Appendix B

Table ATM II-AFI-2

MANAGEMENT OF SECONDARY SURVEILLANCE RADAR (SSR) CODES IN THE AFI REGION

Safety Assessments

-Before using an allocation
-Before using codes not allocated to the States/FIR or not allocated for the purpose
-Letters of Agreement (LOAs) for any exchange of codes not in the plan

Objectives of the new code management plan (CMP)

1. The new code allotment plan) CMP shall provide
States in the AFI region with a means to coordinate the use of
4 096 secondary surveillance radar (SSR) codes in Mode A/3 in the most efficient and economical manner.

2. The plan shall foster the early implementation of a method which will ultimately allow an assigned four-digit code to be maintained for the longest possible time during a flight in the AFI region.

General principles to meet the objective

3. The detailed principles governing the use of SSR codes in the AFI region are based on the following general principles which are complementary to the worldwide provisions (PANS-ATM, Doc 4444, Chapter 8). These principles provide for a smooth transition from the present use of SSR to that mentioned in 2.

4. Mode A/3 codes shall be used for ATM purposes only

5. Codes will be allocated to ATS units on the basis of duly justified operational requirements and their number will be established based on the number of aircraft to be handled simultaneously within a specified area and for a determined period of protection during traffic peaks.

6. Code requirements will be expressed in terms of complete code series (sixty-four four-digit codes in each series) or specified parts thereof. In special cases, such requirements may even cover designated four-digit codes only.

7. Codes intended to be used as international codes will be allocated to specific area control centres (ACCs) for use within participating areas (PAs) consisting of the areas of ATS responsibility of several States.

8. Codes intended to be used for domestic purposes will be allotted to States for use by ATS units which require limited geographical protection for such codes only.

Operational and technical factors involved

9. The following operating conditions are likely to persist for the foreseeable future :

a) both auto-active and passive SSR decoding equipment will be used for ATS purposes in the AFI region;

b) because of this, comparatively simple code assignment methods, such as the assignment by reference to ATC sectors, will coexist with, and vertically or laterally adjoin, more sophisticated computer-assisted code assignment methods; and

c) as 4 096 code capability in Mode A/3 is a prerequisite for full application of sophisticated code assignment methods, it appears essential to make this capability a mandatory requirement for aircraft operating international transit flights. For this reason, an environment of sixty-

four code capability is not taken into account in this context.

10. For guidance material detailing the requirements for the development of automated SSR code assignment systems, refer below to Considerations Relevant to the Progressive Sophistication of Treatment of SSR-derived Data for ATS Purposes

Permanent code distribution and categories Distribution of codes

11. Certain codes are reserved for special purposes on a worldwide scale. The remaining code series for use in the region are, in this CMP, divided into three distinct categories: transit codes for regional use, international codes for use within the PAs and domestic codes for FIR use.

12. The number of codes used for regional transit purposes has to be relatively high, due to the extended geographical protection required in order to reduce to a minimum the chances of confusion between the identity of two or more different aircraft assigned the same four-digit code. Sufficient protection must be allowed to prevent interference with affected PAs in neighbouring regions

13. The number of codes used for domestic purposes can be kept relatively small, as these may be repeated in different States or FIR, as the case may be, even within the same State (or FIR).

14. Where required, the allocation possibilities can be increased significantly by dividing specific code series into eight blocks of eight four-digit codes.

Special purpose codes

15. Specific codes in certain series are reserved for special purposes as follows:

Series 77 — Code 7700 is reserved for use in the event of emergencies. (Codes 7701 – 7777 are temporarily unavailable.

16. Code blocks in the series 00 (with the exception of code 0000) are allotted to States for domestic purposes so that every State in the region is allotted two octal blocks of four- digit codes in such a manner that a code duplication is avoided at the State borders.

