Chapter Two

TECHNOLOGY STUDY

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2.0 Introduction

The purpose of the Kansas City International Trade Processing Center (KC-ITPC) Study is to determine the feasibility and national benefits of establishing the Kansas City region as a place where international trade processing activities can be carried out. In effect, these activities would help to reduce paperwork, streamline transport processes and enhance infrastructure to allow U.S. companies to import and export raw materials and manufactured goods more expeditiously across the NAFTA Trade Corridor.

Figure 2-1: The NAFTA Trade Corridor

In support of this, the KC-ITPC Technology Assessment Study presented here provides an assessment of a collection of technologies and automated services that can support a Virtual Inland Port vision for the KC-ITPC. This vision is centered on providing a series of technology-based solutions which could potentially allow the Kansas City Region to function as an international port of entry for goods and services by allowing for significant increases in In-Bond freight to be transported to Kansas City Intermodal Facilities.
Additionally, this vision is responsive to the direction of the Kansas City Mid-Continent TradeWay Study Policy Working Group, who recommended that a Virtual Process be addressed as one of the options for the KC-ITPC'.

“In-Bond” can be defined as a procedure under which goods are transported or warehoused under customs supervision until they are either formally entered into the customs territory of the United States and duties paid, or until they are exported from the United States. Correspondingly, “In-Bond Freight” is an import or export shipment that has not yet been cleared by U.S. Customs officials, but has physically entered the United States with the approval of U.S. Customs. Figure 2-2 provides an illustrative example of In-Bond shipments that could terminate in Kansas City. Here, by leveraging technologies, substantial numbers of In-Bond shipments make their way by both truck and rail from the Laredo Border Crossing to Kansas City, which then serves as the virtual International Border, as U.S. Customs process the goods into the United States.

Figure 2-2: In-Bond Shipment Notional Example

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Technologies also allow for trucks with in-bond shipments to Kansas City to bypass the significant congestion problems at the Laredo Border Crossing, and to communicate electronically (through the KC-ITPC) with U.S. Customs for inspection notification as they enter the Kansas City Region. Kansas City thus functions as a large-scale virtual inland port, where significant quantities of imports and exports are processed and transferred intermodally across the U.S., and across the Canadian and Mexican borders.

The KC-ITPC Virtual Inland Port Concept will provide significant benefits to the Kansas City regional economy through a significant increase in container and trailer freight processing at intermodal yards, bonded warehouses, manufacturing facilities, and other facilities. This increase in freight processing activities will in turn stimulate the economy by supporting shippers, brokers, and freight handlers.

In terms of the KC-ITPC users, be it the shipper, the broker, the purchaser of goods, or other parties, the virtual concept will also allow for many international trade functions to be accomplished remotely over the Internet. As Figure 2-3 illustrates, a fully integrated KC-ITPC Web page with access to all required systems, information and links is anticipated so that customers can realize many of the services that the KC-ITPC has to offer.

Figure 2-3: Conceptual KC-ITPC Web Page
In conclusion, the primary goal of this technology assessment is to identify the advanced technologies and methods required to enhance, streamline, and simplify international freight movement and processing for the Kansas City metropolitan area and across the NAFTA Trade Corridor, with the information/communications network to process freight virtually across the Mexican and Canadian borders. In supporting this goal, this effort will build upon technologies already deployed or planned such as the U.S Treasury Department’s International Trade Data System (ITDS). The ITDS vision calls for the implementation of an integrated systems approach for the collection, use, and dissemination of international trade data to eliminate redundancies, streamline processing, and share information.

The KC-ITPC Technology Assessment Study is organized as follows:

Section 2.0: Introduction
Section 2.1: Background
Section 2.2: User Services Requirements
Section 2.3: U.S. Government Trade Processing Technology Survey
Section 2.4: Assessment of Potentially Applicable ITS and other Technologies
Section 2.5: Concept of Operations
Section 2.6: System Architecture Preliminary Assessment
Section 2.7: Assessment of Costs and Benefits
Section 2.8: Bibliography
Section 2.9: List of Acronyms
2.1 Background

2.1.1 Overview of International Trade/Shipping Process

International freight, moving to and from North America, typically moves intermodally. Door-to-door transoceanic service requires the cooperative partnership of more than one mode of transportation. Figure 2-4 shows an overview of the international freight transportation system for movement to and from North America.

Figure 2-4: Overview of Intermodal Freight Movement Across the Border

Please see Section 2.9 for a listing of acronyms.
For most shipments, movement of freight from the shipper to the consignee typically involves six general steps:

1) Pick up freight from shipper/manufacturer/producer.

2) Store freight at foreign seaport/airport/railyard/truck yard (Mexico or Canada).

3) Load freight on vessel/aircraft/train/truck.

4) Present freight at U.S. port/land crossing/airport.

5) Deliver to inland terminal using train/truck/barge/pipeline/air.

6) Deliver to consignee/buyer/manufacturer.

At each step, as the freight and accompanying documentation change hands, a variety of information transactions occur. The information transactions required for international freight vary widely depending on the countries of origin and destination, commodity, and terms of sale. The information transactions for a typical international import freight shipment might include:

- Buyer identifies need to purchase goods from overseas seller. U.S. importer contacts overseas shipper, opens a purchase order, and arranges credit through the foreign bank.
- Shipper sends invoice and packing list.
- Cargo is shipped.
- Consolidator or Shipper issues a Freight Cargo Receipt to the Ocean Carrier or Non-Vessel Owning Common Carrier (NVOCC) which issues a bill of lading to the overseas shipper.
- Ocean carrier or NVOCC sends the Bill of Lading to the shipper and a copy of the Bill of Lading with the invoice and packing list to the U.S. broker.
- The original Bill of Lading and Freight Cargo Receipt are sent to the overseas bank by the shipper.
- Ship transmits its manifest to U.S. Customs electronically and to other trade regulators as required.
- Cargo arrives at border.
- Overseas bank sends a bill to the U.S. bank.
- A copy of the Bill of Lading and Freight Cargo Receipt are sent to the importer.
- Importer pays the U.S. bank.
- U.S. bank sends the Bill of Lading to the broker, on behalf of the shipper.
- Broker arranges cargo release with U.S. Customs and other regulatory agencies.
- U.S. Customs releases cargo.
- Broker issues a delivery order to the motor carrier, authorizing freight pick up.
- Cargo is delivered.
- Overseas bank pays the shipper.

2.1.2 “Manual” Customs Processing Overview

When a shipment of commercial goods reaches the United States, legal entry is permitted after: (1) the goods enter the port of entry, (2) estimated duties are paid, and (3) Customs authorizes delivery of the merchandise. During this process only the owner (their agent or purchaser) is responsible for the entry. Customs is responsible for checking, verifying, examining, validating, and authorizing entry. Figure 2-5 outlines the general responsibilities for a commercial entry.

**Figure 2-5: Commercial Entry Process**

<table>
<thead>
<tr>
<th>Owner, Agent, Purchaser Responsibility</th>
<th>Customs Responsibility</th>
</tr>
</thead>
</table>
| **Step 1. Entry: Goods arrive at port of entry.**  
  a. Decide to enter goods for consumption or bonded warehouse/FTZ.  
  b. If consumption, file entry documents:  
    1. Entry manifest  
    2. Right to make entry  
    3. Invoices, packing lists  
    4. Evidence of bond  
    5. Entry summary | If goods not claimed, store in government warehouse.  
  Check documents, process transaction  
  Verify evidence of bond  
  Verify value  
  Verify class and rate |
| **Step 2. Determine the valuation of goods** | Examine goods, validate classification and valuation, authorize entry, liquidate transaction |
| **Step 3. Classify/appraise for tariff rate** | **Step 4. Estimate and pay tariff (check or cash)** |

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1 Note that the basic processes shown here do not include the responsibilities of other agencies (e.g., FDA, DOA) involved with examining commercial entries into the U.S.
2.1.2.1 Owner, Agent, Purchaser Responsibilities

In the northbound direction, it is common for the Mexican broker to work with a U.S. broker in the preparation of the U.S. entry documents. If the Mexican shipper or carrier does not contact a U.S. broker before the shipment reaches the border, the Mexican broker will typically facsimile a copy of the paperwork to a U.S. broker who will enter the information into the Automated Broker Interface (ABI).

At some ports of entry, U.S. brokers maintain small offices in Mexico. These offices are typically used as collection points for information that is forwarded to the U.S. broker’s offices in the United States. This information allows the U.S. broker to prepare the appropriate U.S. entry documents and, in most cases, file them electronically with U.S. Customs using the ABI. In addition, the U.S. broker’s Mexico offices provide a location where truckers can pick up the U.S. entry papers prior to approaching the U.S. border.

The U.S. entry documents for conveyance are:

- **Entry or Inward Manifest** - Typically, the entry manifest is prepared using Customs Form (CF) 7533 and the bill of lading may be used as a supporting document. However, there are other forms for other types of shipments such as CF 3461 for Entry/Immediate Delivery or a Bar Code Form for Line Release. It should be noted that district directors may specify other types of forms for merchandise release unique to their POE operation.

- **Evidence of Right to Make Entry** - Goods may be entered only by the owner, purchaser, or by a licensed broker. When the goods are consigned “to order”, the bill of lading, properly endorsed by the consignor, may serve as evidence of the right to make entry. In most instances, entry is made by a person or firm certified by the carrier bringing the goods to the port of entry and is considered the “owner” of the goods for Customs purposes. The document issued by the carrier is known as a “Carrier’s Certificate.”

- **Invoice or a proforma Invoice** - This document must identify the buyer and seller, port of entry, a detailed description of the merchandise, quantities, weights and measures, purchase price, all charges on the merchandise, and country of origin. While there is no standard format for the invoice, the specific content is well documented. This information can be entered into the *Automated Invoice* system by a broker using the ABI.

In some cases, packing lists may be required and/or there may be documents required to determine if the merchandise is admissible to the United States.
If pre-payments have not been made, then the entry must be accompanied by evidence that a bond is posted with Customs to cover any potential duties, taxes, and penalties that may accrue. Bonds may be secured through a resident U.S. surety company and may be posted in the form of U.S. dollars or U.S. government obligations. In the event that a customs broker is employed for the purpose of making entry, the broker’s bond may be used to provide the required coverage.

If the goods are to be entered for consumption and released from Customs, an entry summary for consumption must be filed and estimated duties deposited at the port of entry within 10 working days of release. The Entry Summary documentation process is as follows.

- **Entry Documents are Returned** - The entry documents described above are returned to the importer, broker or their authorized agent after the merchandise is permitted for release.

- **Entry Summary** - Customs Form 7501 is called the entry summary which is used to collect classification, values and other statistical information on the merchandise entered.

Determining the value of the goods is for applying tariffs or duties. Generally, the Customs value will be the transaction value or price paid (or payable) for the goods when sold for exportation to the United States, plus amounts for the following if not included in the price:

- Packing Costs incurred by the buyer.
- Any selling commissions paid by the buyer.
- Value of any assist (e.g., tools, dies, molds, engineering, artwork, etc.).
- Royalties or license fees.
- Sale proceeds that accrue to the seller.

Classification responsibility rests with the importer, customhouse broker, or other person preparing the entry papers. This step determines the tariff rate that should be applied to the goods. The certificate of origin is a document that certifies to the buyer the country in which the goods were produced. This certificate is required in order to benefit from preferential tariffs, such as those under NAFTA. This form does not have to be submitted with the entry summary documentation; however, it must be kept on file in the event a dispute arises over the tariffs and/or duties charged.
Finally, the owner, agent, or purchaser is responsible for payment of duties. Payment is made by cash or check and is payable to the Treasurer of the United States.

2.1.2.2 Customs Responsibilities

The responsibility of the Customs Service in the entry process can be characterized as: check and verify, examine, validate, authorize entry, and liquidate.

Customs is responsible for checking entry documents and verifying evidence of a bond. When goods arrive at the port of entry, the owner or agent is responsible for making arrangements for the shipment and storage of goods. Goods not claimed are stored in a general warehouse and billed to the owner when goods are received or sold at auction.

In examination, Customs examines the goods to determine their value and suitability for entry. Generally, examination consists of:

1. Valuing goods for Customs and dutiable status.
2. Reconciling the proper markings of goods with the country of origin.
3. Determining whether the shipment contains prohibited items.
4. Determining whether the goods are correctly invoiced.
5. Taking an inventory to identify excesses or shortages of the invoiced quantities.

Validation consists of checking the classification of the goods and appraising the goods for correct valuation. After review of information for correctness, proper appraisement, and agreement of the submitted tariff data, Customs may authorize release for entry into the United States. If the goods are accepted without changes, they are liquidated as entered and a notice is posted by Customs.

Examinations

Primary Inspections. At the Primary Inspection station, the Customs Inspector must begin by determining the citizenship of the driver and any passengers in the vehicle. This is a requirement of U.S. immigration law and must be asked of each driver and passenger. The driver must have the appropriate documentation, typically a passport and visa, to satisfy Immigration and Naturalization Services (INS). If the driver does not have the appropriate documentation, he is referred to INS which have offices at most commercial ports. After determining the citizenship status of each passenger, the officer will proceed to obtain a declaration for any agricultural products, narcotics, merchandise or currency in excess of $10,000. The response to the questions will determine whether the vehicle is sent for inspection or the shipment is processed for release into the U.S.
Finally, while vehicles are at the primary inspection station or in the queue, K9 units will patrol around the vehicles. If a K9 Unit reacts to a vehicle, it will be selected for a secondary inspection. In addition, the agent may send a vehicle to a secondary inspection if he or she finds suspicion about the paperwork, vehicle or driver.

If everything is in order and no inspections are required, the vehicle is allowed to pass through to the final check point and exit the port of entry. Some Mexican vehicles - particularly some tankers - are too large (oversized) for operation on U.S. roadways. These vehicles may have to be trans-loaded onto smaller U.S. vehicles. This transfer occurs within the commercial compound and the oversized vehicle is returned to Mexico.

**Secondary Inspections.** Once the paperwork and computer information has been verified by the agent, the vehicle may need to undergo a secondary inspection for enforcement or compliance monitoring. All **hazardous materials** loads must be inspected by Customs and EPA under Section 13 of the Toxic Substance Control Act (TSCA). If the material is covered under Section 13 of TSCA, a certificate is required to declare what chemicals are being transported and if the shipment complies with all rules of the TSCA. The certificate must be submitted prior to the vehicle arriving at U.S. Customs.

Depending on the specific product, **agricultural, food products, pharmaceuticals and medical equipment** shipments may be sent directly to the agricultural inspection docks where the U.S. Department of Agriculture and or the U.S. Food and Drug Administration inspect the loads.

Additionally, a number of other federal agencies can be involved in the inspection process, including the FWS, CPSC, and the FCC.

USDA has established some low risk products that can be precleared and are only subject to random inspections. In many ports, State and County inspectors may also be present at these inspections.

There are several types of Secondary Inspections which can be conducted: random, compliance, or stratified.

- **Random Inspection** (Enforcement) - This is similar to the Mexican random selection system and serves as a quality control measure. If a random inspection is called for, the vehicle is moved into the secondary inspection area and an agent begins the inspection process. In a random inspection they will verify the contents, check for the appropriate marking for country of origin, and search for contraband. An enforcement inspection may focus on the cargo, the conveyance or the driver.

- **Selectivity Review** (Compliance) - an examination of the entry documents to determine admissibility of the merchandise and/or if other agency requirements or special permits and licenses are present.
• **Standard Cargo Exam** (Compliance) - A standard cargo exam is an examination of the merchandise to determine admissibility and to verify the correctness of the entry documents and invoices. A standard cargo exam is not entirely random, since it is typically targeting a particular shipper, importer, broker or drayage company. A compliance inspection is a directed form of quality control.

• **Stratified Inspection** (Compliance) - A stratified inspection is a quality control inspection that targets a particular product or commodity. These inspections are more intensive than the standard exam and are selected based on a statistical methodology developed as a part of the National Compliance Measurement Program. This form of inspection is generated from the information contained in the bill of lading.

Depending on the type of secondary inspection, the trailer may or may not have to be unloaded. In some cases, the inspector has sufficient room to move within the trailer and nothing has to be removed from the vehicle. In other cases, the entire contents of the trailer will be unloaded. Depending on the level of inspection required, processing of a vehicle in the secondary inspection area may take several hours.

In the event that the trailer must be unloaded, the shipper typically has to pay a fee for unloading the vehicle. In some ports there are stevedores who unload the trucks by hand. In other ports, the brokers have personnel and equipment within the port for unloading vehicles. Palletization of loads has improved the efficiency of this process.

Throughout the secondary inspection process, K9 patrols may be moving in and around the trucks and trailers. If a K9 unit reacts to a vehicle a **Contraband Enforcement Team** (CET) may be called in to aid in the inspection of the vehicle. In Nogales, Arizona, they are using a **Secondary Express** inspection program on all vehicles that move into the secondary inspection area. This program subjects the outside of the tractor and trailer to a very quick but thorough examination. At Otay Mesa, the port is testing an X-ray machine that can scan an entire tractor-trailer rig in a single pass. When fully operational, this may become the first step in all secondary inspections where the X-ray devices are available. Once the vehicle has been X-rayed, it moves to a dock where the actual inspection will occur.

Once a vehicle is released from secondary inspection, it proceeds to the final check point at the U.S. commercial compound. All the paperwork is submitted and the vehicle is allowed to exit the compound.

**Safety Inspections.** All U.S. states have vehicle safety inspection and weigh station programs. Depending on the state, there may be either a permanent or temporary inspection/weigh station at the border. Where permanent stations exist, all vehicles exiting the U.S. Customs compound must pass through an inspection/weigh station and are subject to inspection and measurement. The hours of operation of the weigh station match those of the Customs commercial facility. California issues certificates once an inspection has been
performed which remains valid for the current quarter. This approach reduces the number of inspections performed by the highway patrol and minimizes the delay for the truck driver.

In states where there are not permanent stations, temporary inspection stations and scales are used. Until recently, Texas used a system of roving roadside inspectors to patrol the border region. With the increase in truck traffic along the border, Texas has added permanent stations near many of the border crossings. However, staffing limitations keep these stations from operating on the same hours as the U.S. Customs compound. Therefore, the inspection process in Texas is still a random sampling of vehicles rather than all vehicles.

2.2 User Services Requirements

The user services requirements detailed below were selected based on the Virtual Inland Port Concept of providing a series of technology-based solutions which could potentially allow the Kansas City Region to function as an international port of entry for goods and services. These user services are responsive to the direction of the of the Kansas City Mid-Continent TradeWay Study Policy Working Group, which recommended that a Virtual Process be addressed as one of the options for the KC-ITPC. Moreover, these user services will act to reinforce each other, creating an integrated set of value-added services (i.e., a “one-stop-shopping” approach) which can act to support increased use of the Kansas City Region as an inland port, thereby acting to promote economic growth in the region.

Before addressing the specific user service requirements, it is important to note that one single “global” user requirement that must be met is access to the KC-ITPC functions through the public Internet. A fully integrated Web page with access to all required systems, information and links is required so that customers can realize the specific user services described below. The Web site must also have the capability of providing secure password-protected access for certain functions of a sensitive nature (e.g., private shipment tracking, manifest of goods on a container, electronic payment via credit card, etc.).

An overview of the KC-ITPC user requirements is presented in Figure 2-6. The specific descriptions of each user service requirement are as follows:

- **International Border Electronically Expedited Clearance.** An electronic system that can automatically and accurately identify the carrier, vehicle/train, driver/engineer, and cargo will be used to verify the required credentials and clear transponder-equipped vehicles/trains (with a U.S. Customs Inspector’s authorization) into the U.S. from the international borders with Mexico and Canada. This will require standard DSRC (Dedicated Short Range Communications) vehicle-to-border inspection station communications consistent with the NATAP (North

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American Trade Automation Prototype) system. This communication will allow the verification of required credentials to determine if a carrier/vehicle/driver/cargo is in compliance with the goods movement facility requirements of the U.S Customs, and other applicable federal and state agencies. All international credentials processing required for entry into the U.S. will be conducted automatically by all parties involved using the ITDS (International Trade Data System).

- **Electronic Credentialing.** The carrier/driver/trader will be able to electronically file, obtain, and pay for all required licenses, registrations, permits, required for CVO by states and their respective agencies along the corridor. An electronic record of the credential will be sent (using Electronic Data Interchange standards) to the motor carrier’s headquarters or specified location and the regulatory agencies associated with the document consistent with the CVISN (Commercial Vehicle Information Systems and Networks) now in development. The responsible state agencies will initiate and maintain the document clearinghouse necessary to accommodate the specific CVO oversight, including carrier safety information, state tax compliance and other required data. Correspondingly, automated clearance across state borders and automated bypass of state weigh stations will be conducted using a transponder/reader/weigh-in-motion-based system consistent with the Advantage CVO/MAPS (Multi-Jurisdictional Automated Pre-Clearance System) standard. Safe vehicles are cleared electronically while in motion on approach to facility entrances and other inspection sites and are not required to stop for inspection if their records are clear.

