

SURFACE VEHICLE INFORMATION REPORT

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Comparison of GATS Messages to SAE ATIS Standards

Foreword—This SAE Information Report provides a function by function comparison of the GATS implementation of several ITS functions (covered in the U.S. by SAE Standards J2313, J2353, J2354, J2369, and J2374) and notes areas where harmonization opportunities exist. The purpose of this document is to serve the SAE ATIS Committee in its deliberations regarding world ATIS harmonization.

It is recommended that the reader also review the related PDF files of prENV ISO 14821 (Aug 5th, 1999) which contains the overview of the GATS messages. The full set of documents, containing about 6 inches of printed paper, can be found on the SAE web site. SAE will not be repeating GATS material directly in this information report as it is copyrighted by CEN and the original authors.

This document will be published as an SAE Information Report after committee acceptance.

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1. Scope—This SAE Information Report provides a comparative summary between the various messages found in the SAE ATIS standards work (notably SAE J2313, J2353, J2354, J2369 and J2374) and that found in the GATS standard (Global Automotive Telematics Standard). GATS is a message set meant to be deployed on mobile phone systems based on the GSM (Global System for Mobile Communication) phone system which is being deployed in European markets and which the SAE may need to harmonize with as part of the World Standards activities of TC204. This document provides an overview of the various types of supported messages and how they compare with US terms and messages. Some selected features of the GATS work are recommended for assimilation into the next revision of ATIS standards. No attempt at determining a U.S. policy in this regard is provided. This document seeks to provide the reader familiar with SAE ATIS with a high level overview of technical knowledge of the GATS approach in similar areas.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1746—ISP-Vehicle Location Referencing Standard

SAE J2313—On-Board Land Vehicle Mayday Reporting Interface, Rev. 1.0, September 1999

SAE J2353—Draft Standard: Data Dictionary for Advanced Traveler Information Systems (ATIS), Rev. 1.0.0, October 1999

SAE J2354—Draft Standard: Message Sets for Advanced Traveler Information Systems (ATIS), Rev. 1.0.0, September 1999

SAE J2369—Standards for ATIS Message Sets Delivered Over Reduced Bandwidth Media
SAE J2374—Information Report based on Location Reference Message Specification, Rev. B (MDI), May22, 1997
SAE J2540—Messages for Handling String and Look-up Tables in ATIS Standards

2.1.2 ASN PUBLICATION—Available from

ASN.1—Abstract Syntax Notation 1

2.1.3 GATS PUBLICATIONS—Available from the GATS forum or from CEN TC278.

GATS Message Set; Main Part Main2034.pdf 05.08.99
GATS Message Set; Annex 1 - Numbering and ADP Message Header A1_2034.pdf 05.08.99
GATS Message Set; Annex 2 - Basic Information Elements A2_2033.pdf 05.08.99
GATS Message Set; Annex 3.1 - Service-Independent Protocols A31_2033.pdf 05.08.99
GATS Message Set; Annex 3.2 - ADP for Service-Independent Messages A32_2033.pdf 05.08.99
GATS Message Set; Annex 4.1.1 - Specification of Internal Services – Configuration and Master Data Update A4112033.pdf 05.08.99
GATS Message Set; Annex 4.1.2 - Specification of Key Management and Security A4122033.pdf 05.08.99
GATS Message Set; Annex 4.1.3 - ADP for CAS Functionality - Configuration and Key Management - A4132033.pdf 05.08.99
GATS Message Set; Annex 4.2.1 - Specification of Diagnostic Services A4212033.pdf 05.08.99
GATS Message Set; Annex 4.2.2 - ADP for Diagnostic Services A4222033.pdf 05.08.99
GATS Message Set; Annex 5.1.1 - Specification Emergency Service and Break-down Assistance A5112033.pdf 05.08.99
GATS Message Set; Annex 5.1.2 - ADP Emergency and Breakdown Services A5122033.pdf 05.08.99
GATS Message Set; Annex 5.2.1 - Specification Interactive Traffic Information Services A5212034.pdf 05.08.99
GATS Message Set; Annex 5.2.2 - Specification of Broadcast Traffic Information Services A5222033.pdf 05.08.99
GATS Message Set; Annex 5.2.3 - ADP Traffic Information Services A5232034.pdf 05.08.99
GATS Message Set; Annex 5.3.1 - Specification Navigation Services A5312033.pdf 05.08.99
GATS Message Set; Annex 5.3.2 - ADP Navigation Services A5322033.pdf 05.08.99
GATS Message Set; Annex 5.4.1 - Specification Floating Car Data A5412034.pdf 05.08.99
GATS Message Set; Annex 5.4.2 - ADP Floating Car Data A5422034.pdf 05.08.99
GATS Message Set; Annex 5.5.1 - Specification Operator Services A5512033.pdf 05.08.99
GATS Message Set; Annex 5.5.2 - ADP for Operator Services A5522033.pdf 05.08.99
GATS Message Set; Annex 5.6.1 - Specification General Information Services A5612034.pdf 05.08.99
GATS Message Set; Annex 5.6.2 - ADP for General Information Services A5622034.pdf 05.08.99
GATS Message Set; Annex 6.1 - Minimum Onboard Positioning Performance Requirements for Traffic Telematics Terminal Devices A61_2033.pdf 05.08.99
GATS Message Set; Annex 6.2 - Preparation of Extended Location Block A62_2033.pdf 05.08.99
GATS Message Set; Annex 7.1 – GSM specific Parameter A71_2033.pdf 05.08.99

2.1.4 FHWA PUBLICATIONS—Available from Lee Simmons, FHWA, HVH-1 Room 3400, 400 7th Street SW, Washington, D.C. 20590.

National ITS Architecture, Federal Highway Administration, U.S. Department of Transportation, Version 2.0, September 1998

2.1.5 ITE PUBLICATIONS—Available from ITE, 525 School Street SW, Suite 410, Washington, DC 20024.

Message Sets for External Traffic Management Center Communication (MS/ETMC2), TM 2.01, Rev. 2.0, September 1998

2.1.6 CEN PUBLICATIONS—Available from CEN

Traffic and Traveler Information (TTI) – TTI Messages via Traffic Message Coding- Part I: Coding protocol for Radio Data Systems – Traffic Message Channel (RDS-TMS) using ALERT-C

2.1.7 ISO PUBLICATION—Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002.

ISO 9735—Electronic data interchange for administration, commerce and transport (EDIFACT)—Application level syntax rules (Amended and reprinted 1990)
Amendment 1:1992 to ISO 9735:1988

2.1.8 NTCIP STANDARDS—Available from the Institute of Transportation Engineers (ITE), 1099 14th Street, NW, Suite 300 West | Washington, DC 20005-3438 USA, Telephone: +1 202-289-0222 | Fax: +1 202-289-7722.

NTCIP 1403—Standard on Passenger Information (PI) Objects

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1761—Information Report, ITS Terms and Definitions, 1995
SAE J2369-1—Draft of Host Adaptation Annexes, June 1999

3. Definitions

3.1 ADP—Application Data Protocol, i.e., a message set for a telematics service.

3.2 AMPS—Analog Mobile Phone Systems, an analog modulation system (e.g., the native modulation used is not formed of digital data packets) which was first deployed in the US market.

3.3 ASN.1—Abstract Syntax Notation One, a set of formatting and expression rules suitable for defining messages which the US has agreed to publish its standards in and which are also used by TC204. The messages and data elements found in both SAE J documents and GATS documents are now published in ASN.1 formatting.

3.4 ATIS—Advanced Traveler Information Systems. The name of the committee within the SAE which is charged with the “last mile” message formats which are presented to consumers of ITS information.

3.5 BIF-BAP—Bearer Independent Format and Bearer Application Protocol, terminology used to indicate a two step process of first developing the messages (the BIF) then tailoring those messages to a specific application and media which will bear it. Although this terminology is most used among European practitioners and among some ENTERPRISE States, it conceptually was the format followed in developing US ATIS. In this process, SAE J2354 was developed without regard to media restrictions. Other efforts such as SAE J2369 were expressly developed for the restricted bandwidth limits found in mobile media such as sub carriers. GATS on the other hand was developed from the beginning to be hosted on GSM phone technology and is today attempting to use same formats and messages on other media.

3.6 Broadcast Services—In the GSM sense a packet which is sent to all users in a coverage area (rather than addressed to a specific end terminal device in a point to point fashion).