17. States may use discrete codes 7501 – 7577 and 7601 –
7677 for domestic purposes provided they have ascertained that in the area concerned and in affected adjacent areas:

a) no sixty-four code ground equipment is in operation; and

b) 4 096-code ground decoding equipment has the capability of permitting the use of such codes without generating the aural or visual alarms associated with the special purpose codes 7500 and 7600 (see Annex 10, Volume IV, 2.1.4).

Series 00 — Code 0000 is available as a general purpose code for domestic use by any State. (Codes 0001 – 0077 are available for domestic purposes (16 refers)).

Series 20 — Code 2000 is to be used by flights required to set a code without specific ATC instructions when entering an
area where SSR coverage is available. (Codes 2001 – 2077 are available for international transit purposes.) also refer to Doc 4444 chapter
Series 75 — Code 7500 is reserved for use in the event of
unlawful interference. (Codes 7501 – 7577 are available for domestic use subject to specific conditions (17 refers)).

Series 76 — Code 7600 is reserved for use in the event of radio telephony communication failure. (Codes 7601 – 7677 are available for domestic use subject to specific conditions (17 refers)).

International codes

18. International codes are allocated to specific ACCs for assignment to international transit flights. Aircraft will retain the assigned code beyond national boundaries but not normally beyond the AFI region (21 c) refers).

19. Allocation of international codes in the AFI region is based on four participating area which includes the following flight information centres/area control centres (FICs/ACCs):

Multiple Participating Areas

20. AFI has established four (04) Participating Areas within which specific codes are allocated to enable assignment to aircraft codes will as follows;

PA East (12) - Addis Ababa + Djibouti, Juba (Managed by Khartoum), Mogadishu, Asmara, Nairobi, Entebbe, Kigali, Bujumbura, Dar- es –

Salaam, Seychelles, Antananarivo + Comoros, Mauritius

PA South (9) – Lilongwe, Lusaka, Luanda, Beira, Harare, Gaborone, Windhoek, Johannesburg + Manzini+ Maseru,Cape Town

PA Central (3) – Kinshasa, Brazzaville + Douala + Bangui + Libreville, Ndjamena + Douala

PA West (6) – Sal Oceanic (Cape Verde), Dakar + Nouakchott + Bamako + Bissau + Malabo, Abidjan + Ouagadougou + Banjul, Roberts FIR (Conakry + Freetown + Monrovia), Accra + Lome + Porto-Novo, Kano, Niamey + Bamako,

International codes

21. International codes shall be assigned in accordance with the following principles governing the originating region code assignment method (ORCAM):

a) when an aircraft enters the AFI region (either on departure or in flight), it will be assigned a specific four- digit code by the first ATS unit concerned in the region. This code will be selected from a given stock of code series allocated in such a manner that duplication of codes assigned by different centres is prevented within the region;

b) each flight will keep the original code assigned on entering the region for the whole flight time within that region or PA. Appropriate code protection criteria have to be applied in order to avoid duplication by too early reassignment of the same code.

c) normally a code change will be required at the time a flight crosses (leaving) the AFI region boundary. However, in specific cases and by specific arrangements agreed between the ATS units affected during the continuation of the flight, the assigned code may be retained beyond the AFI region boundary.

22. In establishing the number of international code series, account has been taken of the following factors:

a) the lifetime of the air navigation plan of which SSR is but one element. At present this does not exceed a maximum of seven years;

b) the air traffic forecasts for the AFI region in order to determine the likely growth of air traffic classified as international in the region;

c) the requirement for code series for a given ATS unit is derived from the total number of aircraft requiring assignment of a specific code during the busiest period of activity of that ATS unit;

d) in calculating the required code series in accordance with c) above, a "protection period" of approximately two hours is used, i.e. any specific code assigned to an aircraft by an ATS unit is normally available for re-use after a period of two hours following the initial assignment of the code; and

Note: The protection period may be reduced based on the available automation and other guidance provided herein.

e) the assignment of a specific code to an aircraft is made once the aircraft in question is ready for departure on a flight, or when the aircraft in flight is expected to come under imminent control. Permanent code assignments based on the flight number or any other systematic distinguishing features cannot as a general rule be accepted because of the wasteful effects on the economy in the use of codes required.

