Emergency Position Indicating Radio Beacon

The 406 MHz satellite EPIRB transmits a **5W** radio frequency (RF) burst of approximately **0.5s duration every 50 seconds**. Improved frequency stability ensures improved location accuracy, while the high peak power increases the probability of detection. The low duty cycle provides good multiple-access capability, with a system capacity of **90 activated beacons** simultaneously in view of the satellite, and low mean power consumption.

An important feature of the new satellite EPIRB is the inclusion of a digitally encoded message, which may provide such information as the country of origin of the unit in distress, identification of the vessel or aircraft, nature of distress

and, in addition, for satellite EPIRE

code in accordance with the mariti

location protocol, the ship's positio

as determined by its navigatic

equipment.

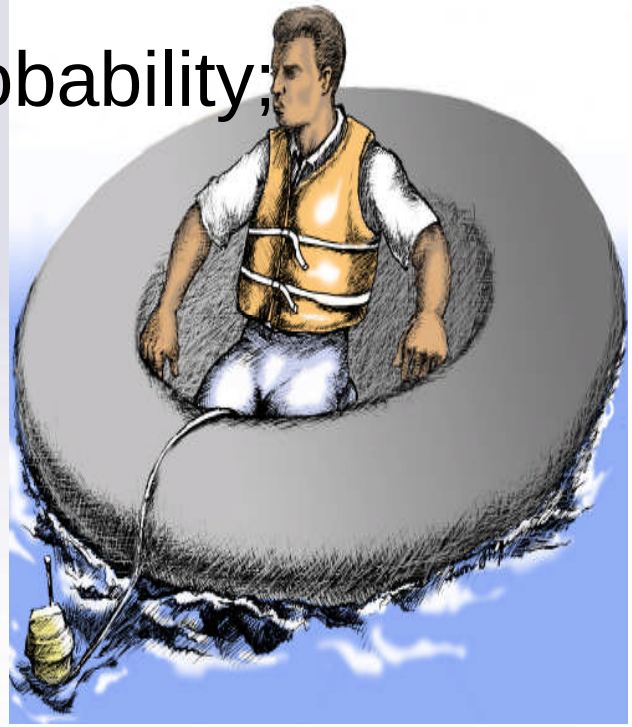
Satellite EPIRBs are dual-frequency 121.5/406 MHz beacons. This enables suitably equipped SAR units to home in on the 121.5 MHz transmission and permits over flight monitoring by aircraft.

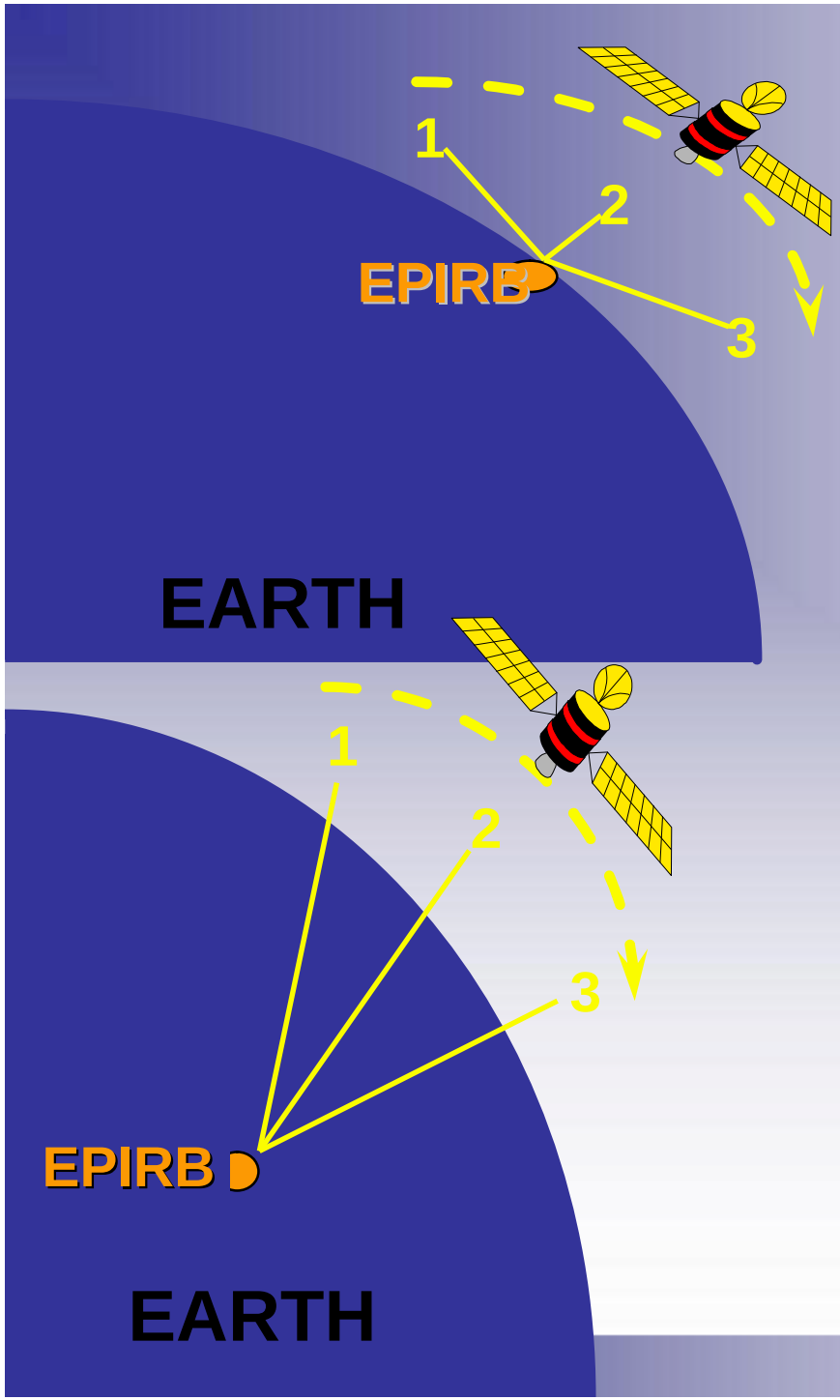
Depending on the type of beacon (maritime, airborne or lar beacons can be activated either **manually or automatically**

