

**ANNEX 28****RESOLUTION MSC.115(73)  
(adopted on 1 December 2000)****ADOPTION OF THE REVISED PERFORMANCE STANDARDS FOR SHIPBORNE  
COMBINED GPS/GLONASS RECEIVER EQUIPMENT**

THE MARITIME SAFETY COMMITTEE,

RECALLING Article (28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution A.886(21), by which the Assembly resolved that the function of adopting performance standards and technical specifications, as well as amendments thereto shall be performed by the Maritime Safety Committee and/or the Marine Environment Protection Committee, as appropriate, on behalf of the Organization,

RECALLING FURTHER that, in accordance with resolution A.815(19) by which the Assembly adopted the IMO policy for the recognition and acceptance of suitable radionavigation systems intended for international use to provide ships with navigational position-fixing throughout their voyages, the Global Positioning System (GPS) and the Global Navigation Satellite System (GLONASS) have been recognized as possible components of the world-wide radionavigation system,

NOTING that shipborne combined receiving equipment for the world-wide radionavigation system offer improved availability, integrity, accuracy and resistance to interference,

RECOGNIZING the need to improve the previously adopted, by resolution MSC.74(69), Annex 1, performance standards for shipborne combined GPS/GLONASS receiver equipment in order to ensure the operational reliability of such equipment and taking into account the technological progress and experience gained,

HAVING CONSIDERED the recommendation on the revision of resolution MSC.74(69), Annex 1 made by the Sub-Committee on Safety of Navigation at its forty-sixth session,

1. **ADOPTS** the Revised Recommendation on Performance Standards for Shipborne Combined Receiver Equipment, set out in the Annex to the present resolution;
2. **RECOMMENDS** Governments to ensure that combined GPS/GLONASS receiver equipment:
  - (a) if installed on or after 1 July 2003, conform to performance standards not inferior to those specified in the Annex to the present resolution; and
  - (b) if installed before 1 July 2003, conform to performance standards not inferior to those specified in Annex 1 to resolution MSC.74(69).

## ANNEX

### REVISED RECOMMENDATION ON PERFORMANCE STANDARDS FOR SHIPBORNE COMBINED GPS/GLONASS RECEIVER EQUIPMENT

#### 1 INTRODUCTION

1.1 The Global Positioning System (GPS) and Global Navigation Satellite System (GLONASS) are space-based positioning, velocity and time systems. The GPS space segment will normally be composed of 24 satellites in six orbits. The spacing of satellites in orbit will be arranged so that a minimum of four satellites will be in view to users world-wide, with a position dilution of precision (PDOP)  $\leq 6$ . The GLONASS space segment will normally be composed of 24 satellites placed in 3 orbital planes with 8 satellites in each plane. The spacing of satellites in orbit will be arranged so that a minimum of four satellites will be in view to users world-wide, with a PDOP  $\leq 6$ .

1.2 A combined receiver, when compared to either the GPS or GLONASS receiver, offers improved availability, integrity, accuracy and resistance to interference; increased ease of installation, and the ability to operate in the differential GPS mode (DGPS), differential GLONASS mode (DGLONASS) and combined DGPS and DGLONASS mode, when available.

1.3 Receiver equipment capable of combining individual satellite measurements from GPS and GLONASS constellations to form a single solution is intended for navigational purposes on ships with maximum speeds not exceeding 70 knots. Such equipment should, in addition to the general requirements contained in resolution A.694(17)\*, comply with the following minimum performance requirements.

1.4 These standards cover the basic requirements of position-fixing for navigation purposes only and do not cover other computational facilities which may be in the equipment.

#### 2 COMBINED GPS/GLONASS RECEIVER EQUIPMENT

2.1 The words "combined GPS/GLONASS receiver equipment" as used in these performance standards include all the components and units necessary for the system to properly perform its intended functions. The equipment should include the following minimum facilities:

- .1 antenna capable of receiving both GPS and GLONASS signals;
- .2 combined GPS/GLONASS receiver and processor;
- .3 means of accessing the computed latitude/longitude position;
- .4 data control and interface; and
- .5 position display.

2.2 The antenna design should be suitable for fitting at a position on the ship which ensures a clear view of the satellite constellations.

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\* Refer to Publication IEC 60945.

