

# **Appendix F:** State-Line Beacon Project

## User Case Studies

by

**Western Highway Institute / ATA Foundation**

February 1994

**C** The  
**rescent Evaluation**



## TABLE OF CONTENTS

<b>BACKGROUND .....</b>	<b>1</b>
<b>STATE ENTRY BEACON DEMONSTRATION PROJECT .....</b>	<b>3</b>
<b>STATE AGENCY CASE STUDIES.....</b>	<b>5</b>
Washington Department of Licensing, Prorate and Fuel Tax Services.. . . . .	8
Oregon Public Utilities Commission .....	9
<b>MOTOR CARRIER CASE STUDY .....</b>	<b>11</b>
Procedures Used Prior to SEB .....	12
Procedures After SEB.....*	12
Impact on Operations and Costs .....	12
<b>SUPPLEMENTS .....</b>	<b>14</b>
• Supplement I - IRP Agreement	
• Supplement II - Discussion Questions Concerning the HELP OBC/Beacon Concept	
• Supplement III - Oregon Administrative Rules: Weight-Mile Tax Record Requirements	

## **Forward**

The Crescent Project element of the HELP Program is a bi-national multi-jurisdictional cooperative research and demonstration initiative involving the public and private sectors in an application of advanced technologies for the creation of an integrated heavy vehicle management system. This initiative is a leading example of the commercial vehicle operations (CVO) aspect of the Intelligent Vehicle Highway Systems (IVHS) concept. Some of the advanced technologies demonstrated in this project include: (1) automatic vehicle identification (AVI); (2) weigh-in-motion (WIM); (3) automatic vehicle classification (AVC); and (4) data communications networks and systems integration.

‘The HELP program, initiated in the early 1980s, consisted of three phases which included assessing the feasibility of the concept, technical studies involving laboratory and field tests, and lastly, a demonstration phase. Perhaps the most significant activity of this project centered on the subject of institutional arrangements, associated with the integration of emerging technologies with current operational policies and practices, within both government and industry sectors.

The demonstration element of the program, referred to as the Crescent Demonstration Project, began in 1991 and involved six U.S. states and one Canadian province. This project was phased into full scale operation over a three year period.

This document is one of several cited below which comprise the evaluation of the Crescent Project. The complete evaluation is reported in the following list of documents:

### ***The Crescent Project: An Evaluation of an Element of the HELP Program: Executive Summary***

#### ***Appendices:***

- A. On-Site Analysis of HELP Technologies and Operations Evaluation Report***
- B. State Case Study Evaluation Report***
- c. Motor Carrier Case Study Evaluation Report***
- D. Crescent Computer System Components Evaluation Report***
- E. Crescent Demonstration Office Evaluation Report***
- F. State Line Beacon Project User Case Studies***

The Evaluation team consisted of the following groups:  
WHM Transportation Engineering Consultants, Inc. (lead group)  
Castle Rock Consultants  
Western Highway Institute, ATA Foundation

In addition, the evaluation team was supported in this effort by:  
Lockheed Information Management Systems  
Booz-Allen & Hamilton Inc.

The team members wish to acknowledge the participation and support of the many individuals and organizations who provided guidance, assistance and encouragement during the evaluation process. While the team members are solely responsible for the content accuracy of these evaluation documents, the process would have been greatly impaired without the recognition of the importance of this effort by all who contributed and their desire to promote efficiency and productivity in future freight systems. To all we are greatly appreciative and indebted.

C. Michael Walton

Chairman, Evaluation Team

## **HELP/CRESCENT DEMONSTRATION**

### **STATE-LINE BEACON PROJECT - USER CASE STUDIES**

#### **BACKGROUND**

Among the last of the projects undertaken in the Technical Study Phase of the HELP program was the On-Board Computer Study completed by Arthur Anderson & Co. in April 1989. This study provided a primer on OBC development with particular emphasis on the application potential of this rapidly evolving technology assuming some tie-in with the shared use, mutual benefit premise of the HELP data collection, and integration project.

In the 1970s, the "trip recorder," a computer tachograph, was used to provide a Vehicle Management System (VMS) that captured speed, RPM, time, distance, and other vehicle operations such as oil pressure and water temperature. Today's more advanced On-Board Computer systems offer a great improvement over the tachograph because they are able to link the driver's activity with the vehicle's activity to quickly provide a wide range of information to management. More advanced electronic monitoring and collection devices are able to capture sensor data from almost any truck or trailer function. Drivers can enter and store information on vehicle status, driver log status, fuel purchases, and even driver notes through data input devices located in the vehicle's cab. Most OBC systems can also collect external truck data through input/output ports. For example, a roadside "beacon" could transmit location, date, and time information to some type of "receiver" in a moving truck. The "receiver" would process the signal and transfer it to the OBC via the input/output port.

The essence of the AVI "Beacon" concept as it applies to the HELP organization would be to provide location, date, and time information from the roadside to the OBC. A roadside transmit beacon would be located on the state lines at a minimum and possibly at additional locations throughout the state. As the vehicle passes a beacon, the signal would be read and the message would be integrated with other sensor information, such as odometer reading or hub mile reading, and stored in the OBC memory to assist in automating the reporting of mileage-based taxes.

The information would be collected throughout the trip in the OBC and downloaded to a central location upon completion of the trip. Additional information such as fuel purchases, trip start, and trip end could be captured by the OBC through driver entry. A program could be developed as part of the vehicle management software (VMS) to summarize the individual trip records and create reports to be submitted directly to the appropriate state institution for processing. In addition, the motor carrier could produce a report of the detailed trip transactions to be used as the source documents required for audit, i.e., replacing manually-prepared trip sheets. The OBC

data can also be used in conjunction with advanced VMS software to generate reports such as driver analysis, driver daily log, fuel tax, and vehicle analysis for management, operations, safety, and maintenance.