System Performance and Operations
Performance parameters

The following parameters are particularly important for the user:

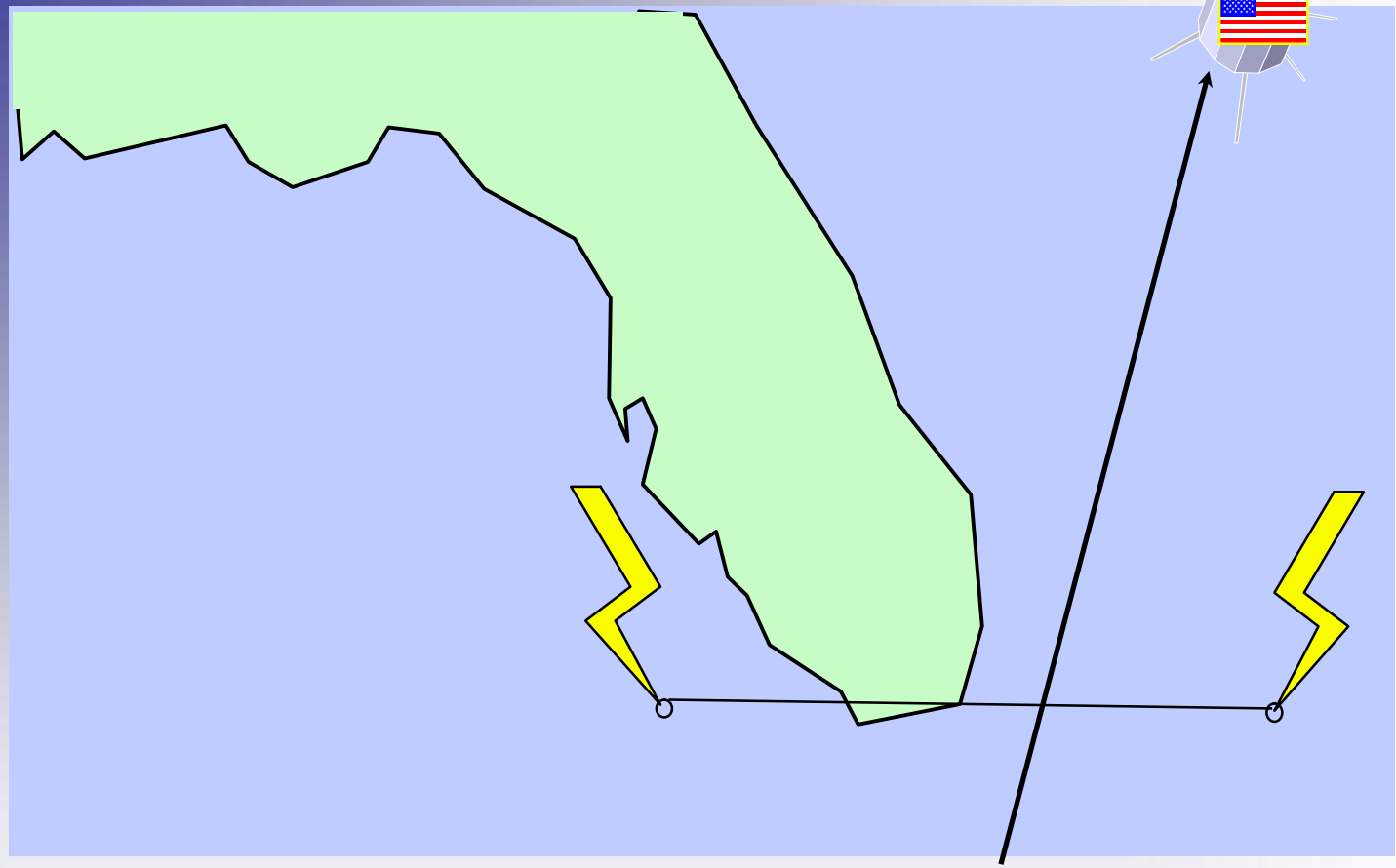
- EPIRB location probability;
- EPIRB location error;
- ambiguity resolution probability;
- capacity;
- coverage; and
- notification time.



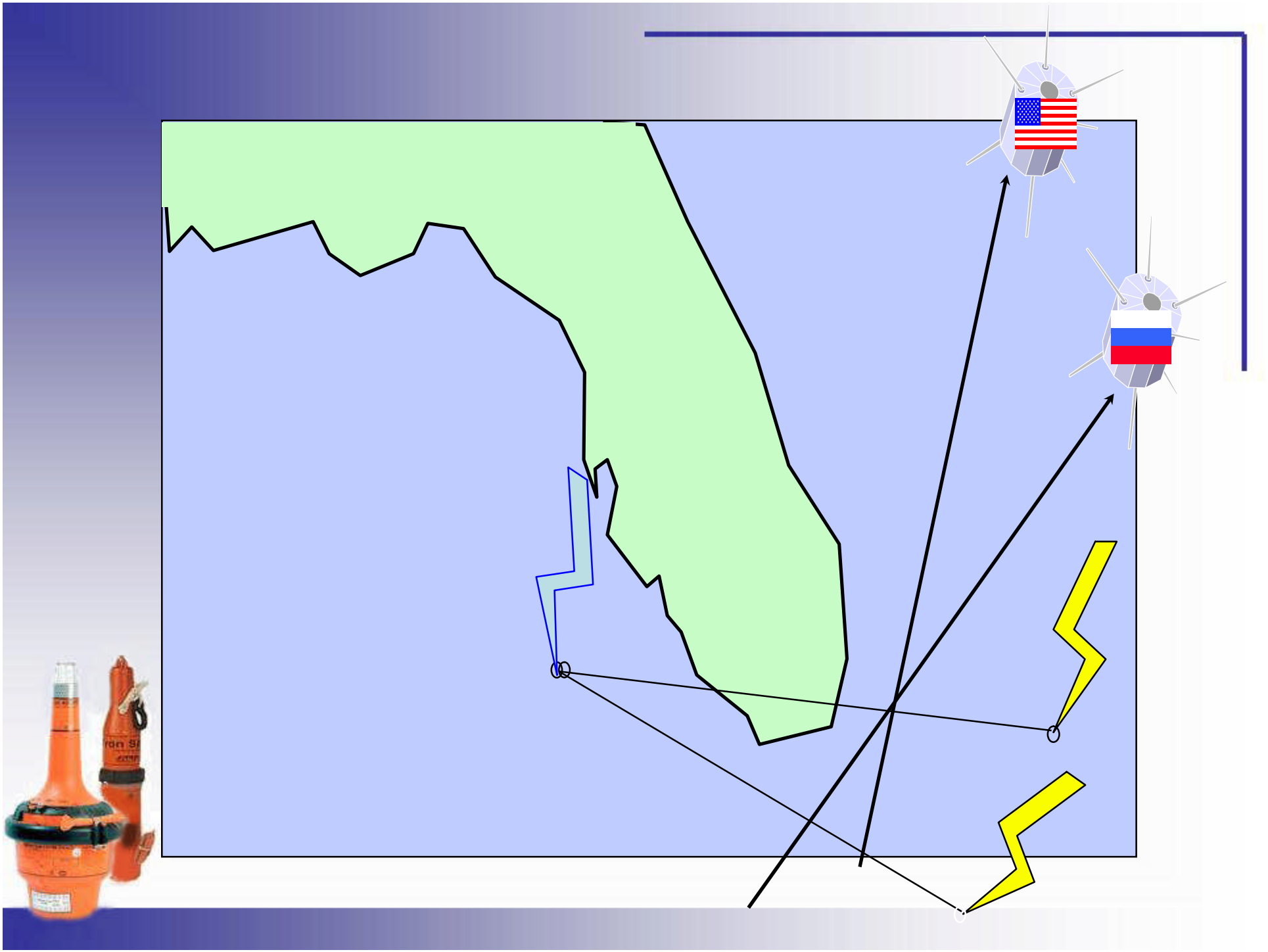


1. ***EPIRB detection probability*** for the 406 MHz satellite EPIRB is defined as the probability of detection by LUT of at least **one message** with a correct code-protected section from the first tracked satellite.

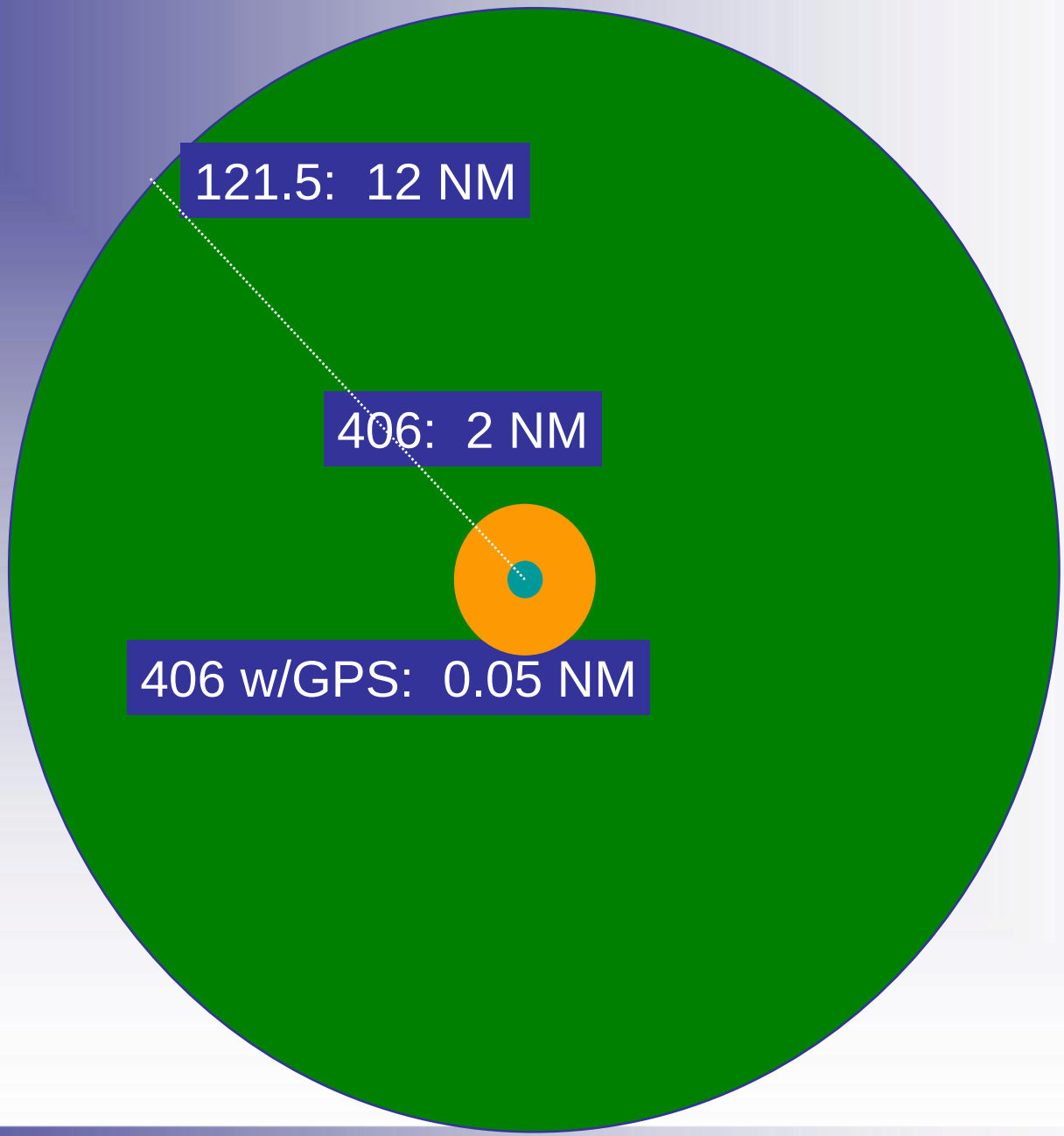
2. ***EPIRB location probability*** for the 406 MHz satellite EPIRB is defined as the probability of detecting and decoding at least **four individual messages** bursts during a single satellite pass so that a Doppler curve-set estimate can be generated by the LUT. At 121.5 MHz, EPIRB location probability is defined as the probability of location during a satellite pass above 10° elevation with respect to the beacon. EPIRB location probability relates to the two solutions **("true" and "mirror")** and not to a single unambiguous result.



TWO EARTH POSITIONS INDICATED
ON OPPOSITE SIDES OF THE SATELLITE TRACK
WHICH ONE IS THE <u>REAL</u> ONE?

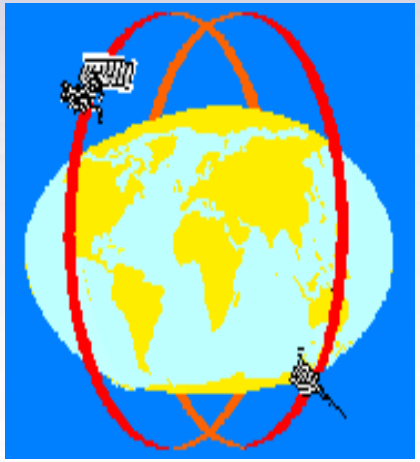


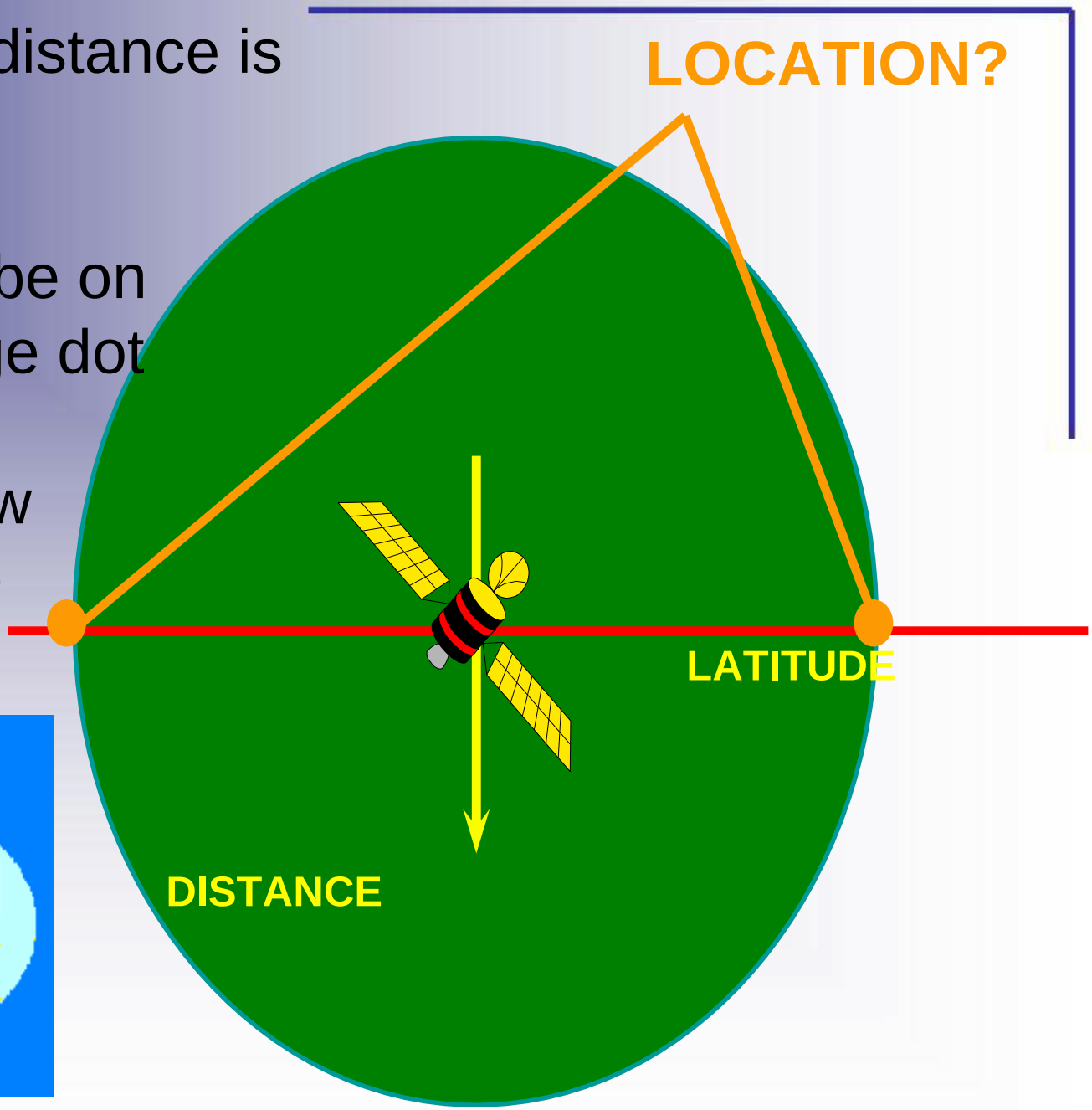
3. ***EPIRB location accuracy*** is defined as the difference between the **location calculated** by the system using measured Doppler frequencies and **the actual location.**


121.5: 12 NM
406: 2 NM
406 w/GPS: 0.05 NM

4. ***Ambiguity resolution probability*** is defined as the ability of the system to select the **"true"** rather than the **"mirror"** location.

- Latitude and distance is determined
- Target could be on either orange dot
- We can't know which! (yet)





LOCATION!

LATITUDE

DISTANCE

5. ***Capacity*** is defined as the **number of EPIRBs** in common view of the spacecraft which the system can process simultaneously.

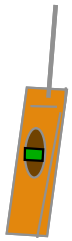
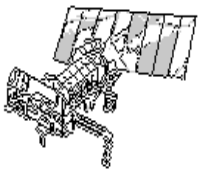
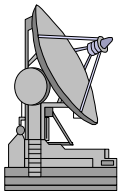
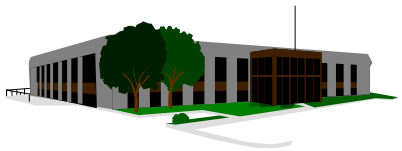
6. ***Notification time*** is the **period** from activation of an EPIRB spectral characteristic. The values given below were confirmed by statistical analysis of over 5,000 beacons during the development and experiment phase.

121.5 MHz EPIRB - Average 6 Hour Notification

406 MHz EPIRB - Average 1 Hour Notification

406 EPIRB with GPS - Average 5 minute Notification

COSPAS-SARSAT Rescue Timeline


1: Beacon	2: Satellite	3: LUT	4: MCC	5: RCC
Best Case: 15 min.	8 min.	5 min.	1 min.	1 min.
Worst Case: 2 Hours	100 min.	10 min.	5 min.	1 min.

Search and Rescue Radar Transponders (SARTs)

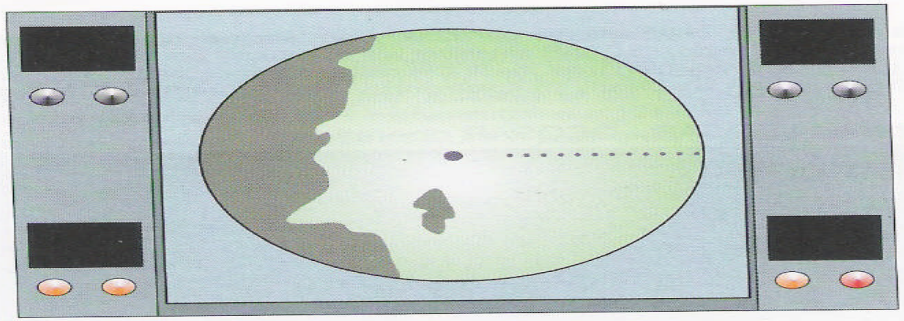
Search and rescue radar transponders (SARTs) are main means in the GMDSS for **locating** ships in distress or their survival craft, and their carriage on board ships is mandatory. The SART operates in the **9GHz frequency band** and generates a series of response signals on being interrogated by any ordinary **9GHz shipborne radar** or suitable airborne radar. No modification is needed to a ship's radar equipment for detecting SART signals. SARTs can be either portable, for use on board ship or carrying into any survival craft, or installed on the ship and in each survival craft, so as to operate after floating free from the sinking ship. They may also be incorporated into a float-free satellite EPIRB.

