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| IALA Recommendation |

R-129

GNSS Vulnerability and Mitigation Measures

Edition 3.0

December 2012

Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

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| Date | Page / Section Revised | Requirement for Revision |
| December 2008 | Whole document | Introduction of e-Navigation and eLoran |
| September 2012 | Whole document | Updated to reflect changes in GNSS since the original draft |
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THE IALA COUNCIL

**RECALLING** the function of IALA with respect to Safety of Navigation, the efficiency of maritime transport and the protection of the environment,

**RECALLING ALSO** Article 8 of the IALA Constitution regarding the authority, duties and functions of the Council,

**NOTING** that the IMO SOLAS Convention obliges administrations to provide such aids to navigation as the level of risk requires and the density of traffic justifies, but does not specify the type of systems to be provided,

**NOTING ALSO** IMO resolutions A.915(22) on Maritime Policy for the Future Global Navigation Satellite System (GNSS), and A.953(23) on World Wide Radionavigation System,

**RECOGNISING** the increasing dependence of all classes of maritime users on GNSS services, and the vulnerability of such services to both intentional and accidental interference,

**RECOGNISING ALSO** that GNSS is a key element within e-Navigation,

**RECOGNISING FURTHER**

1. The existence of conventional Aids to Navigation and VTS as alternative ground-based systems, available to all classes of maritime users,
2. The proposals made because of the study contained in IALA Guideline 1xxx on GNSS Vulnerability and Mitigation Measures,

**CONSIDERING** the proposals of the IALA e-Navigation Committee,

**ADOPTS** the Recommendation on GNSS Vulnerability and Mitigation Measures, as described below,

**INVITES** Members and marine aids to navigation authorities worldwide to implement the provisions of the Recommendation,

**RECOMMENDS** that:

1. National Members and other appropriate authorities take account of the information in IALA Guideline 1xxx on GNSS Vulnerability and Mitigation Measures and the other studies carried out on the options for alternative systems.
2. National Members and other appropriate authorities conduct risk assessments, in terms of the various stages of a voyage relevant to their geographic areas of interest.
3. National Members and other appropriate authorities maintain and improve liaison and partnerships between providers of GNSS.
4. National Members and other appropriate authorities monitor parallel activities on vulnerability mitigation by other bodies and other modes of transport.
5. National Members and other appropriate authorities encourage the transfer of mitigation technology from the military for civil use.
6. In co-operation with industry, National Members and other appropriate authorities support the development of improved receiver performance standards.
7. National Members and other appropriate authorities encourage the use of GNSS receiver equipment compliant with the latest performance standards.
8. National Members and other appropriate authorities raise awareness among users about the vulnerability of GNSS and the need to maintain skills in the use of conventional aids.
9. National Members and other appropriate authorities maintain and develop backup and contingency aids to navigation, which may include radio aids to navigation and conventional aids to navigation, appropriate to the identified level of risk.
10. Where the risk assessment concludes that a backup system (i.e. a system ensuring continued operation, but not necessarily with the full functionality of the primary system) is necessary, service providers should adopt the suggested minimum maritime user requirements (derived from IMO Resolution A.915(22)) listed in Table 1.
11. Risk Assessments

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| --- | --- | --- | --- |
| Event | Probability of Occurrence | Consequences | Mitigation difficulty/cost |
| GNSS Service failure | L | H | H |
| Power supply failure | M | H | L |
| Receiver/antenna failure | M | H | L |
| Onboard interference | M | M | L |
| External interference | L | H | M |
| Ionospheric | L | M | M |
| Jamming | L | H | M |
| Spoofing | L | H\* | H |
| Radar burn-out | L | H | L |

Notes

H = High. High probability means likely to be encountered more than once a year. High consequence means complete loss of use of the system. High difficulty or cost of mitigation means it is unlikely to be achieved.

M = Medium. Medium probability means likely to be encountered less than once a year. Medium consequence means system still usable, but degraded. Medium difficulty or cost means achievable at significant cost.

L = Low. Low difficulty or cost means mitigation should be achieved.

\* indicates the more serious implications of spoofing.

It may be impractical to expect backup systems to achieve some of these standards, such as global coverage in the ocean phase of navigation or metre level accuracy in the port phase. In these cases, it might be necessary to navigate the ocean phase by dead-reckoning, or delay port manoeuvres until the primary navigation system is restored. The argument for a backup system may be dependent on the perceived threat to the primary system and the likely duration of primary system outages.

**REQUESTS** the IALA e-Navigation Committee or such other committee as the Council may direct to keep the Recommendation under review and to propose amendments as necessary.