

MODEL 367X-1 LOCATION TRANSPONDER

APPLICATION NOTE



The model 367X-1 Radar Transponder is a beacon navigational aid optimized for use with airborne weather radar operating in a beacon mode. These radars are Bendix/King RDR 1400 and 1500 series, Honeywell/Sperry PRIMUS 500 and the Litton AN/APS-504(V)5.

The 367X-1 is suitable for locating off-shore drilling sites, buoy moorings, and seamount and landmark locations. The beacon function will assist the pilot in locating or identifying a particular oil rig when it is surrounded by many other.

In the beacon mode, the radar installed in an airborne vehicle can interrogate and receive pulses from the transponder located within a range of 100 nautical miles (typical range vs. altitude is shown in [Table 1](#)). Coded replies are received by the radar on a designated beacon frequency (9310 MHz). The radar Plan Position Indicator (PPI) displays beacon returns indicating the range and bearing with respect to the aircraft. Each radar transponder may be assigned a

different beacon code which will separate replies from multiple units. The coded reply is displayed and identifies a particular beacon reply on the radar indicator.

Table 1

<u>RANGE</u> (<u>nautical miles</u>)	<u>LINE-OF-SIGHT</u> <u>ALTITUDE</u> (<u>feet</u>)
5	30
10	70
12.5	110
25	425
50	1,700
100	6,500

The Herley-Vega model 367X-1 Transponder shown in [Figure 1](#) is FCC Type Accepted for use in U.S. and approved for use in Canada by the Canadian Department of Communications.



Figure 1 - Model 367X-1 Transponder



Figure 1A - Model 367X-1 Transponder Unit with Attached Battery Pack, Model 519-1

MODES OF OPERATION:

Model 367X-1 Transponder operates in the 9.3 to 9.5 GHz frequency range. It is primarily used as a radar tracking aid and provides a switch-selectable, time-coded, target enhancement, multi-pulse reply for positive identification on the radar's PPI (Plan Position Indicator) display.

The on-board weather radar in the aircraft transmits an interrogation signal to the ground-based beacon transponders (367X-1 model). All of the compatible tuned ground beacons that receive the signal sends back a reply signal to the aircraft. The responding beacons, within the area being displayed, will appear on the indicator screen. Each beacon location will appear as one short line (beacon range mark) on the screen. Depending on the brand of the radar, the beacon mark will appear on the screen next to the range mark or, the screen will show various beacon marks in colors with their corresponding range marks in the same color.

The unit is interrogated by a pulse at 9375 MHz. With a pulse width of 2.35 microsecond, the beacon transponder transmits a reply at 9310 MHz which consists of six pulses. The first frame pulse establishes the beacon range. The pulses between the first and last pulse establish the beacon code. The unit has pulsewidth discrimination circuitry so it will answer only weather radars and not marine radars. The weather radar decodes the multi-pulse reply and displays a range mark and beacon identification as shown in [Figure 2](#). A total of 16 different identifications (B0 through B15) can be selected by a front panel switch. When multiple targets are interrogated by the weather radar, they will be displayed and can be identified to the different identifications which were selected. A receiver sensitivity control, is included on the transponder front panel as well as on the radar, allowing the user to adjust receiver sensitivity for his particular application.

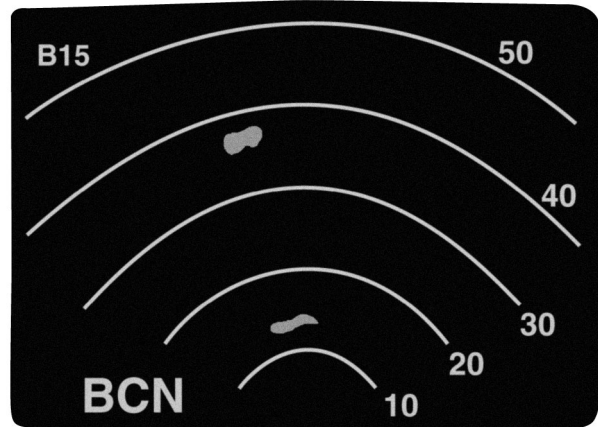


Figure 2 -Typical Range Mark and Beacon Identification Display

The unit has a low power consumption standby mode where only the receiver is powered until the transponder is interrogated by the 2.35 microsecond pulse of a weather radar in beacon mode. After a minimal number of interrogation of the correct pulsewidth are received and processed by the pulsewidth discrimination circuitry, power is applied to the high voltage power supply which makes the transponder operational. The Herley-Vega 367X-1 transponder has an automatic, low power standby mode. When operated in STANDBY AUTO, the transponder will remain in the standby mode with only the receiver circuits energized until a weather radar transmitting at 9375 MHz with a pulsewidth of approximately 2.35 microseconds is received. After the transponder receives pulses at the correct frequency and pulse width, power is applied to the high voltage (HV) power supply. The HV power supply provides filament voltage to the magnetron and, after a 30 second delay to allow the magnetron to warm-up, provides high voltage pulses that cause the magnetron RF pulses. The 367X-1 will continue to respond as long as valid interrogations are present. A short time after interrogations cease, the transponder will automatically revert to the low power standby mode.

When operated in STANDBY ON mode, the transponder commences responding immediately to valid interrogation without the 30 second warm-up delay. Power is only applied to the 367X-1 transponder after radio contact with the airborne vehicle is established. The 367X-1 model responds to valid interrogations with coded pulses in the ARA (Airborne Radar Approach) beacon format. The unit is modular for ease of repair and is housed in a transit case.

When operational the antenna is attached to the lid of the case. The supplied antenna's radiation coverage shown in [Figure 3](#) is 360° in azimuth and 30° in elevation plane.