23. Common criteria applying to traffic figures will have to be established to assess the number of transit codes required by each ACC in the region. The distribution of transit codes should be done by reference to the portion of peak international flights originating from the ACC and that will be assigned an SSR code. A fix time evaluation of each facility could be used to determine the SSR code requirements.

24. All code series allocated to the AFI region must be protected from affected PAs in neighbouring regions.

Domestic codes

25. Domestic codes are allocated for use by flights which, throughout their flight, remain within the boundaries of the agreed area of use of such codes (normally within one FIR).

26. With regard to domestic codes used primarily for terminal control purposes (terminal control area (TMA/APP) and ground controlled approach (GCA), it is assumed that, unless specified otherwise, the area of operational use of the code concerned corresponds to the area of use of the associated air-ground communication channel.

27. Domestic codes should be used so that utmost economy in the number of codes required is achieved. As national requirements vary considerably, no definite rules can at present be established; however, in order to assist FIR, and in order to facilitate required international coordination of use of domestic codes in border areas, the following guidelines are provided.

28. As a general rule, codes employed primarily for transit purposes may be used for domestic purposes in those States where a buffer of one FIR exists between the area where the code is used for transit and that where it is used for domestic purposes. Based on appropriate agreements between the ATS units affected, exceptions to this rule may be made, provided that it is ensured that this will not lead to difficulties.

29. Domestic codes used for terminal purposes (TMA/APP and GCA) or used within specified portions of the airspace (sectors) will be ensured protection in these functions. Adjacent States may use such codes for their domestic purposes provided a buffer equal to one sector or a distance of 60 NM, whichever is larger between the closest edge of the two areas of use exists.

Monitoring of the plan

29. While full implementation of the CMP must inevitably be achieved gradually, it is expected that progressive development of ground facilities will allow in future an increasing number of ATS providers to adhere to the provisions foreseen in the plan.

30. Provisions regarding the progressive implementation of the SSR CMP and its monitoring should be agreed by the AFI region(need for a monitoring mechanism i.e annual report on SSR codes usage and traffic movements to facilitate assessment and review) ARPIG . FIRs expecting to introduce SSR facilities are required to advise the ICAO ESAF or WACAF Regional Offices as applicable, on their intended use of codes at least six twelve (12) months in advance, in order to permit timely accomplishment of any necessary coordination.

ABBREVIATIONS AND GLOSSARY OF TERMS

PA	Participating area. An area of specified dimensions comprising the areas of ATS responsibility of several States wherein a four-digit code assigned to a specific aircraft engaged in an international flight is normally retained by this aircraft while operating in that area.
CMP	Code Management Plan.
AFI PA	The ICAO AFI region except the following States: Algeria, Egypt, Morocco, Spain (Canarias FIR), Tunisia (included in EUR CAP).
ORCAM	Originating region code assignment method (20 refers).
Basic code	An SSR identity code containing combinations of A and B pulses only (also replies from a 4 096 code transponder where no C or D pulses are present): (Z1, Z2, (0, 0) with Zi = 0, 1, 2, . . .7)
Discrete code	An SSR identity code containing all those combinations of A, B, C and D pulses which do not constitute a basic code (cannot be generated by a sixty- four code transponder): (Z1, Z2, Z3, Z4) with Zi = (0, 1, 2, . . .7) and Z3 + Z4 * 0.
Four-digit code	An SSR identity code containing combinations of A, B, C and D pulses (any reply generated by a 4 096-code transponder): (Z1, Z2, Z3, Z4) with Zi = (0, 1, 2, . . .7).
Code series	A group of the sixty-four four-digit codes having the same first two digits.
Code block	A continuous sequence of four-digit codes within a code series. Specific "octal" blocks of eight sequential codes having common first three digits may be identified by reference to the third digit of the full four-digit code (e.g.0-block = codes XX00 to XX07. Codes 0010 to 0017 may be designated as codes 00 (1), codes 0020 to 0027 as codes 00 (2), etc.).
Code assignment	Distribution of SSR codes to aircraft (see PANS-ATM, Doc 4444).
Code allocation	Distribution of SSR codes to services (see PANS-ATM).
International code	A code allotted to a specific ATS unit for assignment to an aircraft engaged in an international flight and which will be retained by this aircraft at least while operating within the related PA.
Domestic code	A code allotted to a specific State for use by a designated ATS unit within that State in relation to flights which remain throughout their operation within the agreed area of use of the code concerned.