- **Shipment and Vehicle Tracking.** Carriers/traders/customers (with approved access by the shipper) and U.S. Customs Inspectors (for in-bond shipments) will be able to track all properly equipped containers/trailers/rail cars in real time and at any location on the NAFTA Trade Corridor. GPS location systems, combined with LEO (low earth orbit) communications or cellular-based CVO communications services will be utilized.

- **In-bond Shipment Security.** For bonded cargo, electronic seal technologies will be employed to provide a method to remotely validate closure status on a container or trailer. Combined with CVO-based cellular or satellite communications and tracking systems, the secure status of a bonded container or trailer shipment could be validated 24 hours per day as the shipment makes its way to and from the Kansas City Region and the international border with Mexico or Canada.

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3 The assumption is made here that a “NATAP-like” deployment of ITDS will be forthcoming in the near future.
• **Intermodal Facility Management.** Managed entrance and exit of trade goods movement from intermodal facilities, (e.g., such as Union Pacific’s rail/truck container transfer facility in North Kansas City) in the Kansas City Region will provide carriers with the advantages of a faster trip, just-in-time pickup and delivery, and security in using the intermodal facility. The ability to exchange information will support the integration of intermodal yards, bonded warehouses and other transportation facilities within the Kansas City Region. Functionally supported by automatic equipment identification (AEI) technologies, this service will allow shippers/brokers/customers (with approved access by the shipper) and U.S. Customs Inspectors (for in-bond shipments) to check on shipment status – the time, condition, driver information, and other relevant information pertaining to the container delivery or exit of the facility will be recorded electronically.

• **Electronic Payment.** An electronic payment system such that transactions between shippers, brokers, customers, U.S. Customs, other federal agencies, state government agencies, and other users can make secure payments (e.g., brokerage fees, shipping charges, state tax payments, federal import tariffs, etc.) by using the KC-ITPC Web page.

• **Corridor-Wide CVO Traveler Information.** By providing connectivity with existing and planned highway traveler and weather information services, as well as traffic management centers (TMCs) located in cities across the corridor, CVO-tailored information will be developed at the KC-ITPC and provided to drivers and other users on the KC-ITPC Web page, and on a dial-in menu system. Most importantly, information will be made immediately available when a significant event disrupts normal corridor operations.

• **Trade Services.** There is a significant potential to provide value-added trade services on the KC-ITPC Web page. As an example, Kansas City Region brokers could have specific links set up on the page such that users of the system could contract for their services over the internet. Adding additional services such as this would promote further the “one-stop-shopping” approach for users of the trade processing center.

The Trade Processing Center virtual inland port set of user services has been developed both to meet the expressed needs of the commercial freight handlers and related industries across the NAFTA Trade Corridor, while at the same time providing the means by which a substantial economic benefit can be realized within the Kansas City Region through establishing the region as an inland international port of entry for rail and CVO users.
Figure 2-6: Kansas City International Trade Processing Center User Services Overview

- **Shipments and Vehicle Tracking**
- **International Border Electronics Expedited Clearance**
- **In-Bond Shipment Security**
- **Intermodal Facility Management**
- **Electronic Payment**
- **Traveler Information**
- **Electronic Credentialing**
  - **ITDS & U.S. Customs Automated Systems**
  - **CVISN & Advantage CVO/MAPS**
- **Trade Services**

www.KC-trade.com
2.3 U.S. Government Trade Processing Technology Survey

The following technology survey has been conducted to identify U.S. government systems (e.g., US Customs, US Treasury) which can support the International Border Electronically Expedited Clearance KC-ITPC User Service. This survey is divided into the following three categories:

- Processing systems currently in use.
- Prototypes recently tested or being tested.
- Future systems in development.

This survey is intended to provide a definition and critique of feasible technologies and programs that can support the realization of the International Border Electronically Expedited Clearance user service. This survey supports the development of the Concept of Operations (Section 2.5). Note that a technology assessment for addressing the remaining seven user services is presented in Section 2.6.

Before proceeding with this technology survey, it is first necessary to make a few background points regarding the functions of U.S. Customs and other import processes.

The major responsibility of the U.S. Customs Service is to administer the Tariff Act of 1930, as amended. Primary duties include the assessment and collection of duties, taxes, and fees on imported merchandise, the enforcement of customs and related laws, and the administration of certain navigation laws and treaties. As a major enforcement organization, the Customs Service confronts smuggling and revenue fraud and enforces the regulations of other federal agencies at United States ports of entry and land and sea borders.

When a shipment of goods reaches the United States, the importer of record (i.e., owner, purchaser, or licensed customs broker) is required to file entry documents at the port of entry. Imported goods are not legally entered until after the shipment has arrived within the port of entry, delivery of the goods has been authorized by Customs, and estimated duties paid. It is the responsibility of the importer of record to arrange for examination and release of the goods.

In addition to the U.S. Customs Service, importers should contact other agencies regarding particular commodities. For example, for regulated food or drug products, importers
should contact the Food and Drug Administration. Similarly, for regulated alcohol, tobacco, firearms, wildlife products, motor vehicles, and other products and merchandise regulated by the 60 federal agencies for which Customs enforces entry laws.

2.3.1 Current Systems

The Customs Service currently uses several processing sub-systems to support their responsibilities and duties. Described here are the Automated Commercial System, Automated Broker Interface, Automated Manifest System, Line Release System, and the Automated Export System. For each, a brief overview describing the purpose, goals/benefits, and capabilities is provided.

2.3.2 Automated Commercial System (ACS)

Since it’s introduction in 1984, Automated Commercial System (ACS) has supported the Trade Compliance process by tracking, controlling, and processing all commercial goods imported into the United States. Through Electronic Data Interchange, ACS has made major advances in reducing paperwork for both Customs and the importing community. The ACS consists of the Automated Broker Interface (ABI), Automated Manifest system (AMS), interfaces to the Line Release system, and other modules identified below. The Automated Broker Interface (ABI) has been instrumental in accomplishing paperless Entry Summary processing, granting accelerated clearance of designated shipments, providing access to Customs reference files, and paying duties via wire transfers. The ACS Automated Targeting System identifies high risk shipments for inspection while low risk shipments are expedited through the import process. Sea carriers utilizing the Automated Commercial System can receive conditional release authorizations up to five days before arriving in the United States, whereas air carriers receive conditional release authorization after “wheels up”.

Additional capabilities of the ACS include:

- Cargo Selectivity System to sort high risk cargo from low risk cargo and determine the type of examination required.
- Entry Summary Selectivity to automate the review of entry summary data using ABI line item data.
- Border Cargo Selectivity System to screen truck and train land border cargo, determine risk assessment and examination requirements, and provide inspectors for the cargo, driver, company, and tariff information.
- ACS Quota System to track quantity controls on imported merchandise, compare
quantities against visas, transmit the information to the country of origin, and simplify reconciliation of imports and exports.

- Automated Invoice Interface (AII) to allow filers to send electronic invoice information to Customs.

- Faster data entry, processing, and issuance of drawback payment when drawback claims are submitted on a diskette or through ABI.

- Electronically file Customs protests for ABI participants.

- Electronically file a formal or informal consumption entry from a location other than a port of arrival (POA) or the designated examination site (DES). Remote Location Filing is a prototype program that allows an approved participant to file a consumption entry with Customs at remote locations within the United States.

- Track cargo in the United States from the port of unlading to the port of entry or exportation. The National In-bond System is incorporated in the AMS and uses departure, arrival, and closure data to track cargo and retain control over all sea in-bond movements associated with automated bill of lading.

- Eliminate the need for paper documentation by utilizing the data available in the AMS. The Paperless Master In-bond program controls the movement and disposition of master in-bond (MIB) shipments from the carrier’s custody at the port of unlading to the same carrier’s custody at the port of destination.

ACS also electronically transfers data on import transactions to other government agencies. These interfaces allow participants to comply with Department of Transportation, Bureau of the Census, Federal Communications Commission, Food and Drug Administration, and U.S. Fish and Wildlife Service requirements. By electronically filing data with other government agencies (OGA), participants can:

- Receive faster OGA cargo release.
- Reduce the amount of paper documents.
- Receive OGA edit results on entry and entry summary data.
- Identify transactions subject to OGA review.
- Receive OGA cargo status and authorizations for cargo dispositions.

For additional information about ACS refer to the U.S. Customs Web site at:

http://www.customs.ustreas.gov/imp-exp2/auto-sys/acs.htm
2.3.3 **Automated Broker Interface**

The Automated Broker Interface (ABI) is an integral part of the ACS allowing high-volume qualified participants to file import data electronically with the Customs Service. ABI participants can utilize the statement processing and automated clearinghouse features to consolidate multiple ABI entries into a single payment transaction and make payments electronically. ABI also interfaces indirectly with the Automated Manifest System to allow faster identification and release of low risk shipments.

With ABI, participants can:

- File entry release data electronically for cargo release processing.
- File a consolidated entry summary, combining multiple release transactions on a single entry summary.
- File consumption entries, Transit In Bond entries, Free Trade Zone entries, and warehouse withdrawals for consumption.
- File selected "bypass" entry summaries electronically, without providing additional paper documentation.
- Transmit U.S. Customs Declaration (invoice and summary in one message) in EDIFACT syntax; summary data in Customs syntax; invoice data in Customs syntax.
- Receive results of ACS edits and validations during development and testing of entry summary transactions. Choose the edit results you receive--acknowledgement for all transactions or for error/warning transactions only.
- Receive paperless designation for general exam entry transactions.
- Update entry dates electronically.
- Change selected shipping details on entries in Customs status up until the time cargo arrives.
- Designate one broker to receive all of an importer's liquidation information through the National Importer Liquidations (NILS).
- Certify entry summary for cargo release processing — a separate CF-3461 transaction is not required.
• Receive conditional cargo release results up to five days before the ocean conveyance arrives, “wheels up” for air transport, same day for truck transport and rail transport.

• Receive priority handling through exam/release processing (including quota and on-stop-quota).

• File drawback claims electronically.

• Choose from several payment options — send one check for each entry summary, one check for summaries on a statement, or pay statements electronically through the Automated Clearinghouse (ACH).

For additional information about ABI refer to the U.S. Customs Web site at:


2.3.4 **Automated Manifest System**

The Automated Manifest System (AMS) is an inventory control and release notification system for sea, air, and rail carriers that facilitates cargo flow and entry processing by providing electronic authorization of cargo release prior to arrival. AMS expedites the movement and delivery of cargo through the In-Bond system by reducing the reliance on paper documents and processing manifest and waybill data. AMS also provides faster identification and release of low risk shipments through interfaces with Customs Cargo Selectivity system, In-Bond system, and the ABI. AMS participants include: sea, air, and rail carriers, port authorities, service bureaus, freight forwarders, and container freight stations.

Port authorities and service centers can file and receive both manifest and cargo data for multiple carriers calling at multiple ports. Using a unique bill of lading number, manifest data can be transmitted electronically for all cargo enroute to the United States prior to vessel arrival. This allows Customs an opportunity to review the submitted documentation and determine, in advance, whether the merchandise merits examination or whether to release it immediately upon arrival. The carrier, upon receiving a release from Customs, is able to make decisions on staging cargo and the importer can arrange for examination, release, and further distribution of the merchandise. All of this can be accomplished before the merchandise actually arrives.

Air AMS allows carriers to "arrive" an in-bond shipment and to file in-bond, permit to proceed, and local transfers electronically. The carrier obtains notifications of releases, in-bond authorizations, general order, permit to proceed, and local transfer authorization upon flight departure or arrival from the last foreign port. Air waybill data can be transmitted in
any sequence. Carriers have the option to transmit bills at random or group them by flight. Amendments to any air waybill information can also be transmitted electronically through AMS. Air AMS increases data reliability and electronic enforcement capability by standardizing the way the trade community and the U.S. Customs Service communicate.

Rail AMS allows rail carriers to electronically transmit bill information to Customs. When all bills on a train are known, the rail carrier transmits a "consist" of the bills and containers in standing car order. This allows Customs an opportunity to review the submitted documentation and determine, in advance, whether the merchandise merits examination or release. The carrier, upon receiving a release from Customs, is able to make decisions on staging cargo, and the importer can arrange for examination, release, and further distribution of the merchandise.

For additional information about AMS refer to the U.S. Customs Web site at:


2.3.5 Line Release System

Line Release Entries are a specialized pre-filed electronic entry that allows cargo imports with consistently problem-free cargo manifests and invoices to bypass standard Customs and other regulatory inspections. Line release commodities must also be free of enforcement concerns (such as marking violations, penalties, seizures, fraud, and suspected narcotics); require no special documentation; and be selected by Customs management centers and ports on the basis of high volume and low risk cargoes.

The Line Release System tracks and releases highly repetitive shipments at land border locations. Customs scans a bar code into a personal computer, verifies that the bar code matches the invoice data, enters quantity, and releases the cargo. The cargo release data is transmitted to ACS, which establishes an entry and the requirement for an entry summary, and provides ABI participants with release information. In addition, Line Release participants can:

- Obtain a release using a barcode instead of preparing form CF-3461 or CF-3461 ALT.
- Utilize an automated release system without additional hardware/software requirements.
- Receive expedited release approval.
- Receive detailed reports of all Line Release transactions electronically.
• Electronically create entry records from Customs output reports.

• Gain the release of shipments requiring other agency documentation by using the Special Messages feature to alert Primary Inspectors of the need for other agency forms.

2.3.6 Other Modules

For information about other ACS modules refer to the U.S. Customs Web site at:

http://www.customs.ustreas.gov/imp-exp2/auto-sys/acs.htm

2.3.7 Automated Export System

The Automated Export System (AES) is a joint venture between the U.S. Customs Service, the Foreign Trade Division of the Bureau of Census (Commerce), the Bureau of Export Administration (Commerce), the Office of Defense Trade Controls (State), other federal agencies, and the export trade community. AES is an information gateway designed to assure compliance with and enforcement of laws relating to exporting, improve trade statistics, improve customer service, manage Harbor Maintenance Fee collection, and has as its goal paperless reporting of export information by the year 2002. Four key AES benefits of interest to our commercial customers are one-stop export filing, the savings inherent in the paperless system, the improved accuracy of trade statistics and the AES Post-departure Authorized Special Status (AES-PASS).

AES requires exporters and carriers to file some specific export information in advance of exportation, just as is required by law today in the paper reporting environment. The Shipper's Export Declaration (SED) must be completed and filed by the exporters or their agents before the cargo leaves the country under current law. During Phase I of the implementation participating companies were required to dual report; i.e., they submitted both paper and electronic Shipper's Export Declarations (SED's). This allowed the Bureau of Census (Commerce) to evaluate the integrity of the electronic data they received. As a result of the first evaluation by Census, completed in June 1996, AES expanded to collect both commodity shipment data and vessel manifest data electronically at all U.S. seaports on October 1, 1996.

On July 1, 1997, AES expanded to collect the exporter/forwarder commodity shipment data for all other modes of transportation. The first enhancement was the roll-out of the AES Post-departure Authorized Special Status (AES-PASS) program on November 1, 1997. During 1998, AES began electronic decrementation of State Department licenses (SP5s) which culminated with automatic decrementation for AES participants. The requirements for the collection of transportation data for air and overland are under development through meetings with industry transportation groups. Implementation of this segment of the system
is planned to be phased-in early in 1999. Other 1999 enhancements include automatic release of in-bond and temporary in-bond (TIBs) and automatic close out of drawback.

For additional information about AES refer to the U.S. Customs Web site at:


2.3.8 Prototype Systems

The Customs Service is also testing or recently tested several prototype programs to support their responsibilities and duties. Two are described here, the Border Release Advanced Screening and Selectivity System and the North American Trade Automation Prototype demonstrations.

2.3.9 Border Release Advanced Screening and Selectivity (BRASS)

The Border Release Advanced Screening and Selectivity (BRASS) system is the newly designed program that will enable the U.S. Customs Service to efficiently process low risk, high volume, and repetitive cargo at the land border Ports of Entry. The new system enhances the statistical research and tracking capabilities of the Line Release System in the Windows 3.1, 95, or NT graphical interface environment. In addition, BRASS will:

- Establish national quality standards (volume level requirements and compliance rate standards).
- Develop national standard operating procedures for all Customs ports.
- Consider several options for centralizing the application process.
- Allow easy changes to targeting goals (5 types of exams can be programmed; 2 by inspectors).
- Facilitate management and sharing of data and reports.

2.3.10 North American Trade Automation Prototype (NATAP)

The Heads of Customs Conference in 1994 established the Information Exchange and Automation Working Group (WG), which designed and coordinated the development of a model trade process called NATAP. The purpose of NATAP was to demonstrate and assess the potential benefits of harmonized trade processes using common data, codes, and syntax. NATAP allowed the NAFTA governments (US, Mexico, and Canada) to experiment with new procedures and technologies without the expense of committing to a full production system. The Prototype demonstrated and tested a process based on electronic commerce, a
standard North American data transaction record, communications through the Internet, and cutting edge ITS technology, including transponder/radio frequency identification devices (RFID).

All three countries agreed to implement NATAP together, although each did so with a unique, country-specific perspective. In the US, NATAP was used as a proof-of-concept for the International Trade Data System (ITDS), a special project under the Office of the Vice President. As such, the US designed a new system that interfaced with several US government agencies involved in trade to process NATAP transactions. Mexico integrated the NATAP data requirements into its existing legal production system, while Canada designed a stand-alone database that ran parallel to its existing system and interfaced to other agency systems.

In the existing process, traders (importers, exporters, or brokers) in North America are required to submit data and/or documents to the three governments to conduct international business. These data elements do not have the same names nor are they defined or coded in the same manner among the three countries. Each country has its own separate automated systems. In addition, a single country may have more than one system to process trade data. The US, for example, uses the Automated Broker Interface (ABI), the Automated Manifest System (AMS), the Automated Export System (AES), and is developing the Automated Commercial Environment (ACE). Canada uses the Accelerated Commercial Release Operational Support System (ACROSS), Customs Automated Data Exchange (CADEX), and Release Notification System (RNS). Mexico uses the Sistema Automatizado Aduanero Integral (SAAI). This multitude of systems uses an array of proprietary formats and syntaxes, different data, and different coding. NATAP eliminated these variations and complexities by integrating the various data sets used by the three governments into a single trilateral standard set of trade data. Use of this set allowed traders in all three countries to use the same data elements—with standard definitions and standard coding—for submitting trade data to all three countries. Furthermore, NATAP attempted to eliminate the variety of proprietary data transmission syntaxes by employing the UN/EDIFACT protocol as the standard for all three countries.

Because of certain unique requirements of each country, the standard set contains some country-specific data elements that are used by one or two countries, but not all three. Examples of country-specific elements are the General Services Tax (GST) for Canada, Surety Code in the US and Value Added Tax (IVA) in Mexico. In all, there are 26 country-specific data elements in the standard set.

Standard codes were adopted, when possible, to reduce the amount of data transmitted and stored. For example, each trading entity is identified by a unique DUNS number rather than by name and address. International standard codes (ISO codes) were used where they were
available. Where ISO codes did not exist, NATAP established its own standard codes (for example, the North American Transaction Number (NATN), Trip/Load Number (T/LN), and the Driver Registration Number).

Figure 2-7 shows conceptually the U.S. implementation of NATAP for commercial vehicle operations. As an enrolled vehicle passes the advance reader location at the approach to the border crossing and inspection/processing compound, the system electronically screens it using DSRC. The system reads carrier, vehicle and cargo identification data, as a trip/load number, from a transponder installed in the vehicle cab. This information is sent through the Traffic Facility Integrated Communications (TRAFIC) system to the NATAP system. When the vehicle reaches the US Customs primary inspection point, the decision reader reads the transponder a second time. This action again prompts the TRAFIC system to forward the trip/load number to the NATAP system. The NATAP system displays selected information to the inspector’s workstation in the primary inspection booth (see Figure 2-8 for example). The NATAP information consists of immigration, transportation, and related documentation regarding the status of the carrier, driver and cargo. Considering the information provided, customs inspectors instruct the driver to proceed to the compound exit, to a secondary (more detailed) inspection, or to a state roadside inspection facility. The customs inspectors relay these instructions to the driver via a red or green signal displayed both on the transponder and on a traffic signal adjacent to the primary inspection booth. The system reads the transponder a third and final time as the vehicle reaches the exit of the compound. If the vehicle has completed all inspections satisfactorily, and has all required documentation in order, the system gives the driver a green light to exit the compound.
Figure 2-7: Conceptual NATAP Implementation for Commercial Vehicle Operations
NATAP was implemented at six international truck ports and one rail crossing: Buffalo/Ft. Erie, Detroit/Windsor, El Paso/Ciudad Juarez, Laredo/Nuevo Laredo, and Nogales/Nogales, Otay Mesa/Mesa de Otay. Each NATAP port was equipped with Dedicated Short Range Communication (DSRC) systems consisting of transponders, readers, antennae, traffic signals, and computer systems.

