actually represent air traffic and the operational environment;

b) Measurability – it must be possible to associate them to one or more clearly established performance indicator, enabling the establishment of a data gathering process and the comparison of the results;

c) Attainability – the time parameters and the resources available for implantation must be taken into account;

d) Relevance – they must be defined wherever performance problems and/or opportunities for improving the ATM Community expectation service are anticipated;

e) Opportunity – they must be met in due time.

3.3.6 Performance management must be performed by means of specific performance objectives, to be measured by means of performance indicators. These indicators have to be defined aiming at quantifying how well the performance objectives are met. When describing the performance indicators, the metrics to be used have to be defined, as well as how to get them. One performance indicator example is "average delay opening the aircraft doors for each arrival" which can be established for verifying how well the performance objective "timely arrival improvement" is being met.

3.3.7 In order to calculate this performance objective, one must gather data on estimated and actual door opening times for arriving aircraft. Using this data, one can determine the total delay (support metrics), which divided by the number of arrivals (support metrics) will enable this indicator to be calculated.

3.3.8 Demand forecasts have to be used as input for some performance goals. The capacity goal for an operational environment (ACC, APP, airspace volume, etc), for instance, will depend on the demand forecast. Such a forecast must generate the information required for getting a better understanding of the traffic characteristics.

3.3.9 This qualitative forecast is an important tool for ATM system planning. The demand forecasts that contain just the number of flights and the aircraft sizes, based on the number of seats, are not enough for, e.g., analyzing the impact of performance improvements due to onboard equipment installation. Analysis of future required performance can require information about aircraft "mix," percentage of the fleet with specific equipment onboard, among others.

3.3.10 The demand forecasts may have different time and scope horizons. These characteristics must be oriented by the requirements set by the performance goals. ACC capacity planning for the next year can, for instance, demand a more accurate, and more detailed, demand forecast than that required for developing a 20-year strategic planning. Depending on the time horizon and on the geographic region, the forecast methods may differ. A forecast for the next year for a single control unit usually applies purely statistical methods, whereas a forecast for a long term planning for an entire country will use a specific economic analysis and several scenarios.

3.3.11 The actual performance of the system must be checked at regular intervals, by means of operational data measurements and performance indicator calculations, aiming at:

a) Establishing the initial performance of the system (baseline);
b) Controlling progress on meeting the performance objectives, by means of a performance indicator – performance goals comparison.

3.3.12 The forecast of the ATM system future performance will be paramount in orienting the planning process for the improvements. The research and development initiatives must be organized aiming to enabling risk analysis for the following situations:

a) Keeping the current ATM system, with no modifications whatsoever. In this case, the ATM system would be subject to the alterations the service provider cannot control, such as: air traffic growth, fleet composition changes, etc.;
b) Implementing changes that do not yield the expected improvements in system performance. In this case, the performance goals are not met.

3.4 NATIONAL ATM EVOLUTION

3.4.1 AIRSPACE ORGANIZATION AND MANAGEMENT (AOM)

3.4.1.1 In a short and medium term, the Airspace Organization and Management will continue to be based in a fixed route structure, with the improvements brought by PBN implementation. In view of the necessity to guarantee the airspace structure efficiency, the airspace planners must apply correct techniques in the route network reorganization, as airspace modeling and ATC simulation, with the following objectives:

a) To validate the proposed airspace structure;
b) To evaluate the PBN implementation impact, including the SID and STAR RNAV and/or RNP procedures, RNP approximation procedure, and approximation and arrival procedures based in FMS.
c) To guarantee a favorable cost/benefit relation.
d) To optimize the airspace division, to make it transparent for the users and reasonable in terms of work load to the controllers.

3.4.1.2 In a long term, it must be evolved, gradually, to a random and/or flexible route system, in which the user will define the trajectory to be used. In a first phase the use of these random and/or flexible routes will be done between the end of the SID at the origin airport and the beginning of the STAR at the destination airport. In a second phase it will be possible to choose a random and/or flexible SID and STAR, depending on the terrain conditions around each aerodrome. In this case it will be necessary to use an adequate ATM automatization, from the air navigation service provider and from the airspace users, including the interaction between the ground and on-board systems.

3.4.1.3 The real time Airspace Management is an attribution of the Air Navigation Management Center (CGNA) and must guarantee adequate use of the airspace by all system users.

3.4.1.4 The best, balanced and equitable airspace use by the civilian and military users will be facilitated by the strategic coordination and dynamic interaction between them and the CGNA, allowing the establishment of the optimum flight trajectory, reducing the operational cost. In this way pre-defined Special Use Airspace will be kept to a minimum, even if activation is only temporary. The airspace reservations must be proportional to the intended use. The CGNA will coordinate the airspace use in a dynamic way, based in the needs presented by its diverse users.

3.4.2 DEMAND CAPACITY BALANCING (DCB)

3.4.2.1 In normal operational conditions, the ATM system must have sufficient capacity to meet the normal or seasonal air traffic demand, in its optimum flight profile, in order to guarantee the scheduled take-off and landing times. The air navigation infrastructure related to the ATM (CNS, MET, AIS, ATC Automation) and the associated human resources will be allocated, aiming at the optimum system operation.

3.4.2.2 Tools and processes to predict air traffic demand will be implemented in order to supply the information needed by the air navigation infrastructure and human resources planning.

3.4.2.3 In case of unexpected events that can cause degradation in the system capacity (for example: adverse meteorological conditions, inoperativeness in the air navigation system or in the airports and unexpected demand) the necessary actions of Capacity and Flow Management will be applied by the CGNA. These actions will allow a balance between capacity and demand, in order to prevent a system overload and providing the necessary conditions for the use of the maximum available capacity. The CGNA will be able to develop the necessary capacity and demand management actions, in tactical and strategic level, using the following process/tools:

a) Analysis of the flight intentions (Ex. HOTRANS) in a period of up to 6 months, aiming at:
    - Optimize the existing capacity, in order to meet each flight intention in its optimum profile, mainly time and route;
    - To develop a joint proposal of necessary changes in time and route;

- To provide the necessary indicators to the DECEA, ANAC and INFRAERO planning sectors, concerning the necessity of ATC and/or airport capacity.

b) Use of Slots ATC (Ground Delay Program) – To be used in case strategic planning is not implemented, allowing the definition of the take-off schedule, in order to prevent the saturation in the control sector and in the airport.

c) Use of alternative routes– It will give the necessary conditions to avoid restrictions in the aircraft take-off schedules, by proposing alternative routes, in case of unexpected events that could affect the ATC and/or airport capacities. The alternative routes must be listed in a specific catalogue, and must be submitted to a process of viability analysis, including the accelerated time simulation.

d) Flight Plans Initial Treatment – It will be the process to make the requested adjustments of en-routes and flight schedules, when necessary, through an efficient communication between aircrafts operator, ATS agencies and CGNA.

3.4.2.4 The Capacity and Flow Management improvement will provide the necessary conditions for a secure/safe, ordered and clear air traffic flow. The procedures associate to the Capacity and Flow Management will make the following items possible:

a) Secure/safe air operation, by keeping the ATM system demand inside its traffic capacity, maintaining an efficient aircraft flow.

b) To minimize the operational cost to the airspace users caused by capacity restrictions in the air traffic, and airport control systems.

c) Improvement in the system capacity, indicating to the ATC and airport infrastructure improvement.

3.4.2.5 To guarantee the correct use of the Capacity and Flow Management, the maximum capacity in the control sector and in the airports will be established through the optimizations of these capacities, such as:

a) Reduction in the runway occupation time, through fast exits implementation and applicable procedures to ATC and to the pilots.

b) Implementation of air traffic procedures that explore the maximum of the available airport infrastructure, such as: parallel approaches under VMC, implementation of dynamic sequencing tools for terminal area operations.

3.4.2.6 The Capacity and demand balance implementation will be based in a Collaborative Decision Making process (CDM), looking for synergy among CGNA, aircraft operators, ATS agencies and airport operators, aiming at capacity optimization, and to fulfill the air traffic demand. If it is not possible, the CDM must be applied for the equitable distribution of the necessary restrictions.

3.4.3 ATM AUTOMATIZATION

3.4.3.1 The implementation of the ATS surveillance system and the datalink application should consider the ATC automatization aspects, such as modifications in the existed ATC system, as well as the integration requirements, mainly with the States of the SAM region, in order to ensure adequate and dynamic interoperability between them.

3.4.3.2 The new ATS surveillance system application strategy and the datalink application should consider the associated ATM automatization tools such as: conflict prediction, conflict resolution warning, trajectory conformity control, functional integration between the ground system and the aircraft system, etc.

3.4.3.3 In the long term, the ATM automatization must consider the gradual system evolution, in order to satisfy the Global ATM Operational Concept components not satisfied in short and medium terms, such as Traffic Synchronization, ATM Service Delivery Management, Conflict Management and Airspace User Operations. These components will demand automatization levels directly related to the decision-making process, in all levels, with extremely complex security/safety requirements.

3.4.4 AERODROME OPERATIONS

3.4.4.1 The Capacity and Flow Management will depend on project efficiency and on airport management, mainly in the movement area, as the eventual increase in the air traffic demand will have to be absorbed by the airports.

3.4.4.2 The airport infrastructure planning must consider the use of simulation tools, aiming at guaranteeing the efficiency of the operations in the take-off and landing runway, as well as in the surface movement. The use of joint simulations for airport and airspace always has to be applied, as it is the most efficient way to obtain an adequate aircraft flow, based on integrated project and management.

3.4.5 PERFORMANCE-BASED AIR TRAFFIC MANAGEMENT

3.4.5.1 Performance-Based Air Traffic Management will be implemented gradually, in short term, establishing Key Performance Areas and objectives, indicators and performance goals to be used on new service and/or equipment implementations or replacements in the Brazilian airspace.

3.4.5.2 In order to implement the Performance-Based Air Traffic Management, the tools required for collecting and processing indicator data that will allow the evaluation of the performance goals and objectives must be specified and implemented.

3.4.5.3 The Implementation Program for this conception must establish performance goals and objectives for each project, in order to allow for their scoping, justification and efficacy control.

3.4.6 OTHER ELEMENTS OF THE ATM OPERATIONAL CONCEPT

The other elements of the ATM operational concept are based on expectations, due to the lack of implementation experience. To make its application possible, new procedures, process and capacities will be necessary, which are unavailable currently. In this way these components will be included in this Concept of Operations as soon as they are developed.

3.5 MAIN PROJECTS

3.5.1 Phase I – Present to 2010

a) Definition of the Objectives and the Goals for performance tools that will orient new service and/or tool implementations or replacements;

b) Publication of an Annual Document that contains the evaluation of the Objectives, the Goals and the Performance Indicators for the previous year, and sets the goals to be met the next year;

c) Definition and implementation of data collection tools and processes that support analyzing the performance indicators bound to objectives and performance goals;

d) Implementation of modeling and ATC simulation tools, to validate the new airspace structure;

e) Implementation of tools and process for air traffic demand forecast;

f) Implementation of tools for ATC and Airport capacity calculation;

g) Implementation of approach and departure sequence tools;

h) Implementation of air traffic procedures to explore the existing airport infrastructure;

i) Definition of the air navigation infrastructure and human resources necessary to the air traffic demand predict up to 2020;

j) Capacity consolidation for the strategic implementation of the ATFM actions, considering:

- Operation of the Management System of HOTRANS;
- Integration between the Airspace Presentation System and the Data Treatment

System;
- Integration between the Control Tower Management System (SGTC) and CGNA's Data Visualization and Treatment System (STVD);
- Flow Management Cells (FMC) automatization and integration into CGNA's Data Visualization and Treatment System (STVD).

l) Implementation of tools of ATC Slots calculation (Ground Delay Program);

m) Alternative route catalogue development;

n) Flight Plan Initial Treatment implementation.

3.5.2 Phase II – 2011 up to 2015

a) Implementation of tools and capacities for real-time airspace management, considering:
- System operation monitoring, via outage identification and control;
- Implementation of the military air operations coordination cell, aiming at easing the cohabitation of military and general air circulations;
- Integration of meteorological information into CGNA's Data Visualization and Treatment System (STVD), including the definition of how to collect the meteorological information that matters;
- Evaluating the impact of meteorological phenomena on air circulation;
- Automation of the information analysis processes.

b) Implementation of new ATM automatization tools: conflict prediction, conflict resolution and warning, trajectory conformity control, functional integration between the ground system and the aircraft system, etc.

3.5.3 Phase III – 2016 up to 2020

a) Evaluate the implementation of the other elements of the ATM operational concept;

b) Extend service offers to regional partners.

4. COMMUNICATIONS

4.1 GENERAL ASPECTS

4.1.1 The aeronautical communication has as main function the verbal, message and data communication interchange, between users or automated system, and to support Navigation (GNSS) and Surveillance (ADS) functions.

4.1.2 Basically, there are two aeronautical communication categories:

a) Operational communications – fixed and mobile; and
b) Technical and administrative.

4.1.3 The operational communications are composed by fixed network (ground-to-ground link) and mobile network (air-to-ground link). The fixed network is composed by the telephony network and the ground-ground telecommunications infrastructure (LAN, MAN, and WAN), which will compose the ATN – Aeronautical Telecommunications Network, where currently exist long distance networks (WAN) based in satellite system (TELESAT), covering all National territory, using the FDMA SCPC PAMA/DAMA access method, and will be evolved to a TDMA or CDMA digital technology and also to an IP digital network using MPLS technology, connecting the SISCEAB main operational centers.

4.1.4 The air-to-ground operational communication mobile network is composed by:

a) Telecommunication infrastructure in VHF; and
b) Telecommunication infrastructure in HF.

4.1.5 The telecommunication infrastructure in VHF is composed by a long-range VHF radio system with AM modulation, forming robust voice communication networks, necessary to en-route flight operation (ACC), to terminal areas (APP), and to aerodromes (TWR). These systems, with analogical technologies, have a series of interferences, will be gradually replaced by a communication digital system in VHF, as Data Link Digital (VDL 2), in the period of 2010-2015, and by new technologies being studied by the aeronautical community (system B VHF MC CDMA) in the period of 2015-2020, composing the new communication system between pilots and controllers – CPDLC.

4.1.6 The communication infrastructure in HF forms a national system, structured throughout the years, capable of supplying service in several locations within the Brazilian airspace. Currently, the system is not used to the airplane/ground communication due to other services availability, except in the oceanic airspace and the Amazon airspace.

4.1.7 The Aeronautical Fixed Telecommunication International Network infrastructure – AFTN is responsible for the meteorological operational messages flow, AIS, flight plan, and others. About AFTN is important to consider:

a) The Diffusion Command and Control station still work properly but the equipments and operational system reached the end of their life cycle. It is significant, considering the daily message traffic, including operational, management and service communications.

The projection presents an increase in the quantity and traffic volume, and it is necessary to supply AFTN service information in other places.

b) The current message system (CCAM) that uses the AFTN network as ATM "backbone", will be improved to a new operational message distribution system (ATS message Distribution System - AMHS), based in IP, and will have the ATN network as its telecommunication infrastructure.

4.1.8 The current communication system used by ATS agencies supports the long-distance communication for the Brazilian airspace operation. Its architecture is composed by several data and voice sub-systems, distributed in all SISCEAB, and their infrastructure are formed by satellite communication link, with FDMA access technology, microwave digital links with high traffic capacity (2Mbps – E1) and PABX digital telephone central.

4.1.9 There has recently been developed, as primary network, a digital network based in IP protocol, using MPLS technology, composed by multi-protocol equipment (digital interface) as routers, which supports synchronous and asynchronous data, ATN, IP and FR networks, supplying services of images, data, and analogical and digital voice.

4.1.10 The microwave link E1 (MAN) and the MPLS network (WAN) form a Integrated Network of Digital Communication, which supplies communication services of quality, to the main DECEA operational agencies, such as radar, diagnosis system and alarm.

4.1.11 A Telecommunications infrastructure is being implemented, called SISCEAB Communications Digital Network– RDCS. In this infrastructure all telecommunication subsystem, installed or/and in modernization and implementation phase, will be included, such as:

a) Transition of the E1 Digital Link to a communication system based in WiMAX (norm IEEE – 802.16 d) technology, aiming at the SISCEAB metropolitan network(MANs) modernization;
b) Implementation of an integrated management system of SISCEAB communication network;
c) MPLS network enlargement and modernization;
d) Implementation of the Aeronautical Telecommunication Network - National ATM;
e) Technical and administrative communication network– INTRAER/DECEA;
f) Interconnection with the region SAM satellite network – REDDIG;
g) TELESAT system modernization.

4.1.12 A VSAT satellite communication network type constitutes the TELESAT system. Its main control node is located in Rio de Janeiro. The network is a star configuration, with FDMA (Frequency Division Multiple Access), (PAMA - Permanent Assignment Multiple Access) and (DAMA - Demand Assignment Multiple Access) types technology of access to the transmission environment, and 60% of its capacity is in “open channel” and 40% are available “on demand”. The open channels are used to support the ATS service. The TELESAT covers all national territory, and it is in cost/benefit analyze phase for all TELESAT system, in order to define its utilization as one of the RDCS network segment.

4.2 SYSTEM CAPACITY

4.2.1 For the Communication infrastructure, the objective is the increase in the aeronautical communications system coverage, accessibility, capacity, integrity, security/safety and performance. In most cases, the communication will be done through data interchange, while the voice communication will be used in non routine operations or emergency. The emphasis will be in the connectivity and global operation.

4.2.2 In order to optimize the airspace operation, the transition from a voice communication primary system to a system based on data interchange must be done. The communication infrastructure must evolve to support the data transference in real time, during all flights phases.

4.2.3 SCENARIO DESCRIPTION

4.2.3.1 In the Oceanic airspace:

a) The CPDLC application, with the ADS-C and RNP-4, in the oceanic airspace, will be the basic tool that will give the necessary condition for the 30 NM minimum horizontal separation application, mainly in the EUR/SAM corridor. Even in other oceanic airspace with lower air transit density, the CPDLC will provide a reliable communication, and will reduce the pilots and controllers work load, increasing the operational security/safety. In these areas, the CPDLC will be supported by on-board system as Boeing FANS 1 and Airbus FANS A, using the INMARSAT satellite segment (L Band).

b) In the future, the use of the HFDL and on-board system based in ATN/IP must be analyzed. Also, the voice system based in high frequency system (HF) will continue to be used. In a first phase, this system will be used in aircraft that do not support communication based in datalink. In a second phase, the HF system will be used in non routine operations or emergency. However, as the HF system has an inferior audio quality and is subject to frequency congestion, some or all of these communications could be transferred to the AMSS - aeronautical mobile satellite service system, current or future, in L Band, if the cost/benefit analysis presents their acceptability.

4.2.3.2 IN THE CONTINENTAL AIRSPACE:

a) The ADS-B services will be supported by extended pulse communication infrastructure of SSR Mode S or of VDL 2. For implementation in isolated homogeneous areas, as Bacia de Campos “offshore” operations, the “Universal Access Transceiver’ (UAT) may be applied, if the cost/benefit analysis is favorable. Also, the utilization of the AMSS (L Band) as a system VHF secondary network and for low altitude coverage is being studied.

b) The CPDLC application in the continent, to replace the voice communication, will result in an increase in the operational security/safety, and in a decrease in the controllers and pilots work load. However, the CPDLC application in airspace with high density air traffic will be done with the simultaneous use of verbal communications in VHF, mainly in the TMA, due to the velocity requirements in the ATC interventions. When the CPDLC is used in a continental airspace with high density air traffic, the datalink technology to be used must guarantee pilots and ATC message latency and the send/receive acknowledgement. The datalink communication service will be done in accordance with the ARINC 623 standard and will be introduced using initially the ACARS protocol, and could change to IP in the future. In areas of low/medium density air traffic, for messages where timing is not important, the CPDLC service introduction will be done through ATN/VDL Mode 2 service.

c) The voice communication will continue to be supported through the 25 kHz DSB-AM system. In areas with VHF band congestion, or by demand of the economical or operational requirements, this service also could be supported by 8.33 kHz DSB-AM system.

d) The implementation of Datalink Communication among ATC Agencies will improve the operational security/safety and will reduce the coordination errors between the ATC Agencies. The communication between ATC Agencies must predict the Message Handling Services capacity, through the AMHS, with automatic exchange of operational information through a traffic transference system, making possible the coordination of messages between adjacent sectors controllers.

4.3 EVOLUTIVE TRAJECTORY

4.3.1 A critical element in the evolutive trajectory, mainly in high density areas, is the specter availability. The studies to minimize this problem, mainly in Europe and in the USA, choose the 8.33 kHz system, with VDL technology and B-VHF MC CDMA technology.

4.3.2 All systems and sub-systems (AMSS, VDL, SSR Mode S and HF datalink, and others) are Aeronautical Telecommunications Network (ATN) segments, and will be integrated through ATN/IP router. As a consequence of the technological advance, a new communication system could be developed in the next years. The adequacy of the current and future communication system, considering the scenario to support the ATM emergent requirement and RCP levels, must be estimated in quantitative terms as function of the operational environment.

4.4 MAIN PROJECTS

4.4.1 PHASE I – TODAY UP TO 2010

a) Air Traffic Services (ATS) Message Handling Services implementation - AMHS;

b) VDL Mode 2 full implementation;

c) Development, implementation and integration of a telecommunication infrastructure (RDCS) to support all SISCEAB, with an open architecture, in order to absorb all current and future services necessary to the CNS/ATM transition program;

d) Technical/operational requirements studies and documentation, to the CAR/SAM regions, allowing the ATM automation between all ATC agencies.

4.4.2 PHASE II - 2011 UP TO 2015

a) Planning of VHF AM gradual deactivation, due to the VDL system implementation, considering the required backup infrastructure;

b) New technologies development to the CPDLC System;

c) ATM Automatization implementation to the CAR/SAM region;

d) National ATN Implementation (SISCEAB);

e) Communication Digital Infrastructure implementation, based in IP, totally integrated, for the SISCEAB and region SAM;

f) Viability analysis for satellite bidirectional data link application (L Band) to support ADS-B and data transfer requirements.

4.4.3 PHASE III – 2016 UP TO 2020

a) Start of the gradual VHF AM deactivation, due to VDL systems implementation, considering the required backup infrastructure;

b) SISCEAB Communication Digital Network – RDCS, implemented and integrated completely, through REDDIG and MEVA II network, as base to ATM Integration and Automation in the Region;

c) Intensification of the studies for a new CPDLC communication system, based on B-VHF MC CDMA, and possibly based on IP.

5. NAVIGATION

5.1 GENERAL ASPECTS

5.1.1 PERFORMANCE-BASED NAVIGATION

5.1.1.1 Performance-Based Navigation specifies the RNAV system performance requirements to aircrafts that operate in ATS route, in an instrument approach procedure or in the airspace.

5.1.1.2 The performance requirements are defined in terms of accuracy, integrity, continuity, availability and necessary functionalities for the operation proposed by an airspace concept. The performance requirements are identified in the navigation specifications, which identify the equipments and sensors that could be used to satisfy such requirements.

5.1.1.3 There is RNP specification and RNAV specification. The RNP specification has the monitoring and alert performance on-board of the aircraft, and it is assigned as RNP "X", where X is the accuracy value associated with the navigation performance. The RNAV specification does not have monitoring and alert performance on-board of the aircraft, and in the same way, it is assigned as RNAV "X".

5.1.1.4 The navigation based in performance depends on:

a) The RNAV system installation on-board the aircraft, which is being approved to meet the functional and navigation performance requirements, specified to RNAV and/or RNP operations in a specific airspace;

b) The fulfillment, by the flight crew, of the operational requirements established by the RNAV operation regulating entity;

c) One explicit concept of airspace, which includes RNAV and/or RNP operations; and

d) The availability of one infrastructure that promotes adequate air navigation.

5.1.2 GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)

5.1.2.1 The main way to meet the performance requirements recommended by PBN is the satellite navigation. In order to understand the Satellite Navigation components, is important to review the relation between the GNSS, the Satellite Based Augmentation System (SBAS), the Ground Based Augmentation System (GBAS) and Aircraft Based Augmentation System (ABAS). The base for navigation, positioning, and global synchronism is supplied by 3 GNSS satellite constellations:

a) The Global Positioning System (GPS –United States);

b) The Galileo (Europe, to be operational in 2012); and

c) The GLONASS (Russia).

5.1.2.2 The satellites use medium Earth orbit, with inclination of 50 to 65 degrees in reference to the equatorial plane. The quantity of satellites in each orbit is calculated based in the altitude, in order to cover all Earth surface. The constellations supply the user with navigation capacity, with global covering, including capacity for non-precision approach. There are four augmentation systems to minimize limitations of accuracy, integrity, availability and service continuity: SBAS, GBAS, GRAS and ABAS. With them, the GNSS is able meet the civil aviation requirements.

5.1.2.3 Satellite Based Augmentation System (SBAS)

a) The SBAS can be used for increasing the system availability and integrity, for route navigation, Terminal Management Area (TMA), non-precision approach and approach with vertical guidance (APV) based in baroaltimeter (Barometric Vertical Navigation - Baro-VNAV). The SBAS is an essential requirement for the APV I and II procedures that will probably give operational minima (ceiling and visibility) lower than the Baro-VNAV.

b) A SBAS system covers a large area as navigation support. Although one satellite has hemispheric cover, additional satellites are needed in order to guarantee redundancy. The SBAS can give integrity to the GPS, Galileo and GLONASS constellations, and can increase the system accuracy, integrity, availability and continuity. The systems can also be used to give position and time information to be used by the ADS-B/C – (Automatic Dependent Surveillance).

c) Some SBAS projects under development in the different regions of the world are:

- WAAS – Wide Area Augmentation System – USA.
- EGNOS – European Geostationary Navigation Overlay Service - under development by the European industry (Alcatel and Thales), orientated by the

European Space Agency, the European Commission and EUROCONTROL.

- MSAS – MTSAT Satellite-based Augmentation System - Japan
- GAGAN – GPS Aided Geo Augmented Navigation System - India

d) The SBAS is formed by equipments and software, and is used to improve the Standard Positioning Service (SPS) of the US Global Positioning System (GPS). The system may also support additional systems, such as Galileo and GLONASS. The SBAS improves the GPS performance for continuous coverage in all flight phases. SBAS improves the GNSS performance in the following aspects:

- Improves the availability and reliability, as it uses the GEO satellite in addition to the GPS constellation as synchronism source, and is always on sight in its coverage area;
- Improves the accuracy, using GPS Differential correction techniques;
- Improves the security/safety, using integrity monitor.

e) The SBAS gives a Signal-in-Space (SIS) to the certified aircraft avionics, in any phases of flight. The GNSS satellite data are received and processed in the SBAS Reference Station (SRSs), which are strategically placed in order to provide adequate coverage to the required service volume. These data are sent to the SBAS Master Stations (SMSs) that process data that comes from multiple SRSs, in order to determine the integrity, the differential correction and the residual errors for each monitored satellite according to the ionospheric grid point (5º latitude and 5º longitude) where the user is.

f) Multiple SMSs can be used to eliminate specific failures in a SBAS network. The information that came from the SMSs is sent to each Ground Uplink Subsystem (GUS), and transmitted together with the GEO navigation message to the GEO satellites. The GEO satellites transmit these data to the Users by GNSS frequency, using GNSS modulation. Each SBAS ground station/subsystem is connected through a Ground Communications Network (TCN).

g) Figure 4, below, presents the FAA`s Wide Area Augmentation System – WAAS. This is currently the only operational SBAS in the world.

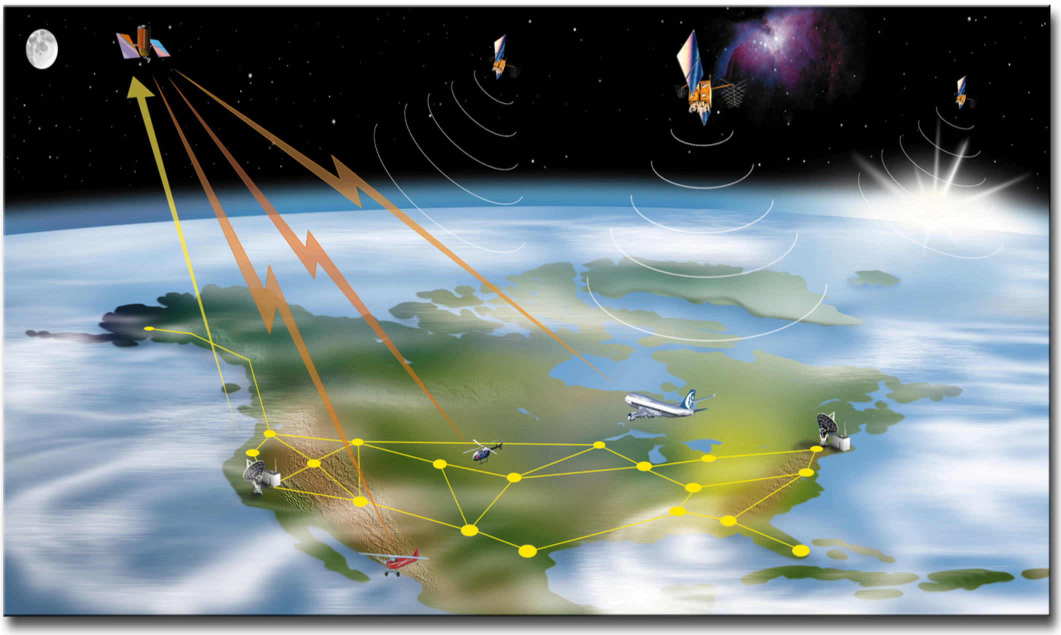

Figure 4 FAA's WAAS Configuration

h) Although the SBAS technology is available to be used now, it will not be used in Brazil in short and medium term based in the following reasons:

- The ionospheric interference will adversely affect the reliability of the GNSS signal, in practically all areas of Brazilian airspace, resulting in an unfavorable cost/benefit relation.
- About 85% of the Brazilian air operations happen with commercial aircraft in airports with an adequate air navigation infrastructure.
- The implementation of a second civil frequency in the GPS, and the start of GALILEO operations, may improve the GNSS integrity and availability enough to make the SBAS implementation unnecessary.

5.1.2.4 Ground Based Augmentation System (GBAS)

a) The GBAS is used for all categories of precision approach, landing, guided take-off, missed approach and surface operations, within the GBAS coverage (approximately 20 nautical miles for approaching service). The GBAS will provide the necessary conditions to RNP value inferior to 0.3 in TMA operation, allowing the reduction in the minimum separation between aircrafts, and between aircrafts and obstacles. Also, the GBAS can provide:

- Operational redundancy: the GBAS availability, for CAT I precision approach, is larger than SBAS';

- CAT I service in mountainous terrain;
- CAT II/III for multiple runways with only one GBAS installation;
- Positioning information with high precision, which allows navigation in low visibility surface.

b) Initially, the GBAS system will be certified to Category I operations, so it will be implemented at airports of higher air traffic level, where the ILS substitution will bring more benefits for the system operation and maintenance. GBAS has excellent cost-benefit in airports with more than one runway and in places with adjacent airports in a 20NM radius, since it can replace several ILS. The GBAS is projected to give precision approach and landing capacity CAT I/II/III. The GBAS will give local coverage of approximately 20 NM, if IFR approaches are considered, and it could support multiple operations in this size of airspace. The GBAS consists of 3 primary subsystems, as present in Figure 5:

- The satellite subsystem, which provides reach signal and orbital parameter, for the GPS use.
- The GBAS ground subsystem, which provides VHF Data Broadcast, including Differential Corrections and integrity parameters. Also, the ground station gives the information status to the Air traffic Control (ATC) and for the maintenance technicians.
- The airborne subsystem receives and decodes the correction, integrity and the VDB ascendant link data. It uses the correction data with the satellite range signal to estimate, with high integrity and accuracy, the position, velocity and time.

c) Coverage: Each GBAS approach has a coverage volume, which is inspected in flight and authorized for use. For aircraft adequately equipped, this volume goes approximately from 20 NM of the runway approach extremity to 4 NM beyond the runway approach extremity. Each ground GBAS has a coverage volume of VHF Data Broadcast, which is extended from the surface visual line up to 10,000 feet above ground level (AGL), with a radial distance of 23 NM from the VDB antenna. Within the coverage volume, the GBAS gives terminal, approach and landing capacities for multiple runway extremities. The reach of the protected VDB reception– 60 NM – is defined as the airspace volume where the VDB signal has spectrum protection, integrity and can be received, decoded and used by an on-board user. In many cases, for an on-board user, it is probable that the VDB reception extends until the reach of the visual radio (100 to 200 NM).

d) Operation in adjacent airports: the GBAS capacity may provide service in adjacent airports, within the station service volume and will depend on several factors, such as: signal power, terrain conditions, distance between airports, and others. It is desirable that all airports inside a GBAS service volume could be provided with the same service level, in order to prevent the implementation of two stations.

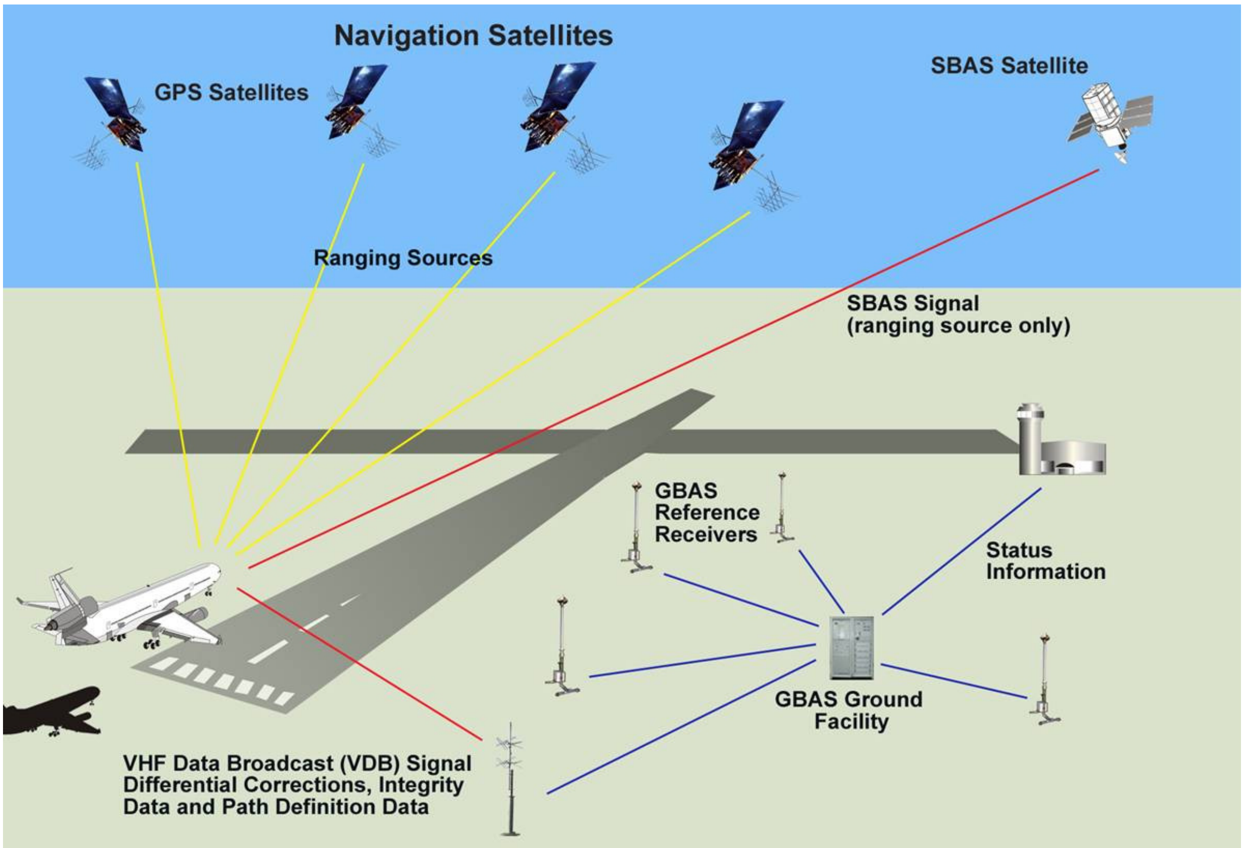

Figure 5 Ground-Based Augmentation System (GBAS)

5.1.2.5 Ground-based Regional Augmentation System (GRAS)

a) GRAS is being developed by Australia. This system will use a grid of reference stations and correction messages with national range, using VHF. This system works like a GBAS, but its reference stations are far apart, in order to cover a large area (all of Australia). Due to this, precision is lower and it can provide, at best, APV approaches.