CONSIDERATIONS RELEVANT TO THE PROGRESSIVE SOPHISTICATION OF TREATMENT OF SSR-DERIVED DATA FOR ATS PURPOSES

Introduction

1. The In AFI region many ATS providers are relying increasingly on the use of secondary surveillance radar (SSR) in automated air traffic control (ATC) ground systems to ensure uninterrupted identification and tracking of individual aircraft and maintenance of radar/flight plan correlation.

2. The common availability of specified capabilities in automated ATC ground systems has been recognized as being essential for:

a) the participation of individual automated ATS units in a cooperative environment;

b) the application of a common SSR code assignment method in accordance with the ICAO principles; and

c) the efficient utilization of four-digit SSR codes in automated ATS ground systems.
d) the safety of flights due to reduction of Controller/pilot workload related issues

3. This "Statement of essential common capabilities for automated ATC ground systems in relation to the use of SSR" lists the capabilities concerned; it is intended to become a common part of the basis for minimum operational specifications for automated ground systems.

General system consideration

4. The application of automatic data processing in ATC ground systems allows for great freedom in the definition of system capabilities. This freedom should be exploited to:

a) provide for all essential capabilities related to the use of SSR in the most simple manner having due regard to operational requirements; and

b) enable individual automated ATC ground systems to function as part of a cooperative environment and to comply with agreed

conventions facilitating such cooperation (e.g. principles, technics and basic rules for code management including assignment, code assignment methods, etc.).

5. Individual automated ATC ground systems should, as part of a cooperative environment, be capable of making the maximum use of four-digit identity codes previously assigned

by other units controlling the aircraft concerned, i.e. they should not introduce any code changes or, if this is impossible in some circumstances, they should require only the minimum of changes.

6. Taking into account a possible cooperation of ATC ground systems within the AFI region with others outside the region and the range of four-digit identity codes which may be utilized under such arrangements, automated ATC ground systems should be capable of performing all system functions related to the use of SSR for any four-digit identity code.

7. Automated ATC ground systems should be designed to allow the use of a minimum number of four-digit identity SSR codes. (The application of sophisticated code correlation methods may reduce the number of codes needed in comparison with those required when simpler methods are used.)

8. The processing of SSR data in automated ATC ground systems should be aimed at reducing the need for controller intervention.

Essential capabilities for automated ground systems

9. It is essential that automated ATC ground systems be designed to have certain capabilities in common, based on the assumption that:

a) the maximum use will be made of previously assigned four-digit identity SSR codes and of Mode C;

b) only where continuing use of previously assigned codes would give rise to ambiguity will new four-digit identity codes be assigned in accordance with a suitable common SSR code assignment method;

only where continuing use of codes allocated to a system would give rise to ambiguity will new four-digit identity codes be allocated to a specific system in accordance with a suitable common SSR code assignment method;

only where use of previously assigned codes gives rise to ambiguity will new four-digit identity codes be assigned

c) the prime use of four-digit identity codes will be to facilitate automatic identification, automatic tracking and automatic radar/flight plan data correlation; and

d) the differentiation of aircraft essential for the execution of these functions can be achieved through the use of a single, adequately protected code per flight.