- 3.7 EDIFACT**—Electronic Data Interchange For Administration, Commerce and Transport Early European work in ITS was formatting in accordance with the EDIFACT Syntax (ISO 9735), but it is now being replaced with the use of ASN.1 formatting.
- 3.8 GATS**—Global Automotive Telematics Standard. A mobile phone system based on the GSM (*Global System for Mobile Communication*) phone system deployed in Germany and other areas of Europe. The GATS system provides a message set which offers many of the same services in US ITS-ATIS. GATS is being advanced by the CEN TC278 process as a standard.
- 3.9 GSM**—Global System for Mobile Communication a digital phone systems deployed in Europe and which provides a short datagram message service upon which GATS is built.
- 3.10 ILOC**—Intersection Location, An Intersection Location (ILOC) exists where two or more intersecting roads with different road attributes meet, and on a road at the point of a road attribute change, i.e., a road number or road name change.
- 3.11 Interactive Services**—In GSM this refers to services which the user interfaces with menu and other display placed on the GSM phone to request specific information. GATS provide a number of specifications regarding such “end application” whereas the SAE work is limit to only the message sets, leaving the actual application up to the implementers.
- 3.12 Information Service Provider (ISP)**—In the context of the ITS, a public or private entity which may be responsible for gathering, fusing, analyzing, and/or reporting transportation related information to users, including vehicles and non-mobile users. In the sense of GATS the ISP is closely aligned (if not the same entity as) the controller of the gateway which interacts with the end using GATS terminals.
- 3.13 LRMS**—Location Referencing Message Set—A body of work outlining a number of “profiles” used in the description of affected areas, typically roadway segments. The preferred methodology for use in ATIS is the ISP → Vehicle profile (SAE J1746) which provides a mean to send Lat-Long values between the ISP and the vehicle. A highly compressed form of this is the GRID profile which is suitable for limited bandwidth applications. Indexing values, which typically require prior agreement between users, are called Geometry profiles in this body of work. A standard (SAE J1746) is now being developed in this area to use indexes.
- 3.14 MLOC**—Maneuver Location, Defined by the ERTICO Committee on Location Referencing Report as “Each maneuver involves three ILOCs: the starting ILOC of the maneuver, the intermediate ILOC that contains the road in question, and the ending ILOC of the maneuver. The relationship describing an affected maneuver is called a Maneuver Location (MLOC).”
- 3.15 NA**—National ITS Architecture, the body of the US FHWA sponsored work outlining the US overall architecture for the ITS systems. This large effort, from which the SAE and other participating SDOs have developed message interface standards, has been widely duplicated under local government sponsorship in other parts of the world.
- 3.16 NTCIP**—National Transportation Communications for ITS Protocol, NTCIP is the U.S. body of work concerned with roadside devices and many of the actual equipment systems used in the roadway side of ITS. Some of these devices, for example a roadside changeable message sign, can contain the same information found in GATS and ATIS roadway advisory messages.
- 3.17 PSAP**—Public Safety Answering Point, U.S. nomenclature for the entity which answers, determines the response for, and often dispatches aid when an emergency number (911 in the U.S.) is called. The U.S. market almost exclusively used one number for this function (most of the rest of the world uses three numbers) and it is operated by public agencies for the public good. Vehicle based systems at this time are handled entirely by private agencies which in turn convey calls to these official public agencies. These firms are often called private PSAPs.

- 3.18 RDS**—Radio Data System, also called Radio Broadcast Data System (RBDS) in the U.S. A modulation and message framing standard for sending low speed (1187.5 BPS) data over the sub carrier area of commercial FM broadcast standards. It was developed in the mid-80's and used to send a variety of information packets. It allows a fraction of this capacity (~37 BPS) to carry traffic messages at the rate of about one per second. This portion, called Traffic Message Channel (TMC), employed a two part ATIS message wherein one part was an index table of location references and the other part was an index into a table textual description of the event. The precise table values used have varied significantly over the past 15 years. The location numbering has invariably been redeveloped by each deployment. The phrases, while also varying to some degree, have been stable and are being advanced in the CEN TC204 process. They are commonly called Alert C and Alert+. In the parlance of this document, the LRMS format used would be called a geometry profile, while the index format used would be considered static one. A recommendation for using this media and the TMC format while keeping within the goals of this document is provided in Section 8.
- 3.19 RDS-TMC**—Radio Data System - Traffic Message Channel, the proper term for the delivery of incident text messages over the RDS-RBDS modulation format. This format has been deployed in various ways over the low speed subcarrier in the EC and to a small degree in the US (RDS an 1187-bit per second raw data rate stream with ~200 useable bits per second). The message format used consists of hard coded locations (by index value and therefore requiring a common agreed upon map) combined with textual messages (which can be expanded into the local language of choice). There are no link impedance concepts in the RDS messages, only short textual descriptions. The text look up tables are not that different from the method used here, however, they are never transmitted over the media and do not change or evolve once issued.
- 3.20 SDO**—Standard Developing Organizations. In the US those organizations, which are certified by ANSI to set US national standards and which adhere to certain open meeting processes in doing so, are the developers of the various message set standards which taken together with the National Architecture form a generally complete and coherent ITS system.
- 3.21 Service Center**—A GATS term referring not only to private PSAP firms but to any service provider organization in general.
- 3.22 Service Provider**—An ITS term for any entity which provides some service. In the context of MAYDAY this refers to the private PSAPs who expect to handle non-MAYDAY messages and hence add value to the equipment installed in the vehicle. Example of such uses include car theft recovery, roadside assistance, specialized medical services, and general vehicle maintenance and servicing operations provided by the dealer and/or the manufacturer of the vehicle. The use of shared equipment for both MAYDAY and to service these other non-life threatening needs is a key expectation of ITS proponents.
- 3.23 TCIP**—Transit Communications Interface Profiles, TCIP is a suite of data interface standards for the transit industry. The TCIP standards committee is sponsored by the Institute of Transportation Engineers and funded by the US Department of Transportation's Joint Program Office for ITS. SAE ATIS interfaces and uses elements of TCIP to represent messages concerning transit.
- 3.24 Telematics**—Applied combination of communications and information technology to in-vehicle equipment. The definition, when used by its proponents, is meant to imply a wider set of services than just "MAYDAY + ATIS" would encompass from the perspective of an ITS practitioner. It is useful to consider that GATS, a private company venture, is interested in a wide range of profitable services - well beyond just those which ITS, a government sponsored initiative, is interested in from a perspective of public benefit and better management of roadway assets.
- 3.25 Terminal Device**—In the GATS nomenclature a terminal device is the end users (typically vehicle mounted) equipment suite consisting of at least a GSM phone and then whatever additional equipment is required to support the services that that terminal performs.

- 3.26 TMDD**—Traffic Management Data Dictionary, a body of work sponsored by ITE (Institute of Traffic Engineers) which deal with messages and definitions of traffic related information. The SAE J standards make extensive use of these message elements so the interoperability can occur from the data source (TMDD issued) to the ISP and then the end terminal device. The standards committee developing these two works remains in close cooperation to ensure the continued harmony between the. We are not aware of any similar connection in the GATS work.
- 3.27 TPEG**—Transport Protocol Experts Group, a next generation digital message set for use over digital broadcast radio. Comprised of many early RDS practitioners, this group is developing a message set content which is in many ways similar to GATS and ATIS where traffic information is concerned and it represents yet another group which must be accommodated in some fashion if a world harmony of ATIS like message is to occur (which is the primary reason for TC204 to exist). TPEG is also organized under the work structure of TC204.
- 3.28 WAP**—Wireless Application Protocol, One of several proposed formats to bring information control to small wireless devices such as phones. The WAP forum a private industry association promotes WAP among a number of standards and other forums including GATS and the WWW. While WAP as a protocol is itself under an ever-growing list of alternative protocols and business alternatives, it is often today seen as tightly aligned with the GATS forum.
- 4. Overview**—It is beyond the scope of this document to provide a complete statement of the issues presented in merging ATIS, GATS and other related standards and deployment efforts. Any such summary would also leave out the valid efforts of other deployment in other regions of the world as well. The primary purpose for which ISO TC204 was created was to provide a forum to resolve such conflict and achieve, in so far as possible, a world class standard. This document limits itself to a comparison of US ATIS with (predominantly German) GATS, intentionally only a portion of the “big picture” of harmonization.

As the very briefest of summaries, the original background of each is as follows. In the US, the ITS industry is a cooperative development between the US Department of Transportation (USDOT), a number of ANSI standards setting organizations (of which the Society of Automotive Engineers is one) and both public and private interests. A large amount of effort (much of it subsidized by the Federal Government) has gone into developing literally hundreds of related technical specifications used to deploy a complete ITS system. Of this, ATIS represents the “last mile” of information for traveling consumers, but it should be stressed that ATIS is a relatively small portion of ITS overall. GATS, by way of contrast, was developed by private electronics and communication companies which had an interest in the GSM phones systems and its successful deployment.

Whereas the US ITS effort is rather “far flung” in that it cover a great many areas, it is also lacking in definition for actual products and complete end-to-end systems. This omission was on purpose and it was felt to provide the greatest opportunity for private industry to innovate, yet insure interoperability by use of commonly accepted message exchange formats. GATS by contrast originally devised a complete end-to-end system specification for the deployment of a specific product with specific features and needs. As would be expected it is tightly bound up with the implementation details which the choice of GSM phone technology placed on it. Both of these efforts, as part of their advancement in TC204, are emphasizing the “message set” formats and de-emphasizing any implementation technology choices so that the most neutral message set can be re-used on the widest base of enabling technology.

Readers desiring just an overview are advised to read Section 5. The harmonization comments presented here are the same as those in Section 6.

Section 6 provides more details and an eclectic collection of observations, but requires at least a familiarity with the organization of the SAE ATIS Message Sets.

Section 7 outlines items in the existing SAE message effort which could be improved by incorporating GATS concepts. This section does not deal with harmonization *per se*, but rather with changes to make SAE J2353 and J2354 more effective.

A note on references:

All document references in GATS are with respect to the August 5th, 1999 release of the message set and cite the PDF file names found in the ZIP package. The GATS documents are drafts and subject to change.

All page references are to either the page numbering of current SAE standards or the page numbering of the GATS document package of August 5, 1999. Some of the SAE documents are drafts and subject to change. Others are official U.S. standards and are available from SAE publications.

[Both sets can be found on the committee members' web site]

5. ***Taxonomy Comparisons***—In this section of the report, we compare the functional makeup of the GATS services with that of the SAE ATIS work (as seen from the perspective of the flows and market packages of the ITS National Architecture). In the subsequent chapters, each of these major functions is further examined and compared with ATIS messages.

As stated in Chapter Four, GATS was devised to be the one and only message set standard found on the GSM phone network. U.S. ATIS efforts presumed that the messages would be one of many message sets coexisting on any particular network environment, and hence needed to concern itself only with ATIS aspects. Further, ATIS is strictly a message set and does not provide any particular insights or requirements on how user functions are built upon the messages. This was done to maintain the most flexibility in deployment while not overburdening private/public systems with a fixed user interface system.