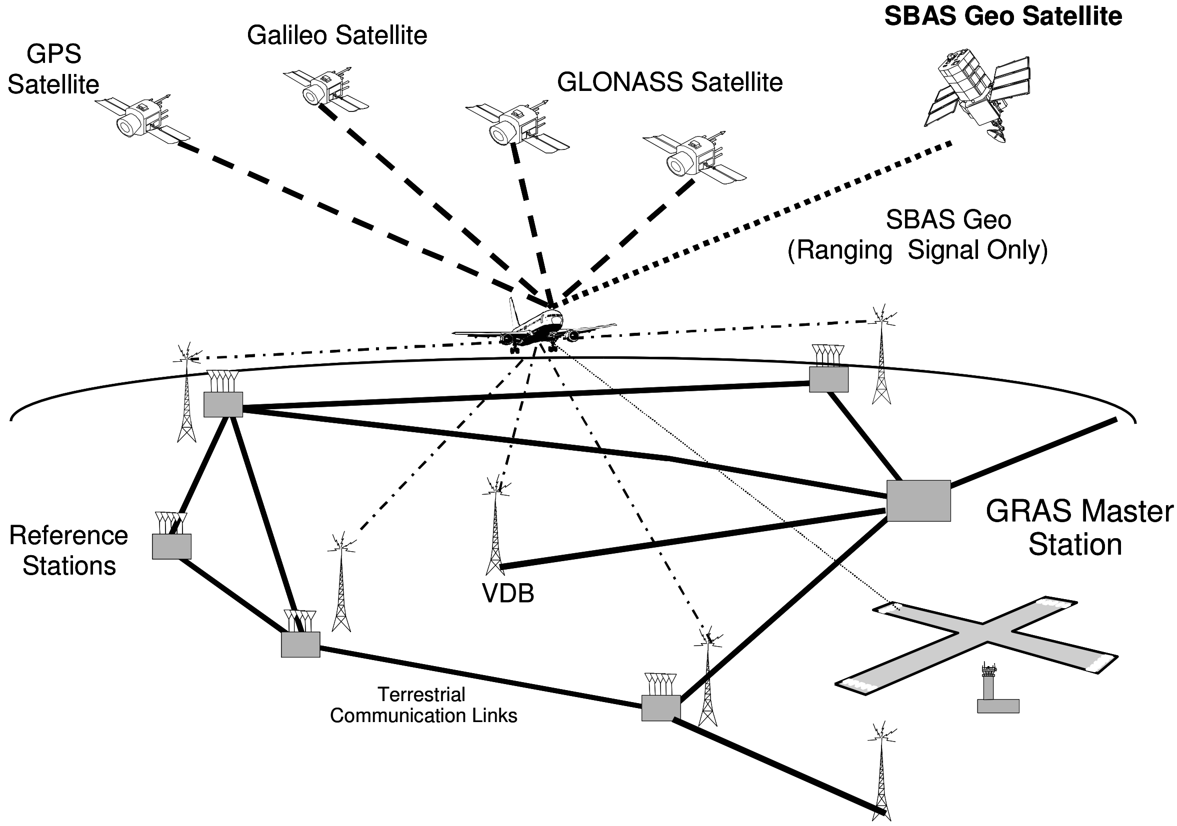

Figure 6 Ground-based Regional Augmentation System (GRAS)

5.1.2.6 Aircraft Based Augmentation Systems (ABAS)

a) It is the system that allows the increment in the GNSS integrity function, based in information from the Satellite system and/or other available sources in the aircraft navigation system.

b) The ABAS consist basically of an algorithm in the receiver (RAIM), which considers that 4 satellites are required to obtain position and synchronism and with the presence of 5 or more satellites in line, it periodically verifies the position, calculating it with different sets of 4 satellites and verifies if the calculated positions are inside an adequate tolerance in order to keep the required navigation performance.

c) Additionally, it can have other algorithm that compare the position calculated by GNSS with other systems, such as IRS, DME, Altimeter, indicating a system integrity fault if discrepancies are found between the systems.

d) The existence of RAIM algorithm is demanded for the GNSS use in air navigation procedures. This algorithm is very effective; provided no more than one satellite fails and the information about satellite availability are conveniently informed to the system. It has an impact in the navigation service availability and continuity, considering the necessity of 5 or more satellites for its functioning.

e) The Aircraft Based Augmentation Systems – ABAS (RAIM) is widely used in Brazil to authorize the execution of GNSS procedures, to ensure its performance since en-route operations, STAR and non-precision approaches, as a secondary navigation means. The use of this kind of "augmentation" as a basic means of navigation depends on the implementation of instruments of GNSS performance control (GPMS) and institutional arrangements.

5.1.2.7 IONOSPHERE

a) The GNSS signals are subject to several sources of interference in their path to the receiver. One of the most important ones, and difficult to correct, is the ionosphere.

b) The ionospehere is a layer in the upper atmosphere between 50 km and 1200 km above the Earth's surface. It is ionized by the ultraviolet rays and other solar radiation. It affects the radio signal propagation in several ways, depending on the frequency.

c) The main cause of the great variation in the GNSS signals are the iono delays, related to the 11-year solar cycle and to seasonal changes. The delays increase with the solar activity, and are bigger at noon (local time) than at night; they tend to be bigger during equinox. There are big fluctuations near the magnetic Equator and low latitude regions. These fluctuations are random and affect the GNSS information. The ionosphere over the tropical area is irregular and difficult to model. The decision to use any GNSS must consider:

- Need to mitigate the ionosphere effects;
- Adequacy of existing software (ex: SBAS and GBAS);
- User intent to install the required equipments on board;
- Possibility to use other means to support the operational requirements;
- Accurate cost-benefit analysis.

5.1.2.8 Ground Based Components

a) VOR – VHF Omnidirectional Radio Range – This system provides the basic orientation to the en-route navigation, terminal and non-precision approach. The information supplied by the VOR for the aircrafts is the aircraft magnetic azimuth relative to the VOR ground station.

b) DME – Distance Measuring Equipment – Radiotelemetric Equipment – The DME operation is executed by sending and receiving pulse pairs – two pulses of fixed duration and separation, using a decoder. The transponder must reply all interrogation, and the time difference between interrogation and reply is measured by the interrogator's timing circuitry and translated into a distance measurement.

c) ILS – Instrument Landing System – It is a precision approach ground based system, which provides precise guidance to an aircraft approaching. It gives to the pilot indications of distance for optimum point of landing. It provides lateral and vertical guidance, as well as other navigational parameters required by an approach or landing. Nowadays the ILS is one of the main precision landing systems approved by the ICAO, and although it is adequate, it has limitations related to location, frequency allocation, cost, and performance.

d) NDB – Non-Directional Radio Beacon – Aeronautical Radio Beacon is a radio broadcast station non-directional, working in low and medium frequency to transmit ground wave signal to aircraft receiver. The non-directional radio beacon for air navigation are used to complement the VOR-DME during the transition of en-route phase to the airport approach, or as an assistant to the non-precision approach in many airports.

5.2 SYSTEM CAPACITY

5.2.1 The Brazilian airspace navigation system capacity must provide conditions to an adequate navigation, considering the meteorological conditions in each region, as well as the air traffic density, including operations en-route, in TMA, approach and landing. The integrity, accuracy, and performance must be improved, using the Performance Based Navigation (PBN), mainly through the Global Navigation Satellite System (GNSS).

5.2.2 THE PBN MAIN BENEFITS ARE:

a) Increase in the airspace security/safety, through the continuous and stabilized descending procedures implementation, with vertical guidance, significantly reducing events of Controlled flight into terrain (CFIT);

b) Reduction in the aircrafts flight time, through the implementation of optimum flight trajectory, independent of the ground air navigation, reducing the fuel consumption and, consequently, reducing the emissions to the environment;

c) Utilization of the RNAV and/or RNP capacity already installed in a lot of aircraft fleet that flight within Brazilian airspace;

d) Trajectory optimization, in any meteorological condition, making possible to prevent critical conditions of terrain and environment, such as aircraft noise, through the use of RNAV and/or RNP trajectories;

e) Implementation of more precise trajectory, approach, take-off, and landing, reducing the dispersion and giving more predicable traffic flow;

f) Delay reduction in airspace and airports with high density air traffic, with the increase in the ATC capacity, due to the implementation of parallel routes, new points in the TMA and approach procedures with lower operational minimum;

g) Potential reduction in the parallel routes separation in order to accommodate more air traffic in the same flow;

h) Work load reduction for the air traffic controller and pilot. The use of RNAV and/or RNP trajectory will reduce the necessity of radar vectors, and consequently, the time used in the pilot/controller communications.

5.2.3 SCENARIO DESCRIPTION

5.2.3.1 Oceanic Airspace

The oceanic airspace has low-density air traffic; therefore no expressive modifications in its structure are expected in the short term (up to 2010). In medium term, the RNP 4 should be applied in the EUR/SAM corridor, and with the use of ADS/CPDLC, it will give the necessary conditions for the 30 NM lateral and longitudinal separation. The RNP 4 application will depend on the aircraft fleet evolvement that uses this airspace, due to the necessity of datalink communication implementation, in order to make the separation reduction feasible.

5.2.3.2 Continental Airspace – En-route operations

a) The air traffic demand in the Brazilian airspace is relatively low, if compared with the American and European airspaces, so the RNAV-5 in the superior airspace will be enough to meet in the short-term, the needs of airspace restructuring, in order to meet the user and air navigation service provider needs. It is important to say that the RNAV-5 is the most simple navigation specification available for immediate application that will appear in the Performance Based Navigation Manual (Doc. 9613), and it will allow the inclusion of a larger number of users in a exclusive use airspace, since it allows the use of all types of air navigation.

b) In medium term, the RNP-2 could be used, with the expansion of the GNSS application, if the airspace users are adequately equipped. The use of RNP-2 will ease the deactivation of the ground air navigation support, since the navigation specification will depend on the GNSS utilization. However, the establishment of a backup system for the GNSS will be necessary, as so the development of contingency procedures in case of failure of this system. The RNP-2 is narrowly related to the ADS-B implementation, since this surveillance technique needs the GNSS information for the positioning information precision. The RNP-2 application will make necessary an improvement in the information system concerning the GNSS operation, which could be obtained from the GNSS Monitoring System (GPMS).

c) It is important to emphasize the importance of the RNAV and/or RNP criteria harmonization in the CAR/SAM regions, in order to prevent the necessity of multiple approvals for the intra and inter regional operations.

5.2.3.3 Continental Airspace – Terminal Control Area (TMA)

a) The TMA operations have its own characteristics, due to the separation minimum applicable between aircrafts and between aircrafts and obstacles. Moreover, the operation of aircrafts with distinct performance, including flights in the inferior airspace and use the same take-off and landing runways represents an additional complexity to the air navigation services.

b) The TMA operation efficiency depends on the airports management and efficient design, aiming at the maximum utilization of the airport capacity, as so its adequate evolution, because the increase in the air traffic demand must be absorbed by the airport infrastructure.

c) In short term, the RNAV-1 will be applied to the TMA with ATS surveillance service. The navigation infrastructure must be adequate in order to allow the use of DME/DME and DME/DME/INS operations, aiming at supporting the user without GNSS, and to provide backup infrastructure to the GNSS. At this phase operations of aircrafts equipped and non-equipped RNAV-1 will be admitted, provided an adequate number of aircrafts are equipped, and ATC simulations ensure its feasibility, considering an eventual increase in the workload of the air traffic controllers. In medium term, the RNAV 1 approval will be compulsory to the TMA operation with larger complexity and air traffic demand (exclusive airspace).

d) In TMA without radar surveillance service and/or without adequate air navigation infrastructure, the RNP-1 could be used, with exclusive use of GNSS, provided there is an adequate number of aircrafts approved and ATC simulations ensure its feasibility.

e) In what concerns to approach, RNP APCH non-precision approach procedures must be implanted in all airports with IFR regulation. In short term, conventional approach procedures must be kept for non-equipped aircrafts.

f) One of the main causes of controlled flight into terrain (CFIT) events is the approach procedure where several descending and leveling phases are applied. The stabilized approach operations are essential to prevent this kind of accident.

g) Procedures of approach with vertical guidance (APV), based in Baro-VNAV will be applied, for a more efficient trajectory until the runway head, allowing an uninterrupted flight trajectory since the descent until the aircraft touchdown. The 3-D navigation will be essential and approach procedures APV Baro-VNAV must be implanted, in short term, in all airports with IFR, with priority for airports without ILS procedures.

h) The RNP APCH AR approach procedures will be implemented where big operational benefits are attainable, at airports with significant obstacle environment.

i) In medium term the ILS navigation services could be replaced by GBAS system, which provide the demanded accuracy, availability, integrity and continuity by all precision approach categories. GBAS equipments could be installed in some airports, where operational benefits can be reached.

j) The GBAS system and the precision approach procedures, in ground and on-board, will improve the en-route and TMA (SID and STAR) operation, including curve approach trajectory. Also, the GBAS will improve the reliability of the information supplied to the ADS-B. The transition between arriving and approach will be improved by the GLS procedures. In some airports, the ILS system will be kept as a GNSS/GBAS backup.

5.3 MAIN PROJECTS

5.3.1 PHASE I – TODAY UP TO 2010

a) Implementation of GBAS CAT I stations in airports with enough operational demand;

b) RNAV-5 implementation to en-route operation;

c) SID/STAR RNAV-1 implementation in Brasília, Recife and São Paulo;

d) RNP APCH and APVBaro/VNAV approach procedures implementation in IFR airports;

e) RNP AR approach procedures implementation, where operational benefits could be gain;

f) Automatic tool implementation for air navigation procedures elaboration, aiming at new procedures demand, such as RNAV e RNP;

g) GNSS backup infrastructure implementation;

h) DME infrastructure change to comply with ICAO requirements for RNAV

(DME/DME) in selected terminals.

5.3.2 PHASE II – 2011 UP TO 2015

a) GBAS CAT II implementation in selected airports;

b) Air navigation ground support deactivation process start-up, keeping only the backup infrastructure;

c) RNP 2 implementation to en-route operations;

d) SID/STAR RNAV-1 implementation in the others Brazilian TMA;

e) GLS approach procedures implementation in the main Brazilian airport.

5.3.3 PHASE III – 2016 UP TO 2020

a) Continue the air navigation ground support deactivation process, keeping the backup infrastructure, if necessary;

b) Operation with own satellite or existed satellite leasing viability analysis, considering provide GNSS service to other state (ex. GPMS), which could allow operation independent of WAAS and/or EGNOS;

c) GBAS Cat III implementation in selected airports;

d) CAT I approaches implementation in the other Brazilian airports;

e) Make the Brazilian navigation architecture available to South American Region, in order to develop a regional capacity.

6. SURVEILLANCE

6.1 <u>GENERAL ASPECTS</u>

6.1.1 ATS SURVEILLANCE SERVICE

6.1.1.1 The ATS Surveillance Service will be provided using ADS-B services, primary radar, secondary radar, Multilateration, or any other similar ground based system that allows the aircraft identification. The ATS Surveillance Service can be subdivided in:

a) Independent Surveillance:

- Primary Surveillance Radar (PSR);
- Secondary Surveillance Radar (SSR);
- Multilateration.

b) Dependent Surveillance:
   - ADS-B.

6.1.1.2 Primary Surveillance Radar

The Primary Surveillance Radar is an independent surveillance system that provides information on direction and distance of any object in movement, within its coverage area. The primary radar is an important tool for national security, also to the surveillance of Approach Control in high aircraft flow.

6.1.1.3 Secondary Surveillance Radar

a) The secondary radar provides data to the air traffic control, using the on board transponder interrogation, at the frequency of 1030 MHz from ground to air, and 1090 MHz from air to ground. Currently there are three kinds of secondary radar:
   - SSR – basic secondary radar;
   - MSSR - monopulse secondary surveillance radar; and
   - SSR Mode S – secondary radar with selective interrogations.

b) The SSR and MSSR provide information of aircrafts identification (Mode A), and of altitude (Mode C) to the ATC. The Mode-S radar uses mono-pulse antenna with selective interrogation. The SSR Mode S is the latest ground based surveillance system. In addition to Mode A/C surveillance capacity, the Mode S supports datalink transactions and is defined as a sub-net subordinate to ATN. The Mode-S also uses extended information fields, periodically generated, in order to support automatic dependent surveillance (ADS-B), and to improve the airborne collision avoidance system performance. The periodically generated extended information fields are formed by a group of messages that provides information of position, velocity, and aircraft identification.

6.1.1.4 Multilateration

a) Multilateration is a kind of independent cooperative surveillance that uses the signals transmitted by an airplane to calculate its own position. As the Multilateration system can use the airplane existing transmissions, the WAM system can be used without modification in the on board equipments. To process the ground signals, appropriate receiver station and one central processing station are required.

b) A Multilateration system consists of several antennas that receive a signal from one aircraft, and one central processing station that calculates the aircraft position based on the time difference of arrival (TDOA) of the signal to these antennas.

c) Multilateration techniques have been successfully used in the airport surveillance. Usage of these techniques is increasing, through its application in bigger areas such as terminal management area (TMA). These systems are called Wide Area Multilateration (WAM).

6.1.1.5 ADS-B

a) The ADS-B should provide surveillance service with superior capacity, if compared with the ATS surveillance system based in radar, due to the improvement in the information update rate, which could be up to 2 times per second.
b) Due to its low cost, if compared with the radar equipments, the ADS-B could improve the ATS surveillance capacity in the national airspace, mainly in remote areas, where radar equipments do not have a good cost/benefit relation.
c) The aeronautical community is investigating the ADS-B use for the air-air surveillance (ADS-B In), to provide traffic information to the pilots in the cabin, in order to identify the aircrafts equipped with ADS-B position, increasing their situational awareness. In the future, with this information, the pilot will be able to provide his own separation, in specific situations.

6.1.2 ADS-C

6.1.2.1 The Automatic Dependent Surveillance based in Contract (ADS-C) will allow the intercontinental flights in the oceanic airspace. When installed in the aircraft and in the ground, these capacities and procedures will improve the aeronautical security/safety and efficiency, and will reduce the aircrafts minimum separation.

6.1.2.2 The ADS-C transmits aircraft position, identity and other information to ground systems.

6.1.2.3 All ADS-C communications are point-to-point and are always exchanged between two terminal systems, for example: aircraft and ground function.

6.1.2.4 The ADS-C has a bi-directional communication flow between the aircraft and the ground functions. The communication link can use geostationary satellite resources.

6.1.2.5 One “contract” is used by the ground system to control the position information rates and the transmission conditions. This “contract” begins in the ground function and must be an agreement between the ground equipment and the aircraft. It allows the data transmission requirements to be specified by the ground function (data and rate to be sent to ground). One aircraft can have several different contracts with different ground function at the same time.

6.1.2.6 By using a point-to-point datalink, each ADS-C message reception is reliable, unless there is a datalink communication total loss, in which case the sender will be notified. The system reliability is ensured by the data distribution to whom it may concern or by the communication failure information.

6.1.3 REQUIRED SURVEILLANCE PERFORMANCE (RSP)

6.1.3.1 The ICAO is developing a plan aiming at defining the Surveillance, Navigation, Communication and Air Traffic Management performance requirements, in order to ensure that the system is configured to provide the optimum functional level. The most efficient systems are hybrids, with different technologies (ex: ADS/Multilateration).

6.1.3.2 The ICAO surveillance system requirements are:

a) The surveillance systems must provide aircraft position information up to date to ensure the adequate separation;
b) For low density continental airspace, used for en-route operations, including remote areas, a 12 seconds update rate is adequate;
c) In high density en-route/terminal environment, a 4 seconds update rate is more appropriate;
d) The surveillance system accuracy must support the minimum separation to the defined airspace;
e) The surveillance system must allow the ATM to provides to the user one en-route flight trajectory choice and to accommodate emergency procedures; and
f) The surveillance system must support search and rescue operations.

6.1.3.3 The ADS implementation needs:

a) Position data provided by the on-board navigation equipment;
b) Message timing information in the period of 1 second;
c) Air-ground datalink; and
d) Ground infrastructure providing information to the ATC.

6.1.3.4 The RSP will consider aspects such as capacity, availability, accuracy and update rate. An eventual RSP establishment will allow the future planners to evaluate the development of different operational scenarios and the surveillance system configuration efficacy.

6.2 SYSTEM CAPACITY

6.2.1 The surveillance system used within Brazilian airspace must be improved and extended to oceanic and remote areas, supporting the necessary coverage in high air traffic density area, looking for the most favorable cost/benefit relation to the airspace users and to the air navigation service provider. The surveillance must gradually evolve to allow an improvement in the crew situational awareness specifically where the CPDLC will be applied. The improvement in the surveillance will focus the Automatic Dependent Surveillance (ADS) implementation, through ground-air and air-air datalink, combined with an accurate and reliable aircraft navigation system.

6.2.2 SCENARIO DESCRIPTION

6.2.2.1 Oceanic airspace

a) In the Oceanic airspace, the ADS-C will be the adequate tool for the improved surveillance system implementation, which will replace the position report via HF. The ADS-C use, combined with the CPDLC and RNP-4, will provide the necessary conditions to the 30 NM minimum horizontal separation implementation, mainly in the EUR/SAM Corridor, allowing more users to use their preferred flight levels.

b) The ADS-C will be supported by the on-board FANS 1 (Boeing) and FANS A (Airbus), using satellite. In the future the use of HFDL and on-board ATN based systems must be evaluated.

6.2.2.2 Continental Airspace

a) In the continental airspace, based in the Civil Aviation requirements, the ADS-B will allow the reduction in the radar system currently used, with a lower cost, contributing to the air navigation service provider and to the airspace user system efficiency.

b) The effective ADS-B surveillance coverage will be enough to provide ATS surveillance within Brazilian Airspace, using the FL 100 as reference, for en-route operations, and in controlled airspace, and the TMA minimum altitude for operations in this airspace. The coverage will be better than the current coverage with radar, as the ground ADS/B station cost will allow the coverage "overlap" mainly in regions with higher air traffic demand and making the system resilient.

c) About the situational awareness on-board the aircraft, the "ADS-B IN" will allow the flight crew to obtain information about close aircrafts, increasing the operational security/safety. In long term the "ADS-B IN" information will be part of the Airborne Separation Assistance System (ASAS), which will be the tool that will provide the flight crew with the necessary elements for doing its own separation.

d) The secondary radar systems must be kept as a system backup, and to provide surveillance service to non-equipped users in a transition phase.

e) In specific cases, where the cost/benefit relation is favorable, the Multilateration could be provided. However, in this case, it is important to remember that this system does not give the necessary situational awareness to the flight crew due to not receiving information from other aircraft.

6.3 MAIN PROJECTS

6.3.1 PHASE I – TODAY UP TO 2010

a) Start the Mode-S, ADS-B and/or Multilateration at Bacia de Campos off-shore operation and other similar airspace;

b) ADS-C service immediate implementation;

c) Implement a test platform for the ADS-B implementation in the continental airspace;

d) Install surface movement surveillance capacity in selected airports, using Multilateration and/or ADS-B.

6.3.2 PHASE II – 2011 UP TO 2015

a) Install ADS-B coverage within the Brazilian airspace, with the following references:
   - En-route operations: FL 100;
   - TMA operations: TMA inferior limit;
   - Coverage in the higher air traffic density area (FIR Brasília and Curitiba; FIR Recife littoral zone).

b) Plan discontinuing the Primary Radar use in the civil aviation wherever no operational requirements mandate it;

c) Plan the secondary radar coverage "overlap" deactivation process, for en-route operations (assuming all users are adequately equipped with ADS-B).

6.3.3 PHASE III – 2016 UP TO 2020

a) Start to discontinue the Primary Radar use in the civil aviation wherever no operational requirements mandate it;

b) Start the secondary radar coverage "overlap" deactivation process, for en-route operations (assuming all users are adequately equipped with ADS-B);

c) To analyze embarked surveillance system, in order to support some of the Global ATM Operational Concept components (AO, DCB, TS and CM);

d) To make the service available to regional partners.

7. AERONAUTICAL SERVICES (AIS AND MET)

7.1 AERONAUTICAL INFORMATION MANAGEMENT (AIM)

7.1.1 GENERAL ASPECTS

7.1.1.1 The basic scope of the Aeronautical Information Management is defined by the ICAO Annex 15: “aeronautical information service must receive and/or originate, compare or combine, edit, format, publish/store and distribute aeronautical data/information relative to all national territory, and areas external to this perimeter where the State is in charge of the air traffic service”. This clearly presents the relevant activities required to meet the AIM needs on the SISCEAB.

7.1.1.2 Considering the AIM mandatory elements, the service scope can be split in three functional areas:

a) Information Acquisition;

b) Information Management;

c) Information Distribution.

7.1.1.3 The Aeronautical Information contains all required information to describe the air navigation infrastructure and its status or the required condition to support flight operations. We can consider that the air navigation infrastructure, as describe here, is composed of airports, navigation aids, communications, surveillance, air traffic management, provided flight information services, navigation procedures, air space, and risks to air navigation. This is different from flight information, which deals with dynamic information that specifically impacts the flight, as climate conditions, traffic, and flight plan information.

7.1.1.4 The need for aeronautical information is established based on the ICAO requirements defined in Annex 15, and they consider the user expectation, and the characteristics of the operational systems used by the ATM provider.

7.1.1.5 The AIM role is to acquire, manage and store aeronautical information, to distribute it to the operational units, when required, and to be prepared to further distribute it to operators and users. This role sets the AIM as the focal point for acquisition and distribution of information related to the Air Navigation System usage by air traffic users, Company employees and others directly interested. AIM functions include data and information acquisition, aeronautical information management, information and data binning in documents and reference products, and maintenance of quality management processes.

7.1.1.6 AIM implementation must reach the following objectives:

a) Accelerate the information flow between source and users, through real time gathering of aeronautical information, and with the use of datalink between aircraft and AIM database;
b) Develop a reference source of aeronautical information products for operational use (Aeronautical Information Publishing subordinated to the ICAO);
c) Identify opportunities to reduce the time required to implement changes to the aeronautical information;
d) Establish an auditing process to ensure the information integrity from the source to its distribution;
e) Keep a certified quality management system for aeronautical data/information, according to the principles and policies of the Security/Safety Management System (SMS);
f) Meet customer expectations for aeronautical information supply; and
g) Meet the State internal requirements referent to the aeronautical information and data products.

7.1.2 GNSS PERFORMANCE MONITORING SYSTEM (GPMS):

7.1.2.1 With the development of CNS/ATM technologies based in satellite, the Civil Aviation Authorities around the world face the challenge of having the next generation of ATC and ATM system more dependent of GNSS system, such as GPS and Galileo, which are out of its operational control. The GNSS benefits were recognized by ICAO, but the solution to face the dependency challenge, without the operational control, is not concluded yet. Moreover, the singular characteristics of the ionosphere in the Southern Latitudes require the ability to monitor GNSS signals and to transmit the service level status through the Brazilian airspace. The navigation system based in satellite has generated a challenge to the service availability prediction. The impact of an inoperative satellite is not intuitive, due to constellation dynamics. The capacity of performance monitoring in real time and of prediction are necessary as an essential tool to ensure the secure/safe operation of all navigation systems based in satellite.

7.1.2.2 Nowadays there is no capacity to generate NOTAM with information in the graph format in real time, to support the space based navigation or augmentation system associated. A Performance Monitoring System should be responsible for ensuring that satellite based systems, such GPS, Galileo, WAAS, EGNOS, MSAS, LAAS, and future services GNSS, SBAS and GBAS, can supply a continuous, secure/safe and reliable signal.

7.1.2.3 The NOTAMS are, typically, specific for place and service. The specific NOTAMS for satellite based navigation offer important challenges to the AIS system, since a failure can affect a large geographic area and can include multiple airports, with different service levels. The GNSS Performance Monitoring Network will carry out the following functions:

a) To collect GNSS SIS data;

b) To execute the correction in the GNSS SIS navigation data and the integrity processing;

c) To send the data collected in (a) and generated in (b) to the Real Time Processing Subsystem of SVM and to the Main Database Subsystem.

7.1.2.4 Elements of basic data include GPS measurement data from each monitoring station, plus GPS differential correction, and integrity data generated by the Master station.

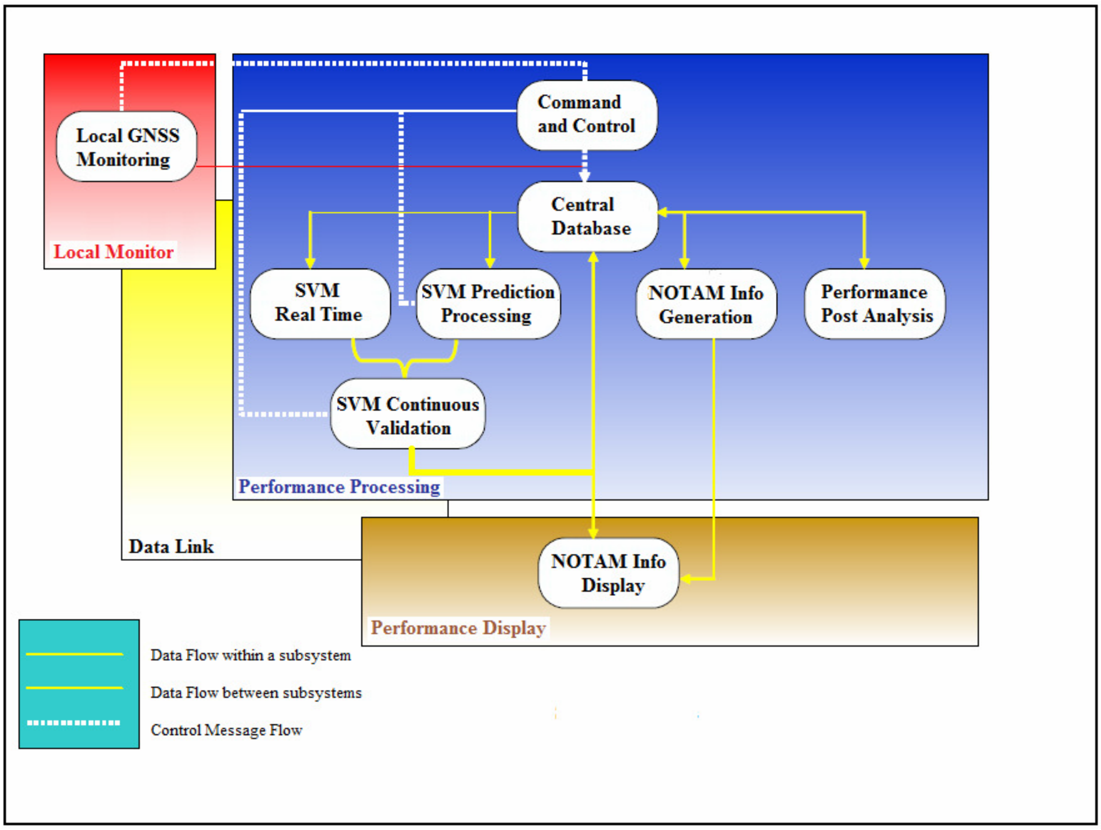

Figure 7 GPMS Architecture Diagram

7.1.2.5 Prediction processing and Real Time Service Volume Model (SVM): For a country that does not have the GNSS constellation control (GPS) and wants to develop the GPS as a basic way of navigation, a Service Volume Model (SVM), able to generate real time information, is an essential evaluation tool to develop the capacity to generate information for the daily air operations. The operational service volume model will be used, which informs prediction performance of receiver equipments as RAIM (TSO C129) and SBAS (TSO C145/146).

7.1.2.6 The possibility of use of these two receivers (TSO C129 and C145/146) aims at providing users with any of the possible equipment configurations. The basic difference between the two equipments is the logic of the RAIM algorithm used: the TSO C129 logic uses the SA and the TSO C145/146, being more modern, considers the SA deactivation in the GPS constellation, by the North American Government.

7.1.2.7 Data Analysis and Filing: The collected data will be used for real time analysis and database filing. The operator or analyst will access the stored data in case of accident investigation and report elaboration. Periodically, a backup copy will be made, and the backup will be kept separately in CD/ROMs or remote hard disks. The database will include the following functions:

a) Data Collection;

b) Database Management;

c) Historical Data Analysis.

7.1.2.8 Operational applications: As it was mentioned the NOTAMS are, typically, specific for place and service. The specific NOTAMS for satellite based navigation offer important challenges to the NOTAM system, since a failure can affect a large geographic area and can include multiple airports, with different service levels. Flight Service Station and/or air traffic staff have to monitor and predict short-term fluctuations in the service volume in the real time satellite navigation service, in order to give secure/safe support to flight operations in the national airspace system. The GPMS will integrate a real time SVM and graphic capacity in order to generate accurate and real time NOTAM information, to meet the ICAO standard text. The real time performance-monitoring network will evaluate the short-term performance (up to 2 hours) and long term (more than 2 hours) for all satellite based navigation system. The short-term evaluation will allow the operator to give real time information to the Air Traffic Control, about the continuity and availability parameters for the system and the impact of these parameters in the approach availability.

7.1.2.9 The Performance Monitoring has to ensure the GNSS operation monitoring and has to give, in real time, to its operators and users, the following data, through a simple Graphical User Interface (GUI):

a) GNSS Continuous and Current Operational Status;

b) GNSS Previous Performance, continuously registered (e.g. 30 min);

c) GNSS Future Performance, continuously predicted (e.g. 30 min);

d) Real Time Analysis;

e) Short Term Prediction;

f) Real Time Exhibition.

7.1.2.10 The GPMS will evolve gradually, with the implementation of master stations and GNSS Real Time Monitor (GRTM), in order to provide initial monitoring capacity to the Brazilian airspace. This architecture will guarantee to DECEA the signal performance in the space, when its use is authorized within Brazilian airspace. The system will monitor GPS, WAAS, EGNOS, GBAS, ABAS and other augmentation systems that will be implemented.

7.2 MAIN PROJECTS

7.2.1 Phase I - Today to 2010

a) Implement GPMS to cover all Brazilian airspace.

7.2.2 Phase II – 2011 to 2015

a) Enhance GPMS, in order to include all IFR airports and SBAS and GBAS installations.

7.2.3 Phase III – 2016 to 2020

a) Enhance GPMS with additional stations, including master stations, reference stations and monitoring terminals in air traffic control organizations in all of Brazil and in any neighbor Nations that participate in the system, in order to monitor any new satellite constellations or augmentation systems that may be implemented.

