



Transponders for Timber Management

by Skip Garrett, P.E., Mechanical Engineer

BACKGROUND

This transponder project began as a result of recommendations from the Forest Products Identification and Tracking group. This group was organized by the Director of Timber Management to investigate opportunities for improving forest-product accountability by using new technology. The goal of this project is to study and report on the use of transponders to identify boundary, leave, wildlife, and environmentally-superior trees.

INTRODUCTION

Transponder systems provide a reliable and flexible way to identify logs, trees, or stumps automatically. Unlike magnetic or bar code methods, transponders require no direct line-of-sight between the identification tag and the reader and work well in harsh outdoor environments. Transponders can be read when embedded in wood (or when the wood grows over the transponder) and should last virtually forever since there is no battery to replace. The reader reads transponder tags automatically with no need for operator entry and can interface directly with computer data bases. This can facilitate identifying, tracking and recording significant information concerning superior trees or research-study trees.

Transponder systems can be used as a key component in theft prevention and detection programs. They can be attached to stumps (low in the bole or in a root) to positively

identify a boundary or leave tree and can be used as evidence in a timber theft case if trees are removed or boundaries moved. When attached to logs, they can be read at any point from the stump to the mill yard for tracking purposes and when compared with information in a data base, the specific timber sale they came from can be identified.

TRANSPONDERS

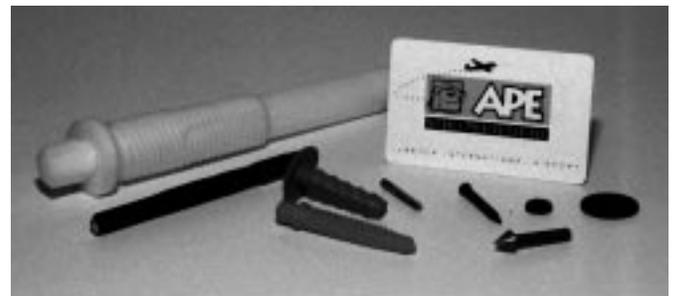


Figure 1. Transponders are available in various sizes and shapes and have a wide range of costs and capabilities.

Transponders are the main element of radio-frequency identification systems that are based on low-frequency FM transmission techniques. (See figure 1.) Small transponders, also called tags, are attached to or embedded in an object to be tracked. To interrogate or read the tag, the reader device sends out a power burst to the transponder via an antenna. This power burst charges up the passive (no battery) transponder. The transponder returns a signal that carries the data stored within it. Read-only transponders have a unique, factory-installed, permanent identification code while read/write models



have the capability to store data and are available with various amounts of memory. The reader devices are portable and data collected from the transponders can be stored and later uploaded to a computer for data processing.

Radio-frequency identification systems overcome the limitations of other automatic identification approaches because they do not require line-of-sight between the transponder and the reader. This means they work effectively in environments with excessive dirt, dust, moisture, and poor visibility. In addition, because they work at low frequencies, the system will work through most non-metallic materials.

TEST UNITS

SDTDC selected two systems for testing that are designed for use in wood (for identifying and tracking telephone poles, railroad ties, pallets, etc.) that utilize read-only transponders encapsulated in rubber or plastic shapes that screw-in or press-fit into predrilled holes (3/8 inch diameter by 2 inch deep/9.5 by 51 mm) and have a read range of up to one foot (0.3 m)(see figure 2).

The screw-in type (purchased from Rydex at \$14.60 each, part number PT-01261-41, along with a reader from Texas Instruments, model number RI-HHU-W3DG-00, that costs \$1350) has a drive head, used for installation, that can then be detached making the transponder very difficult to remove. The rubber-encapsulated press-fit transponders (purchased from Electronic Identification Devices for \$4 each, part number 100-A, with a reader, model number LID-502, that costs \$1060) are easily and quickly installed. (A new system not yet tested by SDTDC came on the market using transponders shaped like nails which are simply hammered into wood. (See figure 3). These transponders cost \$3.50 each, part number ST 101N; the associated reader, model number ST 302-2, costs \$800, and both are available from Microcom.) The portable, hand-held reader devices are used to read and store transponder information along with date/time information. Both are equipped with RS-232 ports so data can be easily downloaded to a PC.



Figure 2. The screw-in shape (made by Rydex) and the press-in shape (made by EID) were tested on the Tongass NF.



Figure 3. Nail-shaped transponders with reader (made by Microcom).

EVALUATIONS

Transponders, readers, and installation tools were evaluated for Forest Service use on the Tongass National Forest in Alaska. Boundary trees and leave trees on two timber sale units were marked with transponders. They were installed in the stump at ground level on the downhill side of the tree to make installation and reading easier. All of the transponders functioned properly before, during, and after harvesting operations. However, the screw-in type appeared to provide a better attachment to the wood since the press-fit could be pried out and in one instance, the tree sap pushed-out one of the press-fit transponders. Some manufacturers recommended using a two-part epoxy rather than the encapsulation shapes (or in conjunction with them) to secure transponders to the trees.

