



**THE UNIVERSITY
OF BIRMINGHAM**



MICROWAVE INTEGRATED SYSTEMS LABORATORY

**Active Radar Transponders
for Maritime Applications
-RTS-**

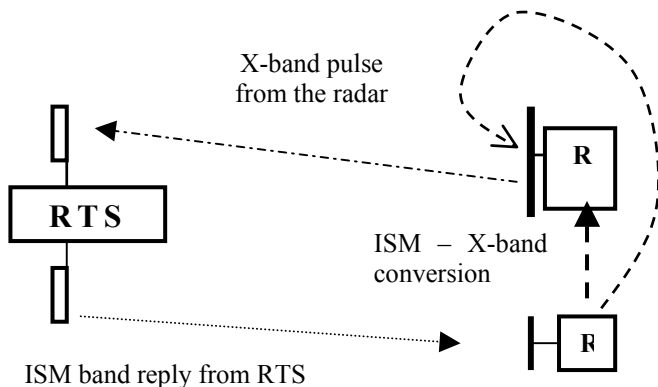
**International patent Number:
G01S 13/76, 13/87
International Publication Number:
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The RTS is a state-of-the-art universal radar-transponder, which can be used for the location and identification of marine objects on the sea surface. The major functions of RTS are:

- To reinforce a received radar ranging signal;
- To modify this signal for the RTS identification
- To retransmit the modified signal back to the illuminating radar

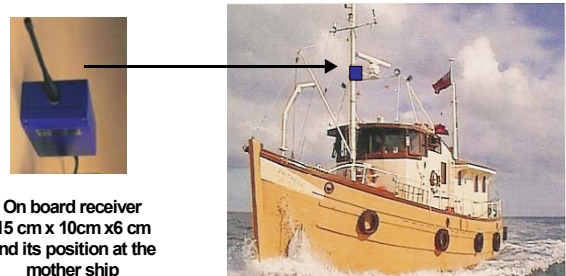
This transponder forms part of a network, which consists of several RTS transponders, a radar (possibly working in the X-Band) and a signal receiver. Both the radar and the signal receiver are located at the observation area. The RTS receives signals at the radar frequency and retransmits information converted to another (possibly the licence-free ISM) frequency band data back to the receiver.

This retransmitted signal is synchronised with the



radar ranging pulse that shows up as a mark on the radar display or a computer at the RTS position. The transponders that are placed in the marine objects are lightweight, compact devices, measuring only 10 cm long and 3 cm in diameter (excluding batteries, which can be changed depending on the nature of the application). They possess an intelligent wake-up system that ensures a long battery life in the passive standby mode.

This portable receiver, which is installed near the radar, is designed such that it operates automatically: it does not require professional staff for maintenance or operation; does not have any wire connections to the radar and is compatible with any radar type.

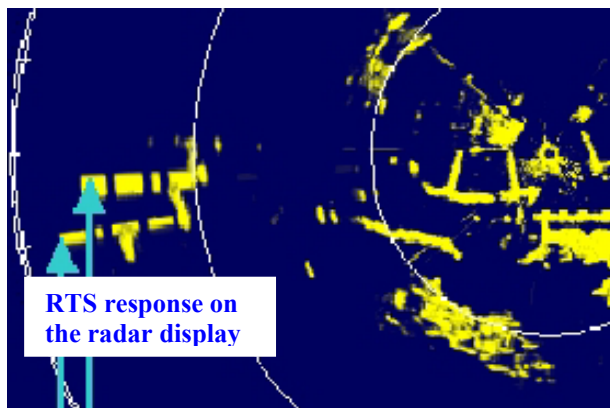


RTS transponders operate in a fashion similar to traditional navigational radar beacons at spread spectrum frequency bands. Therefore, they do not require licensing for use in national and international waters. Moreover, these transponders are designed so that they can operate in large numbers, simultaneously, within the radar observation area without introducing mutual interferences. To provide a high level of security, data transmitted by the transponders is strongly encrypted.

The equipment at the observation point locates marine objects by illuminating a specific area with the radar. The transponder of an object present in the illuminated area senses the radar scan and transmits a response signal. The radar uses this signal to determine the object position with about 50 m rms range.



The receiver on the radar site extracts the 32-bit information encoded onto this signal that uniquely identifies the marine object and its status. The radar display or computer then graphically displays this combined information. The display indicates over an all horizon-limited distance, and can selectively switch object responses on and off, so as not to mask the natural radar picture. On the other hand the signals from RTS are detectable only by the authorised radar.

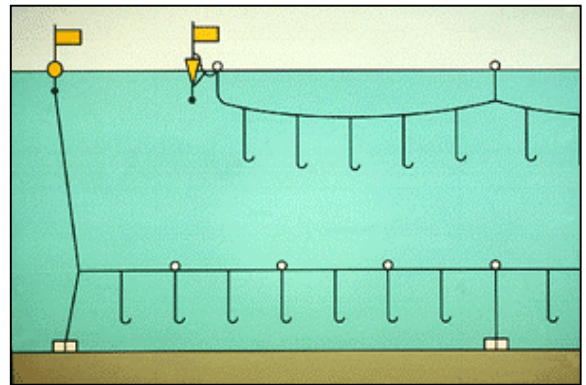


In contrast to the widely used SATR, Radar Beacons and other similar RTS does not clutter the radar channel and can be used in unauthorised manner.

Applications:

- National border protection and monitoring.
- Detection of unauthorised crafts, such as smugglers and terrorist activities.

- Protection of economically valuable resources, such as oil fields.
- Operation in economic exclusion zones.
- Remote verification of fishing vessel licences.
- Identification and remote monitoring of fishing equipment such as fishing nets, lines and cages.
- Identification of underwater exploration tools.
- Identification of divers and diver equipment
- Oceanographic studies.
- Non-governmental navigation system development.
- Marine competition area monitoring.
- Local area navigation system.



Example of the market volume – long line fishing

<i>RTS</i>		<i>Receiver Station</i>	
Gross	84,000	Gross	84,000
% market penetration	20%	% market penetration	20%
Net RTS units	168,000	Net Base units	16,400
Assumed price per	200	Assumed price per	1,500
Assumed total market \$M	33.60	Assumed total market \$M	25.20