SWIFT

Seattle Wide-area Information For Travelers

Institutional Issues Study

Contract Number: WSDOT Y-5908

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EXECUTIVE SUMMARY

The Seattle Wide-area Information for Travelers (SWIFT) project was a highly successful Intelligent Transportation System (ITS) Field Operational Test (FOT) that was conducted over a four-year period from 1993 to 1997. The purpose of the project was to test the efficacy of a High Speed Data System (HSDS), or FM Sub-carrier, to disseminate incident, bus and speed/congestion information via three different end-user devices: pager watch, portable computer and in-vehicle navigation device. Six hundred ninety (690) commuters, many with route- or mode-choice options, participated in the FOT and provided user-acceptance evaluations. Other evaluation components examined the system architecture, communications coverage, deployment cost and institutional issues that affected the project.

The primary purpose of the *SWIFT Institutional Issues Study* evaluation was to collect information regarding the institutional issues (e.g., policies, jurisdictional issues, internal and external factors) that affected design, development, testing, deployment and conduct of the SWIFT Field Operational Test (FOT); determine how these issues were overcome and what lessons could be learned. A secondary purpose of the evaluation was to document the history of the SWIFT project.

The methodology for the *SWIFT Institutional Issues Study* consisted of two sets of questionnaires and two sets of semi-structured interviews that were conducted with fourteen (14) SWIFT team-member representatives at two different points during the conduct of the SWIFT FOT: about midway through the conduct of the test and after the test was completed. All SWIFT team-member responses were independently collected and SWIFT institutional issues were primarily identified by determining which topics were addressed by two or more individuals. Historical information was collected from various sources throughout the project.

SWIFT represents one of the first ATIS FOTs conducted in this country. Earlier tests were conducted in Orlando, FL (TravTek) and Minneapolis/St. Paul (Genesis) among others, yet the SWIFT FOT appears to have extended considerably the available database of information regarding ATIS effectiveness and acceptance. The addition of real-time bus information, in particular, has set the SWIFT FOT apart from others already conducted.

One of the significant aspects of the SWIFT teaming agreement was the long-term interest in ITS and commitment of the organizations involved. For instance, the majority of the SWIFT team members articulated a long-term interest in ITS deployments. In addition, three organizations—Seiko, Etak and Metro Traffic Control—committed themselves to fielding a "SWIFT-like" system after the project was completed. This degree of interest and commitment resulted in all of the SWIFT team members working together in a very effective, cooperative fashion throughout the FOT.

A critical organizational structure that was instituted to implement SWIFT was the weekly teleconference. This simple, yet cost-effective method of managing and discussing the technical issues involved with the project was attributed by many of the SWIFT team members to a primary instrument of the project's success. In particular, the SWIFT teleconferences enabled the representatives of each organization to keep abreast of the developmental status of the project, to brainstorm solutions to encountered problems and to develop scheduling sense to see

the project through to the end. Others simply enjoyed the "camaraderie" that was exhibited by the teleconferences, and felt that these discussions cemented their commitment to each other.

Evaluation issues were important to the SWIFT team members throughout the project. On many occasions, team-member representatives reiterated or stated their commitment to assisting with the independent evaluation, as the documentation left by this effort would be the primary legacy of the project.

Institutional issues that primarily affected the SWIFT project were:

- Responsibilities— because some team members did not meet expectations others had of them, other SWIFT team members ended up performing activities that were outside, or in addition to, their responsibilities when they started the project.
- Role clarity— related to responsibilities, differential expectations regarding the role that each organization should play in the SWIFT teaming agreement caused some development, testing and deployment delays.
- Public/Private Partnership— confusion as to the differential role of public and private agencies in a public/private partnership caused delays in contract negotiations.
- Patent/Copyrights— related to public/private partnership issue, concerns about how patent and copyrights should be assigned to the SWIFT team members caused contract-signing delays and/or re-negotiation of SWIFT contracts.
- Standards/Protocols— SWIFT team member representatives differed in their attributions as to whether ITS standards and protocols might save development time
- Procurement/Acquisition— Some felt that ill-defined procurement processes contributed to SWIFT problems such as the use of Dauphin sub-notebook computers and "phased" deployment of end-user devices.
- Market Uncertainty— Not knowing whether consumers will ultimately accept ITS products and services contributed to some development uncertainty and associated deployment problems with the SWIFT project
- Contracting/Auditing— Difficulty understanding and submitting to government contracting requirements caused some headaches among SWIFT private-sector team members
- User Perception/Acceptance— concern was expressed about how well the SWIFT system would be accepted by end users, or operational test participants, because user inputs and prototyping were minimal during the design phase.

Organizational/jurisdictional (i.e., the first three items above), financial (i.e., the second three items above), regulatory/legal issues (i.e., the seventh and eighth items above) and public acceptance (i.e., the last item above) categories of issues were rated as the most important by SWIFT team-member representatives as measured by the number individuals who wished to discuss issues in these categories. In particular, each of the institutional issues in the organizational/ jurisdictional category were each discussed by three (3) or more people, while the same number of issues were each addressed by two (2) people in the financial category. In addition, the two regulatory/legal category issues were discussed by two (2) or more people and the issue discussed in the final issue category (i.e., public acceptance) was addressed by three (3) SWIFT team-member representatives.

Primary organizational/jurisdictional concerns centered around the significance of ensuring that each and every member of the team understands its responsibilities and roles throughout the development process. Earlier on, for instance, apparent differences in how some organizations viewed their involvement in the SWIFT project caused some to view certain development activities (e.g., bubble diagrams) as being a waste of time. Others didn't understand and/or misinterpreted their role in the project which also caused them to waste time. Integrating the concerns of the issues addressed in this category can lead to the attribution that some organizations viewed the SWIFT FOT as being a "research and development" project rather than a "demonstration," or actual implementation project. As a result, some organizations exhibited a greater sense of urgency in completing their assigned tasks, or in building the SWIFT system, than did other organizations. This occurrence resulted in some hard feelings among the team members, but it was generally conceded that others "picked up the slack" for those who didn't clearly understand their responsibilities and roles.

Financial issues related to the conduct of the SWIFT FOT addressed procurement/acquisition, contracting/auditing and market uncertainty. Procurement issues causing SWIFT to be defined and built very quickly causing certain operational disadvantages (e.g., use of Dauphin sub-notebook computer) to be built into the system. In addition, contracting/auditing issues contributed to development delays in other areas of the project that otherwise resulted in the perception of an uneven workflow for the project. For example, these issues were generally thought to have been the primary contributor to the "phased" deployment of end-user devices that was experienced by the project. Finally, issues and questions regarding the ultimate marketability of ATIS services such as those provided by SWIFT probably caused some of the SWIFT participants question and/or otherwise delay some of the development efforts for the project.

SWIFT regulatory and legal issues were significant in that the SWIFT project represented the first time some of the private team members had ever dealt with government contracts and/or entered into a "public/private teaming agreement." As a result, some private SWIFT team members were concerned about losing the proprietary rights to some of the software they contributed to the project, while some public SWIFT team members felt uncomfortable with granting their private-sector counterparts the capability to make money on the joint efforts of the group. The primary result of the lack of clarity regarding SWIFT regulatory and legal issues was a delay in getting many of the SWIFT team-members under contract. This caused the project to be subjected to unnecessary risk according to some team members, or caused a lot of anxiety among others with vested financial interests in the project.

A final important issue, in the public acceptance category, was the FOT participant, or end-user's, perception and acceptance of the SWIFT system. With all of the respondents who addressed this issue being from the private sector, the significance or implication of this issue is that customer acceptance of ITS projects is crucial to the overall success of this type of application. Thus, it is crucial to obtain end-user inputs throughout the system design, development, testing and fielding process.

As with other ITS FOTs, a number of newly-identified issues were delineated by the SWIFT project. These issues primarily centered around the particulars of developing new systems, such as human factors contributions during user-interface design, integration testing, protocol migration and server connectivity. Nonetheless, other newly-identified issues addressed other implementation aspects of the SWIFT project, such as the general lack of familiarity with transit data, that team members were spread out geographically, leadership issues, education and training of co-workers and how the independent evaluation was supposed to be conducted. Overall, a good summary is that it is important to address the "logistical" aspects of applying information technology to solving transportation problems.

Primary SWIFT lessons learned were:

- Responsibilities of the team members need to be clear from the onset
- Roles of the team members need to be delineated and understood by all
- Each side of the public/private partnership needs to understand the principles and ideals that govern the other
- Patent and copyright rules of the Federal government need to be modified to include models for public/private partnerships that address the distribution of patent and copyrights among the team members
- ITS standards and protocols should be modified so that both public and private entities agree as to their contents
- Procurement and acquisition processes need to be better defined so as to facilitate, not hinder, ITS deployments
- Issues regarding ITS market uncertainty need to be delineated so that development processes will be facilitated
- Government contracting and auditing requirements need to be clarified for private-sector ITS public/private partnership team members
- Market research and user-system prototyping should be included in ITS projects to ensure that the system is well received

Other findings indicated that the goals of the SWIFT project were relatively clear; the perceived benefits and risks of participating in the FOT varied widely among the team members; WSDOT, Seiko and Etak were most often mentioned as the champions of the project; the majority of the team members agreed that consumer acceptance was crucial to commercial deployment of the system; and that a subscription-based model was best suited for future deployment of the SWIFT system. The historical significance of providing real-time bus information was also cited as a major contribution of the project.

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1. INTRODUCTION

The United States (U. S.) Congress passed the Inter-modal Surface Transportation Efficiency Act (ISTEA) in 1991. The purpose of this legislation was to re-invigorate the country's transportation infrastructure by providing needed repairs to the highway system, encouraging the development of inter-modal transportation facilities and applying information technology (IT) solutions to transportation problems.

The Intelligent Transportation Systems (ITS) initiative grew out of ISTEA's interests to apply IT solutions to transportation problems. Specifically, the U. S. Department of Transportation (USDOT) developed the *National Program Plan for ITS* (1994) in order to guide the deployment of ITS around the country. The goals of the USDOT ITS program are to:

- Improve the safety of surface transportation
- Increase the capacity and operational efficiency of the surface transportation system
- Enhance personal mobility and the convenience and comfort of the surface transportation system
- Reduce the environmental and energy impacts of surface transportation
- Enhance the present and future productivity of individuals, organizations and the economy as a whole
- Create an environment in which ITS can flourish

Operational tests present opportunities to develop, deploy and evaluate specific implementations of ITS. According to the Federal Highway Administration (FHWA) document, *Generic ITS Operational Test Guidelines* (1993), prepared by The MITRE Corporation, an ITS Field Operational Test (FOT) is a "joint public/private venture, conducted in the real world under live transportation conditions..." that "...serve[s] as [a] transition between Research and Development (R&D) and the full-scale deployment of [ITS] technologies." Thus, FOTs represent a significant step in accelerating the deployment of ITS in North America.

Conducting FOTs results in feedback from the public regarding the viability and perceived usefulness of a specific ITS implementation. This information can be used by the public and private organizations involved to determine the best approach toward full-scale implementation after the FOT is completed. Also, lessons are learned during the conduct of an FOT that will enable the Federal, State and Local governments in partnership with industry and non-profit, academic institutions to bear, conceive, design, develop and deploy an ITS that provides the best possible services to the traveling public.

1.1. SWIFT Project

On September 8, 1993, the Federal Highway Administration (FHWA) published a request for ITS FOTs. The concept for the SWIFT project was submitted in response to this request on

January 6, 1994 by the SWIFT Project Team. The SWIFT Project Team proposed to partner with the FHWA to perform an operational test of a wide-area ITS communications system in the Seattle area. The proposed system incorporated a flexible FM sub-carrier High Speed Data System (HSDS) that had been developed and commercially deployed in the Seattle area by one of the SWIFT Project Team members. The HSDS would be used to transmit traveler information to three receiving devices provided by other SWIFT Project Team members. It was anticipated that the SWIFT Operational Test would provide valuable information regarding the viability of these devices for traveler information systems. SWIFT Project Team members included:

- Delco Electronics Corp., a subsidiary of General Motors Corporation (Delco)
- Etak, Inc. (Etak)
- Federal Highway Administration (FHWA)
- International Business Machines, Inc. (IBM)
- King County Department of Metropolitan Services (Metro Transit)
- Metro Traffic Control, Inc. (Metro Traffic Control)
- Seiko Communications Systems, Inc. (Seiko)
- Washington State Department of Transportation (WSDOT).

On April 6, 1994, the SWIFT proposal was accepted by the FHWA contingent upon the filing of a signed Memorandum of Understanding (MOU) by all SWIFT Project Team members and a Teaming Agreement between the Washington State Department of Transportation (WSDOT) and the FHWA. The SWIFT MOU was signed on October 18, 1998 and the SWIFT Teaming Agreement was completed on January 10, 1995. Following the fulfillment of these requirements by the SWIFT project team, construction of the SWIFT system was initiated.

In addition to guiding the signing of the SWIFT MOU and Teaming Agreements, WSDOT also negotiated separate contracts with the University of Washington (UW) and Science Applications International Corporation (SAIC) to participate in the SWIFT project. The University of Washington was retained to provide data gathering and fusion services for the project, while SAIC was retained as the independent evaluator. In this regard, SAIC signed their contract with WSDOT on September 13, 1994 and UW on November 17, 1994.

As part of the their contract with WSDOT, the University of Washington also developed and demonstrated a dynamic ride-share matching system called Seattle Smart Traveler (SST). SST used the UW Intranet to match ride requests with drivers. Participants registered and requested/offered rides using a web-like page, and riders would be notified of pending rides by email. The project also used 65 SWIFT Seiko MessageWatchs, or pagers, to let riders know where to call to set up a ride. These SST users also participated in SWIFT and received traffic incidents and general information messages. A separate evaluation of SST was conducted by the Texas Transportation Institute and, thus, the SWIFT evaluation did not address the SST project.

1.2. SWIFT System Description

An overview of the SWIFT system is shown in Figure 1-1, while Table 1-1 lists the primary types of information that were delivered by SWIFT. Each SWIFT receiving device regularly scanned the FM airwaves to identify, retrieve and display the information/messages intended for it.

The SWIFT system was divided into five (5) data components:

- Generation— gathering of the information to be transmitted
- Processing— formatting of the information to be transmitted
- Transmission— broadcast of the information to travelers
- Reception— receipt of the transmitted information by SWIFT devices
- Interpretation— use of the transmitted information by operational test participants.

Each of these is described in the following sections.

Table 1-1. Information Delivered by SWIFT.