10. In detail, automated ATC ground systems should be capable of automatic:

a) exchange of four-digit identity codes, in particular, of timely transmission to adjacent centres concerned of information on the code previously assigned to flights to be transferred;

b) assignment of four-digit identity codes, in all instances where no previous code assignment has been made or where previous assignments are found to be unsuitable;

c) recognition of SSR codes, in particular, decoding of all SSR codes transmitted within the SSR coverage of a centre (auto-active decoding);

d) processing of SSR code information, including:

1) initiation of automatic tracking of SSR responses;

Note.— This does not exclude tracking on the basis of primary radar returns in areas where adequate primary coverage is available.

2) determination for each code whether it meets the criteria to be established for unambiguous correlation;

3) recognition of any code duplications affecting correlation;

4) proposing action to controllers to resolve code duplications affecting correlation;

5) establishment of initial correlation between real-time radar information and current flight plan information on the basis of decoded SSR replies (including Mode C information). Correlation should be achieved sufficiently in advance of time at which an aircraft enters the jurisdiction of a centre;

6) maintenance of correlation between real-time radar information and current flight plan information on the basis of decoded SSR replies and/or coincidence of flight plan information (route, heading, FL, ground speed, set altitude) or other distinguishing criteria and radar information;

7) storage of code information until a time at which its activation and protection is desired; and

8) activation of stored information for correlation at a given time and/or within a given airspace;

e) display of information, including:

1) presentation in a suitable manner of decoded SSR
replies and/or correlated flight plan information;

2) filtering of information to be displayed on the basis of
SSR-derived data (Modes A and C); and

3) indication of code duplications;

f) initiation of alarms, indicating the detection of special codes as specified on a regional or worldwide basis, maintenance of tracking and correlation on aircraft using these codes; and

g) recovery from ground system degradation. In cases of ground system degradation (excluding display component failure) to the extent that essential SSR-derived information is not di splayed, automated ATC ground systems should be capable of restoring all essential information within the shortest possible time. Until full serviceability can be restored, the above aim may necessitate suppression of functions of secondary importance.

(ESAF to originate State letter on adherence to the AFI plan SSR code assignment procedure)

Development of automated SSR code assignment systems

11. As the level of automation currently available could be a limiting factor in code assignment and thus reflect on the code allotment, the following principles for the development of automated SSR code assignment systems should be observed:

a) automated systems shall not require the use of basic codes when there is a need to recognize a grouping of aircraft (Formation flights). The automated equipment shall be able to achieve group recognition on the basis of a four-digit code common to such grouping;

Note.— International transit flights are not to be transferred on such common codes to adjacent ATS units unless specifically agreed between the units concerned.

b) automated systems shall be capable of using code blocks (parts of a code series) without getting confused if, in a neighbouring system, other blocks of the same code series (with the same first and second digits) are used;

c) automated equipment shall be capable of coping with a reasonable number of code conflicts rather than preventing code duplications by means of more complicated and less economical code allocation and assignment methods;

Note— It is expected that this feature will become even more important as traffic increases.

d) automated systems shall be capable of identifying and as applicable rejecting codes that are not allocated for the FIR/ blocks of airspace in which the service is being provided.

e automated systems shall be capable of assigning codes with reference to the category of a flight, i.e. transit codes shall be assigned to international transit flights and domestic codes to flights confined within the smaller area of use reserved for such codes;

f) automated systems shall permit the addition of a sophisticated capability of assigning codes with reference to the routing or special code protection required for specific

flights, especially when this will permit economies in the number of codes required;

g) the code assignment logic of an automated system shall not impose any restrictions on the free choice of any specific additional codes if this is required to satisfy new requirements; and

h) automated code assignment systems shall aim at international cooperation.

