NATO STANDARDIZATION AGENCY
AGENCE OTAN DE NORMALISATION

26 September 2003 NSA/0828-AIR/4565

STANAG 4565 (EDITION 1) – AIRBORNE MULTI-MODE RECEIVER (MMR) FOR PRECISION APPROACH AND LANDING

Reference: AC/224-D/926 dated 15 May 2000

1. The enclosed NATO Standardization Agreement, which has been ratified by nations as reflected in the **NATO Standardization Document Database (NSDD)**, is promulgated herewith.

2. The reference listed above is to be destroyed in accordance with local document destruction procedures.

3. APP-4 should be amended to reflect the latest status of the STANAG.

ACTION BY NATIONAL STAFFS

4. National staffs are requested to examine their ratification status of the STANAG and, if they have not already done so, advise the NAFAG, DI-IS, through their national delegation as appropriate of their intention regarding its ratification and implementation.

Original Signed

Jan H ERIKSEN
Rear Admiral, NONA
Director, NSA

Enclosure:

STANAG 4565 (Edition 1)

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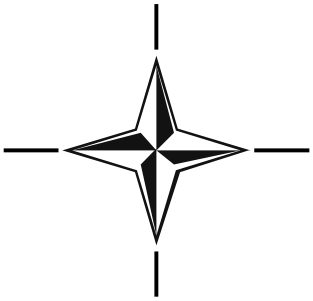
STANAG 4565
(Edition 1)

NORTH ATLANTIC TREATY ORGANIZATION
(NATO)



NATO STANDARDIZATION AGENCY
(NSA)

STANDARDIZATION AGREEMENT
(STANAG)

SUBJECT: AIRBORNE MULTI-MODE RECEIVER (MMR) FOR PRECISION APPROACH AND LANDING

Promulgated on 26 September 2003

Original Signed

Jan H ERIKSEN
Rear Admiral, NONA
Director, NSA

RECORD OF AMENDMENTS

No.	Reference/date of Amendment	Date Entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Director NATO Standardization Agency under the authority vested in him by the NATO Standardization Organisation Charter.

2. No departure may be made from the agreement without consultation with the tasking authority. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

DEFINITIONS

4. Ratification is "In NATO Standardization, the fulfilment by which a member nation formally accepts, with or without reservation, the content of a Standardization Agreement" (AAP-6).

5. Implementation is "In NATO Standardization, the fulfilment by a member nation of its obligations as specified in a Standardization Agreement" (AAP-6).

6. Reservation is "In NATO Standardization, the stated qualification by a member nation that describes the part of a Standardization Agreement that it will not implement or will implement only with limitations" (AAP-6).

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. The NSDD gives the details of ratification, implementation, reservations and comments of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions.

FEEDBACK

8. Any comments concerning this publication should be directed to NATO/NSA – Bvd Leopold III - 1110 Brussels - BE.

STANAG 4565
(Edition 1)

NATO STANDARDISATION AGREEMENT (STANAG)

AIRBORNE MULTI-MODE RECEIVER (MMR) for PRECISION APPROACH and LANDING (PAL)

ANNEXES:

A. Minimum and Desired Capabilities of a Military Airborne Multi-Mode Receiver (MMR) Precision Approach and Landing System (PALS).

B. MMR Control and Display.

APPLICABLE DOCUMENTS

A. International Civil Aviation Organisation (ICAO) International Standards and Recommended Practices (SARPS), Aeronautical Telecommunications, Annex 10 to the Convention on International Civil Aviation, Volume I (Radio Navigation Aids) dated July 1996.

B. STANAG 4184: Microwave Landing System (MLS) Edition 3 dated November 1998.

C. STANAG 4550: Use of Local Area Differential Global Positioning System (LDGPS) for Military Precision Approach and Landing (latest edition).

D. RTCA/DO 229B: Minimum Operational Performance Standards (MOPS) for Global Positioning System/Wide Area Augmentation System (GPS/WAAS) Airborne Equipment dated June 1999.

E. RTCA/DO-226: Guidance Material for Evolving Airborne Precision Area Navigation Equipment with Emphasis on MLS dated May 1995. (Note: Supersedes DO-198).

F. RTCA/DO-245: Minimum Aviation System Performance Standards (MASPS) for the Local Area Augmentation System (LAAS) dated September 1998.

G. RTCA/DO-246: GNSS Based Precision Approach Local Area Augmentation System (LAAS) - Signal-in-Space Interface Control Document (ICD) dated September 1998.

H. RTCA/DO-253: Minimum Operational Performance Standards (MOPS) for GPS Local Area Augmentation System (LAAS) Airborne Equipment dated 11 January 2000.