Device/Information Received	Traffic Incidents, Advisories, Scheduled Events and Road Closures	Route Guidance	Traveler-Service Information	Freeway Loop-Sensor Information	Bus Locations and Schedules	Time and Date, Personal Paging and General Information Messages
Seiko MessageWatch	Yes	--	--	--	--	Yes
Delco In-vehicle Navigation Device	Yes	Yes	Yes	--	--	Yes
SWIFT Portable Computer	Yes	--	Yes	Yes	Yes	Yes

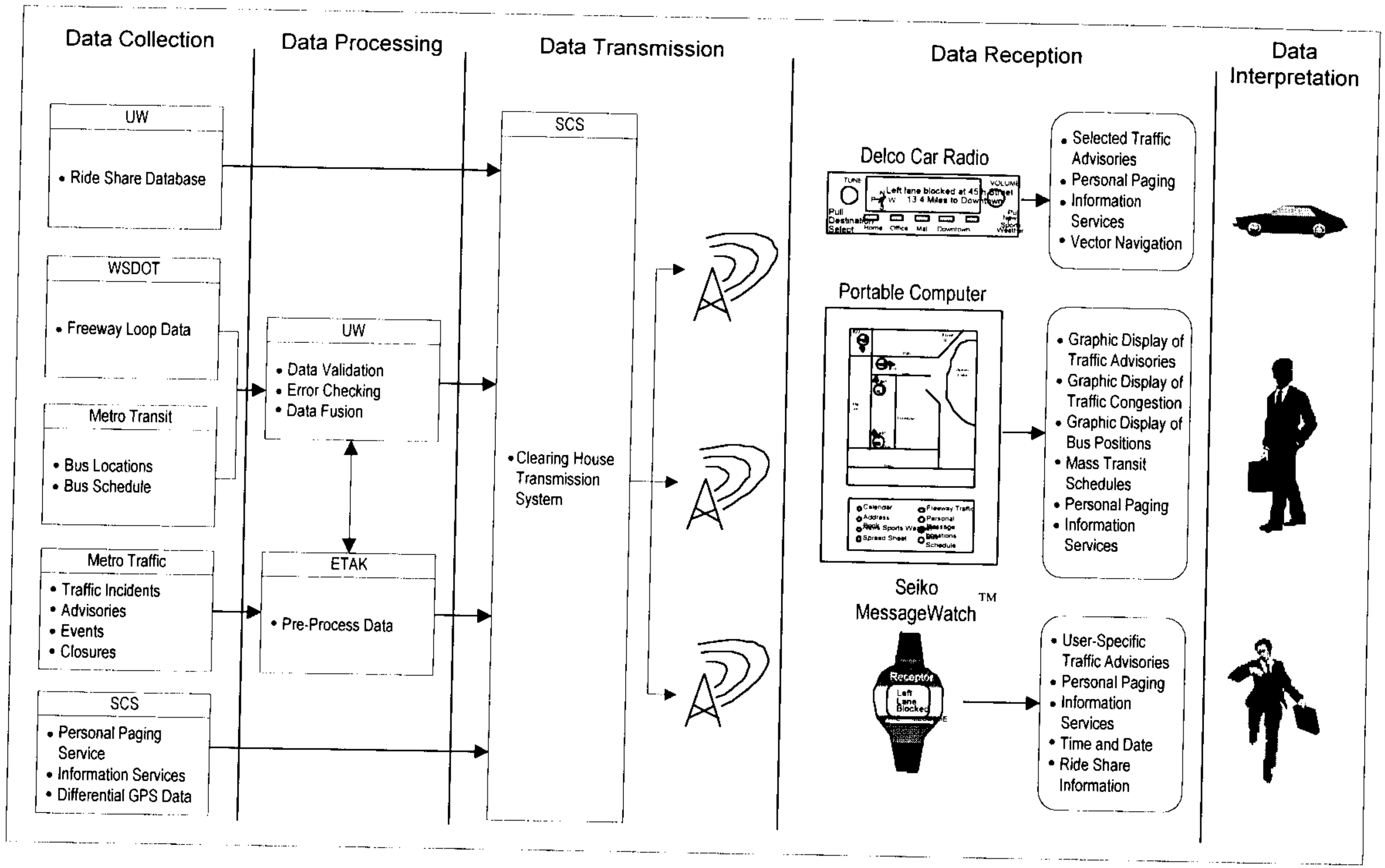

Figure 1-1. SWIFT System Description.

1.2.1. Generation

Table 1-2 provides a listing of the information that was provided to SWIFT FOT participants. This information was generated by Metro Traffic Control, Etak, Delco, WSDOT, Metro Transit and Seiko.

Table 1-2. SWIFT Data Generation.

Data Generator	Data Generated
Metro Traffic Control, Inc.	Traffic Incidents, Advisories, Scheduled Events and Road Closures
Delco and Etak	Route Guidance
Etak	Traveler-Service Information
WSDOT	Freeway Loop-Sensor Information
Metro Transit	Bus Locations and Schedules
Seiko Communications Systems, Inc.	Time and Date, Personal Paging and General Information Messages

Traffic Incidents, Advisories, Scheduled Events and Closures

This information was generated by Metro Traffic Control personnel who routinely compiled incident information for use in traffic reports delivered to several Seattle-area radio stations. Information, consistent with the International Traveler Information Interchange Standard (ITIS), was entered into a Traffic Work Station (TWS) developed by Etak, Inc. The TWS located the incident and the operator added descriptive information about the incident, such as "truck overturned" or "right lane closed." The TWS then formatted the message for transmission and forwarded it to Seiko.

Route Guidance

As part of the in-vehicle device they developed for the SWIFT project, Delco supplied a route-guidance system that assisted local drivers by providing a directional pointer to pre-selected destinations. This system incorporated a Global Positioning System (GPS) antenna that was placed on the roof of the SWIFT FOT participant's vehicles that participated in this portion of the test, and was tied into a Geographic Information System (GIS) that Etak supplied. Users would select destinations from an "Etak Guide" which contained the latter's geographic coordinates. Users could also enter latitude/longitude coordinates as destinations, save the current positions of their vehicles as destinations and select to receive Estimated Time of Arrival (ETA) information based upon the current speed of their vehicles. The route guidance provided by the directional pointer was static— no turn-by-turn directions were provided, only a vector arrow pointing in the direction the driver needed to go to reach the destination.

Traveler-Service Information

As indicated, the in-vehicle device for SWIFT provided traveler-service information (i.e., Etak Guide) to its users. This same information was also presented as a "Yellow Pages" directory on the SWIFT portable computers. Users could select the name of local-area businesses or organization by category (e.g., service stations, restaurants, colleges and universities, tourist destinations, etc.) and receive a display of the appropriate address and telephone number in order to guide their travel. Portable computer users could also select to have the locations of their selections presented on the map of Seattle that accompanied the SWIFT application.

Freeway Loop-Sensor Information

Traffic congestion information was derived from the existing WSDOT freeway management system in Seattle. Vehicles were detected with a network of 2,200 standard traffic loops, and UW used the loop information to estimate speeds, which were then expressed as a percentage of the posted speed limit. The speed information was compared to freeway bus speeds to detect any errors. Congestion information was then packaged into a format that could be directly transmitted and sent to Seiko via the Internet.

Bus Locations and Schedules

Bus location and schedule information was provided by King County Metro Transit. Their Automatic Vehicle Location (AVL) system uses small roadside transmitters, wheel (distance) sensors and pattern matching to locate buses in the system. Each location was updated about once every minute and a half. Raw data from Metro Transit's system were sent to UW, where each coach location was converted into latitude and longitude. The UW then generated all of the information including the route and trip number into a format ready for transmission, which was sent to Seiko via the Internet. The SWIFT project included all the fixed routes that Metro Transit operates, or up to 900 buses during peak periods.

Time and Date, Personal Paging and General Information Messages

All SWIFT devices also received and displayed information services currently available to Seiko MessageWatch customers. These included time and date, weather reports, financial-market summaries, sports scores, ski reports and lotto numbers. All SWIFT devices could also function as a personal pager.

1.2.2. Processing

Data generated by WSDOT, Metro Transit, and UW were collated at UW, where it was validated, converted, corrected and fused. Once these activities had taken place, the data were processed into standardized data packets in order to facilitate ultimate transmission over the HSDS. Information provided by Metro Traffic Control was preprocessed on the TWS. All data from UW and Metro Traffic Control were transmitted to Seiko via the Internet.

1.2.3. Transmission

SWIFT data transmission involved sending the processed data to Seiko which formatted the data packets for transmission over the HSDS transmission network. Once formatted by Seiko, the data were transmitted over an FM subcarrier at a rate of 19,000 bytes per second (19 Kbps). In order to increase the certainty of reception by Seiko MessageWatches, double-level error correction and multiple transmissions were used. Otherwise, asynchronous (or broadcast) message sent to the Delco in-vehicle navigation device and the portable computers were sent only once.

Seiko High Speed Data System

The SWIFT project was based upon the HSDS that is currently used to deliver paging and information services to Seiko MessageWatch customers. The HSDS signal is added to standard FM broadcast transmissions in the form of digital data modulated at a frequency 66.5 khz higher than the standard, or "nominal," FM audio signal. No portion of an FM signal, audio or otherwise, is broadcast below the nominal frequency. FM radio signals are usually broadcast in three frequency groups between the nominal frequency and 55 khz above this frequency. Thus, the SWIFT HSDS signal was presented at a frequency that did not interfere with nominal, or standard FM audio, transmissions.

SWIFT HSDS receivers were "frequency agile," which means they could receive messages from any HSDS-equipped FM station. Seven Seattle-area radio stations transmitted the HSDS protocol to SWIFT devices. Consequently, information was sent from all stations in the area which nearly guaranteed reception of important paging messages.

SWIFT information was transmitted three times (once every 1.87 minutes) from each station for the Seiko MessageWatch. Otherwise, for the portable computers and Delco in-vehicle navigation device, congestion information was transmitted every 20 seconds, incident information every 30 seconds and bus information every 90 seconds. This feature of the Seiko HSDS provided information redundancy which further ensured that SWIFT FOT participants were receiving the most current information provided by their receiving device.

SWIFT Message Formats

All SWIFT information was encoded into a version of the International Traveler Information System (ITIS) message-formatting convention. The North American version of ITIS, which was developed by the Enterprise group, is based on message formats used by the European Radio Broadcast Data System (RBDS). The ITIS codes conserve bandwidth by sending incident and congestion information in a compact form. Some customization of the ITIS formats was necessary for SWIFT in order to adjust for HSDS packet size, which is longer than the RBDS packet. Message formats were also developed to send the SWIFT bus location and speed/congestion data, which are not available in the RBDS.

SWIFT traffic-incident information received by the Delco in-vehicle navigation device was integrated with Global Position System (GPS) location and time/date information received by the same device. The latter capability provided the incident-direction/distance information and the current time of day information presented by the Delco in-vehicle navigation device.

Information transmitted to the three receiving devices used in the SWIFT project is presented below:

- Seiko MessageWatch— incident type/direction, roadway affected and closest intersection. Example: A level 3 incident (i.e., accident) on Southbound I-5 is located near the Mercer intersection.
- Delco In-vehicle Navigation Device— incident type/direction, description, roadway/intersection affected, duration and vehicle-reference (in miles) description. Example: An accident blocking the two outside lanes of Northbound I-5, expected to last for the next 15 minutes, is located 16 miles to the Northwest.
- SWIFT Portable Computer— icon display/text description (including incident type, roadway affected, direction, closest intersection, backup and duration) of incidents, icon display of real-time bus position, timepoint schedule information, icon display of speed information (i.e., closed, 0-19, 20-34, 35-49, 50+ and no data) and speed icon location description. Example: Vehicles are traveling at 50% of normal speed at the Mercer speed sensor.

1.2.4. Reception

Three types of HSDS-capable receiver devices, each developed and manufactured by private entities through consultation with their SWIFT team members, provided SWIFT FOT participants with incident information, traffic speed/congestion information, bus information, informational messages (e.g., forecast weather, sports scores, stock-market information) and personal pages, depending upon the device. The devices were:

- Seiko MessageWatch
- Delco In-Vehicle Navigation Device
- SWIFT Portable Computer

Figures 1-2, 1-3 and 1-4 show examples of the three receiving devices used for SWIFT. Operational features of each of these devices are described in the following sections.

Seiko MessageWatch

These devices are commercially available and widely used in the Seattle area to deliver personal-paging services and "information service" messages. Current information-service messages include weather forecasts, financial market summaries, local sports scores and winning lotto numbers. SWIFT traffic messages were featured as an added information service.

SWIFT test participants who used the Seiko MessageWatch supplied information to the Evaluator about the usual routes, directions, days and times of the day they traveled. Traffic messages indicating the location and severity of traffic problems that the user might encounter were sent based on the resulting travel profile. Because the Seiko MessageWatch stored eight messages, only traffic problems that resulted in substantial delays were sent.

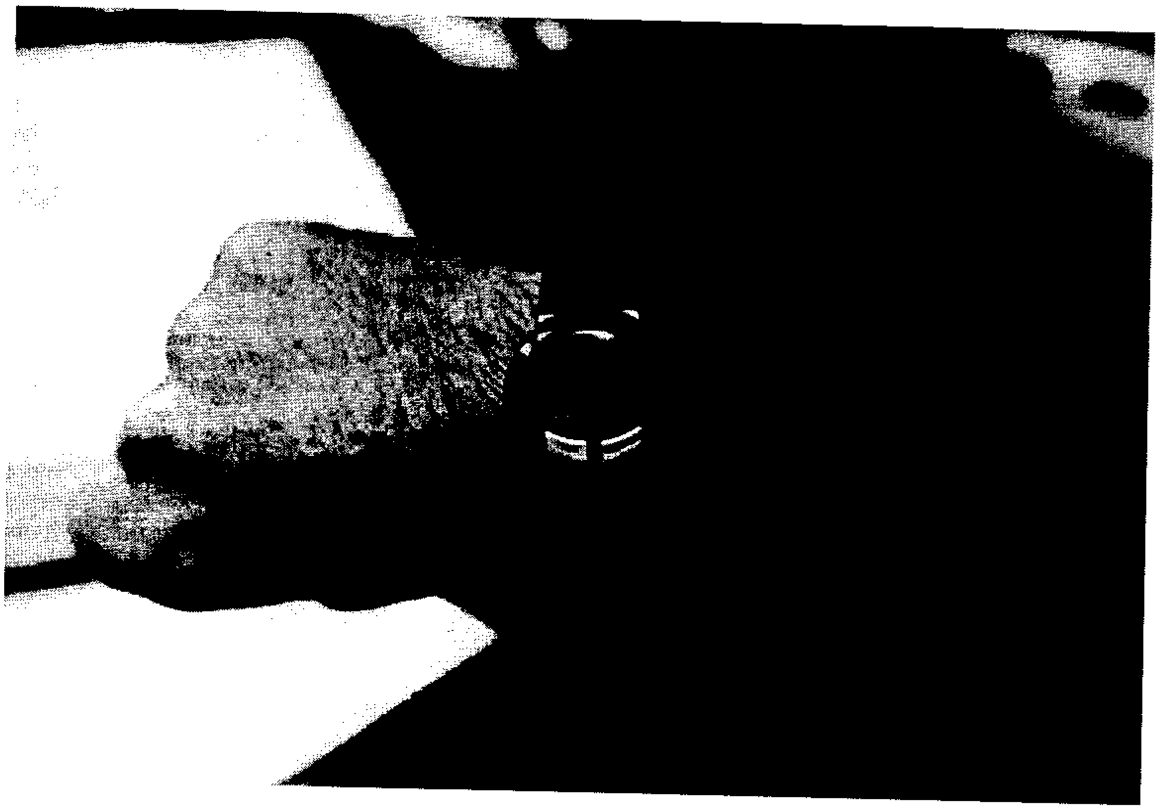

Figure 1-2. Seiko MessageWatch.

Delco In-Vehicle Navigation Device

This device incorporated a route-guidance component, GIS, GPS receiver and the speakers of a radio/compact disc player to present real-time traffic information to users. The whole package was placed into one of four vehicle types: 1995 or newer Buick Regals, Oldsmobile Cutlass Supremes and Saturns, and GMC Rally Vans.

The Delco device included the capability to select destinations from a "Yellow Pages" directory of local landmarks, hotels, restaurants, businesses and street corners selected by the user. The GPS provided the current location of the vehicle and a directional display associated with the route guidance system indicated the direction (relative to the vehicle) and distance to the selected destination. The stereo speakers were used to announce received messages.

Real-time traffic-incident information was transmitted over the Seiko HSDS. The HSDS receiver was built into the Delco in-vehicle navigation unit filtered out any messages that were outside a pre-defined distance (e.g., 20 miles) from the current location of the vehicle. The navigation unit also decoded upon demand the SWIFT traffic messages from text into a "voice" that provided incident details to the driver. Although messages were retransmitted every minute, only new or modified messages were announced to the driver.