7.3 METEOROLOGICAL SERVICES

7.3.1 GENERAL ASPECTS

7.3.1.1 The meteorological service scope is to establish a structure that allows a transition from the current aeronautical meteorological system to an automated real time system that meets, in quality and opportunity, the SISCEAB needs as part of the Global ATM system.

7.3.1.2 The ICAO Global ATM system concept requires the prompt access to real time global meteorological information. This requirement can only be met when most of the meteorological systems are automated.

7.3.1.3 Only real time automated information, including ADS messages, will allow accurate on-board information of altitude winds and air stream forecasts, and the development of the meteorological situation over the planned procedures for approach and climb. It is then natural the high use of meteorological information through datalink to update on-board systems in all flight phases. This includes, among others, the implementation of D-ATIS and D-VOLMET systems.

7.3.1.4 On the other hand, more accurate meteorological information associated with the real time transmission will be required by the ATM to support its tactical and collaborative surveillance decisions, in the context of its 7 main components, contributing to the optimized use of the air space. This process is currently named “nowcast”.

7.3.1.5 The SISCEAB is the most complex and broad air navigation system of the Region, committed with most of the international flows and with an expressive national traffic, and its move to adopt the whole Global ATM Operational Concept, will require adapting its national aeronautical meteorological project to the regional and global plans. This is the only way that it will be able to keep its technical and managerial competency in this field, compatible with the roles set to the SISCEAB.

7.3.1.6 The expected results from the implementation of meteorological services compatible with the Air Traffic Management requirements are:

a) Foster as possible the creation of a global, integrated and transparent meteorological system to provide meteorological services to the international civil aviation.

b) Publish at ATC organizations and at the air companies operational control centers, real time information of the superior wind fields, in the WAFS global forecast exposition format, and wind fields derived from wind information reported automatically from aircrafts through ADS messages; severe weather forecasts and reports, specially volcanic ash, thunderstorms, clear sky turbulence and ice formation, to support tactical decisions relative to aircraft security/safety, air traffic flow management, and also to update flight plans to distribute the aircraft in flexible routes.

c) Provide automatic uplink to the airplane of meteorological conditions of the airfield, at approach and landing, through the D-ATIS, D-VOLMET, and automated systems dedicated to detect severe weather conditions.

d) Provide automatic downlink of the meteorological information, derived from airplane sensors (wind, temperature, turbulence and humidity) to the ATC computers, to provide monitoring of the wind superior fields in real time, wind profiles during descent, in order to help on the automatic sequencing of the aircraft to maximize the capacity of the operation during approaches; and in parallel, to provide ways and numeric models of global meteorological forecasts to improve the quality of all subsequent global forecasts.

e) Allow the use of meteorological sensors to generate information to feed the intelligent processing systems that will provide report messages and automated forecasts of windshields over the airfield, helping the aircraft separation optimization, and specially to maximize the capacity of the runway.

7.3.2 MAIN PROJECTS

7.3.2.1 Phase I - Today to 2010

a) Implement uplink of the automate reports generated by the meteorological ground stations (D-ATIS) in the following airports: Guarulhos, Galeão, Congonhas and Santos Dumont;
b) Implement an automated uplink to the airplane of the meteorological information from the D-VOLMET, to replace the VHF VOLMET in the Atlantic FIR;
c) Implement an automated downlink of wind and temperature data generated by the airplane on landing approach, during climb and cruise.

7.3.2.2 Phase II – 2011 to 2015

a) Implement uplink of the automate reports generated by the meteorological ground stations (D-ATIS) in the following airports: Brasília, Campinas, Recife, Salvador, Porto Alegre, Curitiba, Manaus, Confins and Pampulha;
b) Implement an automated uplink to the airplane of the meteorological information from the D-VOLMET, to replace the VHF VOLMET in the Amazon, Brasília, Curitiba and Recife FIR;
c) Implement an automatic windshield/microburst detection system and provide that the warnings generated can be automatically displayed through uplink;
d) Automatically display the products generated by the WAFC, VAAC and TCAC globally in the ATC and CGNA operational consoles, as well as in the air companies.

8. HUMAN FACTORS AND HUMAN RESOURCES

8.1 HUMAN FACTORS

8.1.1 The new CNS technologies and the air traffic operational management concept require a clear differentiation between the "human factor" and the "human resource" concepts that were treated almost as synonymous in the traditional analysis. Most aeronautical accidents have as a contributing factor the human performance. Although it is the most flexible and valuable piece of the aeronautical system, the human being is also the most vulnerable to factors that can negatively affect its behavior. For an improved security/safety and effectiveness it is mandatory to better understand the human factor and apply this knowledge pro-actively and broadly. The “Human Factor” is an expression that the ICAO decided to define clearly and objectively, as its uninformed use could be associated with any factor related to the human beings.

8.1.2 The introduction of the components of the Global ATM Operational Concept in the transition of the SISCEAB to the CNS/ATM system concept will imply in an important impact to the performance of the human component, on the ground and on-board. This way, using the human factor concept throughout the development and implementation process will provide the necessary basis for secure/safe implementations, and will be the key success element in all process.

8.1.3 Many aeronautical disciplines will change due to the new CNS/ATM technologies. There will be significant changes to the ATM and CNS people environment, particularly for the Air Traffic Controllers (ATCO). Information technologies, data communications and process automatization will be intensively used in most ATS facilities.

8.1.4 The transition process to the new concept does not mean the human resources will require immediate adaptation. Just like the ATM System, the human resources should be adapted progressively, as new procedures, functions or technological resources are implemented and become ready for service. This way, it is of the utmost importance that the Human Factors impact on the implementations are analyzed immediately, defining new required psychotechnical profiles, academic requirements, basic professional training, job training, etc.

8.1.5 IMPORTANT AREAS

8.1.5.1 Automatization and advanced technologies in the ATM system

The human factor must be considered since the operational concept phase, so that the system to be implemented can leverage the advantages from the human intervention capacity and from the technologies based on high levels of automatization. All system development must be based on the automatization principles designed around the human being.

8.1.5.2 Airplane and ATM system integration

The CNS/ATM system will allow high level of integration between the airplane and air traffic management systems. As many system components will interact in a direct way, the communication between pilot and controllers will be changed. A systemic approach will be required to handle the airplane/ATM system integration to avoid that the operation become too complex.

8.1.5.3 Human performance in the new ATM system

The human element will continue to be key in the new system and the satisfactory application of the ICAO ATM Concept will depend on him. Special attention will be given to the factors related with the organization and management of the collective and individual performance in the air traffic management. The information management in complex systems, the impact of the increased use and dependency of the communication through data, the automated tools for decision support, the individual responsibility and the capacity of intelligent intervention are items that will be formally discussed in the many implementation phases.

8.2 HUMAN RESOURCES

8.2.1 The adequate supply of Air Navigation Services is always dependent on the selection, supply and capacitation of the human resources in the operational and technical areas, as well as the availability in the required quantity to support the different services.

8.2.2 The required profile for DECEA professionals, in special the air traffic controllers, will be highly changed. The most important changes will be the communication through datalink, the increased automatization and the supply of new services, as they will be in all levels more committed with the success of the operators planning (e.g., sharing the airplane separation between controllers and pilots).

8.2.3 The need for human resources capacitation will be specially increased during the transition period. It will be required to provide training and recycle a large quantity of human resources in the new technologies, equipments and procedures, as well as a sufficient quantity of resources will need to keep the previous qualification to support the current systems. It is important to highlight the need to use adequate training tools, which for the air traffic controllers is composed basically of simulators that need to be the closest as possible to the new operational scenario that will be implemented.

8.2.4 The human resources capacitation planning to implement the components of the ATM Operational Concept must consider the specific requirements of each one of the activities, as for example, the requirements for the PBN capacitation, which contains air space planning activities, air navigation procedures creation, air space security/safety evaluation, operators and airplanes approval, and pilots and controllers training.

8.2.5 The implementation of the ATM Operational Concept components will increase the need of training at the CAR/SAM Regional level, giving opportunities for the Civil Aviation Centers to provide training courses to the States and to CAR/SAM International Organizations. In this context, the Air Space Control Institute (ICEA) will need to become a reference for those States and International Organizations.

9. OBJECTIVES BY FLIGHT PHASES

9.1 SYSTEM CAPACITY

9.1.1 The system capacity must be adequate to the airspace users since the beginning of take-off, while still on the ground, going through TMA flight and en-route phases, until its arrival in the final destination, including the airplane parking. All these procedures form the "gate-to-gate" operation, as presented in Figure 8.

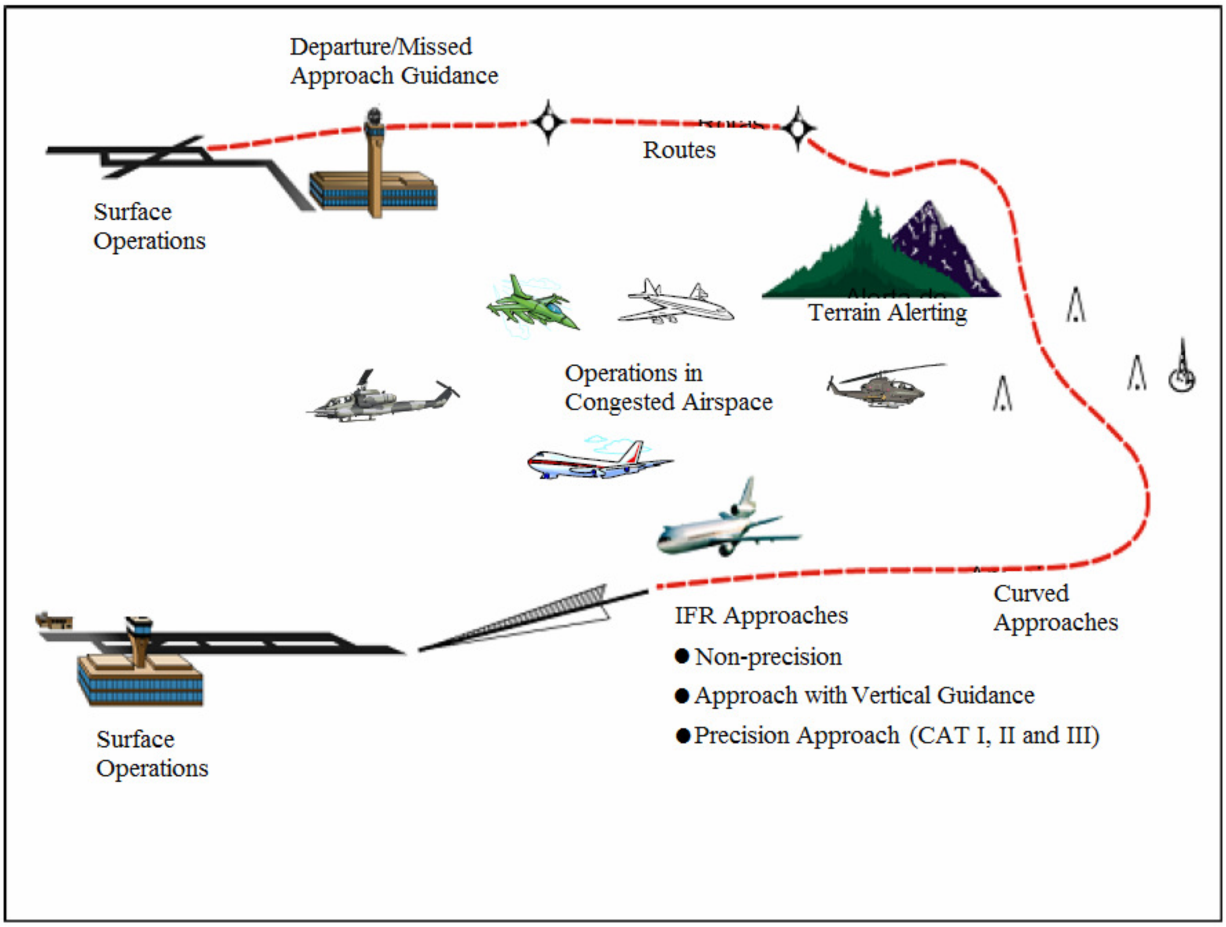

Figure 8 Operational Concept "Gate-to-Gate"

9.1.2 The ATM services will be supported by the communication, navigation, surveillance, AIM and MET infrastructure within the Brazilian airspace. The automatization and process changes will allow the use of strategic steps to avoid the traffic congestion and to meet the demand for user's preferential trajectories.

9.2 AIRPORT SURFACE OPERATIONS

The main objective in surface operations is to remove restrictions in the aircraft movement from the “gate” to the “pushback”, and to the runway, and also in the reverse direction for aircrafts in approach. The forecasted increase in airport movements will imply in an increase in the vehicle movement in the maneuver area, being more intense in peak hours with aircraft concentration. In this way, the use of ground surveillance technology for aircrafts and vehicles will be important to allow the best movement management. This resource will support meeting take-off and approach schedules, especially in areas with visibility restrictions due to meteorological conditions.

9.3 TERMINAL CONTROL AREA OPERATIONS (TMA)

9.3.1 The airspace structure in the terminal control areas will allow the increase in the exit and arrival sector, considering the environmental restrictions, in order to allow the best use of the Performance Based Navigation - PBN (RNAV and/or RNP), following the established operational requirements and using the Flight Management System (FMS).

9.3.2 SPECIFIC GOALS

a) Approach procedures, SID and STAR RNAV application in all TMA;
b) Approach procedures, SID and STAR RNP application in TMA with operational requirements;
c) Establishment of ATC procedures to optimize the RNAV and/or RNP aircrafts operation, which operate in a mixed environment (RNAV and/or RNP approved and non-approved aircrafts);
d) Establishment of departure procedures (SID) and a flexible Standard Instrument Arrival (STAR) system, with optimized climb and descent profile, in order to make a more efficient transition for en-route structure;
e) Reduce aircraft separation criteria;
f) Establishment and certification of specific approach procedures, SID and STAR, for rotary-wing aircraft (helicopters), in order to increase the traffic flow by separating its

operations;

g) Development of flexible RNAV trajectories to allow the flight within the Special Use Airspace (EAC);

h) Development of airspace structure based in RNAV and/or RNP, to include procedures/trajectories for aircrafts flying under IFR, VFR and special VFR operation;

i) Development of procedures to improve the missed approach trajectories, where the operational requirements are present.

9.4 EN-ROUTE OPERATIONS – CONTINENTAL AIRSPACE

9.4.1 The PBN implementation will allow the use of advanced aircraft navigation capacities, and with the available navigation infrastructure, the airspace structure will be improved, including the routes network. In this way, it will be possible to establish routes that meet the airspace user needs, reducing the air traffic controller and pilot workload and lowering the concentration of aircraft around navaids.

9.4.2 The use of exclusive airspace will be necessary for the PBN implementation for en-route operation, where non-approved aircrafts will not be able to enter. In this way, the necessary improvements in the airspace structure can be made. However, the vertical limit for PBN implementation for en-route operation must be analyzed, in order to not prevent operations for a significant amount of airspace users.

9.4.3 SPECIFIC GOALS

a) Establishment of airspace structure to provide optimum descent profile, allowing the aircrafts to remain in higher altitudes for longer periods during arrival phase;

b) Establishment of an automated ATC system to optimize coordination between ATC agencies and sectors of the same ATC agency, in order to reduce restrictions imposed by sectors limits and FIR;

c) Use of flexible routes, with the user's cooperation, in order to avoid demand and capacity instability;

d) Use of structured routes only in high-density traffic environment, to avoid terrain and in case of EAC activation;

e) Development of flexible routes to support direct routing based in RNAV and/or RNP (fixed-wing and helicopter);

f) Development of low altitude airspace structure, using RNAV and/or RNP, to support helicopter "offshore" operations;

g) Development of alternatives and flexible RNAV and/or RNP routes, to allow flights through and/or around the EAC;

h) Use RNAV and/or RNP capacity to reduce the aircraft separation for en-route operations.

9.5 EN-ROUTE OPERATIONS – OCEANIC AIRSPACE

9.5.1 The GNSS and the Inertial System will be used as the main navigation way in the oceanic environment.

9.5.2 The ATC Automated System improvement, the use of Performance Based Navigation, the use of datalink based communication, and the use of Automatic Dependent Surveillance-Contract will be essential to the increase in the oceanic airspace capacity, through the reduction in the aircraft separation, in order to support the forecasted air traffic and existing demand.

9.5.3 SPECIFIC GOALS

a) Increase in system capacity through the reduction in the aircraft lateral and longitudinal minimum separation;

b) Increase in system flexibility, replacing the fixed routes structure by a random route system;

c) Development of ADS/CPDLC capacity.

10. GENERAL COMMENTS

10.1 This document concludes that the ATM System is a cooperative effort of human resources, information, technologies, and services that came from the ATM Provider, Operators, Industry, Airports, State Regulatory Agency, and airspace users. It aims Air Traffic Management in an operationally seamless airspace, configured to the operational security/safety and structured to meet the performance objectives established according to all flight planning expectations.

10.2 The ATM system, as many other systems, needs a constant integration of its elements, aligned to the same objectives and with a perfect interdependence relation with the external environment, since several factors can affect the realization of planned activities for one or more of these elements.

10.3 In this way, the ATM system organization and integration is responsibility of all the national ATM community and it must be organized in order to avoid an eventual instability to the group, either by concept deficiency, method, model or process, as it can damage all the other system elements.

11. FINAL COMMENTS

Subjects not discussed in this plan will be submitted to the DECEA General Director.

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INDEX

APÉNDICE B

PROYECTO DE IMPLANTACIÓN PBN EN LAS TMA BRASILIA Y RECIFE

1 Concepto de espacio aéreo	**Inicio**	**Término**	**Responsable**	**Observaciones**
1.1 Establecer y priorizar objetivos estratégicos (seguridad operacional, capacidad, medio ambiente, etc)	15/12/08	31/03/09	Estados	
1.2 Recolectar datos de tráfico para entender los flujos de tráfico del espacio aéreo en TMA	07/04/08	11/12/09	Estados	
1.3 Analizar la capacidad de navegación de la flota de aeronaves en la TMA	03/11/08	30/11/09	Estados	
1.4 Analizar los medios de comunicación, navegación (VOR, DME) y vigilancia en tierra para atender las especificaciones de navegación y al modo de reversión de navegación	15/12/08	31/07/09	Estados	
1.5 Desarrollar nueva sectorización de las TMA Brasilia y Recife	17/03/09	30/04/09	Estados	
1.6 Desarrolar SID, STARS y procedimientos de aproximación, basados en los objetivos estratégicos del concepto del espacio aéreo	08/09/08	30/04/09	Estados	
1.7 Realizar Simulación en Tiempo Acelerado	26/03/09	28/08/09	Estados	
1.8 Realizar Simulación en Tiempo Real	26/03/09	28/08/09	Estados	
2. Desarrollar plan de medición de la performance			Estados	
2.1 Preparar plan de medición de la performance, incluyendo emisiones de gas, seguridad operacional, eficiencia, etc.	30/03/09	05/06/09	Estados	
2.2 Conducir plan de medición de la performance	01/03/10	01/03/11	Estados	
3 Evaluación de la seguridad operacional			Estados	
3.1 Determinar que metodología será usada para evaluar la seguridad en el espacio aéreo y espaciamiento de rutas, dependiendo de la especificación de navegación, considerando el "airspace modeling", simulaciones ATC (tiempo acelerado y/o tiempo real), pruebas en vivo, etc.	02/03/09	29/05/09	Estados	
3.2 Preparar un programa de recolección de datos para la evaluación de la seguridad operacional en el espacio aéreo	01/06/09	12/06/09	Estados	

3.3	Preparar la evaluación preliminar de la seguridad operacional en el espacio aéreo	15/06/09	31/07/09	Estados	
3.4	Preparar la evaluación final de la seguridad operacional en el espacio aéreo	03/08/09	30/10/09	Estados	
4	**Establecer un proceso de toma de decisiones en colaboración (CDM)**			Estados	
4.1	Coordinar necesidades de planificación e implementación con los proveedores de servicio de navegación aérea, reguladores, usuarios, operadores de aeronaves y autoridades militares	16/04/09	01/03/11	Estados	
4.2	Evaluar fecha tentativa de implementación	02/11/09	27/11/09	Estados	
4.3	Establecer formato de documentación en sitio web PBN DECEA	26/05/08	20/06/08	Estados	
4.4	Reportar avances de planificación e implementación a la oficina Regional correspondiente	20/04/09	30/03/11	Estados	
5	**Sistemas automatizados ATC**			Estados	
5.1	Evaluar la implementación PBN en los sistemas automatizados ATC, considerando la enmienda 1 a los PANS/ATM (FPLSG).	09/02/09	03/04/09	Estados	
5.2	Implementar los cambios necesarios en los sistemas automatizados ATC	17/08/09	29/01/10	Estados	
6	**Aprobación de aeronaves y operadores**			Estados	
6.1	Analizar los requisitos de aprobación de aeronaves, y operadores (pilotos, despachadores y personal de mantenimiento), según lo establecido en el manual PBN, y desarrollar la documentación necesaria.	08/10/08	30/04/09	Estados	
6.2	Publicar las regulaciones nacionales para implementar las especificación de navegación RNAV-1	01/05/09	19/06/09	Estados	
6.3	Iniciar la aprobación de aeronaves y operadores	22/06/09	01/03/10	Estados	
6.4	Establecer y mantener actualizado un registro de aeronaves y operadores aprobados	22/06/09	01/03/10	Estados	
6.5	Verificar la operación dentro del programa de monitoreo continuo (aeronave y procedimientos)	01/03/10	01/03/11	Estados	

7	**Normas y Procedimientos**			Estados	
7.1	Evaluar las regulaciones para el uso GNSS, y si fuera el caso, proceder a su publicación.	07/04/08	09/04/09	Estados	
7.2	Finalizar la implementación de WGS-84	03/08/09	14/08/09	Estados	
7.3	Validación en tierra y Inspección en Vuelo de SID y/o STAR	05/10/09	06/11/09	Estados	
7.4	Establecimiento de Requerimientos y Procedimientos de Validación de la Base de Datos de Navegación	16/06/09	30/10/09	Estados	
7.5	Elaborar modelo de AIC para notificar la planificación de la implantación de la PBN	27/04/09	05/06/09	Estados	
7.6	Publicar la AIC notificando la planificación de implementación PBN	08/06/09	10/08/09	Estados	
7.7	Desarrollar Modelo de Suplemento AIP que contenga normas y procedimientos aplicables, incluyendo las contingencias en vuelo correspondientes	17/08/09	16/10/09	Estados	
7.8	Publicar Suplemento AIP que contenga normas y procedimientos aplicables, incluyendo las contingencias en vuelo correspondientes.	15/01/09	15/01/09	Estados	
7.9	Revisar el Manual de Procedimientos de las unidades ATS involucradas	19/10/09	18/12/09	Estados	
7.10	Actualizar cartas de acuerdo entre unidades ATS	19/10/09	18/12/09	Estados	
8	**Capacitación**			Estados	
8.1	Desarrollar un programa de capacitación y documentación para operadores (pilotos, despachadores y mantenimiento)	01/06/09	28/08/09	Estados	
8.2	Desarrollar un programa de capacitación y documentación para controladores de transito aéreo y operadores AIS	19/10/09	18/12/09	Estados	
8.3	Desarrollar un programa de capacitación para reguladores (inspectores de seguridad operacional de la aviación)	19/10/09	18/12/09	Estados	
8.4	Conducir programas de capacitación	31/08/09	26/03/10	Estados	
8.5	Realizar seminarios orientados a los operadores, indicando los planes y los beneficios operacionales y económicos esperados	01/09/09	12/03/10	Estados	

9	**Decisión de implementación**			Estados	
9.1	Evaluar la documentación operacional disponible (ATS, OPS/AIR)	26/01/09	30/01/09	Estados	
9.2	Evaluar el porcentaje de aeronaves y operadores aprobados (espacio aéreo no excluyente)	26/01/09	30/01/09	Estados	
9.3	Revisar resultados de la evaluación de la seguridad operacional	26/01/09	30/01/09	Estados	
9.4	Publicar trigger NOTAM	20/03/09	23/03/09	Estados	
10	**Sistema de monitoreo de la performance**			Estados	
10.1	Desarrollar un programa de monitoreo post-implementación de operaciones en TMA	02/11/09	26/03/10	Estados	
10.2	Ejecutar un programa de monitoreo post-implementación de operaciones en TMA	26/03/10	31/03/11	Estados	
Fecha de implementación Pre operacional		08/04/10		Estados	
Fecha Definitiva de implementación		08/04/11		Estados	

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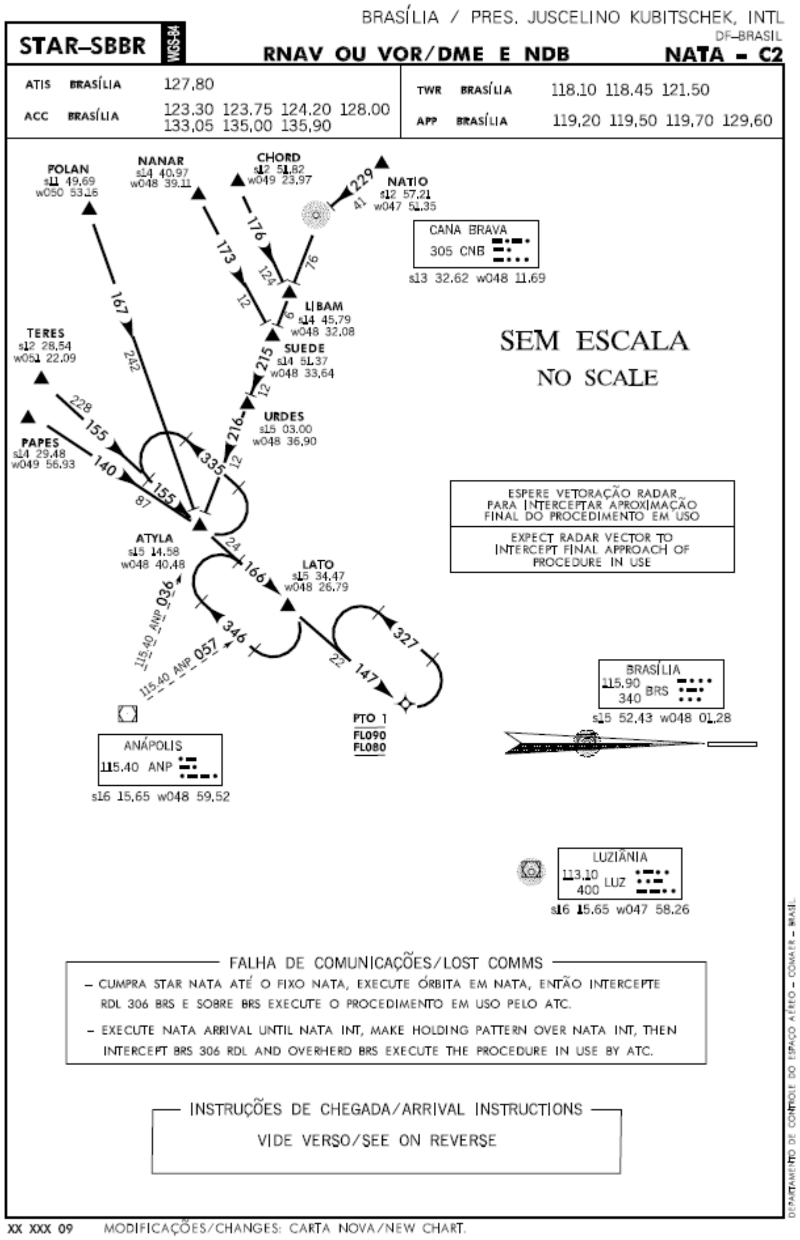
APÉNDICE C

Simulación en Tiempo Acelerado TMA Brasilia
Escenario 2

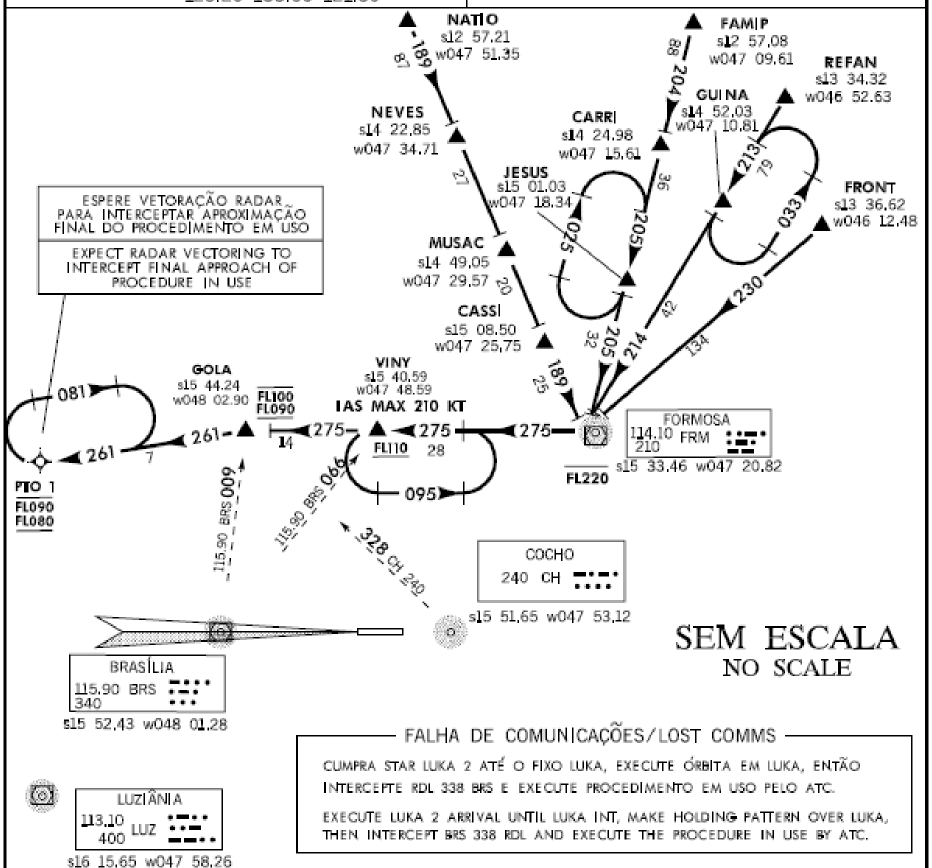
<u>STAR</u>



BRASÍLIA / PRES. JUSCELINO KUBITSCHEK,INTL
DF–BRASIL

STAR – SBBR WGS-84 **RNAV OU VOR/DME E NDB** **LUKA 2 – C2**

ATIS	BRASÍLIA	127.80	TWR	BRASÍLIA	118.10 118.45 121.50
ACC	BRASÍLIA	122.25 123.75 124.20 125.20 135.00 121.50	APP	BRASÍLIA	119.20 119.50 119.70 129.60



FALHA DE COMUNICAÇÕES/LOST COMMS

CUMPRA STAR LUKA 2 ATÉ O FIXO LUKA, EXECUTE ÓRBITA EM LUKA, ENTÃO INTERCEPTE RDL 338 BRS E EXECUTE PROCEDIMENTO EM USO PELO ATC.

EXECUTE LUKA 2 ARRIVAL UNTIL LUKA INT, MAKE HOLDING PATTERN OVER LUKA, THEN INTERCEPT BRS 338 RDL AND EXECUTE THE PROCEDURE IN USE BY ATC.

INSTRUÇÕES DE CHEGADA/ARRIVAL INSTRUCTIONS

I– TRANSIÇÕES/TRANSITIONS:

1 – TRNS FRONT: DO FIXO FRONT PELA RDL 050 FRM ATÉ VOR FRM, ENTÃO...
TRNS FRONT: FROM FRONT INT VIA FRM 050 RDL UP TO FRM VOR, THENCE...

2 – TRNS REFAN: DO FIXO REFAN PELA RDL 033 FRM ATÉ FIXO GUINA E PELA RDL 034 FRM ATÉ VOR FRM, ENTÃO...
TRNS REFAN: FROM REFAN INT VIA FRM 033 RDL UP TO GUINA INT AND VIA FRM 034 RDL UP TO FRM VOR, THENCE...

3 – TRNS FAMIP: DO FIXO FAMIP PELA RDL 024 FRM ATÉ FIXO CARRI E PELA RDL 025 FRM ATÉ VOR FRM, ENTÃO...
TRNS FAMIP: FROM FAMIP INT VIA FRM 024 RDL UP TO GUINA INT AND VIA FRM 025 RDL UP TO FRM VOR, THENCE...

4 – TRNS NATIO: DO FIXO NATIO PELA RDL 009 FRM ATÉ VOR FRM, ENTÃO...
TRNS NATIO: FROM NATIO INT VIA FRM 009 RDL UP TO FRM VOR, THENCE...

II– CHEGADA/ARRIVAL:

...ENTÃO, APÓS VOR FRM PELA RDL 275 FRM ATÉ FIXO LUKA, ENTÃO ESPERE VETORAÇÃO RADAR PARA INTERCEPTAR A FINAL DO PROCEDIMENTO EM USO PELO ATC.
...THEN, AFTER FRM VOR VIA FRM 275 RDL UP TO LUKA INT, THEN EXPECT RADAR VECTOR TO INTERCEPT FINAL APPROACH OF THE PROCEDURE IN USE BY ATC.

XX XXX 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.

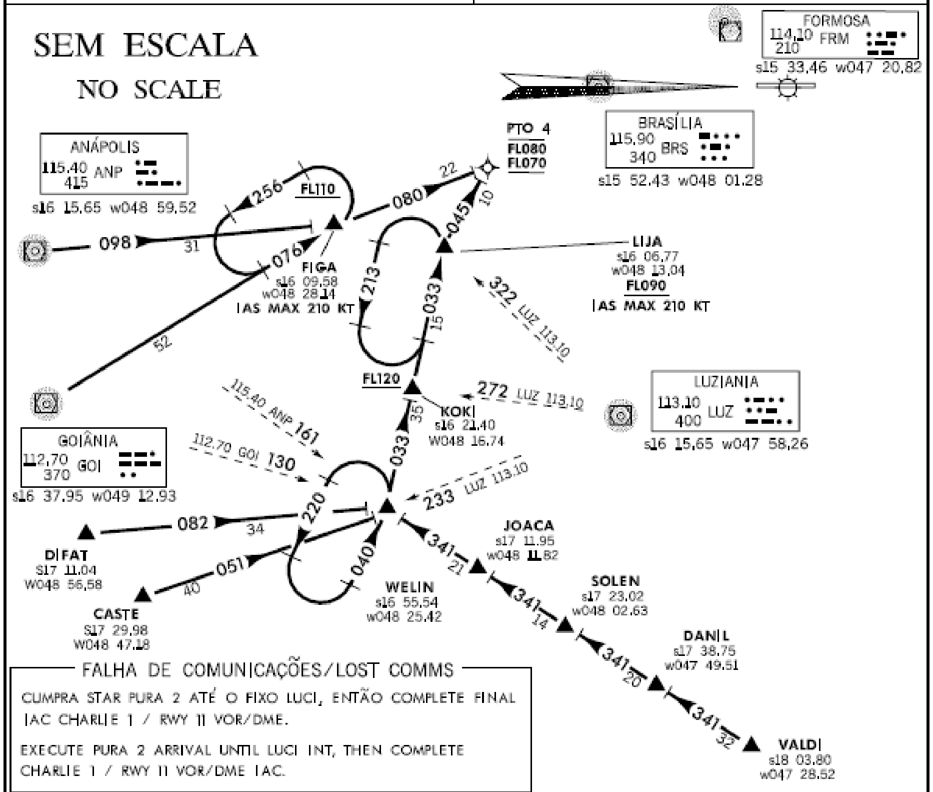
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO - COMAER - BRASIL

BRASÍLIA / PRES. JUSCELINO KUBITSCHEK, INTL
DF–BRASIL

STAR–SBBR WGS-84 **RNAV OU VOR/DME E NDB** **PURA 2 – C2**

ATIS	BRASÍLIA	127.80	TWR	BRASÍLIA	118.10 118.45 121.50
ACC	BRASÍLIA	123.75 124.20 135.00 121.50	APP	BRASÍLIA	119.20 119.50 119.70 129.60

SEM ESCALA
NO SCALE



FALHA DE COMUNICAÇÕES/LOST COMMS

CUMPRA STAR PURA 2 ATÉ O FIXO LUCI, ENTÃO COMPLETE FINAL IAC CHARLIE 1 / RWY 11 VOR/DME.