**Buffalo/Ft. Erie**

The Peace Bridge International Transportation Border Crossing System (ITBCS) is located on the Peace Bridge between Buffalo, New York and Fort Erie, Ontario, Canada. The Peace Bridge ITBCS is an automated international border crossing system that incorporates support for the US Treasury Department's North American Trade Automation Prototype (NATAP) system and electronic screening capabilities for trade and transport related commercial vehicle electronic screening, toll collection, and dedicated commuter lanes. The ITBCS goal is to enable commercial vehicles and daily commuters to cross a “transparent” international border while supplanting current paper-based processes with one supported by electronic data interchange (EDI). The objective was to use ITS technology to facilitate the processing of vehicles and drivers through international border check points and to electronically pay bridge tolls.
The system will employ dedicated short range communications (DSRC) and EDI to poll approaching vehicle transponders. Based on the vehicle identification transmitted by the transponder, the system accesses information to debit toll accounts and allow pre-cleared commuter vehicles and pre-screened commercial vehicles to pass without stopping. The system supports the exchange of information between the trade community and regulatory agencies responsible for customs, immigration and transportation and facilitates the safety screening of commercial vehicles.

**Detroit/Windsor**

The Ambassador Bridge Intelligent Transportation Border Crossing System (ITBCS) is located on the Ambassador Bridge crossing between Detroit, Michigan, and Windsor, Ontario, Canada. The Ambassador Bridge ITBCS is similar to the Peace Bridge ITBCS, in that, it is an automated international border crossing system that incorporates support for NATAP and includes electronic screening capabilities for trade and transport related commercial vehicle electronic screening, toll collection, and dedicated commuter lanes. The Ambassador Bridge ITBCS will also address the safety of commercial vehicles operating in the State of Michigan, and throughout the US, by forwarding transport safety data obtained by the system to the nearest existing commercial vehicle weight and inspection facility. This data will be in a format consistent with those under development under the Commercial Vehicle Information Systems and Networks (CVISN) program, and will allow the Michigan State Police to effectively screen incoming vehicles for safety compliance.

The system is similar to the Peace Bridge ITBCS in that it will employ dedicated short range communications (DSRC) and EDI to poll approaching vehicle transponders. Based on the vehicle identification transmitted by the transponder, the system accesses information to debit toll accounts and allow pre-cleared commuter vehicles and pre-screened commercial vehicles to pass without stopping. The system supports the exchange of information between the trade community and regulatory agencies responsible for customs, immigration and transportation and facilitates the safety screening of commercial vehicles.

**El Paso/Ciudad Juarez**

The Texas Regional International Border Crossing System (TRIBEX) is located at three border crossings between Mexico and the U.S. The crossings are the Lincoln-Juarez Bridge between EL Paso, Texas and Juarez, Mexico, the Columbia-Solidarity Bridge, and Ysleta-Zaragosa Bridge between Laredo, Texas and Nuevo Laredo, Mexico. TRIBEX is an automated international border crossing system that incorporates support for NATAP and is similar to the commercial vehicles screening components of the Peace Bridge ITBCS and Ambassador Bridge ITBCS. TRIBEX will also address the safety of commercial vehicles operating in the State of Texas, and throughout the US, by forwarding transport safety data
obtained by the system to the nearest existing commercial vehicle weight and inspection facility. This data will be in a format consistent with those under development under the Commercial Vehicle Information Systems and Networks (CVISN) program, and will allow the Texas Department of Public Safety to effectively screen incoming vehicles for safety compliance.

The system’s operation is largely automatic. The three sites will be equipped with dedicated short range communications (DSRC) equipment to support the US Treasury North American Trade Automation Prototype (NATAP) demonstration project, and will demonstrate Commercial Vehicle Information Systems and Networks (CVISN) messaging, on-vehicle safety monitoring, and cargo security devices. The system polls transponders installed in approaching vehicles, and uses stored information to support the exchange of information between the trade community and regulatory agencies responsible for customs, immigration and transportation.

Laredo/Nuevo Laredo

In addition to its participation in TRIBEX, in February 1997, Laredo/Nuevo Laredo was chosen by Mexico and the United States as the site to test the NATAP applicability to northbound rail shipments. Testing was limited to northbound shipments originating at the Pantaco railyard in Mexico City and crossing the Mexico/US border at Nuevo Laredo/Laredo. Although CUSDECs and CUSCARs for rail were filed, no NATAP rail shipments occurred. However, significant resources and efforts were focused on the rail process to demonstrate NATAP’s suitability for other transportation modes.

The NATAP rail implementation is shown in Figure 2-9. The commodity information for each transaction (there would likely be multiple transactions) was filed in advance, entered into a CUSDEC, and the transportation information was entered into a CUSCAR. CUSDECs and the CUSCAR were filed via the Internet upon the train’s departure from Pantaco. Two CUSREP messages were sent by the train to NATAP. The first CUSREP was sent by the carrier to US Customs prior to the train’s arrival at Laredo to begin US Customs processing of the train and cargo. Either the carrier or Mexican Customs sent the second CUSREP message to US Customs at the time the train crossed the border to serve as the notice of arrival for the train.
The ports of exit and entry were equipped with one AEI antenna/reader to receive data from the transponders that were attached to the rail equipment. Each railcar was equipped with two transponders (one vertical and one horizontal). The antenna read the tag’s serial number from the engine and again from the second car. The redundancy insured the information would be reliably captured. The reader converted the serial number to a T/LN and transmitted the port ID and date/time stamp to NATAP. NATAP then matched the T/LN to the information and transmitted the summary transaction information to a government authorized facility at or near the rail crossing. Inspectors were able to review the data for the train. If NATAP did not authorize release of the shipment, the inspector would notify the trader that the specific railcar required inspection at a bonded facility. If NATAP authorized release of the shipments, the Customs inspector could review the summary (Primary) information prior to arrival at the border and at the arrival of the train. The inspector could also request the detailed (secondary) information (CUSCAR, CUSDEC). The inspector could either release the shipment or select the shipment for inspection at a specific bonded facility. The inspector would then notify the trader to arrange delivery of the specific railcar to the bonded inspection facility. When the inspector released the shipment from his workstation, that would transmit the port ID and date/time information to NATAP to close out the transaction.
Nogales/Nogales

The Expedited Processing at International Border Crossings (EPIC) system was located at the US-Mexican border crossing between Nogales, Arizona, and Nogales, Mexico. The system was developed to demonstrate an electronic trip clearance system to accelerate the crossing of commercial vehicles. The system also supported the Department of Treasury's electronic clearance project at the Nogales border crossing. The objective of the EPIC was to increase productivity for motor carriers and state administrators by integrating administrative functions, and thus expedite international commodity movements through the use of the EPIC system. The EPIC system demonstrated: (1) Integrated pre-clearance processing for cargo, vehicle, and driver; (2) EDI transfer of regulatory data; (3) Electronic International Zone Trip Credentials; (4) Border Traffic Management Information Systems; (5) Trading Partner Transborder Transport Information; (6) Transponder Crossing Status Notification; (7) Pre-arrival selectivity review capability; and (8) Border Traffic congestion information and monitoring. The administrative functions included:

- vehicle registration,
- safety,
- fee payment,
- tax and insurance compliance, and
- trip permit issuance.

The EPIC system consisted of dedicated short-range communications (DSRC) and other automated electronic components. Using an Internet-based operations platform, the information was to be made accessible to those who need it within the transportation industry. Regulatory agencies could contribute to this information via a secure, agency accessible network. Using a series of Readers, the system electronically detected the movements and status of participating vehicles and notified regulatory agencies. Regulatory agencies could then provide an electronic clearance and notification of clearance status to the driver through a transponder mounted inside the windshield of the vehicle. Cleared vehicles could proceed to their destination without additional delays for credential, vehicle or driver verification.

Otay Mesa/Mesa de Otay

The International Border Electronic Crossing (IBEX) system was located at the crossing between Otay Mesa, California, and Mesa de Otay, Mexico. The system was developed to demonstrate an electronic border clearance system to accelerate commercial vehicle traffic through the Otay Mesa, California, international port facility. The primary objective of the project was to develop and demonstrate critical ITS components of an integrated service that would allow selected vehicles to pass through international border check points with expedited inspections or without stopping. The system, in cooperation with the US
Treasury’s North American Trade Automation Prototype (NATAP) program, aimed to significantly reduce the delay incurred by commercial vehicles at international points of entry. The IBEX system was designed to allow the trade community and the appropriate regulatory agencies to electronically exchange:

- customs,
- immigration, and
- transportation data.

Using DSRC, the IBEX system electronically screened an enrolled vehicle as it passed the advance reader at the approach to the border crossing inspection/processing compound. The system read carrier, vehicle and cargo identification data, in the form of a trip/load number, from a transponder installed in the vehicle cab. IBEX forwarded this information through the TRAFIC system to the NATAP system. When the vehicle reached the US Customs primary inspection point, the decision reader read the transponder a second time. This action prompted the TRAFIC system to relay information received about the carrier from the NATAP system to the display in the customs primary inspection booth. The NATAP information consisted of immigration and trade related documentation regarding the status of the carrier, driver and cargo. Based on the information provided, the customs inspector instructed the driver to proceed either to the compound exit or to a secondary, more detailed inspection. The inspectors relayed these instructions to the driver via a red or green signal displayed both on the transponder and on a traffic signal adjacent to the primary inspection booth. The system read the transponder a third and final time as the vehicle reaches the exit of the compound. If all inspections had been completed satisfactorily, and all required documentation was in order, the system gave the driver a green light to exit the compound.

NATAP demonstrated how the North American trade processes and systems of Mexico, United States, and Canada could function more effectively through the use of common data elements, documents, and standardized processes for commercial customs clearance. In general, NATAP made significant progress in automating international trade. The three NAFTA governments successfully demonstrated an international harmonized trade process using standard data; a fully electronic environment; and advanced use of the Internet, EDI, encryption, and ITS technology for trade. The prototype proved that the NATAP concepts were viable and show promise of producing substantial benefits for the governments and the trade community.

NATAP participants suggested that some paper-based clearance processes in all three countries are relatively slow and inefficient, and often do not provide enough useful information to the inspector. NATAP created harmonized, totally electronic border crossing processes among all three countries for import, export, and in-transit shipments using state-of-the-art DSRC communication technology. Using windshield-mounted transponders, NATAP DSRC systems detected the truck at the border, identified the truck, distinguished the lane at the inspection booth, and sent the status of the transaction (red or green) to the transponder for display inside the truck.
For additional information about NATAP refer to the U.S. Department of Treasury Web site at:

http://www.itds.treas.gov

2.3.11 Future Systems

The Customs Service is also planning future programs to support their responsibilities and duties. Two are described here, the Automated Commercial Environment and the International Trade Data System.

2.3.12 Automated Commercial Environment (ACE)

The U.S. Customs Automated Commercial Environment (ACE) is an information technology development effort intended to replace the Automated Commercial System. Since it’s introduction in 1984, ACS has supported the Trade Compliance process by tracking, controlling, and processing all commercial goods imported into the United States. New technologies, changes in the business of Customs commercial processing, and increasing expense and difficulty for ACS enhancements all led to the development of ACE.

The goal of ACE is to:

- provide automated tools to increase trade compliance while decreasing costs of compliance,
- give users a more efficient system (greater flexibility and minimum processing time), and
- minimize time and resources required for implementing enhancements in response to statute changes.

The development of the ACE architecture and infrastructure is entirely consistent with the Customs Information Technology (IT) architecture framework. This framework provides the technical reference model, the product portfolio, principles and guidelines, standards and processes for developing the ACE application architecture and infrastructure within the overall Customs enterprise-wide technology strategy. The ACE architecture and infrastructure is an open and flexible implementation of the Customs IT architecture framework and is capable of supporting many Customs applications. ACE will deal with two broad types of interactions:
• High volume, real-time, transactional processing directly supporting the life-cycle of an entry, from pre-arrival data (provided by the Trade to Customs), through selectivity, inspection, verification, and the final entry summary acceptance.

• Analytical processing of historical transaction data, which allows users to search for non-compliance trends and anomalies, which in turn may lead to further action. This processing will be performed on a national server.

Process Improvement Teams working with Business Process Re-engineering teams have redesigned the Trade Compliance process. Five key processes were identified within Trade Compliance: Account Management, Target and Analyze, Verify, Enforce, and Revenue. The primary new concept that is pervasive throughout the entire redesigned process is that of Accounts. The account-based approach will extend the informed and enforced compliance efforts that are currently possible in the legacy transaction-oriented system.

Several system development efforts, collectively known as the Automated Commercial Environment (ACE), have already started to implement or prototype the redesigned processes. The initiatives currently under development include the National Customs Automation Program/Prototype, Data Warehouse, Reference Center, and the Trade-Analysis and Analytical-Selectivity Prototype (TAP). Under ACE, all functions and components will be fully integrated, system and database redundancies will be eliminated, processing capacity will be increased, and users will experience improved capabilities.

The following sub-sections provide a brief overview of each high-level process.

**Account Management**

Account Management is a new concept originating from the Trade Compliance process redesign; therefore, it does not correlate directly to any set of functionality currently implemented in ACS. Account Management encompasses the full range of Customs activities to establish, manage, and service accounts in the trade community. This includes outreach with accounts to facilitate informed, voluntary compliance with U.S. trade laws. The goal of the Account Management Process is to create mechanisms to establish and maintain business relationships with accounts in the trade community which support informed compliance, increase customer service, and provide a national view of an accounts' Trade Compliance activity.

In ACE, the global account activity profiles will contain a real-time summary of the account's activity summarizing the baseline of the account's compliance and its current compliance rate. Using the account management facilities in ACE, Customs can create action plans for accounts, document goals that need to be accomplished to improve compliance, and establish joint plans between an importer and Customs to reduce redundancies effort in the import process.
Target and Analyze

The goals of the Target and Analyze process are to use a uniform process to: identify, develop, and measure methods to address and track Trade Compliance initiatives and issues affecting international trade, at all levels and by all disciplines of Customs; employ a single, uniform, automated system to effectively identify and monitor transactions, accounts, and industries; and provide Customs and other government agency users information in a form suitable to meet analytical requirements.

Verify Process

The Verify Process will validate the compliance of accounts through account and transaction verifications, detection of trade violations, and interdiction of contraband. A major functionality enhancement for the Verify Process is workflow/workload management to allow for separate lines of a declaration to be verified by the appropriate specialists. It is conceivable that a distinct declaration line-item could be routed to different parts of the country based upon work capacity and employee expertise.

Key process features of the Verify Process include:

- Uniform, standardized and automated verification procedures and systems.
- Expedited cycle times for verification activities.
- Elimination of duplicate examinations and reviews.
- Flexibility to adjust workloads to meet changing conditions.

The following are specific features incorporated into the core verification sub-processes to meet customer needs:

- Emphasis an account-based approach, including multiple-transaction verifications.
- Verification results linked to accounts and easily retrievable by authorized parties.
- Uniform standards for verification activities, to facilitate uniform treatment of account transactions and improve the efficiency of verification activities.
- Quality control reviews built into sub-processes to insure standards are met and maintained.
- Selection for verification from ranked mandatory and optional targets, with emphasis on high-risk accounts and transactions, to provide flexibility in ports' control of resource allocation and workload.
• Ability to establish baseline compliance rates for most activities subject to verification.

• Single cargo examination and release procedure to promote uniformity, eliminate duplicate examinations and reviews, and improve the efficiency of examination and release procedures.

• Reduced cycle times through the use of standardized, more efficient verification procedures; and by using cycle time data to identify problem areas.

• Maximum information dispersal and feedback to customers, including automated access to transaction status information via ACE; two-way communication; and providing increased information on the basis for actions, such as reason for rejection, etc.

• Systems-generated actions, such as automatic generation of appropriate entry-summary holding codes when a Request for Information is issued, etc.

**Enforce Process**

Enforcement in the redesigned Trade Compliance process will select responses to non-compliance which are commensurate with the nature, extent and impact of the offense, and pursue responses designed to both remedy past non-compliance and prevent its occurrence.

Key features of the redesigned Enforce Process include:

• Customs-wide enforcement goals and priorities to focus Customs efforts and resources on significant trade issues, and to integrate Customs enforcement actions into overall agency efforts to achieve the goals of the Trade Compliance.

• Responses commensurate with non-compliance, to place instances of non-compliance in the context of the overall compliance of the involved account, and to focus enforcement efforts and resources on high-impact, significant violations.

• Interdisciplinary involvement in enforcement actions to facilitate informed problem solving and early legal input to insure there is a legal basis for seizures, investigations, liquidated damages claims, and penalties.

• Responses which both remedy past violations and facilitate future compliance, to create credible deterrents to violative conduct and achieve the goals of Trade Compliance.

• Accountability at all levels for meeting the goals of Trade Compliance, to insure that enforcement actions are undertaken in furtherance of achieving maximum compliance with trade laws.
• Performance measures which recognize efforts to meet the goals of Trade Compliance, rather than focusing on enforcement actions as ends in themselves.

Revenue Process

The goal of the Revenue Process is to ensure the accurate recording and accounting of all financial aspects of the Trade Compliance Process, to include meeting all requirements of the Chief Financial Officers Act of 1990.

Key features of the redesigned Revenue Process include:

• Automated, centralized accounts receivable subsidiary ledger, to incorporate all Trade Compliance and related accounts receivable into one systems record inventory and storage location while meeting all reporting requirements.

• Focus on account-based versus individual transaction processing by implementing a periodic statement process and account-based analysis methodology.

• Improved methods for processing collections, including cash receipts and user fees.

• Additional electronic processing relating to Customs financial transactions, including customer ability to initiate Customs Automated Clearing House (ACH) transactions through their financial institution, electronic disbursements from Customs, and electronic certifications of disbursements both between field offices and the Accounting Services Division (ASD, formerly the National Finance Center), and between the ASD and the Treasury Financial Management Service.

• Matching drawback payments to related import entries and decreasing the balance available for drawback.

• Strengthened internal controls related to bonds and voluntary tenders.

• Improved audit trails in automated systems, including an automated journal record of all financial transactions that provides for updating, balancing, and financial reporting to assure validity and reliability of the financial statements and cost accounting methodologies/programs in effect.

For additional information about ACE Technical Architecture refer to the U.S. Customs Web site at:

The original concept for ITDS was first documented in the 1993 FACET (Future Automated Commercial Environment Team) Report. The US Customs Service commissioned the Team to make recommendations for the redesign of its commercial processing systems. US Customs directed the Team to examine international trade processes from both the government and trade community perspectives and to employ modern information management technologies. The FACET Report included the following key recommendations:

- Original commercial data should be used as the basis for government trade processing.
- Import and export requirements should be standardized and integrated.
- An integrated trade database and processing infrastructure should address both the needs of the various government agencies and the public’s need for international trade information.

In the September 1993 report, Creating a Government that Works Better and Costs Less, the Vice President’s National Performance Review (NPR) formally designated the ITDS as an information technology initiative. In September 1994, the US Customs Service formed a Task Force at the request of the Office of Management and Budget (OMB). This task force comprised representatives from 53 federal agencies and developed the conceptual framework for an ITDS. In the May 1995 report, Concepts and Recommendations for an International Trade Data System was published. The report provided the basis for the Vice President’s establishment of the ITDS Project in September 1995 through an Executive Memorandum to the Heads of Executive Departments, Agencies and Independent Establishments. Further, this report provided the underpinning conceptual foundation for the eventual system development effort and subsequent directives from the project’s Board of Directors. The report achieved this by:

- Defining the mission for ITDS;
- Providing a set of design and development principles;
- Targeting a series of benefits; and
- Preparing a series of high-level functional descriptions articulating system capabilities.

The February 1997 report, Access America: Reengineering through Information Technology, again referenced the project. The Access America report, written by the NPR
and the Government Information Technology Services (GITS) Board, included the following key recommendations:

1) use NATAP to validate the concept of ITDS;

2) eliminate unnecessary reporting; and

3) develop and execute an implementation plan for ITDS.