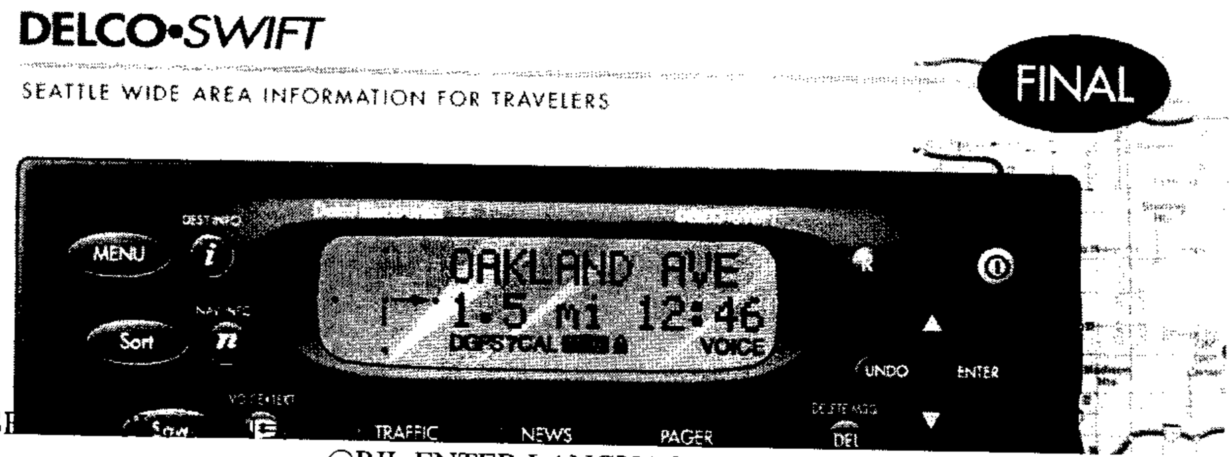

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Figure 1-3. Delco In-vehicle Navigation Device.

SWIFT Portable Computer

The SWIFT project primarily used IBM Thinkpad and Toshiba Satellite portable computers. Some Dauphin sub-notebook computers were distributed before they were discontinued due to negative user feedback. The Thinkpads were 486 machines, used Windows 3.1, had a built-in, "butterfly" keyboard and presented information on an active matrix, SVGA color display. The Satellites were Pentium 100 machines, used Windows 95 and also presented information on SVGA color displays.

A separate HSDS receiver unit, or Radio Receiving Module (RRM), was attached to the SWIFT portable computer's serial port. This unit had approximately the same footprint as the portable computer and was often attached to the portable computer via Velcro tape. Primary SWIFT information presented on the portable computer included real-time traffic incident, speed/congestion and bus-location information.

All of the traveler information for SWIFT portable computers was displayed using Etak GIS software to show the location of each piece of data. The software allowed the user to select the type(s) of information (i.e., traffic incident, speed/congestion or transit-vehicle location) to be displayed on a map of Seattle. A "Yellow Pages" directory was also installed and linked to the GIS software to show the location of a selected business or point of interest. SWIFT portable computers also offered transit schedule information from static database tables inside the computer.

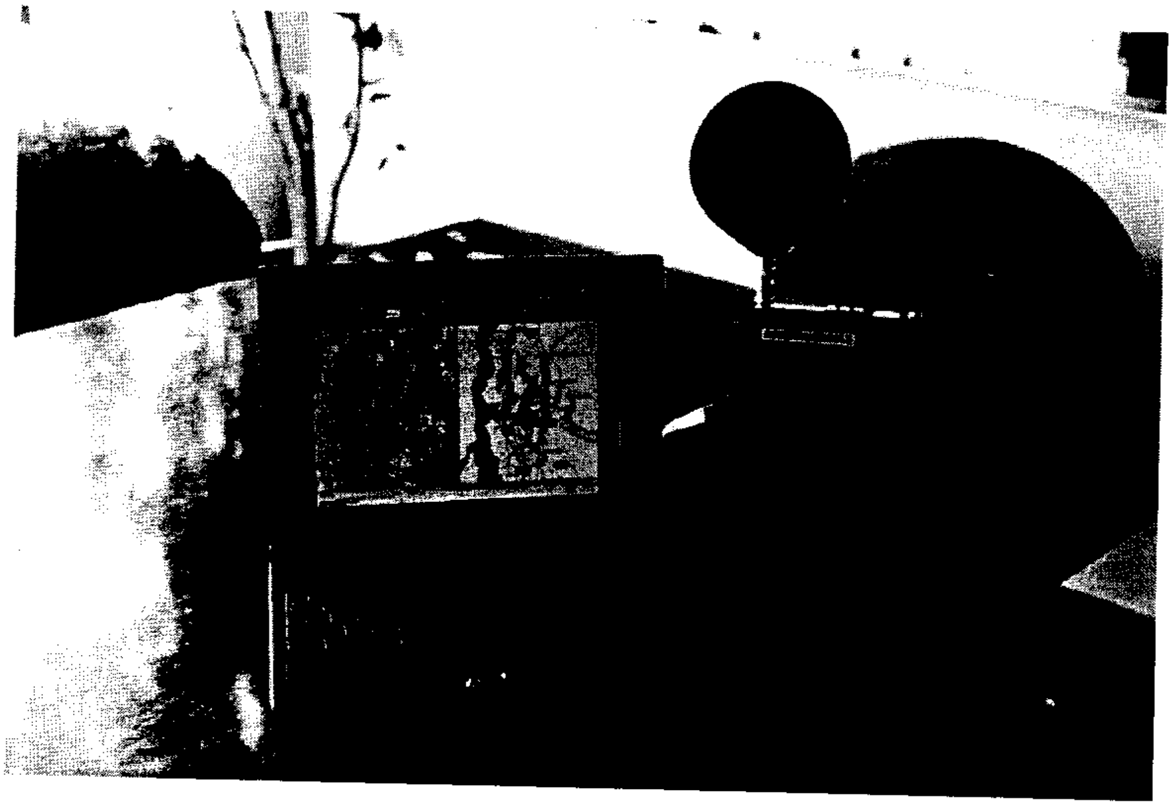

Figure 1-4. SWIFT Portable Computer and RRM.

1.2.5. Data Interpretation

The data interpretation portion of the SWIFT system involved hypothesized processes that affected how users were able to interact with the system. Among those user perceptions that were addressed were the following:

- Data Reception— whether SWIFT information was received
- Data Timeliness— whether SWIFT information was received in a timely fashion
- Data Reliability— whether SWIFT information was regularly received
- Data Display— whether SWIFT information was displayed appropriately
- Data Fidelity— whether SWIFT information was accurate
- Data Validity— whether SWIFT information affected travel behavior.

1.3. SWIFT Field Operational Test Evaluation

Once the SWIFT system was completed, an FOT was conducted with 690 users who were recruited from the community in order to assess the system. With the majority of the SWIFT system completed by June 30, 1996, the SWIFT FOT evaluation was conducted for fifteen (15) months from July 1, 1996 through September 20, 1997. The goals of the SWIFT FOT evaluation, listed in order of priority, were to evaluate:

1. Consumer Acceptance, Willingness to Pay and Potential Impact on the Transportation System – determine user perceptions of the usefulness of the SWIFT receiving devices, how much consumers would be willing to pay for such devices and services and assess how SWIFT-induced changes in users' driving behavior might impact the Seattle transportation network if the SWIFT system was fully deployed.
2. *Effectiveness of the HSDS Transmission Network* – determine how well the SWIFT HSDS communications system functions.
3. *Performance of the System Architecture* – determine how well the various SWIFT components work singularly and together.
4. *Institutional Issues That Affected the Operational Test* – identify how institutional factors associated with the SWIFT public-private partnership affected the FOT, with emphasis on implications for deployment.
5. *Deployment Costs* – estimate how much money it would take to deploy and maintain a SWIFT-like system.

Five evaluation studies were conducted as part of the SWIFT FOT evaluation. These studies paralleled the five SWIFT FOT evaluation goals and were implemented at various times during the 15-month test. Table 1-3 provides a summary of SWIFT evaluation information.

As part of the conduct of the SWIFT FOT evaluation, the Evaluator was responsible for user recruitment. This involved the recruitment of approximately 1,200 individuals before selection of the 690 FOT participants was made. The final breakout of SWIFT participants is shown in Table 1-4.

Table 1-3. SWIFT Evaluation Information.

Study/ Activity	Study Leader	Test Plan Completion Date	Primary Data Collection Periods	Primary Data Collection Methods	Final Report Completion
Consumer Acceptance	Jeff Trombly	August 19, 1997	Spring, Summer and Fall, 1997	Questionnaires, Telephone Surveys, Focus Groups	March 31, 1998
Communications	Jim Murphy	August 19, 1997	Fall, 1997	Field Tests	June 29, 1998
Architecture	Hesham Rakha	August 19, 1997	Spring, 1997	Data logging and Field Tests	March 31, 1998
Deployment Cost	Mark Jensen	August 19, 1997	Summer, 1997	Data Collection	March 31, 1998
Institutional Issues	Bruce Wetherby, Principal Investigator	August 19, 1997	Spring and Fall, 1997	Questionnaires and Semi-structured Interviews	March 31, 1998

Table 1-4. SWIFT Participant Breakout.

Device/Condition	Existing	New	Metro Transit Van Pool	Total
Seiko MessageWatch	50	470	--	520
Delco In-vehicle Navigation Device	--	65	25	90
Portable Computer	--	80	--	80
Total	50	615	25	690

Selection criteria for each category of SWIFT user varied, primarily depending upon the assumed operational requirements for each device type. As a result, two types of Seiko MessageWatch users (i.e., existing [i.e., those who owned their own watches] and new [i.e., those who were given a Seiko MessageWatch for the first time]) and two types of Delco in-vehicle navigation device users (i.e., new [i.e., SOV commuters] and Metro Transit Van Pool [i.e., HOV commuters]) were recruited. The majority of the eighty (80) SWIFT portable computer users were bus riders with mode-choice options.

The SWIFT FOT Evaluator was also responsible for the following activities:

- Device configuration/software installation
- Device distribution/installation scheduling
- Training/instruction on device usage
- Travel profile entry/maintenance
- SWIFT Help Desk
- User problem analysis/feedback to team members
- Device collection/de-installation
- SWIFT newsletter (writing, publication and mailing; WSDOT responsible for editing and breadboarding).

1.4. Purpose of SWIFT Institutional Issues Study

The purpose of the *SWIFT Institutional Issues Study* was to document the institutional issues encountered during the implementation of the SWIFT FOT, as measured by responses of team-member representatives to questionnaires and semi-structured interviews, and to assess the impact of these issues upon actual (i.e., future) system deployment. A secondary purpose was to document the history of the SWIFT project.

1.5. Objectives

The objectives of the *SWIFT Institutional Issues Study* were to:

- Identify those institutional issues encountered during deployment
- Identify institutional issues relative to the SWIFT public-private partnership
- Document policy, jurisdiction issues and other external factors or issues
- Document project and its history

For the purposes of this presentation, the first three objectives are considered identical in that all issues identified for the SWIFT FOT were believed to have relevance to the future deployment of the system. Information that was collected to support the documentation of SWIFT institutional issues included:

- Institutions affected
- Description of issue
- Where in project life cycle problem occurred
- Description of how issue affected the overall project
- Indication as to whether obstacle was overcome, and how
- Lessons learned

Information that was collected to support a description of the of the history of the SWIFT project included the following:

- Description of project
- Major ITS functional components and technologies tested
- Project sponsors, participants and champions
- Project agreements
- Project funding
- Internal evaluation process

2. METHODOLOGY

Two methods were used to conduct the SWIFT institutional issues evaluation: questionnaires and semi-structured interviews. Fourteen (14) SWIFT team-member representatives were selected through consultation with WSDOT's SWIFT Project Manager to provide questionnaire comments and to participate in the semi-structured interviews.

Implementation of SWIFT institutional issues questionnaires and semi-structured interviews occurred at two different times during the FOT: Spring of 1997, after all SWIFT devices had been distributed and the test was operational for nine months, and Fall, 1997 after the SWIFT FOT had been completed. In both instances, the SWIFT questionnaire was faxed to the team-member representatives and conduct of the semi-structured interviews did not occur until the questionnaires were returned. Interviews were either conducted in person or via telephone.

For the 1st SWIFT Institutional Issues Questionnaire, which took approximately 45 minutes to complete, SWIFT team-member representatives were presented with a list of commonly found ITS institutional issues and asked to score which issues actually affected deployment of the SWIFT system. Other issues, beyond those listed in the survey instrument, were also solicited, as were responses to a series of background-information questions. For the 2nd SWIFT Institutional Issues Questionnaire, which took approximately 15 minutes to complete, respondents were asked if they were interested in adding any issues to those previously identified and/or whether they'd like to change the level of emphasis placed on previously-identified issues. They were also asked some additional questions related to the conditions under which the SWIFT FOT was conducted.

Semi-structured interviews were conducted by the *SWIFT Institutional Issues Study* Task Leader, or the SWIFT Principal Investigator. SWIFT team-member representatives were asked during the 1st SWIFT Institutional Issues Questionnaire to provide details on up to five (5) institutional issues that affected deployment of the SWIFT system and to describe any lessons learned. They were also asked some additional background questions. For the 2nd SWIFT Institutional Issues Questionnaire, respondents were also asked to explain any additions or changes of emphasis that they provided, and to answer some summary questions about the SWIFT project. Interviews after the 1st SWIFT Institutional Issues Questionnaire took approximately one and a half hours to complete, while those after the 2nd Institutional Issues Questionnaire took approximately thirty minutes.

SWIFT institutional issues were pre-classified into the following categories:

- Organizational/jurisdictional
- Human resource
- Public acceptance
- Regulatory/legal
- Financial
- Other

Table 2-1 shows the issues checklist that was used as part of the 1st *SWIFT Institutional Issues Study* Questionnaire.

Table 2-1. *SWIFT Institutional Issues Study* Checklist.

Specific types of issues can pose problems/difficulties to your project as well as other ITS projects. Of the types of issues listed below, please determine which issues have emerged on your project. For those issues that are applicable, please rate each one on the degree of severity each has (or had) affected the project.	**DEGREE OF ISSUE SEVERITY** **NA = Not Encountered** **1 = Encountered, but Not Severe** **2 = Slightly Severe, An Irritant** **3 = Moderately Severe, Hinders Progress** **4 = Very Severe, Impedes Progress** **5 = Could Stop the Project**
ISSUE TYPE	
1. ORGANIZATIONAL/JURISDICTIONAL	
Intra-agency	
Inter-agency	
Public/Private Partnerships	
Management	
Culture Differences	
Upper Management "Buy-in"	
Role Clarity	
Responsibilities	
Goals	
2. HUMAN RESOURCE	
Administrative Burden	
Education/Staffing/Training	
Labor	
3. PUBLIC ACCEPTANCE	
User Perception and Acceptance	
Societal Equity	
Environmental Concerns	
Privacy Issues	

Table 2-1. *SWIFT Institutional Issues Study* Checklist (Continued).

--CONTINUED-- Specific types of issues can pose problems/difficulties to your project as well as other ITS projects. Of the types of issues listed below, please determine which issues have emerged on your project. For those issues that are applicable, please rate each one on the degree of severity each has (or had) affected the project.	**DEGREE OF ISSUE SEVERITY** NA = Not Encountered; 1 = Encountered, but Not Severe; 2 = Slightly Severe, An Irritant; 3 = Moderately Severe, Hinders Progress; 4 = Very Severe, Impedes Progress; 5 = Could Stop the Project
ISSUE TYPE	
4. *REGULATORY/LEGAL*	
Anti-trust	
Patent Rights	
Standards/Protocols	
5. *FINANCIAL*	
Liability/Insurance	
Procurement/Acquisition	
Benefits	
Profits	
Market Uncertainty	
R&D to Deployment Strategy	
Cost-sharing	
Contracting and Auditing	
6. *OTHER ISSUE* (please specify)	

3. RESULTS

Results of the *SWIFT Institutional Issues Study* evaluation are presented in the following sections:

- History of SWIFT project
  - --Teaming Agreement
  - --Project Description
  - --Methods Used to Promote Institutional Cooperation
  - --FOT Milestones
- Institutional Issues Encountered
- Lessons Learned
- Other Findings

3.1. History of SWIFT Project

Information documenting the history of the SWIFT project is presented in the following sections. This includes information describing the construction of the SWIFT teaming agreement, a detailed project description, methods used to promote institutional cooperation and FOT milestones.