EXECUTE PURA 2 ARRIVAL UNTIL LUCI INT, THEN COMPLETE CHARLIE 1 / RWY 11 VOR/DME IAC.

INSTRUÇÕES DE CHEGADA/ARRIVAL INSTRUCTIONS

I – TRANSIÇÕES/TRANSITIONS

1 – TRNS VALDI: DO FIXO VALDI PELA RDL 161 ANP ATÉ FIXO WELIN, CURVA A DIREITA HDG 033 ATÉ FIXO PURA, ENTÃO...
TRNS VALDI: FROM VALDI INT VIA ANP 161 RDL UP TO WELIN INT, RIGHT TURN 033 HDG UP TO PURA INT, THENCE...

2 – TRNS CASTE: DO FIXO CASTE PELO HDG 051 ATÉ FIXO WELIN, CURVA A ESQUERDA HDG 033 ATÉ FIXO PURA, ENTÃO...
TRNS CASTE: FROM CASTE INT 051 HDG UP TO WELIN INT, LEFT TURN 033 HDG UP TO PURA INT, THENCE...

3 – TRNS DIFAT: DO FIXO DIFAT PELA HDG 082 ATÉ FIXO WELIN, CURVA A ESQUERDA HDG 033 ATÉ FIXO PURA, ENTÃO...
TRNS DIFAT: FROM DIFAT INT 082 HDG UP TO WELIN INT, LEFT TURN 033 HDG UP TO PURA INT, THENCE...

4 – TRNS GOIÂNIA: DO VOR GOI PELA RDL 076 GOI/ RDL 256 BRS ATÉ FIXO FIGA E PELA RDL 076 GOI ATÉ FIXO PURA, ENTÃO...
TRNS GOIÂNIA: FROM GOI 076 RDL UP TO FIGA INT, VIA GOI 076 RDL/ BRS 256 RDL UP TO PURA INT, THENCE...

5 – TRNS ANÁPOLIS: DO VOR ANP PELA RDL 098 ANP ATÉ FIXO FIGA E PELA RDL 076 GOI/ RDL 256 BRS ATÉ FIXO PURA, ENTÃO...
TRNS ANÁPOLIS: FROM ANP 098 RDL UP TO FIGA INT, VIA GOI 076 RDL/ BRS 256 RDL UP TO PURA INT, THENCE...

II – CHEGADA/ARRIVAL:

...DO FIXO PURA VIA HDG 069 PARA O FIXO LUCI E ENTÃO COMPLETE O PROCEDIMENTO EM USO PELO ATC.

...FROM PURA INT VIA HDG 069 UP TO LUCI THEN TURN RIGHT TO INTERCEPT LLZ AND COMPLETE FINAL APPROACH PROCEDURE AUTORIZED BY ATC

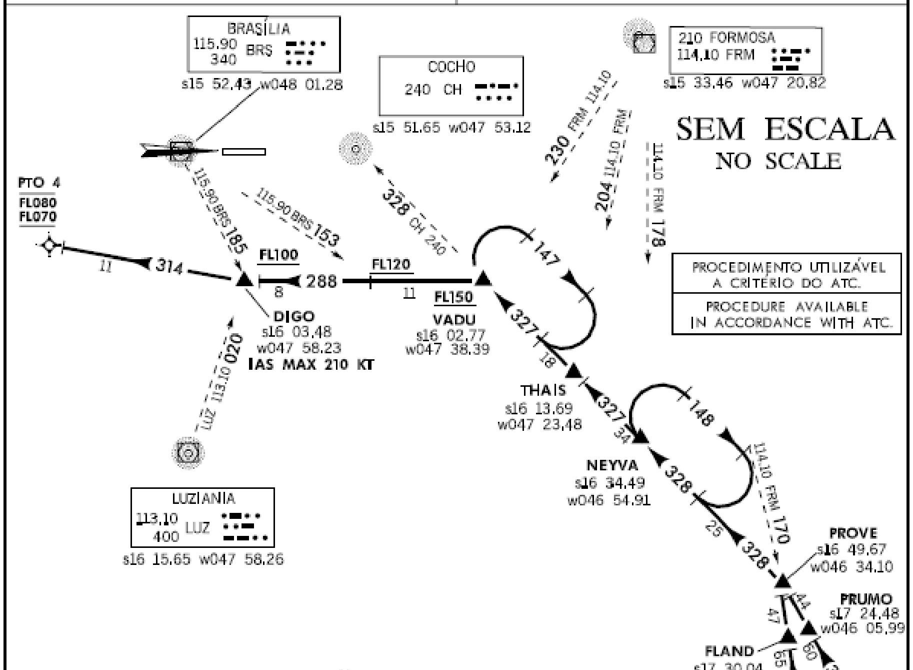
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO – COMAER – BRASIL

XX XXX 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.

BRASÍLIA / PRES. JUSCELINO KUBITSCHEK,INTL
DF–BRASIL

STAR – SBBR WGS-84 **RNAV OU VOR/DME E NDB** **PURA 3 – C2**

ATIS	BRASÍLIA	127.80	TWR	BRASÍLIA	118.10 118.45 121.50
ACC	BRASÍLIA	123.00 123.75 124.20 125.05 127.30 133.10 135.00	APP	BRASÍLIA	119.20 119.50 119.70 129.60



FALHA DE COMUNICAÇÕES/LOST COMMS

CUMPRA STAR PURA 3 ATÉ O FIXO GERA, EXECUTE ORBITA EM GERA, INTERCEPTE RDL 220 BRS E EXECUTE PROCEDIMENTO EM USO PELO ATC.

EXECUTE PURA 3 ARRIVAL UNTIL GERA INT, MAKE HOLDING PATTERN OVER GERA, THEN INTERCEPT BRS 220 RDL AND EXECUTE THE PROCEDURE IN USE BY ATC.

INSTRUÇÕES DE CHEGADA/ARRIVAL INSTRUCTIONS

I– TRANSIÇÕES/TRANSITIONS:

1 – TRNS TRÊS MARIAS: DO VOR TRM PELA RDL 343 TRM ATÉ FIXO PROVE, ENTÃO...
TRNS TRÊS MARIAS: FROM TRM VOR VIA TRM 343 RDL UP TO PROVE INT, THENCE...

2 – TRNS REINA: DO FIXO REINA PELA RDL 170/QDM 350 FRM ATÉ FIXO PROVE, ENTÃO...
TRNS REINA: FROM REINA INT VIA FRM 170 RDL/350 QDM UP TO PROVE INT, THENCE...

II– CHEGADA/ARRIVAL:

...ENTÃO, APÓS FIXO PROVE PELO QDM 328 CH ATÉ FIXO NEYVA E PELO QDM 327 CH ATÉ FIXO VADU, CURVA A ESQUERDA HDG 288 ATÉ FIXO GERA, ENTÃO VIA RDL 343 LUZ ATÉ FIXO PURA, ENTÃO RUMO 069 PARA O FIXO LUCI, ENTÃO EXECUTE PROCEDIMENTO DE APROXIMAÇÃO EM USO PELO ATC.

...THEN AFTER PROVE INT BY CH 328 QDM UP TO NEYVA INT BY CH 327 QDM UP TO VADU INT, TURN LEFT 288 HDG UP TO GERA INT, THEN VIA RDL 343LUZ UP TO PURA INT, AND VIA HDG 069 UP TO LUCI INT, THEN INTERCEPT FINAL APPROACH PROCEDURE IN USE BY ATC.

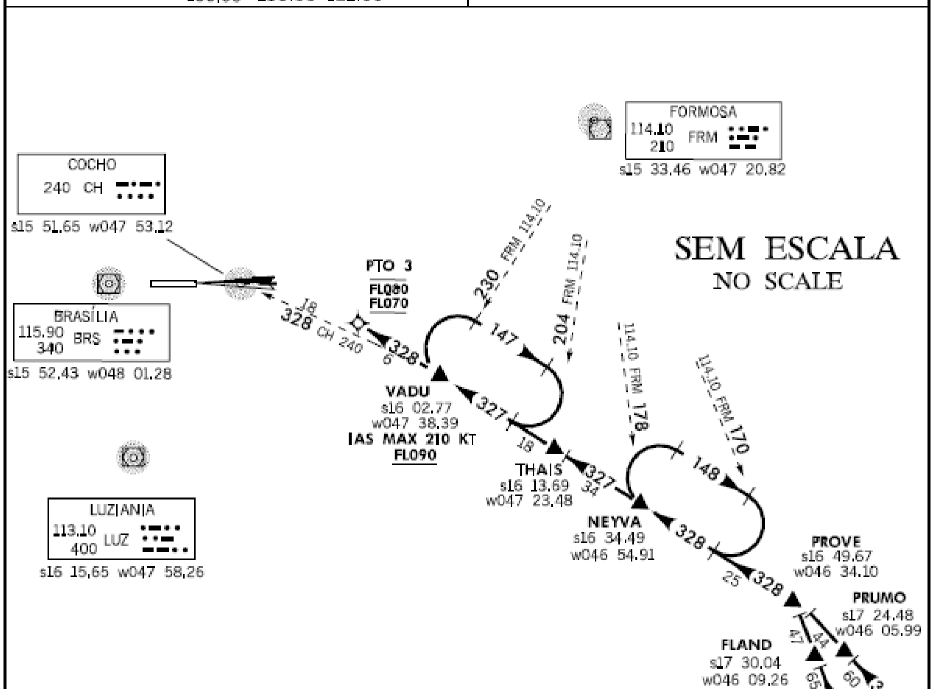
XX XXX 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.

DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO – COMAER – BRASIL

BRASÍLIA / PRES. JUSCELINO KUBITSCHEK,INTL
DF–BRASIL

STAR – SBBR WGS-84 **RNAV OU VOR/DME E NDB** **URADI 1 – C2**

ATIS	BRASÍLIA	127.80	TWR	BRASÍLIA	118.10 118.45 121.50
ACC	BRASÍLIA	123.00 125.05 127.30 133.10 135.00 135.55 121.50	APP	BRASÍLIA	119.20 119.50 119.70 129.60



FALHA DE COMUNICAÇÕES/LOST COMMS

CUMPRA STAR URADI 1 ATÉ O FIXO URADI, ENTÃO COMPLETE FINAL IAC CHARLIE 2 / RWY 29 VOR/DME Y.

EXECUTE URADI 1 ARRIVAL UNTIL URADI INT, THEN COMPLETE CHARLIE 2 / RWY 29 VOR/DME Y IAC.

INSTRUÇÕES DE CHEGADA/ARRIVAL INSTRUCTIONS

I– TRANSIÇÕES/TRANSITIONS:

1 – TRNS TRÊS MARIAS: DO VOR TRM PELA RDL 343 TRM ATÉ FIXO PROVE, ENTÃO...
TRNS TRÊS MARIAS: FROM TRM VOR VIA TRM 343 RDL UP TO PROVE INT, THENCE...

2 – TRNS REINA: DO FIXO REINA PELA RDL 170/QDM 350 FRM ATÉ FIXO PROVE, ENTÃO...
TRNS REINA: FROM REINA INT VIA FRM 170 RDL/350 QDM UP TO PROVE INT, THENCE...

II– CHEGADA/ARRIVAL:

...ENTÃO, APÓS FIXO PROVE PELO QDM 328 CH ATÉ FIXO NEYVA E PELO QDM 327 CH ATÉ FIXO VADU, CURVA A DIREITA HDG 356 ATÉ FIXO TOTI E INTERCEPTE RDL 106 BRS ATÉ FIXO URADI, ENTÃO COMPLETE FINAL DO PROCEDIMENTO EM USO PELO ATC.

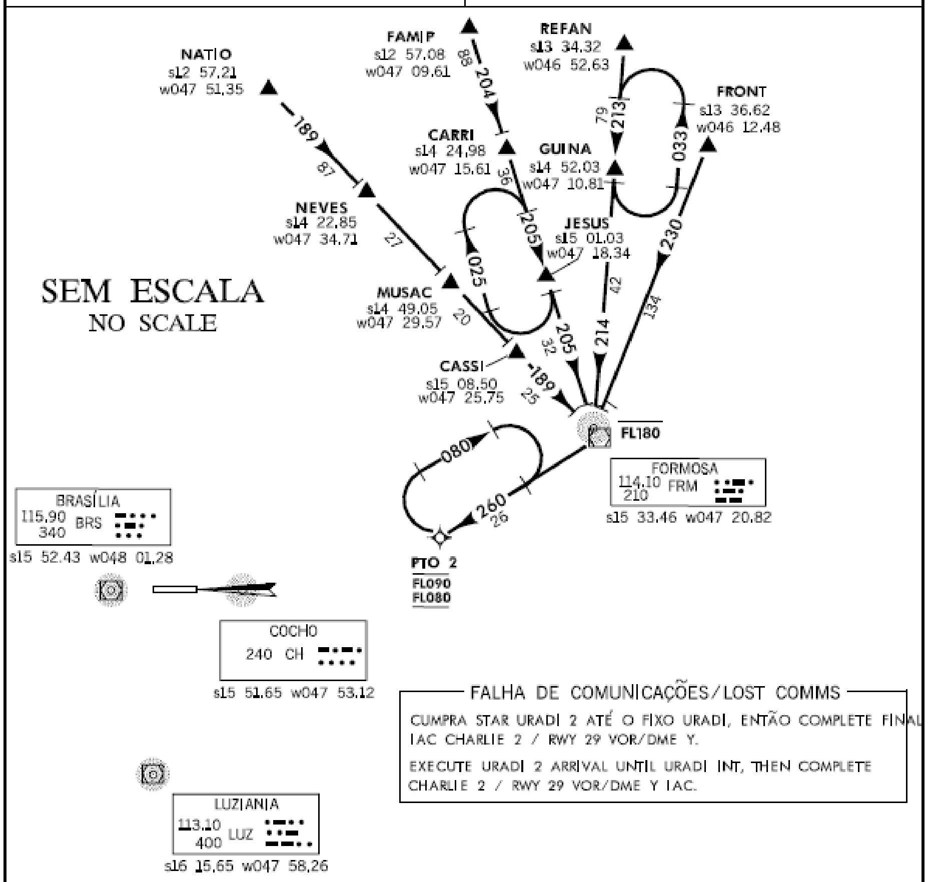
...THEN AFTER PROVE INT VIA CH 328 QDM UP TO NEYVA INT VIA CH 327 QDM UP TO VADU INT, RIGHT TURN 356 HDG UP TO TOTI INT, LEFT TURN INTERCEPT BRS 106 RDL UP TO URADI INT, THEN COMPLETE FINAL APPROACH OF THE PROCEDURE IN USE BY ATC.

XX XXX 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.

BRASÍLIA / PRES. JUSCELINO KUBITSCHEK,INTL
DF–BRASIL

STAR – SBBR WGS-84 **RNAV OU VOR/DME E NDB** **URADI 2 – C2**

ATIS	BRASÍLIA	127.80	TWR	BRASÍLIA	118.10 118.45 121.50
ACC	BRASÍLIA	122.25 123.75 124.20 128.00 135.00 135.90	APP	BRASÍLIA	119.20 119.50 119.70 129.60



INSTRUÇÕES DE CHEGADA/ARRIVAL INSTRUCTIONS

I– TRANSIÇÕES/TRANSITIONS:

1 – TRNS FRONT: DO FIXO FRONT PELA RDL 050 FRM ATÉ VOR FRM, ENTÃO...
TRNS FRONT: FROM FRONT INT VIA FRM 050 RDL UP TO FRM VOR, THENCE...

2 – TRNS REFAN: DO FIXO REFAN PELA RDL 033 FRM ATÉ FIXO GUINA E PELA RDL 034 FRM ATÉ VOR FRM, ENTÃO...
TRNS REFAN: FROM REFAN INT VIA FRM 033 RDL UP TO GUINA INT AND VIA FRM 034 RDL UP TO FRM VOR, THENCE...

3 – TRNS FAMIP: DO FIXO FAMIP PELA RDL 024 FRM ATÉ FIXO CARRI E PELA RDL 025 FRM ATÉ VOR FRM, ENTÃO...
TRNS FAMIP: FROM FAMIP INT VIA FRM 024 RDL UP TO GUINA INT AND VIA FRM 025 RDL UP TO FRM VOR, THENCE...

4 – TRNS NATIO: DO FIXO NATIO PELA RDL 009 FRM ATÉ VOR FRM, ENTÃO...
TRNS NATIO: FROM NATIO INT VIA FRM 009 RDL UP TO FRM VOR, THENCE...

II – CHEGADA/ARRIVAL:

...ENTÃO, APÓS VOR FRM PELA RDL 241 FRM ATÉ FIXO ZAPI, CURVA A DIREITA HDG 269 ATÉ FIXO TOTI E INTERCEPTE RDL 106 BRS ATÉ FIXO URADI, ENTÃO COMPLETE FINAL DO PROCEDIMENTO EM USO PELO ATC.

...THEN, AFTER FRM VOR VIA FRM 241 RDL UP TO ZAPI INT TURN RIGHT HDG 269 UP TO TOTI INT AND INTERCEPT BRS 106 RDL UP TO URADI INT THEN COMPLETE FINAL APPROACH OF THE PROCEDURE IN USE BY ATC.

XX XXX 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.

BRASÍLIA / PRES. JUSCELINO KUBITSCHEK, INTL
DF–BRASIL

STAR–SBBR WGS-84 **RNAV OU VOR/DME E NDB** **URADI 4 – C2**

ATIS	BRASÍLIA	127.80	TWR	BRASÍLIA	118,10 118,45 121,50
ACC	BRASÍLIA	123,75 124,20 135,00 121,50	APP	BRASÍLIA	119,20 119,50 119,70 129,60

INSTRUÇÕES DE CHEGADA/ARRIVAL INSTRUCTIONS

I – TRANSIÇÕES/TRANSITIONS

1 – TRNS VALDI: DO FIXO VALDI PELA RDL 161 ANP ATÉ FIXO WELIN E PELA RDL 220 BRS ATÉ FIXO LIDI, ENTÃO...
TRNS VALDI: FROM VALDI INT VIA ANP 161 RDL UP TO WELIN INT AND VIA BRS 220 RDL UP TO LIDI INT, THENCE...

2 – TRNS CASTE: DO FIXO CASTE PELA RDL 232 LUZ ATÉ FIXO WELIN E PELA RDL 220 BRS ATÉ FIXO LIDI, ENTÃO...
TRNS CASTE: FROM CASTE INT VIA RDL 232 LUZ UP TO WELIN INT AND VIA BRS 220 RDL UP TO LIDI INT, THENCE...

3 – TRNS DIFAT: DO FIXO DIFAT PELO HDG 082 ATÉ FIXO WELIN E PELA RDL 220 BRS ATÉ FIXO LIDI, ENTÃO...
TRNS DIFAT: FROM DIFAT INT 082 HDG UP TO WELIN INT AND VIA BRS 220 RDL UP TO LIDI INT, THENCE...

4 – TRNS GOIÂNIA: DO VOR GOI PELA RDL 076 GOI ATÉ FIXO FIGA E PELA RDL 098 ANP ATÉ FIXO LIDI, ENTÃO...
TRNS GOIÂNIA: FROM GOI 076 RDL UP TO FIGA INT AND VIA ANP 098 RDL UP TO LIDI INT, THENCE...

5 – TRNS ANÁPOLIS – DO VOR ANP PELA RDL 098 ANP ATÉ FIXO FIGA E PELA RDL 098 ANP ATÉ FIXO LIDI, ENTÃO...
TRNS ANÁPOLIS: FROM ANP 098 RDL UP TO FIGA INT AND VIA ANP 098 RDL UP TO LIDI INT, THENCE...

II– CHEGADA/ARRIVAL:

...PELA RDL 099 ANP ATÉ FIXO ZOTI E ENTÃO CURVA A ESQUERDA PARA FIXO URADI, ENTÃO COMPLETE PROCEDIMENTO EM USO PELO ATC.

...THEN INTERCEPT ANP 099 RDL UP TO ZOTI INT, THEN TURN TO THE LEFT UP TO URADI INT, THEN COMPLETE APPROACH PROCEDURE IN USE BY ATC.

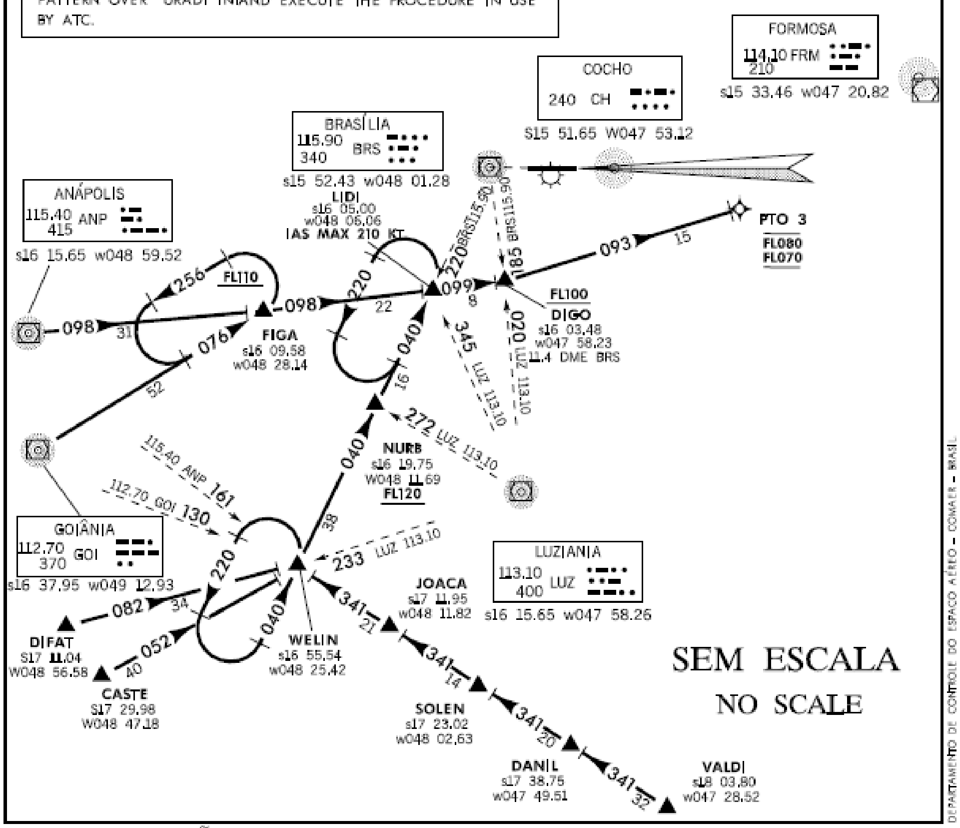
FALHA DE COMUNICAÇÕES/LOST COMMS

– CUMPRA STAR URADI 3 ATÉ O FIXO URADI, EXECUTE ÓRBITA NO FIXO URADIE EXECUTE O PROCEDIMENTO EM USO PELO ATC.

– EXECUTE URADI 3 ARRIVAL UNTIL URADI INT, MAKE HOLDING PATTERN OVER URADI INTAND EXECUTE THE PROCEDURE IN USE BY ATC.

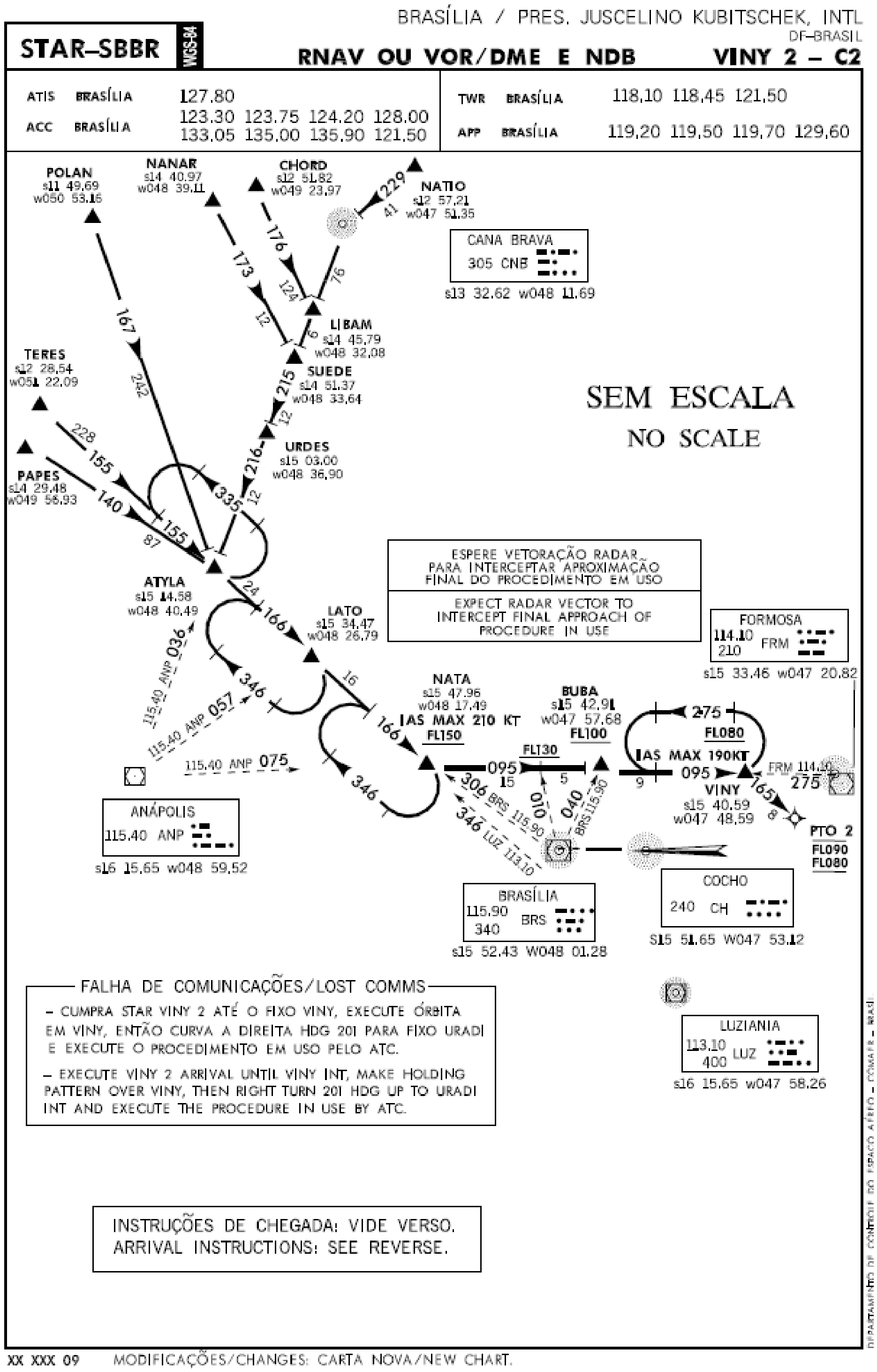
PROCEDIMENTO UTILIZÁVEL A CRITÉRIO DO ATC.

PROCEDURE AVAILABLE IN ACCORDANCE WITH ATC.



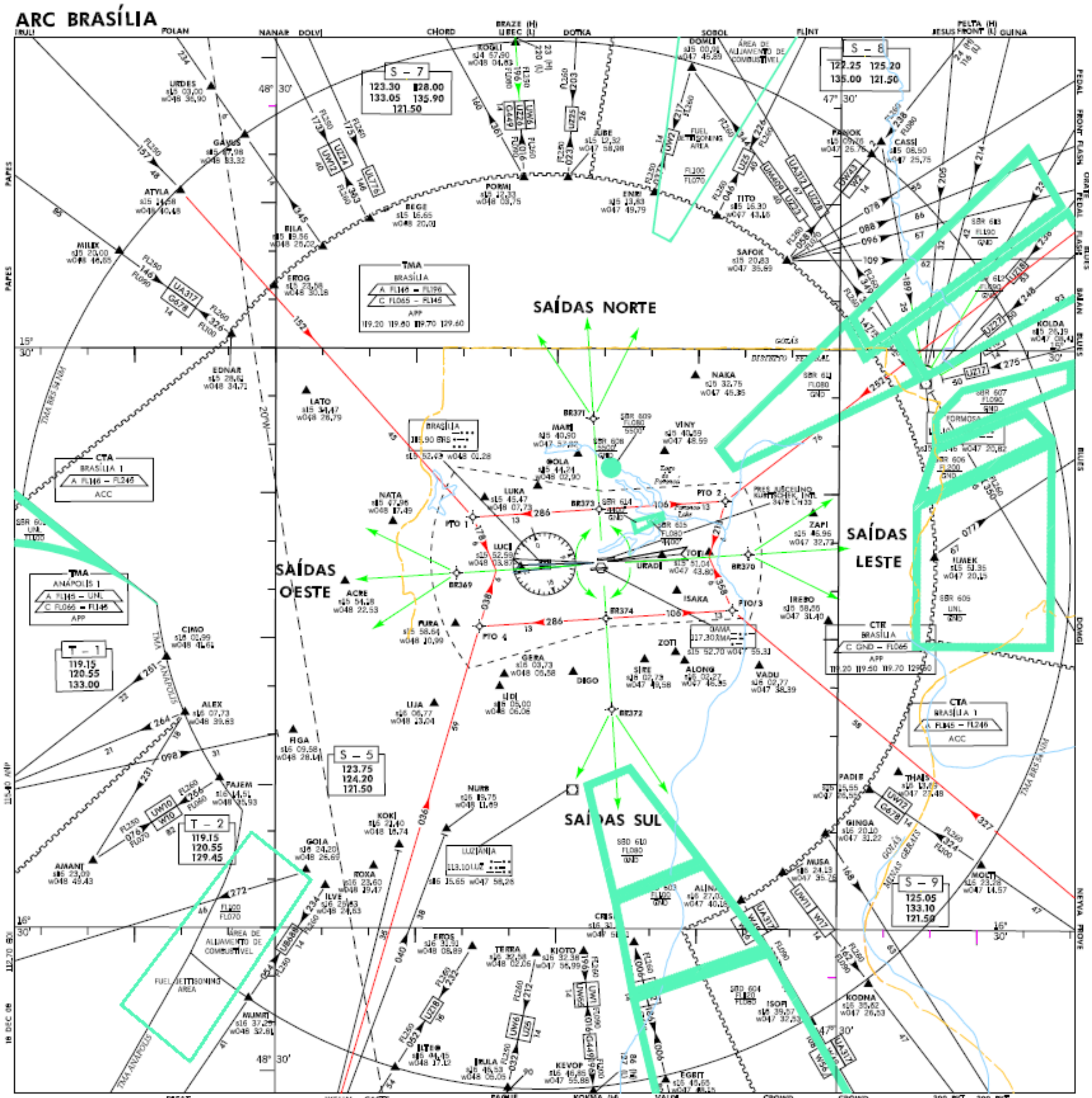
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO – COMAER – BRASIL

XX XXX 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.

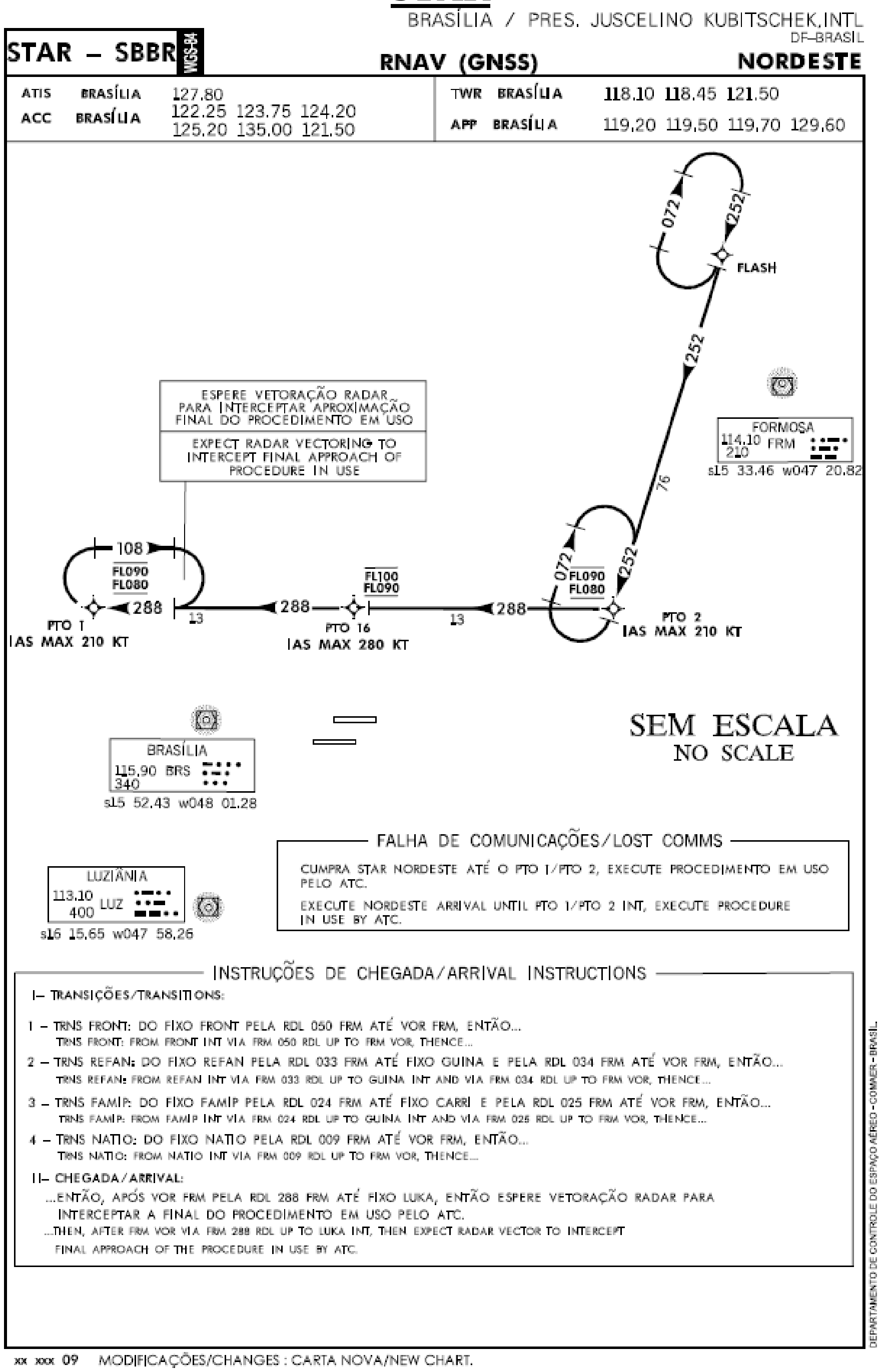

BRASÍLIA / PRES. JUSCELINO KUBITSCHEK, INTL
DF–BRASIL
STAR–SBBR
WGS-84
RNAV OU VOR/DME E NDB
VINY 2 – C2
ATIS BRASÍLIA 127.80
ACC BRASÍLIA 123.30 123.75 124.20 128.00 133.05 135.00 135.90 121.50
TWR BRASÍLIA 118,10 118,45 121,50
APP BRASÍLIA 119,20 119,50 119,70 129,60
POLAN s11 49.69 w050 53.16
NANAR s14 40.97 w048 39.11
CHORD s12 51.82 w049 23.97
NATIO s12 57.21 w047 51.35
CANA BRAVA 305 CNB
s13 32.62 w048 11.69
LIBAM s14 45.79 w048 32.08
SUEDE s14 51.37 w048 33.64
TERES s12 28.54 w051 22.09
URDES s15 03.00 w048 36.90
PAPES s14 29.48 w049 56.93
SEM ESCALA
NO SCALE
ATYLA s15 14.58 w048 40.49
LATO s15 34.47 w048 26.79
ESPERE VETORAÇÃO RADAR PARA INTERCEPTAR APROXIMAÇÃO FINAL DO PROCEDIMENTO EM USO
EXPECT RADAR VECTOR TO INTERCEPT FINAL APPROACH OF PROCEDURE IN USE
FORMOSA 114.10 210 FRM
s15 33.46 w047 20.82
NATA s15 47.96 w048 17.49
IAS MAX 210 KT
FL150
BUBA s15 42.91 w047 57.68
FL100
FL130
FL080
IAS MAX 190KT
VINY s15 40.59 w047 48.59
PTO 2
FL090
FL080
ANÁPOLIS 115.40 ANP
s16 15.65 w048 59.52
BRASÍLIA 115.90 340 BRS
s15 52.43 W048 01.28
COCHO 240 CH
S15 51.65 W047 53.12
LUZIANIA 113.10 400 LUZ
s16 15.65 w047 58.26
FALHA DE COMUNICAÇÕES/LOST COMMS
– CUMPRA STAR VINY 2 ATÉ O FIXO VINY, EXECUTE ÓRBITA EM VINY, ENTÃO CURVA A DIREITA HDG 201 PARA FIXO URADI E EXECUTE O PROCEDIMENTO EM USO PELO ATC.
– EXECUTE VINY 2 ARRIVAL UNTIL VINY INT, MAKE HOLDING PATTERN OVER VINY, THEN RIGHT TURN 201 HDG UP TO URADI INT AND EXECUTE THE PROCEDURE IN USE BY ATC.
INSTRUÇÕES DE CHEGADA: VIDE VERSO.
ARRIVAL INSTRUCTIONS: SEE REVERSE.
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO – COMAER – BRASIL
XX XXX 09 MODIFICAÇÕES/CHANGES: CARTA NOVA/NEW CHART.