### 3 PERFORMANCE STANDARDS FOR COMBINED GPS/GLONASS RECEIVER EQUIPMENT

#### 3.1 The combined GPS/GLONASS receiver equipment should:

- .1.1 be capable of receiving and processing the Standard Positioning Service (SPS) signals of the GPS as modified by Selective Availability (SA) and range code signals in GLONASS and provide position information in latitude and longitude World Geodetic System (WGS) 84 co-ordinates in degrees, minutes and thousandths of minutes. Means may be provided to transform the computed position into data compatible with the datum of the navigational chart in use. Where this facility exists, the display and any data output should indicate that the co-ordinate conversion is being performed and should identify the co-ordinate system in which the position is expressed;
- .1.2 operate on the L1 frequency signal and C/A code in GPS and L1 frequency signal and range code in GLONASS;
- .1.3 be provided with at least one output from which position information can be supplied to other equipment. The output of position information should be in accordance with the relevant international standards\*;
- .1.4 have static accuracy such that the position of the antenna is determined to within 35 m (95%) in non-differential mode and 10 m (95%) in differential mode with horizontal dilution of precision (HDOP)  $\leq 4$  or position dilution of precision (PDOP)  $\leq 6$ ;
- .1.5 have dynamic accuracy such that the position of the ship is determined to within 35 m (95%) in non-differential mode and 10 m (95%) in differential mode with HDOP  $\leq 4$  or PDOP  $\leq 6$  under the conditions of sea states and ship's motion likely to be experienced in ships\*\*;
- .1.6 be capable of selecting automatically the appropriate satellite transmitted signals for determination of the ship's position with the required accuracy and update rate;
- .1.7 be capable of acquiring satellite signals with input signals having carrier levels in the range of -130 dBm to -120 dBm. Once the satellite signals have been acquired the equipment should continue to operate satisfactorily with satellite signals having carrier levels down to -133 dBm;
- .1.8 be capable of acquiring position to the required accuracy, within 30 min, when there is no valid almanac data;
- .1.9 be capable of acquiring position to the required accuracy, within 5 min, when there is valid almanac data;

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\* Publication IEC 61162.

\*\* Resolution A.694(17); Publications IEC 6721-3-6, IEC 60945 and IEC 61108-3.

- .1.10 be capable of re-acquiring position to the required accuracy, within 5 min, when all GPS and GLONASS signals are interrupted for a period of at least 24 h, but there is no loss of power;
- .1.11 be capable of re-acquiring position to the required accuracy, within 2 min, when subjected to a power interruption of 60 s;
- .1.12 be capable of re-acquiring an individual satellite signal and utilizing it in the position solution within 10 s after being blocked for 30 s;
- .1.13 generate and output to a display and digital interface\* a new position solution at least once every 1 s;
- .1.14 have a minimum resolution of position, i.e. latitude and longitude of 0.001 minutes;
- .1.15 generate output to the digital interface\* course over the ground (COG), speed over the ground (SOG) and universal time co-ordinated (UTC). Such outputs should have a validity mark aligned with that on the position output. The accuracy requirement for COG and SOG should not be inferior to the relevant Performance Standards for Heading\*\* and SDME;\*\*\*
- .1.16 have the facilities to process DGPS and DGLONASS data fed to it, in accordance with Recommendation ITU-R M.823 and the appropriate RTCM standard; and
- .1.17 be capable of operating satisfactorily in typical interference conditions.

#### **4 PROTECTION**

Precautions should be taken to ensure that no permanent damage can result from an accidental short circuit or grounding of the antenna or any of its input or output connections or any of the combined GPS/GLONASS receiver equipment inputs or outputs for a duration of 5 min.

#### **5 FAILURE WARNINGS AND STATUS INDICATIONS**

5.1 The equipment should provide an indication if the position calculated is likely to be outside of the requirements of these performance standards.

5.2 The combined GPS/GLONASS receiver equipment should provide as a minimum:

- .1 an indication within 5 s if either:
  - .1.1 the specified HDOP has been exceeded; or

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\* Conforming to Publication IEC 61162 series.

\*\* Resolution A.424(XI).

\*\*\* Resolution A.824(19).

- .1.2 a new position has not been calculated for more than 1 s.

Under such conditions the last known position and the time of the last valid fix, with explicit indication of this state, so that no ambiguity can exist, should be output until normal operation is resumed;

- .2 a warning of loss of position;
- .3 DGPS and DGLONASS status indication of:
  - .3.1 the receipt of DGPS and DGLONASS signals; and
  - .3.2 whether DGPS and DGLONASS corrections are being applied to the indicated ship's position;
- .4 DGPS and DGLONASS integrity status and alarm; and
- .5 DGPS and DGLONASS text message display.

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