RELATED DOCUMENTS

A STANAG 4392: A Data Interchange Format for NAVSTAR Global Positioning System (GPS), Annex D: Format and Usage of Precise Positioning Service (PPS) DGPS Messages for Aviation and other High Performance Applications.

B. STANAG 4533: Precision Approach and Landing Systems (PALS) Transition Strategy.

C. Draft Standards and Recommended Practices (SARPS) for Global Navigation Satellite Systems (GNSS), ICAO Document.

D. STANAG 4294: NAVSTAR Global Positioning System (GPS) – System Characteristics (Part 1, Edition 2 dated December 1997) plus Summary of Performance Requirements (Part 2, Edition 2 dated June 1995).

INTRODUCTION

1. It is likely that different types of precision landing aids may be used around the world during an undefined transition period. It is therefore necessary that aircraft be capable, where operationally required, of making approach and landings with a variety of these aids. This could be achieved by using separate avionics for each aid (in which case it would be referred to as a “Multi-Mode Capability” (MMC)), or by using a dedicated single Multi-Mode Receiver (MMR), or a combination of the above.

2. The function of the airborne MMR is to provide precision flight path deviation guidance to the aircraft during the final approach and landing phase of flight. The MMR may operate in ILS, VOR, MLS and differential GPS (civil LAAS/Ground Based Augmentation System (GBAS) and military LDGPS) modes. In the ILS, VOR and MLS modes, the MMR shall receive the RF signal from the ILS/VOR antenna (the Localiser antenna can double as a VOR antenna) or MLS antennas as appropriate, decode the signal, calculate the deviation data and output the deviation data to the host aircraft interface. In the military LDGPS mode, and the civil LAAS/GBAS mode, the MMR shall be capable of obtaining position, velocity and time (PVT), differentially corrected pseudorange/range rate, and other required data from an embedded or external GPS receiver. A data broadcast receiving capability compatible with an ILS/VOR receiver shall be embedded within the MMR to receive LDGPS differential data transmissions.

3. If the GPS receiver is embedded in the MMR, it should include growth capacity capability for a space based augmentation system (SBAS).

4. To support ILS and MLS precision approach and landings, a Distance Measuring Equipment (DME) function external to the MMR may be required.

5. Annex A to this STANAG provides details of the minimum and desired capabilities of a military MMR PALS. Annex B provides details of the MMR control and display functions.

AIM

6. The aim of this agreement is to define the military MMR airborne equipment capable of enabling precision approaches to Fixed Base airfields and Tactical airstrips during military operations by:

a. Providing technical and operational guidance on the utilisation of the MMR by means of a living document with wide availability and subject to periodic review.

b. Defining the term “Multi-Mode Receiver or MMR” for NATO use. [Note: the space/ground systems signals-in-space are defined in Applicable Documents A (ILS and MLS), B (MLS), C (LDGPS) and Related Documents A, C and D, plus national documents]

c. Defining a set of minimum MMR characteristics and capabilities, which could serve as the basis of a NATO Staff Target for any co-operative development and acquisition programme.

AGREEMENT:

7. Participating Nations agree:

a. That only airborne MMR PALS equipment capable of containing:

(1) ILS/VOR/VOR compliant with Applicable Document A and conforming to ICAO FM radio-broadcast interference resistance requirements.

(2) MLS compliant with Applicable Document B and capable of MLS Auxiliary Word reception.

(3) GPS and Differential GPS (DGPS) compliant with Applicable Documents C, D, F, G and H, and Related Documents A, C and D.

(4) Data broadcast reception capability for the VHF band (LDGPS/LAAS/GBAS) compliant with Applicable Document C.

shall be referred to as MMR equipment within NATO. [Note: the STANAGS are appropriate references for MLS and DGPS because they may tailor the ICAO Annex 10, Applicable Document A].

b. To exchange information and co-operate in the definition of interoperable landing systems and the development of airborne and ground equipment for NATO military use.

c. That the Distance Measuring Equipment (DME) avionics providing the ranging function for the MLS, will meet the requirements of the ICAO DME standards detailed in Applicable Document A. [Note: DME and ILS Marker Beacons currently provide the ranging element for straight-in approaches.]

d. That the signals-in-space characteristics for each of the precision approach and landing facilities utilised by the MMR shall be compliant with the latest version of Applicable Documents A (ILS and MLS), B (MLS), C (LDGPS) and Related Documents A, C and D.

IMPLEMENTATION OF THE AGREEMENT

8. This STANAG is considered implemented when a nation has issued the necessary orders/instructions to their subordinate forces placing the concepts based on this agreement into effect.