Simulación en Tiempo Acelerado TMA Brasilia
Escenario 3

VISIÓN GENERAL



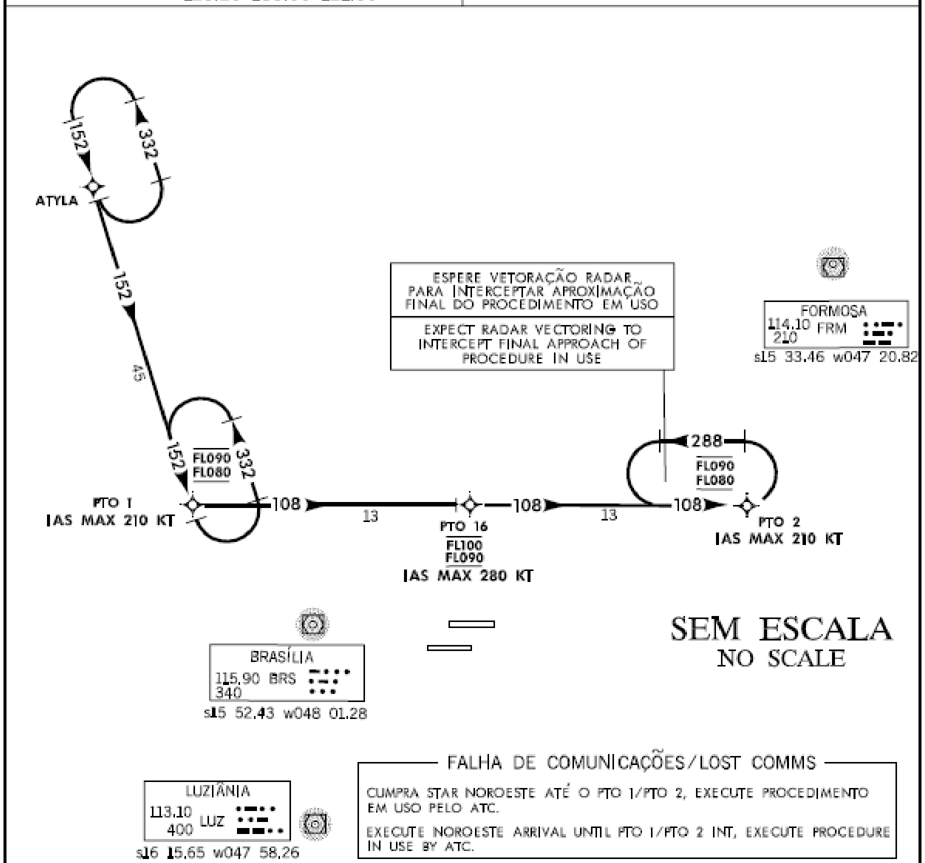
Simulación en Tiempo Acelerado TMA Brasilia
Escenario 3
STAR



BRASÍLIA / PRES. JUSCELINO KUBITSCHEK,INTL
DF–BRASIL

STAR – SBBR WGS-84 **RNAV (GNSS)** **NOROESTE**

ATIS	BRASÍLIA	127.80	TWR	BRASÍLIA	118.10 118.45 121.50
ACC	BRASÍLIA	122.25 123.75 124.20 125.20 135.00 121.50	APP	BRASÍLIA	119.20 119.50 119.70 129.60



FALHA DE COMUNICAÇÕES/LOST COMMS

CUMPRA STAR NOROESTE ATÉ O PTO 1/PTO 2, EXECUTE PROCEDIMENTO EM USO PELO ATC.

EXECUTE NOROESTE ARRIVAL UNTIL PTO 1/PTO 2 INT, EXECUTE PROCEDURE IN USE BY ATC.

INSTRUÇÕES DE CHEGADA/ARRIVAL INSTRUCTIONS

I– TRANSIÇÕES/TRANSITIONS:

1 – TRNS FRONT: DO FIXO FRONT PELA RDL 050 FRM ATÉ VOR FRM, ENTÃO...
TRNS FRONT: FROM FRONT INT VIA FRM 050 RDL UP TO FRM VOR, THENCE...

2 – TRNS REFAN: DO FIXO REFAN PELA RDL 033 FRM ATÉ FIXO GUINA E PELA RDL 034 FRM ATÉ VOR FRM, ENTÃO...
TRNS REFAN: FROM REFAN INT VIA FRM 033 RDL UP TO GUINA INT AND VIA FRM 034 RDL UP TO FRM VOR, THENCE...

3 – TRNS FAMIP: DO FIXO FAMIP PELA RDL 024 FRM ATÉ FIXO CARRI E PELA RDL 025 FRM ATÉ VOR FRM, ENTÃO...
TRNS FAMIP: FROM FAMIP INT VIA FRM 024 RDL UP TO GUINA INT AND VIA FRM 025 RDL UP TO FRM VOR, THENCE...

4 – TRNS NATIO: DO FIXO NATIO PELA RDL 009 FRM ATÉ VOR FRM, ENTÃO...
TRNS NATIO: FROM NATIO INT VIA FRM 009 RDL UP TO FRM VOR, THENCE...

II– CHEGADA/ARRIVAL:

...ENTÃO, APÓS VOR FRM PELA RDL 288 FRM ATÉ FIXO LUKA, ENTÃO ESPERE VETORAÇÃO RADAR PARA INTERCEPTAR A FINAL DO PROCEDIMENTO EM USO PELO ATC.

...THEN, AFTER FRM VOR VIA FRM 288 RDL UP TO LUKA INT, THEN EXPECT RADAR VECTOR TO INTERCEPT FINAL APPROACH OF THE PROCEDURE IN USE BY ATC.

DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO –COMAER–BRASIL

xx xxx 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.

BRASÍLIA / PRES. JUSCELINO KUBITSCHEK,INTL
DF–BRASIL

STAR – SBBR WGS-84 **RNAV (GNSS)** **SUDESTE**

ATIS	BRASÍLIA	127.80	TWR	BRASÍLIA	118.10 118.45 121.50
ACC	BRASÍLIA	122.25 123.75 124.20 125.20 135.00 121.50	APP	BRASÍLIA	119.20 119.50 119.70 129.60

INSTRUÇÕES DE CHEGADA/ARRIVAL INSTRUCTIONS

I– TRANSIÇÕES/TRANSITIONS:

1 – TRNS FRONT: DO FIXO FRONT PELA RDL 050 FRM ATÉ VOR FRM, ENTÃO...
TRNS FRONT: FROM FRONT INT VIA FRM 050 RDL UP TO FRM VOR, THENCE...

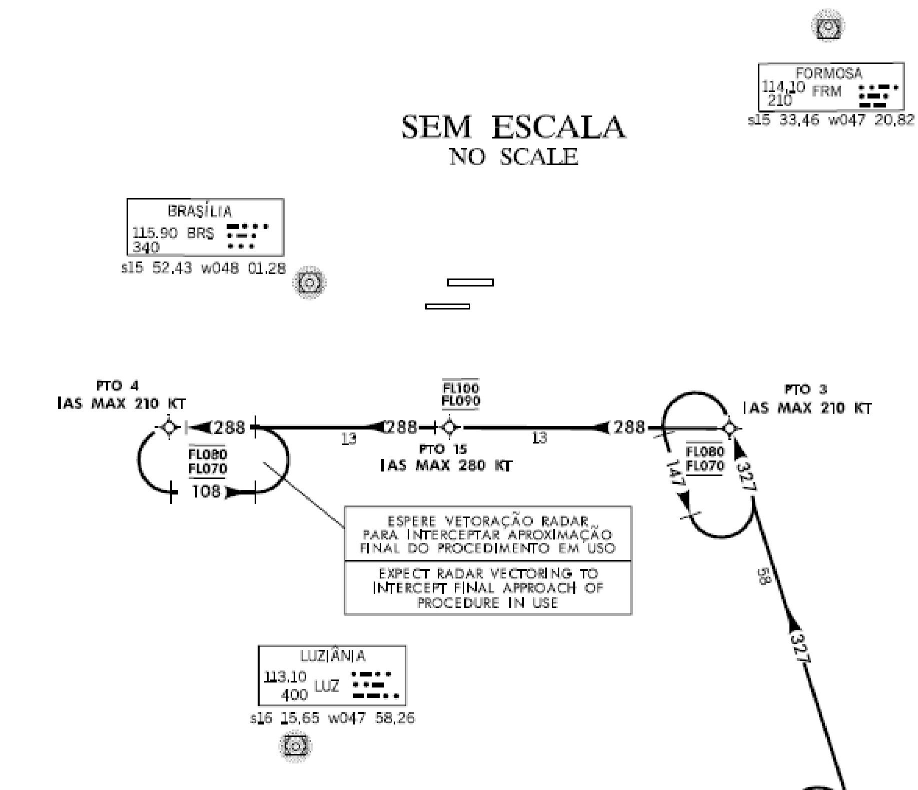
2 – TRNS REFAN: DO FIXO REFAN PELA RDL 033 FRM ATÉ FIXO GUINA E PELA RDL 034 FRM ATÉ VOR FRM, ENTÃO...
TRNS REFAN: FROM REFAN INT VIA FRM 033 RDL UP TO GUINA INT AND VIA FRM 034 RDL UP TO FRM VOR, THENCE...

3 – TRNS FAMIP: DO FIXO FAMIP PELA RDL 024 FRM ATÉ FIXO CARRI E PELA RDL 025 FRM ATÉ VOR FRM, ENTÃO...
TRNS FAMIP: FROM FAMIP INT VIA FRM 024 RDL UP TO GUINA INT AND VIA FRM 025 RDL UP TO FRM VOR, THENCE...

4 – TRNS NATIO: DO FIXO NATIO PELA RDL 009 FRM ATÉ VOR FRM, ENTÃO...
TRNS NATIO: FROM NATIO INT VIA FRM 009 RDL UP TO FRM VOR, THENCE...

II– CHEGADA/ARRIVAL:

...ENTÃO, APÓS VOR FRM PELA RDL 288 FRM ATÉ FIXO LUKA, ENTÃO ESPERE VETORAÇÃO RADAR PARA INTERCEPTAR A FINAL DO PROCEDIMENTO EM USO PELO ATC.
...THEN, AFTER FRM VOR VIA FRM 288 RDL UP TO LUKA INT, THEN EXPECT RADAR VECTOR TO INTERCEPT FINAL APPROACH OF THE PROCEDURE IN USE BY ATC.



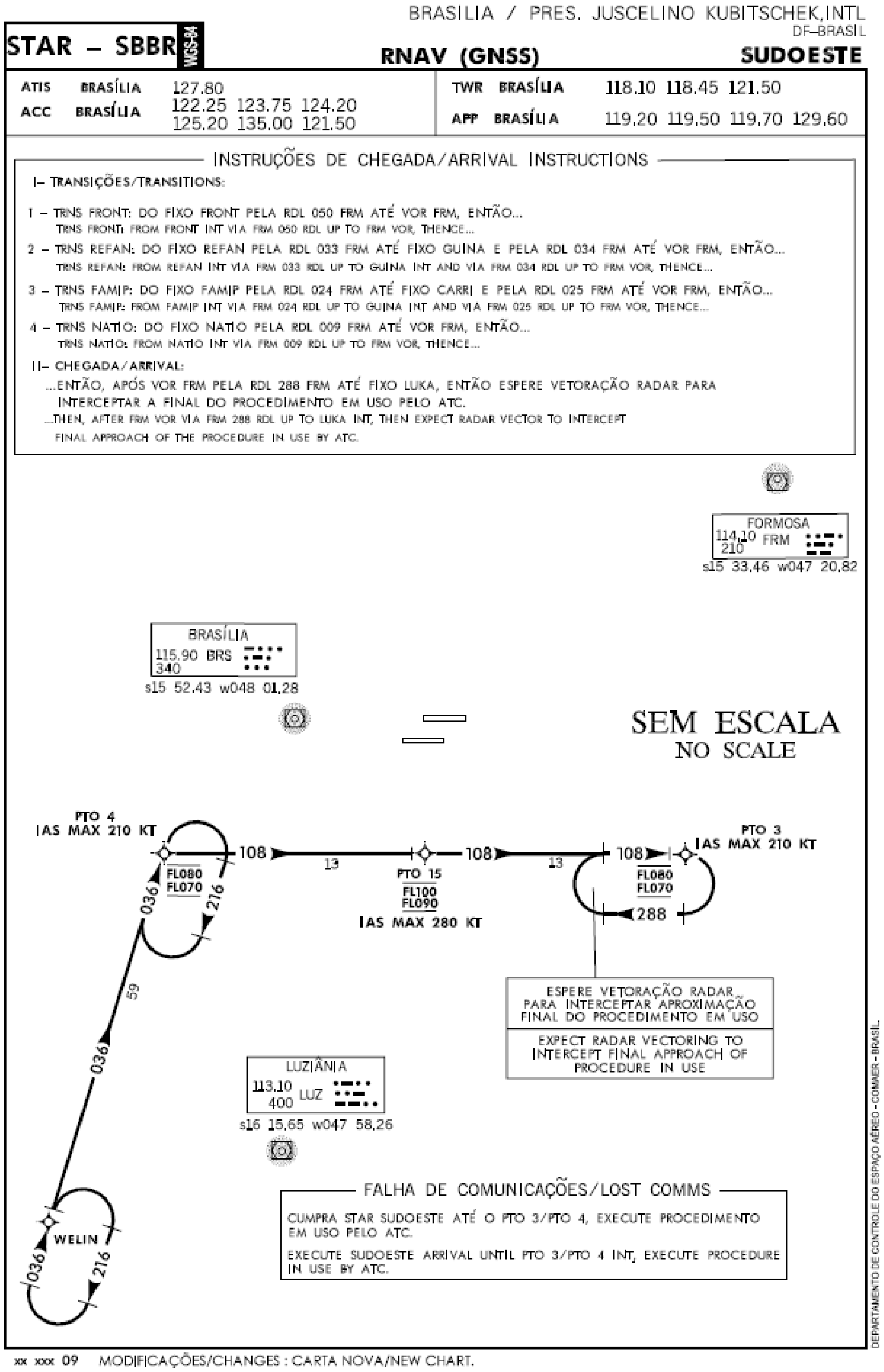
FALHA DE COMUNICAÇÕES/LOST COMMS

CUMPRA STAR SUDESTE ATÉ O PTO 3/PTO 4, EXECUTE PROCEDIMENTO EM USO PELO ATC.

EXECUTE SUDESTE ARRIVAL UNTIL PTO 3/PTO 4 INT, EXECUTE PROCEDURE IN USE BY ATC.

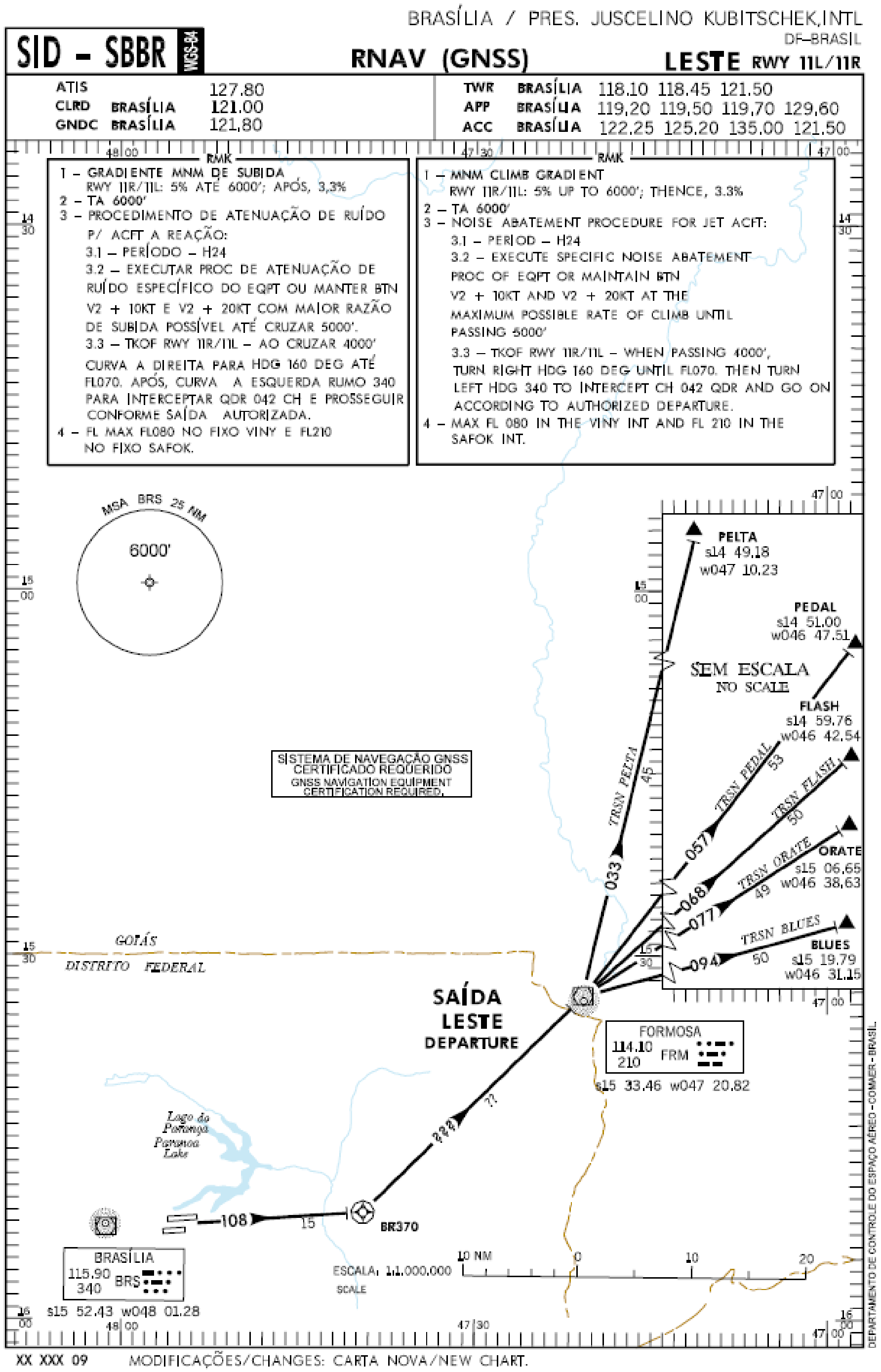
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO – COMAER – BRASIL

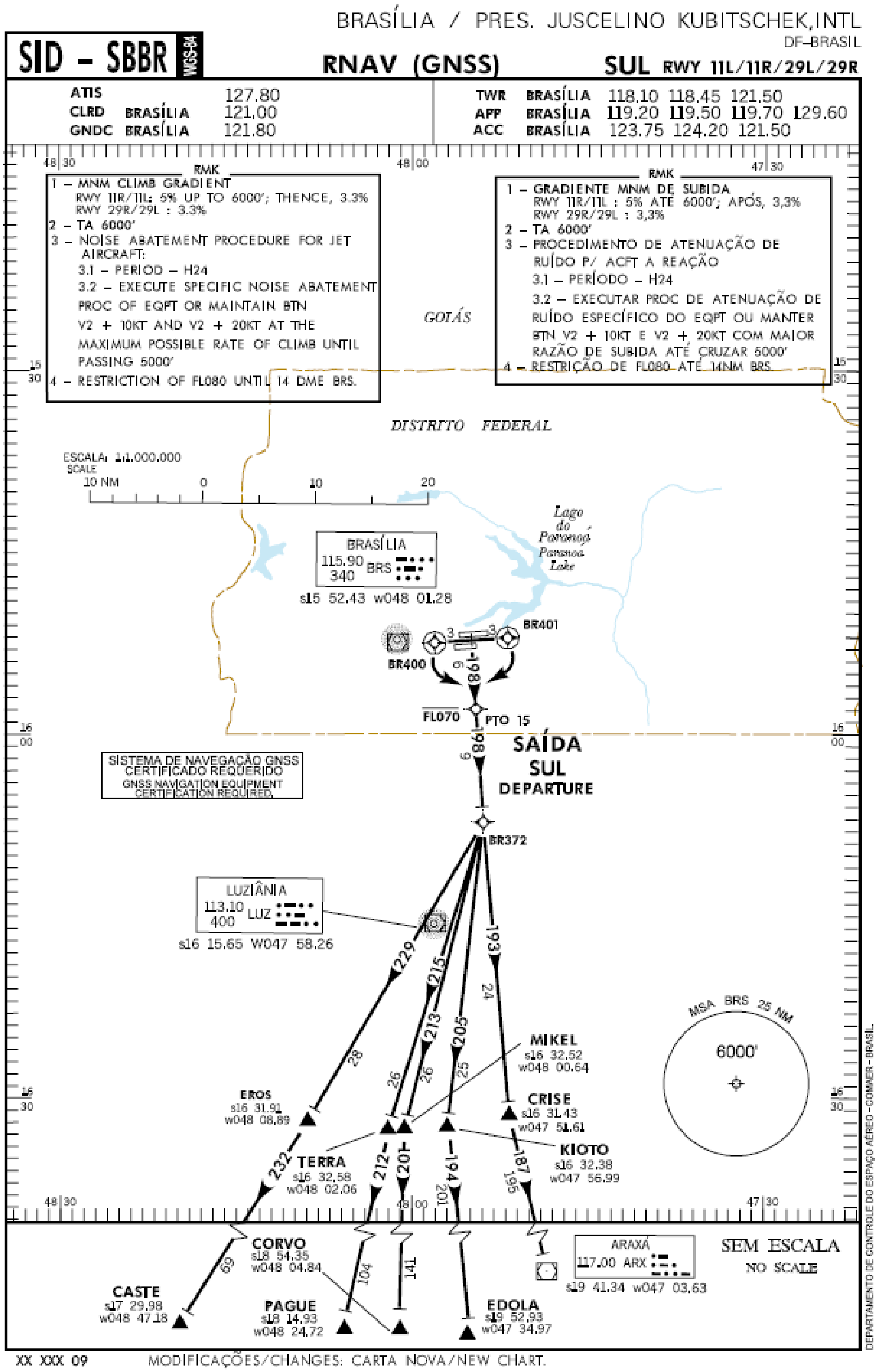
xx xxx 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.



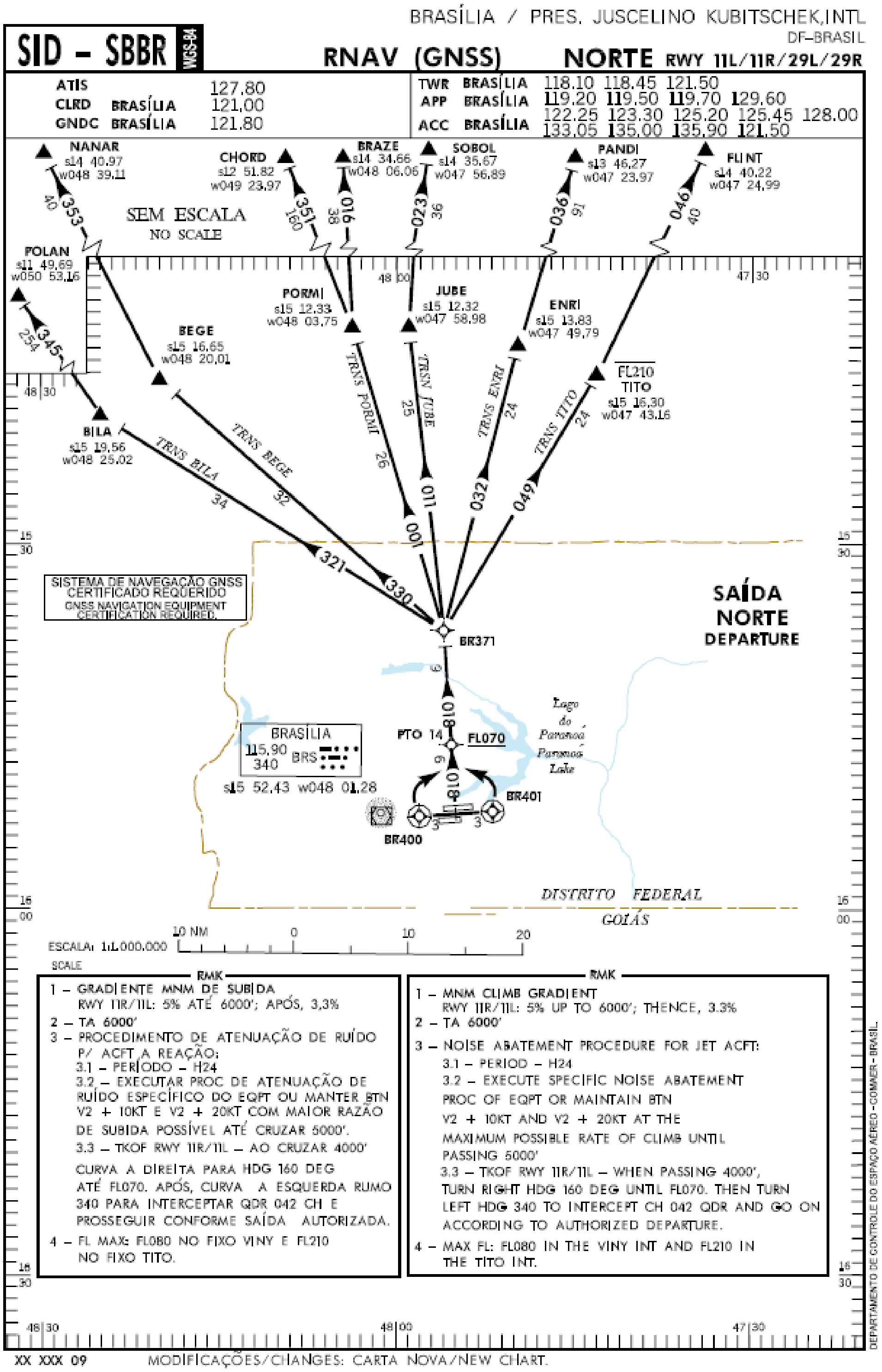
xx xxx 09 MODIFICAÇÕES/CHANGES : CARTA NOVA/NEW CHART.

Simulación en Tiempo Acelerado TMA Brasilia
Escenario 3
SID

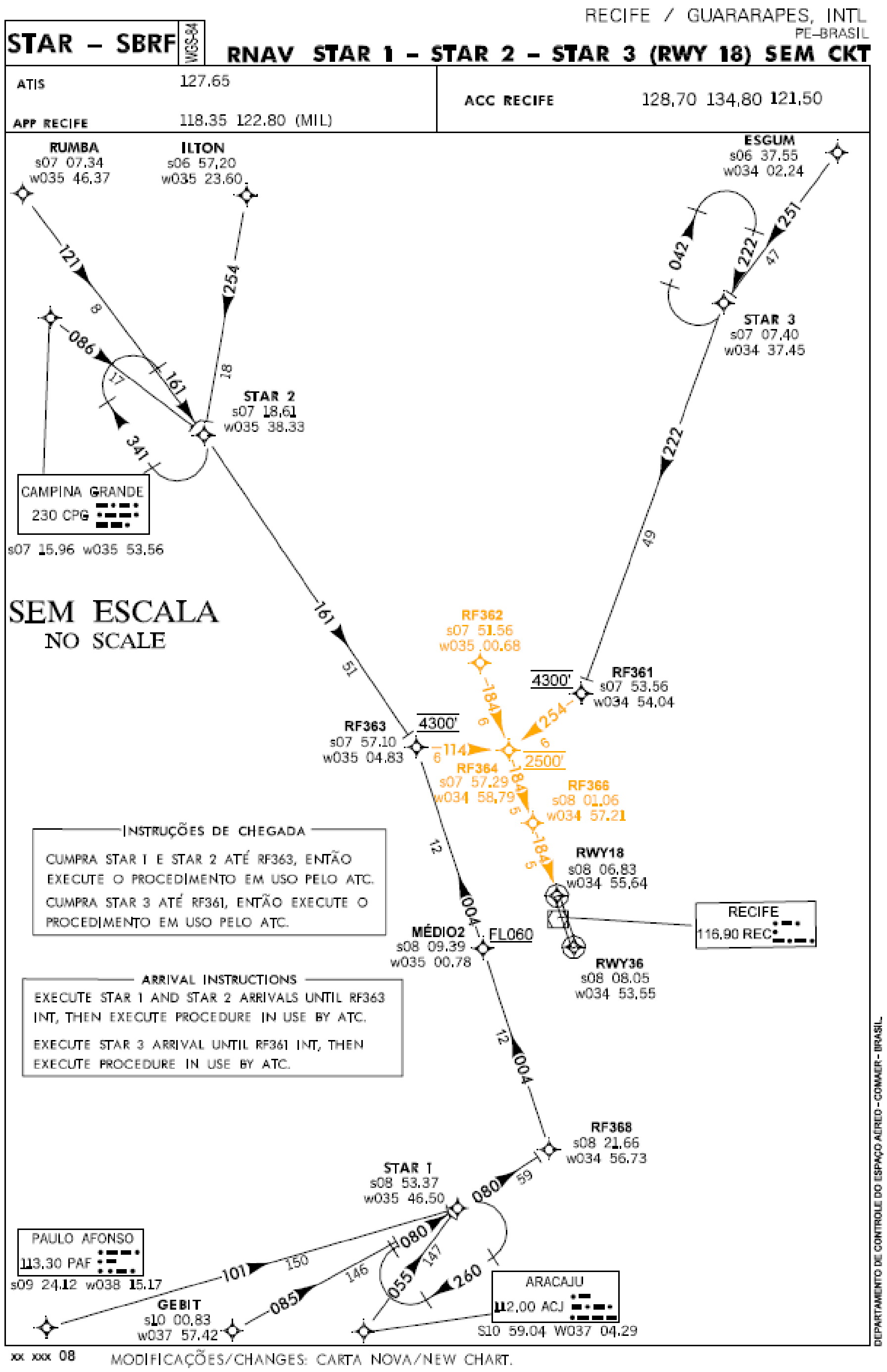


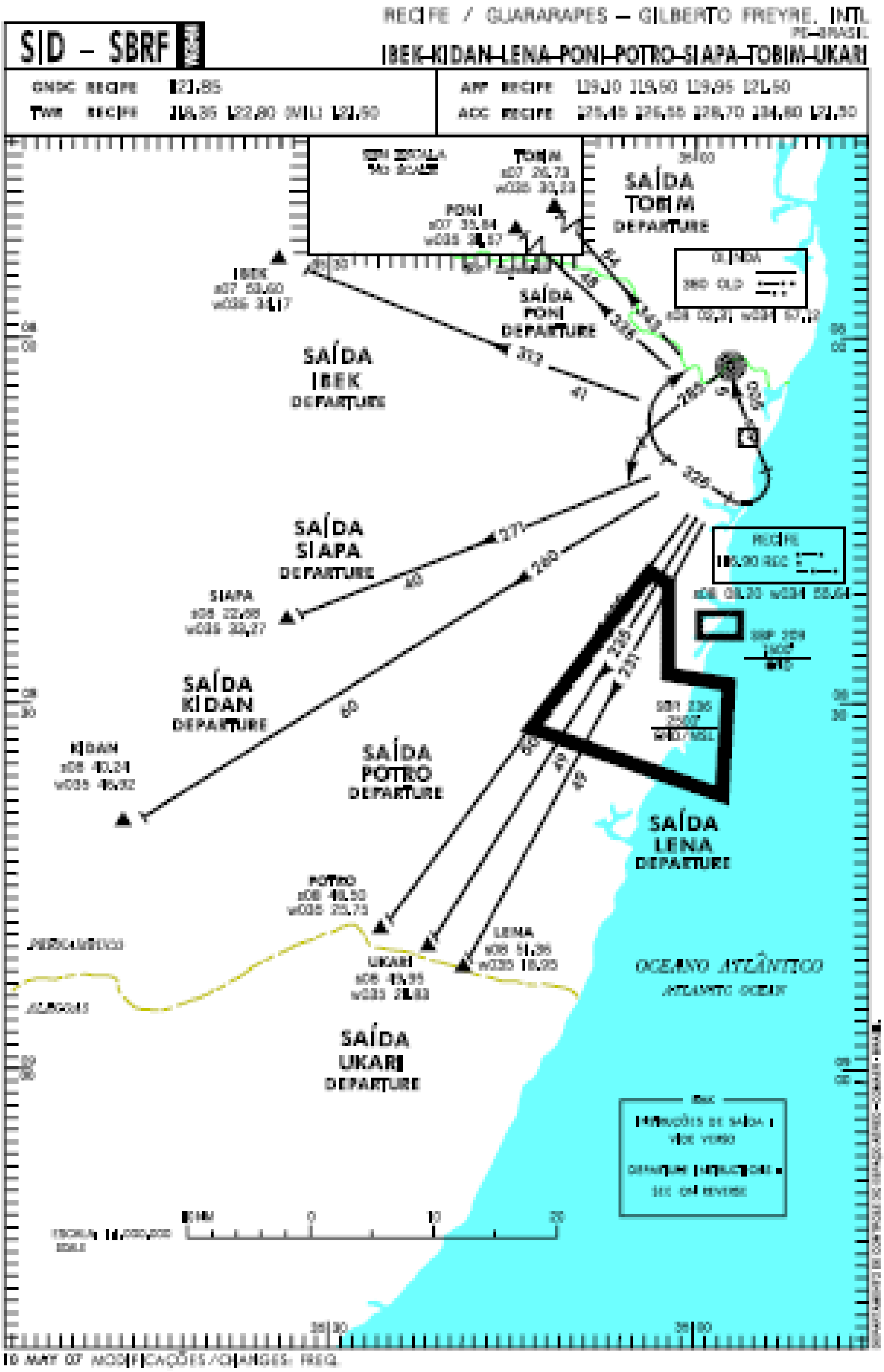


BRASÍLIA / PRES. JUSCELINO KUBITSCHEK,INTL
DF–BRASIL
SID – SBBR
WGS-84
RNAV (GNSS)
SUL RWY 11L/11R/29L/29R
ATIS 127.80
CLRD BRASÍLIA 121.00
GNDC BRASÍLIA 121.80
TWR BRASÍLIA 118.10 118.45 121.50
APP BRASÍLIA 119.20 119.50 119.70 129.60
ACC BRASÍLIA 123.75 124.20 121.50
RMK
1 – MNM CLIMB GRADIENT
RWY 11R/11L: 5% UP TO 6000'; THENCE, 3.3%
RWY 29R/29L : 3.3%
2 – TA 6000'
3 – NOISE ABATEMENT PROCEDURE FOR JET AIRCRAFT:
3.1 – PERIOD – H24
3.2 – EXECUTE SPECIFIC NOISE ABATEMENT PROC OF EQPT OR MAINTAIN BTN V2 + 10KT AND V2 + 20KT AT THE MAXIMUM POSSIBLE RATE OF CLIMB UNTIL PASSING 5000'
4 – RESTRICTION OF FL080 UNTIL 14 DME BRS.
RMK
1 – GRADIENTE MNM DE SUBIDA
RWY 11R/11L : 5% ATÉ 6000'; APÓS, 3,3%
RWY 29R/29L : 3,3%
2 – TA 6000'
3 – PROCEDIMENTO DE ATENUAÇÃO DE RUÍDO P/ ACFT A REAÇÃO
3.1 – PERÍODO – H24
3.2 – EXECUTAR PROC DE ATENUAÇÃO DE RUÍDO ESPECÍFICO DO EQPT OU MANTER BTN V2 + 10KT E V2 + 20KT COM MAIOR RAZÃO DE SUBIDA ATÉ CRUZAR 5000'
4 – RESTRIÇÃO DE FL080 ATÉ 14NM BRS.
GOIÁS
DISTRITO FEDERAL
ESCALA: 1:1.000.000
SCALE
10 NM 0 10 20
Lago do Paranoá
Paranoá Lake
BRASÍLIA
115.90 BRS
340
s15 52.43 w048 01.28
BR401
BR400
198
FL070
PTO 15
SAÍDA
SUL
DEPARTURE
SISTEMA DE NAVEGAÇÃO GNSS CERTIFICADO REQUERIDO
GNSS NAVIGATION EQUIPMENT CERTIFICATION REQUIRED
BR372
LUZIÂNIA
113.10 LUZ
400
s16 15.65 W047 58.26
229
215
213
205
193
MSA BRS 25 NM
6000'
MIKEL
s16 32.52
w048 00.64
EROS
s16 31.91
w048 08.89
CRISE
s16 31.43
w047 51.61
KIOTO
s16 32.38
w047 56.99
TERRA
s16 32.58
w048 02.06
232
212
201
194
187
CORVO
s18 54.35
w048 04.84
CASTE
s17 29.98
w048 47.18
PAGUE
s18 14.93
w048 24.72
EDOLA
s19 52.93
w047 34.97
ARAXÁ
117.00 ARX
s19 41.34 w047 03.63
SEM ESCALA
NO SCALE
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO – COMAER – BRASIL
XX XXX 09
MODIFICAÇÕES/CHANGES: CARTA NOVA/NEW CHART.

