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Comparison of GATS Messages to SAE ATIS Standards

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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.”