A companion battery pack (Model 519-1) can be attached to the side of the unit (see [Figure 1A](#)) for operation at remote locations or as standby failure. The transponder case is watertight.

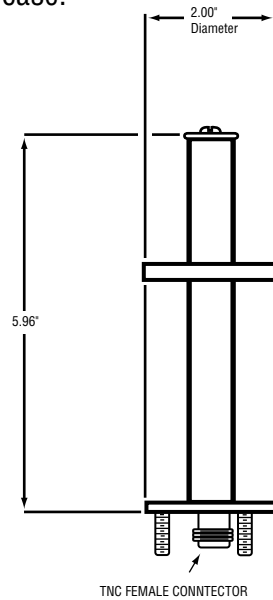


Figure 3 - Standard Omnidirectional Antenna

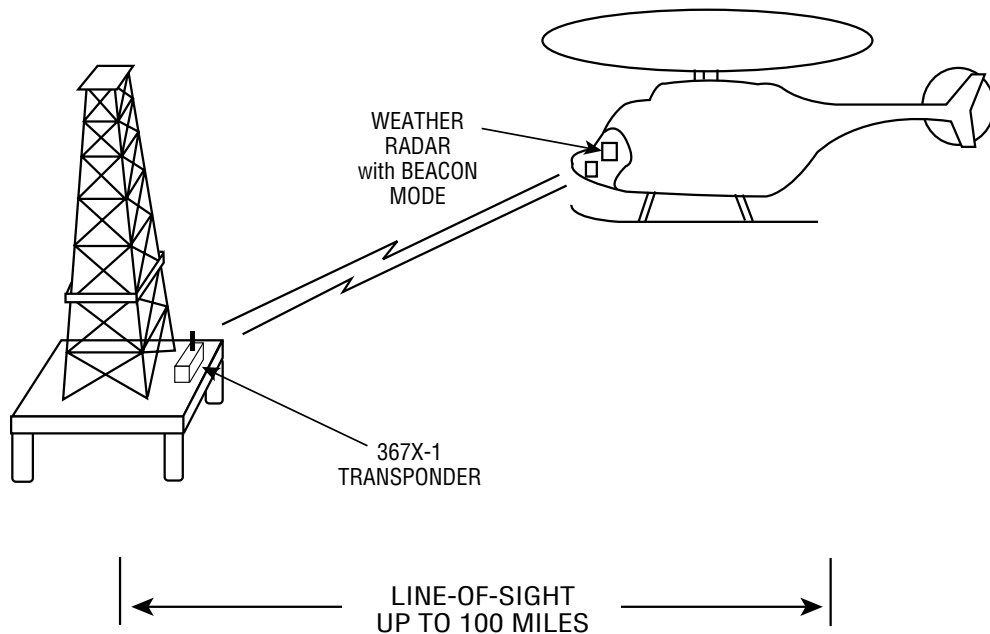


Figure 4 - Typical Installation

APPLICATIONS:

Offshore Oil Drilling Sites:

In the application shown in [Figure 4](#), it is desirable to use a beacon to navigate to and identify a particular oil platform. The 367X-1 is mounted on an oil drilling rig and set to automatically respond to the helicopters used to re-supply and transfer personnel to and from the rig. In a typical operation, the helicopter climbs to the Line-of-Sight altitude - with the weather radar "ON", identifies the beacon reply and flies to the rig. The helicopter with the weather radar in beacon mode interrogates the transponder. The transponder responds with a reply that is decoded and displayed on the helicopter weather radar indicator.

Vehicle Identification/Location System:

The 367X-1 is used in rescue vessel applications, where the helicopter needs to locate/identify a particular rescue boat. The transponder can be hardwired to the vessel power source. The antenna can be remotely located on the rescue boats mast and be cable connected (optionally supplied) to the transponder by using an adapter in place of the antenna on top of the transponder case.

Navigation Aid System:

The 367X-1 is used to identify remote air-fields or drop areas for the logging and fire fighting operations in the absence of a ground navigational system.

The 367X-1 transponder is placed on the runway or other remote location. For this particular application, the STANDBY ON mode is selected (toggle switch located on the front panel) to allow the transponder to immediately commence responding to valid interrogation.

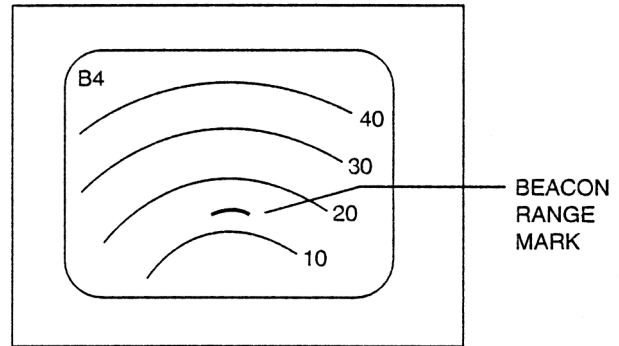


Figure 5 - Typical Weather Radar Operating in Beacon Mode 367X-1 Replying in Code 4

A total of 16 different reply codes can be selected with the code switch on the transponder front panel. When multiple targets are interrogated by the weather radar, they will be displayed and can be identified by the radar, shown in [Figures 2 and 5](#). The 367X-1 will not respond to marine radars due to offset frequencies and a special weather radar interrogation pulsewidth.

Equipment:

Standard:

- a) Transponder 367X-1 tuned to 9.310 transmit and 9.375 GHz receive.
- b) Antenna model 8101X-7.

Options:

- a) Tune to different frequencies in 9.3 to 9.5 GHz range.
- b) Remote RF antenna cable, (15', 25' or 25' long).
- c) Battery pack, model 519-1 with power cable to transponder.