As a prototype, the scope of NATAP was limited to truck and rail land border crossings. As previously mentioned, NATAP was successfully deployed at six border ports and showed that it is possible to standardize data, harmonize international trade processes, and develop interfaces and systems that meet the requirements for government agencies and the trade community. Moreover, the prototype shed light on a host of potential operational efficiency gains and identified new applications for emerging technologies including the Internet, security protocols, and electronic border clearance techniques. The development and implementation of ITDS will incorporate the lessons learned from NATAP.

**ITDS Vision**

The vision of ITDS is to facilitate and promote international trade by addressing some of the problems with the current trade processing environment. ITDS seeks to facilitate and expedite international trade by: reducing costs and burden for the trade community and government, improve enforcement and compliance with government trade requirements, and improve the quality of international trade data.

**Reduce Costs and Burden**

ITDS will reduce burdens on the trade community and the government by eliminating duplicate information requirements and collection of excessive data. Currently, the trade community submits data directly to individual government agencies. In the ITDS trade environment, the trade community will interface with ITDS and provide a common data set to a single collection point.

**Improve Enforcement and Compliance**

ITDS will improve enforcement and compliance with government trade requirements. ITDS will improve the enforcement of each agency’s trade-related mission by providing sophisticated risk assessment techniques. Using a standard data set, ITDS will facilitate information sharing among federal agencies. Many of the federal agencies have no automated capabilities today. With ITDS, agencies will be able to access virtually all the transaction information necessary to assess compliance with legal requirements.

ITDS will also provide the trade community with a single source for trade requirements information, which will enhance traders’ ability to comply with government requirements.
Internet technology will make ITDS document preparation procedures readily available for data submission. This will assist trade users in the complete and accurate submission of necessary information.

**Improve Quality of International Trade Data**

ITDS will be based on a standard data set consistent with commercially used data. This will permit agencies to create more accurate, timely and complete statistics. Moreover, ITDS will edit and validate all data submitted by the trade community to ensure that submissions are complete, accurate and reliable. As a result of compiling data in an “electronic” environment, processing time will decrease and trade information will be available on a timelier basis.

**ITDS Operational Capabilities**

ITDS will support the processing of international trade transactions by processing data related to goods, conveyance, and crew. ITDS operational capabilities will support four government roles: Border Operations, Licensing and Permitting, Statistics, Analysis, Policy, and Reporting, and Trade Promotion.

**Border Operations**

ITDS will provide a fully automated system for managing all import, export and transit trade processes related to cargo, conveyance and crew. ITDS will manage each transaction from declaration filing, pre-arrival processing, arrival processing, through release or export clearance of the shipment. ITDS will also support post-release or post-clearance processes, such as declaration amendments. ITDS may also manage the collection of duties, taxes and fees. ITDS will deploy conveyance identification technologies at the port of entry to expedite shipment processing. This technology will be used to notify federal agencies of an impending shipment arrival. The technology will match the shipment with the corresponding declaration(s).

For transactions submitted by the trade community, ITDS will provide the trade community user-friendly and accessible query and report capabilities. The filer will be able to access previously submitted data, review the transaction status, and obtain the history of the transaction (i.e., who made what changes to what data and when).

ITDS will provide risk assessment options. Risk assessment (also called selectivity) is the process of screening cargo, conveyances and crew to assess if they should undergo further examination to determine admissibility into the United States (for imports) or release from the United States (for exports). Each federal agency will determine its own risk assessment rules; ITDS will never determine an agency’s risk assessment rules. Each federal agency will decide if it wants to conduct its risk assessment within ITDS or on its own system, or some combination thereof.
Licensing and Permitting

ITDS will interface with license and permit-issuing or approving agencies to ensure that import and export requirements have been satisfied. Foreign governments and the trade community (importers and exporters) will be able to file a license or permit number in the standardized ITDS data set for compliance with regulations. ITDS will verify the presence of a license and provide for the automated decrementation of licenses as needed.

For agencies that request assistance, ITDS will develop the capability to perform their license/permit application and issuance process. ITDS will also develop electronic linkages with foreign governments to obtain and house license and permit information on exported commodities to the US. Query and report capabilities will be extended to all users, including foreign governments, in varying degrees of sophistication. ITDS may provide the capability for these users to log onto a specific Web site or network to input data and/or provide for system-to-system data transfer. (For foreign governments, this exercise is largely in support of managing restricted merchandise/quotas.)

Statistics, Analysis, Policy and Reporting

ITDS will provide comprehensive query and report capabilities to support statistical analysis and policy development. The data warehouse is at the core of the component; data marts (subsets of the data warehouse) may also be built to satisfy user requirements. System development initiatives underway at the federal agencies will drive much of the functionality provided by ITDS. The query and report functionality will meet the requirements of the trade community, the federal agencies, and system administration and management.

Trade Promotion

The Trade Promotion component will provide the trade community and the general public easy access via the Internet to trade-related information. It will also enable US companies to identify export opportunities. ITDS will provide a centralized repository of information that includes US rules, regulations, and procedures regarding imports, exports and transits. It will act as an information guide to goods classification; applicable duty, tariff, and fee structures; trade statistics; foreign market research reports; general knowledge pertaining to foreign markets; export finance information; foreign trade contacts; and resources on the Internet (e.g., National Trade Data Bank, Trade Net and other existing federal agency sites).

ITDS Functional Environment

The concept for ITDS is very simple; the trade community will submit one commercially-based data set to the Government for all international trade transactions—one data set to consolidate the information requested on over 400 forms and one interface to replace existing information collection and distribution channels. The data set will comprise the information necessary to process the goods declaration and the transportation or conveyance declaration. Once the declaration is received, the system will edit and validate
the data, distribute the appropriate data to the federal agencies and people who need it, perform risk assessment and selectivity, facilitate inspection process, consolidate agency actions regarding cargo examinations and dispositions, release the cargo, provide for collections and the completion of the trade transaction.

Border crossing technologies will be used to identify the conveyance or shipment upon arrival, receive a provisional release or inspection notification messages, and communicate a time of departure. The addition of these technologies to the trade process will expedite the physical movement of cargo across international borders in addition to serving as a means to inform the shipment’s status to authorized parties.

ITDS will provide a secure environment for the trade community and government operations as well as enable the regulatory agencies to improve enforcement. ITDS will facilitate pre-arrival, arrival, revenue accounting and collection processes along with the capabilities to submit and edit licenses and permits, monitor trade transactions, query and report through the use of advanced data warehouse technology, and provide a single repository for centralized data management and auditing. ITDS will also provide a trade promotion component that will provide the general public and the trade community with basic information on international trade, access to export opportunities and a means for learning more about import and export procedures and requirements.

Although the actual physical design of ITDS is currently under consideration, Figure 2-10 illustrates the ITDS functional environment. It depicts a high-level view of the ITDS functionality and communications with the various users. The figure also shows some of the information flows and user interfaces with the ITDS system. Communication will be facilitated by the use of the United Nations/Electronic Data Interface For Administration, Commerce, and Transportation (UN/EDIFACT) standard syntax.
Proposed User Interfaces

User interfaces will be developed to facilitate each of the designated system user groups including: the transportation and trade community; air, land, rail and sea border operations; regulatory and non-regulatory federal agencies; state governments; banks; sureties; foreign governments; service providers; and the general public.

ITDS will provide two options for the Federal Trade Agencies. The first option is referred to as “interfaced agencies” and the second as “integrated agencies.” An interfaced agency is an agency that chooses to retain the use of their existing automated transaction processing system. For these agencies, ITDS will serve as the data collection and dissemination system. Data will be received from the trade community by ITDS. ITDS will perform basic edits and validations of the data and then extract from the standard ITDS data set only that data
required by the interfaced agency to perform the agency-specific mission. This data will be sent to the interfaced agency by ITDS. The interfaced agency will perform its functions within its own automated system and send the results of the agency processing back to ITDS. ITDS will update the transaction record with the results of the agency process. Any additional processing performed by an interfaced agency will be done on hardware and software designed and maintained by the interfaced agency. ITDS will receive the results of all interfaced agency processes, update the transaction record, and send notification of this processing to the trade community according to rules established by the interfaced agency.

An integrated agency is an agency that chooses to use ITDS as their automated transaction processing system. For these agencies, ITDS will serve as the data collection, dissemination, and processing system. Data will be received from the trade community by ITDS. ITDS will perform basic edits and validations of the data and then process the data according to rules input and maintained in ITDS by the integrated agency. ITDS will update the transaction record with the results of the ITDS processing. Any secondary processing performed by an integrated agency will be done on ITDS hardware designed, maintained and directly linked to ITDS. ITDS will record the results of any integrated agency process, update the transaction record, and send notification of this processing to the trade community according to rules established by the integrated agency.

In those Federal Inspection Sites with a primary processing location, the primary workstation will display the processing results of both interfaced and integrated agencies. This hardware and software will be designed and maintained by ITDS. At secondary processing locations, ITDS hardware displaying the results of all processing by both interfaced and integrated agencies will be provided and maintained by ITDS.

Most of the proposed user interfaces will be specified screen facilities that support the various functional capabilities required by each group. In some cases, a user interface will require a system-to-system interface; the number of such interfaces will depend upon final user requirements (this type of interface is referred to as system integration in the Project Implementation and Transition Plan). Interfaces for the trade community will facilitate the following:

- Declaration transmission, edit and validation capabilities.
- Transaction monitoring.
- Query and report capabilities.
- Account-billing statements.
Interfaces for US Federal regulatory agencies will support the following:

- Border operations.
- Rule maintenance (rules will be maintained for edit and validation, risk assessment, data security, etc.).
- Risk assessment and selectivity.
- Statistical analysis and decision support.
- Query and report capabilities.

Other user interfaces will support:

- Air, land, sea and rail transportation carriers to enable border processing technologies.
- Banks for account payment information.
- Sureties for bond and liability verification.
- Foreign governments for licenses and permits, statistical analysis, trade regulations support, query and report capabilities.
- State and local governments for financial information and trade statistics.
- Service providers for trade data, decision support and statistical analysis.
- The general public for trade promotion.
- Electronic messaging.

For additional information about ITDS, refer to the U.S. Department of Treasury Web site at:

http://www.itds.treas.gov/ITDS/Frames/Build_Frames.cfm?Site=ITDS
2.4 Assessment of Applicable ITS and other Technologies

The following technology assessment has been conducted in support of investigating Intelligent Transportation Systems (ITS) and other technologies which can support the remainder of the KC-ITPC User Services, namely:

- Electronic Credentialing
- Shipment and Vehicle Tracking
- In-bond Shipment Security
- Intermodal Facility Management
- Electronic Payment
- Corridor-Wide Traveler Information
- Trade Services

This assessment is intended to provide a definition and evaluation of feasible technologies and programs that can support the realization of these user services. This assessment sets the stage for the development of the Concept of Operations in Section 2.5.

Note that the technology assessment related to the International Border Electronically Expedited Clearance KC-ITPC User Service is provided in Section 2.3. However, the CVO transponder/reader technologies related to this user service are addressed below.

2.4.1 Electronic Credentialing

CVO Technologies Being Showcased in the CVISN Program

As part of the FHWA’s Office of Motor Carriers ITS/CVO (ITS/Commercial Vehicle Operations) Program, the Commercial Vehicle Information Systems and Networks (CVISN) is a national program with the goal, through the application of ITS and information technologies, of permitting the seamless movement of goods by truck within the United States. The vision to achieve this goal includes motor carriers receiving one electronic submission with credentials from every required agency in every required state, combined with electronic clearance technologies which would allow trucks to drive from coast to coast without stopping at weigh stations or state entry points. The primary benefit
of this vision would be in reducing the cost and increasing the effectiveness of truck-based trade across the U.S. Secondary benefits would include reduction in State agency administrative/enforcement costs, improved national safety monitoring of motor carriers, and improved safety on the roadways due to fewer trucks merging in and out of traffic at weigh station/state borders.

For the past several years, this project has been centered on the two initial prototype states of Maryland and Virginia. However, an effort is now underway which will culminate by 2001 to expand CVISN to the additional eight pilot states of California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, Oregon, and Washington. A significant number of additional states, including Missouri\(^4\), are participating in a “CVO Mainstreaming” program. It is anticipated that, with potential support from Federal ITS funds, that most of these states will deploy CVISN within the 2001 to 2003 timeframe. The program has a goal of being deployed in the majority of states by 2003, and approaching complete deployment throughout the U.S. by 2005.

The CVISN system design, outlined in Figure 2-11, provides for the integration of existing state credentialing and safety information systems with motor carrier-based communications and information systems. Enabling this integration will be a series of core infrastructure system elements which will support the interface of state legacy credentialing systems, electronic payment systems, tax assessment systems, and safety information systems. CVISN thus encompasses a “systems of systems” approach, in that it seeks to integrate existing state and industry systems and databases rather than trying to force a common systems approach from above.

\(^4\) Missouri’s required ITS/CVO Business Plan has been approved by FHWA; however, ITS deployment funding for Missouri to begin deployment of CVISN is not currently programmed for FY 1999 or FY 2000 under TEA-21. It should also be noted here that Missouri is part of the Midwest Regional ITS/CVO Regional Mainstreaming Consortia, which also includes Kansas, Nebraska and South Dakota.
CVISN is composed of three major services: Credentials Administration, Roadside Screening, and Safety Information Exchange. Each of these services is outlined below.

**Credentials Administration** includes a combination of carrier and state government systems. These systems will automate the complete credential process. Electronic submittal of applications, automated processing and cross-checking of applications, automated fee calculation and invoice transmittal, electronic fee payment, and automated issuance and printing of credentials will be integrated into the CVISN system. Credentials Administration will also include and integrate with initiatives that share data among states (known as base-state agreements), including the International Registration Plan (IRP) and the International Fuel Tax Agreement (IFTA). In addition, Credentials Administration will encompass the electronic filing and paying of commercial vehicle fuel taxes.

The electronic credentialing vision under CVISN, which is anticipated to be achieved by 2005, comprises a comprehensive set of functions, specifically:

- Most carriers apply for and pay for credentials electronically, including operating authority, registration, and permits.
- Most carriers file and pay taxes electronically.
• Carriers deal with a “base state” for all business transactions, including registration, permits, taxes and clearance. The base state handles any allocation of fees or taxes to other states, simplifying carrier administration.

• No bingo cards, stamps, decals or paper permits are required for participating carriers.

• Information from one process (e.g., registrations) is available to other processes (e.g., fuel tax) in a timely manner. This reduces data entry and provides improved data for decision-making (i.e., it would permit cross-checks such as denying registration to a carrier with a poor safety history).

• Some aspects of State audits are conducted electronically with participating carriers.

• States routinely interchange electronic information about operating authority, registration, tax, clearance, and safety transactions.

• Shipping transactions are primarily electronic. Shippers place orders, track freight movement, receive invoices, and make payments electronically.

• Figure 2-12: CVISN Electronic Credentialing Operational Concept

The IRP Clearinghouse supports the International Registration Plan base state agreement an acts as a repository to store data related to fees for the states participating in IRP. States send the IRP Clearinghouse a recap (data from approved applications), the Clearinghouse provides the states with transmittals (reports on data processed), then generates a netting report that summarizes the fees due from or owed to states.
The IFTA Clearinghouse supports the International Fuel Tax Agreement and acts as a repository to store data related to fees for the states participating in the IFTA. This component performs the same functions as the IRP Clearinghouse, except does not generate the netting report.

The CVISN program is generating the systems and software necessary to integrate existing state credentialing databases into an overall “system of systems.” The CVISN Carrier Automated Transaction (CAT) system is a personal computer or Web-based software application (Web CAT) specifically developed for Credentials Administration. CAT and Web CAT provides electronic data interchange to legacy state credentialing systems through the credentialing interface (CI). The CI will also provide an interface to the state’s Commercial Vehicle Information Exchange Window (CVIEW) to enable the transfer of credential and tax status flags to the roadside. Additionally, under CVISN’s umbrella are the communication standards that will be used for interfaces to other states, carriers and the federal government in order to insure compatibility.

**Roadside Screening** includes the electronic screening of vehicle at fixed (e.g., weigh stations) and mobile sites to confirm vehicles are safe, at proper weight, have appropriate credentials, or have been placed out of service. The Roadside Screening services are intended to perform these “checks” such that compliant vehicles can proceed on the highway without stopping, while potentially unsafe or non-compliant vehicles are pulled in for closer inspection and confirmation of proper operating credentials. Roadside electronic screening typically consists of the following:

1) Identify carrier, vehicle, and driver via DSRC transponder and standard messages.

2) Check snapshot information when making screening decisions.

3) Automatic pass-through for compliant vehicles/drivers via transponder notification (green light).

4) Pull in untagged vehicle to identify carrier, vehicle, and driver.

5) For non-compliant drivers, check with authoritative source for latest status before issuing citation.
The technologies involved in support of roadside screening, particularly on-vehicle DSRC transponders, AVI roadside transponder readers, and weigh-in-motion (WIM) systems, are addressed in detail in this section.

**Safety Information Exchange** includes the automated recording of vehicle inspection data, the automatic issuance of citations, and the exchange of safety data among agencies. CVISN states plan to use hardware and software tools to automate the safety inspection process. Most states plan to use laptop or pen-based computers equipped with software to allow inspectors to electronically collect and disseminate inspection data at the roadside. ASPEN, the software selected by most states, was developed by the FHWA’s Office of Motor Carriers.

Safety Information Exchange typically consists of the following:

1) Monitor safety performance in safety assurance programs.

2) Collect driver/vehicle inspection data, carrier compliance information, citation, and accident data.

3) Provide safety and credentials snapshots to the roadside for screening and inspections.

4) Check safety history before granting credentials.

5) Share information with other states.
When a truck drives through a CVISN electronic screening station, the CVISN system will check for non-compliance — violations, excessive weight, expired safety checks, or outstanding out-of-service orders. The clearance system will evaluate a carrier in seconds, allowing enforcement personnel to quickly spot trucks with safety or non-compliance violations. Correspondingly, the truck’s transponder will signal the driver (via a red light output) that he/she must pull in and stop at the weigh/enforcement station for further “manual” evaluation by state enforcement personnel.

Advantage CVO and related Automatic Vehicle Identification (AVI) Systems Currently Being Deployed

Supported by the FHWA’s Office of Motor Carriers ITS/CVO Program, and public-private partnerships made up of consortiums of U.S. states, Canadian provinces and elements of the commercial trucking industry, several major AVI-based electronic screening projects are currently either being tested or deployed in various regions of the United States and Canada. Figure 2-14 presents a geographical overview of these projects, all of which are being conducted in a manner consistent with interoperability with the CVISN program described in Section 2.4.1.

Figure 2-14: Overview of AVI-based Electronic Screening Projects in the United States
Of the above programs, Advantage CVO, MAPS and HELP are all operational prototype systems which are currently being deployed, while the I-95 Corridor Coalition program currently consists of three Field Operational Tests (FOTs) in the areas of Electronic Credentialing, Roadside Safety, and Screening.

The types of technologies being deployed in the three operational prototype systems are very similar. In fact all three use the same basic set of transponder, reader and weigh-in-motion technologies. Minor differences exist in relation to software and user interfaces. Of particular note, the Advantage CVO program and the MAPS program, recently entered into an interoperability agreement which from the user perspective essentially merges the two programs by allowing truckers to use the same transponder, motor carriers to use the same internet-based enrollment forms, and provides common security measures to protect motor carrier transaction data.

It seems likely that the Advantage CVO and MAPS partnership will become the standard by which most states will follow in implementing electronic screening programs consistent with CVISN. Supporting this, it should also be noted that the HELP Inc. system being deployed in the Southwest, is technically compatible with the Advantage CVO/MAPS technologies (e.g., they use the same transponder). The only barrier is operational – Help Inc. does not currently allow its transponder ID to be released to other systems for use.

In providing a technological overview, the remainder of this discussion will focus on the Advantage CVO program as the primary example and potential standard for AVI-based electronic screening. The Advantage CVO program is the most mature of the these prototype systems, having been operational for almost four years, and having been deployed at 29 operating sites across the I-75 corridor and into Canada.

Advantage CVO is a partnership of public and private interests along the I-75 corridor. Project partners include the Federal Highway Administration, the six I-75 states (Florida, Georgia, Tennessee, Kentucky, Ohio, and Michigan), the province of Ontario, the Canadian Ministry of Transport, U.S. and Canadian trucking associations, and various trucking companies. The project currently being conducted by the Advantage CVO partnership is an operational test of the Mainline Automated Clearance System (MACS). The objective of MACS is to allow transponder-equipped and properly documented trucks to travel any segment along the entire length of I-75 (and Highway 401 in Canada) with no more than a single stop at an inspection station.