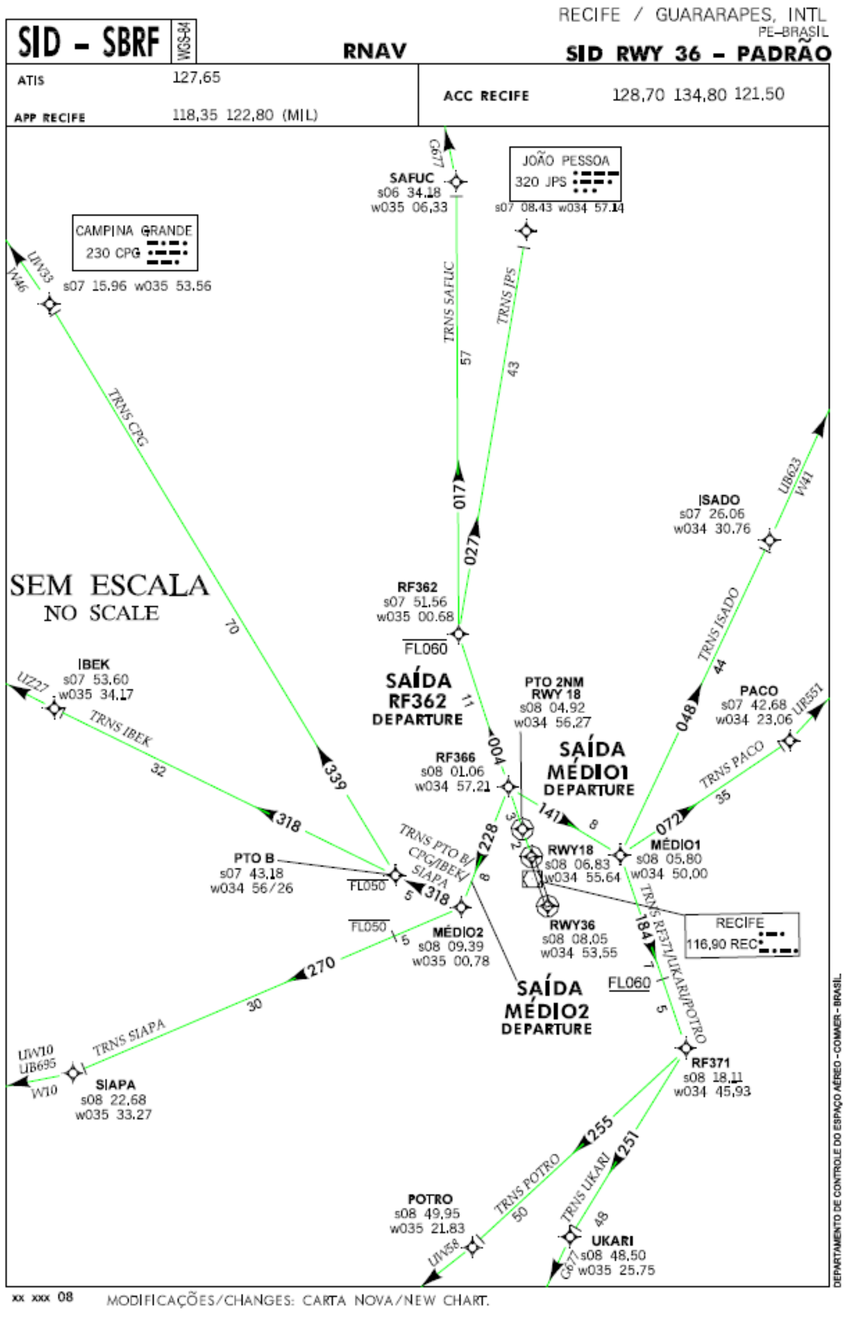

BRASÍLIA / PRES. JUSCELINO KUBITSCHEK,INTL
DF–BRASIL
SID – SBBR
WGS-84
RNAV (GNSS)
NORTE RWY 11L/11R/29L/29R
ATIS 127.80
CLRD BRASÍLIA 121.00
GNDC BRASÍLIA 121.80
TWR BRASÍLIA 118.10 118.45 121.50
APP BRASÍLIA 119.20 119.50 119.70 129.60
ACC BRASÍLIA 122.25 123.30 125.20 125.45 128.00 133.05 135.00 135.90 121.50
NANAR s14 40.97 w048 39.11
CHORD s12 51.82 w049 23.97
BRAZE s14 34.66 w048 06.06
SOBOL s14 35.67 w047 56.89
PANDI s13 46.27 w047 23.97
FLINT s14 40.22 w047 24.99
SEM ESCALA
NO SCALE
FOLAN s11 49.69 w050 53.16
PORMI s15 12.33 w048 03.75
JUBE s15 12.32 w047 58.98
ENRI s15 13.83 w047 49.79
BEGE s15 16.65 w048 20.01
FL210 TITO s15 16.30 w047 43.16
BILA s15 19.56 w048 25.02
TRNS BILA
TRNS BEGE
TRNS PORMI
TRSN JUBE
TRNS ENRI
TRNS TITO
SISTEMA DE NAVEGAÇÃO GNSS CERTIFICADO REQUERIDO
GNSS NAVIGATION EQUIPMENT CERTIFICATION REQUIRED.
SAÍDA NORTE DEPARTURE
BR371
PTO 14 FL070
BR401
BR400
BRASÍLIA 115.90 BRS 340
s15 52.43 w048 01.28
Lago do Paranoá
Paranoá Lake
DISTRITO FEDERAL
GOIÁS
ESCALA: 1:1.000.000
SCALE
10 NM 0 10 20
RMK
1 – GRADIENTE MNM DE SUBIDA
RWY 11R/11L: 5% ATÉ 6000'; APÓS, 3,3%
2 – TA 6000'
3 – PROCEDIMENTO DE ATENUAÇÃO DE RUÍDO P/ ACFT A REAÇÃO:
3.1 – PERÍODO – H24
3.2 – EXECUTAR PROC DE ATENUAÇÃO DE RUÍDO ESPECÍFICO DO EQPT OU MANTER BTN V2 + 10KT E V2 + 20KT COM MAIOR RAZÃO DE SUBIDA POSSÍVEL ATÉ CRUZAR 5000'.
3.3 – TKOF RWY 11R/11L – AO CRUZAR 4000' CURVA A DIREITA PARA HDG 160 DEG ATÉ FL070. APÓS, CURVA A ESQUERDA RUMO 340 PARA INTERCEPTAR QDR 042 CH E PROSSEGUIR CONFORME SAÍDA AUTORIZADA.
4 – FL MAX: FL080 NO FIXO VINY E FL210 NO FIXO TITO.
RMK
1 – MNM CLIMB GRADIENT
RWY 11R/11L: 5% UP TO 6000'; THENCE, 3.3%
2 – TA 6000'
3 – NOISE ABATEMENT PROCEDURE FOR JET ACFT:
3.1 – PERIOD – H24
3.2 – EXECUTE SPECIFIC NOISE ABATEMENT PROC OF EQPT OR MAINTAIN BTN V2 + 10KT AND V2 + 20KT AT THE MAXIMUM POSSIBLE RATE OF CLIMB UNTIL PASSING 5000'
3.3 – TKOF RWY 11R/11L – WHEN PASSING 4000', TURN RIGHT HDG 160 DEG UNTIL FL070. THEN TURN LEFT HDG 340 TO INTERCEPT CH 042 QDR AND GO ON ACCORDING TO AUTHORIZED DEPARTURE.
4 – MAX FL: FL080 IN THE VINY INT AND FL210 IN THE TITO INT.
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO - COMAER - BRASIL
XX XXX 09
MODIFICAÇÕES/CHANGES: CARTA NOVA/NEW CHART.

Simulación en Tiempo Acelerado TMA Recife
Escenario 2




RECIFE / GUARARAPES – GILBERTO FREYRE, INTL
SID – SBRF
IBEK-KIDAN-LENA-PONI-POTRO-SIAPA-TOBIM-UKARI
SAÍDA TOBIM DEPARTURE
SAÍDA PONI DEPARTURE
SAÍDA IBEK DEPARTURE
SAÍDA SIAPA DEPARTURE
SAÍDA KIDAN DEPARTURE
SAÍDA POTRO DEPARTURE
SAÍDA LENA DEPARTURE
SAÍDA UKARI DEPARTURE
OCEANO ATLÂNTICO
ATLANTIC OCEAN
10 MAY 07 MODIFICAÇÕES/CHANGES: FREQ.

Simulación en Tiempo Acelerado TMA Recife
Escenario 3



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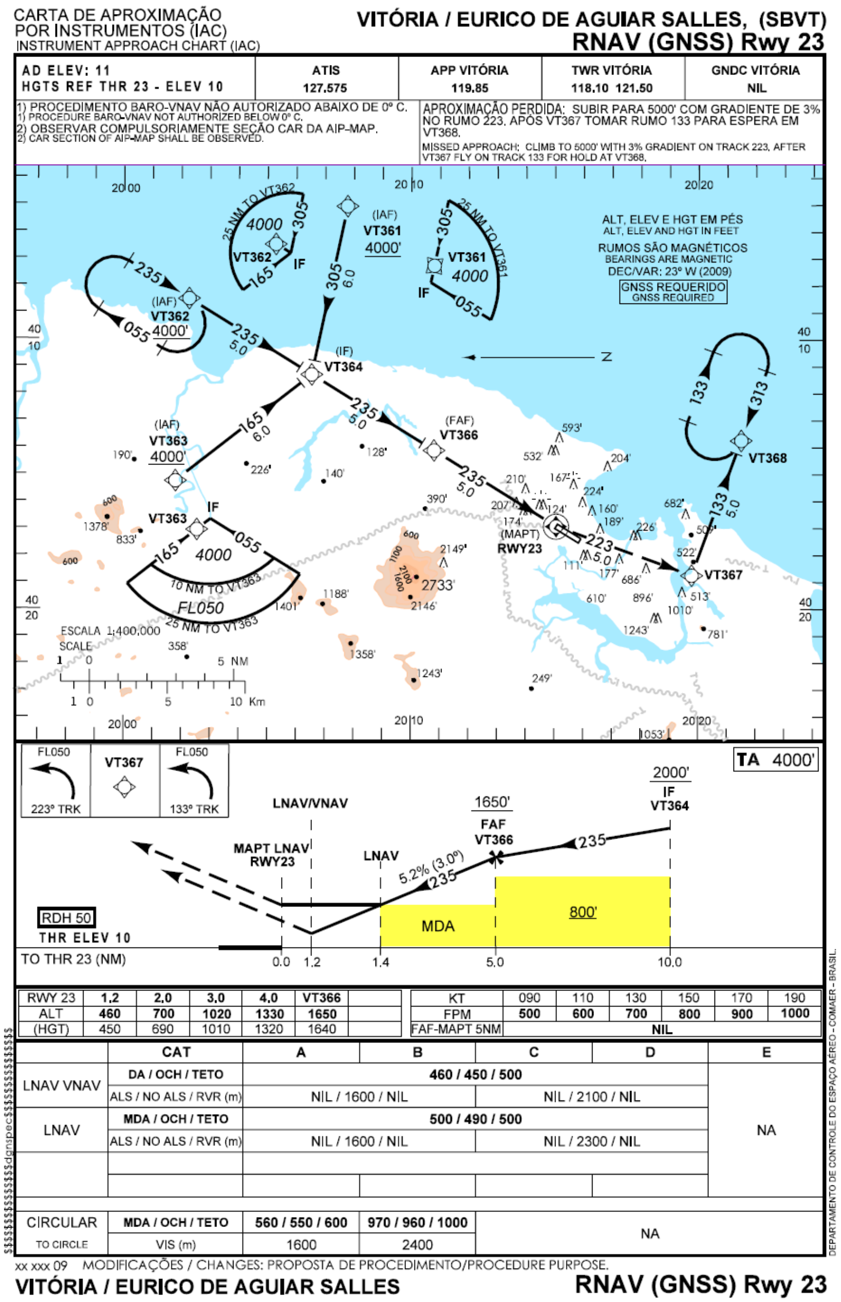
APENDICE D

EJEMPLOS DE PROCEDIMIENTOS RNP APCH CON BARO-VNAV Y SALIDAS RNAV (GNSS)

RNP APCH con Baro-VNAV



CARTA DE APROXIMAÇÃO POR INSTRUMENTOS (IAC)
INSTRUMENT APPROACH CHART (IAC)

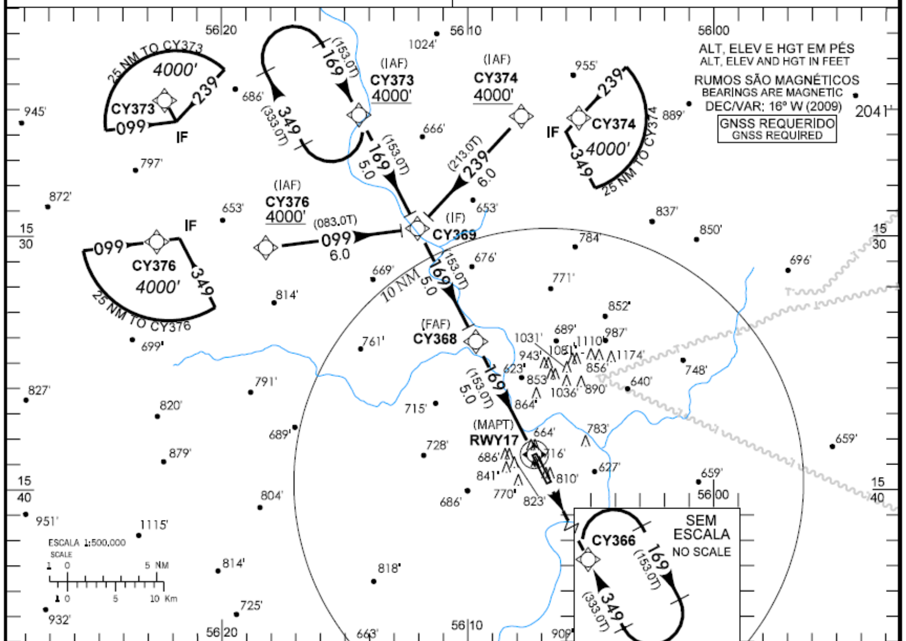
CUIABÁ / MARECHAL RONDON, INTL (SBCY)
RNAV (GNSS) Rwy 17

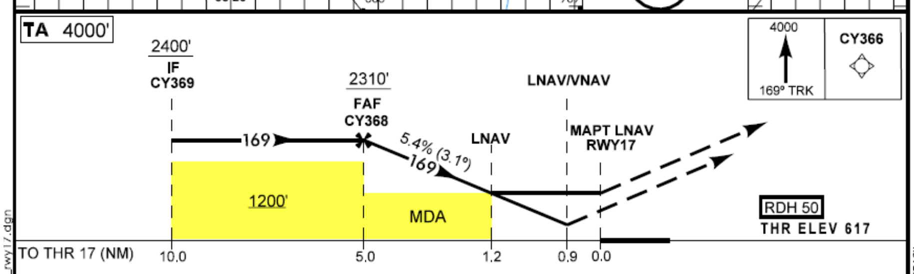
AD ELEV: 617 HGTS REF THR 35 - ELEV 617	ATIS	APP CUIABÁ	TWR CUIABÁ	GNDC CUIABÁ
	NIL	119.40 120.35 121.50	118.10 121.50	NIL

1) PROCEDIMENTO BARO-VNAV NÃO AUTORIZADO ABAIXO DE 0º C.
1) PROCEDURE BARO-VNAV NOT AUTHORIZED BELOW 0º C.
2) OBSERVAR COMPULSORIAMENTE SEÇÃO CAR DA AIP-MAP.
2) CAR SECTION OF AIP-MAP SHALL BE OBSERVED.

APROXIMAÇÃO PERDIDA: SUBIR PARA 4000' NO RUMO 169 PARA ESPERA EM CY366.

MISSED APPROACH: CLIMB TO 4000' HEADING 169 FOR HOLDING AT CY366.





RWY 17	0,9	1,0	2,0	3,0	4,0	CY368	KT	090	110	130	150	170	190
ALT	957	1000	1320	1650	1980	2310	FPM	500	600	750	850	950	1050
(HGT)	340	383	703	1033	1363	1693	FAF-MAPT 5NM	NIL					

	CAT	A	B	C	D	E
LNAV VNAV	DA / OCH / TETO	957 / 340 / 400				
	ALS / NO ALS / RVR (m)	NIL / 1600 / NIL				
LNAV	MDA / OCH / TETO	1030 / 413 / 500				
	ALS / NO ALS / RVR (m)	NIL / 1600 / NIL		NIL / 1900 / NIL		
CIRCULAR TO CIRCLE	MDA / OCH / TETO VIS (m)	NA				

z:\aip-map\map_icao\cuiaba\bcy_barovnav_gnss_rwy17.dgn

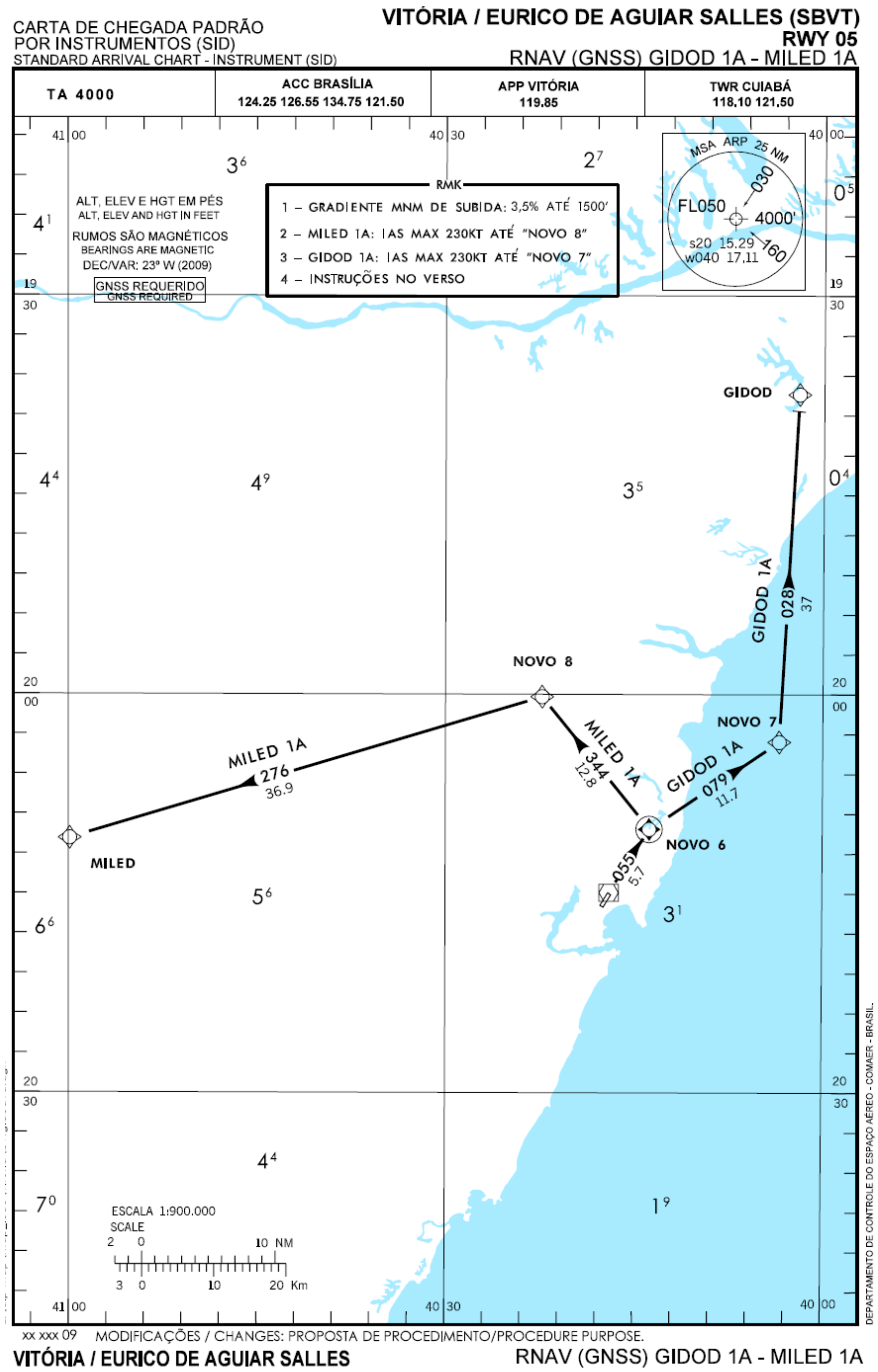
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO - COMAER - BRASIL.

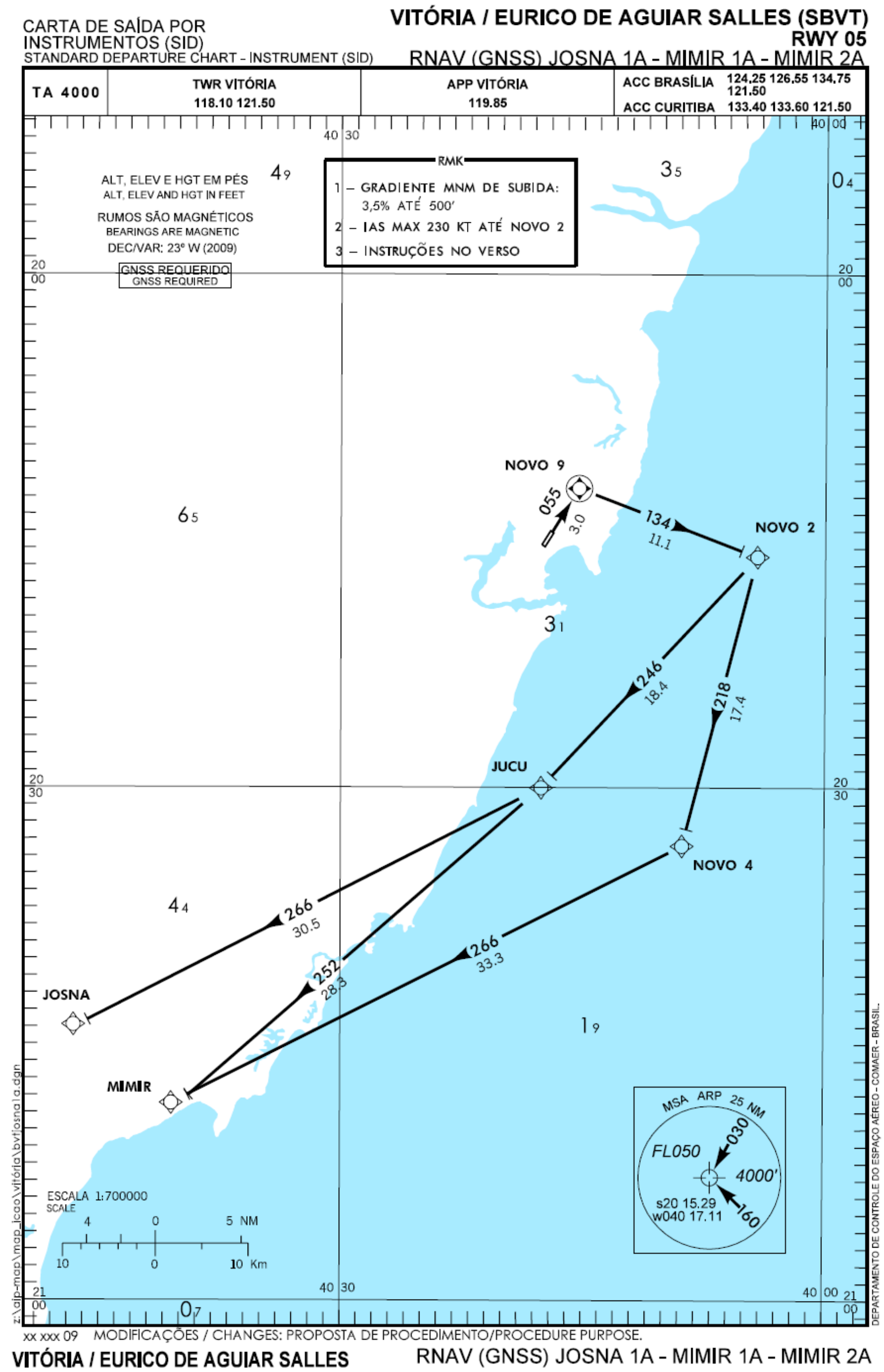
xx xxx 09 MODIFICAÇÕES / CHANGES: CARTA NOVA/NEW CHART.

CUIABÁ / MARECHAL RONDON, INTL

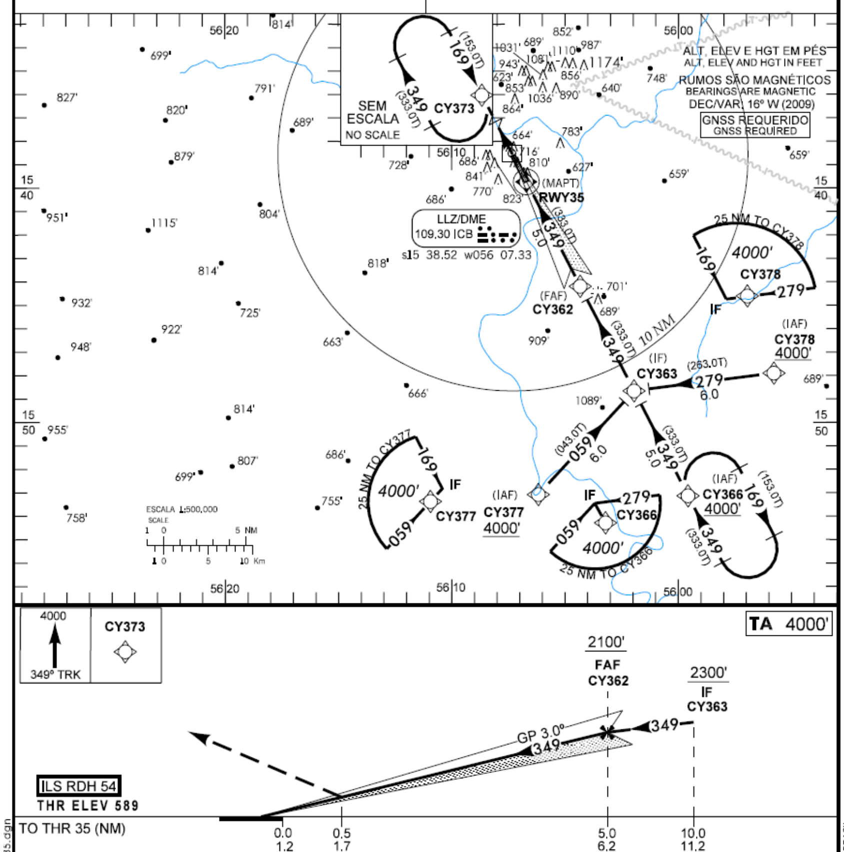
RNAV (GNSS) RWY 17

Procedimientos de Salida IFR RNAV (GNSS)




CARTA DE SAÍDA POR INSTRUMENTOS (SID)
STANDARD DEPARTURE CHART - INSTRUMENT (SID)
VITÓRIA / EURICO DE AGUIAR SALLES (SBVT)
RWY 05
RNAV (GNSS) JOSNA 1A - MIMIR 1A - MIMIR 2A
TA 4000
TWR VITÓRIA 118.10 121.50
APP VITÓRIA 119.85
ACC BRASÍLIA 124.25 126.55 134.75 121.50
ACC CURITIBA 133.40 133.60 121.50
ALT, ELEV E HGT EM PÉS
ALT, ELEV AND HGT IN FEET
RUMOS SÃO MAGNÉTICOS
BEARINGS ARE MAGNETIC
DEC/VAR: 23° W (2009)
GNSS REQUERIDO
GNSS REQUIRED
RMK
1 - GRADIENTE MNM DE SUBIDA: 3,5% ATÉ 500'
2 - IAS MAX 230 KT ATÉ NOVO 2
3 - INSTRUÇÕES NO VERSO
NOVO 9
055
3.0
134
11.1
NOVO 2
246
18.4
218
17.4
JUCU
NOVO 4
266
30.5
252
28.3
266
33.3
JOSNA
MIMIR
MSA ARP 25 NM
FL050
030
4000'
160
s20 15.29
w040 17.11
ESCALA 1:700000
SCALE
5 NM
10 Km
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO - COMAER - BRASIL
xx xxx 09 MODIFICAÇÕES / CHANGES: PROPOSTA DE PROCEDIMENTO/PROCEDURE PURPOSE.
VITÓRIA / EURICO DE AGUIAR SALLES
RNAV (GNSS) JOSNA 1A - MIMIR 1A - MIMIR 2A

Procedimientos de Aproximación RNAV (GNSS) – ILS



CARTA DE APROXIMAÇÃO POR INSTRUMENTOS (IAC)
INSTRUMENT APPROACH CHART (IAC)

CUIABÁ / MARECHAL RONDON, INTL (SBCY)
ILS x Rwy 35

AD ELEV: 617 HGTS REF THR 35 - ELEV 589	ATIS	APP CUIABÁ	TWR CUIABÁ	GNDC CUIABÁ
	NIL	119.40 120.35 121.50	118.10 121.50	NIL

1) OBSERVAR COMPULSORIAMENTE SEÇÃO CAR DA AIP-MAP.
1) CAR SECTION OF AIP-MAP SHALL BE OBSERVED.

APROXIMAÇÃO PERDIDA: SUBIR PARA 4000' NO RUMO 349 PARA ESPERA EM CY373.

MISSED APPROACH: CLIMB TO 4000' HEADING 349 FOR HOLDING AT CY373.

DME ICB	1.7	2.0	3.0	4.0	5.0	CY378
ALT	789	870	1190	1510	1830	2100
(HGT)	200	281	601	921	1241	1511

KT	090	110	130	150	170	190
FPM	450	550	650	750	850	950
FAF-MAPT 5NM	NIL					

	CAT	A	B	C	D	E
CAT I	DA / OCH / TETO	789 / 200 / 200				
	ALS / NO ALS / RVR (m)	800 / 1200 / NIL				
CIRCULAR TO CIRCLE	MDA / OCH / TETO VIS (m)	NA				

xx xxx 09 MODIFICAÇÕES / CHANGES: CARTA NOVA/NEW CHART.

CUIABÁ / MARECHAL RONDON, INTL **ILS x Rwy 35**

z:\aip-map\map_icao\cuiaba\bcy_ils_x_rnav_rwy35.dgn

DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO - COMAER - BRASIL.

- - - - - -

BRASIL
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO
DIVISÃO DE GERENCIAMENTO DE NAVEGAÇÃO AÉREA
AV GENERAL JUSTO, 160 – 2º AND. - CASTELO
20021-130-RIO DE JANEIRO – RJ

TEL: 021 3814-8237 AFTN: SBRJYNYI ADM: PAME FAX: 021 2101-6252 TELEX: 2137113 COMAER BR

AIC
A
08/09
09 ABR 2009

SISTEMA GLOBAL DE NAVEGAÇÃO POR SATÉLITES - GNSS

1 DISPOSIÇÕES PRELIMINARES

1.1 FINALIDADE

A presente Circular de Informações Aeronáuticas - AIC tem por finalidade estabelecer os critérios para utilização do Sistema Global de Navegação por Satélites – GNSS no espaço aéreo brasileiro.