3.1.1. SWIFT Teaming Agreement

The idea for SWIFT started in 1993 when Ed Fischer, FHWA Region 10 ITS Specialist, asked Mike Park, Director of Business Development at Seiko Communications Corporation (Seiko), whether Seiko would potentially be interested in using its communications system to deliver traveler information to commuters. After explaining the FHWA's ITS Field Operational Test (FOT) program and the public-private sponsorship of the program to Seiko and receiving an expression of interest from Mike, a meeting with the Pete Briglia of WSDOT was arranged because WSDOT had the most extensive traffic data-gathering system available in the Pacific Northwest and WSDOT was interested in potentially participating in FHWA's ITS FOT program. After meeting with Pete Briglia, there was a general consensus that Seiko's HSDS provided an excellent and inexpensive means for disseminating traveler information to a wide audience. Thus, the SWIFT team was born with an agreement by Seiko and WSDOT.

The next step in developing SWIFT was to create a larger team. Basically, this involved finding companies or organizations that were either sources of information of interest to travelers, manufacturers of likely end-user devices, or companies capable of configuring the software needed for the project. Because it was providing the basic communications architecture for the project, Seiko took the lead on finding additional SWIFT partners. This involved making presentations around the country to potential team members and soliciting the degree of their interest in the project. From these contacts during the Fall of 1993, IBM, Delco, and Etak (hardware/software manufactures) and Metro Traffic Control, King County Metro Transit and the University of Washington (data sources) were added to the team. The University of Washington was an automatic selection because it had already been monitoring and using the speed, or loop-detector, information being collected for Seattle-area freeways by WSDOT for research purposes and thus was in a natural position to collect and fuse some of the additional information needed for SWIFT (e.g., bus-position data provided by King County).

With the SWIFT team assembled by December of 1993, the next steps involved selecting a project evaluator and writing the proposal to the FHWA requesting FOT funds. Regarding the evaluation, SAIC was selected over SRI after a presentation was made to the SWIFT team members at Seiko's offices in Portland, OR. A primary selection criterion was SAIC's willingness to recruit the operational test participants and maintain a Help Desk that would assist in providing feedback to the SWIFT team members. In addition, under Seiko's direction, the proposal for FOT funds was written by the law firm of Paul, Weiss, Rifkind, Wharton and Garrison and was completed and submitted on January 6, 1994. According to the team members involved, the SWIFT team submitted the least expensive project proposal as possible with a 7.4 million dollar bid. On April 6, 1994, the SWIFT team members received notification that the project had been approved by the FHWA.

After the SWIFT project's selection as an FHWA FOT, the next steps involved the development of an MOU (October 10, 1994) and the signing of a SWIFT teaming agreement (January 10, 1995). These activities specified the work responsibilities of each party, the operational structure of the project, the funding components of the project, intellectual property rights and the liability, warranty and indemnification provisions for the project, among other things. Basically, the SWIFT teaming agreement was not a binding contract, but an agreement in principal to build the SWIFT system. At any point in time, a SWIFT team member could withdraw from the project for whatever reason. Thus, the name "teaming agreement" as opposed to "partnership" or "consortium," the latter terms specifying, connoting or implying a binding or accountable relationship, was used for SWIFT because the participants preferred this nomenclature. The SWIFT teaming agreement was signed on January 10, 1995, but did not include UW which was under a separate contract with WSDOT to support the SWIFT project.

While the SWIFT teaming agreement was being developed, necessary work to conduct the FOT proceeded. Two early activities in this regard included the development of detailed system specifications and the construction of an evaluation plan. SWIFT system specifications were developed in the Fall of 1994 and the Spring of 1995 by engineers associated with each of the components of the SWIFT system architecture. In brief, the SWIFT system architecture included data collection, data processing, data transmission, data reception and data interpretation components, and each of the SWIFT team members were responsible for constructing the system specifications associated with their particular involvement. Specification areas, in particular, that required close collaboration among team members were:

- Data processing, validation, conversion, correction and fusion at UW
- RRM manufacture for each device
- Construction of the TWS
- Field testing

- Data transmission methods and protocols, Message formats and protocols, Mapping of data to GIS.

The *SWIFT Evaluation Plan* was drafted in October, 1994 after the SWIFT team members met to determine and prioritize the evaluation goals and objectives of the FOT. The final version of the *SWIFT Evaluation Plan* was completed on March 17, 1995.

3.1.2. SWIFT Project Description

Table 3-1 provides a summary of significant SWIFT project information.

Table 3-1. SWIFT Project Description Summary.

Information/Type	Description
Background Information	
Geographic Location	Seattle, WA area from Tacoma to Everett
Duration of Project	July '93 through July '98 (6 years)
Duration of FOT	July 1, 1996 through September 20, 1997 (approx. 15 months)
Project Scope	Test efficacy of FM Subcarrier to provide three types of traveler information (i.e., incident, bus and speed/congestion) to Seattle-area travelers
Geographic Scope	SWIFT Communications coverage ranged from parts of Olympia, WA in the South to just North of Everett, while East-West coverage extended approximately 25 miles in either direction from Seattle. The Cities of Bellevue, Everett, Seattle and Tacoma, WA were centrally involved, while large portions of Pierce, Snohomish and Kitsap Counties were peripherally involved.
Jurisdictions Involved	King County State of Washington FHWA Region 10
Project History	Proposal submitted on January 6, 1994 and approved on April 6, 1994. SWIFT MOU (October 18, 1994) and formal teaming agreement signed on January 10, 1995 after project funded by FHWA. Development and testing occurred from 1995 through 1996. FOT conducted from July, 1996 to September, 1997 with corresponding evaluation. Evaluation reports completed in Summer of 1998.
Project Category	Intelligent Transportation System (ITS), or the application of Information Technology (IT) to provide transportation solutions.

Table 3-1. SWIFT Project Description Summary (Continued).

Information/Type	Description
Project Goals and Objectives	From SWIFT Teaming Agreement (1994): 1. Use existing infrastructure to reduce project risk 2. Provide affordable, easy-to-use traveler information services 3. Support intermodalism by providing incident and transit information 4. Demonstrate public/private cooperation 5. Develop in-vehicle navigation device and portable computer software 6. Test efficacy of HSDS 7. Determine optimal operating parameters 8. Conduct evaluation
Start-Up History	See Section 3.1.1
Project Milestones	See Section 3.1.4
Current Status	Completed, but three private team members (i.e., Seiko, Etak and Metro Traffic Control) have signed agreement to provide SWIFT-like traveler information to Puget Sound area travelers starting in the Summer of 1998. SWIFT field operational test participants were allowed to keep their Seiko MessageWatches if they signed up for the new service.
Sponsoring DOT Agency	Washington State Department of Transportation (WSDOT)
WSDOT Managers	Project: Larry Senn (Seattle) Advanced Technology Branch: Pete Briglia (Seattle) Traffic Operations: Dave Peach (Olympia) Field Operations Support Services Center: John Conrad (Olympia)
FHWA Representatives	Mike Morrow, FHWA Olympia Division (Olympia, WA) Ed Fischer, FHWA Region 10 ITS Specialist (Portland, OR) Dan Schierer, FHWA Hdqtrs. Region 10 Liaison (McLean, VA)
Major Functional Components	
ITS Functional Area	Advanced Traveler Information System (ATIS)
ITS America Operational Goals Met	1. Provide up-to-the minute travel information 2. Provide real-time freeway monitoring 3. Improve safety by rapid detection of incidents 4. Manage AVL transit systems (i.e., integration with ATIS)

Table 3-1. **SWIFT Project Description Summary (Continued).**

Information/Type	Description
Technologies Tested	HSDS Internet AVL TWS Speed Induction Loops PCDs --Portable computers --Watch pagers In-vehicle navigation device
Services Provided	Real-time Incident, Speed/Congestion, Bus Position, Traveler-service, Paging, and General Information Messages
Products Tested	Seiko MessageWatch, Delco In-vehicle Navigation Device, IBM Thinkpad portable computer, Toshiba Satellite portable computer, Dauphin sub-notebook computer
Expected Target Markets	Commuters with route/mode-choice options, bus users, HOV users (i.e., car- and van-pool) and work-related travelers
Project Team Members	
Public	FHWA - Region 10, Portland, OR WSDOT – Advanced Technology Branch, Seattle, WA University of Washington, Seattle, WA King County Department of Transportation, Seattle, WA
Private	Delco Electronics, Kokomo, ID Etak, Menlo Park, CA IBM, White Plains, New York Metro Traffic Control, Seattle, WA Seiko Communications, Hillsboro, OR
Project Evaluator	Science Applications International Corporation (SAIC), Bellevue, WA
Major SWIFT Documentation/ Agreements	
FHWA Proposal	January 6, 1994
SWIFT MOU	October 18, 1994
Evaluation Plan	Draft: October 31, 1994 Final: March 17, 1995
SWIFT Teaming Agreement	January 10, 1995
Detailed Evaluation Test Plans	Draft: October, 1995 Final: August, 1997
Evaluation Final Reports	Draft: March, 1998 Final: October, 1998

Table 3-1. SWIFT Project Description Summary (Continued).

Information/Type	Description
Project Funding	
Total Cost	$7,489,040
Expenditures	Public (includes WSDOT, King County and University of Washington): $1,328,640 Private (includes Delco, IBM, ETAK, Metro Traffic Control and Seiko): $5,013,400 Evaluation (SAIC): $1,147,000 TOTAL: $7,489,040
Contributions by Source	Public (includes WSDOT, King County and University of Washington): $1,050,000 Private (includes Seiko, IBM, ETAK, Metro Traffic Control): $1,837,500 Federal Highway Administration: $4,601,540 TOTAL: $7,489,040
Funding Mechanisms	Federal Contribution (61%) Private Contribution (25%) Public Contribution (14%)
Internal Evaluation Process	
Success Criteria	If SWIFT used by FOT participants and impacts their travel behavior
Bench Marking	Hardware: Seiko and Delco Software: Seiko, Delco, Etak, IBM, University of Washington
Field Testing	By all team members, SAIC and UW, Spring 1996
Public Acceptance Concerns	Usability of information
Marketability:	Good
Significant Milestones	
Firsts	1st ITS FOT to use FM subcarrier 1st ITS FOT to provide real-time bus information 1st ATIS FOT to spawn commercial service
Media Coverage	Five (5) television stories, three (3) magazine articles and two (2) newspaper stories

3.1.3. Methods Used to Promote Institutional Cooperation

Four activities were frequently cited by SWIFT team members as the primary methods of promoting institutional cooperation. These were the SWIFT teaming agreement, SWIFT committees, SWIFT teleconferences and the SWIFT newsletter. Each of these is described in the following sections.

SWIFT Teaming Agreement

The SWIFT teaming agreement was designed to provide a voluntary, cooperative working arrangement among all the organizations involved. No entity, for instance, was legally sub-contracted to another, but instead held an "independent contracting" relationship (i.e., could withdraw from the project at any time) with each of the participating organizations. As such, the SWIFT teaming agreement was the primary method used to promote institutional cooperation—all the organizations involved felt as though they were engaged in helping to develop something new, but yet did not feel that they were unduly burdened or obligated to an unacceptable level of financial risk.

Given the loose organizational configuration of the SWIFT teaming agreement, a diagram of this entity is hard to depict. Nonetheless, Figure 3-1 shows the authoritative and communicative structure of the SWIFT teaming agreement, while Table 3-2 provides a narrative description of the responsibilities of each member. Seiko, as the lead private-sector partner, was designated to serve as the primary liaison with WSDOT. Their responsibilities included the coordination of SWIFT teleconferences, preparation of monthly status reports, working with each of the team members to delineate their contractual responsibilities and gathering of all SWIFT team-member invoices on a quarterly basis for submittal to WSDOT for payment. UW had a separate, traditional contractual relationship with WSDOT to perform its services, while SAIC held a similar contract in its role as the independent evaluator. Finally, WSOT, itself, reported to the FHWA because public (i.e., Federal and State) funds for the SWIFT project were funneled through WSDOT to the SWIFT team members.

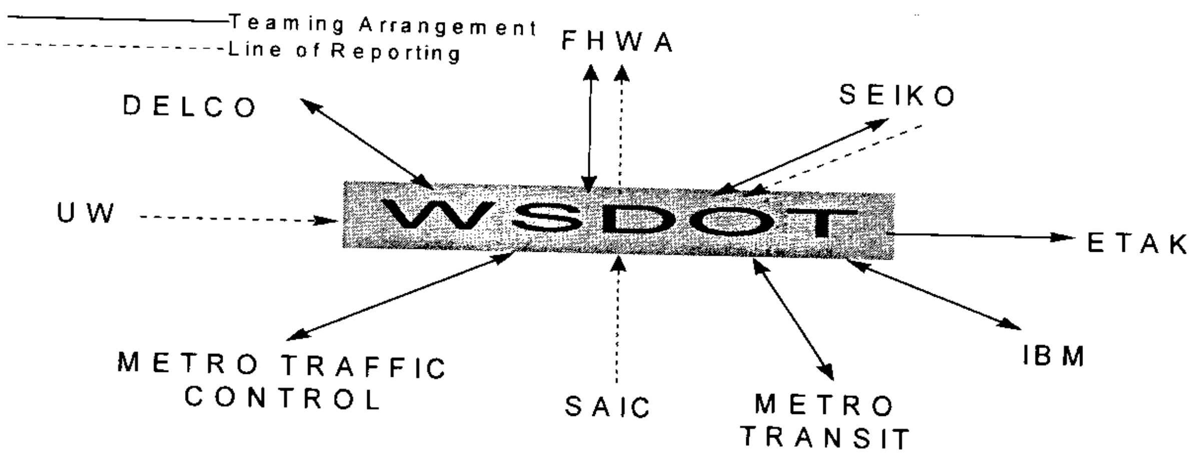

Figure 3-1. SWIFT Teaming Agreement.

Table 3-2. SWIFT Participant Responsibilities.

Participant	Responsibilities
WSDOT	Washington State Department of Transportation, public Team Member responsible for directing State of Washington's involvement with SWIFT project and for conducting the SWIFT FOT under the auspices of the Executive Branch of the State Government
FHA	Federal Highway Administration, specifically, FHWA Division (Olympia), Region (Portland) and Headquarters (Washington, D.C.) offices, public Team Member responsible for providing major funding and technical guidance to SWIFT project
Metro Transit	King County Department of Metropolitan Services (now known as Department of Transportation, Transit Division), public Team Member responsible for providing Seattle-area information regarding bus locations and mass-transit scheduling information
IBM	International Business Machines, Inc., private Team Member and provider of the Dauphin and Thinkpad portable computers
Metro Traffic Control	Metro Traffic Control, Inc., private Team Member and provider of traffic-incident information
Delco	Delco, Inc., a subsidiary of GMC, private Team Member and provider of the in-vehicle navigation device
Etak	Etak, Inc., private Team Member, developer of the TWS and GIS display software for the SWIFT portable computers, and provider of general systems-engineering support
Seiko	Seiko Communications Systems, Inc., private Team Member and provider of the HSDS, RRM and Seiko MessageWatch
UW	University of Washington, public Team Member responsible for SWIFT data collection and fusion, providing ride-share information and general ITS expertise
SAIC	Private entity responsible for conducting an independent SWIFT FOT evaluation under the auspices of WSDOT

Figure 3-2 shows the WSDOT organizational structure that was responsible for implementation of SWIFT project. This figure indicates that SWIFT was funded through the Advanced Technology Branch of the Traffic Operations Division of the Field Operations Support Services Center of WSDOT. Mr. Larry Senn was the SWIFT project manager and Mr. Peter Briglia was the head of the Advanced Technology Branch, the latter of which is the organization within WSDOT that is responsible for ITS projects.