The primary HELP integration opportunity appears to lie in the area of mileage-based tax reporting. Use of an electronic log provides the opportunity to reduce the work required to collect data and prepare tax reports and potentially to reduce costs associated with the state audits which ensure the proper filing of tax information and payment of taxes. The Arthur Anderson work focused on the auditing aspect of the OBC records rather than the tax report generation and submission procedures. This approach was taken because the audit process attests to the accuracy of the report

The base state IRP agreement has outlined data that must be maintained for individual trips for registration purposes. As part of the agreement, the carrier must agree to keep such records or face the possibility of permanent cancellation of apportioned privilege. IFTA, the more recently formed fuel tax compact, will likely follow a similar course but is not at this time as specific regarding the audit data requirements. Nevertheless, each state's auditing procedure differs somewhat, based upon the information maintained by the state and the sophistication of their information systems (i.e., trip miles gathered at ports of entry compared to reported miles). It was suggested, therefore, that the auditing groups are likely the key institutions associated with OBC record-keeping acceptance.

No case was found among the Crescent states where an auditing institution would not accept OBC-created records. The OBC records, however, were not necessarily considered by the auditors as being any more reliable than hand-created trip records. In fact, the records created by the OBC were often judged to be inaccurate and incomplete. For example, odometer readings as reported by the OBC frequently varied from those of the physical odometer and therefore required detailed audit verification. However, at the time of the Arthur Anderson study, the use of the OBC records for purposes of trip documentation was quite limited and little experience with OBC trip record audits had been gained.

A common problem found by auditing institutions was that many of the OBC reports did not provide all the information required for the audit. Other typical problems associated with the OBC records and collection of data included:

- poorly implemented OBC/VMS systems,
- inadequate driver training regarding system use,
- poorly designed VMS trip reports, and
- inaccurate odometer readings.

No clear legal constraints were found restricting the use of OBCs. The issue of concern at the time was not with the use of the OBC log but rather with the reliance on the OBC log. The “next step” demonstration program outlined by Arthur Anderson was far too ambitious for consideration and HELP work subsequently focused on developing a more limited concept for demonstrating the identified potential.

## **STATE ENTRY BEACON DEMONSTRATION PROJECT**

Concurrent with the effort to develop a scaled-back, fundable demonstration program, motor carrier interests suggested replacing the AVI/transponder signal generation concept with a simple “through the air” radio transmitter and receiver system. Lockheed technicians involved with the Crescent Demonstration Operator (CDO) contract were quick to see the potential and developed a simple prototype unit using “off the shelf” components.

With the approach validation in hand, Lockheed submitted an unsolicited proposal to implement a redefined work program using above-ground radio frequency transmission which was subsequently accepted and implemented as the state entry beacon (SEB) demonstration. The SEB project, undertaken during 1992 and 1993, was designed to provide a means for properly-equipped users to electronically determine and record when and where a vehicle crossed a state border.

In the system, the beacons continuously broadcast a message that contains the location, the current date, and the time. SEB receivers (located in the trucks) monitor the beacon messages and provide the means for determining the time and direction of the border crossing. The vehicle’s OBC extracts the border crossing information from the SEB receiver and other sensors provide the odometer or hubometer readings at the time of the crossing. This information is subsequently used to determine how many miles the vehicle has traveled in each state.

In the demonstration, four SEB receivers were placed in trucks operated by Food Express and connected to OBCs from Advanced Recording Instruments (ARI). Another five receivers were installed in INCO Express trucks and connected to ARGO-supplied OBCs. Beacons were established at the following locations:

- I-205 at the Washington - Oregon border,
- Highway 433 at the Washington - Oregon border,
- I-5 at the Washington - Oregon border (near Portland, Oregon), and
- I-5 at the California - Oregon border (near Hilt, California).

At periodic intervals, border crossing information was downloaded from the on-board computers from each of the test vehicles. The evaluation plan specified that the data from the OBC

would be compared to the data from the driver trip envelopes. Lockheed noted that comparing the OBC results with nearby automatic vehicle identification units might have provided worthwhile additional information. However, since this was not planned, the vehicles used in the experiment did not necessarily have identification transponders installed.

INCO Express did not allow access to the driver trip envelopes. As a consequence, it was necessary to compute system accuracy by analyzing the continuity of the border crossings. For the Food Express trucks, the computer reports were compared with the trip records provided by the truck drivers. The computed accuracy was calculated as the number of SEB-detected crossings divided by the number of crossings reported by the driver. It was noted that, since the driver trip envelope entries are made manually, some inaccuracies are likely due to normal human error.

Lockheed observed from both theoretical and experimental data that the accuracy of crossing detection is a direct function of the RF environment in which the beacons are located. The ideal location was a long stretch (one to two miles) of relatively straight, flat roadway with no large RF obstacles. While there were insufficient test sites in the demonstration to determine the degree of straightness and flatness necessary for good system performance, small curves or small elevation changes are not expected to affect performance. Large hills, bridges, and other RF obstacles should be avoided, but they can be dealt with. The data from the I-205 location, the best of the locations, demonstrate that the system can perform with at least 98% crossing detection accuracy given a good RF environment. The accuracy can be increased with further improvements in the RF hardware.