1.2 ÂMBITO

As disposições estabelecidas nesta AIC aplicam-se a todos aqueles que, no decorrer de suas atividades, venham a utilizar o GNSS como meio de navegação aérea primário.

2 DISPOSIÇÕES GERAIS

2.1 A 10ª Conferência de Navegação Aérea, da Organização de Aviação Civil Internacional - OACI, realizada em 1991, endossou a concepção do sistema de Comunicações, Navegação, Vigilância/Gerência de Tráfego Aéreo - CNS/ATM, buscando o emprego de novas tecnologias disponíveis, de forma a propiciar um melhor gerenciamento do tráfego aéreo.

2.2 Com as primeiras iniciativas de implantação de sistemas CNS/ATM por alguns Estados e Grupos Regionais de Planejamento e Implementação (PIRG), observou-se à necessidade de se desenvolver um conceito completo, buscando um sistema ATM global integrado, atendendo a requisitos operacionais claramente estabelecidos. Este conceito formaria a base para a implantação coordenada das tecnologias CNS/ATM.

2.3 Em resposta às necessidades supracitadas, a Organização de Aviação Civil Internacional (OACI) elaborou o Conceito Operacional ATM Global, que foi aprovado pela 11ª Conferência de Navegação Aérea, e publicado como o Doc. 9854 AN/458.

BRASIL **AIC**
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO **A**
DIVISÃO DE GERENCIAMENTO DE NAVEGAÇÃO AÉREA **08/09**
AV GENERAL JUSTO, 160 – 2º AND. - CASTELO
20021-130-RIO DE JANEIRO – RJ **09 ABR 2009**

TEL: 021 3814-8237 AFTN: SBRJYNYI ADM: PAME FAX: 021 2101-6252 TELEX: 2137113 COMAER BR

GLOBAL NAVIGATION SATELLITE SYSTEM – GNSS

1 PRELIMINARY GUIDELINES

1.1 PURPOSE

This Aeronautical Information Circular (AIC) has the purpose of establishing the criteria for use of the Global Navigation Satellite System (GNSS) within the Brazilian airspace.

1.2 SCOPE

The procedures established by this AIC are applied to all those who use the GNSS as the primary means of navigation.

2 GENERAL GUIDELINES

2.1 The 10th Air Navigation Conference of the International Civil Aviation Organization – ICAO, held on 1991, endorsed the concept of Communications, Navigation, Surveillance / Air Traffic Management System – CNS/ATM, considering the use of the new available technologies in order to achieve a better air traffic management.

2.2 After further development work of the implementation of the CNS / ATM system by some States and Planning and Implementation Regional Groups (PIRG), it was observed the need of a complete concept, moving towards an integrated global ATM system, in order to establish clear operational requirements. Such concept would be the basis for the coordinated implementation of the CNS / ATM technologies.

2.3 After analyzing the needs proposed, the International Civil Aviation Organization (ICAO) has developed the Global *ATM Operational Concept*, Doc. 9854 AN/458, approved by the 11th Air Navigation Conference.

2.4 Em um esforço para ajudar aos Estados com a implantação do Conceito Operacional ATM Global, a OACI publicou o novo Plano Global de Navegação Aérea. Este plano concentra-se na perspectiva de oferecer melhorias técnicas e operacionais que permitirão aos exploradores de aeronaves obter benefícios em curto e médio prazo.

2.5 O planejamento global se concentra em objetivos de performance específicos, apoiados por um conjunto de "Iniciativas do Plano Global" (GPI). O GNSS é uma ferramenta essencial para a implementação de uma série de GPI, tais como: Navegação Baseada em Performance (PBN) e Aplicações de enlaces de dados.

2.6 Desta forma, o emprego do GNSS previsto nesta AIC proporcionará a transição necessária para a aplicação das GPI envolvidas, por meio da antecipação de alguns elementos da Navegação Baseada em Performance (PBN).

3 CONCEITUAÇÃO

3.1 CONTINUIDADE

Capacidade do sistema em proporcionar informações válidas de navegação para a operação pretendida, sem a ocorrência de interrupções não programadas.

3.2 DISPONIBILIDADE

A disponibilidade de um sistema de navegação é o percentual de tempo em que são utilizáveis as informações providas por este sistema. É uma indicação da capacidade do sistema em proporcionar informações utilizáveis dentro de uma determinada zona de cobertura, bem como do percentual de tempo em que se transmitem sinais de navegação, a partir de fontes externas. A disponibilidade é função das características físicas do entorno e da capacidade técnica das instalações dos transmissores.

3.3 EQUIPAMENTOS BÁSICOS DE NAVEGAÇÃO AÉREA

Equipamentos previstos e nas quantidades estabelecidas no Regulamento Brasileiro de Homologação Aeronáutica (RBHA).

3.4 EQUIPAMENTOS SUPLEMENTARES DE NAVEGAÇÃO AÉREA

Equipamentos que devem ser utilizados em conjunto com um equipamento básico de navegação aérea. A aprovação dos equipamentos suplementares para determinada fase de voo exige que se transporte a bordo um equipamento básico de navegação aérea para a referida fase. Quanto à performance, um equipamento suplementar de navegação aérea deve satisfazer aos requisitos de precisão e de integridade para tal operação ou fase de voo, não sendo necessário satisfazer aos requisitos de disponibilidade e de continuidade.

2.4 In an effort to facilitate implementation of the Global ATM Operational Concept, ICAO has published a new Global Air Navigation Plan. The revised Plan was developed to ensure that near and medium term benefits would be realized through a focused effort.

2.5 In accordance with the Global Plan, planning will be focused on specific performance objectives, supported by a set of “Global Plan Initiatives” (GPI). The GNSS serves as an essential tool for the implementation of a series of GPI, such as: Performance-Based Navigation (PBN) and Data Link Applications.

2.6 Therefore, the use of GNSS prescribed by this AIC will bring the needed transition for the implementation of the involved GPI, by introducing some elements of the Performance-Based Navigation (PBN).

3 CONCEPTIONS

3.1 CONTINUITY

The capability of the system to perform its function without unscheduled interruptions, during the intended operation.

3.2 AVAILABILITY

The availability of a navigation system is the percentage of time that the information provided by the system is usable. It is an indication of the capacity of the system to provide usable information within the specified coverage zone, as well as the percentage of time that navigation signals transmitted, from external sources, are available to use. The availability is a function of both physical characteristics of the environment and the technical capabilities of the transmitters’ installation.

3.3 BASIC EQUIPMENT OF AIR NAVIGATION

Equipment whose type and amounts are established in the Brazilian Rules of Aeronautical Homologation.

3.4 SUPPLEMENTAL EQUIPMENTS OF AIR NAVIGATION

Equipments that shall be used together with a basic equipment of air navigation. The approval of the supplemental equipment for a certain flight phase demands that a basic equipment of air navigation is transported on board for the referred flight phase. Concerning the performance, a supplemental equipment of air navigation shall satisfy the accuracy and integrity requirements for such operation or flight phase, not being necessary to satisfy the availability and continuity requirements.

3.5 INTEGRIDADE

Garantia de que todas as funções do sistema de navegação estão dentro dos limites de performance operacional. É a capacidade do sistema de navegação aérea de proporcionar aos usuários avisos oportunos nos casos em que o mesmo não deva ser utilizado.

3.6 MONITORAMENTO AUTÔNOMO DE INTEGRIDADE ASSOCIADO AO RECEPTOR (RAIM)

Técnica através da qual um receptor GNSS determina a integridade dos sinais de navegação sem se referenciar a sensores ou a sistemas de integridade externos ao próprio receptor.

3.7 NAVEGAÇÃO DE ÁREA (RNAV)

É um método de navegação que permite a operação de aeronave em qualquer trajetória desejada dentro da cobertura de auxílios à navegação aérea ou dentro dos limites de capacidade de sistemas autônomos ou a combinação destes.

3.8 NAVEGAÇÃO EM ÁREA TERMINAL

Fase da navegação em que as aeronaves seguem rotas especificadas de saída ou chegada (SID ou STAR) ou qualquer outra operação entre o último fixo em rota e o fixo de aproximação inicial (IAF).

3.9 NAVEGAÇÃO VERTICAL BAROALTIMÉTRICA (Baro-VNAV).

É um sistema de navegação que apresenta ao piloto um guia vertical calculado com referência a um ângulo de trajetória vertical especificada (VPA), nominalmente de 3º. O guia vertical calculado pelo computador é baseado na altitude baroaltimétrica e especifica um ângulo de trajetória vertical desde a altura do ponto de referência (RDH) para procedimentos de aproximação com guia vertical (APV).

3.10 PRECISÃO

É o grau de conformidade entre a informação sobre posição e hora que proporciona o sistema de navegação e a posição e hora verdadeiras.

3.11 PROCEDIMENTO DE APROXIMAÇÃO COM GUIA VERTICAL (APV)

Procedimento de Aproximação por instrumentos que utiliza guia lateral e vertical, porém não satisfazendo os requisitos estabelecidos para as operações de aproximação de precisão.

3.5 INTEGRITY

The assurance that all the functions of the navigation system are within operational performance limits. It is the capacity of the air navigation system to provide the users with opportune warnings in case it shall not be used.

3.6 RECEIVER AUTONOMOUS INTEGRITY MONITORING (RAIM)

Technique whereby an airborne GNSS receiver determines the integrity of the navigation signals without referring to other sensors or to other integrity systems external to the receiver.

3.7 AREA NAVIGATION (RNAV)

A method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

3.8 NAVIGATION IN THE TERMINAL AREA

Phase of navigation when the aircraft follow specific routes for departure or arrival (SID or STAR), or any other operation between the last fix en route and the initial approach fix (IAF).

3.9 BAROMETRIC VERTICAL NAVIGATION (Baro-VNAV)

It is a navigation system which presents computed vertical guidance to the pilot referenced to a specific Vertical Path Angle (VPA), nominally three degrees. The onboard avionics computer resolves vertical guidance data based on barometric altitude and it is specified as vertical guidance angle from the Reference Datum Height (RDH) to the approach procedures with vertical guidance (APV).

3.10 ACCURACY

The degree of conformance between the position and time information provided by the navigation system and the true position and time.

3.11 APPROACH PROCEDURE WITH VERTICAL GUIDANCE (APV)

An approach with vertical guidance is an instrument approach procedure which utilizes lateral and vertical guidance, but which does not meet all the performance requirements needed for precision approach and landing operations.

3.12 ROTA RNAV

É uma rota ATS estabelecida para aeronaves capazes de empregar navegação de área.

4 SISTEMA GLOBAL DE NAVEGAÇÃO POR SATÉLITES (GNSS)

4.1 A constelação satelital atualmente disponível para uso operacional é o “Global Positioning System (GPS)” provido pelos Estados Unidos da América, entretanto, outros sistemas estão em desenvolvimento e atenderão aos Padrões e Normas Recomendados (SARPS), da OACI. Os sinais do GPS necessitam ser melhorados de forma a atender os requisitos operacionais para as diversas fases do voo.

4.2 A navegação GNSS é baseada em um contínuo conhecimento da posição espacial de cada satélite e proporciona precisão horizontal da ordem de 20 metros, com 95% de probabilidade (95 % do tempo) e 300 metros com 99,99% de probabilidade, sem a utilização de técnicas destinadas a melhorar a performance do sistema.

4.3 No entanto, a constelação básica GPS não provê avisos com antecedência suficiente, quando um satélite transmite uma informação inválida. Por esta razão, os aviônicos utilizados para navegação IFR devem melhorar o sinal Básico GPS para, além de outros fatores, assegurar sua integridade.

4.4 O termo “Aircraft Based Augmentation System (ABAS)” inclui uma melhoria e/ou integração do GNSS com as informações disponíveis a bordo da aeronave, de forma a melhorar a performance dos sistemas satelitais.

4.5 A técnica ABAS mais comum é chamada “Receiver Autonomous Integrity Monitoring System (RAIM)”. O RAIM usa medidas satelitais redundantes para detectar sinais errôneos e alertar aos pilotos.

4.6 Um receptor GNSS que se apóie unicamente na função RAIM necessita de um mínimo de 5 (cinco) satélites em linha de visada, tornando necessário que o piloto efetue verificações de disponibilidade da função RAIM, antes de ingressar nas fases de navegação pretendidas (rota, chegada, saída, e/ou aproximação).

3.12 RNAV ROUTE

It is an ATS route established for aircraft capable of using area navigation.

4. GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)

4.1 The satellite navigation systems available for operational use is the Global Positioning System (GPS) of the United States. However other systems are being introduced and they will answer the ICAO Standard and Recommended Procedures. The GPS signals must be improved in order to support the operational requirements for the various phases of flight.

4.2 The GNSS navigation is based on a continuous acknowledge of the spatial position of each satellite and provides horizontal accuracy of around 20 meters, with 95% of probability (95% of time) and 300 meters with 99,99% probability, without using the techniques destined to improve the performance of the system.

4.3 However the basic constellation of GPS does not provides warnings with priority enough, when the satellite provides invalid information. For this reason, the avionics used for the IFR navigation must improve the GPS Basic signal to also guarantee their integrity.

4.4 The term Aircraft Based Augmentation System (ABAS) includes a development and/or an integration of the GNSS with the information available onboard, in order to improve the performance of the satellite systems.

4.5 The most common ABAS technique is known as Receiver Autonomous Integrity Monitoring System (RAIM). The RAIM uses redundant additional satellite measures to check any incorrect signals and to warn the pilots.

4.6 A GNSS receiver that performs only the RAIM function requires at least 5 (five) satellites in sight, as the pilot should check the appropriate RAIM function availability before entering the desired phases of navigation (route, arrival, departure and/or approach).

5 CRITÉRIOS DE UTILIZAÇÃO DO GNSS

5.1 CRITÉRIOS GERAIS

5.1.1 Os procedimentos de navegação aérea previstos nesta AIC (Rota, Chegada, Saída e Aproximação) somente deverão ser executados por operadores e aeronaves aprovados pelo Estado de Registro ou Estado do Operador, conforme o caso. O processo de aprovação de operadores e aeronaves brasileiras é estabelecido pela Agência Nacional de Aviação Civil.

5.1.2 Tipicamente os receptores GNSS devem atender, pelo menos, aos requisitos estabelecidos no Anexo 10, volume I, e no Doc. 9613 (Manual PBN), ambos da Organização de Aviação Civil Internacional, observando as classes de equipamentos necessárias para a operação em cada fase do voo. No entanto, o processo de aprovação de aeronaves e operadores, mencionado em 5.1.1, determinará as exigências quanto aos receptores GNSS.

5.1.3 O receptor GNSS Básico verifica a integridade dos sinais recebidos da constelação de satélites, através de um monitor autônomo de integridade (RAIM), de forma a determinar se os satélites estão fornecendo uma informação confiável. Alarmes de RAIM podem ocorrer devido a um número insuficiente de satélites ou devido a uma geometria inadequada dos satélites, que podem fazer com que o nível de confiança na solução de posição seja inferior ao aceitável. A posição da antena na aeronave, a posição dos satélites em relação ao horizonte e a atitude da aeronave podem afetar a recepção do sinal de um ou mais satélites. Considerando o fato de que a posição relativa dos satélites está em constante mudança, a disponibilidade de RAIM deverá sempre ser avaliada. Se o RAIM não estiver disponível, outro tipo de navegação deve ser usado ou o horário do voo modificado até que o RAIM esteja disponível. Em voos longos, os pilotos devem considerar a avaliação periódica do RAIM durante o voo. Isto pode prover indicações antecipadas de uma falha não programada de um satélite a partir da decolagem.

5.1.4 As coordenadas geográficas utilizadas nos procedimentos de navegação aérea baseados em GNSS e nas cartas publicadas pelo DECEA têm como referência o Sistema Geodésico Mundial (WGS-84).

5.1.5 Deverá ser feita a previsão de disponibilidade da função RAIM antes da decolagem e do ingresso em cada uma das fases do voo.

5 CRITERIA FOR THE USE OF GNSS

5.1 GENERAL CRITERIA

5.1.1 The procedures for the air navigation included in this AIC (Route, Arrival, Departure and Approach) must be accomplished only by the operators and the aircraft approved by the State of the Register or the State of the Operator, according to the situation. The process for the approval of the Brazilian operators and aircraft are established by the Civil Aviation National Agency (ANAC).

5.1.2 Usually, the GNSS receivers must attend, at least, the requirements established in the Annex 10, volume I, and in the Doc. 9613 (PBN Manual) , observing the classes of equipments needed for the operation in each phase of flight. However, the process for aircraft and operator approval, mentioned above in 5.1.1, will determine the requirements for the GNSS receivers.

5.1.3 The Basic GNSS receiver verifies the integrity of the signals received by the constellation of satellites through a Receiver Autonomous Integrity Monitoring System (RAIM), in order to determine if the satellites are furnishing trustful information. RAIM alarms may occur due to a small number of satellites or due to inadequate geometry of the satellites that may turn the trust level in the position solution lower than the acceptable. The position of the aircraft antenna, the position of the satellites in relation to the horizons and the attitude of the aircraft may affect the reception of the signal of one or more satellites. Considering the fact that the relative position of the satellites is always changing, the availability of the RAIM must always be evaluated. When the RAIM is not available, other type of navigation must be used or the schedule of the flight must be changed until the RAIM is available again. During long flights, the pilots must consider the periodic evaluation of the RAIM during the flight. This may furnish indications of a non predictable failure from a satellite since the departure.

5.1.4 The geographical coordinates used in the air navigation procedures based on GNSS and on the charts published by DECEA have as reference the World Geodetic System (WGS-84).

5.1.5 A prediction of the availability of the RAIM function must be made before the departure and the entrance to each phase of flight.

5.1.6 As informações de altitude utilizadas deverão ser fornecidas pelo altímetro barométrico da aeronave.

5.1.7 Quando houver discrepância significativa entre as informações do receptor GNSS e dos auxílios à navegação aérea instalados no solo, os pilotos deverão utilizar as informações provenientes destes últimos.

5.1.8 Os operadores de aeronaves não devem solicitar ou inserir no plano de voo procedimentos de navegação aérea baseados em GNSS, caso não tenham recebido a correspondente aprovação operacional e da aeronave pela autoridade competente, conforme previsto em 5.1.1. Neste caso, se uma aeronave receber uma autorização do órgão ATS para executar um procedimento GNSS, o piloto deverá informar a incapacidade de atender a autorização e requerer uma nova autorização.

5.1.9 É recomendável a aplicação de diretor de voo ou piloto automático, no modo de navegação lateral, quando disponível, nas operações em rota, terminal (SID e STAR) e Procedimentos de Aproximação IFR.

5.1.10 Os órgãos ATS não estão aptos a fornecer qualquer informação sobre a integridade operacional do sistema. Isto é particularmente importante quando a aeronave for autorizada a iniciar uma aproximação. Procedimentos devem ser estabelecidos para os casos em que forem previstas falhas na navegação GNSS. Nestas situações os pilotos devem reverter para um método alternativo de navegação.

5.1.11 BASE DE DADOS DE NAVEGAÇÃO

5.1.11.1 Os operadores deverão assegurar-se que a base de dados utilizada para navegação esteja atualizada de acordo com o ciclo AIRAC correspondente. A base de dados de navegação deve estar atualizada para a duração do voo. Em caso de ocorrência de mudança do ciclo AIRAC durante o voo, operadores e pilotos devem estabelecer procedimentos para assegurar a precisão dos dados de navegação, incluindo os auxílios requeridos para definir rotas e procedimentos.

5.1.11.2 Para assegurar a correção da base de dados, os pilotos devem verificar os dados apresentados no “display” do equipamento, após o carregamento do mesmo no plano de voo ativo, antes de voar o procedimento, a fim de garantir a correção e a coerência da rota autorizada pelo ATC e as eventuais modificações subsequentes, assim como sua coerência com as cartas publicadas pelo DECEA. Caso não haja conformidade, as informações da base de dados não poderão ser utilizadas. Alguns receptores possuem um “moving map display” que ajuda o piloto na condução das citadas verificações.

5.1.6 The information on the altitude used must be supplied by the barometric altimeter of the aircraft.

5.1.7 When there is a significant discrepancy between the information from the GNSS receiver and the air navigation aids installed on the ground, the pilots must use the information provided by such aids.

5.1.8 The aircraft operators should not request or include in the flight plan the air navigation procedures based on GNSS, when they do not receive the corresponding operational and aircraft approval by the competent authority, according to the prescribed in the item 5.1.1. In such case, if an aircraft receives a clearance from the ATS unit to accomplish a GNSS procedure, the pilot must inform that he/she can not accomplish the authorization and request another one.

5.1.9 It’s recommendable, when available, the use of a flight director or autopilot in lateral navigation mode in en route, terminal (SID and STAR) Operations and IFR Approach Procedures.

5.1.10 The ATS units are not capable to furnish any information on the operational integrity of the system. This is especially important when the aircraft is authorized to begin an approach. Procedures must be established for the instances when failures on the GNSS are foreseen. In such situations the pilots must reverse to an alternative navigation method.

5.1.11 NAVIGATION DATABASE

5.1.11.1 The operators must assure that the database used for the navigation is updated with the corresponding AIRAC cycle. The navigation database must be updated for the flight duration. If there is any change to the AIRAC cycle during the flight, the operators and pilots must establish procedures to assure the accuracy of the navigation data, including the air navigation aids required to define the routes and procedures.

5.1.11.2 To assure the correctness of the data base, the pilots must check the data showed on the display of the equipment, after stored on the active flight plan, before flying the procedure, in order to guarantee the correctness and the coherency of the route authorized by the ATC and any occasional subsequent changes, as well as its coherency with the charts published by DECEA. If there is any discrepancy, information on the data base shall not be used. Some receivers have a moving map display that helps the pilot to check such information.

5.1.11.3 A Base de Dados de Navegação deve ser obtida de um provedor que atenda aos requisitos estabelecidos nos documentos RTCA DO-200A/EUROCAE ED 76, "Standards for Processing Aeronautical Data", conforme previsto no Doc. 9613 (Manual PBN).

5.1.11.4 Discrepâncias que invalidem um procedimento devem ser reportados ao provedor de base de dados de navegação e os procedimentos não devem ser utilizados pelos tripulantes de voo.

5.1.11.5 Os operadores de aeronaves devem conduzir verificações periódicas na base de dados de navegação, a fim de atender aos requisitos de garantia de qualidade do sistema.

5.1.12 PRÉ-VOO

5.1.12.1 Todas as operações IFR com um receptor GNSS devem ser conduzidas de acordo com o manual de operações da aeronave. Antes de um voo IFR empregando o receptor GNSS, o operador deverá assegurar-se de que a operação, o equipamento e a instalação estejam aprovados e certificados pela autoridade competente para a operação IFR pretendida.

5.1.12.2 O piloto/operador deverá seguir os procedimentos específicos de inicialização e autoteste para o receptor GNSS como descrito no manual de operações da aeronave.

5.1.12.3 O piloto deverá conhecer, dentre outros aspectos constantes do processo de aprovação operacional, mencionado em 5.1.1:

a) Operação e limitações do receptor GNSS instalado em sua aeronave, incluindo criação, ativação/alteração de rotas, seleção e ativação de procedimentos de subida e de descida;

b) Procedimentos para verificação da disponibilidade da função RAIM; e

c) Seleção dos modos de navegação em Rota, em Terminal e em Aproximação.

5.2 CRITÉRIOS ESPECÍFICOS

5.2.1 VOO EM ROTA

5.2.1.1 As aeronaves voando sob regras de voo por instrumentos deverão possuir os equipamentos básicos de navegação aérea (ver item 3.3) apropriados para a rota a ser voada, os quais deverão obrigatoriamente ser utilizados, caso haja alarme de integridade e nos trechos da rota em que haja previsão de indisponibilidade da função RAIM.

5.1.11.3 The Navigation Data Base must be obtained through a provider that complies with the requirements established by the documents RTCA DO-200A/EUROCAE ED 76 “Standards for Processing Aeronautical Data”, as foreseen in Doc. 9613 (PBN Manual).

5.1.11.4 Discrepancies that invalidate a procedure must be reported to the navigation database supplier and affected procedures shall not be used by flight crew.

5.1.11.5 Aircraft operators should consider the need to conduct their own database checks in order to comply with the requirements for the quality assurance of the system.

5.1.12 PREFLIGHT

5.1.12.1 All the IFR operations with a GNSS receiver must be conducted according to the aircraft operations manual. Before flying IFR, using a GNSS receiver, the operator must be sure that the operation, the equipment and the installation are approved and certified by the competent authority for the intended IFR operation.

5.1.12.2 The pilot/operator must follow the specific procedures at the beginning of initialization and auto-test of the GNSS receiver as described on the aircraft operations manual.

5.1.12.3 The pilot must know, among others aspects included in the operational approval process, mentioned on 5.1.1:

a) Operation and limitation of the GNSS receiver installed in the aircraft, including the route creation and route activation/deactivation, as well as selection and activation of departure and approach procedures.

b) Procedures to check the availability of RAIM function;

c) Selection of navigation modes: en Route, Terminal and Approach.

5.2 SPECIFIC CRITERIA

5.2.1 EN ROUTE FLIGHT

5.2.1.1 Aircraft flying under instrument flight rules shall have the basic equipment for air navigation (see item 3.3) appropriate for the route to be flown. Such equipment shall be used compulsorily, when there is an integrity alarm and on the portion of the route where the function RAIM is supposed to be unavailable.

5.2.2 CHEGADA PADRÃO POR INSTRUMENTOS (STAR) E SAÍDA PADRÃO POR INSTRUMENTOS (SID)

5.2.2.1 Os equipamentos das aeronaves deverão ser aprovados de acordo com a classe de equipamento prevista para execução de SID ou STAR GNSS.

5.2.2.2 As aeronaves executando SID GNSS ou STAR GNSS deverão estar com seus equipamentos básicos de navegação sintonizados nas frequências adequadas, de forma a proporcionar transição rápida e segura no caso de ocorrência de alarme de RAIM. Caso haja previsão de indisponibilidade da função RAIM durante o período de voo, somente deverão ser utilizados os equipamentos básicos de navegação aérea.

5.2.2.3 A STAR e a SID GNSS só poderão ser utilizadas caso sejam extraídas de uma base de dados, por meio da inserção do designador do procedimento, que:

a) Contenha todos os “way-points” descritos na carta que descreve o procedimento de aproximação a ser voado; e

b) Apresente os “way-points” na mesma sequência em que estão publicadas na carta que descreve o procedimento.

5.2.2.4 A sequência de “way-points” estabelecida nas STAR e SID pode ser modificada pelo piloto, como resultado de autorizações ATC, por meio da inserção (a partir da base de dados) e da exclusão de “way-points”.

5.2.2.5 Na execução de SID e STAR RNAV não é permitida:

a) A criação manual de novos “way-points”, não previstos na base de dados, por meio da inserção de coordenadas geográficas ou quaisquer outros meios.

b) A modificação do tipo de “way-point”, de “fly-over” para “fly-by” e vice-versa.

5.2.2.6 Caso a aeronave seja retirada de sua rota pré-estabelecida, em consequência de uma vetoração radar, o piloto não deve modificar o plano de voo inserido no sistema, até que uma nova autorização seja emitida pelo controlador de tráfego aéreo, a fim de que seja possível voltar à rota inicial, em um ponto especificado pelo órgão ATC ou empregar uma nova rota autorizada.

5.2.2 STANDARD TERMINAL ARRIVAL ROUTES (STAR) AND STANDARD INSTRUMENT DEPARTURE (SID)

5.2.2.1 The equipments of the aircraft must be approved according to the class of the equipment prescribed for the execution of the SID or STAR GNSS.

5.2.2.2 Aircraft accomplishing GNSS SID or GNSS STAR must have their basic navigation equipment tuned on the appropriate frequencies, so as to provide fast and safe transition in the case of occurrence of RAIM alarm. In case that there is prevision of unavailability of the RAIM function during the flight period, only the basic equipment of air navigation shall be used.

5.2.2.3 GNSS STAR and GNSS SID may be used only when extracted from a data base, by inserting the procedure designator, that;

a) Include all waypoints described by the chart that describes the approach procedure to be flown; and

b) Show the waypoints on the same sequence as they are published by the chart that describes the procedure.

5.2.2.4 The sequence of waypoints established by the STAR and SID may be changed by the pilot, as a result of the ATC clearances, by the inclusion (from the database) and exclusion of the waypoints.

5.2.2.5 The following is not allowed when accomplishing the SID and STAR RNAV:

a) The manual creation of new waypoints, not prescribed by the database, by including the geographical coordinates or by any other means.

b) The change on the type of the waypoint from fly-over to fly-by and vice versa.

5.2.2.6 When the aircraft is removed from the determined route, as a consequence from the radar vectors, the pilot must not change the flight plan included on the system, until a new clearance is issued by the air traffic controller, in order to come back to the initial route, at a point specified by the ATC unit or apply a new cleared route.

5.2.2.7 Os pilotos poderão observar pequenas diferenças entre o rumo publicado nas cartas de navegação e o rumo apresentado no receptor GNSS. Tais situações são normalmente resultantes de diferenças entre a declinação magnética aplicada pelo equipamento e a aplicada por ocasião da confecção das cartas. Diferenças menores ou iguais a 3º são operacionalmente aceitáveis, conforme previsto no item 3.3.4.2 do Doc. 9613 (Manual PBN).

5.2.2.8 Os pilotos deverão empregar um indicador de desvio lateral, diretor de voo ou piloto automático no modo de navegação lateral.

5.2.2.9 No caso de execução de SID, o piloto deverá seguir o previsto no manual de operações, a fim de garantir que o modo "saída" (departure) do receptor seja selecionado. Se o modo "saída" não estiver disponível, então o modo terminal deve ser selecionado para assegurar a performance requerida.

5.2.2.10 Alguns segmentos de uma SID podem requerer uma intervenção manual do piloto, especialmente quando uma vetoração radar é utilizada para interceptação de um rumo ou bloqueio de um fixo.

5.2.3 PROCEDIMENTOS DE APROXIMAÇÃO GNSS

5.2.3.1 Planejamento Pré-Voo

5.2.3.1.1 Além das verificações normais realizadas no planejamento pré-voo, os seguintes procedimentos devem ser executados:

a) O piloto deve assegurar-se que os procedimentos de aproximação, incluindo aqueles dos aeródromos de alternativa, são selecionáveis de uma base de dados de navegação válida e atualizada e cuja execução não está proibida por instrução da companhia aérea ou NOTAM.

b) O piloto deve assegurar-se que os auxílios à navegação aérea necessários para as operações no aeródromo de alternativa estão disponíveis.

c) O piloto deve tomar conhecimento de NOTAM ou material disponibilizado em briefings que possam afetar adversamente a operação do sistema da aeronave ou a disponibilidade dos procedimentos de aproximação no aeródromo de destino e/ou de alternativa.

d) O piloto deverá designar um aeroporto de alternativa que possua procedimento de aproximação em operação baseado em auxílios à navegação aérea convencionais.

5.2.2.7 Pilots may observe small differences between the heading included in the navigation charts and the heading shown by the GNSS receiver. Usually such situations are caused by the difference between the magnetic declination applied to the equipment and the one applied during the issue of the charts. Differences equal to or lesser than 3 degree are operationally accepted, as foreseen in Doc. 9613 (PBN Manual), item 3.3.4.2.

5.2.2.8 Pilots must use a lateral deviation indicator, flight director or autopilot on the lateral navigation mode.

5.2.2.9 When accomplishing the SID, the pilot must follow the prescribed on the operations manual, in order to guarantee that the departure mode of the receiver is selected. When the departure mode is not available, the terminal mode must be selected to ensure the required performance.

5.2.2.10 Some portions of one SID may require a manual intervention of the pilot, especially when radar vectors are used to intercept a heading to or over heading a waypoint.

5.2.3 GNSS APPROACH PROCEDURES

5.2.3.1 Pre-Flight Planning

5.2.3.1.1. In addition to normal procedure prior to commencing the approach the crew must verify the following procedures:

a) Pilot must assure that the approach procedures, including the alternative aerodromes, are collected from a valid and updated navigation data base and that the execution is not forbidden by any air company instruction or by NOTAM.

b) Pilot must assure that the air navigation aids needed to the aerodrome operations at the alternative aerodrome are available;

c) The pilot must be aware of the NOTAM or any available information included in briefing that may affect adversely the operation of the aircraft system or the availability of the approach procedures at the destined aerodrome and/or the alternative aerodrome.

d) Pilot must designate an alternative aerodrome that offers an approach procedure in operation based in conventional air navigation aids

5.2.3.2 Procedimentos Operacionais da Tripulação antes do Início da Execução do Procedimento de Aproximação

5.2.3.2.1 Além dos procedimentos normais previstos, antes do início da execução de um procedimento de aproximação IFR, o piloto deve, antes de atingir o Fixo de Aproximação Inicial (IAF) e de forma compatível com a carga de trabalho da tripulação, verificar a correção do procedimento carregado no sistema da aeronave, comparando-o com a carta publicada, incluindo a sequência dos “waypoints” e a coerência de rumos e distâncias;

5.2.3.2.2O piloto deve checar, a partir das cartas publicadas, “map display” ou “Control Display Unit” (CDU), os tipos de “way-points” que serão utilizados (“fly-by” ou “fly-over”).

5.2.3.2.3 Para sistemas multi-sensores, o piloto deve se certificar que o sensor GNSS está sendo utilizado para o estabelecimento de posição da aeronave.

5.2.3.2.4 As aeronaves devem iniciar um procedimento de aproximação GNSS a partir do Fixo de Aproximação Inicial (IAF). No entanto, intervenções táticas do ATC podem ser necessárias por intermédio de uma vetoração radar ou autorização para voo direto para fixos específicos, que poderão resultar em interceptação da fase inicial ou intermediária do procedimento de aproximação, sem passar pelo Fixo de Aproximação Inicial (IAF) e/ou Fixo Intermediário (IF). Além disso, poderá ser necessária a inserção de “way-point” carregado a partir da base de dados. Ao cumprir as instruções do ATC, a tripulação deve atentar para o seguinte:

a) A entrada manual de coordenadas no sistema de navegação, para operações em área de controle terminal, incluindo procedimentos de aproximação IFR, não é permitida;

b) Todas as altitudes mínimas previstas no procedimento devem ser observadas;

c) O ingresso diretamente no Fixo Intermediário pode não assegurar a correta separação de obstáculos, caso não seja observada as instruções do ATC. Além disso, o ângulo de interceptação do curso, nesse fixo, deve ser menor ou igual a 45º, conforme previsto no item 5.3.4.2 do Doc. 9613 (Manual PBN); e

d) Autorizações de proa direta para o Fixo de Aproximação Final (FAF) não são permitidas.

5.2.3.2 Operational Procedures of the Crew before the Beginning of the Approach Procedure

5.2.3.2.1 Besides the normal procedures in force, before the beginning of the IFR approach procedure, the pilot must, before reaching the Initial Approach Fix (IAF) and according to an adequate workload, check if the procedure stored on the aircraft system is correct, comparing it with the published chart, including the sequence of waypoints and the coherency of the headings and distances;

5.2.3.2.2 Pilot must also check from the published charts, map display or Control Display Unit (CDU), which waypoints are fly-by and which are fly-over.