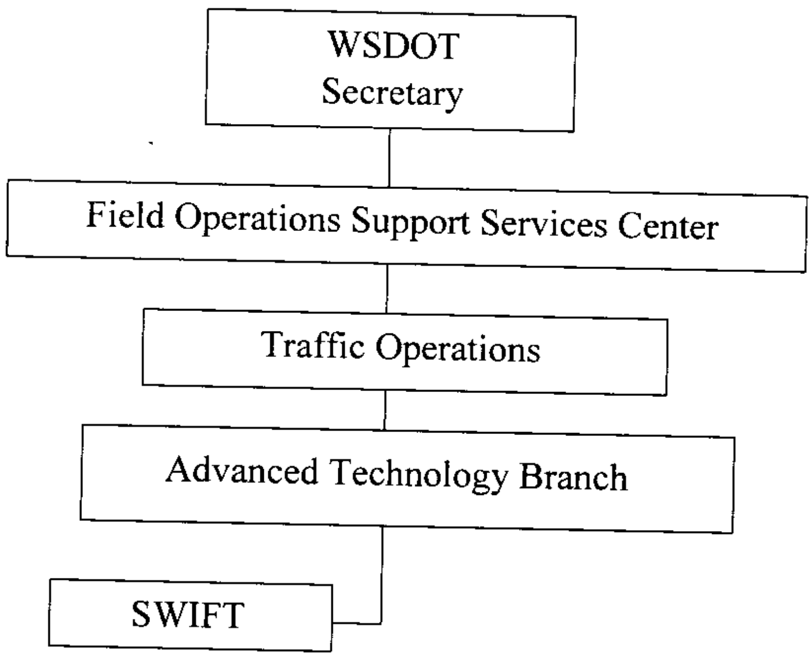

Figure 3-2. WSDOT Organizational Structure.

<u>SWIFT Committees</u>

Figure 3-3 shows the three committees that were formed as a result of the SWIFT teaming agreement. Basically, these committees were created in order to provide operational direction to the project and served as the primary means through which the team members interacted with each other regarding managerial, technical and evaluation issues.

The SWIFT Steering Committee was comprised of management representatives of each team member and the independent evaluator. The primary purpose of this committee was to coordinate the direction of the SWIFT project. Specific activities in this regard included milestone scheduling, making operational decisions regarding the overall conduct of the test and problem solving. This committee also provided the greatest opportunity for institutional cooperation to be exhibited among the SWIFT team members. The SWIFT Steering Committee met face-to-face approximately every three (3) months throughout the organizational life of the SWIFT project, and was extremely effective in providing management guidance.

The SWIFT Steering Committee consisted of two subcommittees: Technical and Evaluation. The Technical Committee was responsible for directing the system design, development, integration and testing components of the SWIFT system, while the Evaluation Committee was responsible for overseeing the conduct of the SWIFT independent evaluation. The committees met on alternate weeks and were comprised of engineers and other technical representatives from each of the SWIFT team members and independent evaluator.

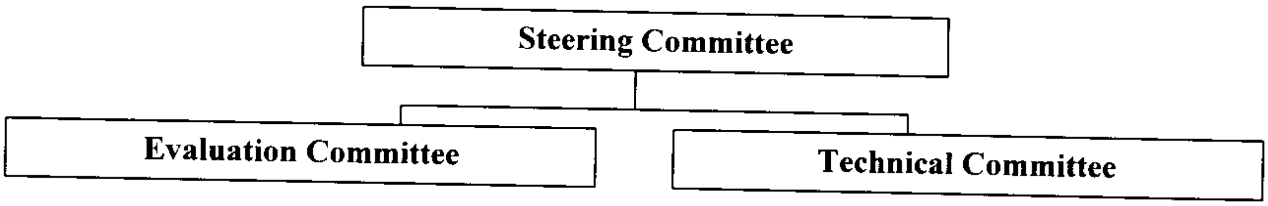

Figure 3-3. SWIFT Committees.

SWIFT Communication and Data-Sharing Vehicles

Unique communications and data-sharing features of the SWIFT project included weekly teleconferences and the creation of a SWIFT File Transfer Process (FTP) Internet site. In particular, the SWIFT Steering Committee directed the convening of the Technical and Evaluation Committees on alternate weeks throughout the life of the SWIFT project, and also suggested that a SWIFT FTP site be setup in order to ensure that SWIFT team-member personnel were able to electronically share important documents and information. In addition, throughout the life of the project, team members were encouraged to communicate via email distribution lists to their colleagues.

SWIFT teleconferences provided the opportunity for SWIFT team members to coordinate among themselves and otherwise maintain a high-level awareness about how the project was proceeding. A predominant feature of these meetings was a round-table discussion by each person in attendance of the status of his/her involvement with the project. These presentations and the discussions that ensued allowed all those in attendance to reach consensus and make decisions regarding the day-to-day, technical and evaluation activities of the project which were instrumental in contributing to the success of the project. After time, however, the distinction between Technical and Evaluation Committee gatherings of personnel was blurred as issues generated by either group would be addressed during the weekly SWIFT teleconferences. Nonetheless, the effectiveness of both of these committees was not short-changed as the weekly SWIFT teleconferences served to enable the team members to more effectively address in a time-critical fashion the issues that were discussed.

The SWIFT FTP site was developed and maintained by UW. This password-protected site enabled the storage of over 10 gigabytes of information (e.g., design documents, software, evaluation plans etc.) that enabled the members to obtain up-to-the-minute details regarding the project. Many times, SWIFT team members commended the efficiency of the site for helping them to share software upgrades and assist with the field testing of products. Finally, SWIFT team members were quite prolific in their email communications, thus enabling the instantaneous and wide-spread sharing of information among its members.

SWIFT Newsletters

In order to improve communications among the SWIFT team members, the FOT participants and the SWIFT evaluator, a SWIFT newsletter was published about every three months during the conduct of the FOT. This publication was jointly produced by SAIC/TransCore and WSDOT, and primarily focused on evaluation activities of interest to the FOT participants, such as planned questionnaires and focus groups. Nonetheless, the publication served to increase awareness of SWIFT FOT status among all the team members and as often as a catalyst to stimulate discussion during SWIFT teleconferences.

3.1.4. FOT Milestones

Major SWIFT FOT milestones and dates are shown in Table 3-3.

3.2. Institutional Issues Encountered

Fourteen (14) SWIFT team-member representatives scored a total of 191 SWIFT institutional issues. As shown in Table 3-4, the average score ascribed to a SWIFT institutional issue was 1.78. On a five-point scale from 1 (encountered: not severe) to 5 (encountered: could stop the project), this score was just below two (2) (encountered: slightly severe, an irritant). Overall, by providing this collective score, the SWIFT team-member representatives indicated that they felt that that the identified impacts of the SWIFT institutional issues were not a hindrance to the progress of the project. A score of three (3) (encountered: moderately severe, hinders progress) would have to been obtained to register any impedance to the project.

Details regarding thirty-eight (38) SWIFT institutional issues were derived through further discussion with the *SWIFT Institutional Issues Study* task leader. The issues extrapolated in more detail with each SWIFT team-member representative were the most severe scored by the respondent, with the average ranking provided to these issues being 3.05. The details that were derived from each respondent elicited comments about: (1) the institutions impacted by the issue, (2) the nature of the impacts/ impediments/ constraints provided by the issues, (3) where in the SWIFT project cycle the issue occurred, (4) how the issue affected the overall project, (5) whether the issue was resolved, and how or why not; and (6) how the issue could have been handled more efficiently/effectively (i.e., lessons learned). Table 3-5 provides a summary of the SWIFT institutional issues that were discussed by team-member representatives.

Nine (9) topics were discussed by two or more SWIFT team-member representatives as having impacted the SWIFT FOT. Since these topics represent the extent to which there was agreement among the SWIFT team-member representatives regarding the institutional issues that affected the SWIFT FOT, these topics are described in the following sections.

Table 3-3. SWIFT FOT Milestones.

Milestone	Month/Period(s)
Concept	Summer, 1993
Team formed	Fall, 1993
Evaluator selected	Winter, 1993
Proposal submitted to FHWA	January, 1994
Proposal accepted by FHWA	April, 1994
Preliminary planning	Summer, 1994
Evaluation goals and objectives defined	September, 1994
MOU completed	October, 1994
Evaluation plan drafted	October, 1994
Teaming agreement signed	January, 1995
Evaluation plan completed	March, 1995
System development starts	Spring, 1995
Detailed system design completed	Fall, 1995
RRM prototype completed	January, 1996
HSDS tested with watches	Spring, 1996
Portable computer software tested	Spring, 1996
Test participants recruited	Spring, 1996
Seiko messagewatches distributed	Summer, 1996
In-vehicle prototype completed	Summer, 1996
In-vehicle prototype tested	Summer, 1996
Field operational test starts	July, 1996
In-vehicle devices distributed	Fall, 1996
Detailed test plans drafted	Fall, 1996
Portable computer software tested 2nd time	Fall, 1996
Portable computers distributed	Winter, 1996
SWIFT newsletter initiated	January, 1997
Primary *Architecture Study* evaluation data collection period	Spring, 1997
Primary *Consumer Acceptance Study* evaluation data-collection period	Spring, Summer and Fall, 1997
Primary *Institutional Issues Study* evaluation data-collection period	Spring and Fall, 1997
Primary *Deployment Cost Study* evaluation data-collection period	Summer, 1977
Primary *Communications Study* evaluation data-collection period	Fall, 1997
Field operational test extended	June, 1997
Field operational test ends	September, 1997
Evaluation reports drafted	January, 1998
Evaluation reports completed	Spring, 1998

Table 3-4. Average Score Ascribed to SWIFT Institutional Issues.

Respondent	Total Score	# Issues Scored	Average Score
Private Sector			
1	28	14	2.00
2	55	22	2.50
3	26	15	1.73
4	30	22	1.36
5	12	12	1.00
6	8	7	1.14
7	11	7	1.57
8	19	17	1.11
Sub-Total	*189*	*116*	*1.62*
Public Sector			
9	16	11	1.45
10	19	13	1.46
11	38	15	2.53
12	40	13	3.07
13	11	4	2.75
14	28.5	19	1.50
Sub-total	*152.5*	*75*	*2.03*
TOTAL	341.5	191	1.78

3.2.1. Responsibilities

Four individuals, three representing private SWIFT team members, indicated that they believed there was some confusion regarding the responsibilities that were assigned during the establishment of the SWIFT teaming arrangement. In particular, the three private-sector respondents felt that the University of Washington overstated its business (i.e., money-making) interest in the SWIFT project which conflicted with their understanding of the nature of the SWIFT public/private partnership. That is, although the University of Washington was not an official member of the SWIFT teaming agreement, it does have the potential to license or potentially sell software that it developed for the SWIFT system. Thus, these individuals felt that this activity was not UW's primary role in SWIFT and that these interests were reserved for the

Table 3-5. Institutional Issues That Were Discussed by SWIFT Team Member Representatives.

Issue/Respondent	Private								Public						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	N
1. ORGANIZATIONAL/ JURISDICTIONAL															
Responsibilities		X	X		X								X		4
Role Clarity		X			X								X		3
Pub/Pri Partnership	X											X		X	3
Intra-agency												X			1
Inter-agency														X	1
Cultural differences			X												1
Management "Buy-in"	X														1
2. HUMAN RESOURCE															
3. PUBLIC ASSISTANCE															
User Per/Accept		X				X		X							3
Privacy Issues								X							1
4. REGULATORY/ LEGAL															
Patent/Copy Rights			X						X			X			3
Standards/Protocols		X							X						2
5. FINANCIAL															
Procure/Acquisition				X					X						2
Market Uncertainty							X			X					2
Contract/Auditing	X		X												2
Profits												X			1
6. OTHER ISSUES															
Integration Testing													X		1
Unfamiliarity with Transit Data											X				1
Geographically Spread Out											X				1
Protocol Migration							X								1
Leadership											X				1
Server Connectivity				X											1
Education/Training				X											1
Evaluation														X	1
Human Factors									X						1
TOTAL:	3	4	4	3	2	1	2	2	4	1	3	4	3	3	39

private-sector companies involved. Further, two representatives believed that one private-sector partner failed to pursue some of its original objectives. Another concern was that certain operational functions (e.g., training of employees, debugging of software, collection of the primary impact of the responsibilities issue on the SWIFT project was to slow down the project, not only by extending the time spent during construction of the SWIFT teaming agreement, but also by interfering with operations. This issue also impacted the SWIFT project by causing mistrust of the intentions of the University of Washington and by requiring some team members to complete the activities of another.

3.2.2. Role Clarity

Three SWIFT team-member representatives, two private and one public, felt that assigned roles for the SWIFT project were sometimes confusing. Two partner representatives believed that one private-sector partner was more of an "ivory tower," or research, organization that did not apply the proper business focus to the project. This resulted in some design activities (i.e., physicals) being conducted before others (i.e., functionals) that should have been conducted first. The public-sector representative also complained that he spent "a lot" of his time answering questions from operational personnel representing one private team members which was outside the scope of his job description. The primary impact of the lack of role clarity in the SWIFT project, according to these respondents, was that it slowed down system development process. In particular, the aforementioned extraneous activities helped to delay development of the SWIFT portable computer software application. This issue also cut into the time personnel were able to spend on assigned operational activities. Overall, it was felt that this issue could potentially affect the future deployment of SWIFT.

3.2.3. Public/Private Partnership

Three representatives, two public and one private, expressed concerns about the nature of the SWIFT public-private partnership. The concerns expressed were that each side did not clearly understand the other, and that the goals of each side appeared to be at odds with the other. In particular, it was mentioned that the SWIFT teaming arrangement represented a "new" way of conducting business for the government agencies involved, for WSDOT in particular, and that traditional software-development practices needed to be modified so as to allow potential money-making rights and continued proprietary rights to the software. This issue was more directly stated by one public-sector representative, who felt that the goals of both organizations were incompatible (i.e., one wanted to make money and the other wanted to make travel easier for the public). The ascribed impacts of this issue upon the SWIFT project, however, varied among the respondents: one indicated that this issue had no major impact upon the project, another indicated that it delayed the signing of the SWIFT contract and the third felt that it resulted in a system that was not as technically effective as it could have been. An independent analysis of this issue, provided by the *SWIFT Deployment Cost Study*, revealed that the SWIFT public-private partnership would result in a profitable endeavor for the private-sector team members.

3.2.4. Patent/Copyrights

Two public and one private SWIFT team-member representatives indicated that they felt issues with patent/copyrights were troublesome for the SWIFT project. In particular, software proprietary rights were mentioned by all three respondents as being a sticking point (i.e., caused talks to take longer) during SWIFT contract negotiations. The issue appears to be that current government regulations (i.e., Federal Acquisition Rules) specify that the government shall retain the ownership rights to all developed software. This means that the private company that actually developed the software must rescind their proprietary interest in, or control over this software, once it is developed. Since the SWIFT project was a public/private partnership, however, and one which actually encouraged private investment with the potential for profit, contract negotiations required WSDOT to give up some of the State's inherent rights to the SWIFT software so that the private-sector could continue using and/or licensing it. This was a particularly important issue to Etak who was developer of the Traffic Workstation (TWS) and IBM. What was particularly important for the private sector partners was their right to retain proprietary use of any pre-existing software (e.g., geocode drivers).

