

AIS SART Vs Radar SART Trials

Over five years ago tests were performed on the airborne and detectability of various locating devices, including AIS SARTs as a GMDSS-certified device, as a man-overboard device and as an EPIRB homer; a GMDSS-certified radar SART; a 121.5 MHz locating signal and a 406 MHz signal. The following is a summary of results.

Key West Florida, January 2009

On 14 January 2009 the US Coast Guard performed airborne tests in Key West Florida in seas 1-2 ft, Winds 040 at 10 kts of the following equipment:

- AIS-SART prototypes according to the then draft IEC61097-14, mounted at various heights at the test position, 0, 0.1, 1.0, 1.5 and 3.0 meter above sea surface.
- EPIRB (406 and 121.5): Deployed in water and floating in its normal operating position.
- 9 GHz radar SART: Mounted at a height at 1m above sea surface.

RESULTS

The results obtained for the AIS-SARTs deployed in the water, is comparable with the range obtained from the 406 MHz EPIRB towards an aircraft.

See table below for complete range measurements versus altitude.

The results obtained at the various altitudes were:

ALTITUDE	Range obtained
20000 ft:	119 – 132 Nm ¹
10000 ft:	84 – 97 Nm

¹ AIS software limit of 200 contact display. AIS contacts detected exceeded 200 contact limits for all flight altitudes except 1000 ft. This very likely limited AIS detection ranges recorded. An open ocean environment with fewer AIS transmitters may produce higher detection ranges.

5000 ft: 59 – 79 Nm
1000 ft: 28 – 65 Nm

The lowest range is at all altitudes with the AIS-SART floating in water, and is comparable with what would be obtained from a small float free EPIRB.

For the AIS-SART mounted at 1m above sea level, the results were among the highest at all altitudes.

The results obtained at 1000 ft for two of the units; 970000003 and 970000007 was remarkably high and well beyond line of sight. For these units it might have been abnormal conditions, such as tropo scatter or aircraft scatter, i.e. messages being reflected by the body of another aircraft that lead to this range. All the details from the airborne AIS would have been needed to do a more complete analysis on this. The results from the other units at 1000ft were more in line with what would be expected from a theoretical point of view.

CONCLUSION

The range performance are according to, or exceeding the expectations. Together with previous tests done in Oban Bay, Scotland this shows that the IEC draft specification 60097-14 fulfils all range performance requirements for the AIS-SART mounted at 1m antenna height.

An EPIRB with an AIS-SART transmitter would have an antenna height comparable with the antenna height of the unit with ID code 9700000008. The detailed results shows that this performed very well and it was only at the lowest altitude that the range was significant lower than the higher units. This is because many of the transmissions from this unit were sent while the antenna was below the water surface; therefore the likelihood of getting transmissions through is lower.

The AIS-SART with ID code 970000003 was mounted on “Oscar”, a simulated person floating in the water. The results obtained from this unit shows that AIS-SART used as a man over board alert has a good potential as a life saving device. The test from this unit can also be seen as the result that could have been obtained from an EPIRB or PLB that is raised from the sea level.

Table 1 Key West Airborne Test Results

Unit type	ID	Height a.s.l.(m)	20000ft	10000ft	5000ft	1000ft	Notes
AIS-SART	970000002	3.0	119 nm	94 nm	70 nm	30 nm	Mounted on aux vessel Discovery at 3.0 m antenna height
AIS-SART	970000003	0.1	132	94	65	53	Floating on a simulated person in the water, height 0.1 m above water surface.
AIS-SART	970000005	1.5	127	97	67	31	Mounted on aux vessel Discovery at 1.5 m antenna height
AIS-SART	970000007	1.0	129	95	79	65	Floating, mounted on a pole 1m height
AIS-SART	970000008	0.0	129	84	59	28	Floating, mounted in the water surface, in and out of water
EPIRB	406 MHz	0.0	126	115	68	52	Floating in the water, attached to the boat with the integral line
EPIRB	121.5 MHz	0.0	8	7	5	4	Homer on the 406 MHz EPIRB
Radar SART 9 GHz		1.0	23	22	30	33	Floating in the water for the 2 first passes, at the two last passes a second radar transponder where switched on, this improved the results on the lowest altitudes.
Radio - line of sight		1.0	176	125	89	41	

Hawaii, January 2010

The US Coast Guard conducted tests on 20-21 January 2010 using a long range search and rescue aircraft of three AIS SARTs, a radar SART, a 406 EPIRB, and an EPIRB fitted with a 121.5 MHz beacon and with an AIS beacon. The aircraft was capable of homing on 121.5 and 406 MHz, detecting and displaying AIS targets, and carried a x-band radar having a SART mode. Satellite detection of the AIS devices was also performed during these trials and results presented in the annex courtesy of and with the permission of ExactEarth.

Table 2 Hawaii Airborne Test Results

Unit Type	Altitude (ft)				Notes
	20 K	10 K	5K	1 K	
	20 K	10 K	5K	1 K	Ranges are Approximate in Nautical Miles
Line of Sight	174	123	87	39	Calculated
AIS EPIRB	145	102	70	33.5	Inbound Only
EPIRB	155	117	76	32	Outbound
406 MHz	156	115	76	37	Inbound
121.5 MHz	**0	*X	*X	1.2	Outbound Inbound
AIS SART (1)	140	94	70	30	Inbound
AIS SART (2)	145	Inop	Inop	Inop	Inbound
AIS SART (3)	137	96	68	19.5	Inbound
RADAR SART	90	*X	*X	38	Inbound

**Aircraft Did not try to detect 121.5 and RADAR SART on 5 K and 10 K passes.*

*** Aircraft did not detect 121.5 MHz on the 20 K pass.*

Tested results were results were only slightly less than line of sight of the EPIRB, AIS SART, and AIS EPIRB. Line of Sight Calculations: 20 K = 174 nm, 10 K = 123 nm, 5 K = 87 nm, 1 K = 39 nm.

Annex: Report on ExactEarth Satellite AIS-SART-EPIRB Sea Trials