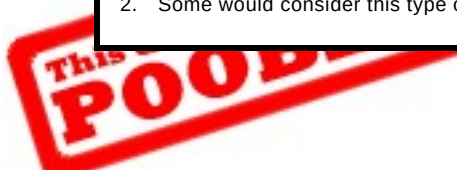
By comparison, the GATS documents were derived from essentially a complete system specification and deals to a much greater degree with the issues of functional embodiment found in the end user's device. GATS provides support features such as downloading to the user device a set of menus for selection options and features – nothing of this type of functionality exists in the ATIS work. In addition, the need to provide a number of network control features such as conditional access and security are covered in GATS as well. Administrative functionality of this type was purposefully omitted from the ATIS work.¹

It should be noted that the recent revision of GATS (August 5, 1999) provides a much sharper differentiation between the media aspects (in this case a GSM phone) and the message set than prior versions did. However, a degree of overlap between “pure” messages and how messages are used to build an end product still exists.² For the purposes of a comparison with ATIS, we will ignore these aspects of the message set except when they cause a degree of “layer pollution” which would effect potential harmonization.

- 5.1 **The Big Picture**—The GATS environment defines each end user equipment terminal as providing the functionality of one of three classes, each with basic requirements for functionality as well as providing the functionality of the prior classes. In this list of classes, the most basic functionality is what in the U.S. is considered a vehicle MAYDAY device. The second level is what would be considered a navigation device. The third brings to the navigation device additional information services (concierge type services – mostly ill defined at this point in time). As every GATS device is by definition a 2-way phone link, there is not really an equivalent concept of autonomous navigation found in some other products.

1. The current SAE work plan deals with some limited “profile” mapping of the message set into selected media (such as the Internet and WAP). In general, it continues to presume it will be co-existing with other messages in a mixed environment and that each distribution media used will provide the administrative support required.

2. Some would consider this type of device functionality to be more properly the realm of an API standard than belonging to a message set.



The names of these functions differ from those used in the U.S., and it is the purpose of this section to provide a concise "cheat sheet" of terms. The document can also be used to see how the scope of the GATS work (both here and in CEN TC278 WG4) fits with the work plans of various TC204 working groups and the original scope of the work item proposal. Quoting from the "GATS 2 Main Part" document (Page 6), Section Two, the primary services of GATS are considered to be:

- a. Breakdown and emergency services
- b. Interactive traffic information services
- c. Broadcast traffic information services
- d. Navigation services (route assistance, route advice, homing)
- e. Operator services
- f. General information services
- g. Floating car data collection

Quoting again from the "Main" GATS document, Section 7, these are organized in a 3-tier approach as follows:

Group 1: Core Functionality

- a. Emergency service
- b. Breakdown service
- c. Basic functions related to access and configuration management

Each terminal or service provider operating according to this document shall at least provide this functionality.

Group 2: Traffic Information and Navigation

- a. Interactive traffic information services
- b. Broadcast traffic information services
- c. Navigation services
- d. Floating car data collection³

Each terminal designed to offer services in this context shall at least support

1. An interactive traffic information service based on spatial filtering according to submitted selection criterion (circle or sector)
2. Floating car data collection

Each service provider operating according to this document shall at least provide

1. An interactive traffic information service based on spatial filtering according to submitted selection criterion (circle or sector)
2. A route guidance service

Group 3: Information Services and others

- a. General Information Services
- b. Operator Services
- c. Other Services to be added in future issues of this document

Support of services from this group is optional for both terminals and service providers.

3. Floating car data is what we would refer to in the U.S. as "probe data."

The previous is the best quick answer to the question “*What is GATS?*” It is first, foremost, and always more a MAYDAY system than what a US reader would call a *Navigation* system, and finally, (like every other commercial ATIS product) it leaves open an information-services portal to take advantage of any promising consumer applications which may come to be developed in the future. It is hosted in the GSM phone system,⁴ but as the effort is moved into the WAP protocol, it can be implemented in other ways. A GSM phone handset can also be a pager; which brings up commercial issues outside the scope of this document.

A summary of these functions is presented below to answer the related questions “What is inside GATS?”, here it is expressed in terms of American ATIS terminology, and compared to the related SAE standards. In the next section, each of these areas is greatly expanded and the contents of the actual messages are compared. Finally, some recommendations on harmonization actions are provided in each case.

- 5.2 MAYDAY (SAE J2313)**—The MAYDAY function is a very prominent one in the GATS standard. As in the U.S. experience, security seems to sell and therefore this function is seen as essential. There is basically a one-to-one mapping with the ITS MAYDAY function and the SAE J2313 “Land Vehicle MAYDAY Reporting Interface” Standard.

Note that the “core functionality” listed in extract from GATS provided in 5.1 is given as being: Emergency Service and Breakdown Service. This tracks reasonably well with the US MAYDAY approach and the two services are virtually identical in the nature of the messages. In both cases, calls are processed by a 3rd party response center. The widely held U.S. concept of a “three button” system is analogous to these two services, with the concierge service being the 3rd button. The GATS protocol also has provisions for crash severity (so called ACN products in the US market) but also lacks any industry consensus on how the data is to be used. Like the SAE J2313 MAYDAY Standard, a variety of sensor information from the vehicle is available. Unlike the SAE standard, there are no specific provisions for carrying a private vendor’s data with the message. Nor is the protocol readily useable for sending manufacturer vehicle status and maintenance events (as has become common in the US market). Both standards support a combination of manual and automatic initiation methods, and the use of voice data.

- 5.2.1 HARMONIZATION THOUGHTS**—This is perhaps the easiest one to deal with. U.S. tagging for MAYDAY is simple and explicit, as is GATS in many ways, but neither is inter-operable.⁵ The data structures used in each are largely alike and the differences do not seem to be based on any particular merit in one standard or the other. The overwhelming needs of public safety may also help to make this a successful candidate for merging.

- 5.3 Interactive Traffic Information Services (SAE J2354)**—This area of functionality maps most closely to SAE J2354 in that it provides messages for two-way transactional-based exchanges of roadway information. The message set supported in GATS is more verbose in the area of how information can be requested, but is less varied in the actual type of information supported. Further, as there is emphasis on the perceived profitable services, other items such as parking lot capacity and transit information have received less attention in GATS than in the SAE Standards (which were sponsored in part by the FHWA and reflects the flow of the National Architecture). As the use of GATS is a metered service, there is also an emphasis on interactive over broadcast dissemination of this type of information.

4. GSM is a widely deployed digital phone standard in Europe. In the U.S., two providers are now deploying it with commercial sales in Year 2000. The reader may be aware of some “surf the web on your phone” advertising, a portion of which is based on a combination of U.S. GSM and the WAP work.

5. The subject of technical approach for a common tagging environment was a large point of dissuasion at the Germany meetings. It was generally agreed that a simple but extensible tagging based on reused “clumps” of data structures would accommodate moving the messages to a common point.

The GATS message set supports the same basic set of messages to request information based on route, proximity, and preferences - but it defines these in a more detailed level. It also has some provisional or "subscriber" services wherein the user is notified of updates or changed conditions of selected routes. There are also provisions for voice output messages (if the service center supports this). In the SAE standards, this information is provided to the user in the form of always the most up to date information. In GATS, a process also exists to "cancel" previous messages in the user device message stored when the event is no longer valid. The actual traffic information is not expressed in terms of link impedance, but in textual messages, each is appended to a common map datum and tagged with start, stop, and duration time values.

- 5.3.1 HARMONIZATION THOUGHTS—The formats here are quite a bit different from the SAE ones, even if the basic underlying content is not. SAE and TMDD are likely to be adding *description-cause-advice* fields where previously only a description field existed due to incorporating some of the METS work - which will also serve to move ATIS closer to the GATS efforts. Compounding any discussion of change in this area is the close fitting of the SAE work with that of the standards in TMDD, TCIP, and NTCIP so that a coherent US deployment could take place. There was nothing analogous for GATS to be aligned with during its development. This area will be harder to harmonize.

- 5.4 **Broadcast Traffic Information Services (SAE J2369)**—This area of functionality maps most closely to SAE J2369 in that it provides *transaction-less* messages for broadcasting of roadway information. Broadcasting in this sense means from local, small coverage diameter (~10 mile) cellular tower sites with information of importance to the local areas.⁶ The message set supported in GATS is basically like that for interactive traffic services and comments above apply. As mentioned above, GATS is a metered service- there is an emphasis on interactive over broadcast dissemination of this type of information. However, it appears that the actual broadcasting over GATS does not use the broadcast message services of the GSM phone network, rather than its being sent by a point-to-point (and encrypted) delivery,⁷ which would be in keeping with the revenue generating side of the network operation.

SAE messages are densely packed into a frame of data with updates on dozens to hundreds of links at once. The GATS format is not packed in a similar fashion. SAE messages use a table compression scheme, which has no equivalent in GATS. GATS provides for the various European languages and supports a 6-bit sub-portion of ASCII as well as the Latin_1 variant. SAE supports a compressed form of ASCII, ASCII itself, Latin_1 and Unicode. SAE is more closely aligned with Japanese VICS standards in terms of framing format. In terms of textual phrases, SAE is more like RDS and TPEG than like GATS in that it makes use of index to table phrases. GATS has also implemented some of the "classic" RDS phrases. Like SAE J2354, J2369 provides link travel times, impedance, and speeds - as well as incident textual information, whereas GATS is less supportive of this. SAE ATIS in the broadcast mode is now adding the transit and weather information which exists in SAE J2354, this currently not well supported in GATS.

- 5.4.1 HARMONIZATION THOUGHTS—The formats here are quite a bit different from the SAE ones, even if the basic underlying content is not. Comments are like those for SAE J2354. GATS, as a pay per use service, has less reason to make use of a densely packed broadcast message. The US need for this type of message is often from the State DOTs who are acting to present it directly to a public client (rather than an ISP). This area will be harder to harmonize.

6. In the U.S., *broadcast* is a term typically used to mean "non-interactive" as often as it is meant to imply a one-way transmission media. Web sites offering ATIS information (but not filtering it to individual user needs) can be considered broadcast. Commercial FM Subcarrier technology, often viewed as a promising broadcast media, typically provides a coverage diameter of 100 miles, much wider than the ~10 of a cellular site. Perhaps the most key point defining this term is that it is incumbent upon the end user to sort out from the provided information that which pertains to his unique needs. In this respect, both SAE ATIS and GATS are alike, placing the filtering burden on the end user device.