The software provided by the OBC manufacturers provided two types of reports, i.e., the individual trip reports and the state mileage records:

- The first report is a computer version of the driver trip envelope. Each entry contains fields for the border states, the direction of the border crossing, the highway number, the date and time of border crossing, and the time since the border was crossed. The OBC additionally reports the date and time, the odometer reading, and the current truck speed. This report constitutes the “raw data” that might be maintained by trucking companies for tax audit purposes.
- The second report is a synopsis of the number of miles driven in each state over a given period of time (i.e., daily, weekly, monthly, yearly, etc.). This report produces the data necessary for filing fuel and registration tax reports for each state. The OBC software utilized does not currently generate the actual tax forms, but does provide the information that could be transcribed to the actual form.



Tax auditors from California, Washington, and Oregon were contacted by Lockheed at the beginning of the demonstration. Reports generated by software provided by the OBC manufacturers were submitted to the three audit agencies for evaluation and follow-up interviews were held with the Washington and Oregon agencies at the end of the test period. Since the SEB/OBC systems were installed strictly as a demonstration, the reports generated by the OBC software were used solely as a basis for determining how well the system operates and were not used to actually replace the existing system of reporting mileage-base road usage taxes.

## STATE AGENCY CASE STUDIES

Carriers are subject to audit from all authorities that levy taxes. This could result in multiple audits occurring within a given year. As the government structures are unique in each state, the institutions performing the audits differ from state to state and the procedures vary somewhat as well.

Although state statutes are usually very specific regarding the tax requirements, they may or may not identify the specific information required for an audit. The statutes typically give a state the right to examine the carrier's books in order to substantiate tax records presented to the taxing authority. In most cases it is the responsibility of the auditing institution to set policy as to what is actually required.

Multistate agreements such as IRP and IFTA direct the base state to conduct the audit for all members of the agreement. These agreements do, however, allow all states to examine the records if they feel it is appropriate. A base state agreement will typically define minimum audit requirements and may even provide "policy" guidance concerning specific audit procedures. The IRP Audit Guidelines, for example, include a specific section dealing with On-Board Recording Devices. A copy of the relevant IRP section, which became effective in the 1992 registration year, is included in Supplement I.

Typically, when a state selects a carrier for audit examination, all applicable taxes will be examined at the same time; although this is not the case in all states (i.e., California PUC and Board of Equalization) Audits are performed in a consistent manner from one carrier to another and are usually performed at the carrier's home office due to the volume of records required. A pre-audit questionnaire may be requested so that the auditors can get a general overview of the carrier and the records maintained. An opening conference between the auditors and the carrier is used to review the carrier's operations and record flow. Once the auditor understands the flow, he or she will conduct a review of the internal controls of the company. During this process the auditor will use the following records to verify the controls:

- trip sheets/trip reports/individual vehicle mileage record,
- driver safety logs,
- routing information,
- bills of lading,
- invoices,
- payroll records,
- fuel purchases, and
- prior audit records.

The auditor will also examine other factors such as the relationship of miles between states, operational revenues and costs, port of entry records (if available), as well as other external indicators. From this assessment of the company's internal controls, an error factor will be developed. Sample audit periods will be selected and the records will be reviewed. The error factor will be applied to the sample, and a tax liability will be determined. Based upon these findings, the auditor will determine the necessity for an assessment or refund and its amount.

The primary purposes of a registration audit is to ensure that the miles reported by jurisdiction are correct. An audit will also verify that all required vehicles were registered and that the associated information is correct (vehicle make, year, price, in-service date). If mileage is determined to be incorrectly reported, an audit assessment may result in a shift of registration fees from one state to another and/or additional registration fees. Since auditing is basically a sampling process, a selected portion of various record types are closely scrutinized and their accuracy evaluated. Under the IRP agreement, the following information is required in an Individual Vehicle Mileage Record (IVMR.):

- date of trip (starting and ending),
- trip origin,
- route of travel,
- total trip miles,
- mileage by jurisdiction,
- unit number or vehicle identification number,
- vehicle fleet number,
- registrant's name,
- trailer number, and
- driver signature.

Summary computer printouts are not accepted without the corresponding IVMR detail. Although actual miles are required by the IRP agreement, standard map miles usually are considered an acceptable method of reporting. This latter method is widely used within the industry. All miles traveled must be included in the calculation.

Weight-distance taxes are not covered under the IRP agreement. Therefore, all audit responsibility typically lies with some designated agency in each specific state wherein such taxes are in force. Audits for these taxes are totally vehicle-specific with the focus directed much more toward the examination and matching of IVMR records with “observation reports” generated by the state. In addition to the IRP requirements, the following data would be required on a trip-by-trip basis to satisfy the weight-distance reporting requirements of the several Crescent states using these taxes:

- registered weight (GVW),
- empty weight,
- total actual weight,
- average weight factor,
- full or empty load indicator,
- vehicle type,
- fuel type,
- reduced rate authority, and
- taxable/untaxable miles indicator.

The three different pieces of weight data are not required by any single state, but the requirements for weight-distance taxes differ from state to state. For example, New Mexico uses the registered GVW, while Oregon uses a combination of registered and actual weight.

In order to establish the significance and acceptance of the OBC/SEB concept, officials with audit responsibilities in Washington and Oregon were interviewed. Each had some prior contact with Lockheed concerning the project, and each was provided a copy of Lockheed’s July 1993 “Report on the On-Board Computer/ Beacon Evaluation Study.” Interviewees were also provided a list of discussion questions (see Supplement II) which subsequently served as the agenda for discussion.