The system today is using AVI equipment to perform vehicle monitoring, electronic ticketing, and credentials checking. When a properly equipped truck enters the system, an "information packet" is generated at the first station and updated at each subsequent station until the truck exits the system. Currently, the system utilizes Type II transponders. System operators will soon have the option to switch to Type III transponders when they become available.
Each of the twenty-nine truck weigh stations has been equipped with a weigh station computer which interfaces with various subsystems to detect the equipped trucks in advance, verify weight and credentials for automated mainline clearance, communicate with the driver, and transmit the truck-specific data (trip data packet) to the next downstream station. A gateway computer, remotely located from the weigh stations, is utilized for secondary tasks such as report generation, database query, and data entry and updates. Participating truck companies tag each vehicle with an AVI transponder, which identifies the vehicle electronically. With each trip on the Interstate, a tagged vehicle will trigger the creation of a trip data packet by the first weigh station computer. Information for the packet (linked to a specific tagged vehicle) is gained from various subsystems that serve the weigh station computer.

The trip packet is automatically updated and forwarded as the vehicle proceeds through the corridor. The trip packet is the crucial link that becomes the basis for clearance at the next weigh station encountered.

There are also many potential system enhancements that have been recognized utilizing the AVI transponder technology, including:

- Providing traveler information and safety advisories to transponder-equipped vehicles. The Advantage CVO transponder has an interface that can be connected to other onboard devices, such as an onboard computer or display device. When
connected, the transponder can receive messages from the roadside and display them for the driver.

- Providing an automated, multistate permit-issuing capability. The partnerships, databases, and communications infrastructure established for Advantage CVO can be used to support automated issuing and monitoring of permits for travel anywhere on the Advantage CVO corridor. This capability could include oversize/overweight permits or any other type of temporary operating permit.

- Improving incident detection using Advantage CVO vehicles as probes. The ability to detect transponder-equipped vehicles as they pass selected points makes them ideal to serve as probes to determine travel times and detect incidents or congestion.

- Monitoring safety. As devices are developed that can continuously monitor various safety parameters of the vehicle and the driver, the Advantage CVO transponder can be used to communicate this information to the roadside for use by enforcement agencies.

- Collecting tax data. Collection of data on kilometers traveled for use in allocating fuel tax could be greatly improved and automated, thus improving data accuracy. This could reduce the administrative burden on trucking companies and state agencies and could result in a more equitable assessment of taxes.

- Tracking the movement of hazardous materials (HAZMAT) and responding to incidents. The movement of HAZMAT could be tracked by equipping trucks with Advantage CVO transponders. Response to HAZMAT incidents could be enhanced by providing truck-specific cargo information and response guidelines in the MACS database.

### 2.4.2 Shipment and Vehicle Tracking

**HighwayMaster CVO Communications/Tracking System**

**Current HighwayMaster System**

HighwayMaster is currently the only mobile communications system that offers the trucking industry both real-time voice and data communications, combined with GPS location information. Recent product enhancements include in-route estimated time-of-arrival (ETA), in-cab fax capabilities, and an automated state fuel tax reporting system. Several major trucking fleets have selected HighwayMaster as their wireless data/voice communications system, including Wal-Mart, American Freightways, AmeriTruck, Burlington Motor Carriers and CFI.
The HighwayMaster communications component is based on utilizing existing cellular phone networks for communications. Through strategic alliances with wireless industry companies such as GTE, Southwestern Bell Mobile Systems and more than 70 cellular providers, HighwayMaster can provide wireless communications services in more than 99 percent of the available cellular coverage areas in the United States and 100 percent of the A-side cellular coverage areas in Canada.

**Figure 2-16: HighwayMaster Truck Components (HighwayMaster 5000 Series)**

Tracking functions are provided by the addition of a GPS receiver. The receiver is integrated into the HighwayMaster communications device so as to allow real-time latitude and longitude data to be provided to the end-user over the HighwayMaster cellular network. In addition, the system includes patented dispatch software and turnkey operating systems management, and is available permanently installed or as a portable unit.

All communications across the cellular network are transmitted to the HighwayMaster operations network facility in Dallas, Texas. From there, the data is processed as required, and transmitted to the end-users.

**Future Upgraded HighwayMaster System with Trailer Tracking**

HighwayMaster is developing a tracking solution for detachable trailers utilizing Cellemetry® Data Service technology. Cellemetry Data Service enables a variety of
equipment to be remotely monitored by using the existing cellular network's non-voice data and control channels. Cellemetry Data Service is a patented technology developed by BellSouth.

**Figure 2-17: HighwayMaster Cellemetry-Based Trailer Tracking System Overview**

This upgraded HighwayMaster system will transmit the following information from a device attached to the back of a trailer to the end user’s operations center:

- GPS location of the trailer (from a tracker device attached to the back of the trailer).
- Business event (tether/untether, low battery) and/or trailer "state" (loaded/unloaded, rear door open/closed, etc.) information.
- Polling from the end-users operations center to a specific trailer or trailers in a geographic (tied to cellular identification) region.
- Note that a choice will be provided between providing the end-user predefined location reporting schedules for the trailer (as frequently as twice per day and as infrequently as once per month) or event-driven location reporting (e.g., when a state border is crossed).

This system will contain the following elements/attributes:

- All data transmission/exchange will be processed through the Cellemetry Data Service (a non-voice method for transmitting short data messages across the cellular overhead signaling channel) and HighwayMaster's Network Services Center.
- The end-user provided software will include integration to a "mass market" available street level mapping application.
• The trailer unit will be comprised of a Cellemetry transceiver, GPS receiver, microprocessor, antenna, battery and cables.

• The unit will operate for a minimum of 30 days and up to 60 days in an untethered state and will recharge when the trailer is connected to a tractor.

• Cost will be approximately $500 for the hardware and approximately $10-15 per month for service costs.

Qualcomm’s CVO Communications and Tracking Systems

Qualcomm’s OmniTRACS Satellite-Based COV Data Communications & Monitoring System

The OmniTRACS system is a satellite-based CVO data communications and truck monitoring system, which can be configured to provide a variety of information management solutions to CVO end-users, such as payroll, trip reports, vehicle maintenance or virtually any aspect of fleet management. As shown below in Figure 2-18, a keyboard interface within the truck provides for two-way wireless messaging via a special satellite communications antenna which is attached atop the cab. Optional connections with the vehicle and trailer provide remote maintenance and trailer status monitoring capabilities.

Figure 2-18: OmniTRACS Cab Communications Keyboard and Antenna
OmniTRACS system features support direct integration of systems applications through Qualcomm's External Applications Links (EALs). These EALs interface with application or operation software already in use, such as the following:

- Load assignment from dispatch
- Request directions/send
- Arrived at stop
- Update hours of service
- Terminate segment/trailer drop
- Pallet count
- Cash advance request/send
- Request fuel stop directory/send
- Driver Load acknowledgement
- Arrived at shipper
- Leaving stop
- Arrived at consignee
- Trailer drop/hook
- Pallet purchase request
- Telephone credit card request
- On-road breakdown
- Request route/send
- Loaded and leaving
- Update ETA, PTA
- Empty and available
- Trailer yard check
- Payroll inquiry/send
- Fuel authorization request/send
- Request for road service

Taking advantage of Qualcomm's extensive library of EALs allows many users within the same company to automate a variety of functions that were previously handled manually.

Another key to OmniTRACS integration is the built-in "macro" messaging capability. Macros provide preformatted "fill-in-the-blank" messaging. Macros can be updated over the air, easily defined by dispatch and offer extensive data entry validation. All messages are acknowledged and have a return receipt option. Message priority options, password protection and "sleepy" messaging when the ignition is off are other critical built-in features.
OnTRACS CVO Tractor Tracking and Monitoring Application

OnTRACS, a component of the Qualcomm OmniTRACS CVO satellite data communications system, provides the capability to estimate time of arrival (ETA) and to determine whether vehicles are following the expected routes. Specifically, the following information is provided:

- Planned/Projected ETA.
- Displays late/early ETA.
- Distance to next planned stop.
- Out-of-Route miles.
- Easily matches load to vehicle ID.
- Sort information by severity, shipper, consignee.

Figure 2-20: OnTracs Out–of–Route and Planned/Projected ETA Display
TrailerTRACS CVO Trailer Tracking and Monitoring Application

TrailerTRACS, a component of the Qualcomm OmniTRACS CVO satellite data communications system, is a proactive monitoring system that provides vital information concerning trailer identification, location and load status. The system provides the following:

- Positive trailer ID and position with every connect and disconnect.
- Reports trailer inventory by custom landmarks.
- Records location, date and time.
- Reports inventory vs. demand based on historical data.
- Monitors load status.
- Verifies scheduled drops and hooks, reports inconsistencies.
- Monitors reefer operation.

Exception-based monitoring functions are also included, such as:

- Trailer lost.
- Too many or too few trailers at location.
- Unauthorized trailer drop.
- Wrong trailer connected to truck.
- Unscheduled movement.
- Late for intermodal origin.

OmniTRACS State Mileage

The Qualcomm OmniTRACS system allows for automated fuel tax reporting and provides accurate miles driven by state, by truck, by month. The OnTRACS State Mileage system combines the OmniTRACS' satellite positioning and the quality of ALK's PC*Miler®
routing database to determine accurate miles for fuel tax reporting. Vehicle odometer reading works in conjunction with the OmniTRACS position reports and routing system to allocate actual miles by state. The system provides the following functionality:

- Meets IFTA data requirements.
- Simple user interface.
- Automatically allocates miles by state, by truck and by fleet.
- Accurately assigns miles to each state and summarizes fleet mileage activity.
- Formatted for easy use with popular third-party fuel tax reporting software.
- Reduces IFTA audit exposure through data compliance and improved accuracy.

The OnTRACS State Mileage system verifies the data and allocates any unclear segment mileages to the proper jurisdiction. And because OnTRACS State Mileage is exception-based, it provides this accuracy with minimal user effort:

- Exception-based system flags unclear trip segments for user review.
- Convenient summary reports for easy mileage calculations.
- Integrates with ALK's routing system.
- Requires no additional vehicle hardware.

2.4.7 OrbComm/TorreyyComm Railroad Satellite Data Communications/Tracking System

OrbComm LEO Satellite Communications System Overview

The OrbComm system is a wireless, two-way global satellite communications network. It consists of 28 Low Earth Orbit (LEO) satellites, national or regional Gateway Earth Stations and Network Control Centers, and the global Network Operations Center in Dulles, Virginia. The system provides data communications between mobile subscriber equipment and the operator via the Internet or dedicated leased lines for high volume operators.

The OrbComm system uses LEO satellites to provide worldwide geographic coverage. The system is capable of sending and receiving two-way alphanumeric packets, similar to two-way paging or e-mail. The three main components of the OrbComm System are; the space segment - the constellation of satellites; the ground segment - gateways which include the Gateway Control Centers and Gateway Earth Stations, and the Network Control Center.
located in the United States; and Subscriber Communicators - hand-held devices for personal messaging, as well as fixed and mobile units for remote monitoring and tracking applications.

**Figure 2-21: OrbComm System Overview**

The OrbComm system uses 137-138 MHz and 400 MHz frequencies for transmissions down to mobile or fixed data communications devices; and 148-150 MHz frequencies for transmissions up to the satellites. These frequencies, approved for use by LEO satellite systems at the World Administrative Radio Conference in February 1992, were allocated by the FCC to Little LEO mobile satellite services in January 1993. The FCC granted OrbComm a U.S. commercial license in October 1994.

The space segment is a planned array of up to 36 small communication satellites. Twenty-eight of the satellites are planned to be put in service by Q’3 1998 with the remaining eight planned to be launched during 1999. The main function of OrbComm's satellites is to complete the link between the Subscriber Communications system and the switching capability at the OrbComm Network Control Center or a licensee’s Gateway Control Station. The satellites are "orbiting packet routers" ideally suited to "grab" small data packets from sensors in vehicles, containers, vessels or remote fixed sites and relay them through a tracking Earth station and then to a Gateway Control Center.

Communications are processed in four steps: (1) a message sent from an Subscriber Communicator unit in the US -- either stationary or mobile -- is received at the satellite and relayed down to one of four US Gateway Earth Stations that connects the OrbComm
ground system with the satellites; (2) the Gateway Earth Station then relays the message via satellite link or dedicated terrestrial line to the Network Control Center; (3) the Network Control Center routes the message to the final addressee via e-mail, dedicated telephone line or facsimile.

Messages and data sent to an Subscriber Communicator unit can be initiated from any computer using common e-mail systems including the Internet, cc:Mail, and Microsoft Mail. The Network Control Center then transmits the information using OrbComm’s global telecommunications network. There are two types of Subscriber Communicators units -- one enables fixed, remote data communications while the other enables mobile, two-way data and messaging communications.

**TorreyComm’s OrbComm-based Potential Railcar and CVO Tracking and Monitoring Application**

TorreyComm's LEOlink units provide two-way wireless communication between a customer's home office and equipment in the field using the OrbComm satellite system.

TorreyComm has been involved in major rail beta tests over the past year with Union Pacific (UP) and Burlington Northern Santa Fe (BNSF) Railways. In the UP test, LEOlink units were mounted on a refrigerated railcar to track position and temperature as well as report on alarms when problem conditions were detected. This railcar has been in the field for over 6 months and provides real-time operational and position information that was difficult, if not impossible, to collect through other means.

In the BNSF test, LEOlink units report the position on track monitoring and repair equipment. The LEOlink units provide information on availability and utilization of the equipment, thus saving time and resources for the equipment owners. Multiple cars contain the LEOlink units and are currently traveling across the United States.

The LEOlink units are designed for reliable and dependable operation in harsh environments. Each component of the system is designed to survive the extreme temperatures, shock, and vibration levels found in railcars. At the heart of the system is a microprocessor-based core which controls the collection, processing, transmission and reception of the data. With this microprocessor-based core, TorreyComm has been able to optimize applications to conserve external battery power, lower transmission costs, and customize alarms for specific problems.

The LEOlink on-board equipment (OBE) combines the OrbComm transceiver boardset, a GPS receiver, and customer specific interfaces in a rugged enclosure suitable for deployment in the transportation and heavy equipment industries. The transceiver design operates over an extended industrial temperature range, -40ºC to +85ºC, and is tested at the higher shock and vibration levels required for applications in the transportation industry.
Field tests verified user installation and setup procedures for the transceiver as well as the ability to monitor mobile asset location and operation via the OrbComm satellite network. An intensive 4-week controlled test was also completed in 1997 to verify transceiver and OrbComm network reliability to perform the designated functions and data communications.

The OBE is powered by the mobile asset's 12 or 24 volt power system and is active whenever the mobile asset is operating and during scheduled data collection or reporting intervals. The remainder of the time the OBE is in a low power "sleep" mode to minimize drain on the battery. The application reports location and required operating data on a scheduled interval or on request. The basic design incorporates spare analog inputs and digital I/O that may be used to monitor other on-board sensors allowing expanded functionality to meet future on-board requirements.

The information lets owners, lessees or lessors locate, track usage, monitor operation, and schedule maintenance on their mobile assets in the field without relying on manual recording and reporting from job sites.

The OBE design offers an integrated solution that includes the OrbComm communicator and antenna, an optional GPS receiver and antenna, and software to permit efficient installation and autonomous operation. Connection to the mobile asset, including power and connections to the analog inputs and digital I/O, is provided through a cable harness terminated in weatherproof connectors for ease of installation and integration. The connectors also provide a serial interface to support installation, setup, and diagnostics, as well as a debug or logger port to monitor and evaluate OBE operation. TorreyCom also provides a Windows 95 software interface which supports initial installation and setup or field diagnostics.

**Rail and Intermodal Container Automatic Equipment Identification (AEI) Systems**

Rail and intermodal container Automatic Equipment Identification (AEI) systems identify equipment by reading electronically coded radio frequency (RF) identification tags mounted on locomotives, railcars, trailers, end-of-train units and intermodal containers. With an AEI Reader system, shipments can be located at a glance and the most cost effective routes that maximize the use of valuable shipping assets can be planned.
Rail AEI systems typically consist of the following components:

- **AEI Tags.** By far the most common types of tags used in Rail AEI systems are the RF passive backscatter tags, such as the AMTECH ISO/ANSI Standard Tag. This tag can operate on two frequency bands (845-950 MHz and 2400-2500 MHz), can be read by fixed or portable reader systems at line of sight geometry of up to 235 feet, have a lifespan of about 7-10 years, and have a unit cost of about $30. These tags require a physical connection by a portable device for reprogramming.

- **AEI Readers.** Fixed AEI reader systems, such as is shown below in Figure 2-23, are strategically located at all entry and exit points of the yard. If required, these fixed systems can also be augmented by the use of handheld reader systems within the yard. Once a piece of equipment has been identified by the system based on an AEI tag or wheel pattern, the system tracks that piece of equipment through the facility based on the timing of each successive wheel detector input.
• Zero-Speed Wheel Detectors. Once a car has passed the initial AEI reader system and an AEI tag number has been associated with a specific group of wheels, the wheels are tracked through the yard using a network of wheel detectors.

• Wheel Detector Signal Amplifier. By using a signal amplifier as part of the system, wheel detectors can be located up to at least a mile away from the AEI Reader system.

• Central Workstation. The Central Workstation is used to identify and display, in real-time, the location of each piece of equipment in the yard. As successive wheel input information is provided by the network of wheel detectors, the AEI Reader system updates equipment locations stored in the central workstation.

• Remote Displays. Any standard PC can be used to dial into the central workstation to view the same equipment location information as seen on the central workstation. This is an ideal method for sharing information across a number of users, or to monitor the status of equipment at remote yards.
2.4.3 In-Bond Shipment Security

Signal Processing Systems (SPS) SmartSeal

SmartSeal electronic cargo seal, currently being tested as part of the IBEX Field Operational Test (FOT) at the Otay Mesa border crossing in San Diego, is a patented technology that can be used to validate closure status on a container or trailer. The SmartSeal can be configured either as a seal or a lock. A seal configuration provides accountability, while a lock configuration provides physical security.
The SmartSeal is comprised of two electronic functionalities. The first is electronic sensing of loop closure around the bars in the back of the trailer or container. Loop closure is sensed with a digital fiber optic code, and can be protected with encryption technology. The second functionality is wireless communications from the SmartSeal to the roadside. Such wireless communications can be accomplished by DSRC or other means.

It is important to note here that the capability would also exist to integrate the SmartSeal technology with CVO-based cellular or satellite communications and/or tracking systems. Such an integrated system would have the potential to provide adequate security for In-bond shipments from Mexico to Kansas City.

An on-board electronic cargo seal is cost effective when used with a network of roadside readers or other system of communications. ITS deployments of electronic screening, electronic toll collection, vehicle tracking and other types of "electronic infrastructure" now enable electronic monitoring of cargo status, which can be fed directly into existing fleet management systems. The electronic seal technologies could be configured in a variety of modes to support a variety of operations, including:

- Re-closable electronic seals
- Seals integrated into locking mechanisms
- Seals and locks integrated into on-vehicle electronic data acquisition and storage systems
- Integrated with GPS to provide history of movement
- Integrated with cell phone or satellite communications systems for real-time monitoring
- Seals checked remotely at any time (e.g., while the cargo is in the drayage yard or as the trailer is moving at 80 mph on the interstate)
- Protection against tampering utilizing hi-tech software

### 2.4.4 Intermodal Facility Management

#### 2.4.4.1 Automated Gate Systems

Since intermodal freight terminals are such a critical transfer point for moving containers and trailers through the transportation distribution process, the need for automated processing is overwhelming. Automated Gate Systems (AGS) are the ITS response to busy intermodal facilities bogged down with outdated processing systems. AGS results in a system that allows trucks to enter and exit a yard and be accurately processed at the gate in a matter of seconds, versus the many minutes or hours associated with most existing facilities. Through their secure methods of validating container entry and exit from an intermodal facility, they can also support the storage and transfer of in-bond freight containers. Additionally, AGS provide a total gate processing system that improves data accuracy, decreases operating expenses, and increases customer satisfaction.

![Figure 2-26: AGS System In Operation In N. Kansas City U.P. Intermodal Facility](image-url)
Through high resolution linescan video technology, radio frequency identification (Automatic Equipment Identification/Automatic Vehicle Identification) and optical character recognition (OCR), an AGS processes drivers, vehicles and cargo in a fast and accurate manner. Over the past several years, AGS has become the standard for intermodal facility management technology.