5.2.3.2.3 For multi-sensor systems, crew must verify that GNSS sensor is used for position computation.

5.2.3.2.4 Aircraft must begin the GNSS approach procedure from an Initial Approach Fix (IAF). However, tactical interventions from the ATC may be needed by means of a radar vectors or clearance to a direct flight to specific fixes that may result in interception of the initial or intermediate phase of the approach procedure, without passing the Initial Approach Fix (IAF) and/or Intermediate Fix (IF). Moreover, the inclusion of the waypoint stored from the database may be needed. In complying with ATC instructions, the flight crew should be aware of the following implications:

a) The manual entry of coordinates into the navigation system by the crew for operations in terminal control area is not permitted.

b) All the minima altitudes prescribed by the procedure must be observed;

c) The entrance directly to the Intermediate Fix may not assure the correct separation of the obstacles, when the ATC instructions are not observed. Moreover, the angle of course interception, on such fix, must be smaller or equal to 45 Degrees; and

d) Direct to clearance to FAF (Final Approach Fix) is not acceptable.

5.2.3.3 Procedimentos Operacionais após o Início da Execução do Procedimento de Aproximação IFR

5.2.3.3.1 A aeronave deve estar estabilizada no curso da aproximação final antes do FAF, a fim de iniciar a descida no segmento de aproximação final.

5.2.3.3.2 A tripulação deve verificar se o modo aproximação do sistema foi ativado, 2 NM antes de passar o FAF.

5.2.3.3.3 O display apropriado deve ser selecionado, a fim de que a trajetória desejada e a posição relativa da aeronave em relação à trajetória possam ser monitoradas, a fim de permitir a avaliação constante do erro técnico de voo (FTE).

5.2.3.3.4 O procedimento deve ser descontinuado:

a) Se o display de navegação considerar o sistema inválido (“flagged”); ou

b) No caso de perda da função de monitoração de integridade; ou

c) Se a função de monitoração de integridade não estiver disponível antes de passar o FAF; ou

d) Se o Erro Técnico de Voo (FTE) for excessivo, conforme previsto no processo de aprovação operacional, mencionado no item 5.1.1.

NOTA: No caso de emprego de equipamentos que demonstrem capacidade RNP sem a utilização do GNSS, a interrupção do procedimento poderá não ser necessária. A documentação do fabricante deverá ser analisada para determinar como o sistema de navegação da aeronave poderá ser empregado nestas condições. Tais procedimentos deverão ser inseridos no processo de aprovação operacional.

5.2.3.3.5 Durante a execução do procedimento de aproximação, os pilotos devem utilizar um indicador de desvio lateral, diretor de voo e/ou piloto automático, no modo de navegação lateral. Pilotos que empreguem o indicador de desvio lateral (Ex. CDI) devem assegurar que a escala adequada esteja selecionada, de acordo com a precisão de navegação associada aos vários segmentos do procedimento (ex. ±1.0 NM para os segmentos inicial e intermediário, ±0.3 NM para o segmento final).

5.2.3.3 Operational Procedures after the Beginning of the Accomplishment of the IFR Approach

5.2.3.3.1 The aircraft must be established on the final approach course no later than the FAF before starting the descent at the final approach segment.

5.2.3.3.2 The crew must check if the approach mode system is activated, within 2 NM before the FAF.

5.2.3.3.3 The appropriate display must be selected so that the desired path and the aircraft position relative to the path can be monitored for FTE (Flight Technical Error) monitoring.

5.2.3.3.4 The procedure must be discontinued:

a) If the navigation display is flagged invalid; or

b) In case of loss of integrity alerting function; or

c) If integrity monitoring function is not available before passing the FAF; or

d) If Flight Technical Error (FTE) is excessive, as prescribed by the operational approval process, mentioned in 5.1.1**.**

NOTE: Discontinuing the procedure may not be necessary for a RNP system that includes demonstrated RNP capability without GNSS. Manufacturer documentation should be examined to determine the extent the system may be used in such configuration. Such procedure must be included in the operational approval process.

5.2.3.3.5 During the approach procedure, pilots must use a lateral deviation indicator, flight director and/or autopilot in lateral navigation mode. Pilots of aircraft with a lateral deviation indicator (e.g., CDI) must ensure that lateral deviation indicator scaling is suitable for the navigation accuracy associated with the various segments of the procedure (i.e., ±1.0 nm for the Initial and Intermediate segments, ±0.3 nm for the Final Approach segment).

5.2.3.3.6 Os pilotos devem voar no eixo da trajetória do procedimento de aproximação, conforme apresentado nos indicadores de desvios laterais e/ou diretor de voo, a menos que sejam autorizados desvios pelo ATC ou em caso de emergência. Em condições normais de operação, os desvios laterais (diferença entre a trajetória prevista nos sistema de bordo e a posição da aeronave em relação à trajetória) deve ser limitada à metade da precisão de navegação associada com o segmento de procedimento. No caso dos segmentos inicial e intermediário, cuja precisão associada normalmente é de 1 NM, o desvio máximo tolerável é de 0,5 NM. No segmento final, a precisão é normalmente de 0,3 NM e o desvio máximo é de 0,15 NM. Pequenos desvios destes limites durante e imediatamente após as curvas, até um máximo do valor correspondente ao valor de precisão associado ao segmento (ex. 1 NM para os segmentos inicial e intermediário) são aceitáveis.

5.2.3.3.7 No caso de emprego de Baro-VNAV para guia vertical, durante o segmento de aproximação final, desvios acima e abaixo da trajetória definida pelo sistema Baro-VNAV não pode exceder, respectivamente, 100 e 50 pés.

5.2.3.3.8 Os pilotos devem executar uma aproximação perdida, caso os desvios laterais e/ou verticais excedam os valores previstos nos itens 5.2.3.3.6 ou 5.2.3.3.7, a menos que sejam obtidas as referencias visuais para continuar a aproximação.

5.2.3.4 Procedimentos de Contingência

5.2.3.4.1 O piloto deve notificar o órgão ATS, o mais breve possível, sobre a perda de capacidade de efetuar o procedimento de aproximação GNSS, incluindo as intenções da tripulação a respeito dos procedimentos a serem seguidos. A perda de tal capacidade inclui qualquer falha ou evento que leve a aeronave à não satisfazer os requisitos estabelecidos para o procedimento. O operador da aeronave deve desenvolver procedimento de contingência adequado para garantir a segurança da aeronave em caso de perda da capacidade GNSS durante uma aproximação.

5.2.3.5 Procedimentos de Aproximação com Guia Vertical, baseados em Navegação Vertical Baroaltimétrica (APV/Baro-VNAV)

5.2.3.5.1 Alguns procedimentos de aproximação baseados em GNSS poderão especificar mínimos com navegação vertical (VNAV). Esses procedimentos se baseiam no GNSS para navegação lateral (LNAV) e em dados baroaltimétricos como guia para navegação vertical (VNAV).

5.2.3.3.6 All pilots are expected to maintain procedure centerlines, as depicted by onboard lateral deviation indicators and/or flight director during all the approach procedure unless cleared to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the route navigation system computed path and the aircraft position relative to the path) should be limited to half the navigation accuracy associated with the procedure. In case of Initial and Intermediate Segments, taking into consideration that the associated precision is 1,0 NM, the maximum deviation is 0, 5 NM. On the Final Segment, the normal associated precision is 0,3 NM, so the maximum deviation is 0,15 NM. Brief deviations from this standard during and immediately after turns, up to a maximum of the navigation accuracy value (i.e., 1 NM for the Initial and Intermediate segments), are allowable.

5.2.3.3.7 When Baro-VNAV is used for vertical path guidance during the final approach segment, deviations above and below the Baro-VNAV path must not respectively exceed +100/-50 feet.

5.2.3.3.8 Pilots must execute a Missed Approach if the lateral deviations or vertical deviations exceed the values prescribed on items 5.2.3.3.6 or 5.2.3.3.7 above, unless the pilot has in sight the visual references required to continue the approach.

5.2.3.4 Contingency Procedures

5.2.3.4.1 The pilot must notify ATS, as soon as possible, of any loss of the GNSS approach procedure capability, together with the proposed course of action. The loss of such capability includes any failure or event causing the aircraft to no longer satisfy the requirements of the procedure. The aircraft operator must develop the corresponding contingency procedure to guarantee the aircraft safety during an approach procedure, in case of any loss of the GNSS Capability.

5.2.3.5 Approach Procedures with vertical guidance, based on Barometric Vertical Navigation (APV/Baro-VNAV).

5.2.3.5.1 Some approach procedures based on GNSS may specify minima with vertical navigation (VNAV). Such procedures are based on GNSS for the lateral navigation (LNAV) and on baro-altimetric data as guidance for vertical navigation (VNAV).

5.2.3.5.2 Operadores de aeronaves que desejarem executar procedimentos APV/Baro-VNAV deverão obter a aprovação de aeronave e de operações correspondente, conforme previsto no item 5.1.1. Caso não possuam tal aprovação operacional, essas aeronaves deverão cumprir somente os mínimos LNAV, ou seja, somente a navegação lateral baseada no GNSS deverá ser utilizada.

5.2.3.5.3 Os pilotos são responsáveis por qualquer correção de altitudes publicadas, em função da variação de temperatura, incluindo:

a) As altitudes dos segmentos inicial e intermediário;

b) A altitude/altura de decisão; e

c) As altitudes da aproximação perdida subsequente.

5.2.3.5.4 Os procedimentos APV/BARO-VNAV só deverão ser executados com a informação do ajuste local fornecido pelo órgão ATS (diretamente ou por meio do ATIS) do aeródromo, corretamente inseridos no sistema altimétrico da aeronave. Ajustes de altímetro procedentes de uma fonte remota não podem ser utilizados em procedimentos APV/Baro-VNAV.

5.2.3.5.5 Os limites de temperatura mínimas e máximas autorizadas para operações Baro-VNAV serão publicadas na Carta do procedimento de aproximação APV/Baro-VNAV.

5.2.3.6 Plano de Voo

5.2.3.6.1 No Plano de Voo, será inserida, no item (campo) 10, a letra “G” indicando que a aeronave dispõe de equipamento receptor GNSS, aprovado conforme previsto no item 5.1.1.

NOTA: A existência a bordo de equipamento GNSS não dispensa a exigência dos equipamentos básicos de navegação aérea, requeridos para os diversos tipos e fases de voo.

5.2.3.5.2 Aircraft operator that intends to accomplish APV/BaroVNAV must obtain aircraft and operators approval for the corresponding operations, in accordance with 5.1.1. If he/she does not receive such operational approval, aircraft must accomplish the LNAV minima only. In such case, only the lateral navigation based on GNSS can be used.

5.2.3.5.3 The pilots are responsible for any change on the published altitudes, concerning the temperature variation, including:

a) The altitudes of the initial and intermediate segments;

b) The altitude/decision height; and

c) The altitudes of the subsequent missed approach.

5.2.3.5.4 The APV/BARO-VNAV procedures may be accomplished only by the information on the local setting furnished by the ATS unit (directly or through the ATIS) of the aerodrome, correctly stored on the altimetry system of the aircraft. Altimetry settings coming from a remote source shall not be used on procedures on APV/Baro-VNAV.

5.2.3.5.5 The limits of the minimum and maximum of temperature authorized for the operations on Baro-VNAV will be published on the APV/Baro-VNAV Approach Procedure Chart.

5.2.3.6 Flight Plan

5.2.3.6.1 The letter “G” should be placed in block (field) 10 of the Flight Plan to indicate that the aircraft is equipped with GNSS receiver equipment appropriate for the corresponding flight phases.

NOTE: The on-board GNSS equipment does not excludes the necessity of the air navigation basic equipments, required to various types and phases of flight.

6 DISPOSIÇÕES FINAIS

6.2 Os usuários poderão contribuir para o aperfeiçoamento do emprego do GNSS, por meio da implementação dos equipamentos e de sugestões para a melhoria dos procedimentos constantes nesta AIC, as quais deverão ser encaminhadas aos Subdepartamento de Operações do Departamento de Controle do Espaço Aéreo.

6.3 Os procedimentos previstos na presente AIC somente poderão ser aplicados pelos Operadores de Aeronaves Brasileiros após a obtenção da certificação operacional correspondente, de acordo com o processo de aprovação de aeronaves e de operadores estabelecido pela Agência Nacional de Aviação Civil (ANAC), conforme mencionado no item 5.1.1.

6.4 Os casos não previstos nesta AIC serão resolvidos pelo Exmo Sr. Chefe do Subdepartamento de Operações do Departamento de Controle do Espaço Aéreo.

6.5 Esta AIC foi aprovada pelo Boletim Interno do DECEA nº de / / e substitui a AIC A12/99 de 25 NOV 99.

6 FINAL ARRANGEMENTS

6.1 The users may contribute with the improvement of the use of the GNSS, by implementing the equipments, and by suggestions for the development of the procedures mentioned in this AIC. Such suggestions must be addressed to the Operations Subdepartment of the Department of Airspace Control - DECEA.

6.2 The procedures of this AIC will only be applicable by Brazilian Aircraft Operators after obtaining the corresponding Operational Certification, in accordance of a process established by National Civil Aviation Agency (ANAC), as mentioned in 5.1.1.

6.3 Cases not foreseen in this AIC will be resolved by the Chief of the DECEA Operations Sudepartment.

6.4 This AIC was approved by DECEA Internal Bulletin edition nr.21, dated 02 Feb 2009, and will be effective on April 09, 2009, canceling on the same date the AIC A 12/99, dated 25 NOV 1999.

BRASIL
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO
DIVISÃO DE GERENCIAMENTO DE NAVEGAÇÃO AÉREA
AV GENERAL JUSTO, 160 – 2º AND. - CASTELO
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09/09

09 ABR 2009

IMPLEMENTAÇÃO DA RNAV-5

1 DISPOSIÇÕES PRELIMINARES

1.1 FINALIDADE

A presente Circular de Informações Aeronáuticas (AIC) tem por finalidade notificar a intenção de implementar a RNAV-5 nas FIR Amazônica, Brasília, Curitiba e Recife, em 18 de novembro de 2010.

1.2 ÂMBITO

As disposições estabelecidas nesta AIC aplicam-se a todos aqueles que, no decorrer de suas atividades, venham a utilizar rotas de navegação de área (RNAV) nas FIR Amazônica, Brasília, Curitiba e Recife.

2 INTRODUÇÃO

2.1 O contínuo crescimento da aviação torna necessária uma ampliação da capacidade do espaço aéreo e uma utilização ótima do espaço aéreo. O aumento da eficiência operacional derivada da aplicação da Navegação de Aérea (RNAV) foi traduzido no desenvolvimento de aplicações de navegação aérea em diversas regiões e em todas as fases de voo.

2.2 No processo de planejamento do emprego das aplicações de navegação em rotas específicas ou em um determinado espaço aéreo, é necessário definir os requisitos de forma clara e concisa. Desta forma, é possível assegurar que a tripulação de voo e o Controle de Tráfego Aéreo (ATC) conheçam a capacidade e limitações do sistema RNAV, garantindo que o seu desempenho é adequado para as características do espaço aéreo.

BRASIL **AIC**
DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO **A**
DIVISÃO DE GERENCIAMENTO DE NAVEGAÇÃO AÉREA **XX/09**
AV GENERAL JUSTO, 160 – 2º AND. - CASTELO
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RNAV-5 IMPLEMENTATION

1. PRELIMINARY GUIDELINES

1.1. PURPOSE

This Aeronautical Information Circular (AIC) has the purpose of notifying the intent to implement RNAV-5 in the Amazonica, Brasilia, Curitba and Recife FIR, on 18 November 2010.

1.2. SCOPE

The procedures established by this AIC are applied to all those who use RNAV Routes in the Amazonica, Brasilia, Curitba and Recife FIR.

2. INTRODUCTION

2.1. Continuous aviation growth makes it necessary to increase airspace capacity and points to the need for optimum use of available airspace. The improvement in operational efficiency deriving from the application of area navigation (RNAV) has resulted in the development of navigation applications in different regions and in all flight phases.

2.2. In planning navigation applications in specific routes or within a given airspace, it is necessary to define the requirements clearly and concisely. The reason for this is to ensure that the flight crew and the ATC are aware of the capacity and limitations of the navigation system (RNAV) and to guarantee that RNAV system performance is appropriate for airspace characteristics.

2.3 A atual utilização dos sistemas RNAV é realizada de forma similar aos sistemas “convencionais”, baseados em terra. Um sistema RNAV normalmente é identificado e seu desempenho é avaliado por meio de uma combinação de análises técnicas e inspeções em vôo. O Conceito de Espaço Aéreo é desenvolvido com base no desempenho do equipamento RNAV, tornando necessário identificar distintos modelos de equipamento que são apropriados para emprego em um espaço aéreo em particular.

2.4 Para evitar este tipo de especificação RNAV prescritiva, baseado no desempenho dos sistemas de navegação, que resultam em atrasos na introdução de novas capacidades do sistema RNAV e maiores custos para a manutenção adequada e certificação, a OACI desenvolveu o Conceito de Navegação Baseada em Performance (PBN).

2.5 O conceito PBN especifica os requisitos de desempenho do sistema RNAV, em termos de precisão, integridade, disponibilidade, continuidade e funcionalidades, necessárias para as operações propostas no contexto de um espaço aéreo em particular. O conceito PBN representa uma mudança da navegação baseada em sistemas para a navegação baseada em performance. A aplicação da PBN oferece as seguintes vantagens:

a) Reduz a necessidade de manutenção de rotas e procedimentos baseados em sistemas específicos e, em conseqüência, reduz os custos associados;

b) Evita a necessidade de desenvolvimento de operações baseadas em sistemas específicos, a cada evolução dos sistemas de navegação;

c) Permite um uso mais eficiente do espaço aéreo (economia de combustível, redução de ruído); e

d) Facilita o processo de aprovação operacional para os operadores, aplicando-se um conjunto limitado de especificações de navegação, destinados à utilização mundial.

2.6 O Manual sobre Navegação Baseada em Performance (Doc. 9613), da Organização de Aviação Civil Internacional (OACI) estabelece diversas Especificações de Navegação que podem ser aplicadas em nível mundial. Dentro das características do tráfego aéreo da Região Sul-Americana, para operações em rota, a aplicação da RNAV-5 é a mais adequada, tendo em vista que os requisitos de aprovação de aeronaves e operadores permitirão que a maioria das aeronaves equipadas com sistemas RNAV seja capaz de atender tais requisitos e, em conseqüência, operar nas rotas RNAV-5.

2.3. RNAV systems are used today in a way similar to ground-based conventional systems. An RNAV system is normally identified and its performance assessed through a combination of technical analyses and flight tests. The airspace concept is developed on the basis of information about RNAV equipment performance, being it necessary to determine whether different equipment models are appropriate for use in a given airspace.

2.4. In order to avoid this type of prescriptive RNAV specifications based on navigation equipment performance that result in delays in introducing new RNAV system capabilities and higher costs for appropriate maintenance and certification, ICAO developed the Performance-Based Navigation Concept (PBN).

2.5. This concept specifies the RNAV system performance requirements in terms of the accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of the concept of a particular airspace. The PBN concept represents a shift away from systems-based navigation towards performance-based navigation. PBN application offers the following advantages:

a) Reduces the need to maintain routes and procedures based on specific systems and, as a result, reduces the associated costs;

b) Avoids the need to prepare operations based on specific systems for each new navigation system development;

c) Allows for more efficient airspace use (fuel savings, noise reduction); and

d) Facilitates operational approval of operators due to the application of a limited set of navigation specifications intended for global use.

2.6 The ICAO Manual on Performance-Based Navigation (Doc. 9613) establishes various different navigation specifications that can be applied globally. Given the air traffic characteristics for en-route operations in the South American Region, RNAV-5 is most appropriate for use there, inasmuch as the approval requirements will make it possible for most aircraft equipped with RNAV systems to meet those requirements.

2.7 O objetivo da implantação RNAV-5 é otimizar o emprego da capacidade RNAV das aeronaves, o mais breve possível, sem que sejam necessárias modificações significativas nos sistemas de bordo para a maioria das aeronaves.

3 ÁREA DE APLICAÇÃO

3.1 A RNAV-5 será aplicada em todas as rotas RNAV das FIR Amazônica, Brasília, Curitiba e Recife.

4 OPERAÇÕES RNAV-5 DENTRO DAS FIR AMAZÔNICA, BRASÍLIA, CURITIBA E RECIFE

4.1 A partir de 18 de novembro de 2010, somente aeronaves e operadores aprovados RNAV-5 (aeronavegabilidade e operações) serão autorizados a operar nas rotas RNAV das FIR Amazônica, Brasília, Curitiba e Recife.

4.2 A RNAV-5 será implantada conforme os Acordos Regionais de Navegação Aérea. A aprovação de aeronavegabilidade e de operações será realizada pelo Estado do Operador ou pelo Estado de Registro, conforme seja o caso, baseando-se nas normas nacionais de cada Estado. No caso dos operadores de aeronaves brasileiros, o processo de aprovação de aeronavegabilidade e de operações é estabelecido pela Agência Nacional de Aviação Civil (ANAC).

4.3 A documentação e informação atualizada sobre a implantação da RNAV-5 pode ser encontrada no seguinte endereço da INTERNET, do Escritório Sul-Americano da OACI: http://www.lima.icao.int/submenu1.asp?Url=/ICAOSAMNET/AirNav-eDocumentsMenu.asp.

4.4 Informação adicional pode ser obtida por meio dos seguintes contatos:

a) DECEA:
Divisão de Gerenciamento da Navegação Aérea: Tel: ++55-21-21016273; Fax: ++55-21-21016233; Email: dgna@decea.gov.br.

b) ICAO Lima
RO/ATM/SAR: Tel: ++ 511-6118686; Fax: 511-6118689;
Email: jf@icao.lima.int

5 DISPOSIÇÕES FINAIS

5.1 Os casos não previstos nesta AIC serão resolvidos pelo Exmo Sr. Chefe do Subdepartamento de Operações do Departamento de Controle do Espaço Aéreo.

5.2 Esta AIC foi aprovada pelo Boletim Interno do DECEA nº 26 de 09 FEV 2009.

2.7 RNAV-5 implementation aims to optimize the use of aircraft RNAV capacity as soon as possible, without requiring significant changes in airborne equipment for most aircraft.

3. AREA OF APPLICATION

3.1. RNAV-5 will be implemented on all RNAV routes in the Amazonica, Brasilia, Curitba and Recife FIR

4. RNAV-5 OPERATIONS WITHIN THE AMAZONICA, BRASILIA, CURITBA AND RECIFE FIR.

4.1. Starting on November 18, 2010, only aircraft approved for RNAV-5 (airworthiness and operations approval) will be authorized to operate on RNAV routes in the Amazonica, Brasilia, Curitba and Recife FIR

4.2. RNAV-5 will be implemented in accordance with the Regional Air Navigation Agreements. Airworthiness and operations approval will be granted by state of operator or by state of registry, according to each case, under national regulations. The process for the approval of the Brazilian operators and aircraft are established by the Civil Aviation National Agency (ANAC).

4.3. Updated documentation and information about RNAV-5 implementation may be found at the following website of the ICAO South American Office: http://www.lima.icao.int/submenu1.asp?Url=/ICAOSAMNET/AirNav-eDocumentsMenu.asp.

4.4. Additional information, could be obtained through the following contacts:

a) DECEA:
Divisão de Gerenciamento da Navegação Aérea: Tel: ++55-21-21016273; Fax: ++55-21-21016233; Email: dgna@decea.gov.br.

b) ICAO Lima
RO/ATM/SAR: Tel: ++ 511-6118686; Fax: 511-6118689;
Email: jf@icao.lima.int

5. FINAL ARRANGEMENTS

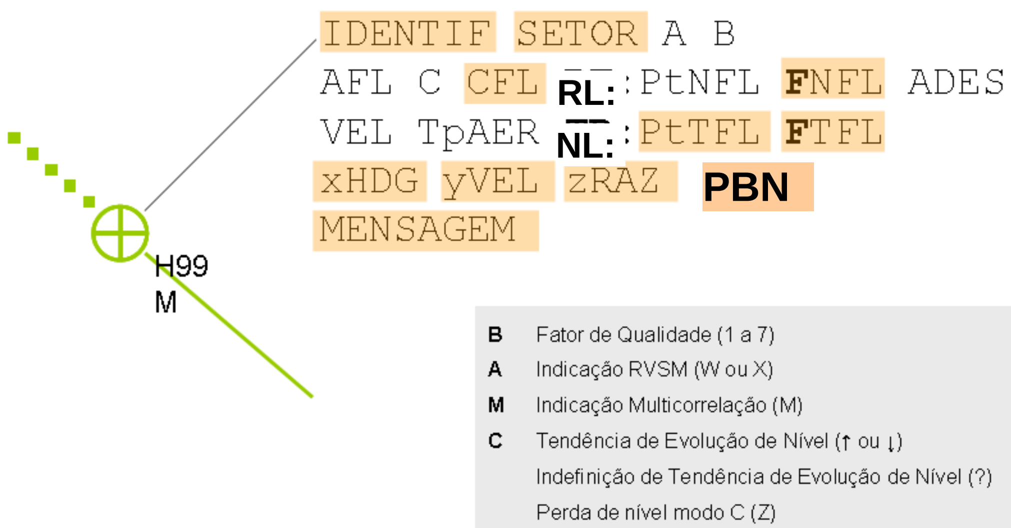
5.1 Cases not foreseen in this AIC will be resolved by the Chief of the DECEA Operations Sudepartment.

5.2 This AIC was approved by DECEA Internal Bulletin edition nr.26, dated 09 FEV 2009.

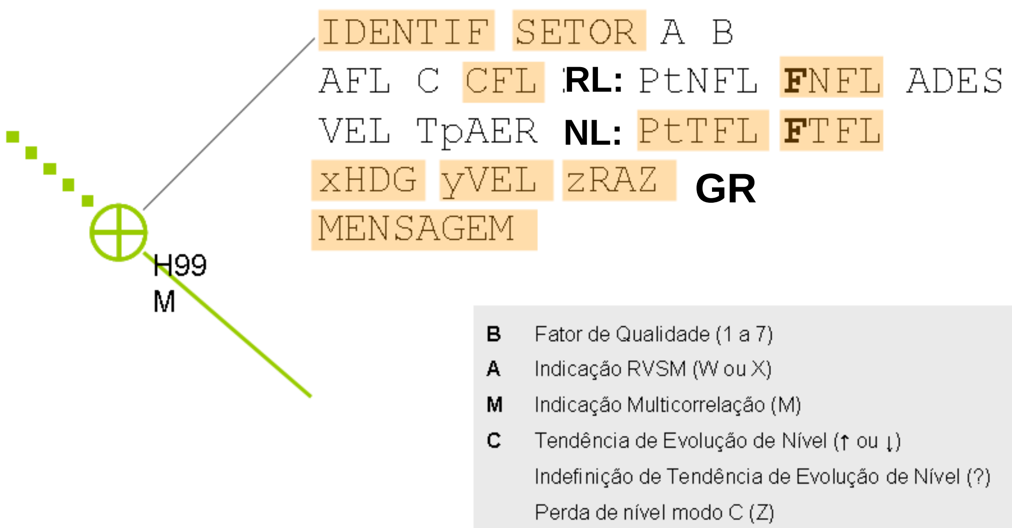
APENDICE G

Nuevo Sistema – Sagitário

Layout del Target Radar

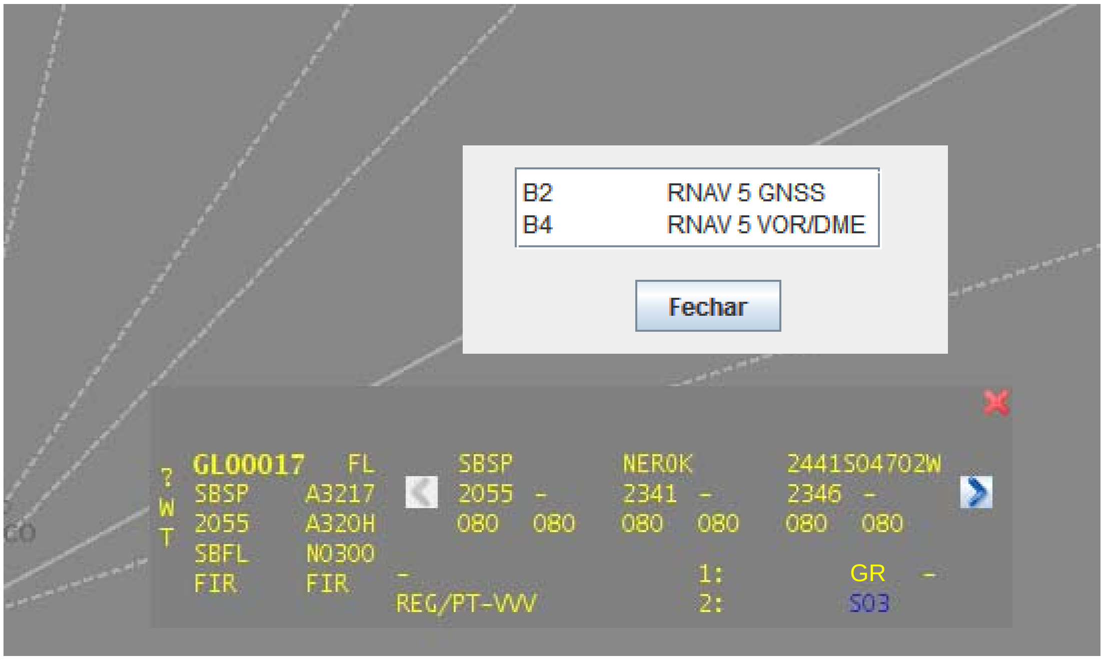


PBN – Campo en que serán insertadas las letras GR



PBN – G (GNSS) y R (Aprobación PBN)

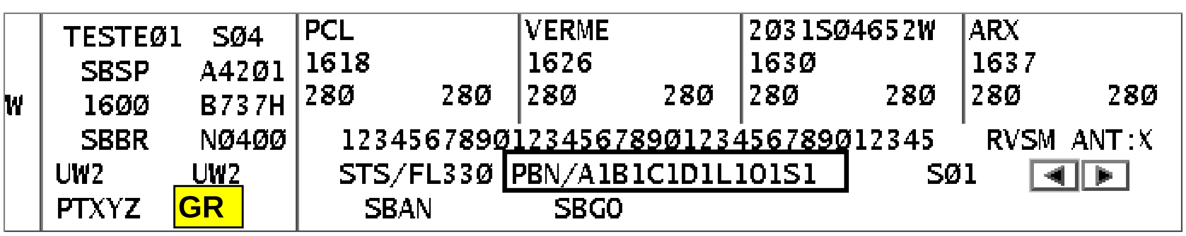
Layout da Faja de Progresión de Vuelo



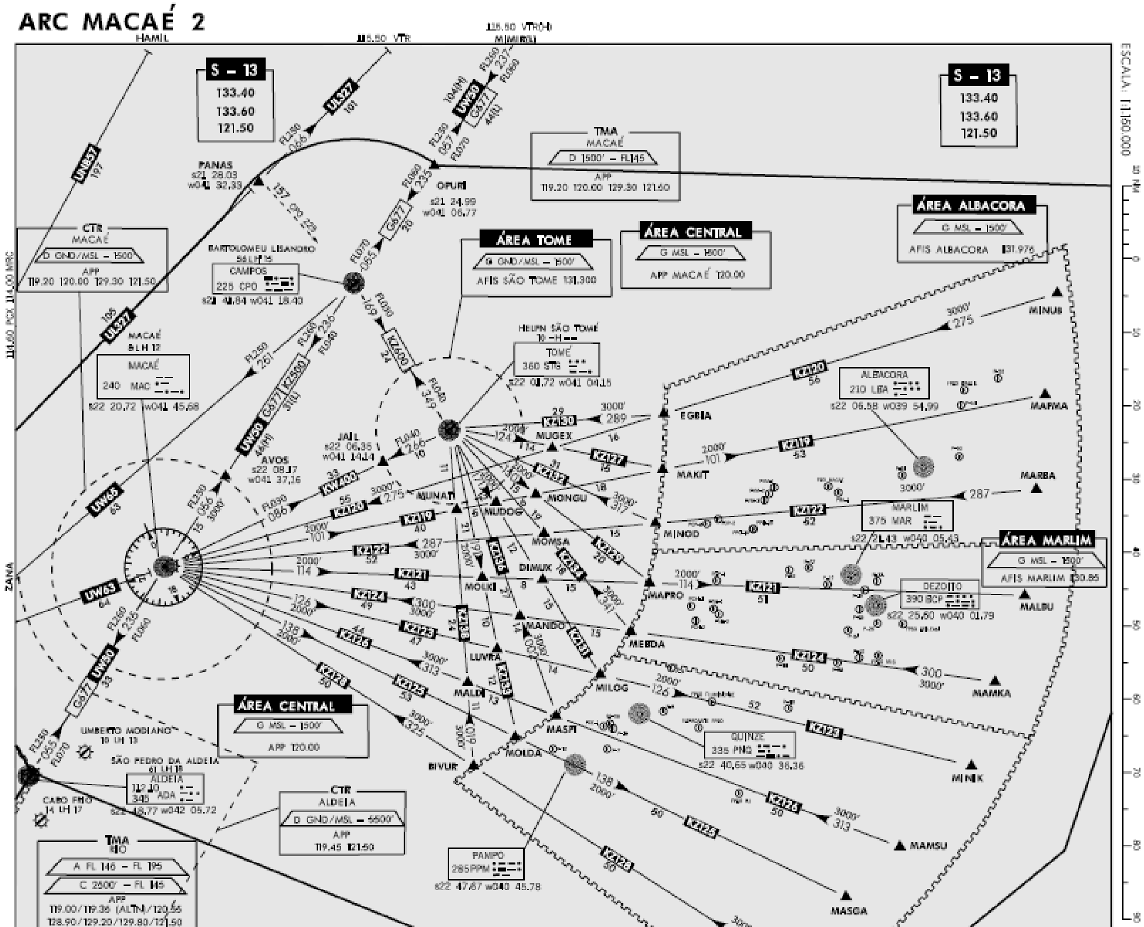
<u>Sistema Actual – X4000</u>

<u>Layout del Target Radar</u>

Layout de la Faja de Progresión de Vuelo



APÉNDICE H



COORDENADAS DOS PONTOS DE NOTIFICAÇÃO

NOME DO FIXO	LATITUDE	LONGITUDE	NOME DO FIXO	LATITUDE	LONGITUDE	NOME DO FIXO	LATITUDE	LONGITUDE
BIVUR	s22 47.91	w041 00.75	MARBA	s22 09.45	w039 38.42	EGRIA	s21 59.59	w040 33.07
MAKIT	s22 07.21	w040 33.19	DIMUX	s22 22.34	w040 50.68	MOLDA	s22 43.87	w040 54.61
MALBU	s22 23.97	w039 39.95	MASGA	s23 05.48	w040 05.73	MOLKI	s22 22.09	w040 59.55
MALDI	s22 36.46	w041 01.60	MASFI	s22 41.02	w040 48.59	MONGU	s22 10.69	w040 51.72
MAMKA	s22 36.85	w039 44.13	MEBDA	s22 29.39	w040 37.70	MOMSA	s22 16.01	w040 50.52
MAMSU	s22 58.56	w039 57.88	MILIG	s23 14.91	w040 15.07	MUDOG	s22 11.78	w040 57.58
MANDO	s22 27.36	w040 54.01	MILOG	s22 36.29	w040 42.17	MUGEX	s22 04.35	w040 49.37
MANTA	s22 31.87	w040 57.33	MINIK	s22 47.40	w039 47.48	MUNAT	s22 12.85	w041 03.33
MAPMA	s21 56.48	w039 37.31	MINOD	s22 14.57	w040 34.19			
MAPRO	s22 22.74	w040 34.96	MINUS	s21 42.56	w039 35.70			

- FIN -