7. Need to confirm this with further review.



- 5.5 Navigation Services (SAE J2354)**—The navigation services offered by GATS involve centrally determined routes (at the ISP, called the service center in GATS). The transactional messages involve the same sort of *start* and *destination* messages used in SAE J2354.

The returned messages support a *turn by turn* routing and do not require the end user device to have a map database. This allows GSM phones such as the Nokia 6160, which has both an alphanumeric screen and an up-down-press button, which functions as a mouse to be used as display terminals. Devices with a map database can also be used. In many regards this is like the old European “Ali-Scout” product in operation except that the cellular network is used in lieu of roadside infrared beacons. The ISP is presumed (but not required) to have real-time information which it takes into account in determining the route. Voice connection to an operator at the ISP is also optionally supported.

- 5.5.1 HARMONIZATION THOUGHTS—The basic way to request a route and select preferences is not very different and could be harmonized. The problem is more in the format of the returned route. There are a number of reasons why this should be standardized for uses beyond just central routines (including incident management asset coordination). Harmonizing this will be a more significant effort. There was a recent ISO NP requesting work on centrally determined routing - the US may want to review that in light of GATS becoming a prior standard in that area.

- 5.6 Floating Car Data Collection (So Called “Vehicle Probes”)**—There is no equivalent set of U.S. standards in this area.

The floating car data message comes also with a set of algorithms to reduce and detect the significant data. While this is not a message set *per se*, it seems to be useful work which we may wish to test and copy in the U.S. in some way.

- 5.6.1 HARMONIZATION THOUGHTS—None at this time.

- 5.7 Information Services (SAE J2354 and J2369)**—This is the catchall of concierge services, press data, stock quotes, and any other data item which the private service center (an ISP to us) could send and sell over the media (called Operator Services in GATS). It is only poorly defined in the GATS document as the “killer app” in this area, it has yet to be discovered and GATS (like other systems) desires to remain flexible in order to change. It is not defined at all in the ATIS standard and the working philosophy was that different media groups and consortia would determine this and that it was beyond the FHWA concerns to fund its development.

In the GATS system, the service center can download a set of menus to create and support whatever services it wants. The top level structure of these allows for five major menus, the first used for systems things, the rest subject to definition into various service groups as makes sense. The use of voice in selection services is also supported. This is used to deliver the required information when a simple text message will not suffice. The message structures allows the creation of more complex returned messages (e.g., one that could be used by another application) but does not devise them at this time.

- 5.7.1 HARMONIZATION THOUGHTS—Recommend we provide information about how such systems can be implemented but not specify them as done in GATS. Many of the media that ATIS will be sent over already have a rich set of features to support this type of operation.

- 5.8 Parking Services (SAE J2354)**—The support for parking services is provided in SAE J2354 in the U.S. No such services are provided in the GATS message set, but *lot full* and *lot nearly full* messages do exist in a general traffic information message.

- 5.8.1 HARMONIZATION THOUGHTS—US ATIS work provides a good starting point for adoption, but must be fitted to the rest of the GATS environment rather than just used to fill a missing “hole” in the current work.

5.9 Transit Services (SAE J2354, J2369, and NTCIP PI Std)—The transit and multi-model operation are not supported in the GATS message set at this time. Transit services are supported as a flow in SAE J2354, and one can interactively request a planned route with transit services. SAE J2369 has the ability to send transit schedules (and schedule adherence is now being added in the Phase II work).

5.9.1 HARMONIZATION THOUGHTS—U.S. ATIS work provides a good starting point for adoption, but must be fitted to the rest of the GATS environment rather than just used to fill a missing “hole” in the current work.

5.10 Weather Services (SAE J2354 and J2369)—The support for weather in GATS is limited to the phrases which exist in RDS-TMC phrases; however, general-purpose phrases can also be created as needed. There are no specific messages that provide for sending weather values *per se* (e.g., temperature, pollution alerts, etc.). Weather information services are supported as a flow in SAE J2354.

5.10.1 HARMONIZATION THOUGHTS—U.S. ATIS work provides a good starting point for adoption, but must be fitted to the rest of the GATS environment rather than just used to fill a missing “hole” in the current work.

6. Detailed Comparisons—In this section of the report, each of the major functional areas identified in Chapter Five is further examined and compared with similar ATIS messages. Some of the atomic elements that make up the messages themselves are compared so that the reader gains a basic understanding of the structures. Differences found in GATS due to the choice of GSM as a network transport media are de-emphasized.

6.1 Some Common Concepts—The following concepts and procedures are used in most of the messages and discussed here for reference in the remainder of the chapter.

6.1.1 LANGUAGES—In order to provide a world class standard, the message set must support more than just English language users. This means one must develop strings into sentences which support not only a specific language but are also expressed in a specific character set. GATS and ATIS take different views of this. GATS, seeking to support a European user base made up of the so-called *Romance* languages can use the Latin_1 character set (of which ASCII is a subset). Those seeking to handle other character sets typically must support Unicode methods (of which Latin_1 is a subset). These are NOT the same - one may send a message in one language, yet speak on the cellular phone with another (in GATS the response language value is used in the ISP to route cellular calls to a call taker with the suitable language skills).

Quoting from GATS: “ Each application message starts with a 16-bit long header. This header provides the message type and the preferred language resp[onse]. [The value indicates] the language used in text elements of this message.”

This header is made up of the following two elements:

Language	5-bits	See Section 1.1 of A1_2034.PDF
Message Type	11-bits	See Section 1.2 of A1_2034.PDF

The 5-bits of language are used to select from a list of European Languages, all implemented in the Latin_1 character set.⁸ There is no support for non-western languages.⁹

In the SAE work, SAE J2354 (transactional ATIS) provides language support in the form of the setting-Type element which can be set to language(0) followed by the selected language in the expression value.

8. In the textual encoding sections, there is a provision for 6-bit text (to save space) and for a “transparent mode” which could (with further inner encodings) carry nearly anything.

9. Nor is there apparent support for Cyrillic (Russian) character sets found in Middle and Eastern Europe markets. The 31 languages do include such things as Chinese and Japanese, which also cannot be expressed in the character strings of the message set.

In SAE J2369 (broadcast ATIS), support is provided by defining the character set used in the context part of the message (analogous to the header of GATS) from a choice of modified ASCII, Latin_1, and Unicode (in increasing use of bandwidth). No language concept is provided.

In SAE J2313 (Mayday), no language support exists and all textual elements are expressed Latin_1 characters.

It is foreseen that in the next update of ATIS standards (when a unified way to handle textual strings will be employed) that a language field will be added along with a character set field.

The 11-bits in the previous are used to select the specific messages which can be considered a protocol aspect of the GATS use of GSM.

- 6.1.2 BASIC ELEMENTS—Similar to the data dictionary work of SAE J2353, GATS provides a document entitled “Basic Elements” which provides common definitions and usage guidelines for the building blocks used in the messages. Differing from SAE work (which like other international standards used ASN.1 as a common means of syntax expression) the definitions of elements in GATS are a somewhat uneven. They can range from simple atomic elements to complex structures (data frames or data concepts in the parlance of the ITS data registry effort). [The most recent version of GATS is using ASN.1].

A number of elements used could be readily adopted by SAE in the spirit of harmonization. A similar number of SAE elements could be adopted by GATS. This is more of a political issue than one of technical merit. In a number of cases, the GATS definitions also fit well with existing ITS practices in other areas outside ATIS. For example, TCIP transit users employ a 32 hour “day” while GATS defined a 0:31 valued DE with the values past 23 reserved. This type of “easy” agreement (now starting to take place in the ITS registry process) could also be done in a common ATIS forum if such an environment could come to exist. Just as there are good concepts within both systems, there are also useful simple data concepts that could be shared with little effort.

- 6.1.3 TAGGING FORMATS—Tagging is the methodology used in the message set to detect the start and end of the elements that make up the message. In messages which are not of fixed length or composed of invariant structures, tagging is used to flexibly determine the contents. A key concept of tagging is to be able to “step over” any element which is not understood or not considered of value. Both ATIS and GATS make use of various tagging systems to achieve this. Also, ASN.1 will often provide a tagging environment if desired – frequently this is not desired in implementation and an explicit system is developed. The vast majority of these are made up of some form of: a unique tag, a length in bytes or bits, and the actual data value.

The tagging employed in GATS is ad hoc and not particularly extendable. This has the side effect of causing the GATS messages to tend to group things (such as a ILOC for example) into a single defined unit.¹⁰ It has the disadvantage of not following any recognized standard tagging environment, hence requiring unique decoder development work for each implementation. This will be problematic when harmonization is undertaken.

SAE by contrast has used three different tagging value systems, each with good reason, but not particularly harmonized. SAE expects to add further schemes as it maps the messages into specific media which themselves often have a predefined tagging scheme employed. In this mindset, SAE ATIS messages tend to fit well into an encapsulated format.

10. It also has the positive effect of making the resulting “lumps” of data more compact to transmit, which presumably was the original implementers primary concern.

There are valid arguments on both sides of this issue. A common, extendable, yet bit efficient tagging adopted by the entire ATIS industry would be ideal. Such a system would allow reuse of common structures (as is done in GATS) rather than simple DEs (as is done on most of ITS). Yet it would also allow both private and public structures to be defined and carried (as in done in SAE J2313 tagging) and also encourage the evolution toward common standards.¹¹

- 6.1.4 LOCATION REFERENCING FORMATS (SAE J2374 AND LRMS)—GATS makes use of the ILOC method which closely follows the LRMS work in the US, notably the ISP -> Vehicle standard, SAE J2374. Quoting again from the basic elements document:

“The method, called ILOC referencing, was developed between September 1995 and October 1997 by the ERTICO Committee on Location Referencing, following earlier work in the framework of the Socrates project. The method provides a location-referencing scheme that is independent from the map database and has no need for doing any pre-coding. An intersection location (ILOC) exists where two or more roads, having different road descriptors, meet. The ILOC descriptor consists of the WGS84 co-ordinate pair of the approximate center of the ILOC (in 10 microdegrees), plus the first five characters of 3 road descriptors, of different road sections connecting at the ILOC. Main road descriptors are road numbers and road names.”