AGS typically include a camera portal, high resolution digital cameras, high intensity lighting, a video inspection system, system software, OCR software, vehicle classification software, mainframe connectivity, and traffic control functionality. In addition, electronic driver identification, automated visual trailer/container inspection, and automatic weighing are typically included and integrated into the facility management system. Moreover, based on the needs of the facility, there are a number of enhancement features that can be incorporated within an AGS, including AEI reader components and CVO AVI reader components to create a comprehensive freight management system that can be made interoperable with other regional systems.

Figure 2-27: AGS Typical Gate Layout

A very important facet of AGS is the OCR of the scanned video image. As shown below in Figure 2-28, the scanned image of the identification numbers on the container are read by the OCR and entered into the system automatically. The accuracy of the OCR system is around 90%, and in cases where the identification fails, the system operator in the gatehouse can usually identify the system remotely based on the scanned video feed and with real-time video communication with the driver.
It should also be noted here that the AGS video system provides a complete three-dimensional scan of the entire tractor, trailer and container (excluding the underside), and top, side, and rear views of the complete vehicle are entered into the archived record of the gate entry/exit. Additionally, real-time video of the driver is recorded, and video inspections of the contents of the container/trailer can also be recorded, if necessary. These features can help facilities fight damage claims using high-resolution digital photos depicting the actual condition of equipment as it enters or exits a yard.
Benefits of AGS include the following:

- Rapid gate processing of all units reduces time for vehicle operators.
- Improved data accuracy.
- Validation of driver through Driver Identification Card; archived record of driver image.
- Reduced labor requirements due to the reduction/elimination of verbal communication and manual paper hand-offs.
- Archived record of equipment images for damage claim resolution leads to reduced equipment damage expenditures.
- Significant improvement in facility security.
- Increased customer satisfaction.

Facility Security System Technologies

In addition to intermodal facility gate systems, a number of technologies also currently exist to support personnel security and monitoring for persons entering, moving within, or leaving a facility. These technologies, which are summarized below, have the potential for providing increased security for both intermodal facilities and bonded warehouses:

- Dig-2 Biometric Verifier. A three-dimensional finger geometry optical scanner for fast, accurate, low cost biometric verification of an authorized person's identity.
- Biometric Card Validator or PIN System. A device capable of validating a person's measured finger geometry with an authorized template stored on a smart card. An alternative validation approach uses a Personnel Identification Number (PIN) and a data base query for the template.
- Smart Registration Card. A registration card equipped with an RFID tag, memory, and a microprocessor. The card is a proximity read device, using backscatter (reflected energy) technology for communications.
- MicroCan Management System. A hand held computer collection device used to positively identify people and equipment. This flexible data acquisition system ensures absolute verification of tagged commercial vehicles, using Touch Memory technology. Touch Memory provides irrefutable evidence that a specific vehicle has arrived at a designated station.
Wireless Ethernet. A wireless LAN system capable of providing “cells” of coverage in a facility (e.g., 3Mbps data rates in a 3,000 ft free space). Fast and seamless roaming between adjacent cells extends the coverage area to the whole facility. Frequency Hopping Spread Spectrum provides robust and reliable wireless communications, with interference avoidance.

2.4.4.2 Electronic Payment

Electronic payment systems consist of a fully mature set of technologies which banks and their intermediaries routinely use to provide themselves and their customers methods by which electronic transactions can be made. In recent years, an increasing emphasis of banks and their intermediaries have been in the development of systems and software that allow their customers to have more control in processing their accounts and transactions automatically. Such systems can allow importers and exporters to conduct electronic payments and other transactions over secure network or internet connections.

As an example of electronic transaction systems that are available today to support international traders, the following systems are offered to its customers by Wells Fargo Bank of California:

- **ACH Express® for Windows.** Allows the organization to make electronic payments from a PC using the Automated Clearinghouse (ACH) standard. Combines the payment efficiency of the ACH with the convenience of a PC.

- **Collection Manager.** Allows organizations to receive ACH, EDI (electronic data interchange standard), paper-based or wire payment information electronically in a format compatible with their accounts receivables system.

- **Electronic Bank Statement Service.** Simplifies the processing and reconciling of an organization’s bank statement by providing the same data they currently receive on their paper statement in an electronic version delivered directly to their minicomputer or PC.

- **Electronic Consumer Collections (ECC).** For organizations whose customers use consumer bill payment services, such as Quicken or Microsoft Money, ECC can receive these payments on your behalf.

- **PC Manager/Information Express.** Allows a PC-based user to reconcile accounts, place stop payments, initiate funds transfers, access Positive Pay information, and pull up Information Express reports.
• **WellsEB™.** Allows the organization to manage transactions for all of its commercial bank accounts through a single, user-friendly program. The advanced, Windows based software eliminates paperwork and rekeying, provides state-of-the-art control and security, and makes merging account data with internal systems faster and easier.

• **WellsNet Information Express™.** Provides access to information about an organization’s commercial bank accounts over the Internet. The user can access a comprehensive suite of current and previous day reports all through any Web browser and Internet Service provider.

• **WellsTax™.** Provides the organization with a method of making tax deposits using a PC. The user can initiate federal and state tax payments directly from the office. The system consolidates tax payments, so with a single on-line session, the user can make payments to as many tax entities as required.

The benefits of electronic payments and transactions include the following:

• Reduction in costs associated with storing physical checks processing payments manually.

• Provides a more efficient way to create and edit your electronic payments.

• Supports Electronic Data Interchange (EDI) automated payment standard, which many international customers are demanding.

• Allows for electronic payment of taxes.

• Provides the ability to access transaction and account information remotely over a secure internet or network connection.

2.4.4.3 **Corridor-Wide Traveler Information**

The approach to providing CVO Traveler Information to KC-ITPC users will be to offer connectivity with existing traveler information systems throughout the corridor. With this in mind, several examples of such systems that are currently being deployed or are scheduled for future deployment are outlined below.
The San Antonio TransGuide System

The San Antonio TransGuide system, short for Transportation Guidance System, is an estimated $151 million Advanced Traffic Management System (ATMS) that is being developed by the San Antonio District of the Texas Department of Transportation (TXDOT). The system utilizes high speed computer technology to help drivers anticipate traffic conditions -- in an effort to increase safety, reduce congestion and carbon monoxide emissions from vehicles stuck in traffic. TransGuide monitors traffic conditions, control traffic signals and allow rapid response to accidents and emergencies. The entire project has been based on the approach that by treating a major city’s highway system not as a series of independent travel ways, but as an efficient network, it will be possible to greatly increase freeway capacity within the metropolitan area.

The intended benefits of TransGuide are to improve traffic flow, reduce delays, reduce accidents, and provide for immediate management and emergency response to any freeway incident. The specifically stated system goals are to:

- Detect incidents within two minutes.
- Change all affected traffic control devices within 15 seconds from alarm verification.
- Allow San Antonio police to dispatch appropriate response from the TOC.
- Assure system reliability and expandability.
- Support future ATMS and ITS activities.

To support these goals the TransGuide system is implementing a variety of ITS technologies, including state-of-the-art inductive loop detectors, variable message signs (VMS), high-resolution video cameras, lane signal controls, and a fiber-based communications line system embedded in all required freeways. All of the data is transferred via a high-speed network to a mainframe computer based at the Traffic Operations Center.
All traffic signals within the project limits are also connected to the TransGuide computer, which takes control when traffic needs to be detoured onto access roads. Depending on the type of incident, signal timing can be modified to address the needs of diverted traffic.

In addition to these technologies, the system has been designed so that it can be flexible enough to support future ATMS and ITS activities. These include links to in-vehicle computers, traffic monitors, map display and other services expected to come online in the next decade.
Figure 2-30 presents an up-to-the-minute view of San Antonio traffic conditions which is an output from the TransGuide System that is provided to the public over the internet.\(^5\) Additionally, this information, along with more specific data, is broadcast to an unlimited number of sources (e.g., transit, emergency response agencies, television and radio stations) using a Low Power Television Station. The data to be transferred includes live video, graphical maps (both the high level views and the lane level views), scenario data (current state of the motorist warning signs), lane closure data (scheduled construction and associated closures) and other information.

**The Kansas City SCOUT Project**

The Kansas Department of Transportation together with the Missouri Department of Transportation are developing a freeway management system using intelligent transportation system technologies with the implementation of a Traffic Operations Center. The traffic operations center is currently under design on 48 miles of interstate. Using the Kansas City Early Deployment Plan as a base point the first phase of the freeway management center components include hardware and software, closed circuit television cameras, traffic detection devices and variable message signs. Expected completion date of the first phase of the freeway management center is in late 1999. Those components that can interface

\(^5\) This Web site can be accessed at the following URL: [http://www.transguide.dot.state.tx.us/map/inmap](http://www.transguide.dot.state.tx.us/map/inmap)
with the Trade Processing Center are limited in the initial phases of the freeway management system, but could include traveler information systems and incident management systems at some point in the future. The KC Scout project will be following the USDOT’s National Architecture of ITS.

**The TrafficNet Nationwide Highway Traveler Information Service**

TrafficNet®, A CUE Corporation service, delivers real-time traffic information in forty major markets over a nationwide network of over 600 FM radio stations. The system utilizes CUE’s vast North American FM subcarrier network that covers more than two million square miles and 95% of the interstate highway system.

![Figure 2-31: TrafficNet North America Coverage (covered areas shown in blue)](image)

TrafficNet allows drivers to receive real-time traffic information on car radios, navigation systems and hand held PC's. Data is first transmitted by satellite to individual FM stations or groups of stations for broadcast. The traffic data can then be received by any standard RDS\(^6\)-capable receiver (with a standard car antenna) with a simple software upgrade. Users can also employ CUE’s FM 50 receiver which offers low-cost FM sub carrier data connections through standard RS232, USB and I2C interfaces. The standard interfaces permit the data to be received in a wide variety of devices including AutoPC and handheld

\(^6\) A radio data transmission standard
computers operating on the Microsoft® Windows CE® 2.0 platform. Additionally, the display panels of all major in-dash navigation systems can also receive the data, and it can also be configured to accept data from commercial service providers such as ETAK and SmartRoute.

**Figure 2-32: TrafficNet FM Subcarrier Receiver**

CUE's Route Builder Software provides the additional capability of allowing user-defined routes to be programmed into the system such that the user will receive information for only the roadways defined. In other words, for each trip, you can program the system to provide only the travel information associated with your route.

In addition to receiving traffic information the receivers can also accept personal messaging including email and voice mail notification. Emergency alerts and activate mayday applications can also be transmitted. Additionally, CUE recently announced the introduction of its TrafficPage service, a local text paging service, that also delivers real time, route specific traffic information to a specially designed pager.

The traffic and messaging services are sold on an annual subscription basis and are available in all major markets in North America.
2.4.4.4 Trade Services

In terms of trade services, the technology aspect involves the “on-line” availability of a variety of trade services, which have increased significantly over the past several years. Access to a large percentage of trade services such as international freight brokerage and freight forwarding services are now available over the public Internet. Figure 2-33 provides an example of an on-line freight forwarding service directory that is currently available on the Internet.

**Figure 2-33: Internet-based Trade Service Example**
2.5 Concept of Operations

Based on the deployment schedule of the International Trade Data System (ITDS), the Commercial Vehicle Information Systems Network, and the forecasted availability/maturity of the various technologies that can support the KC-ITPC User Services, the Concept of Operations has been divided into the following two phases:

- Initial Concept of Operations; to be realized by the end of 2000.

- Final Concept of Operations; to be realized by the end of 2002.

An overview of these concepts or operation and their associated operational requirements are presented below, following a discussion of the core technological concepts. The Concepts of Operations presented here, along with further stakeholder input, can serve as the starting point for developments following the completion of this study, such as the creation of detailed system architecture and the selection and implementation of KC-ITPC-related demonstration projects.

2.5.1 Concept of Operations Core Technological Concepts

The following three elements serve as the core technological concepts by which the KC-ITPC operations will be based on:

1) ITDS Interoperability.

2) Electronically Expedited Clearance of In-bond shipments between the KC region and Mexico/Canada.

3) Virtual Functionality of User Services.

These concepts, addressed in the following discussion, serve as a basis for generating both the Initial Concept of Operations and the Final Concept of Operations, as addressed in Sections 2.5.

ITDS Interoperability

Interoperability with the future ITDS deployment lays the foundation for the entire concept of operations. In order for customs to be processed virtually at the Trade Processing Center in Kansas City, and in order for electronically expedited clearance of in-bond shipments to occur, the KC-ITPC system must have the ability to interface with this system. The ITDS-related functions of the KC-ITPC must be networked and integrated in such a fashion that the operational aspects are transparent to the users. Additionally, in the early phases of the
ITDS deployment before existing U.S. Customs systems (e.g., Automated Broker Interface) are integrated into ITDS, the KC-ITPC must be interoperable or at least have connectivity with these U.S. Customs systems.

**Electronically Expedited Clearance of In-bond shipments between the KC region and Mexico/Canada**

The viability of the entire KC-ITPC *Virtual Inland Port Concept* rests upon the assumption that ITS technologies will allow for in-bond shipments to be adequately assessed by U.S Customs and other Government Agencies during transport from the Mexican or Canadian border to Kansas City. This concept will rely upon ITDS transponder/reader electronically expedited clearance technologies (i.e, a NATAP-like implementation) to allow assessment operations by these agencies to be conducted automatically, an in accordance with proper trade procedures and laws.

Initially, transponder reader stations, consistent with those which will be deployed under ITDS at the Laredo Border Crossing in 2000, will be deployed on all major interstates entering the Kansas City Region. This will allow U.S. Customs and other agencies the option of electronically alerting the in-bond shipment vehicle operator that an inspection is required at the Kansas City Intermodal Inspection Facility. Here, information will be shared electronically across ITDS and the KC-ITPC as the in-bond shipment first passes through the ITDS NATAP-like reader at Laredo, and then again as the in-bond shipment passes through the KC-ITPC NATAP-like reader as it enters the Kansas City Region.

Additionally, rail-based in-bond shipment operations, based on methods that will be examined in the upcoming U.S. Treasury Department/KC Southern Railroad test, will be applied in a similar fashion so as to allow increases in in-bond shipments for rail freight as well.

**Virtual Functionality of User Services**

The system is being based as a *virtual* concept; i.e., to many users the KC-ITPC would not be a physical site; rather it would consist of a menu-driven information system which would be accessed via the Internet. A fully integrated Web page with access to all required systems, information and links is required so that KC-ITPC customers can realize the specific user services as described in Section 2. The Web site must also have the capability of providing secure password-protected access for certain functions of a sensitive nature.

The system architecture, would thus be based on a system of servers and network communications hardware and software, with control functions provided in the form of workstations to required agencies and interests remotely including U.S. Customs, other
federal and state agencies, and other required staff necessary to operate and control the numerous Trade Processing Center functions.

2.5.2 Initial Concept of Operations

Overview

The Initial Concept of Operations, which is overviewed in Figure 2-34, is summarized in the elements presented below. Based upon the deployment schedule of the ITDS, and based upon the availability and forecasted maturity level of the technologies in question, it is assessed that this concept of operations could be realized by the end of the year 2000.

Integrated Web Page

A fully integrated Web page with access to all required systems, information and links so that customers can realize the specific user services offered by the KC-ITPC. The Web site will also provide secure password-protected access for certain functions of a sensitive nature (e.g., manifest of goods on a container, electronic payment via credit card, etc.).

Phase 1 International Electronically Expedited Clearance

Phase 1, as defined here, includes the following:

- Interoperability with the Phase 1 ITDS deployment. Physically, the ITDS Phase 1 deployment includes ITDS implementation at the following sites by April of 2000: Laredo (truck), Buffalo (truck), Otay Mesa (truck), Detroit (truck) and Los Angeles (sea and air). In terms of systems, the Phase 1 ITDS deployment will require that trade users have parallel interfaces with ITDS and existing U.S. Customs automated systems such as the Automated Commercial System and the Automated Broker Interface. As such, the KC-ITPC will need to have interoperability or connectivity with these U.S. Customs systems, in addition to ITDS -- in order for customs to be processed virtually using the KC-ITPC, the system must have the ability to interface with all of these systems. To the user of the KC-ITPC Web Page, the interoperability/connectivity to these systems should be transparent. The system will be designed and integrated such that the user will be able to access all of these systems with the click of a mouse.
• Integrated Network of Transponder Reader systems, consistent with those being deployed by ITDS at the Laredo Border Crossing, on all major interstates entering the Kansas City Region. Here, information will be shared electronically across ITDS and the KC-ITPC as the in-bond shipment first passes through the ITDS NATAP-like reader at Laredo, and then again as the in-bond shipment passes through the KC-ITPC NATAP-like reader as it enters the Kansas City Region. Where U.S. Customs or other Government agencies determine that an inspection is required, the transponder notification signal (i.e., red light) will be sent to the truck driver to alert him/her that a prompt stop at the Kansas City International Trade Processing Center is required.

• Interoperability with the rail in-bond shipments electronically expedited clearance technologies based on methods to be defined in the upcoming U.S. Treasury Department ITDS/ KC Southern Railroad in-bond shipment test program.
Phase 1 In-Bond Shipment Security

This will include an assessment of trip time calculations (i.e., a calculation of expected time of arrival in KC will be made) from when the truck first enters the U.S. at ITDS transponder reader station-equipped border crossings such as Laredo, to the Kansas City Region. As an in-bond shipment truck enters the Kansas City Region, it will pass through the corresponding KC-ITPC transponder reader system, and the system will know if the truck exceeded the expected time of arrival. If the truck has exceeded the expected time of arrival, a “red” transponder signal will be automatically sent, and the truck will be required to proceed for a possible U.S. Customs Inspection at the Kansas International Trade Processing Center. Additionally, it is important to note here that U.S. Customs will have the capability of requiring any in-bond shipment truck to proceed to the Inspection Station using the KC-IPTC transponder reader system – a percentage of random inspections of all in-bond shipments would be expected.

Electronic Payment

In partnership with one or more Kansas City Region banks, a secure electronic payment system will be set up on the KC-ITPC Web Site such that trade customers can make or receive payments or engage in other transactions. Both business-to-business and business-to-government transactions will be possible. For example, brokerage fees, shipping charges, state tax payments, federal import tariffs to U.S. Customs, etc, will be automated by this system.

Corridor-Wide CVO Traveler Information

CVO-tailored information will be developed at the KC-ITPC and provided to drivers and other users on the KC-ITPC Web page, and on a dial-in menu system. Most importantly, information will be made immediately available when a significant event disrupts normal corridor operations. Connectivity with existing and planned highway traveler and weather information services, as well as traffic management centers (TMCs) located in cities across the corridor will be utilized as the primary data source. Connectivity with the KC Scout ITS project may also be utilized to provide traveler information for drivers entering the Kansas City Region.

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1 Note that Phase 1 ITDS may not support electronic payments. This capability should exist under Phase 2/3 ITDS.
Trade Services

KC-ITPC Web Site links, or even systems integrated into the KC-ITPC, are provided as necessary to any Kansas City Region trade services company which can provide a value-added service to freight customers. As an example, Kansas City Region brokers could have specific links set up on the page such that users of the system could contract for their services over the internet.

Operational Requirements

Corresponding to the above discussion, the operational requirements supporting the Initial Concept of Operations are presented as follows:

Integrated KC-IPTC Web Page Requirements

- All KC-ITPC User Services accessed through WWW (World-Wide-Web) page on the public Internet.
- Secure WWW connectivity required for electronic payment and other sensitive functions and transactions.

International Border Electronically Expedited Clearance Operational Requirements

- Interoperability with the Phase 1 ITDS system to include KC-ITPC user access to trade services offered by ITDS to shippers, brokers and other customers.
- In parallel with ITDS interoperability, interoperability with relevant U.S. Customs Services automated services: Automated Customs System (AMS), Automated Manifest System (AMS), Automated Broker Interface (ABI), Line Release System, and the Automated Export System (AES).
- Interoperability with the Phase 1 ITDS deployment of a “NATAP-like” transponder reader-based electronically expedited clearance system at Laredo, Detroit, Buffalo and Otay Mesa – permit positive identification record of in-bond trucking shipment crossing into the United States at Laredo, Detroit, Buffalo and Otay Mesa.
- Interoperability with the rail in-bond shipments electronically expedited clearance technologies based on methods to be defined in the upcoming U.S. Treasury Department ITDS/ KC Southern Railroad in-bond shipment test program.
- Provide positive identification record, consistent with ITDS, of in-bond trucking shipments entering the Kansas City Region; provide for electronic information sharing with ITDS and the Kansas City U.S. Customs Office.
• Record of time and location of each import, export, or in-bond transaction for US, Mexico and Canada.