#### **Washington Department of Licensing Prorate and Fuel Tax Services.**

Mr. Merle Steffenson, Administrator, personally reviewed the materials sent prior to the August 19, 1993 interview. Mr. Steffenson graciously provided the IRP background information sought relative to OBC use for generating trip reports. He indicated that the IRP amendment

relative to “On-Board Recording Devices” being considered in 1989 was balloted in a much reduced form and was formally ratified in 1992. Much of the detail removed from the original proposal was subsequently incorporated in the “IRP Audit Guidelines.” The latter tends to lead toward eventual uniformity, but in fact has only advisory authority. Extracts from the “Guidelines” were provided and are also included in Supplement I.

The proposal cited by Lockheed in their report, an amendment to IRP Article IV addressing an automated renewal process, is in an early deliberation stage and could see numerous changes before finally being circulated for mail ballot. As proposed, the amendment would establish an electronic data interchange (EDI) format and provide for its use in the registration renewal process. Although no specific problems had been identified with the proposal, it was pointed out that many states have already established such procedures.

If eventually adopted, the guidelines for automated renewal would likely be viewed as providing another standardization target to encourage eventual movement toward greater uniformity. Even so, under the base-state concept, individual carriers have little need to deal with more than a single state. The primary beneficiaries of the proposed change would likely be third-party vendors that provide record-keeping services for carriers in many different states.

Washington acknowledges the desirability of having full IRP and IFTA agreement on OBC-related issues. However, states are already accepting OBC reports and, to the extent that a state line mileage marker system might enhance record-keeping capabilities, there would be no conceptual problem with moving ahead on development and implementation of the SEB program. Even so, Washington would still have some concern about data retention procedures and the assured availability of the data for audit. Any system component failure would have to be covered by motor carrier fall back procedures.

Mr. Steffenson agrees with the Lockheed conclusion that for any future implementation of an SEB system, border detection accuracy would need to exceed 99 percent. The OBC odometer representations must be closely tied to those of the physical odometer, and the computer programs for data transcription must be capable of verifying data “sanity” and continuity. In addition, any viable implementation would likely require that all of the IVMR data be integrated along with the appropriate entries concerning fuel purchases and taxes paid en route.

Steffenson pointed out that, even as a total replacement for manually maintained driver trip reports, OBC records are only the first link in the composite accounting system which is totally subject to audit. He suggested that reporting errors of significance are more typically found in the compilation procedures than in the trip record detail.

The trip record detail is considered backup data and is frequently validated in composite using commercially available computer mileage estimation programs. A report such as illustrated

by Lockheed would be useful in verifying the raw data, as is the manual trip log, but interest in individual truck records typically has to do principally with inclusion or exclusion. To be of significant audit utility these reports would have to be standardized nationwide so that a uniform screening model would be developed.

Generally speaking, a broad-based SEB deployment would not likely alter Washington's auditing practices or procedures. The potentially improved border-crossing accuracy is not seen as being particularly significant. OBC records in general tend to make the audit process easier and the SEB might add a measure of confidence in the recorded data. Even so, the internal control review is the principal audit focus, and SEB viability would have to be determined primarily by the potential for motor carrier record-keeping cost reduction.

### **Oregon Public Utilities Commission**

Mr. Robert Ottele, Oregon PUC Audit Manager, served as the Oregon reviewer/sounding board for the case-study project assessment. He also was interviewed on August 19, 1993.

IRP-related matters are handled by others but he indicated familiarity with the OBC material written into the IRP Audit Manual. The "automated renewal process" amendment proposal cited by Lockheed is not a new innovation but rather is viewed primarily as an effort toward establishing more uniformity among state practice and procedures. The primary beneficiaries of such a proposal, Ottele suggested, would likely be reporting services with clients in many different states since individual carriers typically deal with only a single base state.

Oregon will be joining IFTA even though there is currently no commercial vehicle fuel tax component in its truck tax scheme. This is being done to enable Oregon-based carriers to fulfill the reporting requirements for other states through the Oregon PUC. While full IRP and IFTA agreement on OBC issues is not seen as a prerequisite for SEB deployment, a common frame of reference is ultimately a reasonable expectation.

Mr. Ottele, agrees with Lockheed that tightening down the accuracy of the SEB system is important. He also endorses the idea that a precise reading of or correlation with the physical odometer is important so as to provide a reliable cross-check with other "observation data collected by the State. Oregon gives the trip report considerably more audit attention than most other states because of its reliance on mileage taxes.

In the event of a malfunction in SEB services provided by the state, it follows that the state should bear some responsibility. However, this view is at odds with the current legal presumption that the burden of proof resides with the motor carrier. Further, Oregon's "minimum records" rules (see Supplement III) require documents from which travel reconstruction could be

accomplished. It appears that the motor carrier's "sanity" checking of the OBC data must be able to detect and record SEB failures and provide for the entry of an estimate as a part of the record transcription process.

The sample trip report used as an illustration in the Lockheed project report was found to be generally satisfactory but cumbersome to use. As a plus, the time data reported could provide a basis for cross-checking with Oregon's Observation Reporting system. Aside from the focus on mileage accounting, the driver's trip report/IVMRs are currently used in the audit primarily to establish general times and probable locations. Although outside the scope of the SEB project, Oregon PUC would like to have a complete record of all commercial vehicle crossings of the state lines. Some consideration is currently being given to the use of a camera technology for this purpose.

Incorporating SEB data in OBC records would not likely change the susceptibility of a carrier to audit, but it could perhaps expedite the tests for data reliability. OPUC "desk checks" 18 to 20 thousand carrier filings annually from which 10 percent are selected for field audit. If questions arise in the "desk check", a field contact is generally made. The SEB might make testing procedures easier, perhaps even to the point of using EDI for cross-checks with third-party data.

Given a full-blown SEB system, the biggest auditing change would likely be a reduction in the time involvement with the carrier. However, an incremental SEB implementation would likely create additional work for the carriers because of the dual systems required to meet the "minimum records" requirements. Regular route carriers would seemingly be those with the most potential use given only partial deployment coverage.

## MOTOR CARRIER CASE STUDY

The original case study objective was to determine how motor carrier record keeping procedures might be affected by the state-line entry beacon project. Strictly speaking, this was not possible to do, as, at the time the case study interview was undertaken (May 1993), the project had not progressed to a stage where there was any measurable impact on the one participating carrier, Food Express of Arcadia, California.

Food Express is a medium-sized bulk hauler with 90 tractors operating up and down the West Coast. Most of the trailers are bulk, hopper-bottom, using pneumatic unloading mechanisms; and, in those states allowing it, these trailers operate with loads of up to 70,000 pounds. Gross vehicle weight in Oregon and Washington is 105,500 pounds on a permit basis. The routes are regular and quite short-from flour mills or other sources to bakeries. The company also operates a few dry-freight vans for deliveries of flour and other products to the smaller bakeries. Dispatching is relatively simple. The short, regular nature of most routes

accounts for the relatively low-tech approach to fleet management. Generally, other than the electronic engines on the newest tractors, few other devices are used to monitor, govern, or record information. Some of the trucks are equipped with mobile radios and, in other cases, a driver call-in procedure is used. The exceptions to this are the four tractors based in Vancouver, WA that are equipped with OBCs because of the company's involvement with the State Entry Beacon Project.

Because of the nature and progress of the project it is not possible to say with certainty how the use of OBCs and beacons to mark the passage of a truck from one state to another will alter current procedures. As a result, the case study focus changed more toward understanding the mechanics of what was actually being done and putting into perspective the boundaries of its potential.

To determine how this system might affect motor carrier record-keeping procedures, the following interview agenda was explored with the President of Food Express, Mr. Walter Keeney:

- Determine Procedures prior to the SEB: that is, what procedures did the carrier use prior to state line beacon marking?
- Determine Procedures after SEB: that is, how did procedures change as a result of state line beacons?
- Determine Impact on Carrier Operations/Costs: that is determine whether or not the SEB project had any significant impact on the motor carrier's operations or costs.

### **Procedures Used Prior to SEB**

Drivers complete a daily trip report, which is actually an envelope with space for recording odometer readings, state-line crossings, highway numbers and trip distance. Fuel receipts are placed inside; and, at the end of each day, these envelopes are turned into the dispatch office. Bundles of these trip reports are then sent to a third-party firm, which handles (1) fuel tax reporting for Washington, (2) ton-mile tax reporting for Oregon, and (3) registration (prorate) filing to California (California is the base IRP state for Food Express).

### **Procedures After SEB**

The "prior to SEB" procedures are still being followed at Food Express. That is, the project has not progressed to a stage where either the drivers, the company office or the third party firm are yet doing anything different. All that has changed is that four trucks have been equipped with OBCs and the data from these computers are being given to Lockheed for data reduction and system performance evaluation

Based on interviews with both Food Express and Lockheed, following is the understanding of what is supposed to happen when the system becomes operational. Rather than a driver physically recording an odometer reading every time he crosses a state line, the beacon will automatically record this information on the OBC. With this recorded automatically and used in conjunction with the OBC-related software, trip distances, and distance summaries for each state will be determined and reported directly by computer.

### **Impact on Operations and Costs**

To date there has been no impact on the carrier's operations or costs. (If the cost of the installation of four OBCs and the added work of collecting the information from the OBCs for Lockheed's perusal are ignored.)

Food Express' current costs of filing the three forms for which mileage data are required is \$25/month/tractor. Whether procedures and/or costs at Food Express will change when the system becomes operational is not known. At the low end of the spectrum of possibilities, all the SEB might do is replace a series of hand-written entries on the daily trip reports. Conceivably, Food Express could still use its third-party vendor to calculate its taxes and file all the necessary forms. Under this scenario, it is unlikely that the administrative costs for Food Express will change-if anything, they may actually go up as the cost of equipping the tractors with OBCs would not be offset by any significant reduction in administrative costs unless or until the third party service is willing to reduce its fees. Driver responsibility and the chance of human error will, presumably, be reduced, however.

At the other end of the spectrum of possibilities, it is conceivable that the OBC information could be downloaded into a company computer and that Food Express could replace its third-party service agreement by generating the required documents in house. Or, even further in the future, the "ideal" system might be simply to transmit the processed data electronically to the state agencies requiring it. Presumably, this would represent a cost savings for Food Express \$4300 per tractor per year minus whatever additional costs there are associated with the required software, computer time, and administrative effort

However, all of this is speculation. Lockheed is still working on various aspects of the technology to ensure that the SEB system does not have any "misses" (i.e., missed state-line markings on the OBCs) and to overcome the current (May 1993) problem created by the fact that the OBC data are generating somewhat different mileage reports than are the driver-produced records. To date, it is not possible to say how the SEB project might change procedures at Food Express. The third-party firm which does all of the calculations and paperwork for Food Express



has not been sent any of the information from the OBCs. Food Express does not know how the system might ultimately affect its costs.

Presumably the automation of a task currently performed manually by a driver (either by noting the odometer reading as the truck passes a state line or by keying an entry to an OBC) might ease somewhat the business of being a driver. However, it remains largely unknown whether it might actually accomplish the broader “objectives” suggested in the terms of reference for the project, i.e., to:

- “[provide a] significant potential benefit for motor carriers . . .”
- “reduce the burden placed on the motor carriers by the automation of tax reporting and auditing requirements.”

## **SUPPLEMENTS**

## IRP Agreement

## ARTICLE XV PRESERVATION OF RECORDS AND AUDIT

### 1500 PRESERVATION AND AVAILABILITY OF RECORDS

Any registrant whose application for apportioned registration has been accepted shall preserve the records on which it is based for a period of three-years after the close of the: registration year. Such records shall be made available to the Commissioner at his request for audit as to accuracy of computation, payments, and assessments for deficiencies or allowance for credits, during the normal business hours of the day.

***The term "records" includes "operational records" as defined in Section 232.***

***Insofar as the Uniform Operational Audit Procedure Guidelines approved by the IRP jurisdictions (as amended 1988) set forth procedures applicable to the preservation of records sufficient for a determination of true liability. they are hereby incorporated by reference. ]***

### 1502 FAILURE TO PRESERVE OR MAINTAIN RECORDS

If any registrant fails to make records available to the Commissioner upon proper request or if any registrant fails to maintain records from which true liability may be determined, the Commissioner may, thirty days after written demand for an availability of records or notification of insufficient records, impose an assessment of liability based on the Commissioner's estimate of the true liability of such registrant as determined from information furnished by the registrant, information gathered by the Commissioner at his own instance, information available to the Commissioner concerning operations by similar registrants and such other pertinent information as may be available to the Commissioner.

### 1505 ON-BOARD RECORDING DEVICES

On-board recording devices may (at the option of the carrier) be used in lieu of or in addition to handwritten trip reports for apportioned registration recordkeeping purposes. If a registrant exercises this option, any device or electronic system used in conjunction with a device shall meet the requirements identified in the Audit Guidelines. Other equipment monitoring devices, such as those which transmit or may be interrogated as to vehicle location or travel, may (at the option of the carrier) be used to supplement or verify handwritten or electronically-generated trip reports.

October 1, 1992

## ON-BOARD RECORDING DEVICES

### A. On-Board-Recording Devices

On-board recording devices may (at the option of the carrier) be used in lieu of or in addition to handwritten trip reports for purposes of apportioned registration. On-board recording devices may be used along (refer to Section B), in conjunction with an electronic computer system (refer to Section C), or in conjunction with manual systems.

AU recording devices used to generate trip reports or used in conjunction with manual systems must meet the requirements shown in Sections D and E, below. When the on-board recording device is used in conjunction with an electronic computer system and reports are prepared on the basis of data downloaded from the recording device, the overall system must meet the requirements of Sections D, E, and F.

### B. Use of On-Board Recording Device Only

When the device is to be used alone, printed reports must be produced which replace handwritten trip reports. The printed trip reports shall be retained for audit. Vehicle and Ceet summaries which show miles by jurisdiction must then be prepared manually.

### C. Use of On-Board Recording Device in Conjunction with an Electronic Computer System

When the computer system is designed to produce printed trip reports, vehicle and fleet summaries which show miles by jurisdiction must also be prepared.

When the printed trip reports will not be retained for audit, the system must have the capability of producing, upon request, the reports indicated in Section F.

### D. Minimum Device Requirements

1. The carrier must obtain a certificate from the manufacturer certifying that the design of the On-Board recording device has been sufficiently tested to meet the requirements of this provision.

2. The On-Board recording device and associated support systems must be, to the maximum extent practicable, tamperproof and must not permit altering of the information collected. Editing of copies of the original information collected will be allowed. but all editing must be identified and both the edited and original data must be recorded and retained.

3. The On-Board recording device shall warn the driver visually and/or audibly that the device has ceased to function.

4. The device must time and date stamp all data recorded.

Revised September 6, 1990 to provide for on-board recording devices effective with the 1992 registration year

5. The device must not allow data to be overwritten before the data has been extracted. The device shall warn the driver visually and/or audibly that the device's memory is full and can no longer record data.

6. The device must automatically update a life-to-date odometer when the vehicle is placed in motion or the operator must enter the current vehicle odometer reading when the On-Board recording device is connected to the vehicle.

7. The device must provide a method for the driver to confirm that driver entered data is correct (e.g. a visual display of the entered data that can be reviewed and edited by the driver before the data is finally stored).

#### E. Data Collection

To obtain the information needed to verify fleet mileage and-to prepare the "Individual Vehicle Mileage Record(s)" (IVMR) the device must collect the following data on each trip.

1. Date of trip (starting and ending).
  2. Trip origin and destination (location code is acceptable ).
  3. Routes of travel and/or trip beginning and ending life-to-date mileage information.
  4. Total trip miles.
  5. Mileage by jurisdiction.
  6. Power unit number or vehicle identification number.
- And may include, at the discretion of the base jurisdiction, the following additional information.
7. Vehicle fleet number.
  8. Registrant's name.
  9. Trailer numbers or vehicle ID numbers.
  10. Driver ID or name.
  11. Intermediate trip stops.

#### F. Capability of System to Produce Reports

Generally speaking, the reports referred to in this section are not prepared by the On-Board recording device. Instead, these reports are prepared using an electronic computer system which accepts data from the On-Board recording device. The system shall be able to produce the following reports.

1. For each trip, an Individual Vehicle Mileage Record (IVMR) report that includes the information required in Section E. (Note: This report may be more than one page.)
2. A report that indicates when the On-Board recording device was last calibrated and the calibration method used.

Revised September 6, 1990 to provide for on-board recording devices effective with the 1992 registration year

3. An exception report(s) that identifies all edited data, omissions of required data (see Section E), system- failures, noncontinuous life-to-date odometer readings, travel to noncontiguous states, and. trips where the location of the beginning trip is not the location of the previous trip.
4. A monthly, quarterly, and annual summary of. vehicle trips by vehicle number showing miles by jurisdiction.
5. Monthly, quarterly, and annual trip summaries by fleet showing the number of miles by jurisdictions.

G. Carrier Responsibility

1. It is the carrier's responsibility to recalibrate the On-Board recording device when tire size changes, the vehicle drive-train is modified, or any modifications are made to the vehicle which affect the accuracy of the On-Board recording device. The device must be maintained and recalibrated in accordance with the manufacturer's specifications. A record of recalibrations must be retained for the audit retention period.

2. It is the carrier's responsibility to assure their drivers are trained in the use of the computer system. Drivers shall be required to note any failure of the On-Board recording device and to prepare manual trip reports of all subsequent trip information until the device is again operational.

3. It is the carrier's responsibility to maintain a second copy (back-up copy) of the electronic files either electronically or in paper form for the audit retention Period.

4. At the discretion of the jurisdictions, carriers may submit records for audit to the jurisdictions through electronic data transfer.

5. It is the carrier's responsibility to assure the entire record-keeping system meets the requirements of the IRP. It is suggested that the carrier contact the base-jurisdiction IRP Audit Section for verification of audit compliance prior to implementation.

Revised September 6, 1990 to provide for on-board recording devices effective with the 1992 registration year

**Discussion Questions Concerning the HELP OBC/Beacon Concept**

1. In 1989, when HELP's initial OBC study was completed a proposal to amend IRP Article XV, i.e., the addition of "1505 On-Board Recording Devices," had been developed by the Audit Working Group and was under consideration. Was such an amendment subsequently adopted? If so, would you please send me a copy of the as-adopted language.
2. Lockheed's report references and includes a copy of a proposal to an amended IRP Article IV dealing with an automated renewal process. According to Lockheed, this proposal will be considered for ratification at the 1993 IRP Convention next week. Are there any problems foreseen with the adoption of this proposal? If so, what concerns are being expressed?
3. Do you view full IRP and IFTA agreement on these issues as a necessary prerequisite for proceeding further with the development and/or implementation of a state line mileage marker System?
4. From an auditor's perspective, did Lockheed cover all of your potential concerns in the six recommendations given for future implementation (pg. 15)? If no, or if you have additional qualifiers, please comment. (Page over for material referenced.)
5. Assuming that SEB's might be installed and maintained as a state provided service, how would you suggest that a "beacon malfunction" be recognized and handled by a carrier?
6. In accordance with the discussion on pg. 10 of the Lockheed report, would you agree that the sample trip report (pg. 20) fulfills the necessary requirements for tax audit purposes? Could it somehow be retained and used in electronic form? (Page over for material referenced.)
7. Given other means and methods of marking OBC stateline border crossings, what do you see as the strengths or weaknesses of the SEB concept?
8. In your view, how might such a system change the susceptibility of a carrier to various types/levels of audit?
9. How might your audit procedures change to accommodate a MI-blown SEB system?
10. How might any changes brought about by such a system become the means of reducing audit costs for the state? For the carrier?
11. How extensive would SEB deployment have to be before you would consider making changes in the audit system to accommodate it?
12. From your perspective, (if a decision were made to implement) might it be possible and/or advantageous to certify individual carriers or fleets to begin using the system under an incremental SEB deployment plan?

## Text referenced - Question 4

### **RECOMMENDATIONS FOR FUTURE IMPLEMENTATIONS**

Future implementations of the SEB system should include those improvements already enumerated as well as others. These recommendations are summarized below:

1. Utilize Lockheed developed custom hardware to improve border detection accuracy to greater than 99%.
2. Utilize antennas with better front-to-back ratios and the “split beacon” method to eliminate the effects of major RF obstacles such as bridges and hills.
3. Coordinate with OBC manufacturers to allow the SEB receivers to read the current odometer reading at critical locations. This will allow the SEB to eliminate any uncertainties due to major truck speed variations during the SEB time-out period. Further, the maximum error in border location can be reduced from the current  $\pm 0.5$  mile to less than  $\pm 0.05$  miles.
4. A calibration procedure and schedule must be maintained in order to quantify the accuracy of the OBC odometer readings.
5. Procedures dealing with equipment failures (beacons and receivers) must be fully explored and dealt with.
6. Database programs that will automatically check trip data for continuity and “sanity” should be written and tested. Such programs should provide the greatest reduction in effort needed for tax-fee preparation.



## Text referenced - Question 6

The first type of report is a computer version of the driver trip envelope (a sample is shown in Figure 10 in the Appendix). Each entry contains fields for the border states, the direction of the border crossing, the highway number, the date and time of border crossing, and the time since the border was crossed. The OBC additionally reports the date and time, the odometer reading, and the current truck speed. This report constitutes the “raw data” that would be maintained by the trucking companies for tax audit purposes. Upon inspection, the tax auditors from all three-states found the OBC generated trip reports to be generally acceptable for audit purposes with three recommendations. First, the submitted reports did contain “manual” corrections for missing border crossings, which were acceptable to the auditors under condition that any corrections be documented as such. Second, none of the auditors had reservations concerning beacons offset from the actual border so long as the odometer readings are adjusted to accurately reflect where the border crossing actually occurred, and that the offset distance be documented. Finally, the auditors recommended that the odometer reading be adjusted to reflect the two minute “time-out” period of the beacon (i.e. the crossing actually occurs up to 2 minutes before the SEB actually reports the crossing). Note: Oregon also requires the number of axles in the current truck configuration be recorded with the trip information. Although not incorporated during this study, the OBC’s can accommodate this feature.

ADVANCED RECORDING INSTRUMENTS - FLEETSUM (Ver . 8.4)

DATE 03/22/93		STATE BEACON REPORT Report Period: 03/17/93 To 03/21/93		Page 1
-----				
FOOD EXPRESS, INC.				
-----				
Vehicle Number 662				
03/17/93	1242	Driver 21460	Odometer 056631	Speed 65
	CA ==) OR Road 5	03/17/93 11:37	Offset: 0.7 miles.	2 minutes
03/17/93	1831	Driver 21460	Odometer 057003	Speed 60
	WA ==) OR Road 205	03/17/93 17:29	Offset: 0.0 miles,	2 minutes
03/18/93	0911	Driver 21460	Odometer 057065	Speed 58
	OR ==) WA Road 205	03/18/93 08:09	Offset: 0.0 miles,	2 minutes
03/16/93	1122	Driver 21460	Odometer 057106	Speed 58
	WA ==) OR Road 205	03/18/93 10:20	Offset: 0.0 miles,	2 minutes
03/19/93	0913	Driver 21460	Odometer 057167	Speed 65
	OR ==) WA Road 205	03/19/93 08:12	Offset: 0.0 miles.	2minutes
03/19/93	1127	Driver 21460	Odometer 057206	Speed 65
	WA ==) OR Road 205	03/19/93 10:25	Offset: 0.0 miles,	2 minutes
03/19/93	1259	Driver 21460	Odometer 057259	Speed 60
	OR ==) WA Road 205	03/19/93 11:56	Offset: 0.0 miles.	2 minutes
03/19/93	1500	Driver 21460	Odometer 057298	Speed 66
	WA ==) OR Road 205	03/19/93 13:58	Offset: 0.0 miles,	2 minutes
03/19/93	1632	Driver 21460	Odometer 057350	Speed 53
	OR ==) WA Road 205	03/19/93 15:30	Offset: 0.0 miles,	2 minutes
03/19/93	1856	Driver 21460	Odometer 057390	Speed 65
	WA ==) OR Road 205	03/19/93 17:54	Offset: 0.0 miles.	2 minutes

Figure 10 - Sample of the ARI border crossing report

OREGON ADMINISTRATIVE RULES  
CHAPTER 860, DIVISION 68 - PUBLIC UTILITY COMMISSION

---

**Weight-Mile Tax Records Requirements**

860-68-W (1) All carriers must maintain **records** of their motor vehicle operations and make reports on Forms approved by the Commission.

(2) Such records must be kept at the carrier's principal **office** or place of business and be made available for inspection by the Commission or its representatives at all reasonable times.

(3) Such records must be preserved for three (3) years unless their earlier destruction is authorized by the Commission.

(4) All carriers shall maintain records containing the following information for each vehicle. Carriers that fail to 'comply with all weight-mile tax regulations may be required to maintain additional records:

(a) Origin and destination points; Oregon entry and exit points; and actual Oregon miles for each trip;

(b) Pickup and delivery points in Oregon for each trip;

(c) Routes for travel for each trip

(d) Dates of each trip;

(e) Daily beginning and ending odometer or other mileage recording device readings for each vehicle;

(f) load tickets and/or bills of lading for each shipment transported;

(g) Identification of any exempt miles claimed. which shall include beginning and ending odometer or other mileage recording device readings for the exempt portion of each trip. If repeated trips are made to and from the same locations, a one-time recording of odometer or other mileage recording device readings for the exempt portion of those trips may be applied to the total number of trips;

(h) Carriers operating motor vehicles that are issued or required to obtain an annual variance permit under ORS 818.200(1)(a) to (c) with a combined weight of more than 80,000 pounds shall also provide for each reporting period.

(A) Number of axles in the vehicle configuration.

(B) A record of changes of operation. A change of operation occurs when the vehicle configuration remains the same but the actual weight of the vehicle and load changes from over 80,000 lbs. to 80,000 lbs. or under. Empty movements are not changes in operation.

(i) Carriers operating motor vehicles in multiple configurations shall provide the number of miles operated in each motor vehicle configuration for each trip.

(5) All registrants that pay registration fees via registration trip permits must retain a copy of each registration trip permit

Stat. Auth.: ORS Ch 183.756 & 767

Hist.: PUC 18, f. 1-21-55, ef. 9-1-54 (Order No. 33203); PUC 120, f. 10-26-62, ef. 11-15-62 (Order No. 38811); PUC 135, f. 5-9-66, ef. 5-15-66 (Order No. 42332); PUC 148, f. 2-29-63, ef. 9-1-68 (Order No. 44783); PUC 156, f. 8-6-73, ef. 8-15-73 (Order No. 73-507); Renumbered from 860-38-055; PUC 1-1982 (Temp). f. & cf. 2-3-82 (Order No. 82-030); PUCS-1982, f. & cf. 3-15-82 (Order No. 82-162); WC 13-1990, f. & cert. ef. 7-6-90 (Order No. 90-949), corrected 2-1-91; PUC 4-1993, f. & cf. 1-15-93 (Order No. 93-058); PUC 7-1993, f. & cf. 3-19-93 (Order No. 93-285)

(ED. NOTE: The text of Temporary Rules is not printed in the Oregon Administrative Rules Compilation. Copies may be obtained from the adopting agency or the Secretary of State.)

(PUC Print Date March 1993)