The US variation of this uses more complete road names than are transmitted by just the first 5 letters. In the US, when the US table compression methods for such strings are used, typically more characters can be expressed in a smaller space as well.

There is also a grid and offset system much like the GRID profile of LRMS effort (used extensively in SAE J2369 Broadcast) which is used in GATS to efficiently describe incidents in the whole of Western Europe.¹² This technical approach is less elegant than the GRID LRMS in that it allows only a single fixed grid, which cannot be scaled and fitted to local needs. It is in this respect similar to the six “National GRIDS” pre-defined in the US LRMS profile (see SAE J2369 for details) which cover the greater North American continental area and the oceans.¹³ The basic “snap to” value used in GATS is 10 microdegrees. In the US, general ATIS tends to be 1 microdegree, broadcast ATIS is typically 32 microdegrees, and national scale information is 2048microdegrees.¹⁴

A number of more complex geometric values are also provided for in GATS. Some of these are used in the data reduction algorithms employed by the floating car messages (vehicle probe messages). Interested readers should review the basic elements document as well as: Annex 6.1 - *Minimum Onboard Positioning Performance Requirements for Traffic Telematics Terminal Devices* [A61_2033.pdf] and also: Annex 6.2 - *Preparation of Extended Location Block* [A62_2033.pdf].

GATS also makes use of the RDS link encoding systems (and the phrases of Alert-C) which involve a pre-defined exchange of numbered indexes to describe roadway segments. In this respect it uses a 30-bit value where 16-bits are the table index and 10-bits are used as a registration value between implementers. No provision for automatic table downloading or updating is provided.

All of the previously mentioned aside, during the MAYDAY operation the primary exchange is simply sets of Lat-Long pairs sent to the response center.

11. Taken to the extreme one could envision a tagging format where GATS and ATIS co-exist in a cafeteria style environment. This is not the goal of tagging and would be considered a failure in terms of message harmonization efforts.

12. The Japan VICs systems use a similar GRID approach and were perhaps the first to widely deploy such a system.

13. This wide area was devised to provide a means for both national weather and for state-wide event and closure information.

14. Providing a precision of ~4 inches, ~11.7 feet, and ~750 feet respectively.

6.2 MAYDAY (SAE J2313)—See the following GATS documents for more information.

Annex 5.1.1 Specification Emergency Service and Break-down Assistance A5112033.pdf 05.08.99

Annex 5.1.2 ADP Emergency and Breakdown Services A5122033.pdf 05.08.99

The contents of the GATS breakdown and emergency services are analogous to the US MAYDAY services. Both contain largely the same elements but the formatting, ordering and placement (in the message body or in the header sections) differs.

The two systems are sufficiently alike in technical approach that there is little which can be said about them in a broad brush review such as this. Specific comments follow. The list of codes given for breakdown reasons is more exhaustive in GATS (U.S. makers may never fill out such an exhaustive list) but it perhaps should be adopted. The use of the reason for calling (placed in the header for ATIS) is better suited for multiple events (e.g., a roadside breakdown followed by a collision) in U.S. ATIS. GATS uses 9-bits to relate the direction of travel, SAE uses 8 bits, both are wasteful of bits as the value can only be determined to about ~3 degrees. Both have concepts of recent “breadcrumbs” of prior position fixes. Many similar examples can be found by reviewing both documents side by side.

- 6.2.1 **HARMONIZATION THOUGHTS**—This is perhaps the easiest one to deal with. U.S. tagging for MAYDAY is simple and explicit, as is GATS in many ways, but neither is inter-operable.¹⁵ The data structures used in each are largely alike and the differences do not seem to be based on any particular merit in one standard or the other. The overwhelming needs of public safety may also help to make this a successful candidate for merging.

6.3 Interactive Traffic Information Services (SAE J2354)—See the following GATS documents for more information.

Annex 5.2.1 Specification Interactive Traffic Information Services A5212034.pdf 05.08.99

Annex 5.2.2 Specification of Broadcast Traffic Information Services A5222033.pdf 05.08.99

Annex 5.2.3 ADP Traffic Information Services A5232034.pdf 05.08.99

This area of functionality maps most closely to SAE J2354 in that it provides messages for two-way transactional-based exchanges of roadway information.

In US ATIS, a number of flows were devised which can be populated with various messages and used to build applications. U.S. ATIS tends to follow the flows of the National Architecture, extending them as needed. Further, the data items are often taken from (or developed with) other SDOs working on the area of ITS. Figure 1, taken from SAE J2354, show this for the area of interactive traffic information.

15. The subject of technical approach for a common tagging environment was a large point of the discussion at the Germany meetings on September 28-30, 1999. It was generally agreed that a simple but extensible tagging based on reused “clumps” of data structures would accommodate moving the messages to a common point.

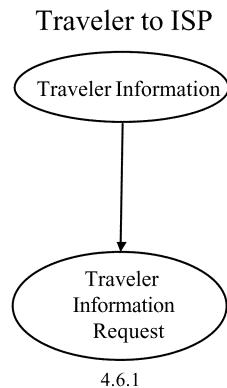
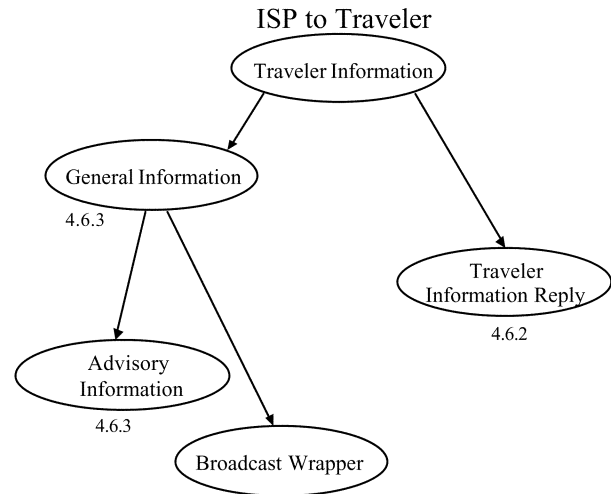
Traveler Information**Traveler Information**

FIGURE 1—ATIS INTERACTIVE TRAFFIC MESSAGES

It is helpful to step back in time a number of years and consider the European environment in which GATS was first developed. At the time, the EDIFACT work was dominant and the concepts of a BIF-BAP were in vogue.¹⁶ In this structure there were attempts to classify message information by application types as follows in Table 1:

TABLE 1—EDIFACT MESSAGE TYPES FROM THE EARLY 1990'S

BIF TYPE	EDIFACT NAME	CONTENT
1	TRAVIN	Traffic/Travel situation information examples: delays, accidents
2	TRAILS	Basic Traffic/Travel information on links examples: speeds, journey times, flows
3	TRADES	Downloading of Traffic/Travel situations descriptions examples: new descriptions not in data base
4	TRALOC	Downloading of Traffic/Travel locations examples: new locations not in data base
5	TRAINS	Public Transit information on schedules examples: routes and times
6	TRADIN	Details of individual travelers examples: means of transport
7	TRAREQ	Requests for other Traffic/Travel information
8	TRAVAK	Acknowledgments of TRAREQ
9	TRACAT	Catalog of available Traffic/Travel information

The previous system has, in general, proved unworkable in deployment. U.S. experiences in this is limited to the Seattle MDI, but in that case, as in Europe, it proved overly complex and unmanageable to clearly keep the nine divisions above in practice. Further, various private enterprises felt that they could combine items above in advantageous ways to serve their own consumer base. It was in part for these reasons that U.S. ATIS has never rigorously segmented ATIS information in a similar way.

16. Conceptually BIF-BAP allows the development of a message set independent of the restraints imposed by the carrier media limitations (typically bandwidth) and allowed a separation of the media profiling from the ultimate message content. U.S. ATIS has followed this up to a point but allows the media operator to determine what specific content he feels is best to carry along (a business decision) by providing a common methodology for him to select it and for the end user to reconstruct it. If the reader wishes to take this perspective then SAE J2354 is the BIS and SAE J2369 is a BAP.

Taken at a high level the mapping from EDIFACT into US ATIS is as follows. You will find elements of functions 1, 2, and 3 combined in a general sort of way in SAE ATIS. ATIS does not differentiate between, say, a pre-planned construction delay and an incident event when they are occurring (preplanned events of all types are handled as predicted events). Item 4, extending a map database to cover a new event, is handled in the ISP → Vehicle Standard SAE J2374 (and in the European work became the ILOC and MLOC formats). Item 5 is now being addressed in the current Phase II ATIS work plan. In general, the process is taking the TCIP "Passenger Information" messages and objects and placing them into the common ATIS framework. Items 6 and 7 are of the most interest with respect to GATS (and will be discussed below), and are handled in the U.S. ATIS mostly in the exchange of user preferences provided in the SAE J2354 messages. Items 8 and 9 delve into issues of protocol and are, in general, ignored by U.S. ATIS and covered in a GSM network way by GATS.¹⁷

GATS is by nature a 2-way *point to point* system. Many of the previous items were first considered from a broadcast viewpoint. Bear in mind that the typical European deployments of the time were State sponsored "for the public good" projects whereas GATS is a private *for profit* system. Every message sent in GATS falls into the item 6 or 7 classification in the above. Therefore, EVERYTHING becomes an "individual traveler" type of message.

GATS provides a message type called TINFO (Traffic Information Report) that is grossly traceable to the EDIFACT terms above. Besides the ability to send messages (with diversion advice - called *hints* in GATS), it also provides a means to send analog voice information over the media as well, which will not be considered in detail here. Heavy use is made of these audio reports and they can be linked and processed such that only the ones pertinent to the end user's current location and course are played. These are of course human usable descriptive summaries and they do not provide machine usable link data for automatic routing (that is, provided by other means). The content of the TINFO messages can be updated, deleted or modified by subsequent messages to maintain currently correct data in the user's device. TINFO content is not connected to anything like the TMDD or TCIP work in the U.S., and as it is mostly "press release text" information this is less critical.

The TINFO message comes in two flavors (Type 1 and Type 2). Each is comprised of several building blocks with similar information found in the U.S., except that GATS makes use of the location encoding and phraseology from prior European RDS heritage in some messages. The two types are composed of:

TINFO Type 1

- Block 1 General Information
- Block 2 Location (using I-loc codes)
- Block 3 Event
- Block 4 Cause
- Block 5 Hint (advice)
- Block 6 Duration
- Block 7 Bypass
- Block 8 Average Speed
- Block 9 Event Position

TINFO Type 2

- Block 1 General Information
- Block 2 TMC Message – using the 11bit Alert C TMC codes

17. Also it should be noted that from the beginning the EDIFACT work has used a number of RDS-TMC phrase concepts to conserve bandwidth. Some projects even began to promote downloadable tables to overcome maintenance problems. The phrases in the early 90's started to divide into distinct description and advice types — a concept which the U.S. did not follow but which can be found in the METS messages now being considered to be brought into standards.

Within the message set of GATS are means to select traffic information based on several geographic concepts (the uplink request message) including a radius from the user location, a wedge projection, and general direction of travel. In addition, information can be requested for a user who is local versus one who is passing through the requested area (the regional request message). SAE ATIS does not contain as strong a set of sub-messages to focus the traffic information in this way and should probably adopt the GATS work after further review. It should be mentioned that SAE has many more “personal” requesting type terms (e.g., scenic, no freeways, etc.)

The data sent by TINFO is either of an audio type or of a textual type. It also contains various LRMS encodings and the textual types are encoded in various ways. Some additional messages provide “translation” of type codes and other information for the end user devices – basically using the center as a look up table of alternatives.¹⁸

There is no information regarding what a U.S. reader might call “flow data” in terms of link travel speeds, congestion or times in this message. A value for average speed is provided in Type 1 Block 8 but nothing like congestion or travel time is provided. As such, this family of messages is more for human consumption and processing and is grossly limited when compared to the machine processing content found in U.S. ATIS which was developed with more of the need of autonomous routing devices in mind (although it also supports such textual messages).

- 6.3.1 HARMONIZATION THOUGHTS—The formats here are quite a bit different from the SAE ones, even if the basic underlying content is not. SAE and TMDD are likely to be adding *description-cause-advice* fields where previously only a description field existed due to incorporation of some of the METS work - which will also serve to move ATIS closer to the GATS efforts. Compounding any discussion of change in this area is the close fitting of the SAE work with that of the standards in TMDD, TCIP, and NTCIP so that a coherent U.S. deployment could take place. There was nothing analogous for GATS to be aligned with during its development. This area will be harder to harmonize.

- 6.4 **Broadcast Traffic Information Services (SAE J2369)**—See the following GATS documents for more information.

- Annex 5.2.1 Specification Interactive Traffic Information Services A5212034.pdf 05.08.99
- Annex 5.2.2 Specification of Broadcast Traffic Information Services A5222033.pdf 05.08.99
- Annex 5.2.3 ADP Traffic Information Services A5232034.pdf 05.08.99

This area of functionality maps most closely to SAE J2369 in that it provides *transaction-less* messages for broadcasting of roadway information. In terms of the EDIFACT classification introduced in the last section, the GATS mapping remains the same, while ATIS in SAE J2369 is a one-way distribution of information providing the first five services.¹⁹

18. It is foreseen that in the forthcoming SAE Standard for handling strings and indexes in ATIS that every media making use of phrases indexed into tables will be using a common descriptive header for coordination. Those media which can support the downloading of tables (most can) will be required to provide automatic updates, leaving only the most restricted media using truly static tables and having the current problems of RDS. The GATS concept of having the service group provide a “per index” translation is perhaps an additional set of support messages which SAE should provide for tables used in 2-way media.

19. It is anticipated that the preference-request messages in SAE J2354 used to request a coverage area of information would be used by SAE J2369 as well when it is placed in a medium that supports transactions. This will be addressed as part of the Phase II work plan under the development of “profiles” — the term used for mapping ATIS messages into specific media and their transactional concepts.

The comments provided in 6.3 apply here as well. GATS does not differentiate much between these two service delivery modes and uses much the same formats. Of course in the case of broadcast message it becomes the responsibility of the end user device to sort out and discard those messages that do not pertain to its unique needs. In the “systems” aspects of the GATS document it states that it is the intention of GATS to allow each service provider to determine what mix of *point to point* versus *broadcast* messages content makes the best economic and business sense for themselves. It also states that the billing for this is beyond the scope of the document.

Besides the initial comments provided in 5.5, the following should be observed. In general, RDS like concepts are used to send both phrases and “quantifier values” of messages connected to indexed location referencing values. No provision to translate the reference index value of a location to an I-Loc (the CEN version of the U.S. LRMS Profile “V → ISP” format) appears to be supported. There is just no fundamental concept of packing a lot of these messages into a convenient data gram for use. This may be because the GATS deployments are not in any way concerned with a public service or “free” aspect as was Japan with VICS, The European Broadcasting Union (EBU) with TPEG, or U.S. ATIS for Broadcast use. All of the latter examples share a basic concept of a package of data containing a dense set of reports on multiple links.

6.4.1 HARMONIZATION THOUGHTS—The formats here are quite a bit different from the SAE ones, even if the basic underlying content is not. Comments are like those for SAE J2354. GATS, as a *pay per use* service, has less reason to make use of a densely packed broadcast message. The U.S. need for this type of message is often from the State DOTs who are acting to present it directly to a public client (rather than an ISP). This area will be harder to harmonize.

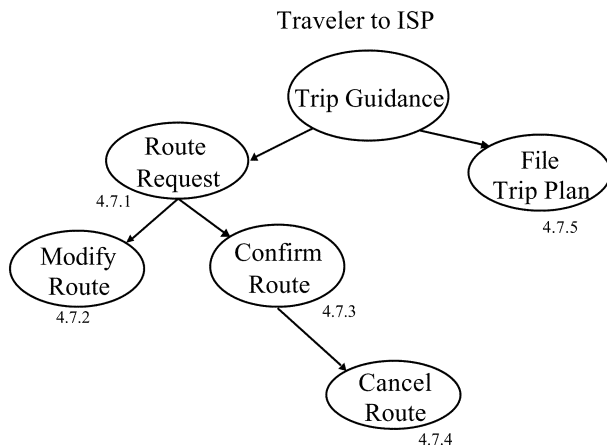
6.5 Navigation Services (SAE J2256)—See the following GATS documents for more information.

Annex 5.3.1 Specification Navigation Services A5312033.pdf 05.08.99

Annex 5.3.2 ADP Navigation Services A5322033.pdf 05.08.99

The navigation services offered by GATS involve centrally determined routes (at the ISP, called the service center in GATS). The transactional messages involve the same sort of *start* and *destination* messages used in SAE J2354. Again presenting the U.S. ATIS figure of supported message we have (taken from SAE J2354):

Trip Guidance



Trip Guidance

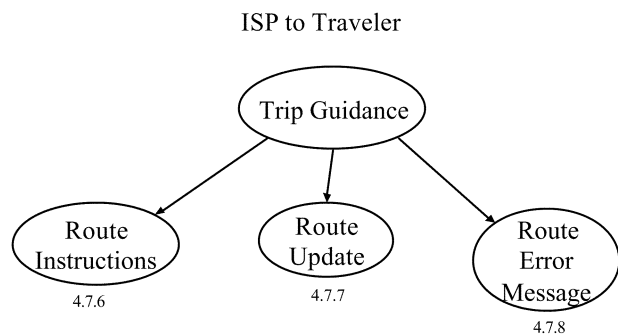


FIGURE 2—ATIS NAVIGATION SERVICES MESSAGES

In the GATS message set, navigation destinations can be entered in the normal ways. Address entries can be

incomplete, crude, or precise, as can Point of Interest entries (POI). Starting location need not be the same of the user's present location. Precise use of this information is left to the service provider, but the message set itself supports the normal sorts of things and is not noticeably different from U.S. ATIS.

The returned route is a set of data objects for each waypoint and what the next segment is to be (street names etc.). The device is presumed to prompt the user once the maneuver has been completed to further ensure that it was done correctly (e.g., "heading east on Main street..."). The route is delivered in small sets of this information. This allows the central routing computer of the service provider to have more up to date control. Among the data returned to the user device are anticipated call-in times. It should be noted that vehicles participating in this process also act as probes (referred to as *floating cars* in the GATS terminology). It should also be noted that the GSM phone systems is a *pay-per-packet* system without the initial call setup delays and fees found in the US AMPS phone system which would make this technical approach cost prohibitive.

The GATS message set provides an icon-ised collection of M-Loc (maneuver locations) that does not exist in the ATIS work. This tends to follow European work in this area and can be employed in the end user device display to provide graphics of the impending navigation way-point. The message set provides values of direction, angle of turn, and which fork to take (supporting roundabouts and complex intersections).

As mentioned in the interactive ATIS portion previously, the SAE messages support for preferences is much wider than that offered by GATS and presumably would result in a wider diversity of returned routes. Figure 3, taken from SAE J2353, illustrates this.