3.2.5. User Perception/Acceptance (Design Process)

Three private-sector representatives were concerned about user perceptions and acceptance of the SWIFT system that resulted from a limited design process. Two expressed the opinion that not enough user inputs were obtained either before or during system development. Rather, the system was designed more by "gut feel" than from actual information indicating user preferences. This occurrence, they argued, could result in the fielded system not being used appropriately, nor being adequately accepted, by the field operational test participants. As a result, the SWIFT system might not fare as well in during the user evaluation phase than the developers thought it might. Another concern was that the users did not always appear to be aware of some SWIFT information, such as the hours of system operation. Thus, this misunderstanding may have contributed to some users being disappointed about SWIFT's performance. Overall, the major reported impact of the concerns expressed about the SWIFT design process in the user perception and acceptance areas was that these issues may influence the outcome of the evaluation. That is, these three individuals were concerned that the system wouldn't be evaluated as positively as one might otherwise expect.

3.2.6. Standards/Protocols

Two individuals, one private and one public, expressed the opinion that standards and protocols issues affected the SWIFT project. Interestingly, these individuals provided diverging opinions about the use of the ITIS message protocol for SWIFT. One, the public-sector representative, felt that when the project became aware of the ITIS protocol—which specifies up to 1,200 different traffic messages that may be used for ATIS—through the Enterprise group, and that this occurrence "saved three (3) months" of development effort. The private-sector partner, on the other hand, felt that the large number of message types in the ITIS protocol caused development within his company to take longer. In particular, the time spent to specify the message formats for all the different types of messages, many of which fit into the same functional category, added to his workload. In addition, because there were no standards or protocols available to address the large-scale dissemination of messages to individually-addressed Seiko MessageWatches, user "travel profiles" needed to be developed which potentially restricted his company's SWIFT development effort. The view of the public-sector's representative, of course, was more positive regarding the usefulness of information technology standards and protocols.

3.2.7. Procurement/Acquisition

One public- and one private-sector SWIFT team-member representatives complained about the procurement/acquisition process for SWIFT. In particular, as was mentioned in the previous role clarity/responsibilities discussion, some of the early SWIFT architectural activities (i.e., different levels of system specification) were not really helpful (i.e., did not contribute to the actual definition of SWIFT) and it was felt that some pieces of functionality (e.g., Dauphins) were essentially "dumped" on the project. Both respondents believed that this decision wasted a lot of time in corresponding system specification (e.g., performance estimates, grayscaling) for these machines, which had dubious perceived value to the project in the first place. Thus, overall, the consensus was that an ill-defined procurement process ended up costing the SWIFT project some time and money that could have been used for better purposes.

3.2.8. Market Uncertainty

Two individuals, one private- and one public-sector representative, expressed their opinions that market uncertainty in the ITS area affected the SWIFT project. The public-sector representative suggested that this factor was behind IBM's decision to use the Dauphin instead of some other platform, while the private-sector representative indicated that this uncertainty ran through the minds of his developers during the planning phase of the contract. The impact of this issue on the SWIFT project was that the Dauphins required replacing by Toshiba portable computers about a quarter of the way into the field operational test. Although this substitution actually ended up contributing to the SWIFT evaluation by demonstrating that the portable computer software was interchangeable across hardware platforms, it did cost the project additional money and decreased the length of the evaluation period for a number of the portable-computer users.

3.2.9. Contracting/Auditing

Two private-sector SWIFT team-member representatives indicated that they felt contracting and auditing issues affected the SWIFT project. In particular, it was mentioned that government contracting requirements were difficult to understand; there were too many required signatures that delayed the whole process, particularly on the FHWA's side; that intellectual property, indemnification and liability clauses were difficult to negotiate; and that the whole process caused development tradeoffs to be made since money had to be spend on resolving contracting issues as opposed to development issues. Primary impacts of the hurdles encountered during the contracting and auditing process were that FHWA-specified deadlines were often missed and the whole project would experience speed-up and slow-down periods that contributed to an otherwise uneven workflow. Ultimately, these delays contributed to the "phased deployment" of SWIFT, or resulted in each of the SWIFT end-user devices being deployed at different times due to the different phasing of the development efforts supporting them.

3.2.10. Issues Address by Only One Individual

SWIFT institutional issues that were discussed by only one team-member representative were:

Intra-agency

A representative of a public agency expressed concern about the "little or no support" that one organization received from other public agencies. This included informing the other agency about data outages and even performing tasks (e.g., moving a phone line) that the other organization paid to have done.

Inter-agency

A public-sector representative expressed concern about how difficult it was for public sector to work with the private sector. In particular, it was reported that auditing procedures were not the same in the two sectors and that each organization appeared to have their own biases about the priority of what needed to be done.

Cultural Differences

A private-sector representative expressed concern about the "different languages" that some of the representatives of SWIFT team members spoke. This caused software development to lag, it was reported, because they had to have "very long" discussions in order to understand each other.

Management "Buy-in"

A private-sector SWIFT team member representative expressed concern about the need for "upper management" within a company to support the research and development efforts of their staff. In particular, it was reported that one private-sector SWIFT team member did not perform some of their obligations to the project because the upper management of the other organization changed and did not understand the significance of their role in the project.

Privacy Issues

A private-sector representative was concerned about how the privacy issue may affect acceptance of ITS products. For example, it was thought that some people may be reticent to participate in ITS projects because of all the "personal-use" information that would need to be provided.

Profits

One public-sector SWIFT team member representative expressed the view that concern over profits impacted the technical design of the project. In particular, it was reported that although public agencies may not do things most efficiently, it does not mean that their approach might not be a better way to do something.

Integration Testing

A public-sector representative expressed the view that "end-to-end" testing of the SWIFT system was not conducted until after the whole system was deployed. This caused some obvious deficiencies with the system (e.g., wrong-way directional messages on the in-vehicle navigation device, no general information messages on the portable computers) to be missed.

Unfamiliarity with Transit Data

A public-sector representative complained about the general lack of understanding that some private-sector companies exhibited toward the real-time bus position application for the SWIFT portable computers. In particular, it was felt that these organizations assumed they knew more about bus applications (e.g., the inner workings of Metro Transit's AVL system) than they demonstrated they knew.

Geographically Spread Out

A logistical concern that was expressed by one public-sector representative was that the wide geographic distribution of the people involved in the project provided some obstacles to working together. In particular, echoing previous concerns about the adequacy of SWIFT integration testing, it was reported that some team members demonstrated their lack of concern about what was going on by not showing up for the testing sessions. Had these people been closer, it was believed, these people probably would have been able to detect and fix some of the deficiencies with the SWIFT system.

Protocol Migration

A private-sector SWIFT representative was chagrined over the fact the in-vehicle navigation device was not received as well as it could have been because certain design characteristics of the TWS communications protocol (e.g., description and location codes) were changed without informing his organization. This caused previously announced SWIFT messages to be repeated each time they were present, which caused problems for the FOT participants and the ultimate acceptance of the SWIFT system.

Leadership

One public-sector SWIFT team-member representative expressed the concern that the dual leadership the project exhibited (i.e., the public- and private-sector co-chairs of the SWIFT Steering Committee) caused some confusion at critical times during the project. In particular, it was felt that this slowed down the testing process and caused certain things to not get tested as well as they should have been.

Server Connectivity

One private-sector representative complained that connectivity problems between the TWS and communications server were not adequately addressed. This problem was caused, it was said, by improper inactivity-timer settings that prevented reconnects. To solve the problem, the project should have looked at the details of the communications server protocol earlier in the project.

Education/Training

One private-sector SWIFT representative explained that some of the staff at one other private-sector organization, in particular, were not properly trained to perform their job functions. This caused personnel at his company to have to step in to solve their operational problems and that this activity correspondingly took away from the effectiveness of personnel at his company.

Evaluation

A SWIFT public-sector team member representative expressed the concern that evaluation Task Leaders were not always properly engaged in gaining thorough understanding of the system. In particular, it was felt that the *Communications* and *Architecture Study* Task Leaders should have been involved earlier in the project, and that this involvement would have helped them write more complete initial drafts of their SWIFT test plans.

Human Factors

One public-sector representative was very concerned that human factors, or usability, issues were not addressed in more detail up front, or during the design phase of the project. In particular, it was felt that this reduced the overall acceptability of the SWIFT products, increased the safety risk for the project and resulted in some devices that couldn't be reused.

3.3. Lessons Learned

SWIFT lessons learned were derived through the extended interviews conducted for the 38 institutional issues that were discussed in more detail by the fourteen (14) SWIFT team-member representatives. These are presented in the following sections for the nine (9) SWIFT institutional issues that were discussed by two or more individuals.

3.3.1. Responsibilities

Lessons learned from SWIFT responsibilities issues were:

- Need to ensure that all entities involved with an ITS project are both *capable* and *committed* to doing the work.
- Perhaps some "team building" experiences are needed so that each side understands the other.
- Partners need to be responsible and follow through with their commitments.
- Perhaps an independent "systems integrator" would have been able to better understand and more quickly pull together the different development perspectives of the SWIFT team members. In addition, support activities and costs need to be more clearly defined in advance.

3.3.2. Role Clarity

Lessons learned from SWIFT role-clarity issues were:

- All the entities involved must agree on the course of action that needs to be taken.
- Public-sector agencies need to be instructed as to the role of the private sector in ITS projects, and to "not be arrogant" regarding their involvement.
- Each organization should ensure that it has the right number of personnel assigned to its tasks and that its personnel are properly trained to perform the functions required by its role in the project.

3.3.3. *Public/Private Partnership*

Lessons learned from SWIFT public/private partnership issues were:

- Need to know about the "nature of the beast" before getting involved—i.e., know how the other side thinks and processes information.
- Work needs to be done to ensure that the public and private sectors have the same goals and motives for participating in ITS projects (i.e., to provide usable information in an efficient and cost-effective fashion to users).
- Although Federal Accounting Regulations (FARs) can be changed in some "special" instances (e.g., the waiving of "march-in" patent rights of the Federal government) to address the unique public/private partnership nature of ITS ventures, further changes are required to facilitate the negotiation process for future ventures.

3.3.4. *Patent/Copyrights*

Lessons learned from SWIFT patent/copyright issues were:

- FHWA needs to provide some models/language for how to sort out patent/copyright issues before the start of a project.
- Clarification/guidance is needed on this topic at the beginning of a project so that it doesn't need to be addressed, or re-negotiated, later.
- Not sure how this issue can be resolved—inherent in every public/private partnership. Nonetheless, it needs to be addressed because the selection of who's software is going to be used will have major ramifications down line.

3.3.5. *User Perception/Acceptance*

Lessons learned from SWIFT user perception/acceptance issues were:

- User prototyping needs to be done in advance of system development. This will enable the design effort to be more interactive and functional.
- Training and instruction is very important to the evaluation of user acceptance—need to make sure that all users understand system operating guidelines (e.g., hours of operation) before start of FOT.
- More market research is needed for ATIS projects, especially regarding the potential use of portable computers. Not sure of SWIFT's "metaphor" for portable computer use, but it is also important that the application match the platform.

3.3.6. *Standards/Protocols*

Lessons learned from SWIFT standards/protocols issues were:

- Need to have complete operational descriptions and functional specifications at the beginning of a project. In particular, user requirements need to be specified very clearly in advance in order to ensure project success.

- Advance knowledge of existing standards (e.g., ITIS) will save time during system planning and definition process. All organizations involved need to make sure that they don't jump into areas of technical development (i.e., promise too much) without fully understanding what they're getting into.

3.3.7. Procurement/Acquisition

Lessons learned from SWIFT procurement/acquisition issues were:

- Strong leadership is required in order to avoid getting entangled with system design problems (e.g., SWIFT's use of Dauphin sub-notebook computers) that are foisted on the project by other organizations.
- Need to ask what the goals/purposes are of certain activities (e.g., early SWIFT bubble diagrams) so that "unproductive" activities are minimized. As a result, developing detailed proposals or plans from the very beginning will minimize the chance of getting involved with unproductive activities. In particular, the roles that each organization will play need to be clearly specified in advance.

3.3.8. Market Uncertainty

Lessons learned from SWIFT market uncertainty issues were:

- ITS applications need good, thorough evaluations and market research. This would help reduce market uncertainty and facilitate product development activities.
- Business plans of team members should include ITS—this will help ensure that the proper development perspective is applied to ITS projects which, in turn, will help to reduce market uncertainty.

3.3.9. Contract/Auditing

Lessons learned from SWIFT contracting/auditing issues were:

- The framework for ITS agreements needs to be provided in advance—currently, perspective regarding contracting and auditing issues is missing.
- Model contracts in the ITS area need to be provided in order to speed up the negotiation process between public and private organizations, especially on the public side.

3.4. Other Findings

SWIFT team-member representatives were asked a number of additional questions regarding various aspects of the SWIFT FOT. These questions included the following:

- What was ranking of team-member involvement and criticality to project?
- What were the project's goals?
- What were benefits of participating for each organization?

- What were risks of participating for each organization?
- Who were the initiators of the project?
- Who do you consider to be the champions (i.e., primary advocates) of the project?
- What were the most important measures of project success?
- Was the project a success, and why?
- What are suggested deployment models for SWIFT?
- What compensation model is suggested for ITS projects?
- What were the successes of the SWIFT project?
- What did you like best about the SWIFT project?
- How does the SWIFT project compare to other ITS projects with which you've been involved?
- What additional types of information do you believe the SWIFT system should have provided to Seattle-area travelers?
- What institutional capabilities/skills are crucial for fielding a successful ATIS?
- What issues for commercial fielding of an ITS project?
- What obstacles (i.e., true barriers) to the SWIFT project were overcome?
- Any last comments?

Answers provided to these questions are presented in the following tables.

Table 3-6 show SWIFT team-member rankings of degree of involvement and criticality of involvement in the SWIFT project. These data show that the University of Washington, Seiko, Etak Metro Traffic Control and WSDOT were rated as having the most involvement with the SWIFT project, while Seiko, WSDOT, King County - Metro Transit, University of Washington and Etak garnered the top rankings as far as criticality to the project. Those ranked in the top five of both categories were Seiko (9.29), WSDOT (9.07), University of Washington (8.85), Etak (8.43) and King County - Metro Transit (4.29).

Table 3-7 provides a summary of the SWIFT project goals that were provided by the team-member representatives. As indicated by the responses, SWIFT private team members appeared to be more concerned about public, or user, acceptance of the system, while public team members appeared to be more concerned about testing the suitability of Seiko's HSDS to transmit traveler information.

Table 3-6. Degree of SWIFT Team-Member Involvement and Criticality.

INVOLVEMENT RANK	CRITICALITY RANK
1. University of Washington (4.64)	1. Seiko (4.93)
2. Seiko (4.43)	2. WSDOT (4.86)
3. Etak (4.29)	3. King County - Metro Transit (4.29)
4. Metro Traffic Control (4.21)	4. University of Washington (4.21)
5. WSDOT (4.21)	5. Etak (4.14)
6. King County - Metro Transit (4.00)	6. Metro Traffic Control (3.86)
7. Delco (3.64)	7. FHWA (3.21)
8. IBM (2.93)	8. Delco (3.14)
9. FHA (2.14)	9. IBM (2.21)
10. PSRC (.93)	10. PSRC (1.14)

Table 3-7. SWIFT Project Goals.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Test the suitability of Seiko's HSDS to transmit traffic/transit information to fixed and mobile receivers	• Test the HSDS to determine if it is adequate for ATIS delivery, assess consumer acceptance and willingness to buy/subscribe to ATIS services and test ATIS information and distribution system
• Provide wireless transportation information to the public	• Demonstrate the use of an FM sub-carrier to deliver en-route traveler information
• Evaluate, from test participant's perspective, the effectiveness of ITS services in improving safety, reducing congestion in the roadway and shortening commute time	• Determine whether the HSDS technology is capable of delivering traffic and transit information to consumer devices, and whether traffic/transit information adds value to consumer device
• Evaluate benefits and market potential of ITS information	• Test FM sub-carrier technology for disseminating traveler information
• Develop ATIS with potential for actual deployment	• Establish the utility of FM sub-carrier as a delivery method for real-time traffic/bus information and demonstrate that having this information allows travelers to make intelligent choices
• Create options for public to receive traffic information that will enable them to choose when to leave for their drive and which route to take	• Demonstrate the value of one-way communications devices for traveler information
• Investigate the feasibility of HSDS deployment as a medium for traffic management solutions	
• Examine the feasibility of a mobile information system for transportation, travel, etc.	

Table 3-8 provides a summary of the benefits of participating in the SWIFT FOT as provided by the team-member representatives. Responses ranged from the more basic (e.g., money, employment) to the actual goals of the test (i.e., demonstrate the use of an HSDS for ATIS purposes).

Table 3-8. Benefits of Participating in SWIFT FOT.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Tests and demonstrates how HSDS can be used for ATIS • Advances HSDS technology	• Helps fund strategic ATIS development • Helps tout WSDOT ITS program
• Develop new products and technology	• Provide better en-route traveler information than provided by commercial radio
• Become more prominent in ITS • Develop partnerships with other members • Evaluate potential market	• Demonstrate a wireless technology capable of delivering a large amount of real-time bus-location information • Determine the usefulness of real-time transit information to the public
• Technical learning • Product/technology development • Develop partnerships	• Money
• Opportunity to develop a system that has potential for revenue	• Employment
• Expansion in the market • Opening of doors for similar projects in other markets	• National demonstration of FM sideband for disseminating traffic/travel information • Potential for private sector markets to contribute to national economy • Demonstrate that additional forms of traveler information are beneficial
• Marketing information • Human interface lessons • Technology experience	
• Opportunity to research, develop and deploy an ATIS • Potential marketability	

Table 3-9 provides a summary of the risks of participating in the SWIFT FOT as provided by the team-member representatives. Private SWIFT team members were concerned about the potential for wasting time, effort and money, while the public team members were very concerned about what the public perception might have been about the project if it had failed.

Table 3-9. Risks of Participating in SWIFT FOT.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• HSDS might not work as well as predicted	• Failure of project would affect public confidence in WSDOT
• No market acceptance of products developed	• Project may be seen as corporate welfare • Project may fail to become operational • Information may not be useful or attractive to consumers
• Lose money	• Uncertain of impact "airing" of real-time bus will have on public • Known limitations of the AVL system may impact test results
• Waste time and effort	• None
• Wasted money if system cannot be deployed	• None
• Other partners may decide not to continue this line of work after the test and we'll need to shop for other partners or close up shop	• Won't work • No market • Doesn't help • Will not continue beyond Federal funding
• Project becomes too costly for benefits	
• No end plan—project may drag on too long	

Table 3-10 provides a summary of those organizations and/or individuals who were attributed by the SWIFT team-member representatives to be the "initiators" of the SWIFT project. Seiko was the most frequently mentioned private-sector team member, while WSDOT was most often attributed to be the public-sector SWIFT originator. These findings corroborate the oral histories that were provided about the SWIFT project.

Table 3-10. Initiators of SWIFT Project.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Seiko prepared and led the response to FHWA's RFP	• Seiko, FHWA and WSDOT
• Seiko. In particular, Mike Park initiated the project, Gary Gaskill led the technical development and Lee Balzer was instrumental in managing the project	• Seiko, FHWA and WSDOT
• Seiko's Mike Park	• Seiko
• Etak's Larry Sweeny	• FHWA
• Seiko	• No response
• No response	• Seiko and WSDOT
• WSDOT and Seiko	
• IBM's Denos Gazis and Barbara Dietrich	

Table 3-11 provides the organizations and/or individuals who were attributed to be the "champions" of the SWIFT project by the team-member representatives. As was the case with the initiators of the project, Seiko and WSDOT were most frequently mentioned as being the primary advocates, or supporters of the project. Etak was also frequently mentioned.

Table 3-11. Champions of SWIFT Project.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Seiko and WSDOT	• Seiko, WSDOT, Metro Transit, Etak and Metro Traffic Control
• Seiko	• Seiko (Mike Park and Lee Balzer), Etak (Larry Sweeny), Metro Traffic Control (Joan Ravier), WSDOT (Larry Senn and Pete Briglia), Metro Transit (Catherine Bradshaw), University of Washington (Dan Dailey) and FHWA (Ed Fischer)
• All team members, but Seiko and WSDOT in particular	• WSDOT (Pete Briglia), Etak (Larry Sweeny) and Seiko (Lee Balzer and Mike Park)
• University of Washington—both Dan Dailey and Rick Kint have been very professional and helped solve problems with their analytic skills	• Seiko (Lee Balzer and Mike Park)
• WSDOT, Etak, Seiko and Metro Transit	• WSDOT (Larry Senn) and Seiko (Lee Balzer)
• Test participants—some have been thrilled with their test device and services and have told others about project	• FHWA, WSDOT, Seiko, University of Washington, Etak, Metro Traffic Control and Metro Transit
• WSDOT and Seiko	
• Seiko, IBM and Etak	

Table 3-12 provides a summary of the measures of SWIFT success as provided by the team-member representatives. Most responses emphasized the significance that participant, or user acceptance of SWIFT would contribute to an evaluation of the success of the project.

Table 3-12. Measures of SWIFT Success.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Users find value in SWIFT services • HSDS performs well in ITS applications • SWIFT helps create a market for ATIS	• Ability to deliver accurate and timely traveler information • Consumer acceptance • Possible conversion to commercial system
• User feedback	• People find the information to be useful (i.e., timely, reliable and accurate) • People want to buy the devices
• Test participants say "this is great!"	• Traveler information is delivered in an understandable and usable manner using HSDS FM subcarrier network from multiple sources • Every partner gets what they know
• Roll out of technology to actual successful products • Market success	• Successful Evaluation
• Marketable service is developed	• People use the information effectively (e.g., avoid traffic jams, use bus more effectively) • Information is available when needed • Appropriate information is available
• Participants use the information to tailor their commutes	• If Seiko, Metro Traffic or Etak decide to market SWIFT services after federal money dries up
• Technical knowledge of ITS is increased	
• Marketing information regarding ITS applications	

Table 3-13 provides the estimations of SWIFT success that were provided by the team-member representatives. Thirteen of fourteen (14) respondents indicated that they felt the SWIFT project was a success, with the final respondent providing no comment.

Table 3-13. Estimation of SWIFT Success.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Yes, overall the system is performing well and users are satisfied with SWIFT services	• Yes, ATIS delivery is a reality and initial consumer acceptance appears to be good. A possible commercial system is in the works
• Technically, yes. Marketwise, yet to be determined	• Yes, there is a desire on everyone's part to succeed despite obstacles or rough spots. Also, project was more of an integration project than the development of new technology
• Yes, because information is being delivered in a fairly timely manner and user devices are reasonably easy to use	• Yes, tremendous teamwork on the part of a diverse set of individuals working on the project. In general, very clearly understood responsibilities and willingness to work out issues as a team. Lots of enthusiasm and good humor
• Yes, so far	• Yes, ITS backbone was established
• Yes, service appears to be marketable	• No comment
• Yes, not only does it inform people and give them choices that they may not have had before, it also gives many of them (i.e., watch and in-vehicle navigation device users) on-the-spot information so they know why they are going slow on the highway, where the problem is and reduced stress as a side effect	• Yes, the partners have proven they could do it (i.e., develop the software, make the links, provide the information and services). It remains to be seen, however, if this will be a service that people will be willing to pay for. But even if they don't in its current form, SWIFT was the beginning for what may evolve later
• Yes, goal was met	
• Yes, we see what is wrong, what needs to fixed and what needs to be improved	

Table 3-14 provides a summary of the suggested deployment models for SWIFT that were provided by the team-member representatives. A subscription-based system, or one where individual travelers would pay money to receive traveler information, was favored by the majority of the respondents.

Table 3-14. Suggested Deployment Models for SWIFT.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Subscription-based system but WSDOT should consider paying communications provider to disseminate broadcast messages of interest to the general public	• Would most likely be a subscription-based system with the possibility of an advertising-based system
• Should be a privately-funded system, most likely a mix of subscriptions and advertising	• Not sure of value public would place on incident information. In particular, not sure if the value of this information would translate into purchasing a watch or portable computer
• Most likely would be a subscription-based system as there is not enough volume to justify the collection of advertising fees	• Should be based upon whoever is willing to pay the bills. This could be private citizens, but could also be the public sector since the disseminated information benefits the public as a whole
• Subscription-based system	• Nature of system (i.e., FM sub-carrier) would cause deployment model to be subscription-based
• Probably a subscription-based system as an Internet model (e.g., WWW) would not work here	• Not really sure, but if the SWIFT information is deemed useful, then individual citizens would be more likely to pay for it
• Would be a subscription-based system with some possibility of advertising	• Would most likely be a subscription- or advertising-based system
• Would probably be an advertising-based system as users don't want to pay monthly fees	
• Would probably be a subscription-based system	

Table 3-15 provides a summary of the ITS compensation models that were provided by SWIFT team-member representatives. The majority of the respondents felt that the government should provide its information for free while the private sector should derive a fee for providing added value.

Table 3-15. Suggested ITS Compensation Model.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• The government should provide basic ITS information for free, especially if it's something everyone should have. The job of the private sector would be to "add value" and package the information for public consumption	• Current model is for public to provide ITS information for free, but there should be a way to cover incremental costs for future services. Would call this an "enlightened self-interest" model
• The government needs to make available what it currently knows to the private sector and does not need to receive any compensation (e.g., raise taxes) for its services	• Public provides base information while private sector "adds value." Nonetheless, government should be able to recover costs of operations and maintenance, perhaps with a percentage of the profits
• The public sector should provide generic travel information to the private sector and can reasonably expect to be compensated for some of their services	• Government should be responsible for providing what is "politically correct," and the private sector should be concerned with "enriching" these services for specific markets
• Believes the government should provide traffic information for free and, if possible, actually increase the amount of information that it disseminates to the private sector	• Public should provide ITS information for free and not receive any compensation
• For the most part, the government should provide transportation-related information for free, especially if it is information that would suit the government's own ends	• The government should provide this information for free, especially if it promotes the efficient use of the public-transportation infrastructure
• Believes that the government should provide traffic information for free, but if they do charge, they should be compensated for their actual costs and not receive any "profit"	• The government should provide ITS information for free and not receive any compensation except for specific costs (e.g., data formatting, connections to private-service providers) associated with deployment
• Believes that government should provide travel information for free, but feels that it perhaps should charge user fees, or "selective taxes" for some services	
• The government should provide as many free, and value-added, services as possible	

Table 3-16 provides a summary of the "successes" attributed to the SWIFT project by the team-member representatives. Among the items mentioned frequently mentioned was the cooperation of the team members. Meeting the goals of the SWIFT project was also deemed to be significant.

Table 3-16. "Successes" of the SWIFT Project.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Interorganizational cooperation, except for [company], has been excellent • Demonstrated that public-private ITS partnerships work • Seiko's HSDS can deliver traffic information • Users seem satisfied and receptive to the information.	• Demonstrated new contracting strategy • Provided ATIS products and services • Delivered on schedule • Showed that people value traffic information
• Delivered data that was required—project has met its goals! • [Private sector partners] have benefited from the government • Overall, favorable feelings about the project • SWIFT teleconferences kept traveling to a minimum	• Project did what it said it was going to do • Had a team that really wanted to succeed! • Good, non-dictatorial leadership • [Company] led proposal and team-building effort and helped WSDOT with management • Good chemistry among the people
• Large number of people have worked together well • Project is perceived to be "successful!"	• The people on the project were good humored, very professional, worked well together, didn't loose interest and had the big view • Teleconferences worked well • In person, Steering Committee meetings worked well • Atlanta press conference (1994) worked very well • SWIFT FTP site and email distribution helped communications • SWIFT email distribution

Table 3-16. "Successes" of SWIFT Project (Continued).

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Never worked with a better group of people • Government subsidy helped [company] develop prototype products and services • Focus of FOT facilitated deployment of SWIFT as an integrated system	• Good role clarity and definition • Cooperation among the members of the group without the traditional prime/sub relationship was excellent • Public perceptions of the project have been good • Changed Metro Transit's own views regarding the value of their AVL data • WSDOT's support of an ITS backbone has been encouraging
• Most cohesive, focused projected [company] has ever worked on • Transit-agency cooperation was "refreshing!" • Partnerships that were developed look like they will endure beyond SWIFT • People who were involved, except for [company], were very dedicated	• SWIFT demonstrated and validated its data transmission model
• Project accomplished what it was supposed to do • Introduced private parties to each other for possible future collaboration	• WSDOT established guidelines for public-private partnerships in the future • UW data management was very beneficial • Metro Transit/WSDOT cooperation was a plus • Showed FM sideband architecture works • Group synergism of weekly teleconference calls was great • Consumer acceptance portion of SWIFT evaluation has been good
• Project goals were met	
• Cooperation was high—personalities were good • ITS application is worthy—needs to be done	

Table 3-17 provides a summary of what SWIFT team-member representatives said they liked best about the project. Most respondents mentioned the opportunity to work with personnel from other SWIFT team-member organizations as one of their highlights.

Table 3-17. What Team-Member Representatives Liked Best About SWIFT.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Working with the project team members • Contributing to the system design • Seeing SWIFT operate successfully	• The cooperative nature of the SWIFT team • The willingness of the team members to pick up the slack when one of the players backed off from their goals • The personalities and commitment of the people involved made it a pleasure to work • The successful delivery of a wireless ATIS • World's first delivery of wireless real-time bus information
• The opportunity to develop some new applications	• The commitment of all the project partners to getting the project completed
• Development, testing and evaluation • Funding support • Very successful project • Provided good demonstrations for customers and exhibitions • SWIFT partners were great to work with • Project lead to real products and services	• The enthusiasm and commitment that the partners brought to the project • Working with people in private industry
• The SWIFT project represents a model from which other projects (e.g., MDI, Seiko MessageWatch, etc.) can draw ideas and experiences	• Collaborative public/private partnership focused on helping solve a major problem in Seattle
• The "partnering" aspects—our relationship with public agencies is much stronger	• Interesting concept
• The unique challenges of working with new concepts and other people in the industry	• Developing the end-user product • The dynamics of the Steering Committee to work out the details needed to solve the development problems and overcome potential obstacles • The focus that all the partners put into successfully making things work
• Good working relationship, cooperation and communications between partners	
• The chance to work in a project with a scope higher than standard day-to-day concerns	

Table 3-18 provides a summary of how SWIFT team-member representatives felt the project compared to other ITS projects. Among the attributions accorded the SWIFT project were that it was a well-managed project, the people involved were very cooperative, that communication among the participants was good and that the project was a leader in developing and providing some types of traveler information to the public.

Table 3-18. How SWIFT Compares to Other ITS Projects.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• It was the best managed • Weekly teleconferences helped tremendously in keeping the project on track	• The cooperative nature of the SWIFT team caused project to proceed very smoothly
• Not been involved with other projects	• It is better— much more open and better spirit of cooperation
• A real leader • Served as a basis for other FOTs and MDIs	• More fun— a "can do" effort because the vendors are partners not contractors
• Speed data more accurate than in the TRAVINFO project • Integration of real-time transit data is mostly absent from other ITS projects	• It was larger and more players
• Fewer meetings, which gives one more time to get things done • Communication via email worked very well • People's expectations seemed to be more in touch with reality than many other projects	• Has not been involved with other projects
• Has not been involved with other projects	• Strongest private-sector participation • Only one to develop marketable service • On time and within budget (for a change!) • Good group of people to work with • Willingness to try new contracting approach
• Has not been involved with other projects	
• Comparable—most ITS projects are avante garde and have high research content	

Table 3-19 indicates what additional types of information that SWIFT team-member representatives thought the project should have provided to Seattle-area travelers. All-clear messages were most frequently mentioned, followed by information for arterial and/or other routes (e.g., collector-distributors). In addition, there was also an interest in providing bridge- and mountain-pass information.

Table 3-19. Additional Types of SWIFT Information That Should Have Been Provided.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• All-clear messages • Mountain-pass messages	• More routes, including major arterial and collector-distributor highways • Bridge status • All-clear messages
• Status of AVL system	• Arterial highways
• What was provided was about right	• Ability for watch users to change travel profiles on a day-to-day basis • Better PDA hardware
• Suggested alternate routes around trouble spots	• Prediction of traffic problems
• No answer provided	• No answer provided
• All-clear messages	• None
• No answer provided	
• Internet capability	

Table 3-20 provides a summary of the institutional capabilities/skills that SWIFT team-member representatives thought were needed for fielding a successful ATIS.

Table 3-20. Capabilities/Skills Needed for Fielding a Successful ATIS.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Close cooperation between public and private sectors	• Organizational support, in particular upper management support • Provide a valuable service— this perception "gives it a reason to be." • Exposure and sales within an organization—ITS projects don't happen overnight
• Fundamental issues is who will pay for ITS services	• Public-sector understanding that the private sector needs to make a profit in order to continue providing service • Private sector understanding that exclusive relationships are difficult, if not impossible • Private-sector understanding of the need to report user information in order to keep public-sector funding flowing

Table 3-20. Capabilities/Skills Needed for Fielding a Successful ATIS (Continued).

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Ability to partner with other organizations • Contractual flexibility • "Can do" spirit with resources to deliver	• Commitment • Access to highly-technical resources • Leadership • Understanding and appreciation of private- and public-sector issues/cultures
• Gathering and utilizing traffic data to its highest potential and distributing the information in a timely manner	• Public relations to get public using the technology
• Appropriate assignment of roles— the public sector must not compete with private sector products and services, especially if the government gives information out for free	• A system integrator would be useful on a production-quality system • More training/support for non techies
• Constant communication among all team members	• Management support for infrastructure, operations/maintenance, funding, staffing, etc. • Willingness to take chances and to try new ways of contracting • Technicians capable of supporting, operating and modifying information collection and dissemination infrastructure
• Responsibility • Flexibility • Buy-in	
• No comment	

Table 3-21 indicates what issues the SWIFT team-member representatives felt were important to address for commercial fielding of an ITS project. Consideration of the long-range, or long-term impacts of ITS was forwarded, as were numerous concerns about ensuring that proper user interfaces are constructed to ensure user acceptance of ITS projects.

Table 3-21. Issues to Address for Commercial Fielding of ITS Projects.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Need better agreement about what data can be provided, how reliable it is, etc. to make sure something will actually be delivered because people are paying for it	• Need a business model (e.g., subscriptions) in order to develop system • Private entities need to do the majority of the coordination work • Determine whether public agencies should be compensated for their efforts
• Need a long-range concept of operations— e.g., wonders why Federal Government is currently funding both Seiko and MITRE FM sub-carrier systems	• Need to address long-term maintenance and infrastructure issues (e.g., operations) • Need to tailor information to users • Need to develop technical standards that will enable national ITS deployment
• Government data needs to be made available for commercial purposes • Solve issue of whether government should be compensated for their involvement • Determine whether government should provide exclusive access to data • Determine whether government should compete with private sector	• Need systematic procedures for conducting business • Field-testing procedures need to be clearly defined
• User interface issues need to be solved • System issues (e.g., metering of messages) need to be solved	• Need partners who want to extend to areas beyond what has already been demonstrated
• Need to define roles—who does what? • Need to know the people with which one is dealing • Need to make sure everyone has the same set of expectations (e.g., schedule, money to be made)	• System integrators are needed to sort out weaknesses in system design • Support issues need to be better thought out, otherwise they can add a lot of "hidden" costs
• Pay extra special attention to details • Make sure everyone knows what's happening	• Some assessment of public benefit is needed • Private-sector infrastructure support (i.e., proper incentive) is needed
• Consider how units should be disposed	
• Need to understand how process for selecting technology works • Incorporate an informal organizational structure—best for getting work done	

Table 3-22 indicates what "obstacles (i.e., true barriers)" that SWIFT team-member representatives thought the SWIFT project overcame. Among the items mentioned were the lack of market research, or user prototyping; deployment of the Dauphin sub-notebook computers; various technical issues (e.g., determination of bus locations, message formatting); and contract-negotiation complexities (e.g., how to deal with State auditing and copy-right practices).

Table 3-22. Obstacles that the SWIFT Project Overcame.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Training all the evaluation people on how SWIFT worked • Less-dedicated project manager • Complexity introduced by multiple software developers for portable-computer application	• State audits of contractors before contractors were allowed to submit information provided by independent auditors • Inflexibility of previous contracting standards (e.g., how cost R&D projects and what do with "march-in rights" established in previous government contracts?)
• Lack of market research—more/better field testing was needed	• Deployment of Dauphins • Determination of bus locations • Lack of human factors
• Message-formatting barriers (i.e., previous ITIS standards were not adequate)	• None
• Deployment of Dauphins	• None
• None	• Nailing down things that weren't defined very well • Some information was not propagated among all the parties • Lack of day-to-day "tweaking" of system
• Field testing of software	• Determination to disseminate SWIFT information on three different devices
• None	
• None	

Table 3-23 indicates the last comments SWIFT team-member representatives had about the project. The majority of the respondents emphasized the successful outcome of the project, and that it was a fun and interesting project on which to work. Others emphasized the significance of the independent evaluation for documenting the outcomes of the project for a wider audience.

Table 3-23. Last SWIFT Team-member Comments about SWIFT Project.

PRIVATE TEAM MEMBERS	PUBLIC TEAM MEMBERS
• Need to get evaluation data out to a wider audience	• State contracting people were very flexible
• Was a successful project—overall, very well done	• One of the most successful ITS operational tests ever conducted—way more good than bad • Everyone was pleasant to work with
• ITS should be viewed as traffic management by State DOTs • Pioneering project in public/private partnership area • Been a great project	• None
• Would like to obtain travel-profile creation and generation software that was developed by system evaluator	• Fun project
• One of the "easiest" ITS projects—everything went very well! • WSDOT very progressive in dealing with private companies	• Interesting project
• None	• Deployment of Dauphin was most troublesome/frustrating part of project • Project personnel were very cooperative • Distributed leadership was excellent • Evaluator was central to operation of project
• None	
• Showed commercial value of SWIFT • Informal structure was very helpful—enabled better work environment	

4. DISCUSSION

SWIFT Institutional Issues Study findings are discussed in this section with respect to their overall implications for ATIS projects elsewhere. This discussion parallels the presentation of these findings in Section 3 of this document, and is provided in the following sections:

- SWIFT history
- Encountered institutional issues
- Lessons learned
- Other findings

4.1. SWIFT History

SWIFT represents one of the first ATIS FOTs conducted in this country. Earlier tests were conducted in Orlando, FL (TravTek) and Minneapolis/St. Paul (Genesis) among others, yet the SWIFT FOT appears to have extended considerably the available database of information regarding ATIS effectiveness and acceptance. The addition of real-time bus information, in particular, has set the SWIFT FOT apart from others already conducted.

One of the significant aspects of the SWIFT teaming agreement was the long-term interest in ITS and commitment of the organizations involved. For instance, the majority of the SWIFT team members have articulated a long-term interest in ITS deployments. In addition, three organizations—Seiko, Etak and Metro Traffic Control—committed themselves to fielding a "SWIFT-like" system after the project was completed. This degree of interest and commitment resulted in all of the SWIFT team members working together in a very effective, cooperative fashion throughout the FOT.

One of highlight of the organizational structures that were instituted to implement SWIFT was the weekly teleconference. This simple, yet cost-effective method of managing and discussing the technical issues involved with the project was attributed by many of the SWIFT team members to a primary instrument of the project's success. In particular, the SWIFT teleconferences enabled the representatives of each organization to keep abreast of the developmental status of the project, to brainstorm solutions to encountered problems and to develop scheduling sense to see the project through to the end. Others simply enjoyed the "camaraderie" that was exhibited by the teleconferences, and felt that these discussions cemented their commitment to each other.

Evaluation issues were important to the SWIFT team members throughout the project. On many occasions, team-member representatives reiterated or stated their commitment to assisting with the independent evaluation, as the documentation left by this effort would be the primary legacy of the project.

4.2. Encountered Institutional Issues

Organizational/jurisdictional, financial and regulatory/legal issues were rated as the most important issues by SWIFT team-member representatives as measured by the number SWIFT team members who wished to discuss issues in these categories. In particular, institutional issues in the organizational/jurisdictional category (i.e., responsibilities, role clarity and public/private partnership) were each discussed by three (3) or more people, while the same number of issues were addressed by two (2) people each in the financial category (i.e., procurement/acquisition, market uncertainty and contracting/auditing). In addition, two (2) regulatory/legal issues (i.e., patent/copyrights and standards/protocols) were discussed by two (2) or more people. A final issue that was addressed by three (3) SWIFT team-member representatives, in the public acceptance category, was user perception and acceptance.

Primary organizational/jurisdictional concerns centered around the significance of ensuring that each and every member of the team understands its responsibilities and roles throughout the development process. Earlier on, for instance, apparent differences in how some organizations viewed their involvement in the SWIFT project caused some to view certain development activities (e.g., bubble diagrams) as being a waste of time. Others didn't understand and/or misinterpreted their role in the project which also caused them to waste time. Integrating the concerns of the issues addressed in this category can lead to the attribution that some organizations viewed the SWIFT FOT as being a "research and development" project rather than a "demonstration," or actual implementation project. As a result, some organizations exhibited a greater sense of urgency in completing their assigned tasks, or in building the SWIFT system, than did other organizations. This occurrence resulted in some hard feelings among the team members, but it was generally conceded that others "picked up the slack" for those who didn't clearly understand their responsibilities and roles.

Financial issues related to the conduct of the SWIFT FOT addressed procurement/acquisition, contracting/auditing and market uncertainty. Procurement issues causing SWIFT to be defined and built very quickly causing certain operational disadvantages (e.g., use of Dauphin sub-notebook computer) to be built into the system. In addition, contracting/auditing issues contributed to development delays in other areas of the project that otherwise resulted in the perception of an uneven workflow for the project. For example, these issues were generally thought to have been the primary contributor to the "phased" deployment of end-user devices that was experienced by the project. Finally, issues and questions regarding the ultimate marketability of ATIS services such as those provided by SWIFT probably caused some of the SWIFT participants to question and/or otherwise delay some of the development efforts for the project.

SWIFT regulatory and legal issues were significant in that the SWIFT project represented the first time some of the private team members had ever dealt with government contracts and/or entered into a "public/private teaming agreement." As a result, some private SWIFT team members were concerned about losing the proprietary rights to some of the software they contributed to the project, while some public SWIFT team members felt uncomfortable with granting their private-sector counterparts the capability to make money on the joint efforts of the group. The primary result of the lack of clarity regarding SWIFT regulatory and legal issues was a delay in getting many of the SWIFT team-members under contract. This caused the project to be subjected to unnecessary risk according to some team members, or caused a lot of anxiety among others with vested financial interests in the project.

Another important issue, in the public acceptance category, was the FOT participant, or end-user's, perception and acceptance of the SWIFT system. With all of the respondents who addressed this issue being from the private sector, the significance or implication of this issue is that customer acceptance of ITS projects is crucial to the overall success of this type of application. Thus, as was indicated, it is crucial to obtain end-user inputs throughout the system design, development, testing and fielding process.

As with other ITS FOTs, a number of newly-identified issues were delineated by the SWIFT project. These issues primarily centered around the particulars of developing new systems, such as human factors contributions during user-interface design, integration testing, protocol migration and server connectivity. Nonetheless, other newly-identified issues addressed other implementation aspects of the SWIFT project, such as the general lack of familiarity with transit data, that team members were spread out geographically, leadership issues, education and training of co-workers and how the independent evaluation was supposed to be conducted. Overall, a good summary is that it is important to address the "logistical" aspects of applying information technology to solving transportation problems.

4.3. Lessons Learned

SWIFT lessons learned were specific to the issues identified:

- Responsibilities of the team members need to be clear from the onset
- Roles of the team members need to be delineated and understood by all
- Each side of the public/private partnership needs to understand the principles and ideals that govern the other
- Patent and copyright rules of the Federal government need to be modified to include models for public/private partnerships that address the distribution of patent and copyrights among the team members
- ITS standards and protocols should be modified so that both public and private entities agree as to their contents
- Procurement and acquisition processes need to be better defined so as to facilitate, not hinder, ITS deployments
- Issues regarding ITS market uncertainty need to be delineated so that development processes will be facilitated
- Government contracting and auditing requirements need to be clarified for private-sector ITS public/private partnership team members
- Market research and user-system prototyping should be included in ITS projects to ensure that the system is well received

4.4. Other Findings

Discussion of the "other" findings of the SWIFT project would indicate:

- The goals of the project were fairly clear, although public and private team members differentially focused on the significance of these goals
- The perceived benefits of participating for each organization varied considerably
- The perceived risks of participating for each organization focused on the possibility of lost time, effort and money
- Seiko, WSDOT and the FHWA were most often mentioned as the initiators of the SWIFT project
- Seiko, WSDOT and Etak were most often mentioned as being the champions of the SWIFT project
- The majority of the team members agreed that consumer acceptance of the SWIFT project was crucial for its success
- The SWIFT team-member representatives were essentially unanimous in their attribution of success to the project
- The most frequently-mentioned deployment model for SWIFT was a "subscription-based" system
- Most SWIFT team members agreed that the public sector should provide ITS information for free while the private sector should "add value" to this information
- The majority of the team members felt the project was well received by the public and a technical success
- Most team-member representatives emphasized the cooperative nature of their colleagues as what they liked best about the project
- SWIFT was viewed favorably when compared to other ITS projects
- Various suggestions were made for how to improve the SWIFT service, including the presentation of all-clear messages and providing traveler information for a wider range of route types
- The proper assignment of roles and responsibilities of team members was deemed a crucial capability/skill for future ATIS projects
- User acceptance issues, and incorporating them into the development process, were highlighted as major factors influencing the commercial fielding of ITS projects
- Various "obstacles" were overcome by the SWIFT project
- SWIFT team members were very appreciative of the working relationships that were developed in the project, and felt that SWIFT was both interesting and fun work

5. SUMMARY AND CONCLUSIONS

The SWIFT FOT was a successful demonstration of HSDS technology for presenting ATIS data to travelers in a large, congested metropolitan area. The project was conceived, planned and executed with a maximum amount of cooperation among the team members and a minimum amount of delay in terms of implementation. In fact, the efficient cooperation of the SWIFT team members resulted in enough money to extend the FOT approximately three (3) months beyond the original time-frame of the project.

SWIFT team members were, for the most part, free in their praise of their partners. Although this ATIS project, like others around the country, experienced some initial organizational responsibility and role problems, the dedication and commitment of the major team members—Seiko, WSDOT, University of Washington, Etak and King County - Metro Transit, in particular—helped to drive the project to completion. In the end, all of the SWIFT team members were glowing in their appraisal of the significance of what the project demonstrated.

Primary lessons learned from the SWIFT FOT pointed toward the need to clearly define the responsibilities and roles of each partner, and to anticipate as much as possible the regulatory and legal impacts of the information-technology system that is being built. The delineation of proprietary use and ownership of application software was seen as central in this regard. In addition, the ability to incorporate teleconferences as a means for facilitating communication among the team members was seen as a major contribution of the SWIFT project.

6. REFERENCES

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