• Record of border/shipper facility departure time and location for international trade transactions.

In-bond Shipment Security Requirements

• Provide for U.S. Customs and other Government agencies electronic assessment and inspection requirement notification of in-bond trucking shipments entering the Kansas City Region. Provide for U.S. Customs and other Government agencies electronic assessment and inspection requirement notification of in-bond trucking shipments entering the Kansas City Region.

• To support U.S. Customs and other Government agencies security concerns, provide for estimation and assessment of expected time of arrival for in-bond shipments; integrate with ITDS and KC-ITPC transponder reader system.

Electronic Payment Requirements

• Credit line/Credit Card/Wiring payment processing and related services over a secure internet connection

• Payment interfaces as required to ITDS,\(^1\) US. Customs and other systems to facilitate user payments for tariffs, tolls, state taxes, freight handling, broker payment, and bank transactions

Corridor-Wide CVO Traveler Information Requirements

• CVO-tailored travel information: roadway incidents, congestion, construction sites, special events

• Highway and Safety Alerts based on vehicle location

• Queuing for alternative routes and their CVO restrictions (HAZMAT, OS/OW)

• Real time weather information and forecasts for locations across the trade corridor

• Support services (e.g., gas, hotels, etc.) and location information (Yellow Pages)

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\(^1\) Note: ITDS may not support electronic payment until Phase 2 or 3.
Trade Services Requirements

- Interface for Kansas City Region international freight brokerage services.
- Interface for “Just-in-Time” Pickup and Delivery planning services to provide value-added support to KC-ITPC customers.
- Interfaces for other trade services provided by companies within the Kansas City Region.

2.5.3 Final Concept of Operations

Overview

The Final Concept of Operations, which is overviewed in Figure 2-35, is summarized in the elements presented below. Based upon the deployment schedule of the ITDS, and based upon the availability and forecasted maturity level of the technologies in question, it is assessed that this concept of operations could be realized by the end of the year 2002. It is also important to note that an assumption has been made here that at least the State of Missouri, but potentially many other states along the corridor, will have deployed the Commercial Vehicle Information Systems and Networks (CVISN), and the corresponding CVO electronic screening systems (e.g, Advantage CVO), by late in 2002.

All elements included in the Initial Concept of Operations:

- Integrated Web Page.
- Phase 1 Internationally Expedited Electronic Clearance.
- Phase 1 In-Bond Shipment Security.
- Electronic Payment.
- Corridor-Wide CVO Traveler Information.
- Trade Services.
Phase 2 International Electronically Expedited Clearance

Phase 2, as defined here, includes interoperability with Phases 2 and 3 of the ITDS deployment. In these phases, the ITDS system deployment will be finalized such that all trade related automated systems within the U.S. Government will be integrated into the ITDS. It is assumed here that this will include all U.S. Customs automated systems: Automated Customs System (AMS), Automated Manifest System (AMS), Automated Broker Interface (ABI), Line Release System, the Automated Export System (AES), and the future Automated Commercial Environment Systems. Where the systems are not included as part of ITDS, the KC-ITPC will still maintain the interoperability or connectivity with these systems that was developed as part of the KC-ITPC Phase 1 International Electronically Expedited Clearance deployment.

Electronic Credentialing

This will be accomplished through KC-ITPC interoperability with the Commercial Vehicle Information Systems and Network (CVISN) and a deployment of an Advantage CVO/MAPS-type state electronic screening system, as these are deployed in Missouri and other states along the corridor. The carrier/driver/trader will be able to electronically file, obtain, and pay for all required licenses, registrations, and permits, required for CVO by states and their respective agencies along the corridor. An electronic record of the credential will be sent (using Electronic Data Interchange standards) to the motor carrier’s headquarters or specified location and the regulatory agencies associated with the document consistent with CVISN. The responsible state agencies will initiate and maintain the document clearinghouse necessary to accommodate the specific CVO oversight, including carrier safety information, state tax compliance and other required data. Correspondingly, automated clearance across state borders and automated bypass of state weigh stations will be conducted using a transponder/reader/weigh-in-motion-based system consistent with the Advantage CVO/MAPS standard. Safe vehicles are cleared electronically while in motion on approach to facility entrances and other inspection sites and are not required to stop for inspection if their records are clear.
Phase 2 In-Bond Shipment Security

Phase 2 leverages new security and monitoring technologies to support further increasing the “comfort level” of U.S. Customs and other agencies so as to allow even greater numbers of in-bond shipments to the Kansas City Region to occur. Electronic seal technologies will be employed so as to provide a method to remotely validate closure status on a container or trailer. Combined with CVO-based cellular or satellite communications and tracking systems, the secure status of a bonded container or trailer shipment could be validated 24 hours per day as the shipment made its way to the Kansas City Region from the international border with Mexico or Canada.

Shipment and Vehicle Tracking

Here, technologies such as GPS satellite communications are leveraged so that Carriers/traders/customers and U.S. Customs Inspectors (for in-bond shipments) are able to track all properly equipped containers/trailers/rail cars in real time and at any location on the NAFTA Trade Corridor.
Intermodal Facility Management

An integrated information system, maintained by the KC-ITPC, will allow non-proprietary data such as vehicle, container, and driver information and status (e.g., arrival and departure time of vehicles and containers) to be exchanged electronically between intermodal facilities, bonded warehouses, and other freight-related facilities throughout the Kansas City Region. Shippers, brokers customers (with approved access by the shipper) and U.S. Customs Inspectors (for in-bond shipments), will be able to check on shipment status in real time using the KCITPC Web Page.

Operational Requirements

Corresponding to the above discussion, and incorporating the relevant operational requirements contained in the Initial Concept of Operations, the complete set of operational requirements supporting the Final Concept of Operations are presented as follows:

Integrated KC-IPTC Web Page Requirements

- All KC-ITPC User Services accessed through WWW (World-Wide-Web) page on the public Internet.
- Secure WWW connectivity required for electronic payment and other sensitive functions and transactions.
- International Border Electronically Expedited Clearance Operational Requirements

- Interoperability with the Phase 1, 2 and 3 of the ITDS system to include KC-ITPC user access to trade services offered by ITDS to shippers, brokers and other customers.
- In cases where such systems are not included as part of ITDS, interoperability with relevant U.S. Customs Services automated services: Automated Customs System (AMS), Automated Manifest System (AMS), Automated Broker Interface (ABI), Line Release System, the Automated Export System (AES), and the future Automated Commercial Environment (ACE).
- Interoperability with ITDS deployment of a “NATAP-like” transponder reader-based electronically expedited clearance system at all international border crossings where the system has been installed by ITDS Phase 3.
- Provide positive identification record, consistent with ITDS, of in-bond trucking shipments entering the Kansas City Region; provide for electronic information sharing with ITDS and the Kansas City U.S. Customs Office.
• Interoperability with the rail in-bond shipments electronically expedited clearance technologies based on methods to be defined in the upcoming U.S. Treasury Department ITDS/ KC Southern Railroad in-bond shipment test program.

• Record of time and location of each import, export, or in-bond transaction for US, Mexico and Canada.

• Record of border/shipper facility departure time and location for international trade transactions.

Electronic Credentialing

• Interoperability with CVISN and applicable state DOT transponder registration databases to accommodate all state credentialing requirements across the trade corridor.

• Positive Identification, Electronic Clearance, and Electronic Data Interchange with all properly equipped vehicles using the Advantage CVO/MAPS (Multi-Jurisdictional Automated Pre-Clearance System) transponder/reader/weigh-in-motion-based standard.

• Interface with standard Electronic Payment systems for tariffs, tolls, state taxes, freight handling, broker payment, and bank transactions.

• Ready-access to CVO regulatory and enforcement information across the trade corridor.

Shipment and Vehicle Tracking

• Real time tracking capability for in-bond shipments, both container and vehicle.

• PTOA (Predicted Time of Arrival) for all in-bond shipments.

• Alert of excessive travel time of in-bond shipments to KC or to other planned destinations from the international border.

• Basic shipment and vehicle tracking functions for all shippers who deploy the applicable technologies on vehicles, containers and trailers.

In-bond Shipment Security Requirements

• Provide for U.S. Customs and other Government agencies electronic assessment and inspection requirement notification of in-bond trucking shipments entering the Kansas City Region. Provide for U.S. Customs and other Government agencies
electronic assessment and inspection requirement notification of in-bond trucking shipments entering the Kansas City Region.

- To support U.S. Customs and other Government agencies security concerns, provide for estimation and assessment of expected time of arrival for in-bond shipments; integrate with ITDS and KCITPC transponder reader system.

- Positive identification of international freight or goods being shipped in secure cargo containers (by truck or rail) or secure trailers (by truck).

- Positive linkage of a specific container or trailer to a specific commercial vehicle and chassis.

- Tamper-proof container seal technology for bonded shipments, with real time event notification.

**Intermodal Facility Management**

- Management control function for providing status information on tractor, trailer, chassis, shipment and driver for containerized trucks entering and leaving intermodal facilities.

- Interoperability between the KC-ITPC and the intermodal facilities within the Kansas City Region to support seamless, enhanced movement of containerized goods.

**Electronic Payment Requirements**

- Credit line/Credit Card/Wiring payment processing and related services over a secure internet connection.

- Payment interfaces as required to ITDS, US. Customs and other systems to facilitate user payments for tariffs, tolls, state taxes, freight handling, broker payment, and bank transactions.

**Corridor-Wide CVO Traveler Information Requirements**

- CVO-tailored travel information: roadway incidents, congestion, construction sites, special events.

- Highway and Safety Alerts based on vehicle location.

- Queuing for alternative routes and their CVO restrictions (HAZMAT, OS/OW).
• Real time weather information and forecasts for locations across the trade corridor.

• Support services (e.g., gas, hotels, etc.) and location information (Yellow Pages).

Trade Services Requirements

• Interface for Kansas City Region international freight brokerage services.

• Interface for “Just-in-Time” Pickup and Delivery planning services to provide value-added support to KC-ITPC customers.

• Interfaces for other trade services provided by companies within the Kansas City Region.

2.6 System Architecture Preliminary Assessment

While a detailed system architecture assessment is well beyond the scope of this report, the following presents an overview of the key elements of a possible system architecture which would support the KC-ITPC Concept of Operations and corresponding virtual technologies presented in the preceding sections of this report. Specifically, the following system architecture-related elements are presented in detail below:

• Network Backbone Technology Assessment.

• Potential Configurations for the Virtual Trade Processing Center.

• System Technology Overview for the Kansas City Region Transponder/Reader Network.

2.6.1 Network Backbone Technology Assessment

Potential Application of Current Technologies

To realize the Kansas City International Trade Processing Center’s virtual concept, a number of networking technologies will need to be applied to support the information integration of a broad number of systems, databases and information sources, potentially including the ITDS, the CVISN, corridor TMC’s and weather information, electronic payment systems, shipment tracking systems, and trade services. The integration of these systems using wide area networking (WAN) technologies will create a “system of systems” which will be accessed by KC Trade Processing Center customers from the Internet.
In examining networking technologies, it is important to note that different technologies are used to address different user needs. Integrating a broad range of closed, controlled and open users into an elegant network infrastructure is a significant challenge. The KC-ITPC will likely need to deploy multiple technologies to integrate the different systems, users and application characteristics. While this will create a complex of services, it will also allow network planners to take advantage of price/performance tradeoffs offered by different technologies for a cost-effective solution. Figure 2-36 presents an overview of some of the wide-area networking technologies that may be utilized in implementing the KC-IPTC network architecture.

Several key points can be made concerning some of the WAN options presented above:

- **Public Internet services** have transformed the way we exchange and access information, but tend to be less secure, dependable, and have lower performance.

- **Virtual Private Network (VPN)** VPN’s allow the use of dedicated high speed network phone lines to create a virtual Wide Area Network (WAN). VPN’s utilize software rather than hardware routing of data so as to allow potential excess bandwidth be used for other communication needs.
• **Frame relay and private lines** satisfy the closed user, with well-defined traffic flows and configurations\(^7\). Private lines are "permanent" and frame relay is built on predefined circuits. This is a more static environment, but it is predictable and appropriate for intra-organizational needs.

• **Asynchronous Transfer Mode (ATM)** accommodates the very high-speed, high-capacity needs of larger organizations, but many organizations (small to medium) will have difficulty justifying even a full T1\(^8\) access.

Of the options presented above, the WAN technology which is perhaps most applicable to creating this KC-ITPC virtual “systems of systems” is the VPN, or Virtual Private Network. A VPN allows the user to utilize dedicated network phone lines (e.g., the SPRINT Fiber Optic Network) to create a virtual Wide Area Network (WAN). As illustrated in Figure 2-37, such a network could potentially provide the required connectivity to support the KC-ITPC requirements for interoperability with ITDS, U.S. Customs Automated Systems, CVISN, and other systems. Additionally, the VPN technology is robust enough to add in hardware elements in the field, as with the KC-ITPC transponder reader system that is anticipated for deployment.

Additionally, it is important that the VPN can be also be used to support the creation of a private **Intranet** as the overall means of information and configuration management for the KC-ITPC. Thus, this Intranet would be a VPN using Internet protocols. Here, functions could be controlled and accessed remotely in a “user friendly” standard internet-based menu system by KC-ITPC managers, engineers, and authorized stakeholders. The KC-ITPC publicly accessible Internet Web Page would be an output of this Intranet, controlled and configured by it, and yet separated by it by a secure Firewall.

A fundamental concept behind VPN technology involves how the dispersed locations are connected to the network. Larger locations that generate higher traffic volumes are typically best served by a dedicated facility using T1 access. This type of connectivity is also called "on-net." Smaller locations often cannot justify dedicated access because of lower traffic volumes. In this case, dial-up switched access is used. Switched connectivity is referred to as “off-net.”

\(^7\) Frame relay can be described as switched transmission option that moves data in frames (discrete units of information) at a maximum speed of 1.5Mbps.

\(^8\) T1 has a speed of 1.544Mbps, a T3 has bandwidth of 44.736 Mbps (28 times a T1). A T1 is a dedicated digital circuit with point to point connections. Each Circuit has 24 channels of 64Kbps. A T3, 28 times a T1, differs from a T1 only in capacity.
The benefits of VPN’s are as follows:

- Virtual private networking saves money in terms of access, network and management resources.
- A virtual private network platform supports global voice, data and video applications.
- Even small offices can be a part of the worldwide network, extending features to all users.

9 Note: PBX is Private Branch Exchange. This is a small telephone/data network for an organization’s premises.
• Because virtual networking is software-based, you can select feature sets to match your needs.

• Compared to a private network, a virtual network is simple to control in terms of managing and maintaining facilities, equipment and database information.

• Potential Application of Future Technologies

Perhaps in the long term, if video teleconferencing and other high bandwidth features are added to the KC-ITPC virtual design, the new Sprint ION networking solution may become a viable solution. ION is a new technology ultra-high-speed, uniform network that will carry any type of information - voice, data and video, rather than on multiple networks. ION will provide all-distance communications—whether it’s three miles or three thousand miles.

By inter-networking with the standard telephone network, the Internet, and other data services, ION will provides the reach that businesses and other users will be requiring in the next decade. The efficient broadband network will enable new broadband applications that are currently not viable or haven’t even been developed yet.

ION will utilize the Sprint domestic network consisting of over 30,000 route miles of fiber — the world’s first and only nationwide all-digital, fiber-optic network. Fiber is a very precious commodity — the laying of fiber represents a very significant investment. Therefore, it is important to maximize capacity of existing fiber routes. To support ION, Sprint has developed a method of amplification that increases the capacity of each fiber strand — up to 4000 percent — thereby accommodating higher traffic loads.

Asynchronous Transfer Mode (ATM) is the ION transport protocol because of its unique ability to utilize high speeds and its ability to carry and prioritize different traffic types. The result is a high-speed, uniform network that will carry any type of information - voice, data and video, rather than multiple networks. Different from other services that claim to be “one-network solutions” ATM is based on defined categories of service that support different speeds and different traffic types for true network integration. Thus ATM delivers a specifically tailored service to the end user to ensure that each application type is being serviced appropriately through the network.
Sprint ION will enable customers to utilize critical business applications in all locations of any size. Examples of value-added applications include: e-commerce, personalized customer care, distance learning, telecommuting, collaboration, and supply chain management.

Sprint is delivering ION in seven major U.S. cities as part of the first phase of the rollout. Sprint has secured key network agreements with Southwestern Bell, GTE, BellSouth and Ameritech that will enable it to begin delivering advanced, high-speed, high-bandwidth services through Sprint ION, Integrated On-Demand Network.
New York, Chicago, Atlanta, Dallas, Houston, Denver and Kansas City have several key elements in place that made them logical choices for the initial deployment of Sprint ION. Those elements include broadband metropolitan area networks (BMANs) and a strong, established business customer base that can immediately benefit from Sprint ION.

### 2.6.2 Potential Configurations for the Virtual Trade Processing Center

The user service requirements from Section 2.2 and concept of operations requirements from Section 5 are incorporated into the description of potential configurations for the Kansas City International Trade Processing Center (KC-ITPC) Virtual Network. Utilizing connections with open (internet), closed (intranet), and controlled (extranet) WAN technologies, KC-ITPC will provide customers a gateway for:

- International Border Electronically Expedited Clearance.
- Electronic Credentialing.
- Shipment and Vehicle Tracking.
- In-bond Shipment Security.
- Intermodal Facility Management.
- Electronic Payment.
- Corridor-Wide CVO Traveler Information.
- Trade Services.

In addition, connection to ITDS will provide Trade Promotion, Statistics and Analysis, Border Operations, and Licensing and Permitting services to customers. Figure 2-40 shows the proposed operational environment for ITDS.
Potential Configurations

The concept of operations in Section 2.5 portrayed the KC-ITPC virtual network as a “system of systems” which pulls together information and services from ITS and trade-related systems and programs. Numerous configuration options for the KC-ITPC are possible given the number of technology alternatives (i.e., networking technologies, connectivity options, etc.) and ITS systems available. This section describes two potential configuration options for the virtual network.
The first configuration option is shown in Figure 2-41. In this configuration KC-ITPC serves as a “pass-through” where information and services are primarily pulled together and organized from outside sources. The one exception is the intermodal facility management user services, where information and services may come from within a KC-ITPC intranetwork (consisting of Kansas City region intermodal yards, bonded warehouses, and other transportation facilities, etc.). Depending on the user service selected, the KC-ITPC virtual network system would communicate with other network systems. For example, if the customer selected the ITDS user service, the KC-ITPC virtual network would communicate over a government private network to the ITDS intranet. If the customer selected electronic credentialing, shipment and vehicle tracking, electronic payment, or in-bond shipment security user services, the KC-ITPC virtual network would communicate over a VPN or internet connection to the relevant extranet. For a customer selecting traveler information or trade services, the system would utilize publicly available networks to access related information from the internet. Finally, intermodal facility management user services would communicate over a VPN to a KC-ITPC intranet.

**Figure 2-41: Configuration Option 1**

To utilize the KC-ITPC Virtual Network, customers (Brokers, Importers/Exporters, CVO, etc.) would access the KC-ITPC Home Page, select one or more user services, and perform a transaction. An example of the Home Page is shown in Figure 2-42. Upon entering the
Home Page, the customer would see a list of available options listed along the left side. In the main section of the screen a query box and search button would allow customers to search for a specific keyword(s). To get back to the Home Page, initiate a service, learn more about the KC-ITPC virtual network, or contact KC-ITPC staff, the customer would select an option listed along the left side. Selecting an option would initiate a transaction and change the information presented in the main section.

Figure 2-24: Example of KC-ITPC Customer Interface Screen on the World Wide Web

2.6.2.2 Configuration Option 2

In this configuration KC-ITPC would have all the functionality in Option 1 but provide customers with additional value added services. Functionally, from the customer’s perspective, this configuration option is similar to Option 1 above, in that, customers would access the KC-ITPC Home Page and select one or more user services. However, specific value added services would be developed and implemented in partnership with other organizations, routed through the KC-ITPC intranet, and delivered to customers via the KC-ITPC Home Page. Four user service areas would be enhanced by value added services: Electronic Payment, In-bond Shipment Security, Traveler Information, and Trade Services.
The dashed lines in Figure 2-43 shows the User Services which would have value added services routed through the KC-ITPC VPN.

Examples of value added services include:

- Electronic Payment user services enhanced to facilitate the payment of local brokerage fees, shipping charges, and corridor-wide state tax payments.