Operational and technical characteristics of SART

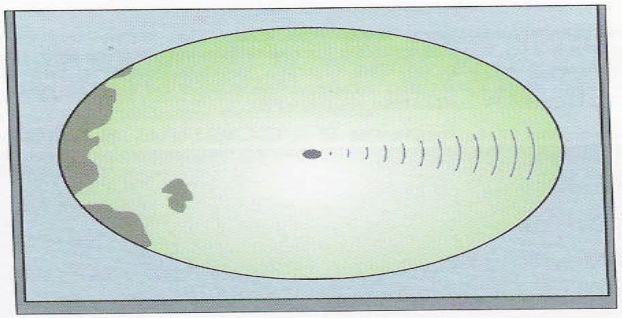
1. The SART can be activated **manually or automatically** when placed into the water so that it will thereafter respond when interrogated.
2. When activated in a distress situation the SART respond to radar interrogated by transmitting a swept-frequency signal which generates a line of blip code on a radar screen **outward from the SART's position** along its line of bearing. This unique radar signal is easily recognized on the radar screen and the rescue vessel (and aircraft, if equipped with suitable radar) can detect the survivors even in poor visibility or at night.

3. The SART provides a **visual or audible** indication of its correct operation and will also inform survivors when it is interrogated by a radar.
4. The SART will have sufficient battery capacity to operate in the **stand-by condition** for **96 hours** and **8 hours in the transmission mode** and will be able to operate under ambient temperatures of -20°C to +55°C.
5. The vertical polar diagram of the antenna and the hydrodynamic characteristics of the device will permit the SART to respond to radar under heavy swell conditions. SART transmission is substantially omnidirectional in the horizontal plane.

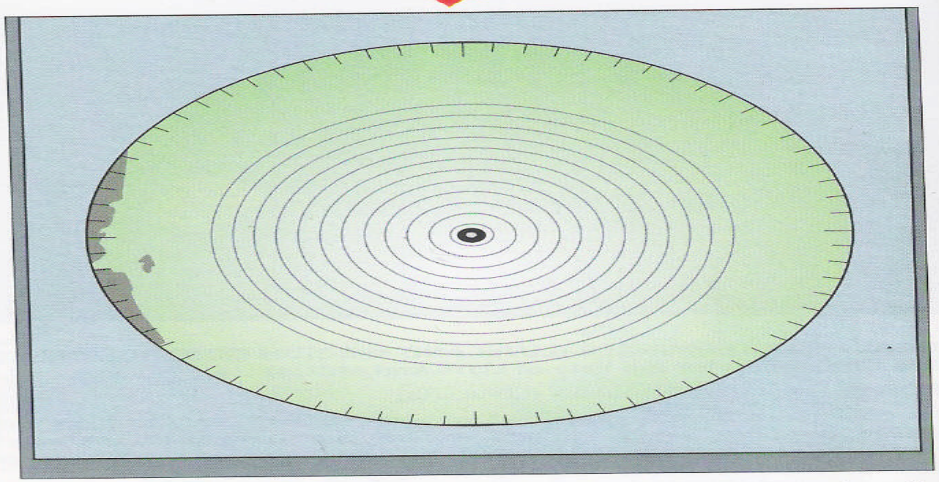
Figure 9 - Basic concept of the Search and Rescue Radar Transponder (SART)



Radar Display showing the SART 12 dot blip code (bearing approximately 90°)



As the search craft approaches to within about 1n mile of the SART the 12 dots will change to wide arcs.



The wide arcs change into complete circles as the SART is closed

With antenna height of 15 metres, detection ranges are up to at least 5 n miles

SURVIVAL CRAFT
IMO recommends SART mounted 1 metre above sea level

IMO SYMBOL FOR SART