Settings

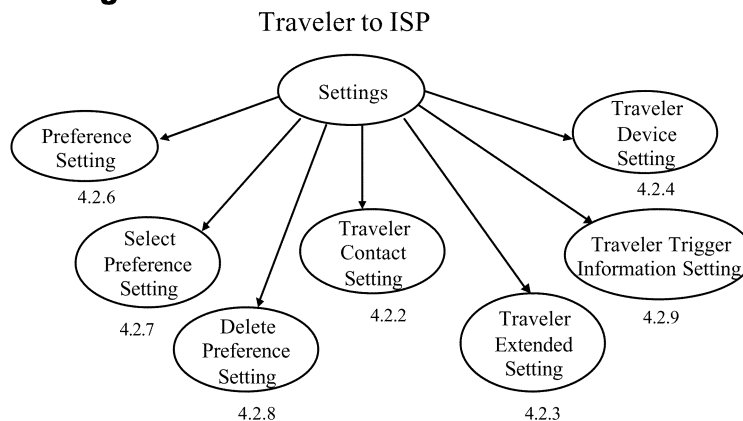


FIGURE 3—ATIS MESSAGES FOR PREFERENCE SETTINGS

There is a section on handling route deviations in the GATS documents. This is another example of where GATS is more of a complete systems design specification than just a message set. The contents provide some example methods of detecting that the user has left the route and commentary on how the message set can be used to reestablish a new route.

All routing is single mode (e.g., in the vehicle by means of the roadway); there are no provisions for transit routing to be done by this message set.

6.5.1 HARMONIZATION THOUGHTS—The basic way to request a route and select preferences is not very different and could be harmonized. The problem is more in the format of the returned route. Here are a number of reasons why this should be standardized for uses beyond just central routines (including incident management asset coordination). Harmonizing this will be a more significant effort. There was a recent ISO WP requesting work on centrally determined routing - the US may want to review that in light of GATS becoming a prior standard in that work.

6.6 Floating Car Data Collection (So Called “Vehicle Probes”)—See the following GATS documents for more information.

Annex 5.4.1 Specification Floating Car Data A5412034.pdf 05.08.99

Annex 5.4.2 ADP Floating Car Data A5422034.pdf 05.08.99

There is no equivalent set of US standards in this area.

The floating car data message comes also with a set of algorithms to reduce and detect the significant data. While this is not a message set *per se* it seems to be useful work which we many wish to test and copy in the U.S. in some way.

6.6.1 HARMONIZATION THOUGHTS—None at this time.

6.7 Information Services (SAE J2354 and J2369)—See the following GATS documents for more information.

Annex 5.6.1 Specification General Information Services A5612034.pdf 05.08.99

Annex 5.6.2 ADP for General Information Services A5622034.pdf 05.08.99

Information services within GATS are a place for private service providers to install a jumping off point for a menu of their own offerings. The GATS messages provide a framework for this but do not provide any partial support or limit on what can then be implemented (called *external applications* in GATS). If GATS were to be modified to support some of the things found in the US NA (e.g., transit, parking and weather) they would probably be placed here.

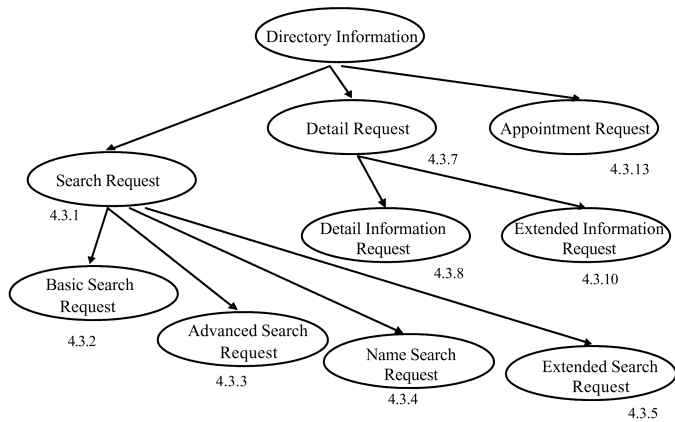
The U.S. ATIS message set provides ways to gather and find a number of services (such as restaurant locations) from a central yellow pages provider but also does nothing to support implementing further services. In general ATIS does not provide a wrapper for à la carte service, presuming this will be handled in the bearing media. For example, over the Internet one could get ATIS formatted messages in combination of SAE J2354 and SAE J2369 formatting. One would not use the formatting of SAE J2354 as a registered MIME type to lookup the SAE on the web pages, <SAE.org>, rather one would use the established formats of the HTTP/HTML standards to do so. The collection of directory related messages is shown in Figure 4, taken from SAE J2354.

The broadcast ATIS message provides means to send “private” data within each of the messages regarding incidents, to allow for implementing a tiered service structure. It also provides a “raw file” transfer and a number of primitive table transferring messages – which can be used to build other services beyond that of ATIS. But it too restricts itself to only specifying ATIS message contents.

6.7.1 HARMONIZATION THOUGHTS—Recommend we provide information about how such systems can be implemented but not specify them as done in GATS. Many of the media that ATIS will be sent over already have a rich set of features to support this type of operation.

Directory Services

Traveler to ISP

**Directory Services**

ISP to Traveler

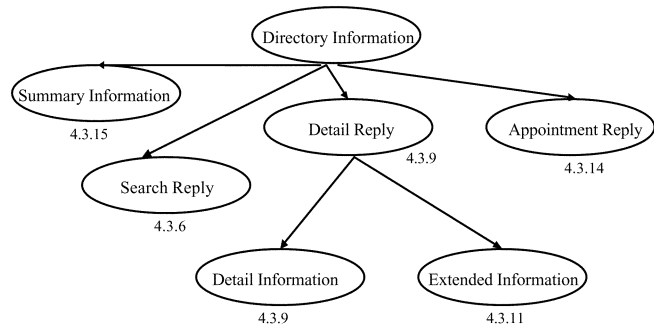


FIGURE 4—ATIS DIRECTORY MESSAGES

6.8 Parking Services (SAE J2354)—See the following GATS documents for more information.

Nothing specific to refer to

There is little covered in the existing GATS document in the areas of transit support services. The rationale for this omission is presumably that early pay-per-use service providers did not feel this service area was initially worth developing. The general information areas could allow this to be added within the existing scope at some later date.

At present there is within the TINFO message structure a simple set of conditions for expressing the conditions of “No vacant parking spaces” and also “Very few vacant parking spaces.” There is no specific flow for parking support as can be found in the NA.

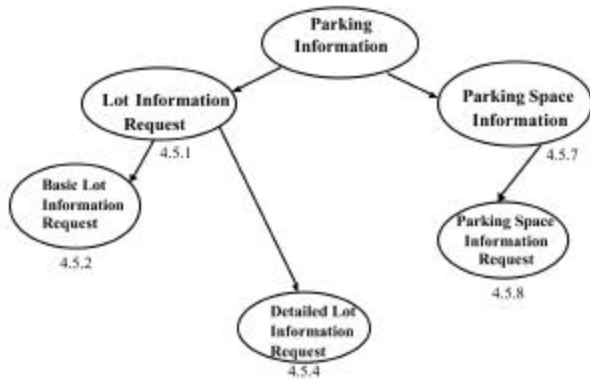
Refer to the basic data element document (A2_2033) in Section 9.3.1 *Quantifiers within the TINFO message* for additional information. TINFO is one of the messages that GATS adopted from the earlier EDIFACT – ERCIO work in Europe.

In the U.S. ATIS, a more extensive message set allowing a *request – response* exchange is provided. Figures 5 and 6 come from SAE J2354.

6.8.1 HARMONIZATION THOUGHTS—U.S. ATIS work provides a good starting point for adoption, but must be fitted to the rest of the GATS environment rather than just used to fill a missing “hole” in current work.

Parking

Traveler to ISP

**Parking**

ISP to Traveler

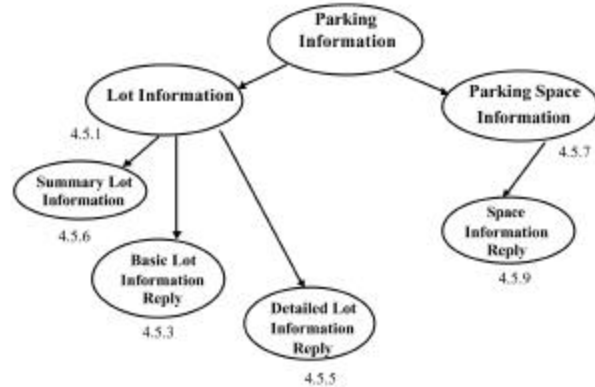
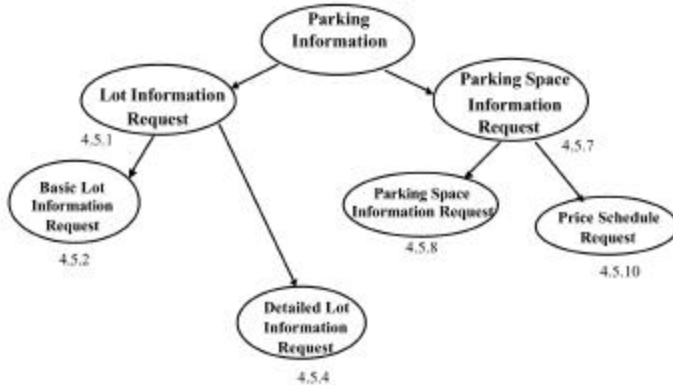


FIGURE 5—ATIS MESSAGES FOR PARKING SERVICES

Parking

ISP to Parking Management

**Parking**

Parking Management to ISP

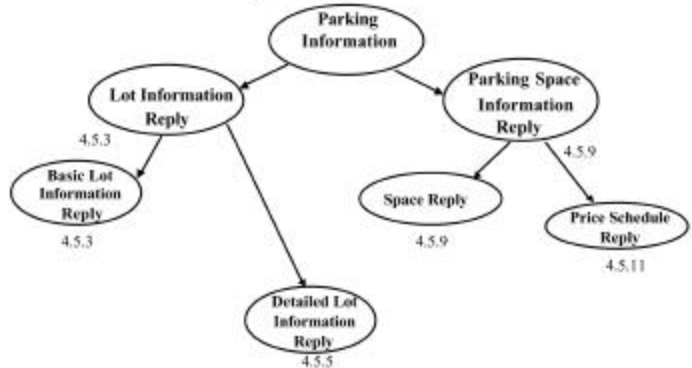


FIGURE 6—ATIS MESSAGES FOR PARKING SERVICES

6.9 Transit Services (SAE J2354, J2369 and NTCIP PI Std)—See the following GATS documents for more information.

Nothing specific to refer to

There is little or nothing covered in the existing GATS document in the areas of transit support services. The rationale for this omission is presumably that early pay-per-use service providers did not feel this service area was initially worth developing. There are some multi-model (bus, plane etc.) messages but nothing like a route table per se. The general information areas could allow this to be added within the existing scope at some later date. One can reasonably assume that airline schedules will be the sort of information early adopters would wish to have, and this may provide a motivation for developing this area.