ANNEX A TO
STANAG 4565

MINIMUM AND DESIRED CAPABILITIES OF A MILITARY AIRBORNE MULTI-MODE RECEIVER PALS

1. The minimum MMR landing capability for military landing fields shall enable approaches to ICAO Category I minima (Category II desired) of the main instrument runway in the precision approach and landing modes of operation implemented (ILS, MLS and/or LDGPS).

2. The MMR avionics shall provide ILS look-alike displays to aircrew when using signals from ILS, MLS, or GPS/LDGPS plus GBAS and/or SBAS during precision approach and landings.

3. It is desirable that the MMR MLS avionics provides computed centreline approaches. A computed centreline approach is a straight-in approach flown to the centreline of a runway where the azimuth antenna is offset from that centreline. The MLS approach path is defined by the MLS ground station data word containing the azimuth offset distance from the runway centre-line, plus the azimuth and elevation position and range information. Applicable Document E provides guidance for any near-airport terminal area navigation system using MLS Random (Area) Navigation (RNAV) sensor inputs.

4. For the MLS mode of operation, the control function should ensure that upon selection of the MLS frequency, the associated DME frequency is automatically selected on the DME receiver (in accordance with Applicable Document A).

5. If the GPS receiver is embedded in the MMR, it is desirable that:

   a. The MMR be capable of operating in a WAAS/EGNOS (SBAS) mode of operation supporting the en-route, terminal, non-precision and Category I precision approach phases of flight in accordance with the requirements of Applicable Documents C and D.

   b. The MMR, when using a PPS code GPS receiver, be capable of supporting a Military Navigation Mode, incorporating PPS Receiver Autonomous Integrity Monitoring (RAIM) for en-route navigation and non-precision approach.

   c. The MMR, when using a coarse acquisition (C/A) code GPS receiver, be capable of supporting the Standard Positioning Service (SPS) RAIM for en- route navigation and non-precision approaches.

6. If the GPS receiver is not embedded in the MMR, the MMR shall be capable of accepting an external GPS input, applying LDGPS corrections from the Data Broadcast, and driving the host platform interface.

7. When using external military PPS GPS receivers, it should be understood that PPS based pseudoranges and pseudorange rates (i.e. with the effects of SA removed) are classified and should not be transmitted across the platform interface to the MMR without proper precautions including Host Application Equipment (HAE) security approval. One method of meeting this requirement is to re-apply the effects of SA as described in STANAG 4392 Annex D, Related Document A. HAE security approval is the responsibility of the National Authority implementing the design of the system.

8. The MMR shall provide ports for the connection of the following antennas (if the function is to be utilised):

a. An MLS forward looking landing antenna that provides continuous uninterrupted signal coverage during approach.

b. An MLS omni-directional antenna mounted in a location to complement the landing antenna that provides signal coverage in roll and pitch as well as through 360° of azimuth.

c. If required, a third MLS rear fuselage mounted antenna to ensure complete coverage in 360° azimuth and +/- 20° roll and pitch for receipt of approach and landing signals.

d. An ILS Glideslope antenna.

e. An ILS Localiser antenna that can also be used as the VOR antenna and the LDGPS Data Broadcast antenna. A VHF vertically polarised antenna may be used to receive GBAS/E signals as recommended by ICAO.

f. A GPS antenna when the GPS receiver is embedded within the MMR.

9. The MMR should be capable of interfacing with existing analogue and digital aircraft systems and displays as required by the aircraft. The interface shall be connected either directly to the cockpit instruments or to a data bus as required by the host aircraft architecture.

10. The aircraft integrator shall ensure that the MMR display functions provide maximum commonality for all modes of operation. This will ease impacts on pilot workload and training issues.

ANNEX B TO
STANAG 4565

MMR CONTROL AND DISPLAY

1. Control of the MMR may be from either the host aircraft Flight Management System (FMS) or a dedicated Control Unit (CU).

2. The MMR control function should have a minimum of five modes of operation: Standby, Functional Test, ILS/VOR, MLS and GPS Landing System (GLS) Mode. The System designer should implement all of these control functions in the MMR control to support ILS look-alike precision approaches.

3. The MMR MLS control mode shall support computed and non-computed approaches and allow selection of manual and automatic mode of operation.

4. Users acquiring systems in the foreseeable future should ensure sufficient capacity for upgrade (e.g. memory, processing capacity, card slots) is inherent in the chosen MMR control system design.

5. The MMR can be purchased in various configurations: ILS/VOR only, ILS/VOR + MLS only, ILS/VOR + augmented GPS only, and ILS/VOR + MLS + augmented GPS. Each configuration will require that its MMR control and system integration be specifically designed for its host aircraft whether it is new or retrofit.