GUIDELINES FOR THE APPLICATION OF TABLE ATS 3

Introduction

1. In accordance with the implementation requirements of the table below, States and organizations responsible for providing air traffic services in the AFI regions should properly apply the procedures of the AFI SSR code allocation plan (CAP) approved by the AFI Planning and Implement- ation Regional Group (APIRG). This document contains guidelines for achieving this objective.

2. It is impossible to cover all potential variables due to the diversity of circumstances and characteristics which, at a given point, might have a bearing on the application of procedures; therefore, it is expected that States will interpret correctly the application criteria and that this guide will serve as an auxiliary document for applying the procedures. It is also noted that the ICAO ESAF and WACAF Regional Offices will be responsible for monitoring the CMP, so States may therefore ask them for clarification when necessary.

General procedures

Use of codes

3. States and organizations responsible for providing services should limit the use of SSR codes to the series allocated to them in TableATM II-AFI-2.

4. States and organizations responsible for services should internally redistribute allocated codes, distributing the available code series or fractions thereof to ATS units equipped with radar systems under their jurisdiction, taking into account the volume of outgoing flights and overflights requiring codes.

Note.— In order to make better use of code series, they may be divided in fractions in such a way that they may be used as a whole or in halves, quarters or eighths of a series, as required, according to the volume of flights served by each ATC unit.

5. Codes are assigned to flights leaving the jurisdiction of the ATS unit where those flights originate. This means that they are assigned to departures from airports within the area and to overflights arriving from airspaces where the code has not been assigned.

6. Efforts should be made to maintain the code already assigned to an aircraft. This assumes that the code is known at the time of coordination and that it may be introduced into the automated processing system, so that the system will recognize when the aircraft enters the radar system coverage area.

Code occupation period

7. In order to protect the use of a unique code for each flight, avoiding its double assignment to another flight within the airspace of a PA, each ATS provider or ATS unit shall determine a “protection period” within its area, i.e. the period of time in which the code used by a flight cannot be assigned to another flight.

8. For maximum economy of codes, the codes should be assigned as closely as possible to the time of flight activation; likewise, when a flight has already been assigned a code and it is not activated within a reasonable time limit, the code assignment should be cancelled, releasing it for use by another flight.

9. In some cases, when flight times within airspaces with radar coverage so permit, codes may be assigned in a cyclical manner; that is, codes are progressively assigned until reaching the last available code, at which time the assignment starts over again from the beginning, irrespective of the time elapsed. In some cases, when feasible, this procedure is simpler for ATC units.

Saturation

10. When the demand for codes exceeds the number available due to unexpected/unforecast increase in traffic, and solutions such as a reduction of the protection period cannot be adopted, ATC units may apply the following measures:
a) in the case of transit flights, use can be made of code series allocated to FIRs belonging to non-adjacent PAs. This procedure should be used in extreme cases after coordinating with those FIRs that might be affected. The ICAO ESAF and WACAF Regional Offices may recommend this solution after studying the possibilities and assessing potential consequences;
b) in the case of domestic flights, use can be made of transit codes allocated to the FIR concerned or, if necessary, to another FIR within

11. Table ATM II-AFI-2 recommends assigning codes from the series apportioned for domestic flights for use by FIRs. Based on the needs of ATS units, this proposal could be

modified to permit a more appropriate application, considering that:

a) the same code can be assigned to different domestic flights, as long as airspaces where the flights take place are not adjacent and there is no intermediate radar coverage area for at least 60 nautical miles;
the same PA, at the same time taking the relevant protective measures to avoid any negative effects.

Assigning codes to domestic flights

b) the rule described in a) above may be applied within the same FIR and also between adjacent FIRs when relevant arrangements have been made;

c) in order to take maximum advantage of this procedure, it is preferable to allocate the same domestic codes in different smaller areas, instead of assigning codes taken from many different series; and

d) when saturation in the demand for domestic codes is fore- seen, the procedure described in b) above may be applied.