6.9.1 HARMONIZATION THOUGHTS—U.S. ATIS work provides a good starting point for adoption, but must be fitted to the rest of the GATS environment rather than just used to fill a missing “hole” in current work.

6.10 Weather Services (SAE J2354 and J2369)—See the following GATS documents for more information.

Nothing specific to refer to

There is little or nothing covered in the existing GATS document in the area's weather information services. The rationale for this omission is presumably that early pay-per-use service providers did not feel this service area was initially worth developing. The general information areas could allow this to be added within the existing scope at some later date. There is a growing feeling among U.S. implementers (not just within ATIS) that a set of weather reporting messages would be of value of the community as a whole.

The U.S. ATIS provides a collection of useful weather elements (some listed below). But it suffers from only being able to present *current* data rather than *predicted* data evolution (e.g., a rate of snowfall versus time). A simple forecasted version is also supported. This is to some degree being addressed in the Phase II work.

Various data element currently supported include:

- a. advisoryArea: location reference for information response
- b. weatherLocation: the location reference for the weather
- c. weather-ForecastOrActual: the weather forecast
- d. weather-Temperature the temperature
- e. weather-HighTemperature: the high temperature recorded
- f. weather-LowTemperature: the low temperature recorded
- g. weather-SkyConditions: the condition of the sky
- h. weather-Probability: the probability assessment for the weather forecast
- i. weather-SpecialConditions: special conditions that elaborate on or extend basic weather information
- j. weather-Visibility: the current or forecasted visibility
- k. weather-WindSpeed: the speed of the wind
- l. weather-WindDirection: the wind direction
- m. weather-Humidity: the humidity level
- n. weather-Pressure: barometric pressure in millibars
- o. weather-SunriseTime: the time for sunrise on a given date
- p. weather-SunsetTime: the time for sunset on a given date
- q. pollution- SmogAlert: reflects the smog alert level
- r. pollution-AirQualityIndex: pollutant level percentile
- s. pollution-CarbonMonoxide: the carbon monoxide levels in a region
- t. pollution-HydroCarbon: the hydrocarbon levels in a region
- u. pollution-SulfurDioxide: the level of sulfur dioxide in a region
- v. pollution-NitrousOxide: the nitrous oxide levels in a region
- w. pollution-Particulate: the level of particulate in a region
- x. pollution-Ozone: the ozone levels in a region

6.10.1 HARMONIZATION THOUGHTS—US ATIS work provides a good starting point for adoption, but must be fitted to the rest of the GATS environment rather than just used to fill a missing "hole" in current work.

7. **Recommended Changes to US ATIS**—As this comparison to GATS was completed a number of minor areas where U.S. ATIS could be improved were noted throughout the prior text. Regardless of further harmonization with GATS, the following areas should be considered for incorporation into the SAE's ATIS standards when the next opportunity for revision occurs. A number of these have already been noted in the existing ATIS Phase II work plans and are currently underway. Other will require additional dedicated resources to undertake. Chief among these would be a more comprehensive representation of ATIS work in the ISO TC204 process.

Limiting the discussion to those items which should be added to or improved in the SAE work, we present the following specific suggestions.

- a. GATS often provides a "which language" data token which should be added to SAE work. The SAE work on strings (as embodied first in SAE J2369 and latter in SAE J2540) provides much better expression of *text* in various formats but does not address the underlying *language* used. Adding this DE would address this issue. However, rather than adopt the GATS formats which is narrow and focuses only on Western European languages, a more general descriptor should be used from ISO work.
2. This is expected to be trivially added in the next revision of SAE J2354 in the current work plan.
3. GATS provides a collection of ways to specify a coverage area for requested ATIS data which is more verbose and has a number of attractive features not found in the ATIS work. For example one can request information based on an expected cone of travel described by a bearing and a length. This format is well suited to requesting multi-state roadway closure events. The message sets dealing with the request of data in ATIS should be expanded to match these features. In addition, the ability to request data in the packed formats of SAE J2369 or the more "client specific" formats of SAE J2354 should be supported in the next revision.
4. This is expected to require a modest level of effort as part of the current "profiling" task of mapping SAE J2354 to specific media.

GATS provide a means to map both messages (typically for textual display or for automated use) and digitized voice (typically for playback use) in its standards. This represents an interesting merging of different media presentation styles, which for GATS as a mobile phone system makes common sense. SAE has received a number of suggestions to expand the content type supported in ATIS beyond that of just messages with textual content to include not only voice but other multi-media types of rich content. It is envisioned that this will be required if ATIS is to fully support of many of the alternative rendering of various content that data issuers and application build desire.

The scope of what this sort of expansion will require is unknown at this time. It is believed that a modest level of additional content can be added under the current work plan without undue effort, but further study is required.

GATS provides a fairly complete set of messages (and also algorithms) for the collection of vehicle probe data. SAE has not yet addressed this (nor has anyone else in the US body of standards setting groups). We would recommend that a brief effort be expended to determine if there are unique US requirements in this area, and baring any dramatic discovery, that the GATS formulation be adopted in large part. This issue is made more complex by recent US desires to use cellular and PCS phone systems in a passive capacity to do much the same thing. One would hope that a unified way of reporting this information to the TMC could be developed regardless of the tracking determination technology employed. There are also some issues of GATS inventor intellectual property which must be better understood in regard to use the GATS work as well.

This is not a covered area at this time, but may be handled in a subsequent committee work plan.

In addition to the above there are a number of other improvements expected to be addressed in the next revision of the ATIS family of standards which do not relate to GATS. They are not covered here, with the exception of the below.

Probably the most important other improvement ATIS standards is the task of mapping ATIS into specific media for actual use. Recall that ATIS has been developed to be largely media independent, whereas GATS was developed directly for the specific media of GSM phones. Ironically both efforts are at this point moving in the direction taken by the other in an effort to provide a complete set of specifications. Also noteworthy is that both groups have chosen mapping their respective message sets into the various formats of the world wide web as a key part of this. For the SAE this is part of the current work plan referred as "profiling" and the specific media mappings to be supported remain to be determined by the committee. It is very likely that this will include taking both SAE J2354 and SAE J2369 (but not SAE J2313) and providing information on how to use these standards with popular internet formats. Provisions to carry the entire message content (basically an encapsulation format) in both MIME and XML are foreseen. Debate continues at this time about other media such as the binary flavor of XML developed by the WAP forum.

Another source of change to the ATIS standard is the continued harmonization with the work of other U.S. SDOs working in the ITS area. The registry process which is now underway is expected to cause a number of modest changes in shared data elements to promote interoperation and harmonization. This is a real and actively engaged process which remains more likely to effect ATIS standards than any of the previous GATS harmonization items.

8. **Summary Recommendations**—This document has provided a comparison of the features found in GATS and how they compare to the SAE ATIS Message Sets and to U.S. ITS terminology. This document can provide a starting point for discussion on how these two bodies of work might be harmonized and what the actual differences to be overcome are.

PREPARED FOR THE SAE ATIS COMMITTEE

Rationale—Not applicable.

Relationship of SAE Standard to ISO Standard—Not applicable.

Application—This SAE Information Report provides a comparative summary between the various messages found in the SAE ATIS standards work (notably SAE J2313, J2353, J2354, J2369 and J2374) and that found in the GATS standard (Global Automotive Telematics Standard). GATS is a message set meant to be deployed on mobile phone systems based on the GSM (Global System for Mobile Communication) phone system which is being deployed in European markets and which the SAE may need to harmonize with as part of the World Standards activities of TC204. This document provides an overview of the various types of supported messages and how they compare with U.S. terms and messages. Some selected features of the GATS work are recommended for assimilation into the next revision of ATIS standards. No attempt at determining a U.S. policy in this regard is provided. This document seeks to provide the reader familiar with SAE ATIS with a high level overview of technical knowledge of the GATS approach in similar areas.

Reference Section

SAE J1746—ISP-Vehicle Location Referencing Standard

SAE J1761—Information Report, ITS Terms and Definitions, 1995

SAE J2313—On-Board Land Vehicle Mayday Reporting Interface, Rev. 1.0, September 1999

SAE J2353—Draft Standard: Data Dictionary for Advanced Traveler Information Systems (ATIS), Rev. 1.0.0, October 1999

SAE J2354—Draft Standard: Message Sets for Advanced Traveler Information Systems (ATIS), Rev. 1.0.0, September 1999

SAE J2369—Standards for ATIS Message Sets Delivered Over Reduced Bandwidth Media

SAE J2369-1—Draft of Host Adaptation Annexes, June 1999

SAE J2374—Information Report based on Location Reference Message Specification, Rev. B (MDI), May22, 1997

SAE J2540—Messages for Handling String and Look-up Tables in ATIS Standards

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GATS Message Set; Annex 5.3.1 - Specification Navigation Services A5312033.pdf 05.08.99

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National ITS Architecture, Federal Highway Administration, U.S. Department of Transportation, Version 2.0, September 1998

Message Sets for External Traffic Management Center Communication (MS/ETMC2), TM 2.01, Rev. 2.0, September 1998

Traffic and Traveler Information (TTI) – TTI Messages via Traffic Message Coding- Part I: Coding protocol for Radio Data Systems – Traffic Message Channel (RDS-TMS) using ALERT-C



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Application level syntax rules (Amended and reprinted 1990)
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NTCIP 1403—Standard on Passenger Information (PI) Objects

Developed by the ATIS Committee