- In-bond Shipment Security user services could combine in-bond shipment security with local intermodal facility management services for additional cargo tracking and security.

- Traveler information enhancements for corridor-specific real-time maps, incidents, video, construction closures, and weather information.

- Trade Services enhancements to encourage utilization of regional/corridor-wide broker services, providing leads for specialized trade services, BBS for posting messages/questions, and initiating on-line rate requests.

Figure 2-43: Configuration Option 2
Configuration Requirements

Although a majority of the network will be distributed and decentralized, the virtual network would require a facility to house the operations and maintenance operations. This facility would serve as the focal point for KC-ITPC virtual operations. Also required would be hardware for data processing and communications and support personnel to maintain, upgrade, and ensure continuous operations. Finally, inter-agency and organizational partnership agreements would be essential to the success of the virtual network. These agreements would: promote strong partnerships; clarify goals, objectives, and responsibilities; strive to overcome non-technical barriers; and foster champions and leaders to effectively motivate, educate, and involve potential users.

2.6.3 System Technology Overview for the KC Region Transponder/Reader Network

As detailed in the Initial Concept of Operations, an integrated network of Transponder Reader systems, consistent with those which will be deployed under ITDS at the Laredo Border Crossing in 2000, is proposed to be deployed on all major interstates entering the Kansas City Region by the end of 2000. This will allow U.S. Customs and other agencies the option of electronically alerting (via effecting a “red light” reading on the transponder) the in-bond shipment truck operator that an inspection is required at the Kansas City-International Trade Processing Center. Here, information will be shared electronically across ITDS and the KC-ITPC as the in-bond shipment first passes through the ITDS NATAP-like reader at Laredo, and then again as the in-bond shipment passes through the KC-ITPC NATAP-like reader as it enters the Kansas City Region.

Additionally, as detailed in the Initial Concept of Operations, this system will include an assessment of trip time calculations (i.e., a calculation of expected time of arrival in KC will be made) from when the truck first enters the U.S. at ITDS transponder reader station-equipped border crossings such as Laredo, to the Kansas City Region. As an in-bond shipment truck enters the Kansas City Region, it will pass through the corresponding KC-ITPC transponder reader system, and the system will know if the truck exceeded the expected time of arrival. If the truck has exceeded the expected time of arrival, a “red” transponder signal will be automatically sent, and the truck will be required to proceed for a possible U.S. Customs Inspection at the International Trade Processing Center.

The following is intended to provide a preliminary technical overview which describes the components of the KC-ITPC Transponder/ Reader System. It is important to note here that the “Type III” transponders proposed here will not only be compatible with the ITDS/NATAP type Transponder/Reader system, but they will also be technically compatible with the Advantage CVO, MAPS, and Help. Inc., electronic screening systems being deployed across the United States.
2.6.3.1 Transponder/Reader System Technology Overview

The basic components of this system include a central computer, a reader, and reader antenna, a vehicle Type III transponder, and a transponder input device. The central computer provides for user control, and monitoring of the system, and can be used to run a complete application, using the reader as a peripheral, or to configure the reader for independent operation. By implementing programmed command, request, and report functions, the reader transfers information between the central computer and transponder when the transponder enters the reader’s communication zone.

The Type III transponder, which is attached to the windshield of the vehicle, communicates via radio frequency with the reader through the reader’s antenna using the Slotted Aloha Time Division Multiple Access (TDMA) protocol. The transponder contains read/write memory that can provide vehicle identification, container/freight information, and memory space for the read/write operations. When used with a transponder input device in the vehicle such as an on-board computer, the transponder becomes the radio frequency-to-digital link between the central computer and the on-board input device/computer. The most common configuration allows for communication with the transponder through the standard RS-232 serial interface.

To notify the driver of an event (e.g., requirement for customs inspection at Richards Gebaur), the reader commands the transponder to activate its LEDs (green, yellow and red lights) and/or beeper. In a more complex communication, the central computer can instruct the reader to write data into the Type III transponder's local memory. Also, the central computer can also instruct the reader to read previously written data from the transponder memory. Additionally, when an on-board device/computer is attached to the input serial port of the transponder, the reader can send messages from the central computer to the on-board device/computer through the transponder.

Driver signaling communication, which is what U.S. Customs-KC would likely use as the means to direct random trucks to divert to the Richards Gebaur Inspection facility, permits the central computer (or reader, if configured for autonomous operation) to enable a pre-programmed alert to the vehicle transponder. Signaling notifications can be configured to enable a single beep or audio series, light a specific LED, or implement a sequence of LED indications.

It is important to note here that readers are capable of performing communications and event notifications automatically whenever a transponder enters its communication zone. Once the reader has finished all automated functions, control of the transponder is passed to the central computer. The central computer may then perform a variety of transponder transactions, including transponder data reads and/or writes, sending transponder control commands, and providing for on-board device/computer reads/writes.
2.6.3.9 **Type III Transponder Technology Overview**

The standard Type III CVO transponder is produced by several companies, including Hughes, Delco Electronics and Mark IV. Type III transponders typically offer the standard serial interface for external device connectivity, such as in connecting to an in-vehicle computer. This interface facilitates up to a 38.4K baud two-way data exchange between a roadside reader and an in-cab device, such as an on-board computer or smart card. Type III transponders operate at a center frequency of 915 MHz in the 902-928 MHz band.

![Figure 2-44: Hughes Type III RS-232 Transponder](image)

Features of the Hughes Type III RS-232 transponder are presented as follows:

- 312 bytes of memory, with an additional 8K bites of extended memory available as an optional feature.
- Three types of data fields: read-write scratch pad, factory programmed I.D., and agency/owner programmable.
- Slotted-Aloha TDMA communications protocol compatible with all Hughes applications.
• Visual indicators (red, yellow, and green LEDs), and audible tones perform six combinations of driver signaling (programmable).

• Design resists tampering and internal components resist interrogation and decoding signals.

• Mounts on the vehicle front windshield.

• Performance resistant to vibration, shock, mechanical or electrical interference, and lightning (except for direct hits).

• Mean time between failure of 833,854 hours (95 years), exclusive of battery.

• One-year manufacturer's warranty.

• Meets ICAO, IATA, and DOT safety regulations for unrestricted shipment.

• Unit costs of the Type III transponders typically average about $60 when purchased in large quantities.

Reader Technology Overview

As described above, readers perform two-way communications between central computers and transponders using the TDMA protocol. With Type II and Type III transponders, a reader will send and receives messages at a 500kb/sec data rate within a one millisecond time frame when an in-vehicle transponder enters the reader's communications zone. The reader's variable communication range permits communication with transponders at up to 300 feet.
Most readers can be rack-mounted, wall-mounted, or pole-mounted. Heaters can be used to maintain cabinet operating temperatures in cold-weather environments. Features of the Hughes Model 200 reader are presented as follows:

- Powered from a standard 90 to 120 VAC 60-Hz power line with less than 200-watt power drain.
- Diagnostic mode permits reader calibration and troubleshooting operations.
- Downloads and performs real-time check of enrolled vehicle list.
- Downloads messages to store and forward to one or all transponders.
- One-year manufacturer’s warranty.
Readers typically cost around $12,000 to $15,000, depending on the accessories and software included. However, if these are to mounted on an interstate, a 30 foot post structure clearance is required. In this case, a 30 feet cantilevered support structure can be used, adding another $20,000 to the hardware cost total.
2.7 Assessment of Costs and Benefits

A cost estimate for the Kansas City area Transponder/Reader System is provided below, along with a discussion of the system-level cost analysis requirements related to the remaining virtual elements of the KCITPC. Additionally, a general discussion of costs and/or benefits related to electronic clearance technologies, ITDS and CVISN is presented.

2.7.1 KC Region Transponder/Reader Network

As detailed in Section 2.6.3.2, and in the Initial Concept of Operations in Section 2.5, an integrated Transponder Reader system network, consistent with that which will be deployed under ITDS at the Laredo Border Crossing in 2000, is proposed to be deployed on all major interstates entering the Kansas City Region by the end of 2000.

Referred to as a “pre-read” in the ITDS program, a truck carrying an in-bond shipment crosses the border and is logged into the ITDS system. The truck approaches these readers and is notified on their in-cab transponder with a red or green indicator (go or no-go) - indicating the customs status of their trip. If the truck receives a green indication on their transponder, they have been cleared through the customs process and may proceed to their destination. A red light indicates that a stop is required for customs inquiries. The driver then notifies their dispatcher who in-turns directs the truck to the main center at Richards Gebaur or to the satellite center at KCI.

The major components of this system include a central computer, deployed reader systems (readers and reader antennas), and structures (where required) to support the reader systems. The cost to deploy these systems at the six interstate sites surrounding Kansas City is presented below in Figure 2-47. Note that these costs are for deployment only, and do not include costs for system design, development and testing, all of which would precede the deployment of this system.

Figure 2-47: KC Region Transponder/Reader Network Deployment Cost Estimate

<table>
<thead>
<tr>
<th>Deployment Cost Element</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reader Systems</td>
<td>6 sites</td>
<td>$15,000</td>
<td>$90,000</td>
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<tr>
<td>Cantilever Structure</td>
<td>3 sites</td>
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<td>$60,000</td>
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<td>Central Computer Systems</td>
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<td>$10,000</td>
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<tr>
<td>Computer Configuration (labor)</td>
<td>Lump Sum</td>
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<td>$15,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total $175,000</td>
</tr>
</tbody>
</table>
In addition, the following ground rules and assumptions have been made in developing this deployment cost estimate:

- Costs do not include ITDS software.
- Costs do not include the administration support of the program.
- Costs do not include the communications costs or fiber usage to transmit information.
- Costs do not include any labor and hardware associated with connecting the reader systems with the fiber network available alongside the interstate.
- The costs do not include the purchase of the Type III Transponders by the trucking companies. It is assumed that the trucking companies will be responsible for procuring the transponders. Note the Type III transponders typically cost around $60 each when purchased in quantity.
- The $20,000 cost for the cantilever structure is the procurement cost only, and does not include the labor cost to assemble it.

2.7.2 System-Level Cost Estimate Requirements

The level of detail required to generate a complete system cost estimate of the network backbone infrastructure (e.g., the VPN), the data connectivity to external links (e.g., ITDS Network, U.S. Customs Network, CVISN Network), and the KC-ITPC web site with embedded user services functionality, is not contained in this report. In order for an accurate system level cost estimate to be conducted, it will first be necessary to take the next step in the systems engineering process, and generate a detailed System Design Study. The System Design Study would include the following elements:

1. System Requirements Analysis (flowing from the operational requirements defined in Section 6 of this report).
2. System Architecture Study (based on the initial architecture concepts presented in Section 7 of this report).
3. Detailed System Design.
The System Design Study would provide the level of detail necessary to estimate the likely major cost elements of the KC-ITPC virtual design, namely:

- Procuring, installing, testing and operating all required hardware and software for the VPN.
- Customized software development for providing interoperability between the KC-ITPC and government systems (ITDS, U.S. Customs systems, CVISN).
- Design or procurement of the Shipment and Vehicle Tracking technology system.
- Hardware and software development to integrate the Kansas City region’s intermodal facilities into an information system accessible through the KC-ITPC.
- KC-ITPC Web Site interoperability and connectivity to private entities supporting KC-ITPC User Services (Electronic Payment, Traveler Information, Trade Services).
- KC-ITPC Web Site development.
- Human Resources required for operations of the KC-ITPC virtual elements.

As an example of a high-tech transportation information system connecting a number of government systems over a large wide-area network, an Information Exchange Network (IEN) is being implemented in the Northeastern U.S. as part of the I-95 Corridor Coalition Project. While the IEN is broader in both technical capabilities and scope of use than the proposed KC-ITPC virtual elements described here, the basic concept of an ITS information system network is analogous.

Conceptually, the IEN will consist of computer workstations and regional servers connected in a wide-area network. Each workstation will provide a point of entry and access to regional and corridor-wide transportation information. This information may consist of text, graphics, video, or some combination, depending on the final requirements. Users of the IEN will also be provided the capability to transmit faxes, exchange computer files, and send and receive e-mail. The IEN would be linked to the individual traffic operations centers of all members of the Coalition.

The life cycle cost of the IEN, including system design, software development, hardware procurement and installation, program management, and multi-year communications costs, is estimated to be about $6 million. This includes the cost of installing 52 workstations at multiple agency sites throughout the I-95 Corridor Coalition region. This equates to a “loaded” per workstation unit cost of about $115,000. Noting that the actual workstation hardware cost is less than $3,000 (a 200 MHz Pentium system), it can be deduced that the
The majority of costs are in system design, software development, hardware/software integration with legacy systems, communications, program management, and personnel travel costs.

It is important to note here that the cost of developing and deploying the KC-ITPC virtual systems would be expected to cost significantly less than the IEN for two very important reasons:

- The IEN costs include deployment at multiple agency locations, with 52 workstations being installed and tested. The KC-ITPC virtual design will likely require just one network control center, with the users accessing the information over the public Internet.

- Unlike the IEN, live video will not be required to be transmitted for the KC-ITPC virtual design. This will result in substantially reduced network bandwidth requirements, which is the main cost driver in sizing a network.

### 2.7.3 Industry Benefits of Electronic Clearance Technologies

The following provides an example of the benefits to U.S. commercial vehicle fleets that could be realized by implementing electronic clearance technologies as part of ITDS and the KC-ITPC. Building on previous research conducted by the North American Superhighway Coalition, the following presents an estimation of the benefits in reduced travel time that could be realized by implementation of a “NATAP-like” electronic clearance system at the Laredo, Texas international border crossing. Note that an overview of the NATAP system is provided in Section 2.3.10, and that the electronic expedited clearance technologies are a main part of the Concept of Operations as defined in Section 2.5. In order to estimate the benefits of electronic clearance technologies at the Laredo Border crossing, the following inputs were required:

- Forecasts of the number of commercial vehicle border crossings (north and south) at the Laredo international border crossing from 2000 to 2007: see Figure 2-48.
The current average time (i.e., “delay time”) it takes a commercial vehicle to cross (north and south) at the Laredo international border crossing: 5.5 hours for northbound vehicles, 2.5 hours for southbound vehicles.\(^\text{11}\)

The future average time (i.e., delay time) it takes for a vehicle to cross (north and south) at the Laredo international border crossing utilizing a “NATAP-like” electronic clearance technology-based system: 15 Minutes.\(^\text{12}\)

The dollar value of one hour’s time (i.e., delay time) related to commercial vehicle operations: $22/hour.\(^\text{13}\)

Market penetration rates for commercial usage of required “NATAP-like” transponders for commercial vehicles using the Laredo international border crossing: Here, it has been assumed that an initial market penetration of 10% will be realized in 2000, to be followed by a yearly increase of 5% annually through 2007 (i.e., reaching 40% market penetration in 2007).

Based on the above inputs, an estimate of the benefits due to travel delay reductions at the Laredo international border crossing is provided in Figure 2-49. This figure illustrates the significant potential efficiency cost savings that the implementation of electronic clearance technologies could provide the commercial freight industry, with savings to industry approaching $200 Million by 2007. Note that these benefits should be considered...
conservative since that they assume modest market penetration rates, a modest time value, and they do not take into account the likelihood of increased delays above the current average times (i.e., 5.5 hours northbound and 2.5 hours southbound) over the next decade.

Finally, it should also be noted that additional industry benefits, including fuel savings and vehicle operation cost savings would also be realized.

2.7.4 ITDS Program Cost-Benefit Analysis Study Results Summary

In September 1998 the ITDS Program Office published the “Cost/Benefit Analysis for the International Trade Data System.” This study presented a comprehensive analysis of the costs and benefits of both industry and government based on a phased deployment of the ITDS at all ports of entry between 1999 and 2003. The main findings of this analysis are as follows: 14

- Total expenditures in support of ITDS development, deployment and operation are estimated at $256 million through the end of the system life cycle in 2005.

- The Government reporting of international trade regulatory burden is neither properly documented nor accurate.

• The Government is not cognizant of the amount of personnel and budgetary resources dedicated to the management of the international trade process.

• In 1997, the trade community spent $3.2 billion to collect, process, submit and retain the information necessary to file international trade forms to the Government.

• By 2005, this cost to the trade community could increase to a minimum of $4.0 billion unless ITDS is deployed.

• As ITDS is deployed, the trade community could save a total of $2.4 billion in filing costs by 2005.

• In 1997, it is estimated that the Government spent anywhere between $11.3 billion and $20.0 billion to manage the international trade process.

• Government-wide, it is projected that the deployment of ITDS could cumulatively result in half a billion dollars in avoided costs by 2005 based upon higher personnel productivity and lower archiving costs. This figure represents the lower-end of expected Government’s benefits because it is derived from a limited range of government costs associated with the management of the international trade process (i.e., it only represents the Government's international trade forms collection, processing, review and storage costs, not information technology costs).

• By 2005, ITDS net benefits (defined as the difference between the ITDS users' discounted savings and all ITDS costs) could reach $2.0 billion, or $9 for every dollar spent. This figure will increase once additional benefits accruing from both the Government and the trade community are included in the cost/benefit analysis. Among these, the reduction in the cost of border delays and the reduction in Government-wide spending for international trade information systems stand out as the most significant benefits that ITDS would generate.

2.7.5 CVISN Program Cost-Benefit Analysis Reported Results

In 1996, The American Trucking Association (ATA) Foundation conducted a cost-benefit analysis in support of potential commercial vehicle users of CVISN, on behalf of the FHWA. According to Steve Crane, chief of the FHWA’s ITS-CVO Division,

“Research from the ATA showed cost benefits for several areas of CVISN. For example, one region showed a 20:1 cost benefit for certain carriers in the credentialing area; that is not across the board for all carriers, but is probably the most pronounced example of a cross-benefit which helps assure industry that this is indeed a good thing.” 15

2.8 Bibliography


28. TransCore, San Diego Virtual Port Concept, presentation.


## 2.9 List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ABI</td>
<td>Automated Broker Interface</td>
</tr>
<tr>
<td>ACE</td>
<td>Automated Commercial Environment</td>
</tr>
<tr>
<td>ACH</td>
<td>Automated Clearinghouse</td>
</tr>
<tr>
<td>ACROSS</td>
<td>Accelerated Commercial Release Operational Support System</td>
</tr>
<tr>
<td>ACS</td>
<td>Automated Commercial System</td>
</tr>
<tr>
<td>AEI</td>
<td>Automatic Equipment Identification</td>
</tr>
<tr>
<td>AGS</td>
<td>Automated Gate System</td>
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<tr>
<td>AII</td>
<td>Automated Invoice Interface</td>
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<tr>
<td>AMS</td>
<td>Automated Manifest System or Agricultural Marketing Service</td>
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<td>APHIS</td>
<td>Animal and Plant Health Inspection Service</td>
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<td>ASD</td>
<td>Accounting Services Division</td>
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<tr>
<td>ATM</td>
<td>Asynchronous Transfer Mode</td>
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<td>ATMS</td>
<td>Advanced Traffic Management System</td>
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<tr>
<td>AVI</td>
<td>Automatic Vehicle Identification</td>
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<tr>
<td>BBS</td>
<td>Bulletin Board System</td>
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<tr>
<td>BNSF</td>
<td>Burlington Northern Santa Fe</td>
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<tr>
<td>BRASS</td>
<td>Border Release Advanced Screening and Selectivity</td>
</tr>
<tr>
<td>BTS</td>
<td>Bureau of Transportation Statistics</td>
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<tr>
<td>BXA</td>
<td>Bureau of Export Administration</td>
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<tr>
<td>CADEX</td>
<td>Customs Automated Data Exchange</td>
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<tr>
<td>CAT</td>
<td>Carrier Automated Transaction</td>
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<td>CDC</td>
<td>Centers for Disease Control</td>
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<td>Customs Form 3461 Entry/Immediate Delivery</td>
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<td>Customs Declaration Message</td>
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<td>Commercial Vehicle Operations</td>
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<td>DES</td>
<td>Designated Examination Site</td>
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<td>DSRRC</td>
<td>Dedicated Short-Range Communications</td>
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<td>ECC</td>
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<td>Expedited Processing at International Border Crossings</td>
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<td>ERS</td>
<td>Economic Research Service</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>FAA</td>
<td>Federal Aviation Authority</td>
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<tr>
<td>FACET</td>
<td>Future Automated Commercial Environment Team</td>
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<td>FAS</td>
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<td>Federal Grain Inspection Service</td>
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<td>FMC</td>
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<td>Federal Rail Administration</td>
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<td>Food Safety and Inspection Service</td>
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<td>Free Trade Zone</td>
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<td>GPS</td>
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