In addition, for over a year all “boom sticks” (large logs chained together to contain ocean-going log rafts and are reused many times until they deteriorate) harvested on the Thorne Bay Ranger District were marked with transponders when felled and tracked throughout their use. Transponders were installed in the same place on all boom sticks, four foot (1.2 m) from the large end, and marked with orange paint to facilitate locating and reading them. (See figure 4.) The transponders and readers performed well in this harsh, salt-water environment. Even when the transponders were under water, the readers were able to receive their signal. Both systems tested used the reader to store data and then upload it into a PC where it was displayed in a table showing the transponder codes and the date and time they were read.



*Figure 4.
Reading transponder installed in boom stick,
(Texas Instruments reader).*

MARKET SEARCH

Transponders, like all electronic devices available today, come in various sizes, shapes, capabilities, and costs. The market for transponder systems is in its infancy and the state-of-the-art is changing rapidly as technology advances and applications develop. This means capabilities are increasing while costs are dropping. Currently, transponders range in price from \$2 to \$100 depending on capability and quantity purchased; reader devices range from \$800 to \$3000. Some readers can be equipped with integral GPS circuits so the reading location can be recorded.

POTENTIAL USES

SDTDC tests showed transponders can be used effectively to identify boom sticks and boundary, leave, and wildlife trees. Researchers or nursery personnel could use them to identify and track superior or research-study trees or seedlings. Law Enforcement could use them in boundary trees or blown-down logs to deter and detect timber theft and provide evidence in prosecuting theft cases.

Transponders could be used by timber cruisers and purchasers to locate and positively identify cruise plot centers. Using transponders for permanent, inventory plot centers that are remeasured every five or ten years would eliminate the difficult problem of reestablishing these points when stakes rot out. They could also be used to permanently identify land-line corners.

As the price of transponders drops with increased usage, it may be possible to use transponders in logs to replace branding and painting. Electronic checkpoints with large drive-through antennas mounted along logging roads or at the entrance to mill yards could be used to read the transponders on passing log trucks to keep track of logs from the stump to the mill yard. Forest Service or purchaser scalers could use hand-held readers and data recorders to establish a log-specific data base, provide a means for after-the-fact check scaling, and keep accurate inventories. As transponder technology expands and utilization grows, more ideas for ways to use them will evolve.

UPCOMING PUBLICATION

An in-depth project report, *Transponder Technology-Resource Identification and Tracking*, SDTDC Publication 9724 1205 is nearing completion and should be available after July 1, 1997.

MANUFACTURERS/DISTRIBUTORS

The following manufacturers and distributors can provide current pricing and additional information regarding transponder systems:

Electronic Identification Devices, Ltd.
1106 Coast Village Road, Suite D
Santa Barbara, CA 93108
(805) 565-1288

Motorola - Indala Corporation
3041 Orchard Parkway
San Jose, CA 95134-2017
(408) 383-4000

Microcom Corporation
8333A Green Meadows Drive North
Westerville, OH 43081
(800) 642-7626 or (614) 548-6262

Rydex, Ltd.
118 Center Ave. North
Mitchellville, Iowa 50169
(515) 967-0294

Texas Instruments
34 Forest Street, MS 20-27
Attleboro, MA 02703
(508) 699-3647

PROJECT PROPOSAL
USDA Forest Service
Technology and Development Program

SDTDC solicits input from the field for suggestions for future projects. Your suggestions are important to us, so please take a few moments to complete this form and return to the address provided.

Project Originator: Name _____ Date _____

Title _____

Unit _____

Mailing address _____

DG address _____ Telephone _____

Project Title: _____

Current Problem/Need

Describe how work is currently being done; current problem/need, location; why improvement is needed.

Proposed Solution

Describe your concept of the end product, i.e., new equipment design, video production, handbook, etc.

Potential Benefits

Describe how this product will improve safety, resource management; increase efficiency, customer satisfaction, productivity; reduce cost, time.

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USDA Forest Service
SDTDC
Attn: Timber Program Leader
444 E. Bonita Avenue
San Dimas, CA 91773-3198

User Feedback Survey

User Name (optional) _____
Title _____
Unit _____

**TRANSPONDERS FOR TIMBER MANAGEMENT
#9724 1303**

Benefits	YES	NO	Amount
Improves safety	_____	_____	_____
Saves money	_____	_____	_____
Saves time	_____	_____	_____
Increases efficiency	_____	_____	_____
Other	_____	_____	_____

How effective or relevant is this information?

What would you change?

General comments: