

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HONDA MOTOR CO., LTD.; AND
AMERICAN HONDA MOTOR CO., INC.,
Petitioner

v.
INFOGATION CORPORATION,
Patent Owner

Case No. IPR2024-01160
U.S. Patent No. 6,292,743

**DECLARATION OF SCOTT ANDREWS
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 6,292,743**

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I. INTRODUCTION

1. I have been retained by Honda Motor Co., Ltd. and American Honda Motor Co., Inc. (collectively, “Honda” or “Petitioner”) as an independent expert consultant in this *Inter Partes* Review (“IPR”) proceeding before the United States Patent and Trademark Office (“PTO”).

2. I have been asked by Honda’s Counsel (“Counsel”) to consider whether certain references disclose, teach, and/or suggest the features recited in Claims 1-19 and 21-22 of U.S. Patent No. 6,292,743 (“the ’743 Patent”) (Ex-1001), currently assigned to Infogation Corporation (“PO”). My opinions and the bases for my opinions are set forth below.

3. I am being compensated at my ordinary and customary consulting rate for my work, which is \$500 per hour. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other financial interest in this proceeding.

II. BACKGROUND AND QUALIFICATIONS

4. All of my opinions stated in this Declaration are based on my own personal knowledge and professional judgement. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this Declaration.

5. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted as Ex-1003. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this Declaration.

6. I have over 35 years of professional experience in fields relevant to the '743 Patent, including vehicle navigation systems. In various positions at, among others, TRW and Toyota, I have been responsible for research and development projects relating to, among others, numerous vehicle navigation systems, located based systems, mobile devices, information systems, and user interface systems.

7. I received a Bachelor of Science degree in Electrical Engineering from the University of California, Irvine in 1977 and a Master of Science degree in Electronic Engineering from Stanford University in 1982.

8. From 1977 to 1979, I worked at Ford Aerospace where I designed, tested, and delivered microwave radar receiver systems.

9. From 1979 to 1983, I worked at Teledyne Microwave, where I developed high reliability microwave components and developed CAD tools.

10. From 1983 to 1993, I worked at TRW, Inc. ("TRW") in the Space & Electronics Group, where I served as a project manager, a department manager, and

an assistant program manager on a variety of spacecraft communications systems projects. My last position at TRW in the Space & Electronics Group was as the manager of the Monolithic Microwave Integrated Circuits (“MMIC”) Products Organization. In that role, I developed TRW’s commercial gallium arsenide (GaAs) MMIC business. During my time in the MMIC Products Organization, I helped produce one of the first cellular phone related RF integrated circuits. I also developed the first single chip 94 GHz radar, intended for use in automotive adaptive cruise control systems. While I was at TRW in the Space & Electronics Group, I received several awards for outstanding performance on independent research and development projects.

11. In 1993, while still at TRW, I moved to the Automotive Electronics Group and became the Director of Systems Engineering and Advanced Products. In this role, I was responsible for the overall management of TRW’s advanced development programs in the automotive electronics space. These programs included, among other things, wireless remote keyless entry systems, vehicle tracking and location systems (e.g., roadside assistance and emergency response systems, including those using global positioning system (“GPS”) technology), emergency vehicle warning systems (e.g., transmitter-receiver systems that would provide a warning inside the user’s vehicle when an active emergency vehicle was

in the vicinity), automotive collision avoidance radar, and other types of vehicle information systems. I served in this role until 1996.

12. While at TRW, I also led the development of an in-vehicle information system based on off-board map databases, wireless data communications, and radio-based location technologies, and developed business and product strategies related to various off-board information services.

13. From 1996 to 2000, I worked at Toyota Motor Corporation (“Toyota”) at the Toyota Headquarters in Toyota City, Japan, as a Project General Manager in the R&D Management Division. My responsibilities included the conceptualization and development of multimedia systems and new technology products and services for Toyota’s future generations of passenger vehicles. My work at Toyota included, among other things, navigation systems with real time traffic information, automated vehicles, vehicle networking systems, and the integration of mobile devices with vehicle infotainment systems.

14. While at Toyota, I also established the Automotive Multimedia Interface Collaboration (“AMI-C”), a partnership of carmakers to develop a uniform computing architecture for vehicle multimedia systems. AMI-C was primarily aimed at developing standards for the integration and use of consumer devices in vehicles, and for a common computing platform to facilitate the rapid introduction of new systems and software in the vehicle. For example, a typical AMI-C system might

support the aftermarket integration of a cellular telephone subsystem and supporting software applications to provide location-based services such as off-board navigation and traffic information to support an in-vehicle navigation display system.

15. In 2000, I founded Cogenia, Inc. to develop an enterprise-class mobile data management software system. This included home and work computing environments, as well as multiple mobile devices. In each case, key data useful to the user was pre-positioned so that it could be easily accessed when and where the user needed it the most.

16. I founded Cogenia Partners, LLC as an independent consultant in the intelligent vehicles and mobile systems industry in January 2001. My primary clients have been various navigation and mobile device makers, automotive manufacturers, and the U.S. Department of Transportation. Since 2001 my work has focused on systems for delivery of services to vehicle occupants, either through personal devices, or through equipment embedded in the vehicle. These systems have included applications for vehicle and roadway safety, information and entertainment, and operational concepts and system designs for high occupancy toll (HOT) lane management using dedicated short range and wide area cellular communications.

17. Between 2006 and 2011, I served as the Chief System Architect for a large Connected Vehicle test bed in the greater Detroit area. This project included extensive systems engineering work, and real-world test and evaluation of short range vehicle to roadside and vehicle to vehicle communications systems and applications, including traffic data collection, in vehicle signage and navigation services. This work also included active involvement with various vehicle communications standards, including SAE J2735, SAE J2945, and a variety of standards associated with Dedicated Short Range Communications (DSRC) systems used, for example in vehicle management, traffic data collection and distribution, safety, tolling and other applications.

18. More recently I served as a technical lead on a project to support the National Highway Traffic Safety Administration (NHTSA) with the development of performance standards for connected vehicle equipment in vehicles. I also developed a variety of test and evaluation systems for the Federal Highway Administration to support the assessment of connected vehicle systems in the roadway environment and developed security credential management systems in support of the connected vehicle effort.

19. I am a named inventor on twenty-four U.S. patents, three Japanese patents, and one European patent. A list of my patents can be found in my curriculum vitae, attached as Exhibit 1003.

20. I have authored numerous technical papers and have been invited to give professional talks at various conferences, including World Congress on Intelligent Transportation Systems, the International Task Force on Vehicle Automation, the International Congress on Transportation Electronics (Convergence), and others. My curriculum vitae (Ex-1003) includes a list of all publications I have authored in the last 10 years and provides further detail regarding my background and qualifications.

III. INFORMATION CONSIDERED

21. In reaching my opinions in this matter, I reviewed the following materials:

Ex. No.	Description ¹
Ex-1001	U.S. Patent No. 6,292,743 (“the ’743 Patent”)
Ex-1003	Curriculum Vitae of Mr. Scott Andrews
Ex-1004	Prosecution History of U.S. Patent No. 6,292,743
Ex-1005	U.S. Patent No. 6,680,694 (“Knockeart”)
Ex-1006	U.S. Patent No. 5,893,113 (“McGrath”)
Ex-1007	U.S. Patent No. 6,334,087 (“Nakano”)
Ex-1008	U.S. Patent No. 5,059,965 (“Geiser”)

¹ Four-digit pin citations that begin with 0 are to the page stamps added by Honda in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, and/or line numbers.

Ex. No.	Description ¹
Ex-1009	European Patent App. Pub. No. EP 0827124A2 (“Watanabe”)
Ex-1010	Japanese Patent App. Pub. No. JP H10-221091A (“Nunokawa”)
Ex-1011	Certified Translation of Nunokawa
Ex-1012	Japanese Patent App. Pub. No. JP H8-110230 (“Endo”)
Ex-1013	Certified Translation of Endo
Ex-1014	INTENTIONALLY LEFT BLANK
Ex-1015	INTENTIONALLY LEFT BLANK
Ex-1016	INTENTIONALLY LEFT BLANK
Ex-1017	INTENTIONALLY LEFT BLANK
Ex-1018	INTENTIONALLY LEFT BLANK
Ex-1019	INTENTIONALLY LEFT BLANK
Ex-1020	Claim Mapping Table
Ex-1021	<i>InfoGation Corp. v. ZTE Corp.</i> , No. 16-cv-01901-H-JLB, D.I. 74 (S.D. Cal. May 5, 2017) (Claim Construction Order)
Ex-1022	<i>InfoGation Corp. v. Google LLC</i> , No. 21-cv-00843-H-LL, D.I. 85 (S.D. Cal. June 8, 2021) (Claim Construction Order)
Ex-1023	Infogation’s Infringement Contentions
Ex-1024	“Behind the Success of the CVCC Engine,” Honda Worldwide, https://web.archive.org/web/20070219081359/http://world.honda.com/history/challenge/1981navigationsystem/text/01.html (last visited July 15, 2024)
Ex-1025	“The Final Test: From Suzuka to Tokyo,” Honda Worldwide, https://web.archive.org/web/20070221131328/http://world.honda.com/history/challenge/1981navigationsystem/text/06.html (last visited

Ex. No.	Description ¹
	July 15, 2024)
Ex-1026	“Creating a Progressive Strategy,” Honda Worldwide, https://web.archive.org/web/20070221131445/http://world.honda.com/history/challenge/1981navigationsystem/text/02.html (last visited July 15, 2024)
Ex-1027	Kunihiro Ishikawa, Michima Ogawa, Shigetoshi Azuma, and Tooru Ito, <i>Map Navigation Software of the Electro-Multivision of the '91 Toyota Soarer</i> , in Proceedings of the Vehicle Navigation and Info. Sys. Conference (Oct. 1, 1991) (“Ishikawa”)
Ex-1028	U.S. Patent No. 4,502,123 to Minami et.al. (“Minami”)
Ex-1029	Robert L. French, <i>Automobile Navigation: Where is it Going?</i> , 2 IEEE Aerospace & Elec. Sys. Mag. 5, 6-12 (1987)
Ex-1030	U.S. Dep’t. of Transp., Fed. Highway Admin., TravTek Global Evaluation and Executive Summary, Pub. No. FHWA-RD-96-031 (Mar. 1996)
Ex-1031	C. Blumentritt, K. Balke, E. Seymour, R. Sanchez, TravTek System Architecture Evaluation, Pub. No. FHWA-RD-94-141 (July 1995)
Ex-1032	Robert L. French, <i>Historical Navigation of Automobile Navigation Technology</i> , Institute of Electrical Engineers (May 1986)
Ex-1033	U.S. Patent No. 6,163,749 (“McDonough”)
Ex-1034	U.S. Patent No. 5,808,566 (“Behr”)
Ex-1035	ISO/TR 14825 Technical Report, <i>Geographic Data Files (GDF)</i> (1st ed., 1996-11-15)
Ex-1036	U.S. Provisional Pat. Appl. No. 60/056,150, filed on Aug. 19, 1997 (“Knockeart Provisional”)
Ex-1037	Chart Mapping Knockeart Provisional’s Disclosures (Ex-1036) to Knockeart (Ex-1005)

Ex. No.	Description ¹
Ex-1038	Yilin Zhao, <i>Vehicle Location and Navigation Systems</i> , Artech House (1997)

22. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

IV. RELEVANT LEGAL STANDARDS

23. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

24. I have been informed and understand that in an IPR proceeding, claims are to be interpreted according to the *Phillips* claim construction standard. I have been informed and understand that claim construction is a matter of law and that the final claim constructions for this proceeding will be determined by the Patent Trial and Appeal Board (“PTAB”).

B. Perspective of One of Ordinary Skill in the Art

25. I have been informed and understand that a patent is to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I understand that, in considering what the claims of a patent require, what was known prior to that

patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

C. Obviousness

26. I have been informed and understand that a patent claim is obvious under 35 U.S.C. § 103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

27. I understand that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial success, long-felt but unmet need, failure of others, copying by others, and skepticism of experts).

28. I understand that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. § 103. I understand that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I further understand that a POSITA is presumed to know the relevant prior art. I understand that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

29. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I understand that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the Patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the Patent are directed;
- whether the combination is of familiar elements according to known methods that yields predictable results;
- whether a combination involves the substitution of one known element for another that yields predictable results;
- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;
- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results;
- whether the combination is “obvious to try”;
- whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same field or a different one based on

design incentives or other market forces, where the variations are predictable to a POSITA;

- whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;
- whether the combination requires modifications that render the prior art unsatisfactory for its intended use;
- whether the combination requires modifications that change the principle of operation of the reference;
- whether the combination is reasonably expected to be a success; and
- whether the combination possesses the requisite degree of predictability at the time the invention was made.

30. I understand that, in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I understand, however, that such a teaching, suggestion, or motivation to combine is not required.

V. LEVEL OF ORDINARY SKILL IN THE ART

31. In my opinion, a person of ordinary skill in the art at the relevant time would have had at least a four-year degree in electrical engineering, computer

science, or related field of study, and at least two years' experience in academia or industry working with navigation systems. This description is approximate, and a higher level of education or skill might make up for less experience, and vice versa. I base this opinion on my experience working on systems similar to those described in the '743 Patent, and my experience hiring and managing engineering staff performing engineering development work on similar systems.

32. Based on my education, training, and professional experience in the field of the claimed invention, I am familiar with the level and abilities of a person of ordinary skill in the art at the time of the claimed invention. Additionally, I met at least these minimum qualifications to be a person of ordinary skill in the art at least as of January 6, 1999. Further, although my qualifications may exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the '743 Patent have been rendered from the perspective of a person having ordinary skill in the art at the time of the invention.

VI. PRIORITY DATE

33. I understand that the application that issued as the '743 Patent was filed on January 6, 1999. I further understand that all prior art references relied upon in this Declaration were published and/or filed before the filing date of the '743 Patent.

VII. CLAIM CONSTRUCTION

34. I have been asked to apply the below constructions for my analysis. I have been informed by Counsel that these correspond to the claim constructions issued by the District Court of the Southern District of California in litigation between InfoGation Corp. and Google LLC involving the '743 Patent. Ex-1022.

- **“optimal route”** – “recommended route based on one or more criteria.” Ex-1022, 0009.

- **“non-proprietary”** – a “format that can be used with mapping databases provided by other manufacturers.” Ex-1022, 0014. I understand that the PTAB similarly construed “non-proprietary” as “formatting that is not specific to the particular mapping database used on the client.” IPR2017-00819, Paper 16 at 14. Both constructions are consistent with one another, and require a route format that is manufacturer-agnostic, such that it can be used by mapping databases from different manufacturers. Indeed, in issuing its construction, the Board noted that the “district court’s construction is similar substantively to the meaning of the term suggested by the intrinsic evidence.” *Id.* at 13. These constructions are also consistent with the specification of the '743 Patent, which repeatedly emphasizes that the alleged invention enables interoperability between different manufacturers or vendors, through the use of a more “open” or industry-wide format, rather than a format that each manufacturer owns. Ex-1001, 2:35-42 (explaining that a problem

with existing systems is that “the proprietary server cannot be used with navigation systems and mapping database provided by other manufacturers”), 3:6-10 (“A feature of the present invention is that the server is hardware and software independent form the client,” such that “navigation systems from any vendor can be easily adapted to work with the server.”).

- **“natural language”** – “includes language spoken or written by humans.” Ex-1022, 0019.

- **“downloading from the server said non-proprietary, natural language description to the client”** – “the server sending the non-proprietary, natural language description and the client receiving the non-proprietary, natural language description.” Ex-1022, 0025-0026.

35. I do not believe that any of the remaining terms (other than those specifically identified above) require construction for the purposes of resolving the issues in this Declaration. I apply the plain and ordinary meaning to the rest of the claim terms, as that plain and ordinary meaning would have been understood by a POSITA.

VIII. TECHNICAL BACKGROUND

A. Navigation Systems

36. Development in the field of vehicle navigation systems began in earnest in the 1980s. Even early navigation systems were able to provide positional and

navigational information to the user. The first commercially-available in-vehicle electronic navigation system was the Honda Electro Gyrolocator. *See e.g.*, Ex-1024, 0001. This map-based navigation system was introduced in August 1981, as a dealer option for the second-generation Honda Accord. *See e.g.*, Ex-1025, 0001. This system was based on a dead reckoning system that used a gyro and wheel sensors to measure the motion of the vehicle from a known point. *Id.* As the vehicle was driven, a small dot would move on the screen mimicking the motions of the vehicle. Transparent maps were placed over the screen so that the user could relate the position of the dot to the road network. *See e.g.*, Ex-1026, 0001. When the dot reached the edge of the screen the user would select the next map overlay and reset the dot to the appropriate point on the new map. A photograph of this system is shown below.



Ex-1024, 0001.

37. In 1991, Toyota introduced the first fully integrated touch screen system that was able to control the entire audio system, the climate control system, trip computer functions, navigation, and television. *See e.g.*, Ex-1027. The Electro MultiVision (EMV) system was initially put into production in 1991 on the Toyota Soarer (known in the U.S. as the Lexus SC300 sports coupe). *Id.* The figure below shows the basic EMV unit. This system differed from the Honda Electro Gyrocator because it contained a digital map database that allowed the map to scroll across the screen as the vehicle moved. *Id.*



Toyota Soarer Electro MultiVision System (Circa 1993)

38. U.S. Patent No. 4,502,123 to Minami et.al. (Ex-1028), which was filed in 1982 and issued in 1985, describes another early navigation system “arranged to

display a road map in accordance with road map information from a cassette tape, and the present location of a motor vehicle equipped with the navigation system.” Ex-1028, Abstract. Using Minami’s system “the user who may be the motor vehicle driver or an occupant, will be informed with the present location and the travelling locus both shown on the map displayed on the CRT screen.” *Id.*, 11:10-12. Minami accomplishes this using distance and direction sensors to determine the present location of the vehicle via dead reckoning and map matching techniques. *Id.*, 2:61-3:5, 6:52-7:47. Minami’s system also includes a microcomputer that “generates a display output signal with which a map of a specific region and information of travelling [sic] route are displayed, by processing various data from the direction detector 1, the distance sensor 2 and the reading unit 3.” *Id.*, 2:61-3:27.

39. By the late 1980s, skilled artisans were already designing systems combining vehicle navigation systems with mobile data communications. In a paper from 1987, R.L. French suggests, “Digital maps and mobile data communications combine synergistically with vehicular navigation to multiply its usefulness and effectiveness, and to enhance the potential market for both. consumer and commercial applications.” Ex-1029, 0001. Mr. French also proposes an architecture for such a combined system including a location sensor, such as Navstar GPS, and a data transceiver used to provide “vehicle-to-infrastructure data communications”:

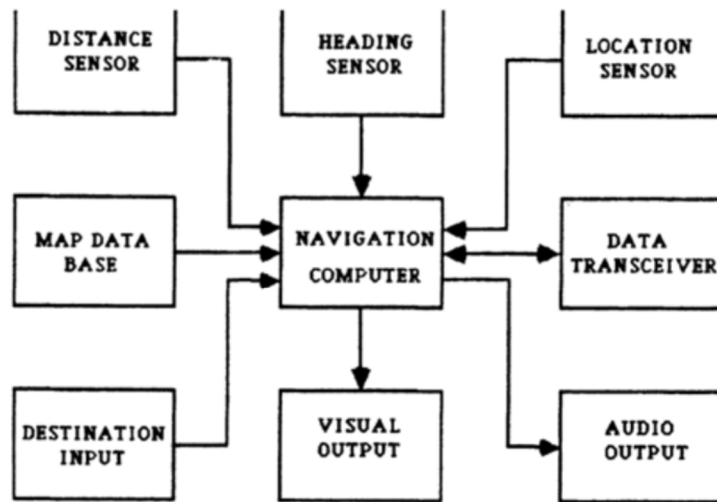


Figure 2. Future System Configuration

Id., Fig. 2; *see also, id.*, 0003.

40. Mr. French also proposes several enhancements to vehicle navigation systems including centralized vehicle location monitoring and dispatch control as well as real-time traffic monitoring:

Major potential roles for data communications in future automobile navigation systems will be to provide current updates (road additions, closures, detours, etc.) for on-board map data bases, and to provide **real-time information on traffic conditions** for systems that include onboard route generation. Mobile data communications offer additional advantages for commercial vehicles using navigation systems, including centralized vehicle location monitoring and dispatch control.

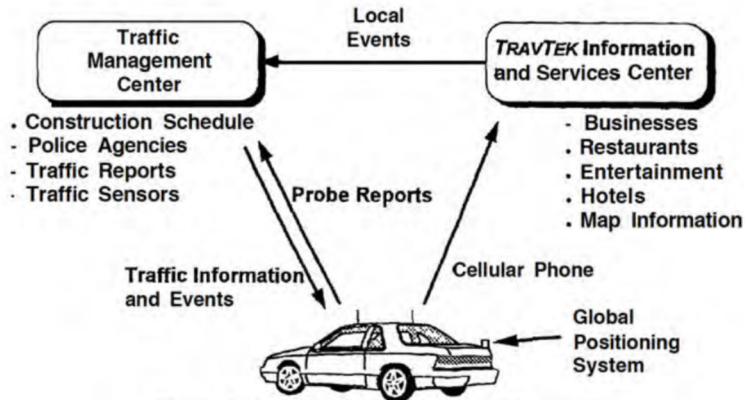
Id., 0005 (emphasis added).

41. One such navigation system combining vehicle navigation and cellular communications was the TravTek system developed in the early 1990s. TravTek was an Intelligent Transportation System developed as a result of a joint research

project between the Federal Highway Administration, Florida Department of Transportation, the City of Orlando, the American Automobile Association, and General Motors. Ex-1030, 0001. An operational field test of TravTek was conducted in Orlando, Florida for a one-year period between 1992 and 1993. *Id.*, 0002.

42. “The TravTek Project provided traffic information, motorist services information, tourist information and route guidance to operators of 100 test vehicles equipped with in-vehicle TravTek devices.” Ex-1031, 0015. The TravTek system consisted of three major subsystems including the in-vehicle TravTek devices and the remotely located Traffic Management Center (TMC) and TravTek Information and Services Center (TISC). *Id.*

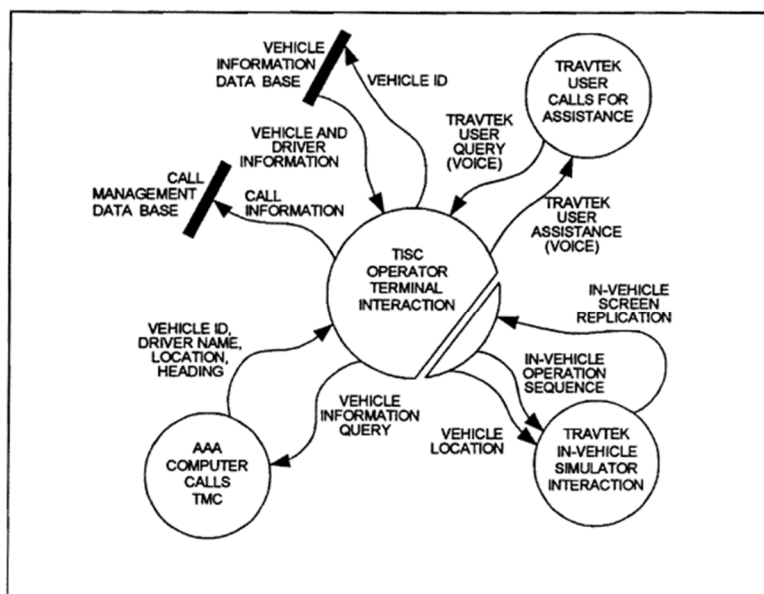
43. “The vehicle subsystem included radio equipment, processors, data storage devices for map data bases and other data, and a display for the driver interface.” *Id.*, 0017. As shown in the diagram below, the TravTek vehicle “had a two-way communications link with the TMC and communicated with the TISC via hands-free cellular phone.”



Ex-1030, 0012.

44. “The TravTek in-vehicle system provided a wealth of information to drivers. This information included a location information data base, route planning, route guidance, and real-time traffic information.” *Id.*

45. Each vehicle was assigned a unique vehicle ID that was used to retrieve vehicle and driver information from a vehicle information database:



Ex-1031, 0044-0045 (emphasis added).

46. If the user needed navigation assistance, “the vehicle location was requested from the TMC via the AAA data base computer, which was connected by a dedicated lease line using 9600 baud modems.” *Id.*, 0044. Thus, the TravTek System was able to track the vehicle’s current location.

47. Regarding the user interface, Mr. French explains, “the interface between an on-board navigation system and the vehicle operator must take into account ergonomics and safety considerations as well as functional requirements.” Ex-1029, 0003. The presentation of route guidance to the user was an important aspect of early user interface design. In 1986, Mr. French noted, “Virtually all high-technology automobile navigation systems use on-board computers to integrate and automate two or more of these technologies to provide vehicle location, heading, routing, or step-by-step guidance.” Ex-1032, 0001. In these automobile navigation systems “[r]eal-time route guidance prompts the driver turn-by-turn over an appropriate route to his destination.” *Id.*, 0005. “Explicit route guidance may be in the form of spoken instructions, displayed symbols (e.g., arrows shaped according to the maneuver), and/or displayed messages.” *Id.*

48. As of the late 1980s, “[m]ost systems proposed or developed . . . use[d] detailed map displays or some combination of symbolic graphics, alphanumeric

messages, and audio signals.” Ex-1029, 0003. Some of these early systems “used a plasma display panel to give route guidance . . .” *Id.*, 0004.

49. In the 1990s, the TravTek in-vehicle system provided two route guidance visual displays including a Route Map display (Figure 6 below) and a “maneuver-by-maneuver Guidance Display” (Figure 7 below):

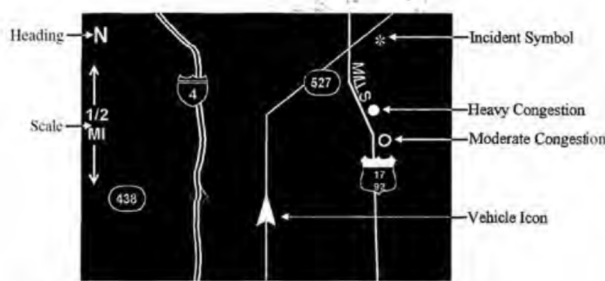


Figure 6. TravTek Navigation Plus display.

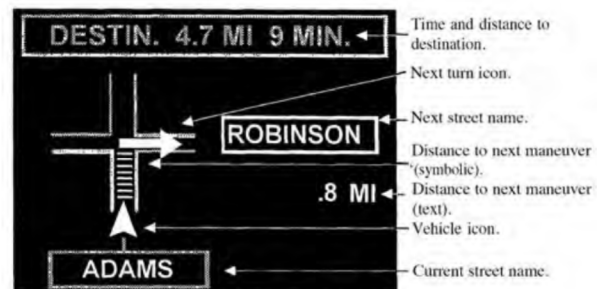


Figure 7. The TravTek Guidance Display.

Ex-1030, 0028-0029.

50. Thus, networked vehicle navigation systems that downloaded routes from servers and displayed them on a screen were well known and conventional for many years prior to the '743 Patent.

B. Map Databases

51. Maps have been used for thousands of years. The earliest known maps, were painted on cave walls to depict hunting areas. The Babylonians used clay tablets on which were scribed diagrams depicting the physical relationships between various geological features such as rivers and oceans. One example, from 600 BC,

shown below depicts the city of Babylon, with the Euphrates river, mountains and a nearby ocean.



Early Babylonian Tablet Map

(<https://www.icsm.gov.au/education/fundamentals-mapping/history-mapping>)

52. Pictorial maps grew increasingly elaborate, detailed, and more accurate over time, and, as printing and paper technologies improved, they became much easier to use.

53. The development of modern computers in the 1950s and 1960's allowed the use of electronic representations of geographic data. The earliest of these electronic mapping systems used various on-board sensors to reflect the motion of the vehicle (ship, airplane or automobile). This motion was electronically transferred

to an indicator on a map. One example is the moving map display used on the Hawker-Siddley Trident airliner in the late 1950s. This system used a paper strip map that scrolled in the longitudinal direction as the aircraft moved. A small stylus would then move from side to side on the map to reflect lateral motion of the aircraft. This system is depicted in the photo below.



The map display with a paper route map fitted. Also clearly seen is the pointer, originally these had a pen nib on the end which drew a line on the map to show the route the aeroplane had flown. This was not very successful and also the maps could not be reused so the nib was removed. Photo: Steve Hall

(<https://www.britairliners.org/airliners-article?title=the-magic-moving-map&id=36>)

54. A similar type of system was used in the 1980s, by Honda's Electro Gyrocom, discussed above. As previously explained, a small dot would move on

the screen mimicking the motions of the vehicle, and transparent maps were then placed over the screen so that the user could relate the position of the dot (i.e., the vehicle) to the road network. When the dot reached the edge of the screen the user would select the next map overlay and reset the dot to appropriate point on the new map. Examples of these map overlays are shown below:



Honda ElectroGyroicator Map Film Overlays

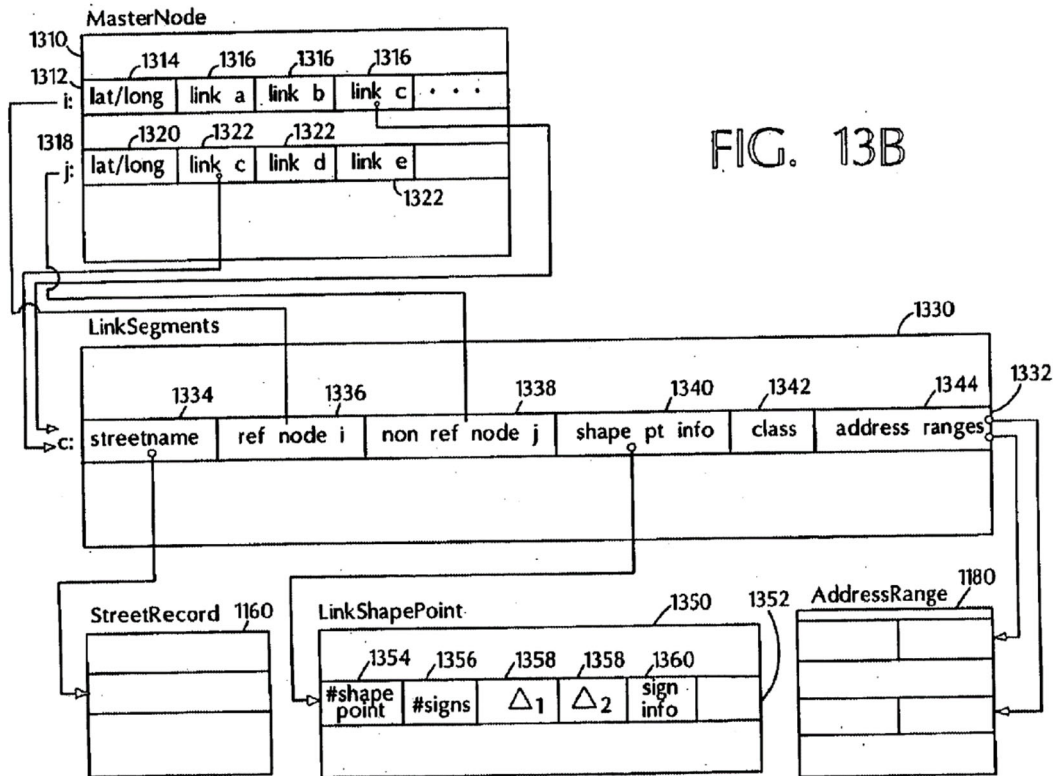
55. Both the Trident system and the Honda system used flat fixed map images, and moved the map and/or an indicator over the map image to indicate the location of the vehicle.

56. Around 1989 the first “navigable map databases” were developed. The use of a database that described the road network in terms of geographic coordinates (e.g. latitude and longitude) meant that the systems could place the user at the center of the map display, and then scroll the map in any direction as the user moved. There

was no need to change map overlays (in the case of the Honda system described above), or to change map scrolls if the route went off the edge of the map (in the case of the Trident system described above).

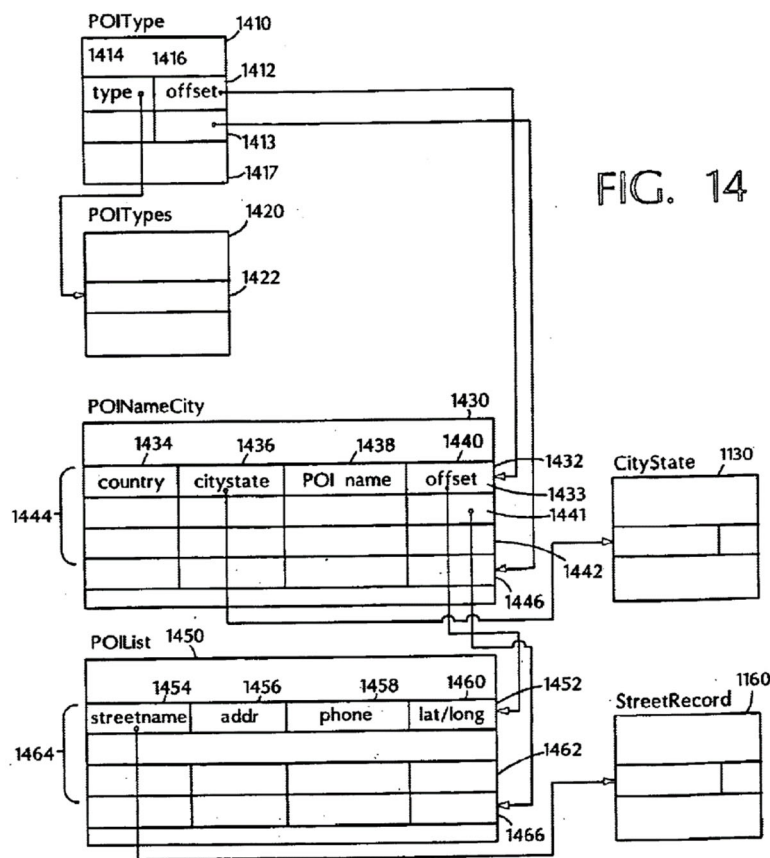
57. Three early map database developers were Navigation Technologies, and ETAK in the United States, and TeleAtlas in Europe. Ex-1038, pp.30, 34-36. These map databases were entirely different from pictorial maps in that they primarily represented the transportation network, and only provided pictorial detail (bodies of water, parks, etc.) for purposes of displaying the location of the user.

58. The underlying data, however was structured around publicly used transportation links. These databases were proprietary, but all of them were based on a similar structure. Specifically the transportation network (primarily roadways and ferry lines at the time) was represented by a series of road segments joined by nodes, thus forming a graph of the roadway network. Each node represented a point where two or more road segments met. The database structure comprised a database record for each road segment. Each record included fields for various attributes for that specific road segment, for example the road name, highway number, geometric shape information, height restrictions, and other such information. For example, U.S. Patent No. 6,680,694 to Knockeart ("Knockeart") describes a typical road network represented as a graph formed by links that connect nodes. Ex-1005, 10:14-34, Fig 7.



60. Using this approach it was then possible to use algorithms to search the database to identify what sequence of road segments could be traveled sequentially from segment to node to segment, to navigate a user from a specified starting point to a specified destination. Various routing strategies could be applied. For example the well-known Dijkstra algorithm determines the shortest path between the starting point and the destination. The equally well-known A* ("A-star") algorithm uses weighted graphs which, in the road network means that larger roads are more favorable than smaller roads, thus the A* algorithm may yield the fastest, but not necessarily the shortest, route. *See e.g.*, Ex-1005, 28:42-60.

61. In addition to the road network database, the map database included a large “point of interest” (POI) database that provided details of specific well-known locations within the road network. Such well-known locations included, for example, businesses, hospitals, public parks, etc. *See e.g.*, Ex-1005, 19:10-43, Fig. 14.



62. One aspect of map databases and navigation systems is the relationship between geographic points on the map, which may be located anywhere, and the road elements and links, which are located at specific geographic points. Stated differently a map of the world contains all possible geographic points, but, because

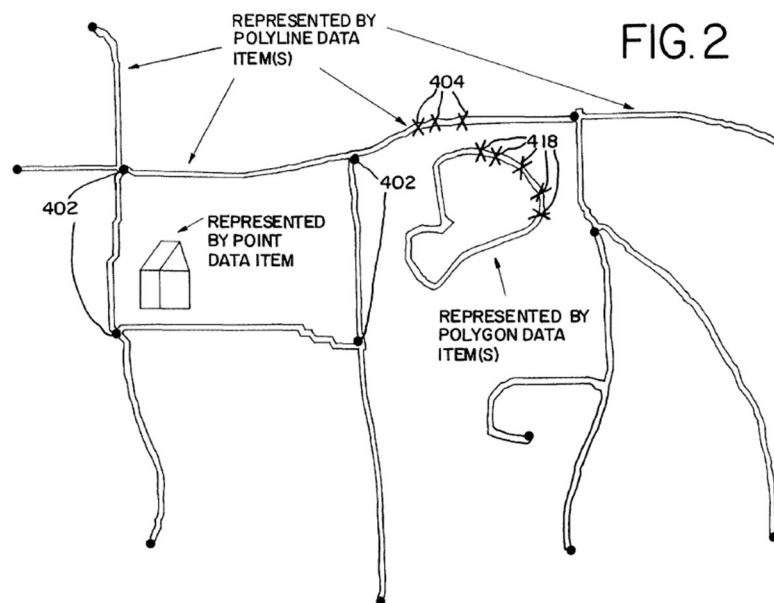
roads do not cover every square inch of the globe, the road network only represents a very small subset of those points. This issue becomes important in two ways. First because of inherent measurement errors, the geographic coordinates of a vehicle reported , for example by a GPS receiver, may not necessarily lie exactly on a road segment in the database. Similarly, any location selected by a user, for example by indicating a location on the display screen also may not lie exactly on a road segment in the database. In addition street addresses represent a completely different “coordinate system” wherein specific locations (i.e., buildings and such) are identified by the street on which they are located, and an address number on that street. In order to coordinate the map database information with the road network and the road network with the various addressing systems used around the world, two processes were developed:

- **Map Matching** is a geometric procedure in which an arbitrary point on the map can be matched to a point on the closest corresponding road segment.
- **Geo-Coding** is a process of assigning address ranges to locations along a road segment.

These two process are, for example, described by Zhao. Ex-1038, Chapter 4 (map matching), p.34 (geocoding).

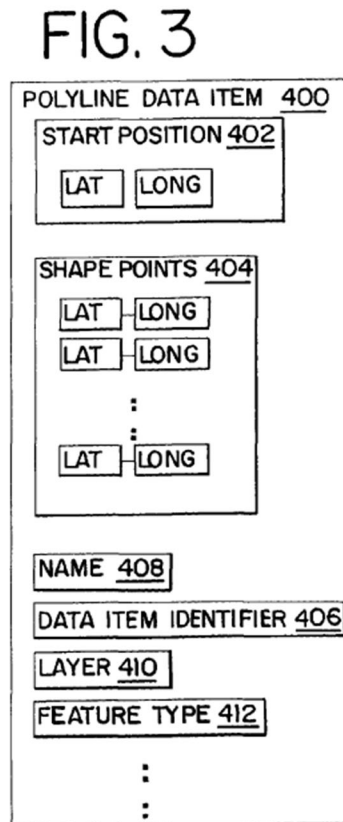
63. The database also included various graphical elements that could be rendered by the display system to create a scalable map image on the vehicle display screen. Thus, rather than storing the entire map as a series of images (requiring multiple images for different display scales) the background map image was very simple, and the various landmarks and road networks were stored as graphical information that was used by the map rendering software to draw the features onto the basic map background. This process is explained in detail, for example, in U.S. Patent No. 6,163,749 to McDonough filed on June 5, 1998 (“McDonough”). Ex-1033.

64. Figure 2 of McDonough, reproduced below, shows a typical section of a map wherein the roads and other features on the map are objects that are dynamically drawn on the map background:



65. McDonough explains that Figure 2 “shows exemplary shape points 404 located along the portion of the road represented by a polyline data item 400. The curving geographic feature is reproduced on the display by drawing straight lines from shape point to shape point beginning with the start position 402. The number of shape points provided for a given shape depends on the shape of the curve and the accuracy or resolution desired in the reproduced display.” Ex-1033, 5:7-15.

66. Figure 3 from McDonough, reproduced below, illustrates a typical database record representing a graphical object:



67. McDonough explains that the diagram in Figure 3 shows “the structure of one of the polyline data items 400 representative of a feature shown in FIG. 2. A polyline data item represents a continuous linear geographic feature located within a geographic area. Each of the polyline data items provided by the map database may represent a continuous linear graphic feature such as a portion of a road, a railroad track, a ferry route, a river, and so on. The geographic feature represented by the polyline data item may be straight or other-than-straight. Each polyline data item 400 contains start position data 402 identifying the start point (latitude and longitude) of the continuous linear geographic feature ... one or more delta shape points 403 used to calculate shape points 404 (FIG. 2) located along the continuous linear geographic feature [between the two nodes 402], a data item identifier 406 that uniquely identifies the type of information (polyline, polygon, point, or other) the data item represents and its location in the map database, and other data.” Ex-1033, 4:28-58.

68. While this same general structure was used in all navigable map databases, the specific details and underlying database management systems were unique and proprietary to the companies that developed them. This was not an issue if the database was integral with the navigation system because the entire navigational program could be developed based on the specific structure of the integral database. A confounding issue with this approach, however was that the

road environment is not static. Road names change, new roads are built, roads may be enlarged, and new intersections may be formed. Points of interest are also in nearly constant flux as businesses are formed, move, and/or disappear. In addition, as soon as map-based navigation systems were developed, including traffic congestion was an immediately obvious and desirable addition. The amount of data in the database taxed the storage technology of the time.

69. The combination of large data storage requirements, rapid obsolescence, and the need for real-time traffic information led to the development of what were known as “Off-Board” navigation systems. These systems typically used a large database located at a server. The user’s navigation device would connect to the server and send the current location and the destination requested by the user. The server would then compute the route, and send data representing the route back to the user’s device. Early versions of this approach simply provided “turn-by-turn directions” to the user, essentially telling the user which road or street to travel on, and then alerting them as they neared a maneuver point. For example, a typical set of turn-by-turn directions might be:

- Continue north on State Street for 200 feet;
- Turn left at First Avenue;
- Travel on First Avenue for 1 mile;
- Turn right on Elm Street;

- Your destination is ahead 500 feet.

70. One exemplary system of this type is described in U.S. Patent No. 5,808,566 to Behr (“Behr”). Ex-1034. This system used a cellular modem to connect a portable device to a remote server. The server included a navigable map database and software to receive route requests, compute the route using the map database, and then send a set of turn-by-turn directions back to the portable device where they could be sequentially displayed to the user as they drove along the route. Behr also describes the addition of real time traffic information to be used to update the map database and to provide traffic condition alerts to the user. *See e.g.*, Ex-1034, 15:46-16:24.

71. Figures 6-8 of Behr illustrate a sequence of “maneuver arms” to guide the user along the route. These “maneuver arms” included both a textual description of the maneuver, as outlined above, and also a small graphical diagram to illustrate the geometry of the upcoming maneuver:

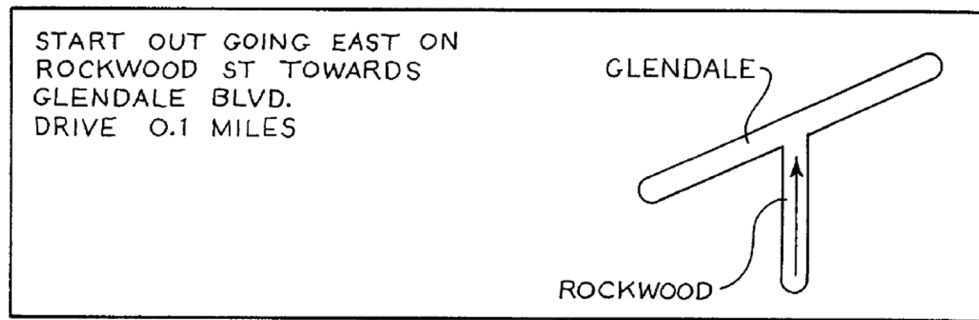


Fig. 6

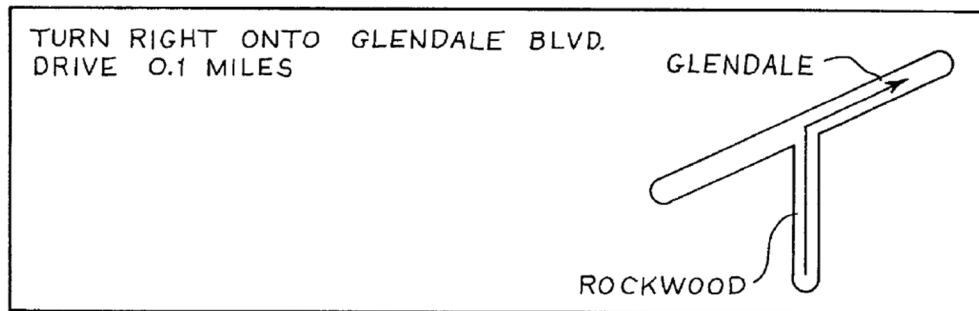
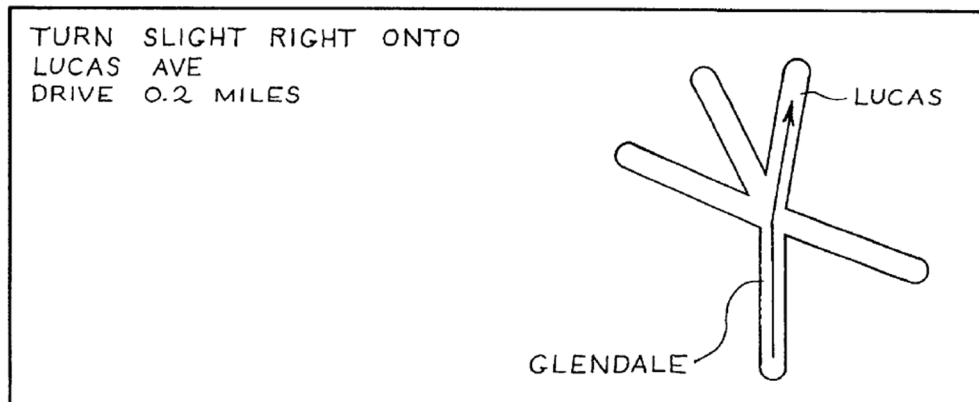


Fig. 7

Fig. 8



72. While these systems did not require large local databases, they did require remote data connectivity to link the user's device and the server. This

connectivity was typically provided using a cellular modem, which could become expensive if large volumes of data were sent. One way to avoid this was to include a subset of the map data in the user's device. This approach included the graphical information for the map in the user's device (as described above by McDonough), but did not include the entire road segment database with all of the road attributes or the millions of points of interest.

73. During this time, the Internet had grown significantly. A core feature of the Internet was that unlike earlier proprietary systems like CompuServe and America Online, where the user was required to use proprietary software to access the service, the Internet used standardized interfaces to allow the user's system to be completely independent from the server system. The only requirement for compatibility was that the system conform to publicly known standards and protocols. One such protocol that was specific to exchanging geographic information was the Geographic Data File, or GDF.

C. Geographic Data Exchange

74. In the mid-1980s a series of European Union sponsored research projects were undertaken to develop and demonstrate the application of technology to improve road safety and mobility. These large-scale projects (DRIVE, DEMETER, CARMINAT, PANDORA, PROMETHEUS, etc.) explored a wide range of applications and technologies including traffic information systems,

navigation and routing systems, commercial vehicle management, automated vehicles, and various driving aids. They formed the basis for what is today the Intelligent Transportation Systems (ITS) industry. One output of this work, in 1988, was the first version of a standard mechanism for exchanging geographic information, specifically in relation to describing the road network, and roadway elements such as buildings, roadway objects, etc.—the Geographic Data Format (“GDF”). *See* Ex-1038, pp.28-30.

75. The Geographic Data Format, GDF 1.0 was released in October 1988. The Task Force European Digital Road Map (ERDM) undertook the development of GDF 2.0, and substantially expanded the GDF 1.0 standard. GDF was a European standard ultimately developed and released by the Committee of European Normalisation (CEN) Technical Committee 278, Working Group 7 (TC278/WG7), which had representatives from most of the 34 European nations, predominantly researchers and developers from many of the European car makers and suppliers. As is described in ISO 14825:1996, GDF 2.0 went through several revisions before ending in 1995 at Release 3.0 as a European standard pre-release (ENV). Ex-1035, 0017. GDF 3.0 formed the basis for the international ISO TR 14825:1996 proposed standard.

GDF 2.1 was released in October 1992 and consists of a revision of Volume 3, the Attribute Catalogue and Volume 9, the Media Record Specifications. The major differences with respect to 2.0 are the

introduction of the Segmented Attribute concept and the Time Domain concept.

GDF 2.2 was released in November 1994. The Feature, Attribute and Relationship Catalogue have been considerably extended. The changes mainly consisted of the introduction of new information items. GDF 2.2 was at the time of release, officially submitted to CEN TC278 for approval as a prENV. For this, the CEN member countries reviewed the document during a three months period. The comments received were subsequently incorporated. The result of this was published in July 1995 as GDF 2.3.

GDF 2.3 was subject to a final editorial review in September 1995.

GDF 3.0 was the result of the incorporation of comments from this review and submitted to CEN TC278 for official approval as ENV in October 1995.

Ex-1035, 0017 (ISO TR14825:1996, Section 4.1).

76. ISO TR14825:1996 is thus a formally released international version of GDF 3.0, which is the specification version identified in McGrath (Ex-1006), and Knockeart (Ex-1005). For example, McGrath describes the same data structures used in GDF, specifically that of Features, Attributes, and Relationships, which are the basic elements used in GDF. *See e.g.*, Ex-1006, 4:61-5:3. McGrath also describes all of the same data elements described in ISO TR14825:1996. For example:

For example, in order to develop the procedures and formats for publishing and processing updates to geographic databases, the incremental update model can be applied to the CEN GDF data model, as follows. In the CEN GDF logical model, the following can be regarded as objects:

(1) node, edge, face

- (2) point feature, line feature, area feature
- (3) relationship
- (4) Source document
- (5) name

Each of these elements is independently defined without reference to other objects of the same type. In the CEN GDF logical model, the following are regarded as characteristics:

- (1) X, Y, and Z values
- (2) set of nodes which make up an edge
- (3) set of edges which make up a face
- (4) geometric composition (“Geometric composition’ is defined as the list of level 0 elements which compose a level 1 feature, or the list of level 1 features which compose a level 2 feature, based on CEN GDF definitions.)
- (5) attributes (For the purposes of the update model, compound attributes and subattributes are considered a Single attribute.)
- (6) text of a name
- (7) descriptive information for Source material

Ex-1006, 5:4-32. *Compare* Ex-1035, 0008 (ISO TR14825:1996, Section 3.1.3, “Node, Edge and Face”), 0018 (ISO TR14825:1996, Section 4.2), 0019 (ISO TR14825:1996, Section 4.3, “Feature Catalogue,” “Attribute Catalogue,” “Relationship Catalogue”), 0075 (ISO TR14825:1996, Section 6, “Attribute Catalogue”), 0188 (ISO TR14825:1996, Section 8.1.2, “Point features, Line features,

[] Area features”), 0253 (ISO TR14825:1996, Section 10.6, “Source Document”), 0363 (ISO TR14825:1996, Section 12.5.9, “Name Record”).

77. The Geographic Data Format (GDF) is a standardized data protocol specifically for describing and exchanging geographic data. The objective of GDF is to:

[I]mprove the efficiency of the capture, the production and handling of road related geographic information. This increase in efficiency is obtained by supplying a common reference model on which users can base their requirements and producers can base their product definition. In addition to this, the standard facilitates the exchange of information, defined according to this reference model. For this it contains the definition of an exchange format which avoid compatibility problems at both the users and the producers side of the information flow.

ISO TR14825:1996, p. iv.

78. GDF uses a hierarchical data model that comprises Features, Attributes, and Relationships. Features are real world physical things in the road environment. For example: Roads, junctions, buildings, administrative areas, and towns. As shown in the figure below, each feature has an identifier, and it may take the form of a point, a line or an area, or some combination of these three graphical constructs. *See e.g., Ex-1035, 0022-0023.*

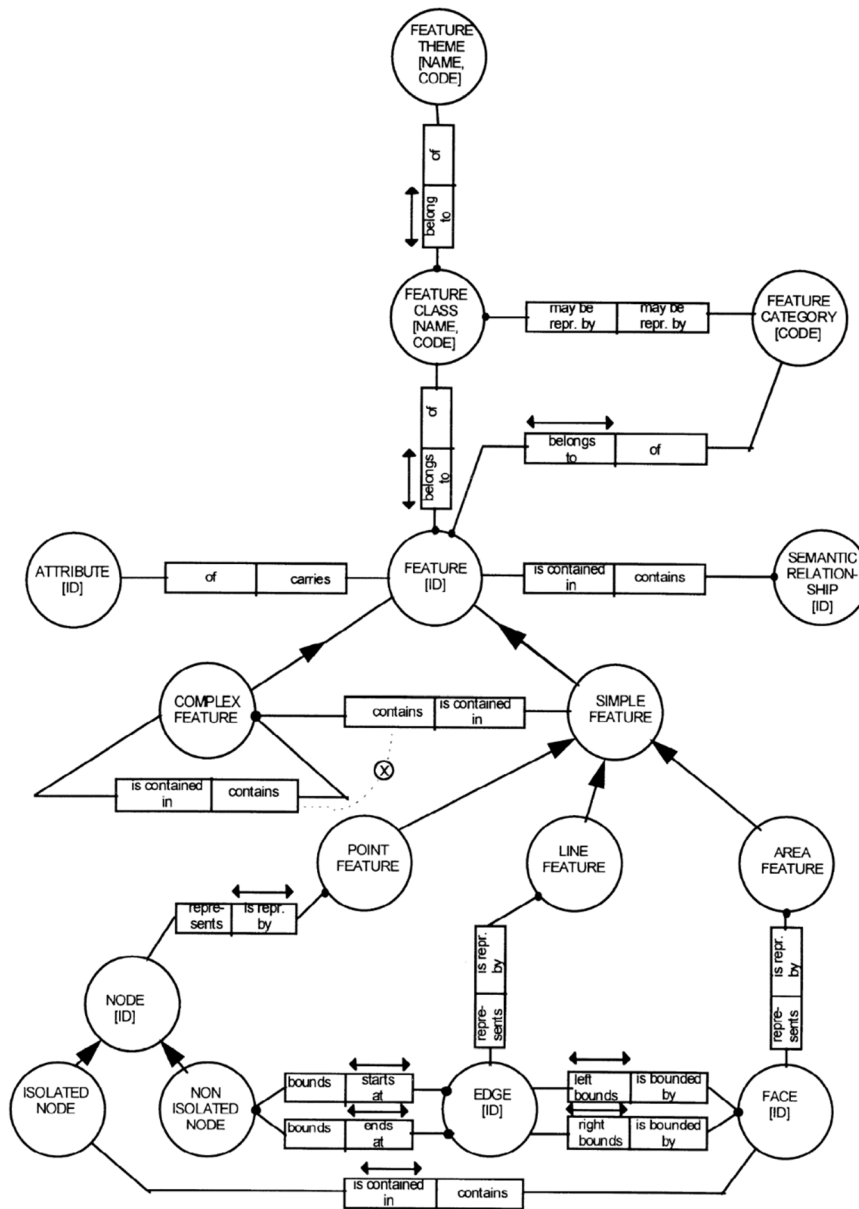


Figure 4.2. The overall Data Model

79. For example, a junction, or a building with a specific address location may be represented as a point, which is defined by the coordinates of a node. A road may be represented by a line, which in turn is defined by an edge, which comprises two nodes: a beginning and an ending node. A larger entity, for example a park, or

a town may be represented by an area, which is defined by multiple edges, and thus a plurality of nodes. Each feature belongs to a feature class and/or a category, and each class is represented by a theme. For example, “roads” and “ferry” are feature classes. If one is seeking to describe both roads and ferries, then the theme “roads and ferries” would be used. Chapter 5 of ISO TR14825:1996 describes in great detail the various features and rule associated with features that are addressed by GDF. Ex-1035, 0026-0074.

80. Every feature also includes attributes. These are characteristics that more fully and uniquely describe the feature. Attributes are defined by a type, and a value. For example an address might be an attribute of a building, it would have the type “Address”, and the value would be the actual address itself:

6.1.1 Attribute Types

Properties of real world objects are represented as attributes. Attributes are classified in the form of attribute types. Each attribute type corresponds to a well defined property of a real world object (e.g. colour).

6.1.2 Attribute Values

To each attribute type are assigned one or more Attribute Values, which can be seen as a particular instance of an attribute type (e.g., the color “green”). Some attribute types may have an infinite number of different Attribute Values (e.g., the values of the attribute type “width”), whereas other attribute types may have only a fixed number of values (e.g., gender, “male” and “female”). The list of permissible values that the attribute can take is called the domain of an attribute....

Ex-1035, 0075.

As these examples illustrate, Attributes may correspond to natural language names. Accordingly, GDF uses a “Language Code” to specify the language in which the names are written:

6.1.8 Names in combination with a Language Code.

The attributes in which a name is specified are language dependent. To specify this dependency, a **Language Code** value should be used in combination with the Name. The Language Code specifies in which language the Name has been defined.

Ex-1035, 0078.

81. Relationships define the connections between different features. So, for example two road features that share a common node would have a relationship that described how one feature is connected to, or related to another. Chapter 6 of ISO TR14825:1996 describes in detail how attributes are described, and represented, and how they may be combined and/or subdivided. Ex-1035, 0075-0169.

82. ISO TR14825:1996 also provides a detailed description of the relationships between features. For example, a road (represented by a line) has a physical relationship to a junction (which is a point where two or more roads connect. Similarly, a city has a logical and physical relationship to the country in which it exists, and a physical relationship to the roads within it. Many of these relationships are critical to certain tasks for which GDF may be used. For example, the relationship between roads and junctions is essential to the process of determining a route from one point to another (a route simply being a sequence of

roads and junctions that pass from one point to another). Chapter 7 of ISO TR14825:1996 describes a detailed protocol for expressing these relationships. Ex-1035, 0170-0187.

83. ISO TR14825:1996 also provides a description of how, using the Feature, Attribute, Relationship descriptions, features can be represented, either individually, or in complex aggregations. This representation is segregated into three levels: Level 0 represents the basic road topology (i.e., which segments are connected to which nodes in the road network; Level 1 represents simple features such as roads, roadway objects such as buildings, and distributed objects such as cities or towns (administrative areas); and Level 2 represents complex aggregations of Level 1 objects. For example, an intersection at Level 2 may only be represented as a junction between two roads. However, many intersections include multiple lanes, each of which may have some restrictions, and each of which may connect only to specific other lanes. Thus the Level 1 description of a Level 2 intersection described would include directional road elements for each lane, and nodes that would link each incoming lane with either internal pathways within the intersection, or other outgoing lanes that Using this level of detail, it is possible to describe specifically which lane to be in to execute a turn, and, depending on the turn, what pathway to take within the intersection. Since lanes only connect (via nodes) with other lanes of the same directionality, this approach allows a complete description

of all of the possible topologically valid pathways through the intersection. This hierarchy is illustrated in Figures 8.2-8.4 of ISO TR14825:1996 as shown below.

Ex-1035, 0190.

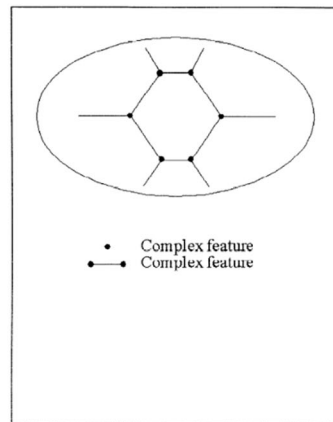


Figure 8.2 Symbols in a Level-2 representation

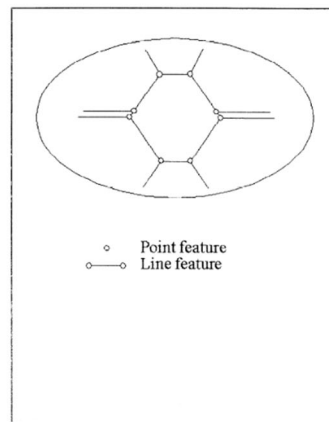


Figure 8.3 Symbols in a Level-1 representation

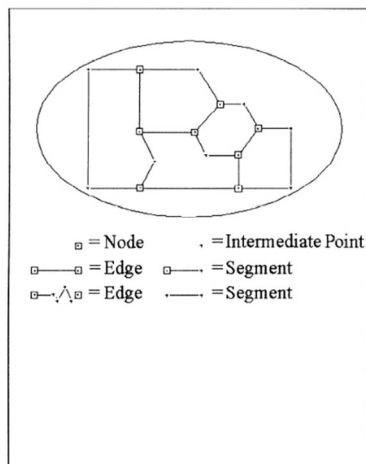
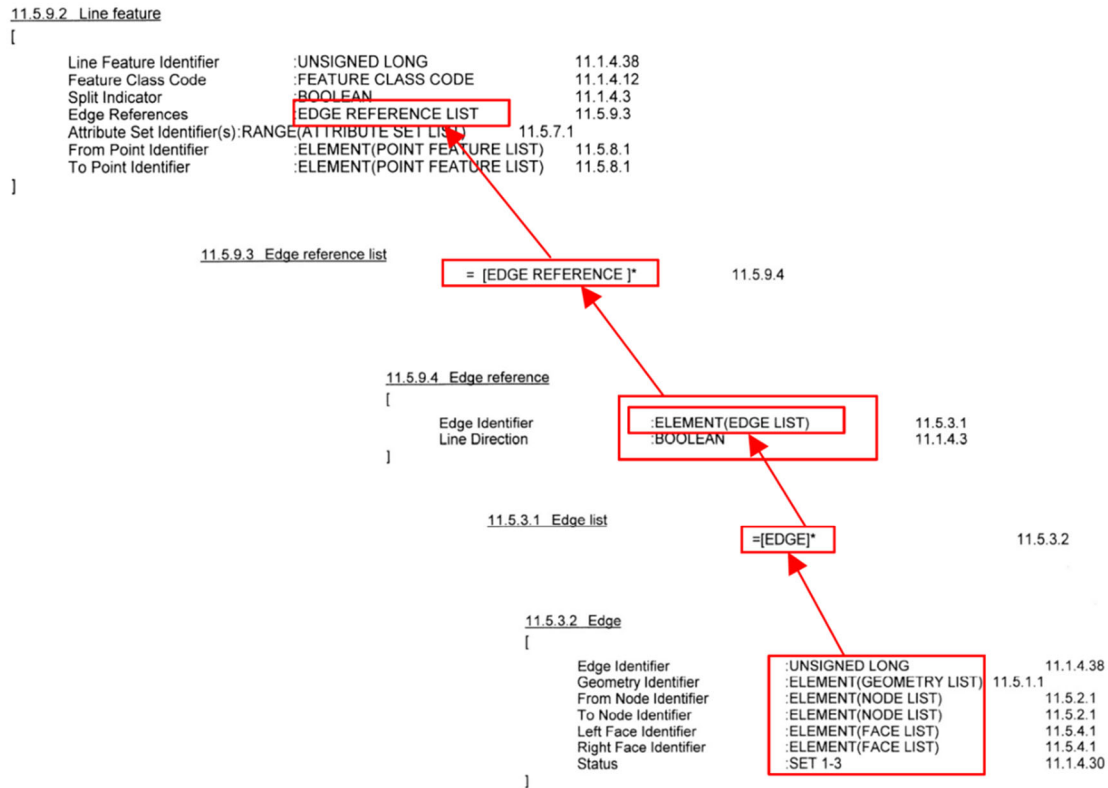


Figure 8.4 Symbols in a Level-0 representation

84. ISO TR 14825 also defines a data description language called ESN, which specifies a particular format and syntax for describing data elements. This data descriptive language also defines a wide array of details in the description of the data elements., such as how coordinates are represented numerically, how dates

and times are represented, etc. These representations are hierarchical, and nested, so, for example as illustrated below, a Line feature requires the feature identifier, the class code, a flag denoting if the line is split, a list of edge references, the attribute types and values for the feature, and the start and end points. Some of these elements are “elementary,” meaning that they can be represented using a specific numerical value, while others are composed of other lower level, but not-elementary constructs. For example, the Split Indicator is a one-bit Boolean number, while the Edge Reference List is a more complex data element that is defined as a list of Edge References, each of which contains a list of Edge Identifier, and a Boolean value denoting the direction of the Line. Thus, the Edge Reference List is a list of Edge Reference data elements each of which is itself a list. This successive nesting continues until the elements are all elementary, and thus can be represented by specific numerical values.



Ex-1035, 0296, 0300-0301.

85. GDF also provides a protocol for how a given exchange of geographic data is to be structured. Specifically using the data descriptive language described briefly above, a geographic data exchange comprises a series of records which can be combined according to a specific protocol and format. Chapter 12 of ISO TR 14825:1996 describes these fields in great detail. Unlike the ESN description above, these fields are simply blocks of numerical and ASCII data. GDF data sets are compiled and sent as records. These records are nested in a way that allows the receiving GDF decoder to parse the blocks of data to recover the specific data

elements, as illustrated in the figure below. The actual data elements are sent as individual data records.

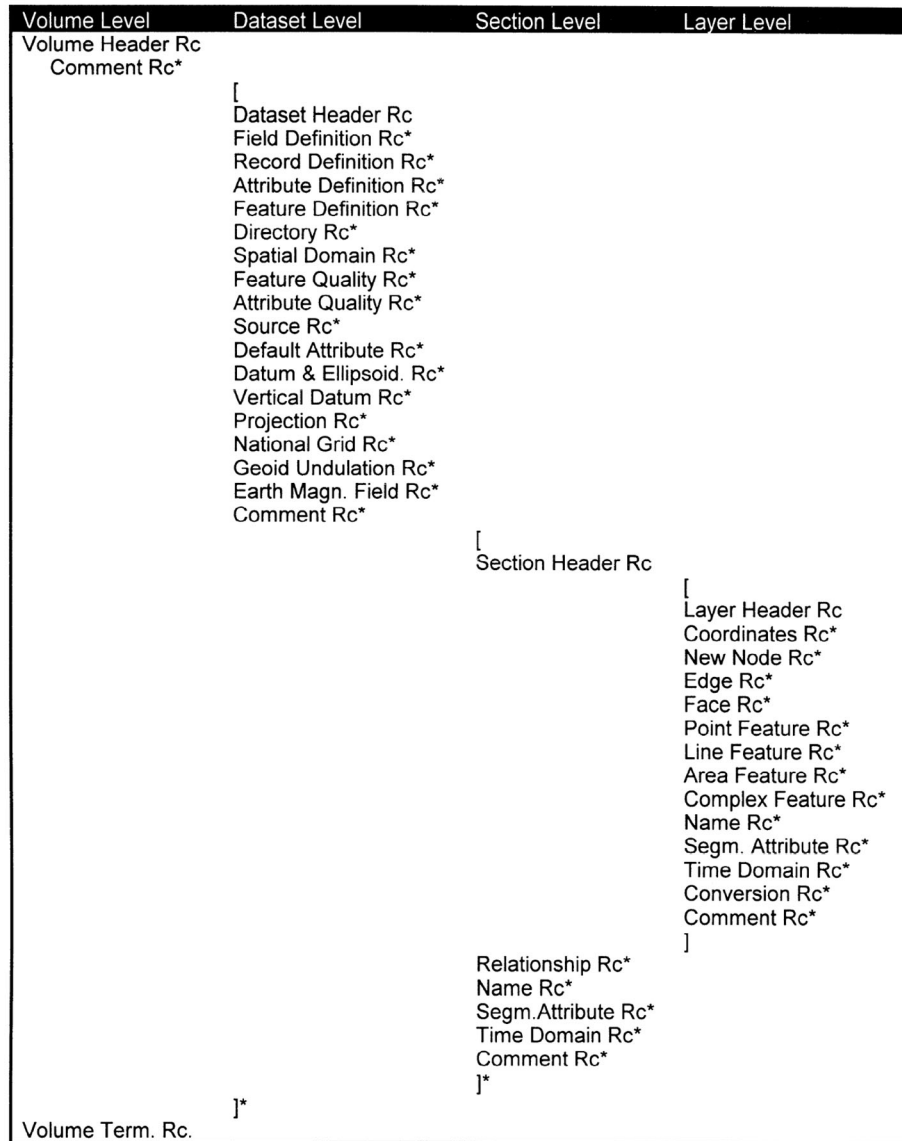


Figure 12.1. Order of records

Ex-1035, 0314. Because different levels of data are expected to be exchanged using GDF, any given volume will not necessarily include every one of the records shown above.

86. The volume record contains metadata related to the entire block of data being conveyed. This data is encoded numerically as shown below.

12.4.1 Volume Header Record			[VOLHDREC]			
Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (01)
SUP_NAME	20	G	<S>			Data Supplier Name Name of the producer or deliverer of this volume
STAN_NAME	10	G	Obl			Standard Name to which this ¹ volume conforms
VERSION	4	G	Obl			Version Number of the standard to which this volume conforms ²
CREA_DATE	6	N	<S>			Creation Date of this volume
VOL_SIZE	10	N	<S>			Volume Size in bytes
ALBUM_ID	10	N	Obl			A unique Album Identifier
TOT_VOL	4	N	<S>			Number of Volumes in the album
VOL_ID	4	N	Obl			A unique Volume Identifier
CHAR_SET	10	G	Obl			Character Set used in this volume
CORI_DATE	6	N	<S>			Date of Copyright
NUM_DASET	2	N	Obl			Field counter
LDASET_ID	8	N	Obl			Dataset Identifier of a dataset which is associated wit this volume
VOL_ID	4	N	Obl			Foreign Volume Identifier of the volume which contains the Dataset Header and the global data
CORI_OWNER *		G	<S>			Copyright Owner Name of the legal Person having the copyrights of this volume

Note: The exact meaning of the data types (N, A, G, etc.) can be found in the Global Data Catalogue

Ex-1035, 0326. The sizes of these fields are important, since this is how the GDF decoder knows what the various numbers in the transmission represent. The length of this header comprises 100 bits plus whatever the variable length of the ASCII representation of the copyright owner is.

87. The dataset header record is shown below.

12.4.2 Dataset Header Record

[DSHDREC]

12.4.2.1 Dataset Identification Subrecord

[DSHDREC.01]

Field name	Size	Type	No data Min.	Max.	Description
REC_DESCR	2	N	Obl		Record Type Code (02)
REC_CODE	2	N	Obl		Record Subtype Code (01)
IDS1-NR	13	G	<S>		International Dataset Identification Number
DASET_ID	10	N	Obl		Supplier Dataset Identification Number, which is unique within the system of the producer (supplier) of this dataset
ED_DATE	8	N	Obl		Edition Date and hour of this particular version of the dataset which constitutes also a unique version number of the present version
NUM_LAN	2	N	Obl		Field counter indicating how many times the next field repeats
LAN_CODE	3	A	<S>		Dataset Language The MARC language code of a language used in this dataset
NUM_CNTRY	2	N	Obl		Field counter indicating how many times the next field repeats
CNT_CODE	3	A	<S>		Country Involved

The ISO-3166 Alpha-3 code of a country involved in the production of this dataset

Ex-1035, 0327. This header will be comprised of 45 bits.

88. Following the dataset header record, the actual data set records are sent. Since there are many different types of datasets within GDF, below I have provided two of the more relevant data set records for the conveyance of route information, the New Node Record and the Edge Record, as well as the Name Record, which clearly illustrates the use of natural language within GDF:

12.5.2 New Node Record [KNOTREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (25)
KNOT_ID	10	N	<S>	1	2E32	Node Identifier The ID-number of the Node which is unique within the section
XYZ_ID	10	N	<S>	1	2E32	Geometry Identifier The ID-number of the [XYZREC] record which contains the coordinates of the Node
FACE_ID	10	N	<S>	1	2E32	Face Identifier The ID-number of the Face containing this Node
STATUS	2	N	<S>	1	5	Status Code 1 = Section border Node 2 = normal Node 3 = Dataset border Node 4 = End of Stubble 5 = Non Section border Node

12.5.3 Edge Record [NEDGEREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (24)
EDGE_ID	10	N	<S>	1	2E32	Edge Identifier ID-number of the Edge, which is unique within the section
XYZ_ID	10	N	<S>	1	2E32	Geometry Identifier ID-number of the [XYZREC] record which contains the coordinates of the Intermediate Points of this Edge
FKNOT_ID	10	N	<S>	1	2E32	From Node Identifier ID-number of the From Node of this Edge
TKNOT_ID	10	N	<S>	1	2E32	To Node Identifier ID-number of the To Node of this Edge
LFACE_ID	10	N	<S>	1	2E32	Left Face Identifier ID-number of the Left Face of this Edge
RFACE_ID	10	N	<S>	1	2E32	Right Face Identifier ID-number of the Right Face of this Edge
STATUS	2	N	<S>	1	5	Status Code 1 = Section border Edge 2 = Normal Edge 3 = Dataset Border Edge 4 = (Not applicable) 5 = Non Section border Edge

Ex-1035, 0356-0357.

12.5.9 Name Record				[NAMEREC]		
Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (41)
NAME_ID	10	N	<S>	1	2E32	Name Record Identifier An identification number of this name record which is unique within a section
DESC_ID	5	N	<S>			Source Description Identifier ID-number of a source document
LAN_CODE	3	A	<S>			Language Code MARC language code of the name specified in the next field
TEXT	*	G	<S>			Feature Proper Name The name of a feature

Ex-1035, 0363.

89. Because some features may include multiple different coordinate points, coordinates (also expressed using natural language) are sent as a group in a separate record denoted XYZREC, shown below.

12.5.1 Coordinates Record				[XYZREC]		
Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (23)
XYZ_ID	10	N	<S>	1	2E32	Geometry Identifier ID-number of the [XYZREC] record which is unique within the section
G_TYPE	1	N	<S>			Geometry Type Code
Q_PLAN	2	I	<S>			Quality Code
DESC_ID	5	N	<S>			Source Description Identifier ID-number of the source document where the information of this record has been derived
NUM_COORD	5	N	Obl			Field counter which specifies how many times the next repeating field group repeats
X_COORD	10	I	<S>	-2E31	2E31	X-coordinate
Y_COORD	10	I	<S>	-2E31	2E31	Y-coordinate
Z_COORD	10	I	<S>	-2E31	2E31	Z-coordinate

Note 1: The exact meaning of the data types (N, A, I, etc.) is explained in the Global Data Catalogue.

Note 2: "Obl" in the field specifications of the data records only means that the field value is required to enable the correct interpretation of the syntax of an individual record. Other fields may be mandatory to enable the interpretation of higher order data structures, but this is not indicated.

Ex-1035, 0355.

90. I note that essentially all communication systems ultimately encode data using this type of header and trailer approach. This is because a digital communication system can ultimately only communicate binary digits, which means that every data element must be represented by a set of one or more binary digits. The communication then is simply a very long stream of binary bits. To reconstruct the meaning of these bits at the receiving end, the receiver uses the bit positions and number of bits per field to parse the incoming data stream into the various information elements described herein. Some of these fields serve no part in the actual data elements themselves, but for example inform the receiver about the length of the next field (if that length is variable). Other fields are used to identify other records, such as the XYZREC described above, that contain critical information to be used in a parent record.

91. Records associated with a particular feature or attribute are related in a specified way as shown in the figure below. These relationships are identified by “pointer fields” that indicate which other records are to be connected to any given record. Examples of these pointer fields are also shown below.

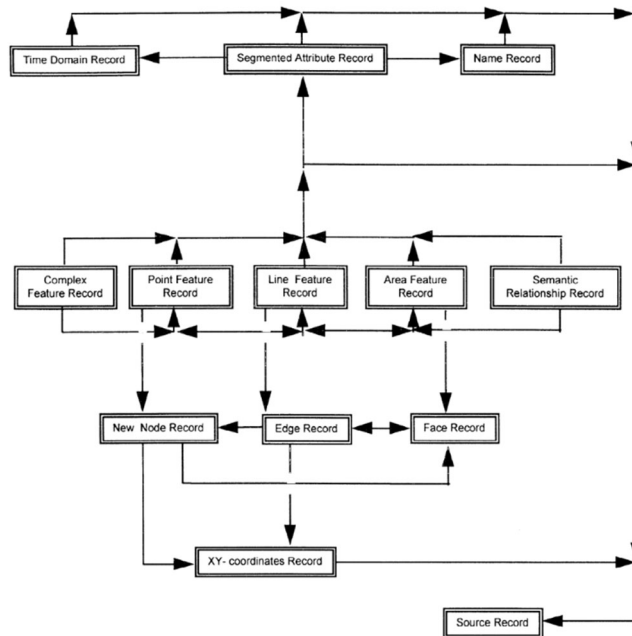


Figure 12.2 Relations between Data Records

Ex-1035, 0316.

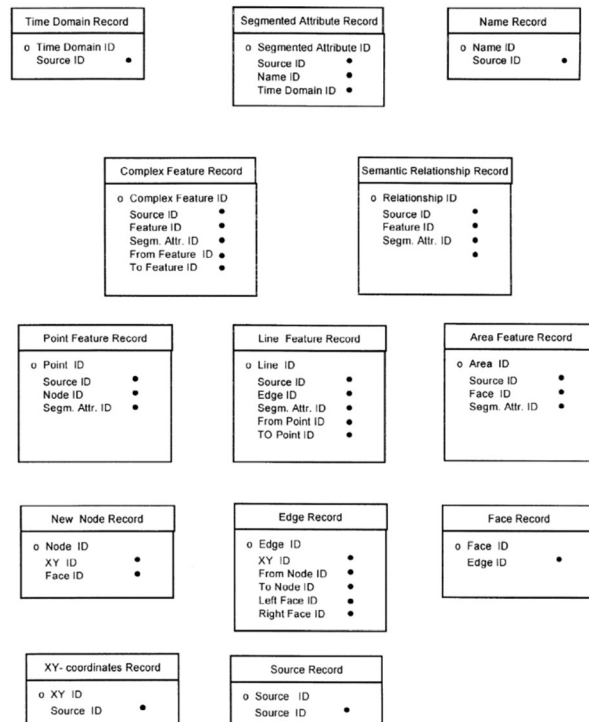
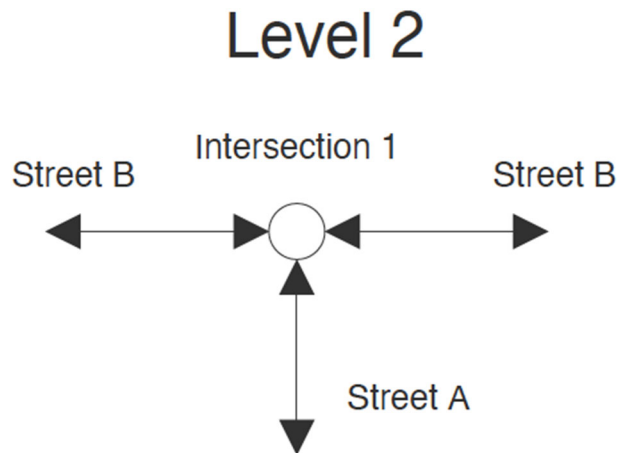


Figure 12.3 Pointer fields and their role in the records

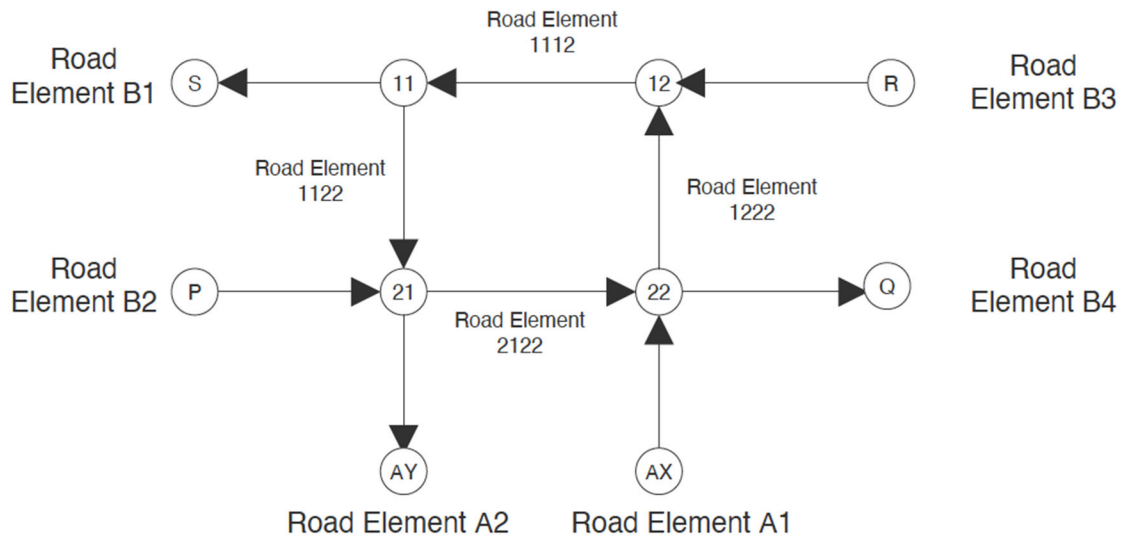
Ex-1035, 0317.

92. GDF is exceedingly rich and detailed, and is able to describe geographic information in a detailed and unambiguous way. For example, as described briefly above, a detailed description of the intersection of two 2-lane roads requires a description of all of the possible pathways through the intersection from each incoming lane to whichever lanes are valid outgoing lanes associated with that incoming lane. This means that the simple description of a junction connecting four road segments is not sufficient for that level of description. This simple Level 2 road intersection is shown below.



But the actual description at Level 1 would need to include a variety of sub-roads (e.g., lanes within a given road segment) with directional attributes linked by sub-nodes, so that each possible pathway through the intersection can be defined. This is shown in the figure below.

Level 1

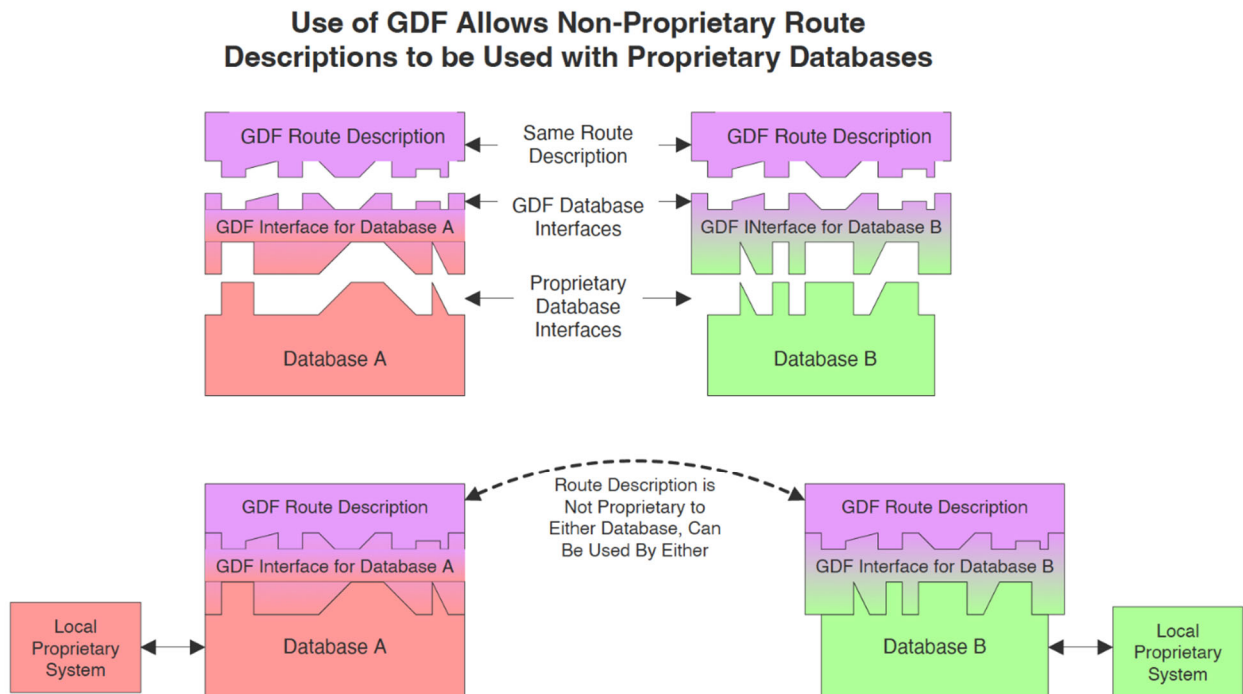


Here each road has been subdivided into directional road elements (e.g., lanes or pathways), and the single intersection has been subdivided into four nodes, each of which is only associated with a few of the road elements. Applying directional attributes and/or restriction attributes to these sub-features allows a description not just of the conceptual element of the intersection, but of the exact valid pathways through the intersection. Multi-lane intersections with dedicated turning lanes, lane restrictions, and such would require a more complex description, but would still be based on these same primitive elements.

93. Because of its flexibility, GDF can convey a very wide range of geographic descriptions, from very simple, as shown above for a Level 2 description, to very complex (i.e. Levels 1 and 0). In many cases, however, the elements to be

described are not particularly complicated. For example, the Level 2 above might be sufficient for describing a simple route that is not seeking to address turn restrictions or lane directionality. In that case the simple construct of an incoming road description, an intersection description, and an outgoing road description might be adequate, since those parts of the intersection that are not traversed do not need to be specified.

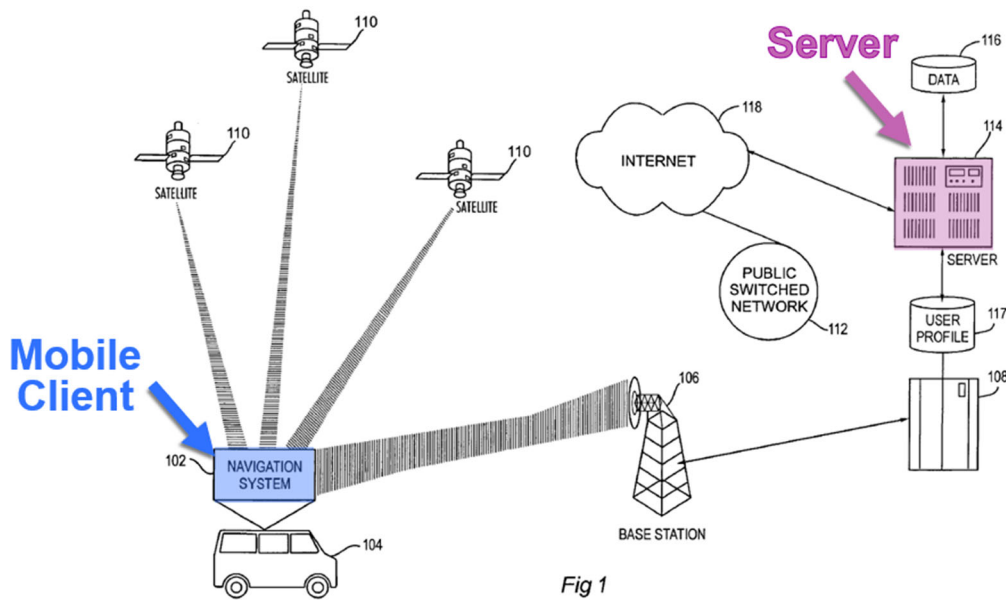
94. To use GDF a database developer can either develop a database that simply mirrors GDF, or they can develop an interface between their database representation of the geographic features and the GDF representation. In practice, most database developers have particular proprietary systems that are optimized in some way to best address the needs of their customers, and thus few navigation databases are native GDF. Instead, for data exchange purposes, they include a bi-directional interface that generates GDF from a description generated using their database, and also is able to translate any received GDF descriptions into a structure that can then be represented in their database. This is illustrated by the figure below.



95. Because GDF is a public open standard, it is not proprietary to any particular database or navigational system.

IX. THE CHALLENGED PATENT

96. The '743 Patent relates to a distributed mobile navigation system that includes a mobile client device and a remote navigation server, as illustrated in annotated Figure 1, below. Ex-1001, Abstract.



97. In response to the client “request[ing] a specific route by uploading start and stop specifications to the server,” the server uses real-time data to calculate “an optimal route for the user.” *Id.*, 3:29-33. The server sends this optimal route back to the client in a “natural language” format, as illustrated in Figure 5, reproduced below. *Id.*, 3:34-35.

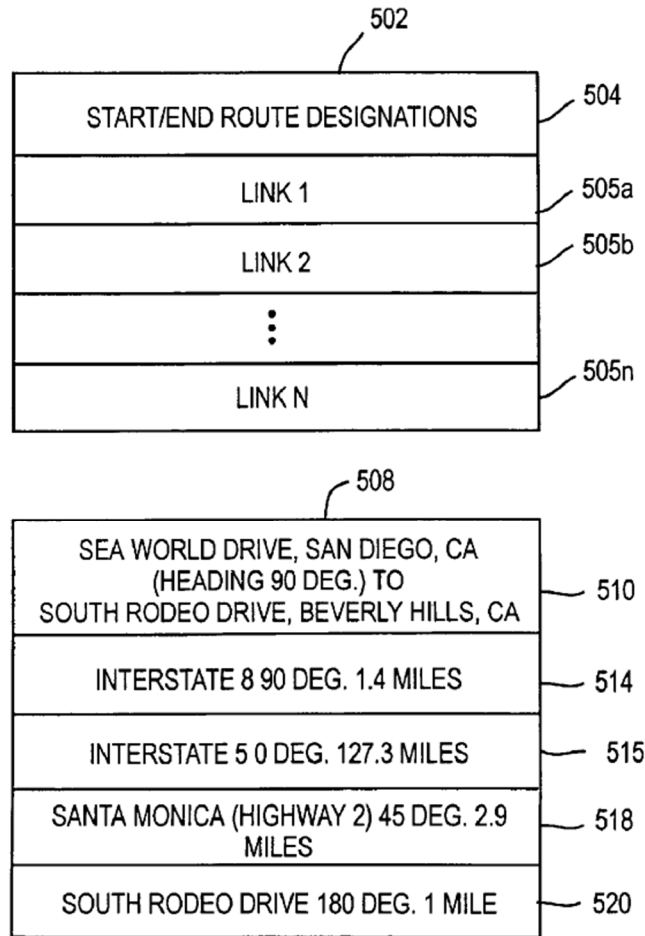


Fig. 5

98. The “natural language” format, in one example, includes “generic terms such as road names and turning directions.” *Id.*, 3:37-40. This is illustrated in Figure 5, for example, which shows the route defined by a series of links, with each link described using English language descriptions, such as “Interstate 8 90 deg[rees] 1.4 miles.” The ’743 Patent states that by using this format, the alleged “invention can be used with any mapping database installed on the client navigation system” and

“navigation systems from any vendor can be easily adapted to work with the server of the present invention.” Ex-1001, 2:48-50, 3:8-10.

99. In response to receiving the natural language formatted route, the client uses a mapping database local to the client to reconstruct the route, “using a mapping reconstruction algorithm stored on the client,” so that it can be displayed “on the display screen on the client navigation system.” *Id.*, 3:40-48.

X. PATENT PROSECUTION HISTORY

100. The '743 Patent was filed on January 6, 1999. Ex-1001, Cover. On October 3, 2000, all original claims were rejected in a first office action. Ex-1004, 0087-0091. The applicant then amended the independent claims to require that the originally-claimed “natural language description” of the optimal route also be a “non-proprietary, natural language description” arguing that the prior art failed to disclose “formatting the optimal route into a non-proprietary, natural language description and downloading the non-proprietary, natural language description to the client.” Ex- 1004, 0110, 0118. The examiner then allowed the claims, with the '743 Patent issuing on September 18, 2001. Ex-1004, 0145; Ex-1001, Cover.

XI. SUMMARY OF OPINIONS

101. I have been asked to consider the patentability of some claims of the '743 Patent in view of certain prior art references. As explained in detail below, it is my opinion that:

- **Ground 1:** Claims 1-7, 12-16, and 21-22 are rendered obvious by U.S. Patent No. 6,680,694 (“Knockeart,” Ex-1005) in view of U.S. Patent No. 5,893,113 (“McGrath,” Ex-1006);
- **Ground 2:** Claims 8-9 are rendered obvious by Knockeart in view of McGrath, in further view of U.S. Patent No. 5,059,965 (“Geiser,” Ex-1008);
- **Ground 3:** Claims 10-11 are rendered obvious by Knockeart in view of McGrath and Geiser, in further view of EP 0827124A (“Watanabe,” Ex-1009);
- **Ground 4:** Claims 17-18 are rendered obvious by Knockeart in view of McGrath in further view of JPH10-221091A (“Nunokawa,” Ex-1011);
- **Ground 5:** Claim 19 is obvious over Knockeart in view of McGrath, in further view of JPH8-110230 (“Endo,” Ex-1013);
- **Ground 6:** Claims 1-2, 4-7, 13-16, and 21-22 are rendered obvious by U.S. Patent No. 6,334,087 (“Nakano,” Ex-1007) in view of McGrath;
- **Ground 7:** Claims 7-9 are rendered obvious by Nakano in view of McGrath, in further view of Geiser;
- **Ground 8:** Claims 10-11 are rendered obvious by Nakano in view of McGrath and Geiser, in further view of Watanabe;
- **Ground 9:** Claim 12 is rendered obvious by Nakano in view of McGrath, in further view of Knockeart;
- **Ground 10:** Claims 17-18 are rendered obvious by Nakano in view of

McGrath, in further view of Nunokawa; and

- **Ground 11:** Claim 19 is rendered obvious by Nakano in view of McGrath, in further view of Endo.

102. The following table is a summary of the above-enumerated grounds:

Ground	Summary
1	Claims 1-7, 12-16, and 21-22 are obvious over Knockeart in view of McGrath
2	Claims 8-9 are obvious over Knockeart in view of McGrath, in further view of Geiser
3	Claims 10-11 are obvious over Knockeart in view of McGrath and Geiser, in further view of Watanabe
4	Claims 17-18 are obvious over Knockeart, in view of McGrath, in further view of Nunokawa
5	Claim 19 is obvious over Knockeart in view of McGrath, in further view of Endo
6	Claims 1-2, 4-7, 13-16, and 21-22 are obvious over Nakano in view of McGrath
7	Claims 7-9 are obvious over Nakano in view of McGrath, in further view of Geiser
8	Claims 10-11 are obvious over Nakano in view of McGrath, in further view of Watanabe
9	Claim 12 is obvious over Nakano in view of McGrath, in further view of Knockeart
10	Claims 17-18 are obvious over Nakano in view of McGrath, in further view of Nunokawa

11	Claim 19 is obvious over Nakano in view of McGrath, in further view of Endo
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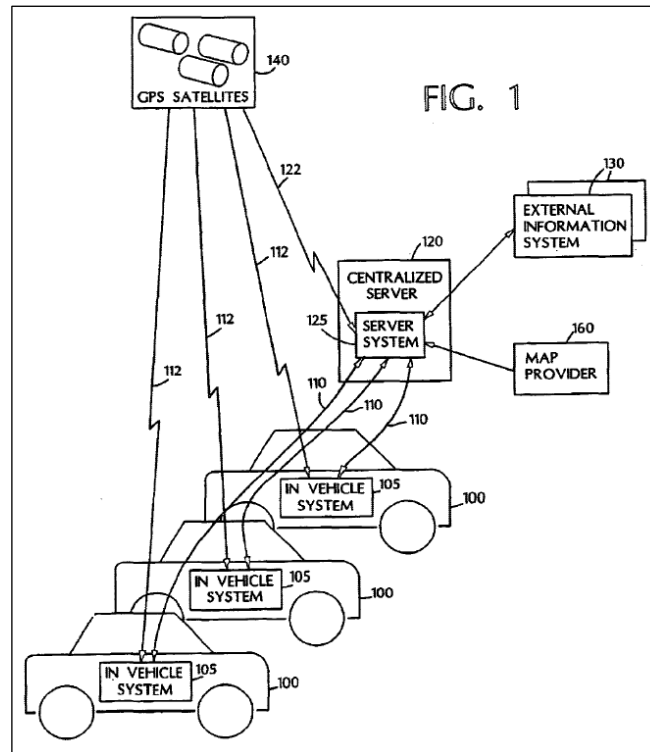
XII. BRIEF DESCRIPTION OF THE APPLIED PRIOR ART REFERENCES

A. Knockeart (Ex-1005)

103. Knockeart was filed on August 19, 1998, and issued on January 20, 2004. Knockeart claims priority to U.S. Provisional Pat. Appl. No. 60/056,150, filed on August 19, 1997 (“Knockeart Provisional,” Ex-1036). I understand that Knockeart is prior art because its filing date antedates the ’743 Patent’s priority date.

104. I have been asked to review and compare the disclosures in Knockeart Provisional to those in Knockeart. I agree with the analysis provided in Exhibit 1037, which demonstrates that Knockeart Provisional provides written description support for Claim 1 of Knockeart, and that Knockeart Provisional provides written description support for the disclosures of Knockeart relied upon in Grounds 1-5 and 9, below.

105. As illustrated in Figure 1 below, Knockeart teaches a vehicle navigation system that can connect to a centralized server system through a wireless communications system. Ex-1005, Abstract, 1:61-65, 7:41-56.



106. Knockeart teaches that the in-vehicle unit sends origin and destination information to the server. *Id.*, Abstract, 1:23-33, 5:15-26, Fig. 15A. The server then calculates an optimal route using the information received from the in-vehicle client. *Id.*, Abstract, 1:66-2:22, 10:43-11:4, 22:33-41, 28:42-29:15, Fig. 15B. The server then formats the route according to the “Geographic Data File” (GDF) format and sends it to the in-vehicle unit. *Id.*, 8:44-52, 15:42-58, 15:66-16:13, 29:15-60, 29:61-30:17, Figs. 8-9.

107. Knockeart explains that the GDF format is “an international standard format”:

The map information is provided in one of a number of interchange formats, such as in the **Geographic Data File (GDF) format, an international standard format**. A map in GDF format includes a data

structure which associates links and nodes and their attributes, and relationships between nodes and links in the graph.

Ex-1005, 15:67-16:6.

B. McGrath (Ex-1006)

108. McGrath was filed on April 25, 1996, and issued on April 6, 1999. I understand that McGrath is prior art, based on its filing date.

109. McGrath discloses a method for incrementally updating a geographic database. Ex-1006, Abstract. As McGrath explains, rather than tailoring the update format to the proprietary format used by a specific customer's geographic database, the updates may be provided "in a non-proprietary format," which the customer may then "translate[] into [the] customer's proprietary format":

It is understood that the transaction updates and/or the geographical data set may be converted from one format to another in connection with the application of the updates. For example, the transactions may be published in a non-proprietary format, translated into a customer's proprietary format, and applied to the customer's geographical data set which also may be in a proprietary format. Alternatively, the customer may convert its existing geographical data set into a non-proprietary format, apply transactions in the non-proprietary format, and convert the updated geographical data set back into a proprietary format.

Id., 13:14-21. McGrath discloses use of the industrywide GDF format (i.e., the same GDF format referenced in Knockart) for this purpose of providing a "non-proprietary format." Ex-1006, 3:66-67. Specifically, McGrath notes that the "GDF 3.0 format is described in a document issued by the CEN (European Committee for

Standardisation) on Oct. 12, 1995,” and incorporates that entire GDF specification by reference:

One format used for geographical data sets is the GDF (Geographic Data File) format.... The GDF format is discussed herein for ease of reference. **The GDF 3.0 format is described in a document issued by the CEN (European Committee for Standardisation) on Oct. 12, 1995, the entire disclosure of which is incorporated herein by reference.** The GDF format also is being considered for adoption outside of Europe by the ISO (International Standards Organization).

Ex-1006, 3:30-39. As I described in the Technology Background Section, GDF is described in a Technical Report published in 1996 by the ISO. *See* Ex-1035. That Technical Report fully describes the GDF format used in McGrath. For instance, the Technical Report describes all of the same GDF data structures—e.g., Features, Attributes, and Relationships—as those described in McGrath. *See* Section VIII.C.

110. McGrath explains that GDF “is especially suitable for transferring geographical data sets from another format or to another format”:

The GDF format is an interchange format for geographical databases. The GDF format is especially suitable for **transferring geographical data sets from another format or to another format.** Accordingly, the GDF format may be used for **transferring or providing geographical data sets from one entity to another.** For example, the GDF [format] may be used by a geographical data set developer/publisher (i.e., an entity that collects the geographical information and enters it into a data format) to transfer its geographical data set to a geographical data set customer (e.g., an entity that incorporates the geographical data set in a navigation system). The GDF [format] also provides a standardized means for a navigation customer and a geographical data set developer to specify, compare, and agree on the types, coverage, and accuracy of a geographical data

set.

Ex-1006, 3:39-54.

111. McGrath provides specific details about GDF. For instance, McGrath explains that the GDF standard uses “[e]lements,” which “are classified into objects and their respective characteristics.” Ex-1006, 4:54-60. McGrath provides various examples of objects, including “a ‘Road Element’ object,” a “Node” object, and a “‘Prohibited Turn’ relationship” object. *Id.*, Table 1, 6:59-63. McGrath explains that each object is associated with one or more “characteristics,” such as “text of a name” and/or “descriptive information.” Ex-1006, 5:17-50.

C. Nakano (Ex-1007)

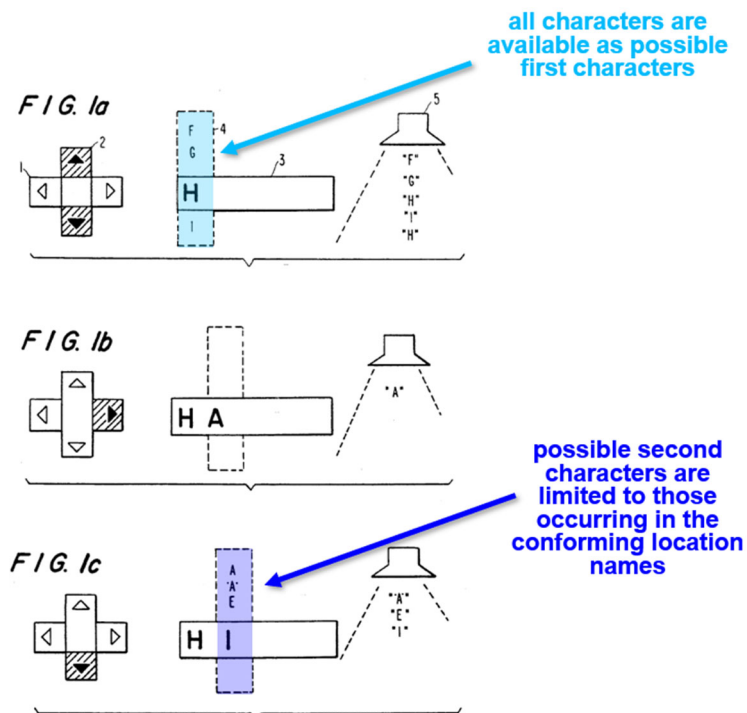
112. Nakano was filed on April 30, 1998, and issued on December 25, 2001. I understand that Nakano is prior art based on its filing date.

113. Nakano discloses a “server/client-type” navigation system in which a mobile terminal requests, from a server, an “optimum route” between user-specified starting and destination points. Ex-1007, Abstract, 11:63-12:6, 15:48-50. In response, the server calculates the optimum route as, e.g., “a route avoiding congestion,” and represents this optimal route as a set of elements with associated element IDs. *Id.*, 14:34-41, 15:64-16:5. The mobile terminal downloads the route, formatted according to the element IDs, and uses those IDs to access locally-stored templates for “restoring” the route. *Id.*, 15:48-53, 17:26-18:6, Fig. 15.

D. Geiser (Ex-1008)

114. Geiser issued on October 22, 1991. I understand that Geiser is prior art, based on its issue date.

115. Geiser discloses a method for efficient location entry in a navigation system. Ex-1008, Abstract, 1:68-2:3. In Geiser's system, a keypad is used to enter location names, character-by-character, as illustrated in annotated Figures 1a-c, below. Each time a new character is entered, the system compares the entered characters to a list of possible location names and identifies a subset of conforming names. *Id.*, 3:10-16. The system then limits the set of characters from which the user may select for the next character position to those that occur in that position in the conforming locations. *Id.*, 3:16-25.



E. Watanabe (Ex-1009)

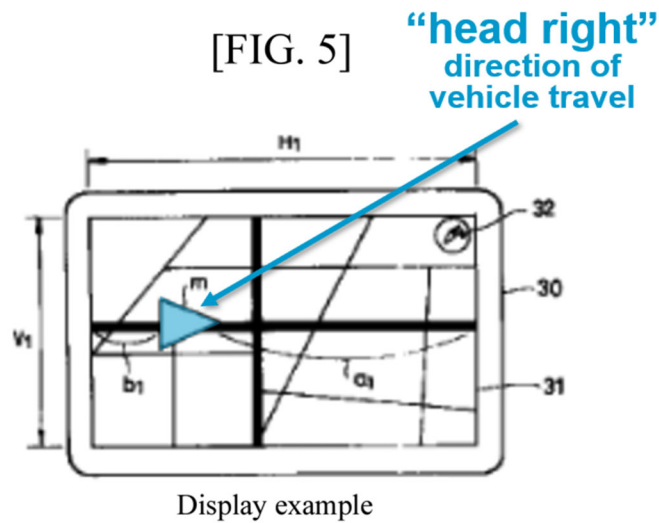
116. Watanabe published on March 4, 1998. I understand that Watanabe is prior art, based on its publication date.

117. Watanabe discloses a vehicle navigation system “with city name selection accelerator.” Ex-1009, Title. To improve the efficiency of the location entry process, Watanabe teaches applying criteria to the set of possible locations from which a user may select to present to the user locations he/she is likely to select. *Id.*, Abstract. Specifically, Watanabe teaches presenting the user with previously entered locations, ordered according to the recency and/or frequency of their prior input. *Id.*, 8:23-35.

F. Nunokawa (Ex-1010)

118. Nunokawa published on August 21, 1998. I understand that Nunokawa is prior art, based on its publication date.

119. Nunokawa discloses “an efficient display” for a navigation system in which, for display screens in “landscape orientation,” the vehicle is displayed as travelling along the horizontal “head right” (or “head left”) direction, as illustrated in annotated Figure 5, below. Ex-1011, Abstract, ¶¶25-26.



120. As Nunokawa explains, this provides an improvement over “head North” systems (i.e., systems displaying the vehicle moving in the vertical direction), because it results in an increased “amount of information displayed ahead of the traveling direction,” “making it possible to easily confirm the route.” *Id.*, ¶¶25-26.

G. Endo (Ex-1012)

121. Endo published on April 30, 1996. I understand that Endo is prior art, based on its publication date. I have been informed by Counsel that Ex-1013 corresponds to a certified translation of Endo.

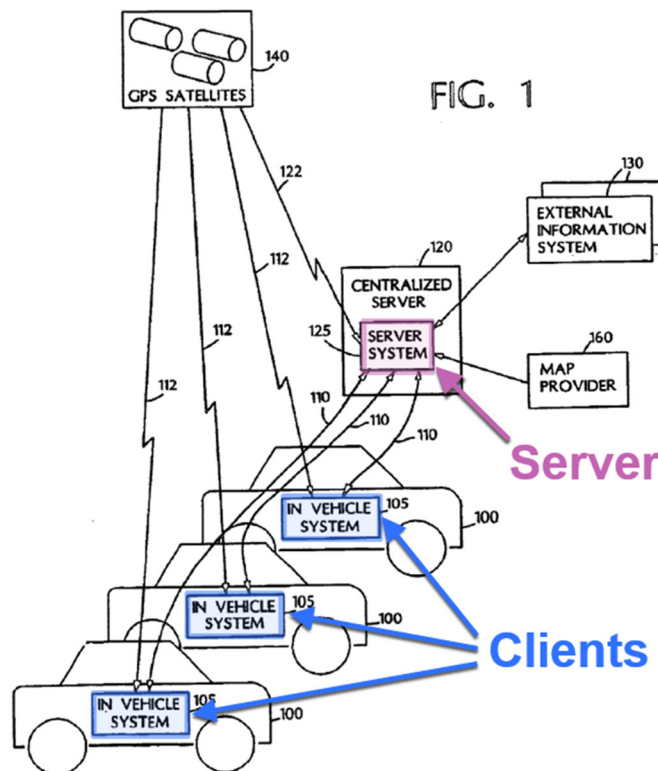
122. Endo discloses a method for correcting the time displayed by a navigation device in a vehicle, based on the current time zone determined using the vehicle’s current position. Ex-1013, ¶¶5-6, 11.

XIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

A. Ground 1: Claims 1-7, 12-16, and 21-22 Are Obvious Over Knockeart (Ex-1005) In View Of McGrath (Ex-1006)

1. A POSITA would have been motivated to combine Knockeart with McGrath with a reasonable expectation of success

123. Knockeart teaches a client-server vehicle navigation system, as illustrated in annotated Figure 1, below. Ex-1005, Abstract, 6:4-5, 8:7-13.



124. Knockeart's in-vehicle clients send route requests to server 120. *Id.*, Abstract. Knockeart teaches that, in response, the server calculates routes using map information formatted according to "*the Geographic Data File (GDF) format, an international standard format,*" and sends those routes to the clients. Ex-1005,

8:44-52, 15:42-58, 15:67-16:13, 29:15-60, 29:61-30:17, Figs. 8-9.² But other than mentioning the use of the GDF format, Knockeart does not describe specific implementation details or examples of the GDF format.

125. A POSITA seeking to implement Knockeart's system would have been motivated to turn to another reference for additional information about GDF, including implementation details related to using the GDF format. McGrath is one such reference. As explained in further detail in Section XIII.A.2.f (Element 1[e]) below, McGrath explains that GDF is a "non-proprietary" format for creating and updating geographic route information. Ex-1006, 3:30-50, 13:9-29. McGrath discloses a "method of providing incremental updates" for a geographical database formatted according to GDF. Ex-1006, Abstract, 4:52-53. Accordingly, McGrath provides specific examples of geographical information formatted according to GDF. *See, e.g., id.*, 4:52-8:21. For instance, McGrath provides examples of route information that may be formatted according to GDF, including information that Knockeart teaches is provided as part of its route. Compare Ex-1005, 29:27-29 (node latitude/longitude), 29:35-36 ("size ... of the road segment") with Ex-1006, Table 1 (node latitude and "road width").

² Throughout, emphasis and annotations are added unless otherwise specified.

126. While Knockeart explains that the GDF text fields may include “special information to be presented to the operator,” it does not define the form of that information. Ex-1005, 29:49-55. But McGrath specifically describes examples of such information, including “information about one-way streets, traffic signals, stop signs, turn restrictions, street addresses, alternative routes, hotels, restaurants,” etc. Ex-1006, 1:22-29; *see also id.*, 6:55-67 (describing a “Prohibited Turn” relationship and a “Validity Period”). Based on these disclosures, a POSITA would have understood that, using GDF-formatted data, “special information” (Ex-1005, 29:49-55) such as, for example, no left turn “between 7:00 am and 9:00 am” (Ex-1006, 6:63-67), a route identification of “US-101 North” (*id.*, 7:65-67), etc., could be provided to an in-vehicle operator, as part of Knockeart’s route.

127. McGrath also explicitly makes clear the benefits of the GDF format, in enabling interoperability between different manufacturer’s mapping databases. In particular, McGrath explains that GDF is “an interchange format”:

The GDF format is an interchange format for geographical databases. The GDF format is especially suitable for **transferring geographical data sets from another format or to another format**. Accordingly, the GDF format may be used for **transferring or providing geographical data sets from one entity to another**. For example, the GDF [format] may be used by a geographical data set developer/publisher (i.e., an entity that collects the geographical information and enters it into a data format) to transfer its geographical data set to a geographical data set customer (e.g., an entity that incorporates the geographical data set in a navigation system). The GDF [format] also provides a standardized means for a navigation

customer and a geographical data set developer to specify, compare, and agree on the types, coverage, and accuracy of a geographical data set.

Ex-1006, 3:39-54. As I explained in the Technical Background Section, this interoperability is facilitated through the use of bidirectional interfaces for transferring between GDF and other mapping database formats. McGrath also describes this concept:

In order to provide a geographical data set in the GDF format, it may be necessary for a geographical data set developer to **convert its data set from its own format into the GDF format**. Similarly, in order for a geographical data set customer to use a geographical data set in a navigation system, the geographical data set customer may need to **convert the geographical data set from the GDF format into its own format**.

Ex-1006, 3:54-61;

It is understood that the transaction updates and/or the geographical data set may be converted from one format to another in connection with the application of the updates. For example, the transactions may be **published in a non-proprietary format [(e.g., GDF)], translated into a customer's proprietary format**, and applied to the customer's geographical data set which also may be in a proprietary format. Alternatively, the customer may convert its existing geographical data set into a non-proprietary format, apply transactions in the non-proprietary format, and convert the updated geographical data set back into a proprietary format.

Ex-1006, 13:10-21.

128. Thus, by incorporating McGrath's GDF implementation details, Knockeart's GDF-based system would enhance interoperability between different

manufacturer's client and server mapping databases and achieve the other benefits of GDF-based formatting.

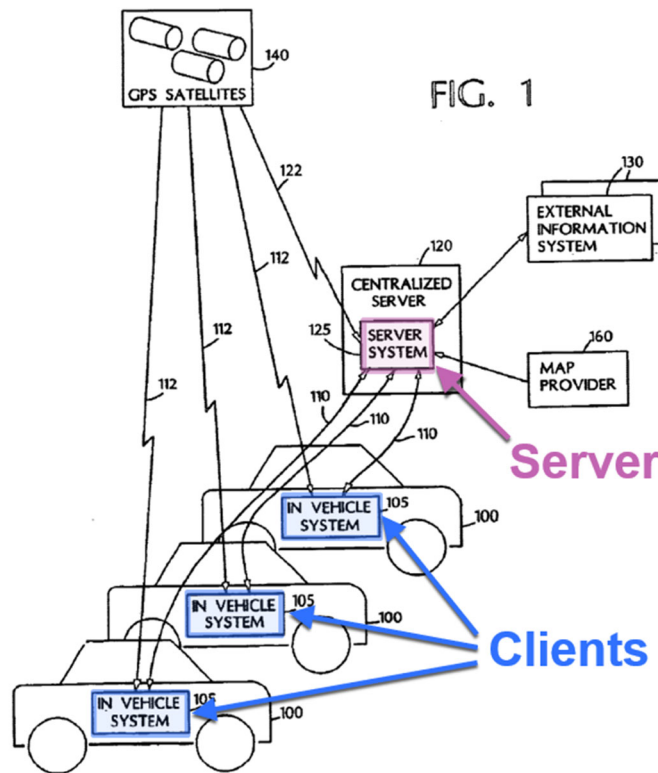
129. Additionally, based on Knockeart's disclosure that the mapping data used by the navigation system "is updated from time to time," a POSITA would have been motivated to search for references, such as McGrath, that describe the updating process. Ex-1005, 37:21-22. McGrath explains that existing methods for updating geographic databases were burdensome, requiring replacement of an entire previous version with a new version, despite the large amount of data which remained unchanged between versions. Ex-1006, 2:11-32. To address this problem, McGrath discloses a method for providing incremental updates to a geographic database, through the use of "transactions." *Id.*, Abstract. McGrath explains that by formatting these transactions according to GDF, they may be used to update geographic databases in any format (i.e., proprietary or non-proprietary). *Id.*, 13:9-21. A POSITA would have been motivated to use McGrath's updating method to update Knockeart's mapping data, to keep the data up-to-date, in an efficient manner.

2. Independent Claim 1

- a. Element 1[pre]: A method for providing an optimal route using real-time information for a navigation system comprising a client and a server, said server coupled to a computer network, said method comprising the steps of:**

130. Knockeart-McGrath teaches and/or suggests the preamble.

131. Knockeart teaches “a *vehicle navigation system*” that “includes an in-vehicle system 105 and a centralized server system 120,” in a “‘*client-server arrangement*,’” as illustrated in annotated Figure 1, below. Ex-1005, Abstract, 6:4-5, 8:7-13.



132. Knockeart teaches a method for providing an optimal route from Knockeart’s server to the in-vehicle client. Specifically, Knockeart’s server calculates an optimal route for the in-vehicle system using real-time information such as “*traffic-related information* ... to determine a fastest route from a starting to a destination location.” *Id.*, 8:53-60. The route calculated by Knockeart’s system

is “optimal” under the district court’s construction of “recommended route obtained using a set of criteria.” In particular, the route is recommended to the in-vehicle operator, and it is obtained based on various criteria, such as the “fastest route,” “the smallest total distance,” “lowest expected travel time,” and/or “avoid[ing] congested” routes or “toll fees”:

[A]n external information system 130 can provide traffic-related information that is used by server system 125 to determine **a fastest route** from a starting to a destination location.

Ex-1005, 8:53-60;

The server system next computes **a best path** to destination 692. “Best” can be based on a variety of criteria such as the smallest total distance, or the shortest expected travel time using information related to the expected speed of travel along links of the roadway graph.

id., 10:43-47;

Route planning can be based on a variety of criteria. **A shortest total distance** uses the actual link distances in the road network to determine the cost of a path. The lower bound on the remaining path can be straight-line distance between an intermediate node and the final node. Route planning can alternatively be based on **lowest expected travel time**. Travel time along a link can be based on an expected speed for different road classes, or can be based on specific speed data stored on the server system and associated with particular links. For example, the server system may know that certain links are congested with slower than expected speeds for their road classes. The route planning algorithm would then tend to **avoid such a congested link** if there are alternative routes that can be taken.

Other alternative route planning approaches can also be used on the server system. For instance, **routes can be constrained to follow particular road segments**, and the cost of routes can include other factors than distance or expected travel time, such as toll fees along the

route.

id., 28:64-29:15;

In another alternative version of the system, the server system plans and downloads several routes, for instance planned according to different criteria, such as **shortest time, shortest distance**, etc. The in-vehicle system displays characteristics of the alternatives (e.g., time, distance) and the operator selects one.

id., 43:33-38.

133. Knockeart's client and server are both coupled to a "wireless communication" network, such as a "cellular" network, over which they communicate. *Id.*, Abstract. This wireless network corresponds to a "computer network," because it connects computing devices. *Id.*, 12:55-65 (in-vehicle system includes "onboard computer"), 14:53-55 (server is a "computer").

b. Element 1[a]: establishing a wireless connection between the client and the server;

134. Knockeart-McGrath teaches and/or suggests Element 1[a].

135. Knockeart explains that the in-vehicle system ("client") "establish[es] a wireless communication channel with the server" ("wireless connection between the client and the server"). Ex-1005, 4:35-39. This wireless connection is then used to "transmit a specification of a destination location" and "receiv[e] the planned route." *Id.*; *see also id.*, Cl. 9 ("establishing a wireless communication channel with the server; and terminating the wireless communication channel after receiving the

planned route”), 6:5-8 (“The system includes ... a wireless communication system for passing data between the onboard computer and a remote server.”).

c. Elements 1[b]: transmitting start and end route designations from the client to the server;

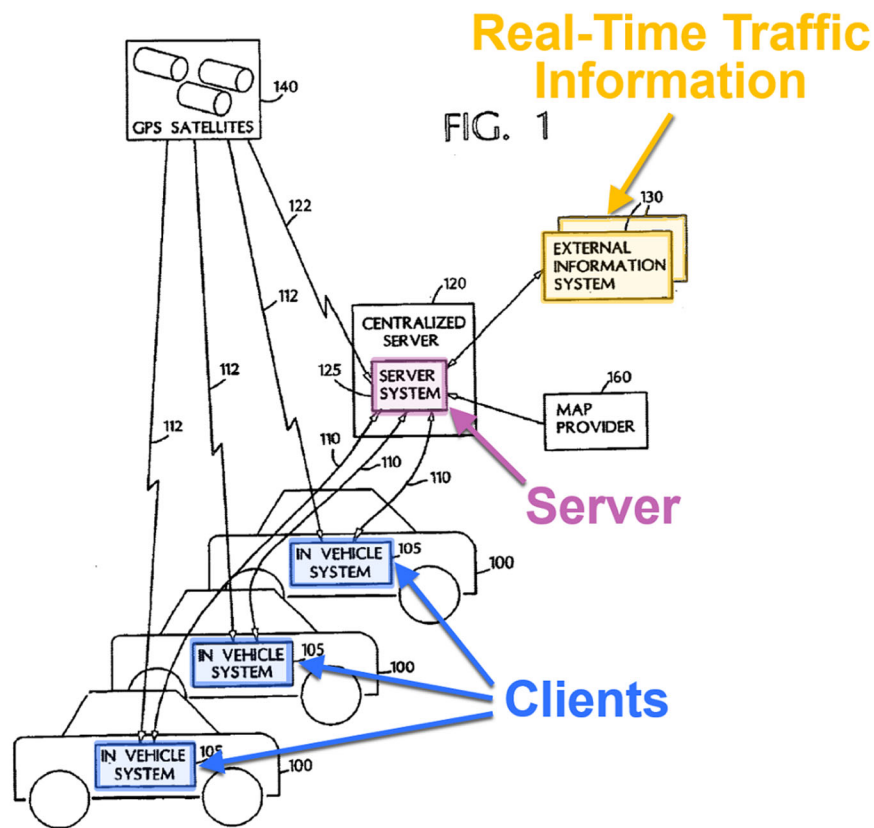
136. Knockeart-McGrath teaches and/or suggests Element 1[b].

137. After the wireless connection with the server is established, Knockeart’s in-vehicle system transmits “*a starting location* (or other location-related data), speed and heading, and *a desired destination* ... to the server system.” Ex-1005, 8:22-25; *see also id.*, Abstract, 1:23-33, 5:15-26, 9:64-10:13, Fig. 15A.

d. Element 1[c]: accessing real-time information by the server;

138. Knockeart-McGrath teaches and/or suggests Element 1[c].

139. As discussed for Element 1[pre], Knockeart’s server accesses “external information” 130 (illustrated in annotated Figure 1, below), which includes real-time information such as “*traffic-related information* that is used by server system 125 to determine a fastest route from a starting to a destination location.” Ex-1005, 8:53-60, 41:5-8 (server uses traffic database “to determine the *current traffic conditions*”).



- e. **Element 1[d]: calculating the optimal route by the server, based on the real-time information and said start and end route designations;**

140. Knockart-McGrath teaches and/or suggests Element 1[d].

141. As illustrated in the route planning flowchart of Figure 15B, annotated below, Knockart's server receives the destination and current vehicle location (step 1553), and determines a planned route to the specified destination (step 1561). Ex-1005, 21:53-56.

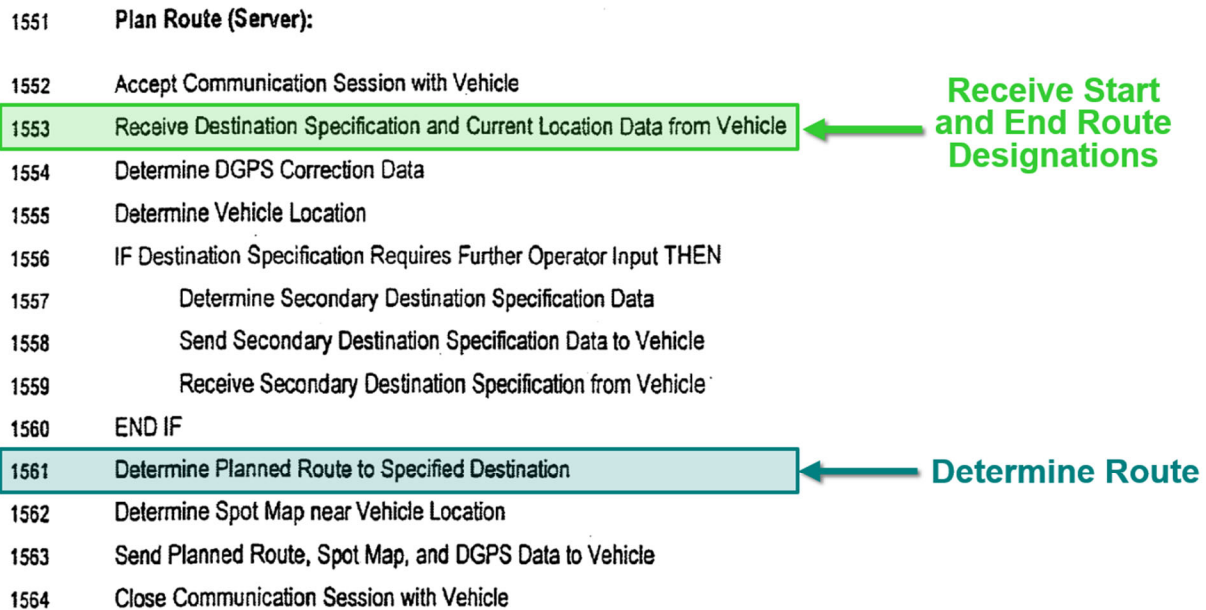


FIG. 15B

142. The route calculated by Knockart's server is based on "external information" 130, which includes real-time "traffic-related information," as discussed for Element 1[c]. *Id.*, 8:53-60. The route calculated by Knockart's system is "optimal" under the district court's construction of "recommended route obtained using a set of criteria." In particular, it is recommended to the in-vehicle operator, and it is based on various criteria, such as the "fastest route," "the smallest total distance," "the shortest expected travel time," and/or avoiding "congested" routes or "toll fees":

[A]n external information system 130 can provide traffic-related information that is used by server system 125 to determine **a fastest route** from a starting to a destination location.

Ex-1005, 8:53-60;

The server system next computes a best path to destination 692. “Best” can be based on a variety of criteria such as the smallest total distance, or the shortest expected travel time using information related to the expected speed of travel along links of the roadway graph.

id., 10:43-47;

Route planning can be based on a variety of criteria. A shortest total distance uses the actual link distances in the road network to determine the cost of a path. The lower bound on the remaining path can be straight-line distance between an intermediate node and the final node. Route planning can alternatively be based on lowest expected travel time. Travel time along a link can be based on an expected speed for different road classes, or can be based on specific speed data stored on the server system and associated with particular links. For example, the server system may know that certain links are congested with slower than expected speeds for their road classes. The route planning algorithm would then tend to avoid such a congested link if there are alternative routes that can be taken.

Other alternative route planning approaches can also be used on the server system. For instance, routes can be constrained to follow particular road segments, and the cost of routes can include other factors than distance or expected travel time, such as toll fees along the route.

id., 28:64-29:15;

In another alternative version of the system, the server system plans and downloads several routes, for instance planned according to different criteria, such as shortest time, shortest distance, etc. The in-vehicle system displays characteristics of the alternatives (e.g., time, distance) and the operator selects one.

id., 43:33-38.

f. Element 1[e]: formatting the optimal route into a non-proprietary, natural language description;

143. Knockeart-McGrath teaches and/or suggests Element 1[e].

144. The route calculated by Knockeart's server is formatted as links connected by nodes, as illustrated in annotated Figure 8, below, where nodes correspond to "maneuvers" that the operator must carry out. Ex-1005, 10:55-11:4 ("[P]lanned route 800 is downloaded from the server system to the in-vehicle system in the form of a sequence of links joined by nodes.").

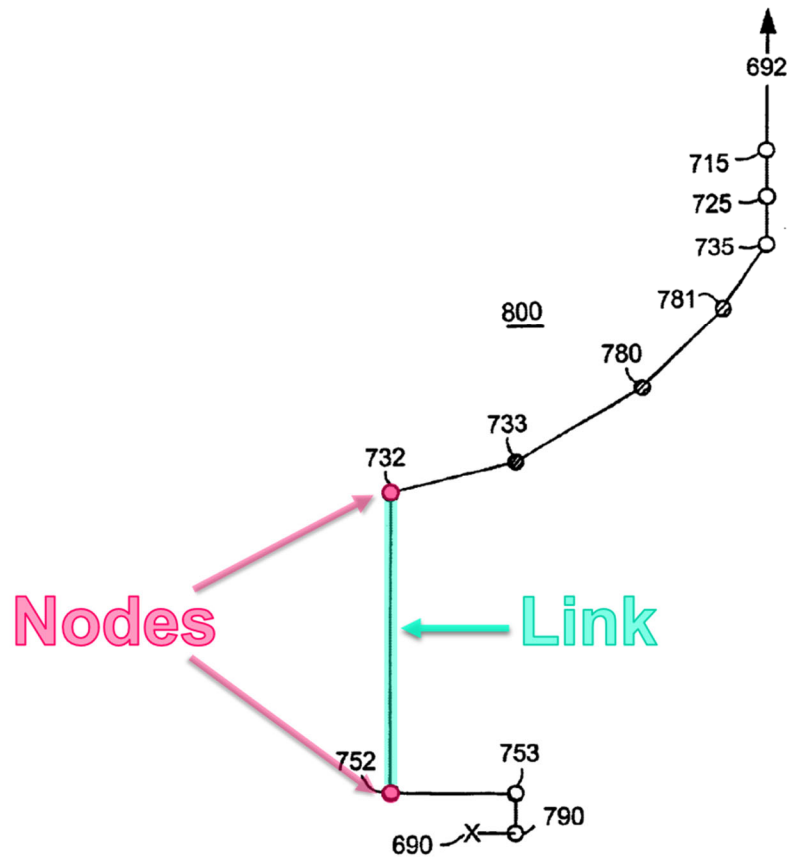


FIG 8

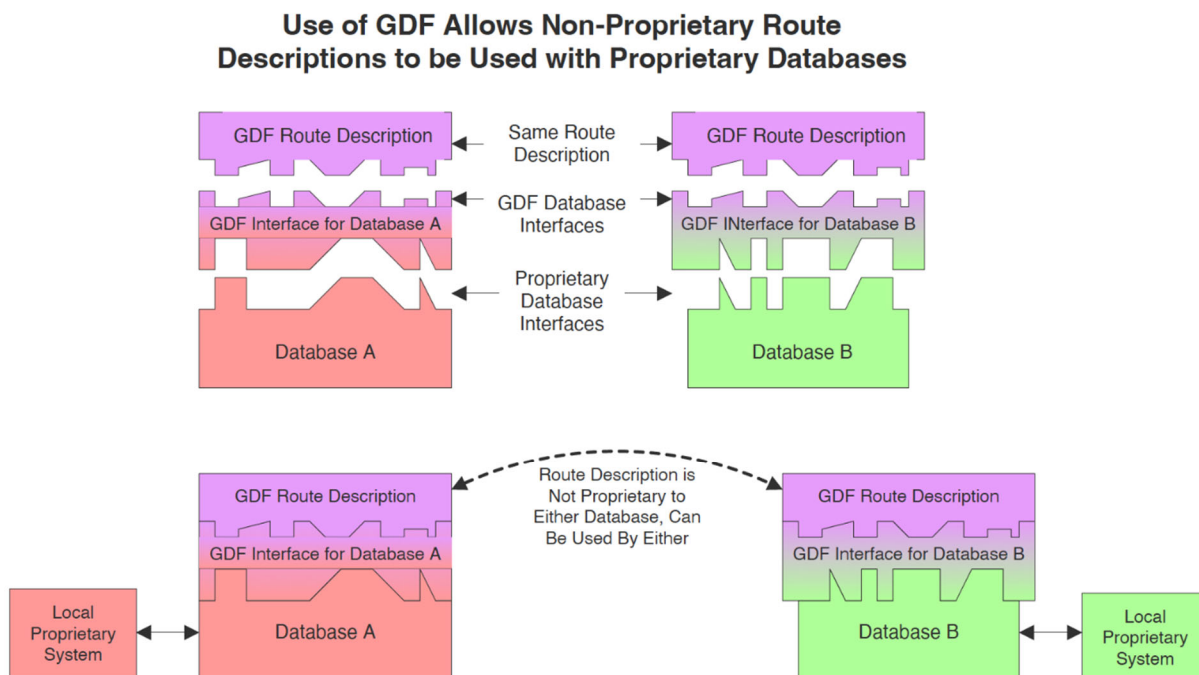
145. As explained in Section XIII.A.1, Knockeart's route is calculated using data formatted according to "*the Geographic Data File (GDF) format, an international standard format.*" Ex-1005, 15:67-16:13. A POSITA would have

understood that the calculated route would/could also be formatted according to GDF. Ex-1005, 8:44-52, 15:42-58, 15:66-16:13, 29:15-60, 29:61-30:17, Figs. 8-9. Notably, a POSITA would have understood that a GDF-formatted route is consistent with Knockeart's description of its route. Notably, Knockeart explains that both the GDF-formatted map data and the calculated route include nodes connected by links. Ex-1005, 15:67-16:13 ("map in GDF format includes ... links and nodes"), 29:17-29 (route includes "a sequence of links" joined by nodes). Further, as explained in Section XIII.A.1, Knockeart's route includes information that McGrath teaches may be formatted according to GDF. *Compare* Ex-1005, 29:27-36, *with* Ex-1006, Table 1.

146. The GDF format used for Knockeart's route is a "non-proprietary" format under the district court's construction of a "format that can be used with mapping databases provided by other manufacturers." As I explained in the Technology Background Section, GDF was designed to be a public open standard for describing and exchanging geographic data. *See* Section VIII.C. Work on the GDF format and specification started in the 1980s in Europe, with GDF 1.0 released in 1988 by the Committee of European Normalisation (CEN) Technical Committee 278, Working Group 7 (TC278/WG7), which had representatives from most of the 34 European nations, predominantly members of various European car makers and suppliers. By 1996, three years before the '743 patent's filing date, GDF 3.0 was

released in a technical report by the International Organization for Standardization (“ISO”)—ISO TR14825:1996. Thus, by 1996, the GDF format was well-known, industry-wide.

147. GDF defines an “exchange” or “interchange” format that may be used to exchange mapping data between databases provided by different manufactures, thereby avoiding compatibility problems that may otherwise arise due to differences in the formats used by the various manufacturers. As I explained in the Technology Background Section, this is accomplished through the use of a bi-directional interface, illustrated in the below diagram, which translates between the GDF format and a manufacturer-specific (e.g., proprietary) format.



148. Such translation is consistent with the '743 Patent's description of the use of its non-proprietary format, where an "algorithm stored on the client" is used to convert a non-proprietary, natural language description of a route into "the format required by the client." Ex-1001, 3:34-45.

149. GDF is also a "natural language" format under the district court's construction of a format that "includes language spoken or written by humans." Each link in Knockeart's route includes "text fields," such as "the name of the street associated with the link" and "the name of the street to be turned onto at the next maneuver point." Ex-1005, 29:24-55. As I explained in the Technology Background Section, this is consistent with the description of GDF in the ISO's Technical Report, which explains that GDF Attributes may correspond to names, written in any language. Street names correspond to language spoken or written by humans. Indeed, this information is similar to that of the '743 Patent's natural language format, as shown in the patent's Figure 5 that illustrates the use of street names and turning orientations as examples of natural language descriptions.

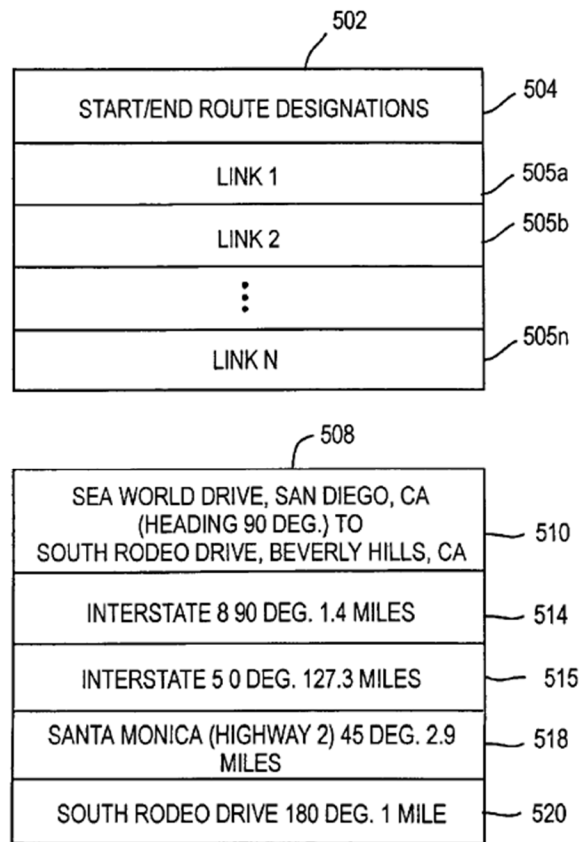


Fig. 5

Ex-1001, Fig. 5.

150. As explained in Section XIII.A.1, a POSITA would have been motivated to combine Knockeart with McGrath. McGrath provides more detailed disclosures and examples of the GDF format that is used to describe routes in Knockeart. Specifically, McGrath presents GDF as an example of a “non-proprietary” format according to which “transaction updates,” for updating geographic data sets, are formatted. Ex-1006, 3:30-50, 13:9-29.

151. McGrath explains that the GDF format is “especially suitable for transferring geographical data sets from another format or to another format.” Ex-1006, 3:39-42. Accordingly, McGrath explains that “the GDF format may be used for transferring or providing geographical data sets from one entity to another entity,” *even though the entities may store the geographical data in different formats* (e.g., different proprietary formats):

The GDF format is an interchange format for geographical databases. The GDF format is especially suitable for **transferring geographical data sets from another format or to another format**. Accordingly, the GDF format may be used for **transferring or providing geographical data sets from one entity to another**. For example, the GDF [format] may be used by a geographical data set developer/publisher (i.e., an entity that collects the geographical information and enters it into a data format) to transfer its geographical data set to a geographical data set customer (e.g., an entity that incorporates the geographical data set in a navigation system). The GDF [format] also provides a standardized means for a navigation customer and a geographical data set developer to specify, compare, and agree on the types, coverage, and accuracy of a geographical data set.

Ex-1006, 3:39-54;

In order to provide a geographical data set in the GDF format, it may be necessary for a geographical data set developer to **convert its data set from its own format into the GDF format**. Similarly, in order for a geographical data set customer to use a geographical data set in a navigation system, the geographical data set customer may need to **convert the geographical data set from the GDF format into its own format**.

Id., 3:54-61;

It is understood that the transaction updates and/or the geographical data set may be converted from one format to another in connection with the application of the updates. For example, the transactions may be **published in a non-proprietary format [(e.g., GDF)], translated into a customer's proprietary format**, and applied to the customer's geographical data set which also may be in a proprietary format. Alternatively, the customer may convert its existing geographical data set into a non-proprietary format, apply transactions in the non-proprietary format, and convert the updated geographical data set back into a proprietary format.

Id., 13:10-21. A POSITA would thus have understood the GDF format in McGrath's system is agnostic to the client's particular database, format, and manufacturer.

152. McGrath also explains that GDF is a “natural language” format under the district court's construction. McGrath explains that a GDF-formatted data set includes “[e]lements,” which “are classified into objects and their respective characteristics.” Ex-1006, 4:54-60. McGrath provides examples of objects, including “a ‘Road Element’ object,” a “Node” object, and a “‘Prohibited Turn’ relationship” object. *Id.*, Table 1, 6:59-63. McGrath explains that each object is associated with one or more “characteristics,” such as “text of a name” and/or “descriptive information.” Ex-1006, 5:17-50. Text in the form of “a name” and “descriptive information” (illustrated below for a “Road Element,” and a “Route Identifier characteristic (characteristic type RT),” Ex-1006, 5:39-51, 7:50-60) is “natural language” because it “includes language spoken or written by humans.”

The diagram illustrates the mapping of a natural language description to a structured table. At the top, a text snippet reads: "object 1001, characteristic RT, now has the value 'US-101 North'". The phrase "US-101 North" is highlighted in a light blue box. A red arrow points from this box down to the "Characteristic Value" column of a table below. The table is titled "TABLE 1" and has a subtitle "Examples of Characteristics". It contains two rows of data. The first row shows "Road Element" as the Object, "Road Width" as the Characteristic Type, and "6 Metres" as the Characteristic Value. The second row shows "Node" as the Object, "X-Coordinate" as the Characteristic Type, and "12.34567° North" as the Characteristic Value. The "12.34567° North" value is highlighted in a light blue box. A red arrow points from the "Natural Language Descriptions" text to this box. The text "Natural Language Descriptions" is written in red.

TABLE 1		
Examples of Characteristics		
Object	Characteristic Type	Characteristic Value
Road Element	Road Width	6 Metres
Node	X-Coordinate	12.34567° North

153. Additional examples of “natural language” GDF route descriptions provided by McGrath include a “Name Attribute” characteristic, such as “Main Street,” “First Avenue,” “US-101 North,” “I-95,” etc., and a “Turn Restriction Attribute” characteristic such as “none,” or “left turn prohibited.” Ex-1006, 7:41-45, 7:65-67, Table 2. As I explained in the Technology Background Section, this is consistent with the description of GDF provided in the ISO’s Technical Report, which explains that GDF Attributes may take the form of Names, corresponding to text written in English or another language. *See* Section VIII.C.

g. Element 1[f]: downloading said non-proprietary, natural language description to the client;

154. Knockeart-McGrath teaches and/or suggests Element 1[f].

155. Knockeart teaches this limitation under the district court’s construction of “the server sending the non-proprietary, natural language description and the client receiving the non-proprietary, natural language description.” As illustrated in annotated Figures 15A-B below, Knockeart’s “server system . . . transmits the computed route to the in-vehicle system [i.e., the client],” where it is received. Ex-1015, Abstract; *id.*, 10:55-11:4 (route “is *downloaded from the server system to the in-vehicle system*”).

1551 Plan Route (Server):
1552 Accept Communication Session with Vehicle
1553 Receive Destination Specification and Current Location Data from Vehicle
1554 Determine DGPS Correction Data
1555 Determine Vehicle Location
1556 IF Destination Specification Requires Further Operator Input THEN
1557 Determine Secondary Destination Specification Data
1558 Send Secondary Destination Specification Data to Vehicle
1559 Receive Secondary Destination Specification from Vehicle
1560 END IF
1561 Determine Planned Route to Specified Destination
1562 Determine Spot Map near Vehicle Location
1563 Send Planned Route, Spot Map, and DGPS Data to Vehicle
1564 Close Communication Session with Vehicle

FIG. 15B

Server sends
GDF-formatted
route

1501 Plan Route (In-Vehicle):
1502 Accept Destination Specification from Operator
1503 Determine Current Location Data
1504 Establish Communication Session with Server
1505 Send Destination Specification and Current Location Data to Server
1506 IF Destination Specification Requires Server Interaction THEN
1507 Accept Secondary Destination Specification Data from Server
1508 Accept Secondary Destination Specification from Operator
1509 Send Secondary Destination Specification to Server
1510 END IF
1511 Wait for Server Response
1512 Receive Planned Route, Spot Map, and Differential GPS Data from Server
1513 Close Communication Session with Server

FIG. 15A

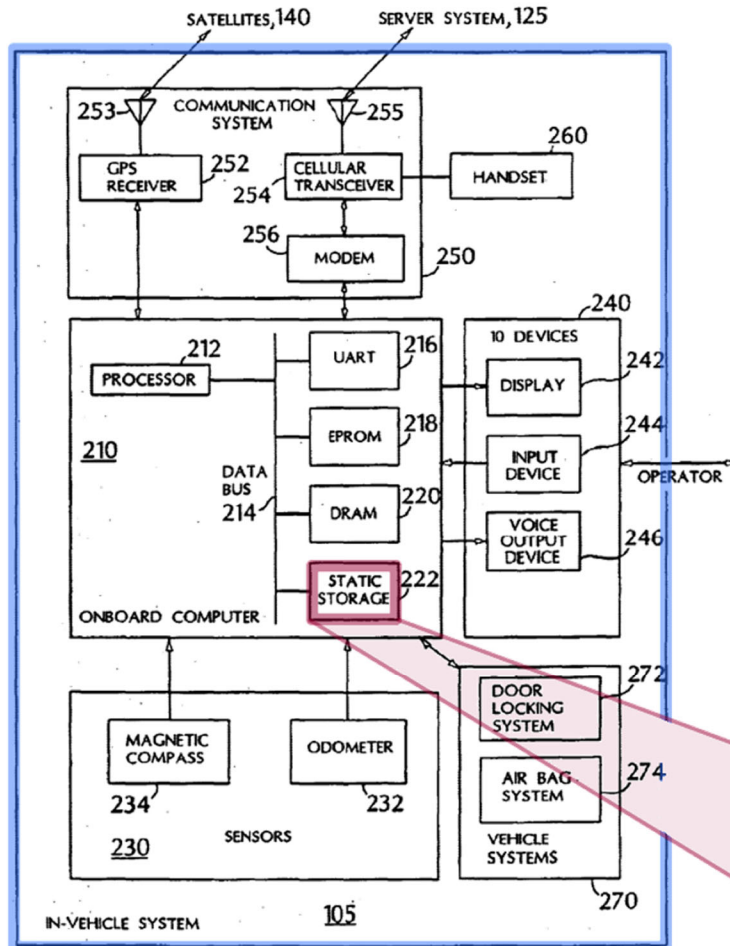
In-vehicle
system receives
GDF-formatted
route

h. Element 1[g]: reconstructing the optimal route by the client using a local mapping database; and

156. Knockeart-McGrath teaches and/or suggests Element 1[g].

157. Knockeart’s in-vehicle unit (“client”) includes an in-vehicle database 432 (illustrated in annotated Figures 2 and 4B, below) “used to *store map-related*

information, such as main roads network ... which is used during route planning and guidance procedures executed on onboard computer 210.” Ex-1005, 13:12-22, 6:4-12 (in-vehicle system includes “storage for a map database”).



In-Vehicle System (Client)

FIG. 2

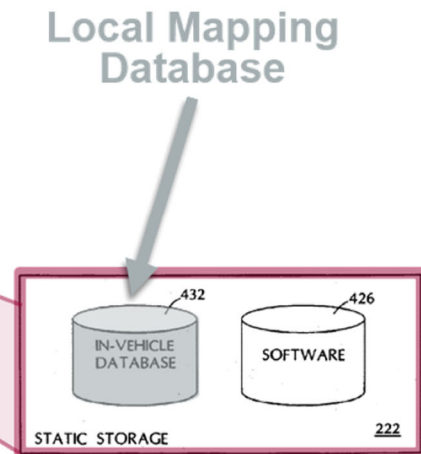


FIG. 4B

158. Knockart teaches using this local database to reconstruct the optimal route:

159. First, the local map database can be used to reconstruct the route during the guidance phase. Specifically, Knockart explains that “the system can take advantage of data in the in-vehicle database to reduce the amount of data”

transmitted from the server to the in-vehicle system. Ex-1005, 29:63-65. As an example, Knockeart explains that this may be done “by referencing stored street names or using references to nodes in the main roads database stored in the vehicle.” Ex-1005, 29:65-67. A POSITA would have understood that in order to display a route to Knockeart’s in-vehicle operator, where that route referenced information stored in “the main roads database stored in the vehicle,” that local in-vehicle database would need to be used to reconstruct the route. Specifically, the links and nodes representing the route would be matched to corresponding links and nodes in the in-vehicle database, and then all of the other data in the in-vehicle database associated with those links and nodes could be used, for example to display the route to the user, including any locally stored graphical map data, point of interest data, etc.

160. Second, Knockeart explains that the local mapping database re-plans the route when the vehicle diverges from the planned route, for example by determining an optimal path that joins the original server-calculated route, “based on the main roads map” in the local map database. Ex-1005, 12:6-13, 12:23-26. A POSITA would have understood that Knockeart’s in-vehicle system would represent the links and nodes of the original route computed by the server in terms of the corresponding links and nodes in the local database (i.e., “reconstruct[] ... using a local mapping database”), as illustrated in annotated Figure 10, below, to enable the

system to use the local database to determine how to re-route the user, when a route deviation occurs. Specifically, the in-vehicle system would need to know the links and nodes within the local database corresponding to the links and nodes of the route computed by and received from the server, in order to determine, using the local database, where the deviation occurred, and how to re-route the vehicle on other links and nodes in the local database back to the received route.

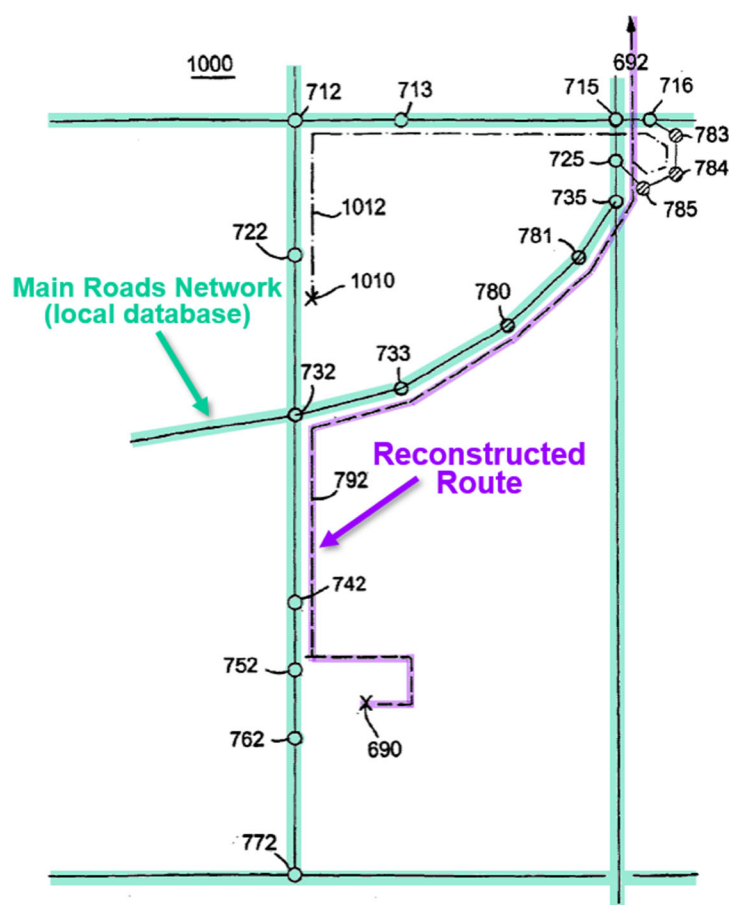


FIG 10

161. Notably, Knockeart teaches that the in-vehicle system tracks the vehicle location and “display the tracked location in conjunction with [a] spot map.” Ex-

1005, 11:19-32, 11:52-64. A POSITA would have understood that, when a spot map is not available, the in-vehicle system would display the vehicle's tracked location together with the locally-stored "preloaded main roads network" ("reconstruct[]" the route using the local database), as illustrated in annotated Figure 10, above. *Id.*, 11:65-12:5.

i. Element 1[h]: displaying said optimal route on a display system coupled to the client.

162. Knockeart-McGrath teaches and/or suggests Element 1[h].

163. Knockeart's in-vehicle unit includes a display system, as illustrated in annotated Figure 2, below:

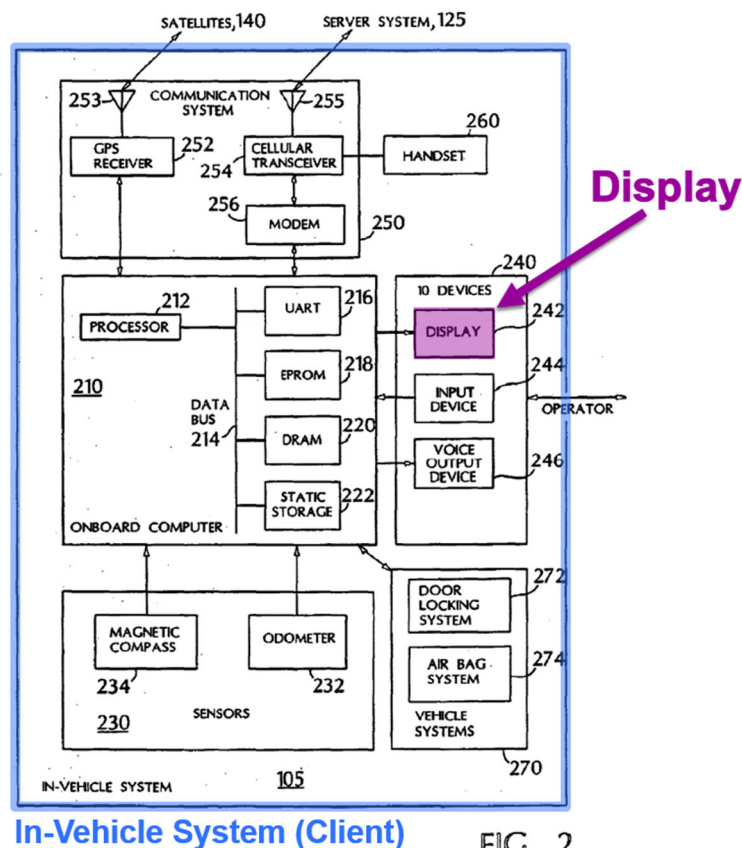


FIG. 2

164. Knockeart's in-vehicle display "provide[s] a detailed map display to the operator that *can be used to provide map-based directions to the operator.*" Ex-1005, 13:40-54. For instance, during the initial portion of the trip, the display presents "the initial portion of the planned route to the operator" on a map around the starting location. *Id.*, 11:38-43, 56-60. In addition, as noted in the previous claim element, this display would be based on data stored in the local in-vehicle database, and this data would have been identified during the re-construction of the route using the local database from the received natural language description (i.e. links and nodes) of the route provided by the server.

3. Dependent Claims 2-7, and 12-14

- a. Claim 2: The method of claim 1, wherein said step of formatting includes the step of dividing the optimal route into one or more links, wherein each link includes at least a street name and a turning orientation.**

165. Knockeart-McGrath teaches and/or suggests Claim 2.

166. Knockeart's route is formatted as "a sequence of links joined by nodes," as illustrated in annotated Figure 8, below. Ex-1005, 10:55-57.



FIG 8

167. Knockeart explains that each link includes a street name:

[F]or each link, the downloaded data includes:

The length of text fields, if any, associated with **the name of the street associated with the link, and the name of the street to be turned onto at the next maneuver point**, and with any signage or other special information to be presented to the operator, and

The text fields themselves.

Id., 29:49-54.

168. Knockart also teaches that each link includes a turning orientation. The '743 Patent explains that the turning orientation can be expressed in a variety of different ways:

It should be noted the turn type could be specified in various ways. For example, the turn type could be specified in terms of absolute degrees, as shown in FIG. 5 or as directional indicators, such as N, NE, E, SE, S, SW, W and NW. Alternatively, the turn type could be specified as a left turn or a right turn, a left bear or a right bear, etc. Any method for describing turns can be used in alternative embodiments of the present invention.

Ex-1001, 10:14-21. Knockart teaches providing turn information both in terms of absolute degrees and left/right turn descriptions:

Nodes along planned route 800 correspond to 'maneuvers' that must be carried out by the operator. For example, the maneuver at node 790 is 'turn left onto road 635'.

Ex-1005, 10:59-63;

The planned route is downloaded as a sequence of route links using a compressed format. For each link in the planned route, the downloaded information includes:

...

Turn information, encoded as an index representing messages **such as "turn right," "keep left," etc.**

Id., 29:24-32;

For each "arm" at a maneuver point, the downloaded data includes data related to **the angles at which the intersecting streets join at the maneuver point**, thereby allowing a relatively accurate graphical representation of the maneuver to be displayed to the operator.

Ex-1005, 29:56-60.

169. In my opinion, a POSITA would have also understood that the “turning orientation” may also be embedded in the GDF description of the route. Specifically if a node connects more than two links (road elements), then specifying the next link to take from that node effectively describes the required maneuver (i.e. the “turning orientation”).

- b. Claim 3: The method of claim 2, wherein said step of reconstructing includes the steps of: searching said local mapping database for a closest match of said street name and said turning orientation for each of said links; and building the optimal route by combining each of said closest matches from said searching step.**

170. Knockeart-McGrath teaches and/or suggests Claim 3.

171. First, Knockeart teaches and/or suggests searching the locally-stored main roads network (“local mapping database”) for a closest match of said street name.

172. As explained for Claim 2, Knockeart teaches sending, for each link in the route, “the name of the street associated with the link, and the name of the street to be turned onto at the next maneuver point.” Ex-1005, 29:50-55.

173. Knockeart also teaches “tak[ing] advantage of data in the in-vehicle database to reduce the amount of data” sent from the server to the in-vehicle system “by referencing” information stored “in the main roads network that is already stored in the vehicle.” Ex-1005, 29:63-67. In particular, Knockeart teaches referencing

“stored street names” or “nodes” in the main roads network. *Id.* A POSITA would have understood that referencing information stored in the local main roads network would reduce the amount of data sent from the server to the in-vehicle system, by enabling the in-vehicle system to use the main roads network to reconstruct and graphically display the route to the user, rather than “download[ing] spot maps” along the route and using those spot maps to display the route (Ex-1005, 29:16-21).

174. As an example, Knockeart teaches transmitting, as part of the route, text fields corresponding to “the name of the street associated with the link, and the name of the street to be turned onto at the next maneuver point.” Ex-1005, 29:50-55. A POSITA would have understood that “referencing stored street names ... in the main roads network” to reduce the amount of data downloaded by the in-vehicle system, by using each referenced “name of the street associated with the link” and “name of the street to be turned onto at the next maneuver point” could involve (i) locating the first link in the main roads network (based on a closest match to the street name), (ii) locating the next link in the main roads network (based on a closest match to the name of the street to be turned onto at the next maneuver point), and then (iii) determining which node in the main roads network connects those two links. Alternatively, a POSITA would have understood that the amount of data downloaded by the in-vehicle system could also be reduced by referencing both “stored street names” and “nodes” in the local main roads network (Ex-1005, 29:63-

67). This could be done by (i) locating the node in the main roads network that most closely matches the location of the first node in the received route, (ii) matching the link in the route to the corresponding link in the main roads network (based on a closest match to the street name associated with the link), and then (iii) repeating these steps to step link-by-node through the received route.

175. As mentioned above, a POSITA would have understood that matching links of the received route to links within the local database (i.e., the main roads network) would have involved identifying a closest street name match. This is because a POSITA would have understood that differences may exist between the street names stored in the in-vehicle main roads network and those transmitted in the route. For example, the stored street names may include abbreviations (e.g., Ave., St., Blvd., Rte., etc.), while the external database may not, or vice versa. Accordingly, to accommodate such differences a POSITA would have understood that searching the main roads network for the name of a street included in the route would have involved searching “for a closest match.”

176. Second, Knockeart teaches and/or suggests searching the locally-stored mapping information for a closest match of said turning orientation.

177. Knockeart teaches sending “data related to the angles at which the intersecting streets join at the maneuver point, thereby allowing a relatively accurate graphical representation of the maneuver to be displayed to the operator.” *Id.*, 29:56-

60. A POSITA would have understood that displaying “a relatively accurate graphical representation of the maneuver,” could be done in an efficient manner using locally-stored graphical turn objects. Indeed, it was well-known in the art to reconstruct routes using locally-stored graphical elements, including for GDF-formatted routes, as used by Knockart. *See, e.g.*, Ex-1035, 0155, 0180; *see also* Ex-1007, 17:19-21, Fig. 12. Thus, a POSITA would have understood that Knockart’s in-vehicle system would include a set of graphical turn objects, and that displaying “a relatively accurate graphical representation of the maneuver” for the vehicle operator would involve searching the locally-stored set for the graphical turn object that is the “closest match” to the downloaded angle corresponding to the maneuver.

178. Finally, where the route is confined to main roads present within the locally-stored main roads network, a POSITA would have understood that the route would be reconstructed by the in-vehicle system (i.e., “building the optimal route”) by “combining each of said closest matches from said searching step.”

- c. **Claim 4: The method of claim 1, wherein said accessing step comprises the step of accessing a traffic database comprising current traffic conditions; and querying said traffic database for determining current traffic conditions between locations defined by said start and end route designations.**

179. Knockart-McGrath teaches and/or suggests Claim 4.

180. As explained for Element 1[c], Knockeart's server accesses an external traffic database containing traffic-related information "to determine a fastest route from a starting to a destination location." Ex-1005, 8:53-60. Obtaining traffic-related information to determine a fastest route requires querying the database for traffic conditions at locations along potential routes ("between locations defined by said start and end route designations") to evaluate which potential route is the fastest, because the travel time for a potential route will depend on the traffic conditions along the route.

- d. **Claim 5: The method of claim 1, wherein said real-time information includes one or more from the set of: current traffic conditions; highway ramp configurations; current weather conditions; constriction information; road restrictions; detour information; and event traffic information.**

181. Knockeart-McGrath teaches and/or suggests Claim 5.

182. As explained for Claim 4, Knockeart's server accesses real-time traffic information corresponding to "the *current traffic conditions* on the operator's trips." Ex-1005, 8:53-60, 41:5-8.

- e. **Claim 6: The method of claim 1, wherein said wireless connection is accomplished using a cellular network.**

183. Knockeart-McGrath teaches and/or suggests Claim 6. Knockeart explains that the in-vehicle system and server may communicate "over *a cellular*

telephone system.” Ex-1005, Abstract, 8:15-20 (same). A cellular telephone communicates over a cellular network.

- f. **Claim 7: The method of claim 1, wherein said transmitting step includes the step of entering into a keypad data entry field, said start and stop route designations including a name for one or more of: a city; a state; a country; and a street.**

184. Knockeart-McGrath teaches and/or suggests Claim 7.

185. Knockeart teaches a keyboard or keypad for entering a destination, including a street address. Ex-1005, 13:55-14:6 (“[a]lternative versions of the system can include an alphanumeric keyboard”), 25:27-29 (“A street address (e.g., *city*, *street*, and number”). While the vehicle’s current location is typically used as the route starting point, Knockeart also recognizes that in other navigation systems “*the operator inputs* the desired destination [] and *the current location.*” *Id.*, 1:23-25. A POSITA would have recognized that enabling the operator to enter the starting point (as Knockeart recognizes was known), and not just the destination, would improve Knockeart’s system by adding flexibility to the route-specification process. Further, Knockeart teaches enabling “an operator to specify a sequence of destinations,” for a route “from the starting location to the first destination, and then from one destination to the next.” *Id.*, 44:4-12. Each user-specified intermediate destination could be viewed as a starting point for the next segment of the trip.

g. Claim 12: The method of claim 1, wherein said downloading step comprises the step of compressing said natural language description.

186. Knockeart-McGrath teaches and/or suggests Claim 12. Knockeart teaches that “[t]he planned route is downloaded as a sequence of route links *using a compressed format.*” Ex-1005, 29:24-55; *id.* 28:25-40 (client- and server-side modems negotiate a “compression” protocol for the data transmission).

h. Claim 13: The method of claim 1, wherein said calculating step further comprises the step of reading user-specific data in calculating the optimal route.

187. Knockeart-McGrath teaches and/or suggests Claim 13.

188. Knockeart’s navigation system employs user-specific data, such as alternative trips, to calculate the optimal route. Ex-1005, 41:21-22. Knockeart’s route-calculation process may take into account user-specified preferences “such as *particular roads the user wants to avoid*” (*id.*, 42:56-57), or “a time saving above which the user is willing to use a road that he or she otherwise wants to avoid.” *Id.*, 42:56-60. Further, a POSITA would have understood that the destination point specified by the user also corresponds to user-specific data.

i. Claim 14: The method of claim 1, wherein said computer network is the Internet.

189. Knockeart-McGrath teaches and/or suggests Claim 14.

190. Knockeart's server is connected to the Internet, over which it accesses "external information systems." Ex-1005, 15:30-33, Fig. 22, 42:28-30 (server is "coupled to the *Internet*").

4. Independent Claim 15

a. Element 15[pre]: A mobile navigation system comprising:

191. Knockeart-McGrath teaches and/or suggests Element 15[pre], to the extent it is limiting, for the same reasons discussed for Element 1[pre].

b. Element 15[a]: a navigation computer;

192. Knockeart-McGrath teaches and/or suggests Element 15[a]. Onboard computer 210 of Knockeart's in-vehicle system, illustrated in annotated Figure 2, below, is a navigation computer, because it provides route guidance to a vehicle operator. Ex-1005, 6:12-18.

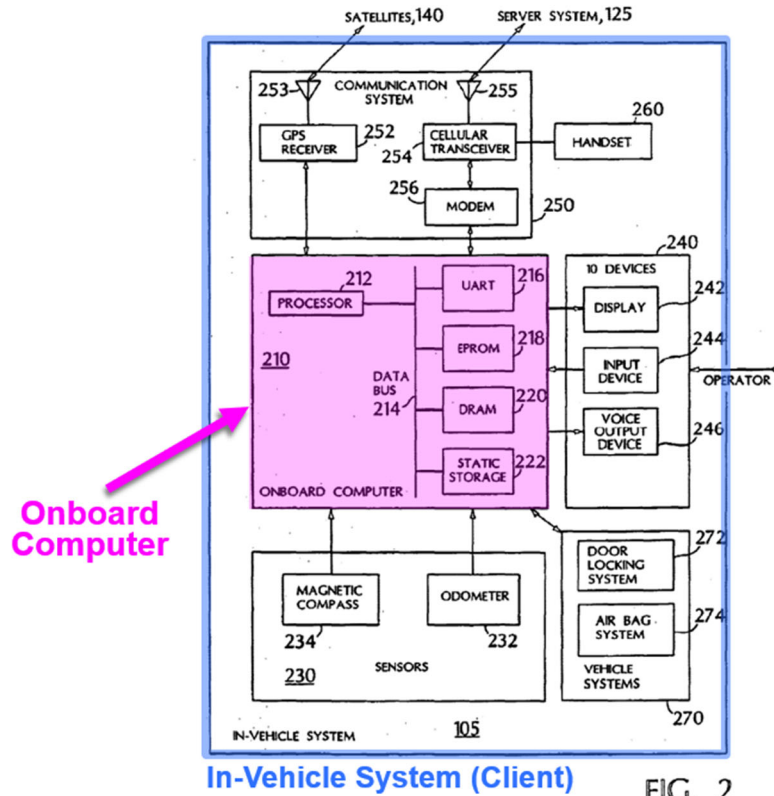


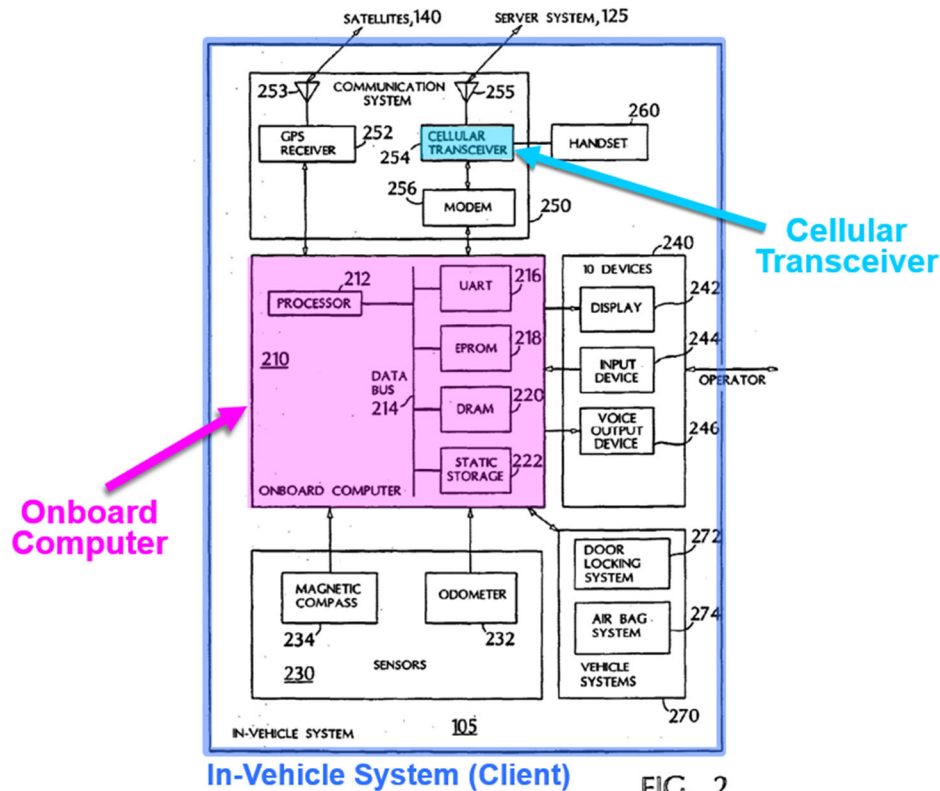
FIG. 2

- c. **Element 15[b]: a wireless transceiver coupled to said navigation computer for connecting with a navigation server, said navigation server for calculating optimal routes based on real-time information, said optimal routes being formatted using a non-proprietary, natural language description;**

193. Knockeart-McGrath teaches and/or suggests Element 15[b] for the same reasons discussed for Elements 1[pre]-1[a] and 1[c]-[e], and the additional reasons below.

194. Knockeart's in-vehicle unit uses a "cellular transceiver" coupled to its onboard computer 210 ("navigation computer") (as illustrated in annotated Figure

2, below) to communicate with the server. Ex-1015, 14:41-42. A POSITA would have understood a cellular transceiver to be a “wireless transceiver”.



- d. **Element 15[c]: a mapping database coupled to said navigation computer for reconstructing said optimal route from said non-proprietary, natural language description; and**

195. Knockeart-McGrath teaches and/or suggests Element 15[c] for the same reasons explained for Element 1[g] and the additional reasons below.

196. Knockeart’s “in-vehicle database 432” of static storage 222 is a mapping database. See Section XIII.A.2.h. While Figure 2 illustrates static storage as included within onboard computer 210, Knockeart explains that “[s]tatic storage 222 is a removable 40 MB flash memory system” that is “coupled” to processor 212

of onboard computer 210. Ex-1005, 13:12-22. Accordingly, a POSITA would have understood that static storage 222 is coupled to onboard computer 210 (“navigation computer”).

- e. **Element 15[d]: a display screen coupled to said navigation computer for displaying said optimal route using said mapping database.**

197. Knockeart-McGrath teaches and/or suggests Element 15[d] for the same reasons explained for Element 1[h] and the additional reasons below.

198. Knockeart’s in-vehicle unit “includes a display 242” coupled to its onboard computer 210 (“navigation computer”) (as illustrated in annotated Figure 2, below). Ex-1005, 13:40.

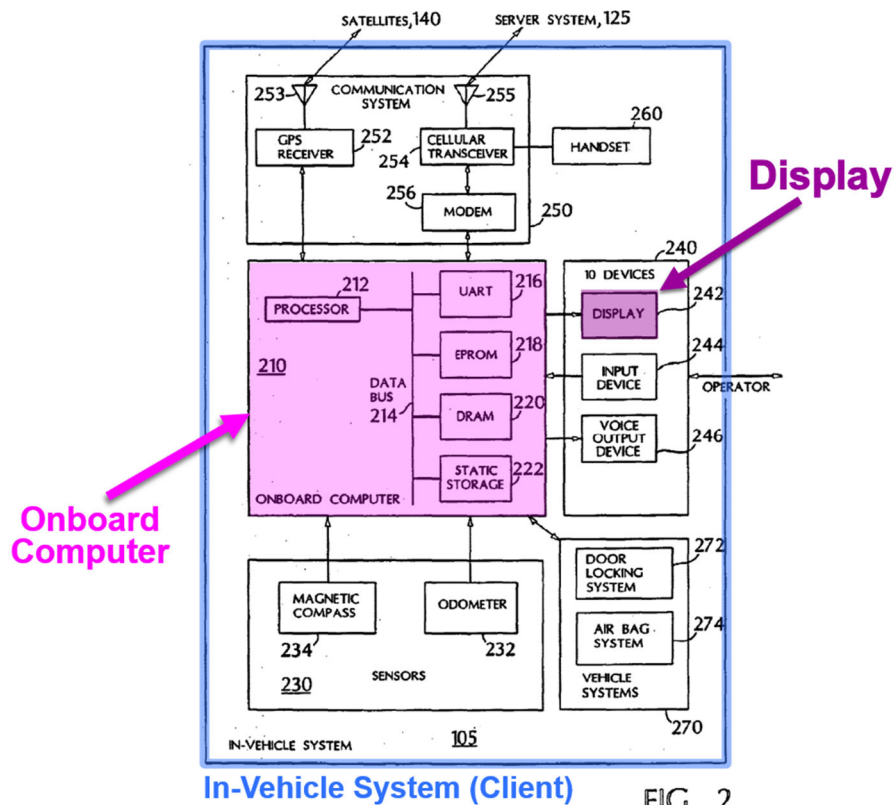


FIG. 2

5. Dependent Claim 16

- a. Element 16[a]: The mobile navigation system of claim 15, further comprising: a GPS receiver coupled to said navigation computer for monitoring position;

199. Knockeart-McGrath teaches and/or suggests Element 16[a].

200. Knockeart's in-vehicle unit "includes a GPS receiver 252" coupled to its onboard computer 210 ("navigation computer") (as illustrated in annotated Figure 2, below). Ex-1005, 14:26-40.

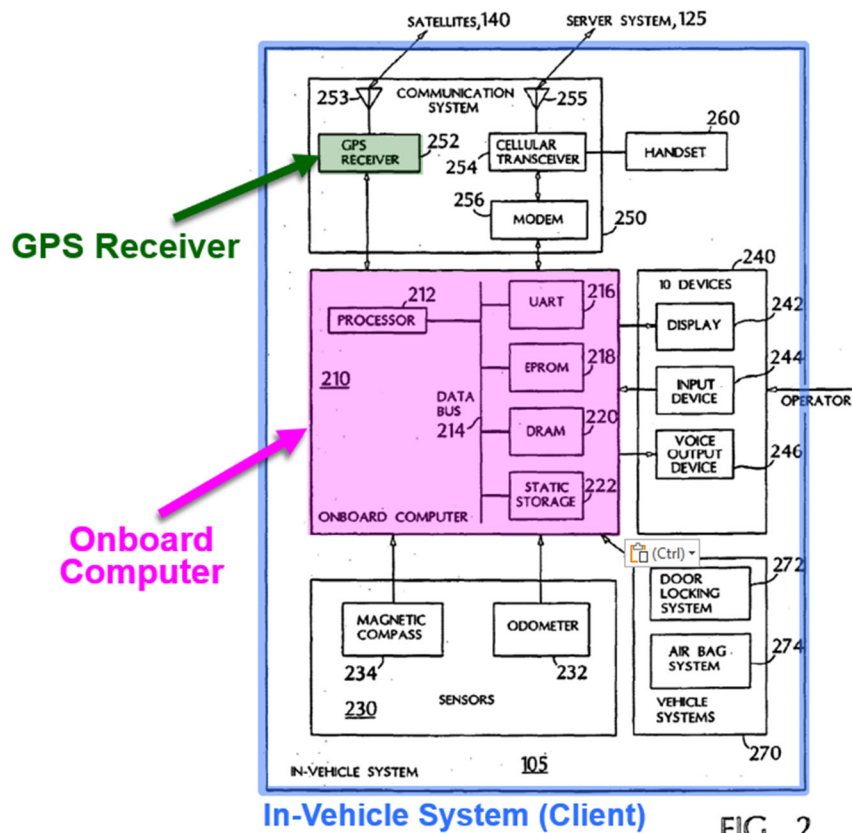
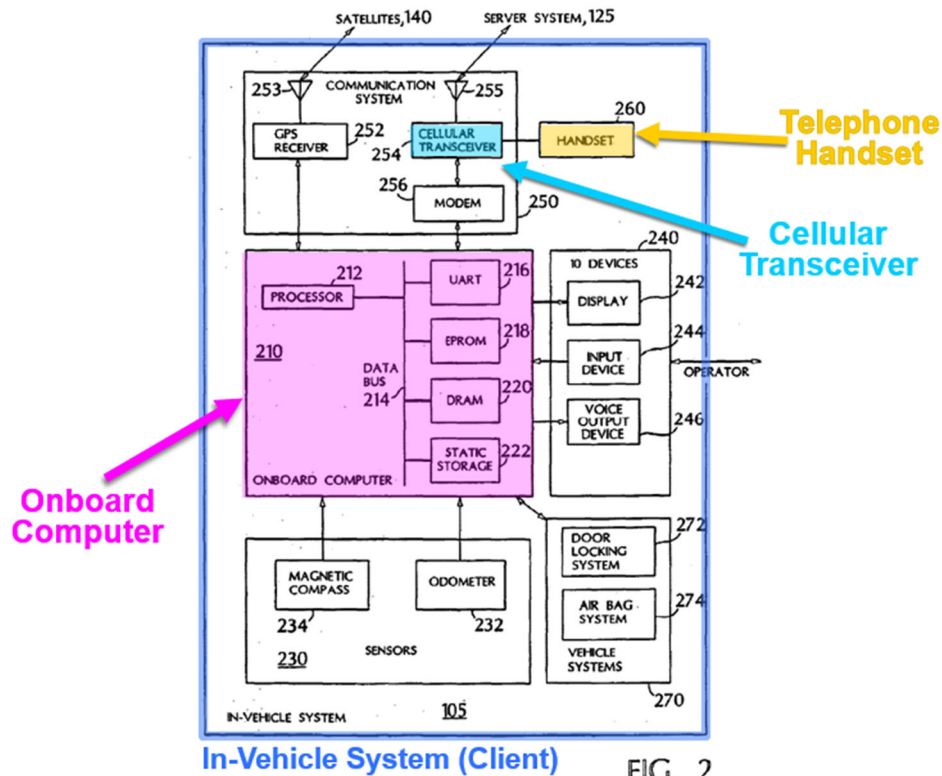


FIG. 2

- b. Element 16[b]: a telephonic device coupled to said wireless transceiver and said navigation computer for making and receiving telephone calls; and

201. Knockeart-McGrath teaches and/or suggests Element 16[b].

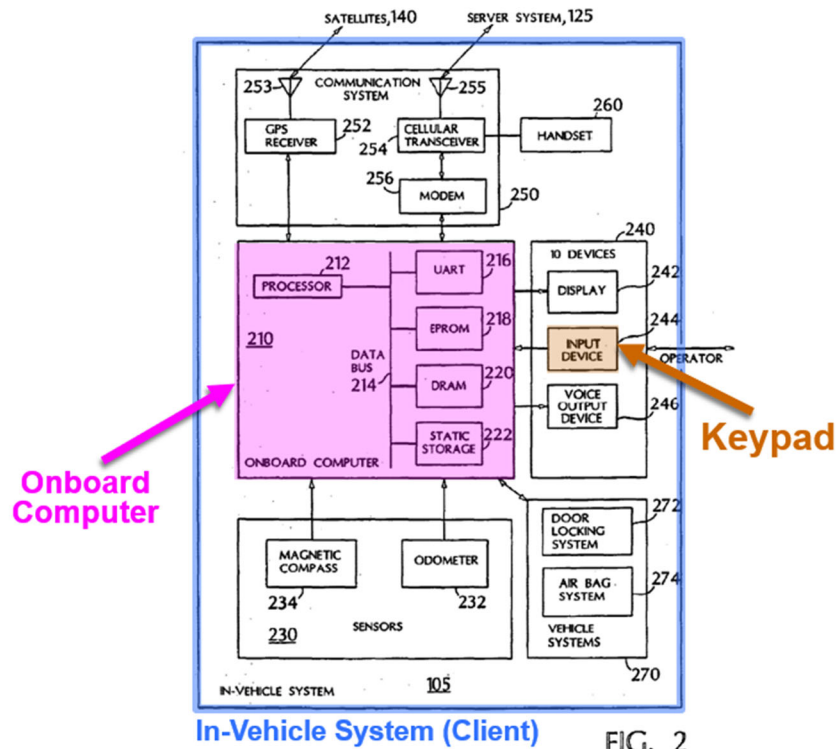
202. As illustrated in annotated Figure 2, below, Knockeart's in-vehicle system includes handset 260 coupled to transceiver 254, with which the vehicle operator can "place standard telephone calls" and receive "inbound call[s]." Ex-1005, 14:48-51, 15:58-16:10.



- c. **Element 16[c]: a keypad coupled to said navigation computer for entering start and end route designations.**

203. Knockeart-McGrath teaches and/or suggests Element 16[c], for the same reasons explained for Claim 7. Specifically, input device 244 of Knockeart's in-vehicle unit (illustrated in annotated Figure 2, below) may be a keypad with

“multiple push buttons,” or a keyboard, coupled to onboard computer 210. Ex-1005, 13:55-61.



6. Independent Claim 21

- a. **Element 21[pre]:** A method for providing an optimal route using real-time information from a server of a navigation system, the navigation system also comprising a client and said server coupled to a computer network, said method comprising the steps of:

204. Knockeart-McGrath teaches and/or suggests Element 21[pre], to the extent it is limiting, for the same reasons explained for Element 1[pre].

- b. **Element 21[a]:** establishing a wireless connection with the client;

205. Knockeart-McGrath teaches and/or suggests Element 21[a] for the same reasons explained for Element 1[a].

c. Element 21[b]: receiving at the server start and end route designations from the client;

206. Knockeart-McGrath teaches and/or suggests Element 21[b] for the same reasons explained for Element 1[b].

d. Element 21[c]: calculating at the server the optimal route based on real-time information at the server and said start and end route designations;

207. Knockeart-McGrath teaches and/or suggests Element 21[c] for the same reasons explained for Element 1[d].

e. Element 21[d]: formatting at the server the optimal route into a non-proprietary, natural language description;

208. Knockeart-McGrath teaches and/or suggests Element 21[d] for the same reasons explained for Element 1[e].

f. Element 21[e]: downloading from the server said non-proprietary, natural language description to the client

209. Knockeart-McGrath teaches and/or suggests Element 21[e] for the same reasons explained for Element 1[f].

g. Element 21[f]: so that the client can reconstruct the optimal route using a local mapping database

210. Knockeart-McGrath teaches and/or suggests Element 21[f] for the same reasons explained for Element 1[g].

- h. Element 21[g]: and display said optimal route on a display system coupled to the client.**

211. Knockeart-McGrath teaches and/or suggests Element 21[g] for the same reasons explained for Element 1[h].

7. Independent Claim 22

- a. Element 22[pre]: A method for providing an optimal route using real-time information at client of a navigation system, the navigation system also comprising a client and said server coupled to a computer network, said method comprising the steps of:**

212. Knockeart-McGrath teaches and/or suggests Element 22[pre], to the extent it is limiting, for the same reasons explained for Element 1[pre].

- b. Element 22[a]: establishing a wireless connection with the server;**

213. Knockeart-McGrath teaches and/or suggests Element 22[a] for the same reasons explained for Element 1[a].

- c. Element 22[b]: transmitting start and end route designations from the client to the server;**

214. Knockeart-McGrath teaches and/or suggests Element 22[b] for the same reasons explained for Element 1[b].

- d. Element 22[c]: receiving from the server an optimal route formatted in a non-proprietary, natural language description and calculated based on real-time information and said start and end route designations;**

215. Knockeart-McGrath teaches and/or suggests Element 22[c] for the same reasons explained for Elements 1[d]-[f].

e. Element 22[d]: reconstructing the optimal route using a local mapping database; and

216. Knockeart-McGrath teaches and/or suggests Element 22[f] for the same reasons explained for Element 1[g].

f. Element 22[e]: displaying said optimal route on a display system coupled to the client.

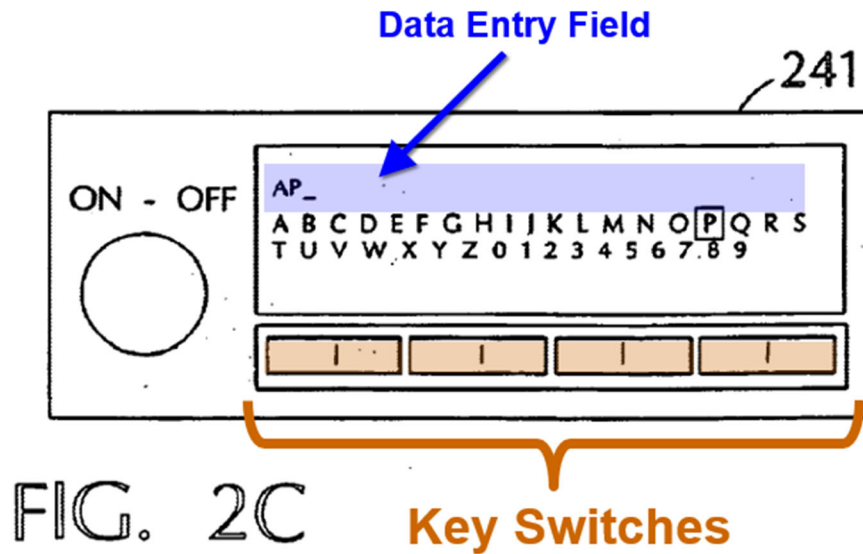
217. Knockeart-McGrath teaches and/or suggests Element 22[e] for the same reasons explained for Element 1[h].

B. Ground 2: Claims 8-9 Are Obvious Over Knockeart-McGrath In View Of Geiser

1. A POSITA would have been motivated to combine Knockeart-McGrath with Geiser and would have had a reasonable expectation of success

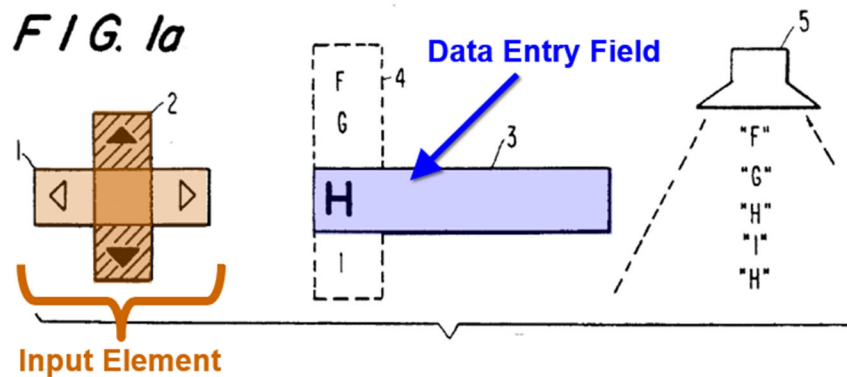
218. As explained in Section XIII.A.1, a POSITA would have been motivated to combine Knockeart with McGrath. A POSITA would have been further motivated to combine Knockeart-McGrath with Geiser, as explained below.

219. Knockeart discloses a navigation system in which a vehicle operator uses a keypad (illustrated in annotated Figure 2C, below) for location entry. Ex-1005, 13:55-14:6, 25:44-46. For instance, “the operator enters letters of a spelling, or digits of a street address, by moving a cursor to a display of the desired letter or digit and selecting that letter or digit.” *Id.*, 26:2-6.



220. Knockeart also teaches a method for improving the efficiency of the location-entry process, explaining that a destination may be selected by “spelling a prefix of the name until it unambiguously specifies a full name.” Ex-1005, 25:65-26:2. Thus, Knockeart teaches auto-completing destination names.

221. Geiser similarly relates to location entry in a navigation system. And, Geiser likewise discloses ways to expedite the location-entry process in a navigation system. Ex-1008, 1:55-58. Geiser’s method uses an “input element” (illustrated in annotated Figure 1a, below) to enter an alpha-numeric location name (e.g., “place, street and street address”), by making “stepwise” selections of alpha-numeric characters. Ex-1008, 2:43-45, 3:43-59, 3:61-64.



222. As will be explained for Claim 8 below, Geiser expedites the location entry process by narrowing the available characters from which to select, based on the already-entered characters. Ex-1008, 1:68-2:3, 3:10-35. That is, reducing the set of selectable letters based on the next sequential letter for any items in the database that match the already entered letters.

223. A POSITA would have been motivated to modify Knockeart's location-input method according to Geiser's teachings to further improve the efficiency of Knockeart's location-entry process. In particular, while Knockeart teaches an efficient location-entry method in which the system auto-completes a location name, once a sufficient number of characters have been entered to "unambiguously" specify the name, a POSITA would have recognized that, for many locations, a user would still need to input a significant number of characters before an unambiguously specified entry is found. Ex-1005, 25:65-26:2. Accordingly, a POSITA would have been motivated to search for references, such as Geiser, that disclose additional ways to improve the location-entry process. Such

a POSITA would have been motivated to adopt the teachings of Geiser to reduce the number of characters that must be selected from, and then entered before the system identifies the intended location.

224. A POSITA would have had a reasonable expectation of success in implementing Geiser's location-entry method in the Knockeart-McGrath system. As illustrated in Knockeart's Figure 2C and Geiser's Figure 1a, above, both systems include keys for selecting characters and data entry fields for displaying the entered characters. Accordingly, configuring Knockeart's system to perform Geiser's method would simply involve simple programming of Knockeart's in-vehicle system, to compare the characters selected using Knockeart's keys to locations stored in a list of potential locations, and limit the next characters that the user can select, based on the location names in the list of potential locations that conform to the already-selected characters.

2. Claim 8:

- a. Element 8[a]: The method of claim 7, wherein said step of entering comprises the steps of: comparing data entered into the keypad data entry field with a database of allowable entries;**

Element 8[b]: determining a set of conforming data items associated with said entered data;

225. Knockeart-McGrath-Geiser teaches and/or suggests Elements 8[a]-[b].

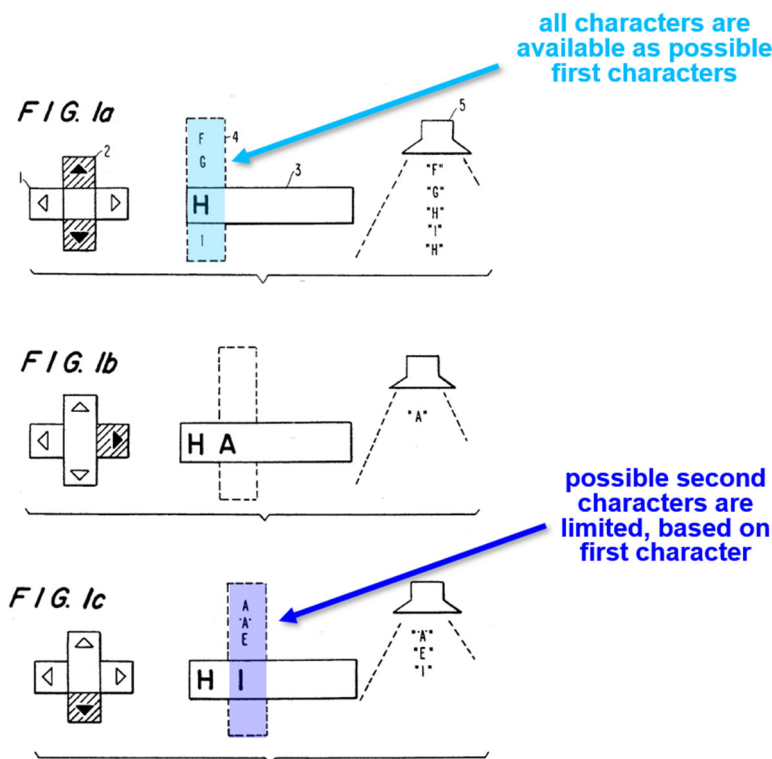
226. As explained in Section XIII.B.1 (motivation to combine Knockeart-McGrath with Geiser), both Knockeart and Geiser disclose “keypad data entry fields.”

227. Geiser teaches that each time a new character is entered and displayed in Geiser’s data entry field, the set of entered characters is compared against a set of destinations contained in a “destination list.” Ex-1008, 3:10-20. Geiser’s “destination list” corresponds to a “database of allowable entries,” because it stores allowable destinations that may be entered by a user. While Geiser refers to the list as a “destination” list, a POSITA would have understood that the locations included within the list could equally be used for starting points because the same location could both be a destination and a starting point (e.g., when leaving the destination).

228. Geiser explains that this comparison is performed to shorten the time taken to enter a location (Ex-1008, 1:68-2:3), by “limiting the number of letters to be run through” during selection of the next character in the location name (*id.*, 3:10-16). In particular, by comparing the entered characters to the locations in the destination list, a subset of allowable destination locations can be identified. *Id.* Thus, for the next character that is to be selected by the user, only those characters “which occur in this position in the subset of destination locations limited by the preceding letter positions” are presented to the user for selection therefrom. *Id.*,

3:16-20. These characters correspond to “a set of conforming data items associated with said entered data.”

229. As an example, as illustrated in annotated Figures 1a-c, below, in response to a selection of “H” as the first character in the location name, the characters that may be selected as the second character in the location name are limited to only those characters that can possibly follow “H” in any potential location name. Ex-1008, 3:1-25, 4:2-8 (similar). While Geiser describes Figures 1a-c in a slightly different context, a POSITA would have understood that they are equally applicable to Geiser’s disclosure of comparing selected characters to location names stored in a list.

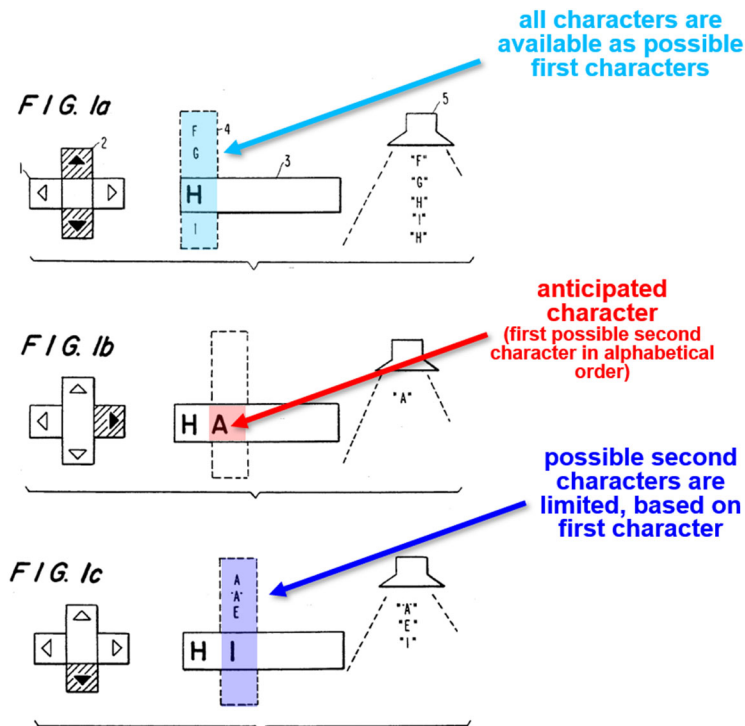


- b. **Element 8[c]: applying a criterion to said set of conforming data items to determine an anticipated data item; and**

Element 8[d]: displaying said anticipated data item in the data entry field.

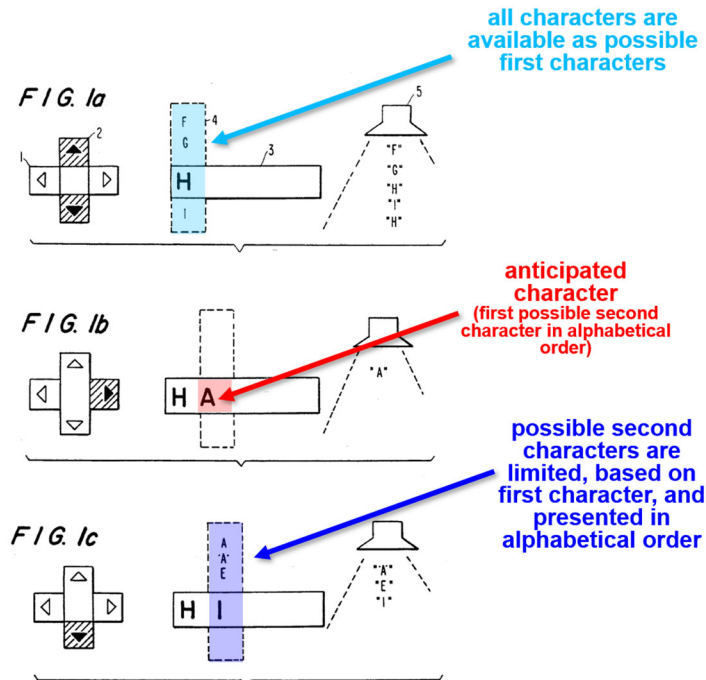
230. Knockeart-McGrath-Geiser teaches and/or suggests Elements 8[c]-[d].

231. Geiser teaches that an alphabetical order criterion is applied to the set of conforming data items to determine an anticipated data item that is then displayed in Geiser's optical display ("data entry field"). For instance, as illustrated in annotated Figure 1b, below, the character "A" is displayed in Geiser's data entry field as the next anticipated character, where "A" corresponds alphabetically to the first character in the list of characters that may follow the entered data, "H" (illustrated in annotated Figure 1c, below).



3. **Claim 9: The method of claim 8, wherein said criterion defines a data item in said set of conforming data items that appears first alphabetically.**

232. Knockeart-McGrath-Geiser teaches and/or suggests Claim 9, for the reasons explained for Claim 8.



C. Ground 3: Claims 10-11 Are Obvious Over Knockeart-McGrath-Geiser In View Of Watanabe

1. Dependent Claims 10-11:

- a. **Claim 10: The method of claim 8, wherein said criterion defines a data item in said set of conforming data items that is used most frequently.**

Claim 11: The method of claim 8, wherein said criterion defines a data item in said set of conforming data items that is used most recently.

233. The Knockeart-McGrath-Geiser-Watanabe combination teaches and/or suggests Claims 10-11.

234. As explained in Section XIII.B.1, a POSITA would have been motivated to combine Knockeart-McGrath with Geiser. A POSITA would have further been motivated to combine Knockeart-McGrath-Geiser with Watanabe. Watanabe is in the same field of art as Knockeart, McGrath, and Geiser, disclosing a vehicle navigation system with a “city name selection accelerator” that is designed to “simplify input operations of city names.” Ex-1009, Abstract.

235. Watanabe teaches applying criteria to the set of possible locations from which a user may select when requesting route guidance, to identify a subset of locations that the user is likely to select. Ex-1009, Abstract. Specifically, Watanabe teaches presenting the user with locations that “have been input in the past,” where those locations are presented in order according to the recency of their input (Ex-1009, 8:23-30), as well as presenting locations that have been entered most frequently (*id.*, 8:30-35).

236. A POSITA would have been motivated to use Watanabe’s recency and/or frequency criteria in Geiser’s location entry method to further Geiser’s stated goal of improving the efficiency of the location entry process (Ex-1008, 1:68-2:3). Specifically, a POSITA would have understood that additional efficiency gains could be achieved for Geiser’s method, by applying a recency/frequency criterion to the locations within Geiser’s list that conform with those characters already entered, to populate Geiser’s data entry field with the conforming location that “is used most

frequently,” or “used most recently.” For instance, a POSITA would have recognized that, when a user selects a first character corresponding to his/her home address, it is likely that the user intends to enter his/her home address. By autocompleting the entry with the user’s home address, the system could save the user significant time in the location-entry process. And, if the user’s home address did not correspond to the address the user intended to enter, Geiser’s method could be used to scroll through a list of conforming next characters.

237. A POSITA would have had a reasonable expectation of success in doing so, as it amounts to a simple substitution of one known element (i.e., Geiser’s alphabetical criterion) for another (i.e., Watanabe’s frequency/recency criterion) to obtain predictable results (i.e., increased efficiency in the location-entry process).

D. Ground 4: Claims 17-18 Are Obvious Over Knockeart-McGrath In View Of Nunokawa (Ex-1011)

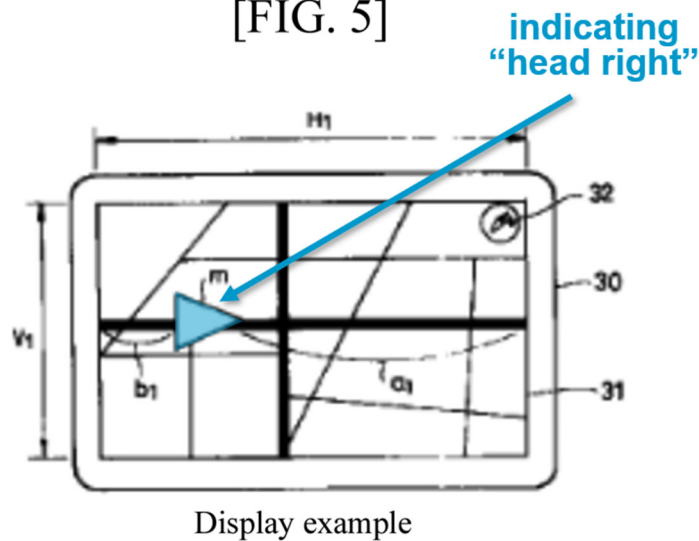
1. Dependent Claims 17-18

- a. Claim 17-18: The mobile navigation system of claim 15, wherein said display screen is used to display the mapping database in a head [right/left] configuration.**

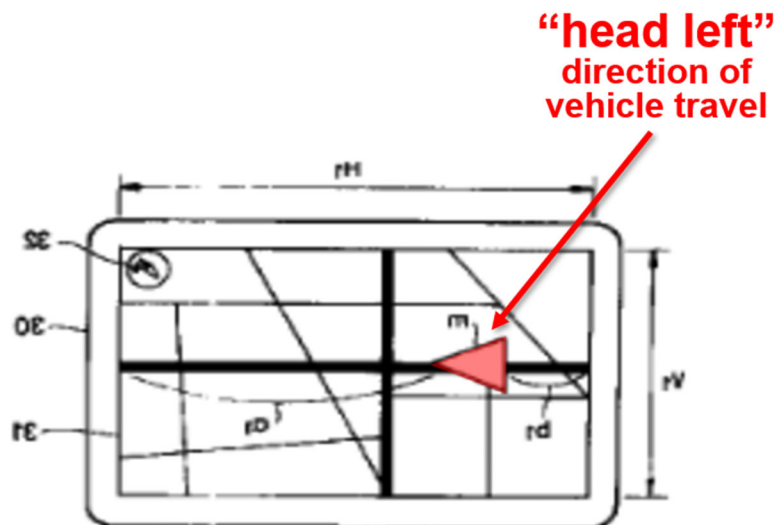
238. Knockeart-McGrath-Nunokawa teaches and/or suggests Claims 17-18.

239. Nunokawa teaches both a head right and a head left configuration for a map display screen. For instance, Figure 5 of Nunokawa (annotated below) illustrates a head right configuration in which “the map is displayed having the right side of the screen set to the traveling direction.” Ex-1011, ¶27.

[FIG. 5]



240. Nunokawa explains that a head left configuration can also be used, in which “the map may be displayed having the left side set to the same.” *Id.* This is illustrated in the modified version of Figure 5, below:



241. As illustrated in Figures 10A-B of the '743 Patent (reproduced below) the '743 Patent illustrates the head right/left display in the same manner as Nunokawa.

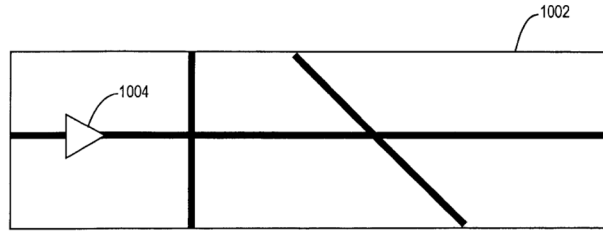


Fig. 10A

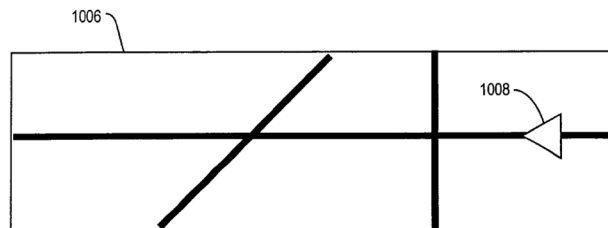


Fig. 10B

242. Nunokawa explains that displaying the road map in a head left/right configuration is advantageous for widescreen displays, as it “results in the amount of information being displayed ahead of the traveling direction to be increased ... in comparison to a head North configuration.” Ex-1011, ¶25. For example, for a screen with aspect ratio of 9:16, if the vehicle position is set as the center of the screen, displaying the map in a head right or head left configuration results in approximately 1.8 times the amount of information displayed ahead of the traveling direction than compared with a head North configuration. *Id.*

243. Nunokawa explains that this increase in information shown improves “the operability of the navigation device,” by making it possible to easily confirm the next road to proceed on from the displayed screen” and reducing the frequency

of scrolling and/or changing the scale of the map to see the upcoming road. Ex-1011, ¶26.

244. A POSITA would have understood that vehicle displays may come in different shapes and would have been motivated to implement Nunokawa's head right/left configurations in Knockeart's in-vehicle unit display, when that display is wider than it is tall. In particular, a POSITA would have understood that displaying a route in a head right/left configuration on the display of Knockeart's in-vehicle unit, as taught by Nunokawa, when that display is wider than it is tall, will improve the "operability" of the in-vehicle unit and increase the amount of travel information, in the same manner expressly taught by Nunokawa (Ex-1011, ¶26).

E. Ground 5: Claim 19 Is Obvious Over Knockeart-McGrath In View Of Endo (Ex-1013)

- 1. Claim 19: The mobile navigation system of claim 16, further including a clock coupled to said navigation computer, wherein said navigation computer is programmed to set said clock to an accurate local time in accordance with a time from said GPS receiver and a current time zone.**

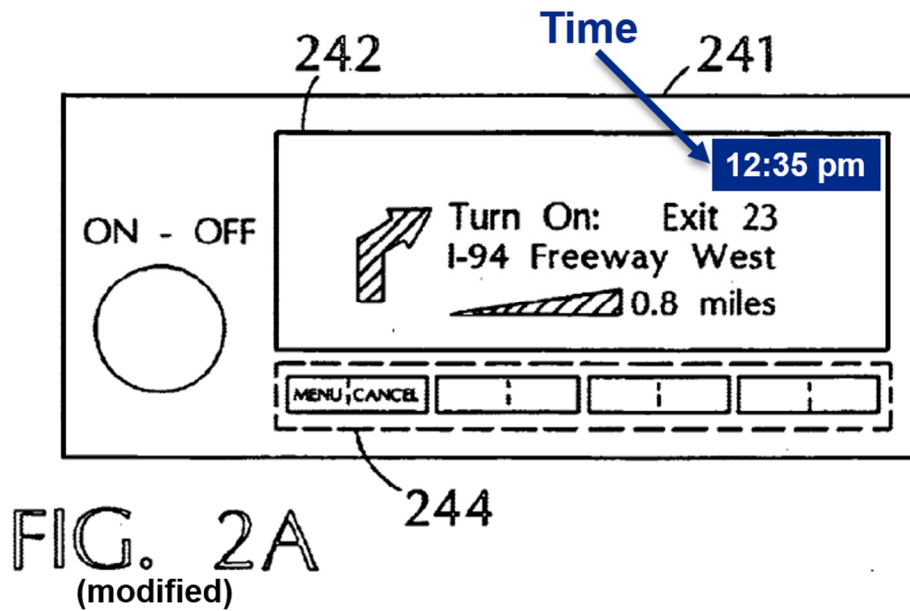
245. Knockeart-McGrath-Endo teaches and/or suggests Claim 19.

246. Endo discloses a method for correcting date/time data displayed on a portable navigation device. Ex-1013, ¶11. Endo uses a vehicle's current position, obtained using GPS, to identify the time zone in which the vehicle is currently located, and then uses a "time difference" to correct the date/time displayed by the navigation device, when that date/time corresponds to a different time zone. Ex-

1013, ¶5. As Endo explains, this may occur because the time zone used by the vehicle corresponds to the location at which the vehicle was purchased. *Id.*, ¶3 (“when the region in which the onboard navigation device was purchased is Japan, the date and time data generated by the GPS receiver is date and time data based on Japan Standard Time (JST), and thus, for example, when a user ... travels by vehicle across borders such as Cambodia, Myanmar, Bangladesh, and India, a time difference in the date and time display will occur because the standard time differs in each country.”).

247. A POSITA would have understood that when Endo’s method is used to correct the date/time generated by a digital clock and displayed on the navigation system display, the clock is “coupled to said navigation computer.”

248. A POSITA would have been motivated to implement Endo’s date/time correction method in Knockeart’s system. Knockeart and Endo are analogous art, both being directed to vehicle navigation systems. Ex-1013, ¶¶2-3. A POSITA would have recognized that navigation systems often display date/time information together with a route (*see, e.g.*, modified Figure 2A, below). For instance, a driver navigating along a route to a restaurant at which he/she has planned to meet a friend at a specific time will likely want to view information about the current time as he/she travels along the route.



249. A POSITA also would have recognized that it was well-known and desirable to use GPS to generate time information within navigation systems, because of the high accuracy provided by GPS time. However, since GPS time is provided in terms of Universal Time Coordinated (UTC)—i.e., the time at the prime meridian in Greenwich, England—the time generated by GPS must be shifted based on the longitude of the current vehicle location, in order to correspond to the current local time (and thus be useful to the vehicle occupants).

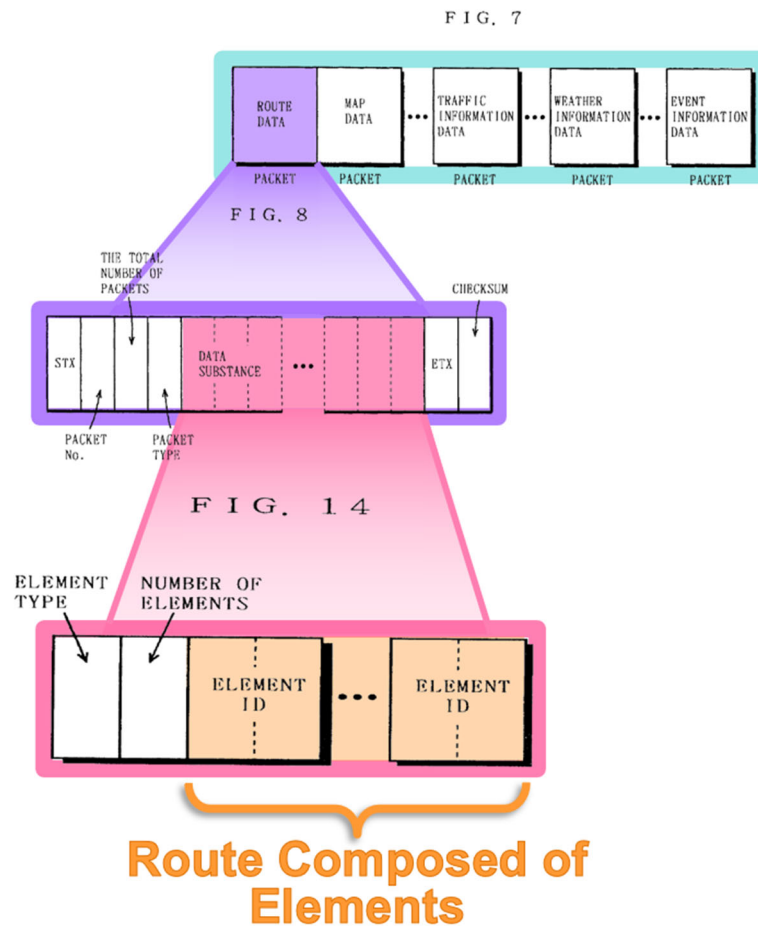
250. A POSITA seeking to include a date/time display in Knockeart's in-vehicle unit that presented the accurate local time to the vehicle occupants would have turned to Endo for implementation details. *Id.* In particular, a POSITA would have recognized that implementing Endo's clock correction method within Knockeart's mobile terminal would provide the expected benefit of automatically

correcting the remote terminal's time in a "convenient" and "simple" manner. Ex-1013, ¶¶5-6.

F. Ground 6: Claims 1-2, 4-7, 13-16, and 21-22 Are Obvious Over Nakano (Ex-1007) In View Of McGrath

1. A POSITA would have been motivated to combine Nakano with McGrath with a reasonable expectation of success

251. Nakano discloses a client-server navigation system, in which the server calculates "optimum" routes between locations specified by the client. Ex-1007, Abstract, 11:63-12:6, 15:48-53. Nakano teaches transmitting the calculated routes (together with route-related information) back to the client in a format designed to reduce telecommunications costs. Ex-1007, 16:3-5. Specifically, Nakano's route is formatted according to a set of element IDs (as illustrated in Figures 7, 8, and 14, modified/combined below). *Id.*, 15:64-16:6.



252. McGrath similarly teaches the use of IDs for identifying map-related information as part of its GDF format. As explained in Sections XII.B and XIII.A.1, McGrath teaches that geographic data formatted according to the GDF standard includes “[e]lements,” which “are classified into objects and their respective characteristics.” Ex-1006, 4:54-60. Each GDF object is assigned an “explicit Object ID,” which “unambiguous[ly] identifi[es]” the object within the GDF-formatted dataset. Ex-1006, 5:52-6:2, 7:50.

253. McGrath also explains that use of the GDF format provides benefits over proprietary formats. For instance, McGrath explains that its GDF format is “especially suitable for transferring geographical data sets from another format or to another format,” and thus it “may be used for transferring or providing geographical data sets from one entity to another entity,” even though the different entities might store the geographical data in different formats:

The GDF format is an interchange format for geographical databases. The GDF format is especially suitable for **transferring geographical data sets from another format or to another format**. Accordingly, the GDF format may be used for **transferring or providing geographical data sets from one entity to another**. For example, the GDF [format] may be used by a geographical data set developer/publisher (i.e., an entity that collects the geographical information and enters it into a data format) to transfer its geographical data set to a geographical data set customer (e.g., an entity that incorporates the geographical data set in a navigation system). The GDF [format] also provides a standardized means for a navigation customer and a geographical data set developer to specify, compare, and agree on the types, coverage, and accuracy of a geographical data set.

Ex-1006, 3:39-54.

254. A POSITA would have been motivated to use McGrath’s GDF format in Nakano’s system. Notably, while Nakano’s elements are manufacturer-specific (e.g., both the server and mobile terminal need to know what the element IDs correspond to), Nakano’s use of primitive elements from which to construct a route is similar in concept to GDF’s use of objects. In particular, a POSITA would have

understood that Nakano's elements could simply be replaced with McGrath's GDF objects, with those GDF objects functioning in essentially the same manner as Nakano's elements, with both identified through IDs. A POSITA would have been motivated to make this substitution in order to use a more common set of element descriptors (i.e., those of the open GDF standard) to describe a similar set of primitive elements.

255. Further, given GDF's use as an interchange format, a POSITA would also have been motivated replace Nakano's elements with McGrath's GDF objects to allow for a route calculated by Nakano's server to be used with local client mapping databases from a variety of different manufactures (rather than, for example, only the same manufacturer as Nakano's server's mapping database), thereby increasing the versatility and interoperability of Nakano's system. In particular, if Nakano's mobile terminal used a proprietary local mapping database, it could simply convert a GDF-formatted route provided by the server into its own proprietary format, as explained in McGrath:

In order to provide a geographical data set in the GDF format, it may be necessary for a geographical data set developer to **convert its data set from its own format into the GDF format**. Similarly, in order for a geographical data set customer to use a geographical data set in a navigation system, the geographical data set customer may need to **convert the geographical data set from the GDF format into its own format**.

Ex-1006, 3:54-61;

It is understood that the transaction updates and/or the geographical data set may be converted from one format to another in connection with the application of the updates. For example, the transactions may be **published in a non-proprietary format [(e.g., GDF)], translated into a customer's proprietary format**, and applied to the customer's geographical data set which also may be in a proprietary format. Alternatively, the customer may convert its existing geographical data set into a non-proprietary format, apply transactions in the non-proprietary format, and convert the updated geographical data set back into a proprietary format.

Ex-1006, 13:10-21.

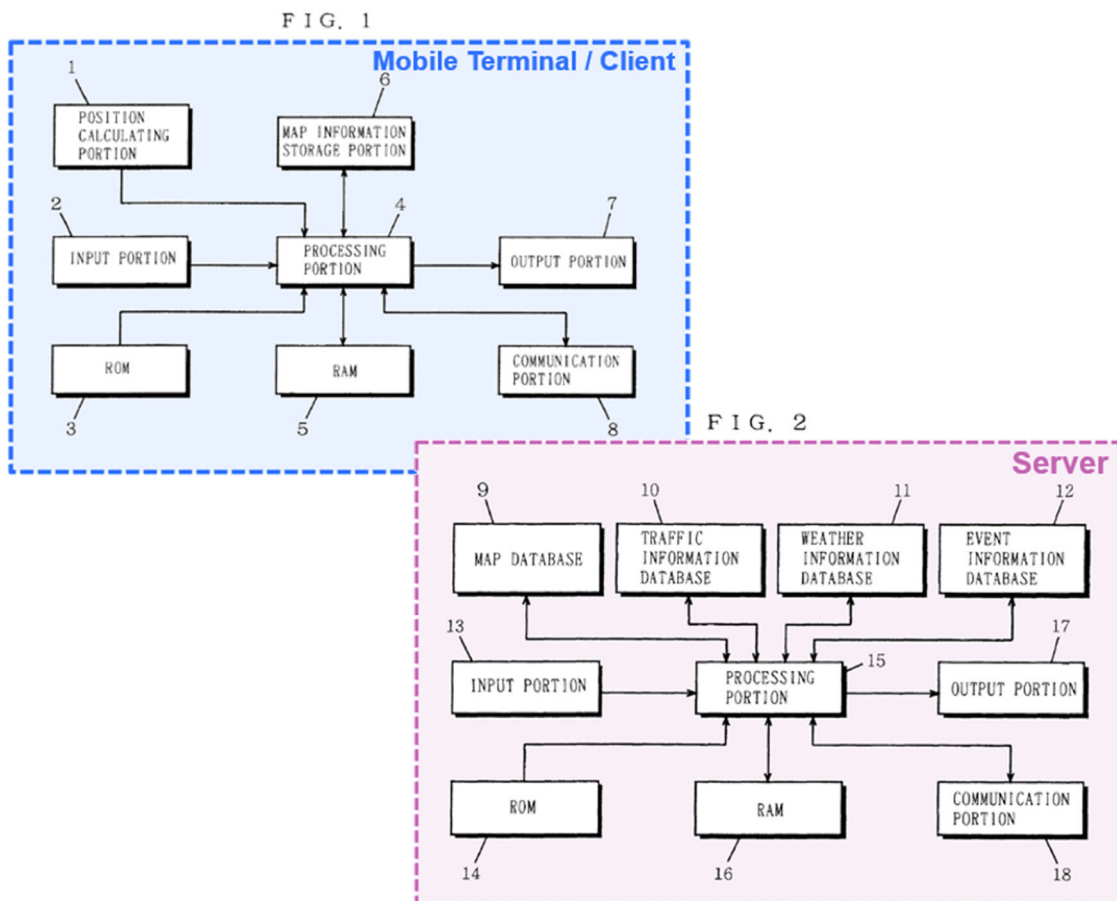
256. A POSITA would have had a reasonable expectation of success in configuring Nakano's server to provide routes formatted according to GDF. explained above, both Nakano's and McGrath's formats include IDs corresponding to route-related elements—Nakano's element IDs and McGrath's object IDs. Ex-1007, 16:3-5; Ex-1006, 7:50-52. And, as explained above, a POSITA would have understood that Nakano's use of element IDs is very similar to the manner by which McGrath's GDF object IDs are used. Thus, in the combined Nakano-McGrath system, in which Nakano's route format is replaced with McGrath's route format, a POSITA would have simply implemented McGrath's object IDs in a similar manner to Nakano's element IDs, to locate locally-stored route-related information.

2. Independent Claim 1

- a. Element 1[pre]: A method for providing an optimal route using real-time information for a navigation system comprising a client and a server, said server coupled to a computer network, said method comprising the steps of:**

257. Nakano-McGrath teaches and/or suggests the preamble of Claim 1.

258. Nakano discloses “a server/client-type map information providing system,” which includes a mobile terminal (annotated Figure 1, below) (the “client”) operated by a vehicle driver, and a remote server (annotated Figure 2, below). The client and server are both coupled to a “telecommunications” network, over which they exchange data. Ex-1007, 15:41-48, 10:18-23, 10:60-65. Nakano’s client and server use the telecommunications network, together with modems, to create a data connection between the client and server, thus establishing a computer network. Ex-1007, 10:18-23 (client-side modem), 10:60-65 (server-side modem).



259. Nakano's client-server system is a "navigation system" and the server provides the client (i.e., the user's mobile terminal) with the "optimum" driving route. Ex-1007, 16:48-50. Specifically, in response to a request from the client for an "optimum route between arbitrary points," Nakano's server obtains the optimum route, and provides it back to the client, where it is displayed for the user. Ex-1007, 10:14-18, 10:58-60, 15:48-50, 18:42-45. Obtaining the optimal route is accomplished using real-time information, such as current traffic conditions. For instance, "[a]t route search, *reflecting the traffic information* stored in the traffic information database 10, *a route avoiding congestion*, for example, may be obtained":

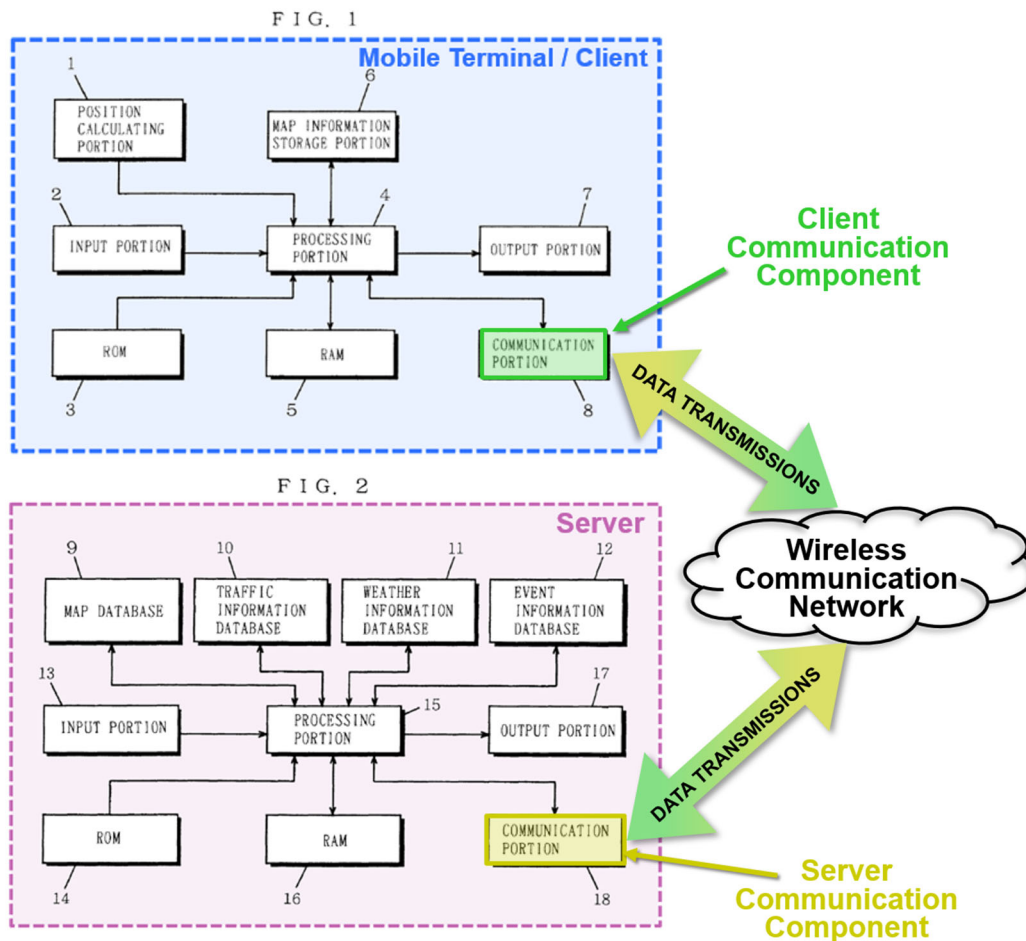
At route search, **reflecting the traffic information** stored in the traffic information database 10, **a route avoiding congestion**, for example, may be obtained. That is, travel time for each link recorded in the map database 9 is **actively changed based on the congestion information** and the regulation information read from the traffic information database 10, and the Dijkstra method is applied to the changed travel time for each link.

Ex-1007, 14:34-43. The resulting route is "optimal" under the district court's construction because it corresponds to a "recommended route" obtained by the server "based on one or more criteria" (e.g., avoiding congestion.

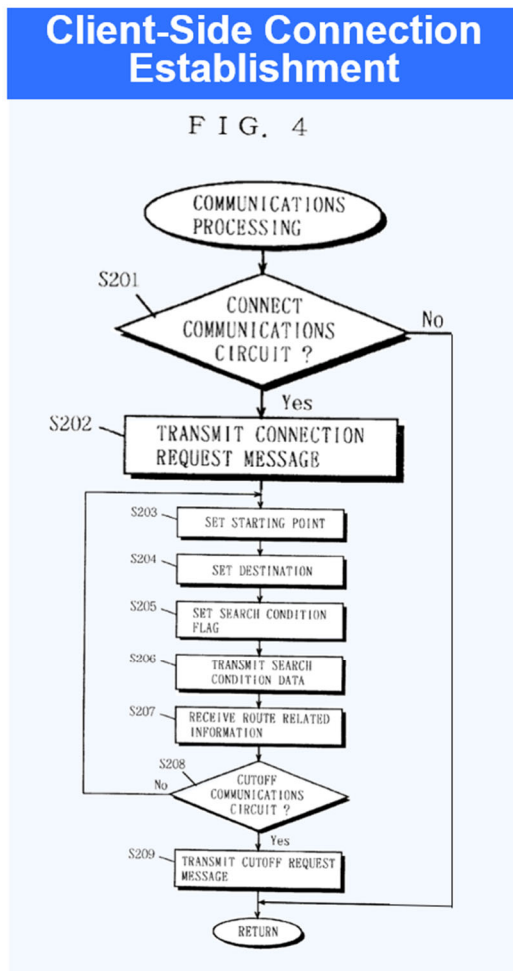
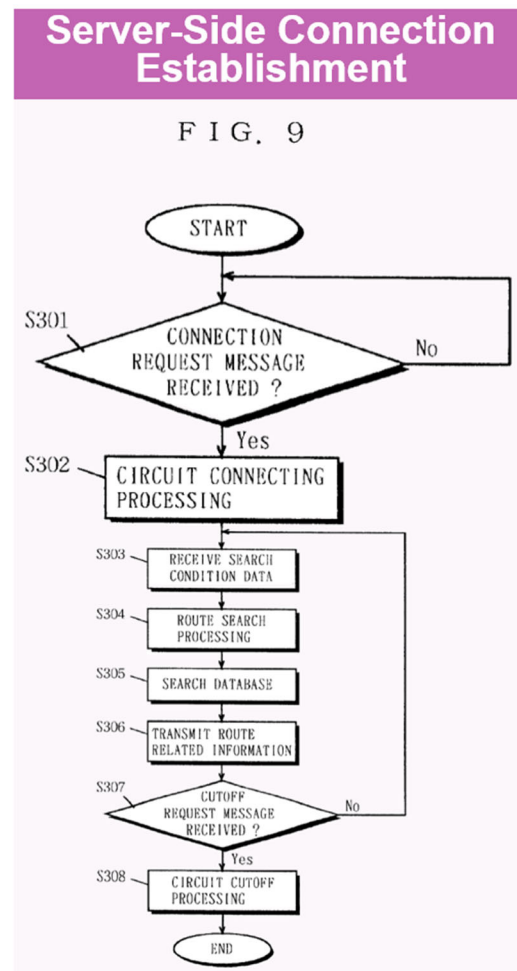
b. Element 1[a]: establishing a wireless connection between the client and the server;

260. Nakano-McGrath teaches and/or suggests Element 1[a].

261. Nakano's mobile terminal client and server communicate and exchange data with one another over a wireless network. Ex-1007, 15:41-48. Specifically, each of the mobile terminal and the server includes a "communication portion" that is used "to transmit/receive data" over the network, as illustrated in annotated Figures 1 and 2, below. Ex-1007, 10:18-23 (mobile terminal), 10:60-65 (server). Nakano explains that the communications circuit between the server and mobile terminal may be a wireless, as it exchanges "data between the cellular phone and the mobile terminal." Ex-1007, 10:18-23.



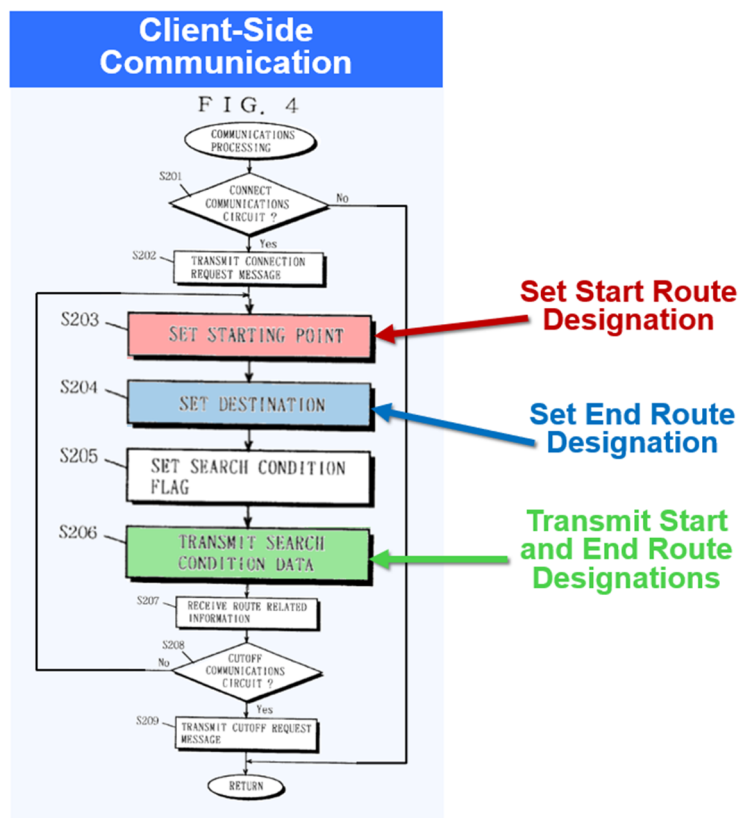
262. Nakano explains that the process for establishing this wireless connection is initiated by the vehicle driver, by instructing the terminal “to connect the communications circuit between the mobile terminal and the server.” Ex-1007, 11:48-55. The client- and server-side connection establishment procedures are illustrated in annotated Figures 4 and 9, below. Ex-1007, 11:56-61, 14:15-21.



c. Element 1[b]: transmitting start and end route designations from the client to the server;

263. Nakano-McGrath teaches and/or suggests Element 1[b], through Nakano's mobile device's transmission of a starting point and a destination to the server.

264. As illustrated in modified Figure 4, below, after a connection is established between Nakano's mobile device and server, the mobile device sets both "a starting point for route searching" (Ex-1007, 11:60-63) and a "destination" (*id.*, 12:1-6). Here, "the present vehicle position" may be set as the starting point of the route, or "a point arbitrarily selected by the driver may be set." Ex-1007, 11:63-67.

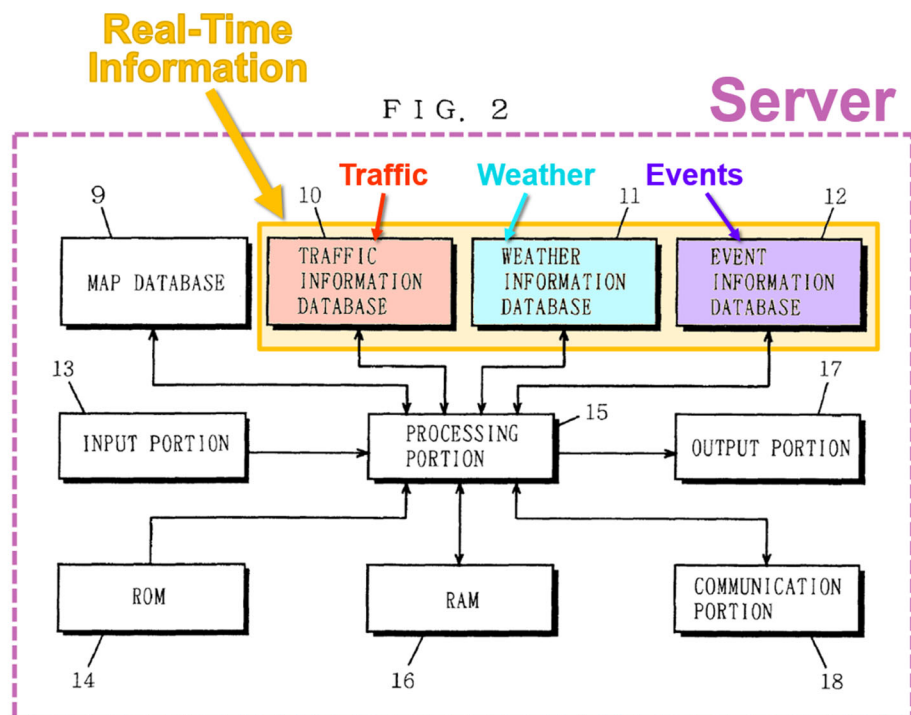


265. The mobile device then “transmits data including the search conditions of the starting point, [and] the destination” to the server. Ex-1007, 12:13-16.

d. Element 1[c]: accessing real-time information by the server;

266. Nakano-McGrath teaches and/or suggests Element 1[c].

267. Nakano’s navigation system is capable of providing map-related information “with a high degree of real-time characteristics.” Ex-1007, 1:33-35. This is accomplished through the use of various databases of real-time information, such as “traffic information, weather information, and event information,” as illustrated in annotated Figure 2, below. Ex-1007, 9:34-38.



268. “Traffic information database 10” stores “information about congested roads” and “information about accidents” (Ex-1007, 10:36-39), and “weather information database 11” stores “weather forecasts and rainfall conditions” (*id.*, 10:41-43).

269. Nakano’s server accesses the real-time information stored in databases 10-12 to determine an optimal route. *Id.*, 14:34-61. For instance, “[a]t route search,” the server accesses real-time traffic information “stored in the traffic information database 10,” to determine the optimal route as corresponding to one that “avoid[s] congestion.” Ex-1007, 14:34-41.

e. Element 1[d]: calculating the optimal route by the server, based on the real-time information and said start and end route designations;

270. Nakano-McGrath teaches and/or suggests Element 1[d].

271. Based on “the search conditions of the starting point, [and] the destination” for the requested route, the server “performs route search processing,” using an existing route calculating method, “such as the Djikstra method.” Ex-1007, 14:22-33.

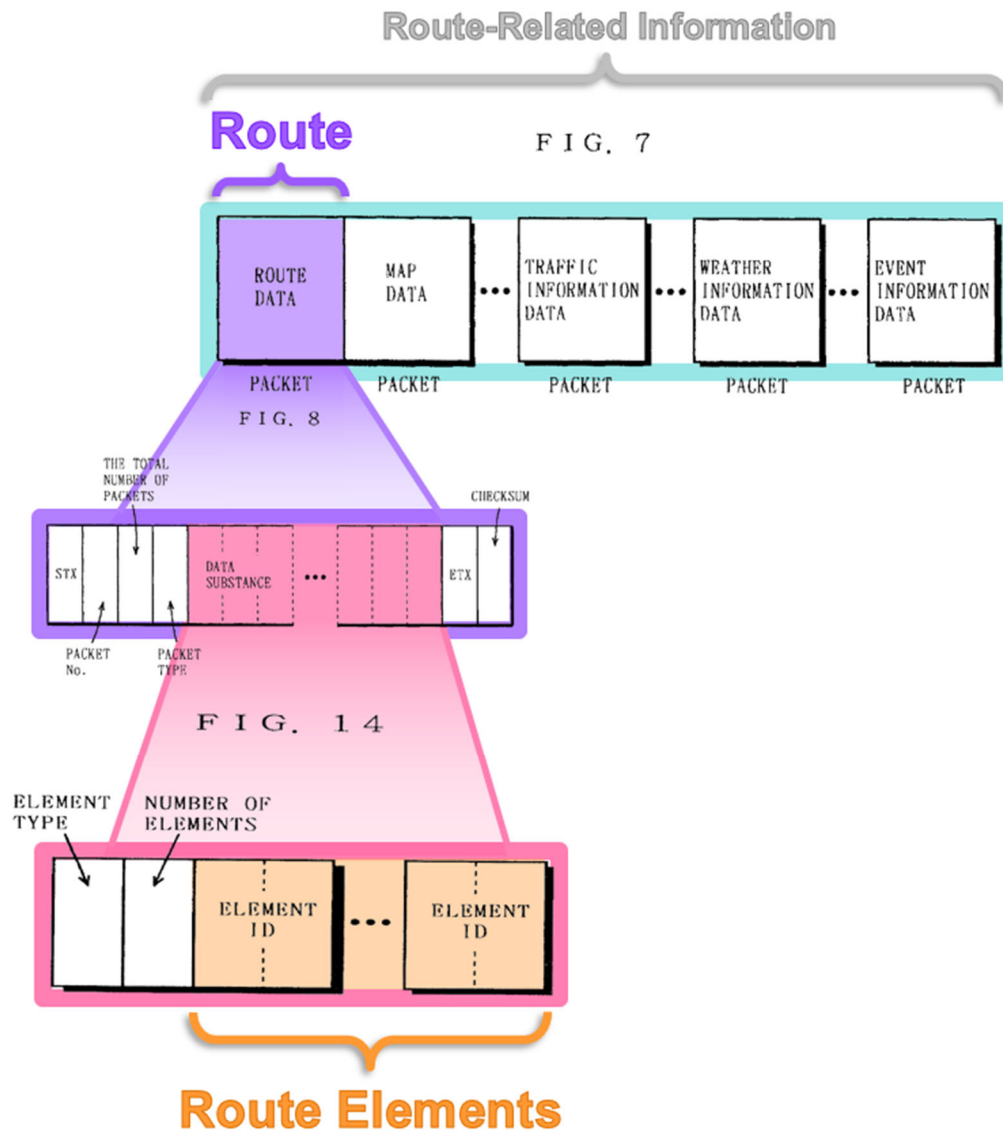
272. Nakano’s route search may use real-time traffic information to calculate the optimal route, e.g. one that “avoid[s] congestion.” Ex-1007, 14:34-36. This is accomplished by “actively chang[ing]” the “travel time for each link recorded in the map database 9 ... based on the congestion information and [] regulation information

read from the traffic information database,” and applying the Dijkstra method “to the changed travel time for each link.” Ex-1007, 14:36-43. The resulting route is an “optimal route” under the district court’s construction of “recommended route obtained using a set of criteria,” because it is recommended to the user based on an “avoid[s] congestion” criterion.

f. Element 1[e]: formatting the optimal route into a non-proprietary, natural language description;

273. Nakano-McGrath teaches and/or suggests Element 1[e]

274. As explained in Section XIII.F.1, Nakano’s route is formatted according to a set of element IDs (as illustrated in Figures 7, 8, and 14, modified/combined below). *Id.*, 15:64-16:6.



275. Each element ID corresponds to a template stored locally at the client, and which may be used by the client for “restoring” the received route. *Id.*, 15:48-53, 17:26-18:6, Fig. 13. A POSITA would have understood that such use of Nakano’s element IDs to conserve network bandwidth resources relies on both the client and server storing mapping data according to the same set of element IDs (e.g.,

the data was provided by the same manufacturer), so that the same element ID unambiguously identifies the same data stored at both the client and the server.

276. McGrath similarly teaches the use of IDs for map-related elements formatted according to the GDF standard. As explained in Section XIII.F.1, GDF includes “[e]lements,” which “are classified into objects and their respective characteristics.” Ex-1006, 4:54-60. Each GDF object is assigned an “explicit Object ID,” which “unambiguous[ly] identifi[es]” the object within the GDF-formatted dataset. Ex-1006, 5:52-6:2, 7:50. For example, McGrath discloses a “Road Element” object, “with explicit Object ID 1001.” *Id.*, 7:50. Additionally, GDF objects can be “unambiguously” identified “by using a (sub)set of the characteristic data that defines the object.” *Id.*, 6:39-50. McGrath explains that its GDF format is “especially suitable for transferring geographical data sets from another format or to another format,” and thus it “may be used for transferring or providing geographical data sets from one entity to another entity,” even though the different entities might store the geographical data in different formats. Ex-1006, 3:42-60.

277. As explained in Section XIII.F.1, Nakano’s element IDs are used in a similar manner to McGrath’s GDF object IDs. However, in contrast to Nakano’s element IDs, McGrath’s GDF format is an open standard that facilitates interoperability between mapping databases provided by different manufacturers. Accordingly, as also explained in Section XIII.F.1, a POSITA would have been

motivated to configure Nakano's server to provide routes formatted in GDF, as taught by McGrath.

278. In Nakano's system, element IDs are used to locate information stored in the mobile terminal's in-vehicle mapping database. Ex-1007, 17:52-57. McGrath similarly explains that the GDF object IDs (and/or natural language characteristics included along with the object ID) can be used to locate the corresponding database entries. Ex-1006, 5:65-6:54. As explained in Section XIII.F.1, Nakano's element IDs are used in the same manner as McGrath's GDF object IDs. Thus, in the combined Nakano-McGrath system, a POSITA would have simply implemented McGrath's object IDs in a similar manner to Nakano's element IDs, to locate locally-stored route-related information. As explained in Section XIII.A.2.f (Ground 1, Element 1[e]), GDF is "non-proprietary" and uses "natural language," under the district court's constructions of those terms.

g. Element 1[f]: downloading said non-proprietary, natural language description to the client;

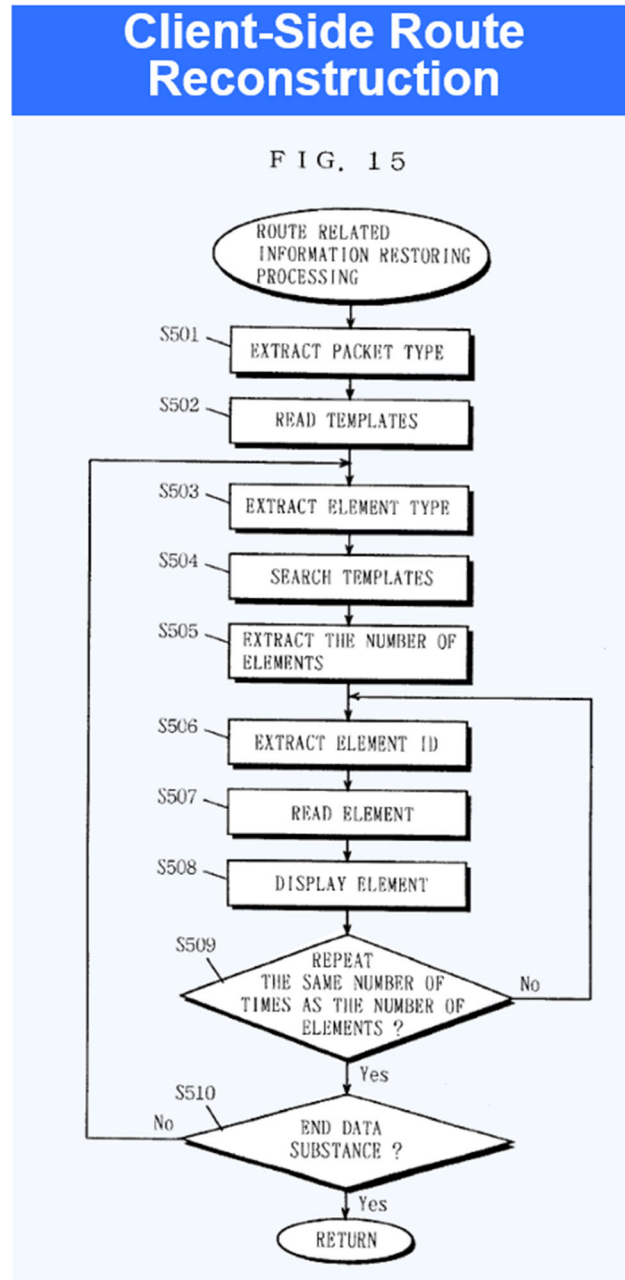
279. Nakano-McGrath teaches and/or suggests Element 1[f] under the district court's construction of "the server sending the non-proprietary, natural language description and the client receiving the non-proprietary, natural language description."

280. As Nakano explains, after the server calculates the optimal route, that route “is downloaded from the server side to the mobile terminal side”—i.e., the server “transmit[s]” the route and the mobile terminal “receive[s]” it. Ex-1007, 15:26-31, Figs. 4, 9

h. Element 1[g]: reconstructing the optimal route by the client using a local mapping database; and

281. Nakano-McGrath teaches and/or suggests Element 1[g].

282. Nakano teaches reconstructing the optimal route at the client mobile terminal using a local mapping database. As explained for Element 1[e] above, Nakano’s route format includes a set of element IDs corresponding to locally-stored mapping information. Figure 15 of Nakano, annotated below, describes the “route related information restoring processing” (Ex-1007, 17:26-30) by which Nakano’s mobile terminal uses the route format and its IDs to reconstruct the route.



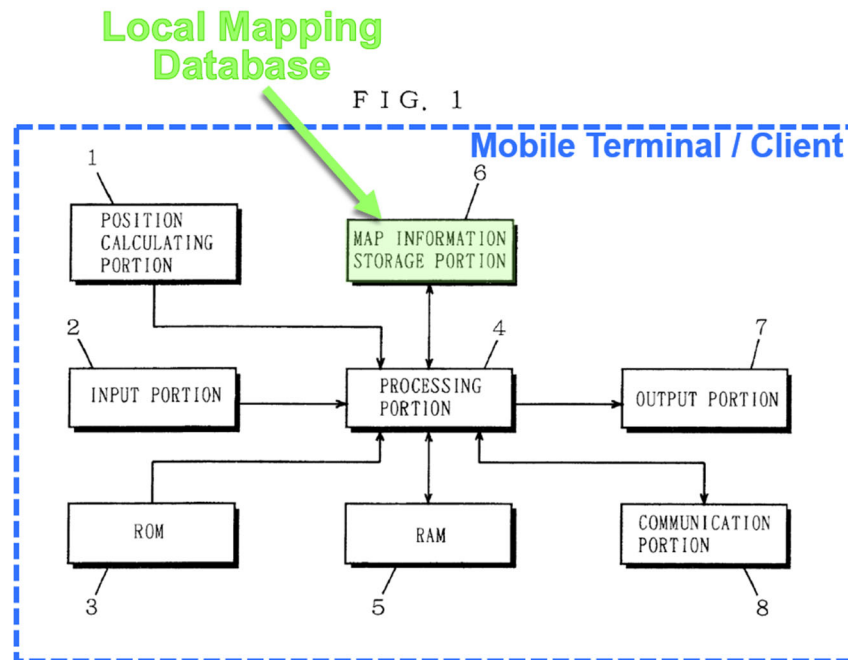
283. As illustrated, in response to receiving a route calculated by the server, Nakano's mobile terminal first extracts "an identifier indicating a type of the packet" (Figure 15, S501), and then reads templates from the local mapping database corresponding to that packet type (S502). Ex-1007, 17:31-46. The terminal next

extracts “the element type from the data substance of the received packet” (S503), and “selects a template including the same element type as that extracted” (S504). Ex-1007, 17:41-46. The element type may correspond to a bitmap, or a character string. Ex-1007, 17:49-52. Next, for each element within the data substance of the received packet, the terminal “extracts the element ID” (S506), and uses the ID to identify “the element stored in the map information storage portion 6.” Ex-1007, 17:54-57. After “read[ing] an element having the [extracted] element ID,” Nakano’s terminal causes “output portion 7 [to] display the element.” Ex-1007, 17:61-18:3. Accordingly, a POSITA would have understood that Nakano’s route reconstruction process involves extracting element IDs from the received route, using those element IDs to locate corresponding graphical route elements (e.g., templates) stored within Nakano’s local mapping database, and presenting the graphical route elements to the user on the mobile terminal display.

284. As explained for Element 1[e], in the combined Nakano-McGrath system, the mapping databases at the server and client use McGrath’s GDF format to describe routes. Reconstructing the GDF-formatted route would involve a similar process, with Nakano’s element IDs substituted with McGrath’s object IDs. Similar to Nakano’s element IDs that each correspond to route elements, each of McGrath’s object IDs corresponds to an object of map-related information stored in McGrath’s

geographical data sets. Ex-1006, 4:54-60. And, as explained in Section XIII.F.1, Nakano's element IDs are used in the same manner as McGrath's GDF object IDs.

285. In the Nakano-McGrath system, Nakano's map information storage portion 6 ("local mapping database"), illustrated in annotated Figure 1, below, would store the route objects according to McGrath's object IDs, such that the object IDs could be used to identify and extract the objects as part of the route reconstruction process.

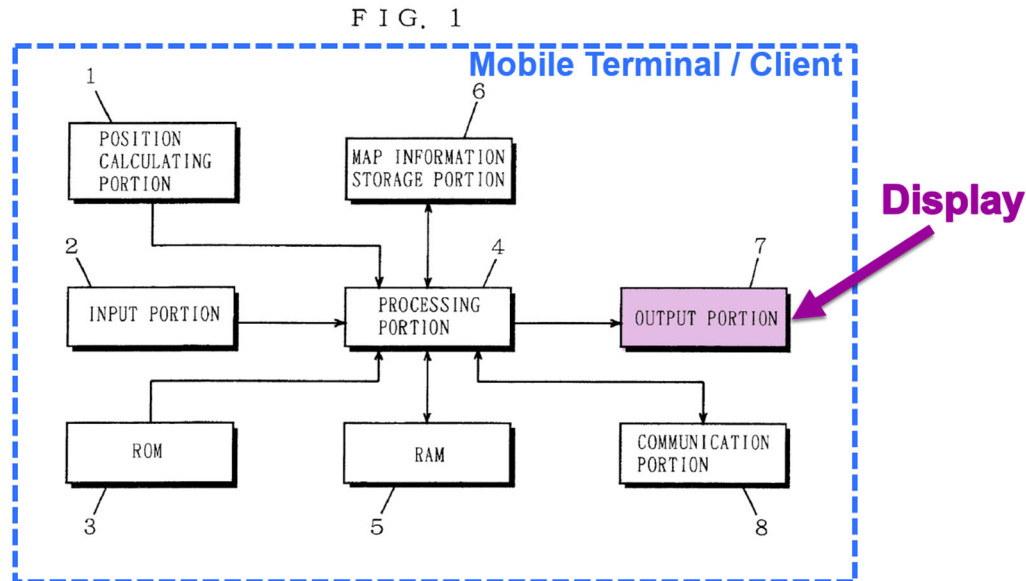


- i. **Element 1[h]: displaying said optimal route on a display system coupled to the client.**

286. Nakano-McGrath teaches and/or suggests Element 1[h].

287. During the route reconstruction process, in response to identifying an element corresponding to an element ID included within Nakano's route format (an

object ID included within the GDF format), the mobile terminal displays that element on “output portion 7.” Ex-1007, 1-5. As illustrated in annotated Figure 1, below, output portion 7 is “constructed of ... a display.” Ex-1007, 10:14-18.



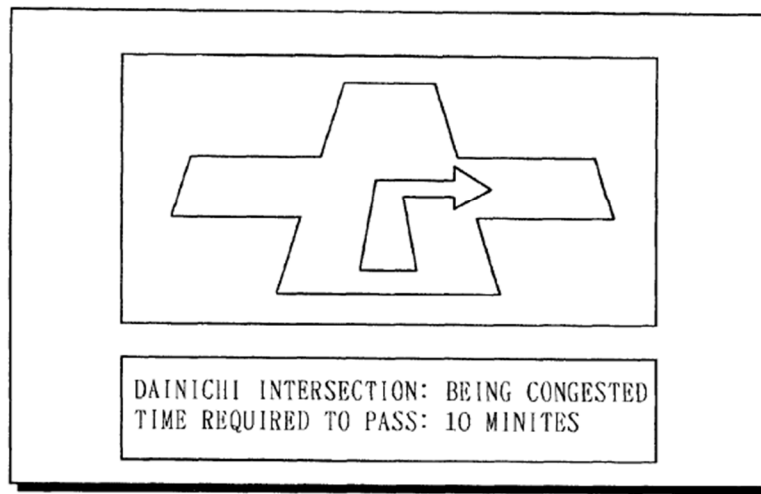
3. Dependent Claims 2, 4-7, and 13-14

- a. **Claim 2:** The method of claim 1, wherein said step of formatting includes the step of dividing the optimal route into one or more links, wherein each link includes at least a street name and a turning orientation.

288. Nakano-McGrath teaches and/or suggests Element 2[a].

289. Nakano represents routes with a set of nodes, connected by links (Ex-1007, 14:34-43), together with a set of additional “elements,” corresponding to additional information related to the route (*id.*, 17:19-21). As illustrated in Figure 12, below, Nakano’s route elements include turning orientations:

FIG. 12



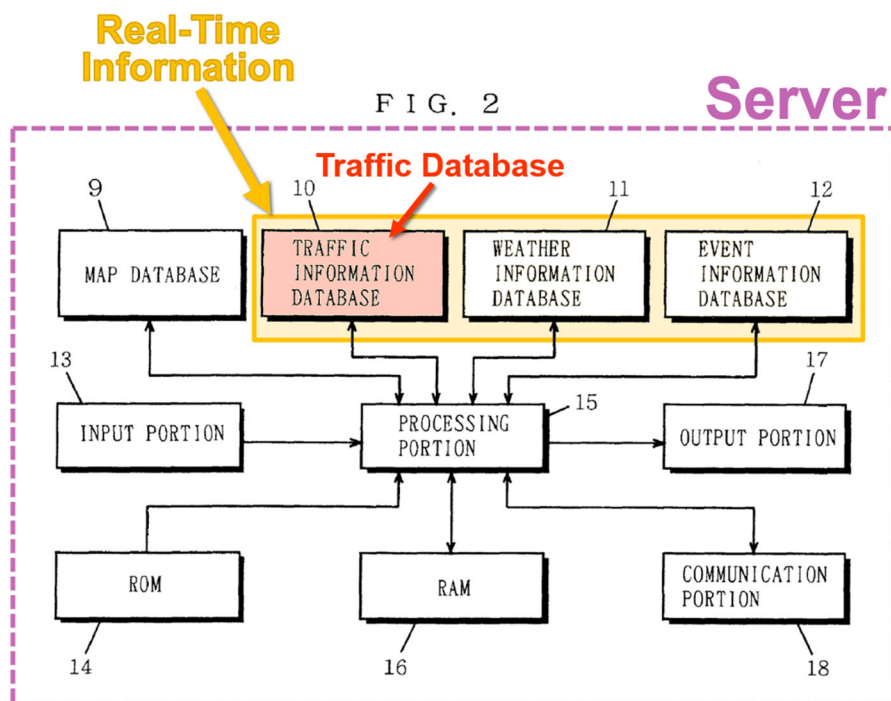
290. McGrath's GDF format also includes nodes, links (in the form of Road Elements between nodes (Ex-1006, 15:47-48)), and additional "[e]lements." Ex-1006, 4:54-50, 15:47-48. McGrath's elements "are classified into objects and their respective characteristics," including route-related information such as road names and turning restrictions. Ex-1006, 4:54-60, Tables 1-2. McGrath explains that a "Road Element" object (claimed "link") may have a "Name Attribute" characteristic corresponding to a street name, such as "Main Street," "First Avenue," "US-101 North," "I-95," etc. Ex-1006, 7:41-45, 7:65-67.

291. As explained in Section XIII.F.1, a POSITA would have been motivated to format Nakano's route using McGrath's GDF format. A POSITA would have understood that, when specifying a route using McGrath's GDF format, a "turning orientation" characteristic could be included for a "Road Element" object

within the route, based at least on Nakano's disclosure of the inclusion of such information, to provide helpful information to the user (e.g., to illustrate the direction of the turn on the displayed map), for use in navigating the route.

- b. **Claim 4: The method of claim 1, wherein said accessing step comprises the step of accessing a traffic database comprising current traffic conditions; and querying said traffic database for determining current traffic conditions between locations defined by said start and end route designations.**

292. Nakano-McGrath teaches and/or suggests Claim 4. As explained for Element 1[c], Nakano's server accesses real-time traffic information "stored in a traffic information database 10" (as illustrated in annotated Figure 2, below), to determine an optimal route that "avoid[s] congestions." Ex-1007, 14:34-41.



293. During the route-search process, Nakano's server "actively change[s]" the "travel time for each link" within a potential route, "based on the congestion information ... from the traffic information database 10." Ex-1007, 14:34-41. Changing the travel time for each link based on the congestion information requires querying the database for current congestion information at the link positions, which are positions along the route "between locations defined by said start and end route designations."

- c. **Claim 5: The method of claim 1, wherein said real-time information includes one or more from the set of: current traffic conditions; highway ramp configurations; current weather conditions; constriction information; road restrictions; detour information; and event traffic information.**

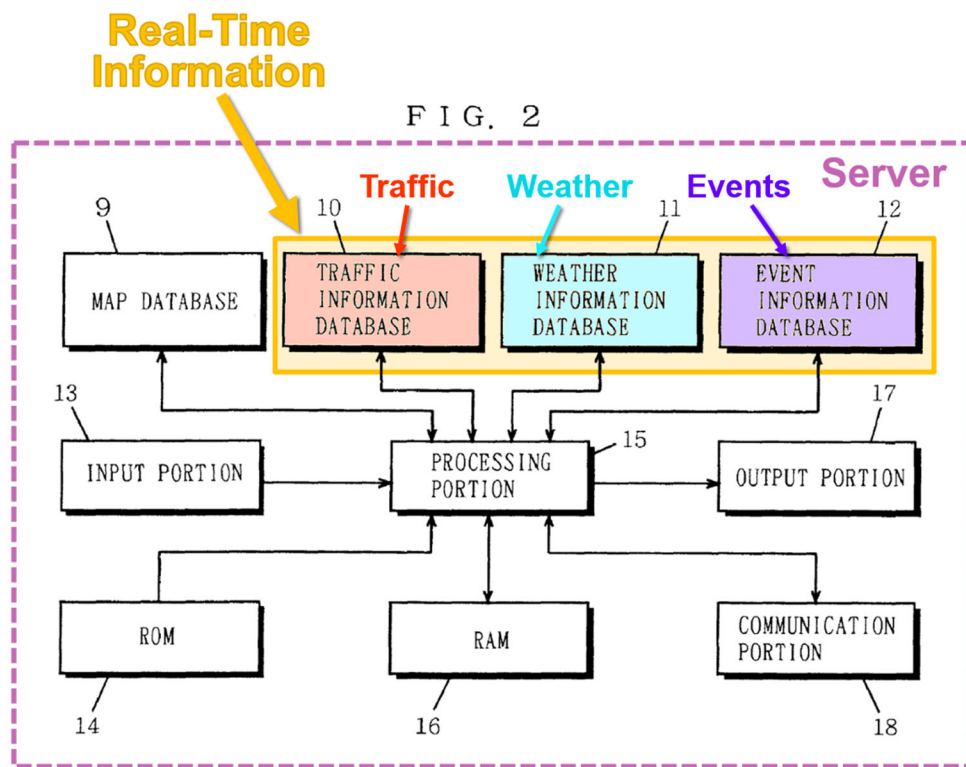
294. Nakano-McGrath teaches and/or suggests Claim 5. As explained for Element 1[c], the real-time information includes "traffic information, weather information, and event information," as illustrated in annotated Figure 2, below. Ex-1007, 9:34-38. Nakano also describes specific types of traffic, weather, and event information, including:

The traffic information database 10 is a database storing **traffic information items** such as **information about congested roads**, **regulation information**, information about accidents, and these information items are transmitted to the mobile terminal as requested. the weather information database 11 is a data base storing weather information items. such as **weather forecasts and rainfall conditions**, and these information items are transmitted to the mobile terminal as requested. The event information database 12 is a database storing

various kinds of event information, and the information is transmitted to the mobile terminal as required

Ex-1007, 10:36-47.

295. A POSITA would have understood the term “regulation information to include “constriction information,” “ramp configuration information,” “road restrictions,” and “ramp configuration information.”



d. **Claim 6:** The method of claim 1, wherein said wireless connection is accomplished using a cellular network.

296. Nakano-McGrath teaches and/or suggests Claim 6. Nakano’s mobile terminal uses “a *cellular* phone and a data communications modem” to “transmit/receive data” to “the server.” Ex-1007, 10:18-23.

- e. **Claim 7: The method of claim 1, wherein said transmitting step includes the step of entering into a keypad data entry field, said start and stop route designations including a name for one or more of: a city; a state; a country; and a street.**

297. Nakano-McGrath renders obvious Claim 7.

298. As explained for Element 1[b], Nakano's mobile device sends both "a starting point" (Ex-1007, 11:60-63) and a "destination" (*id.*, 12:1-6) to the server for route searching. Nakano explains that the vehicle driver may enter the destination using input portion 2 of the mobile terminal. Ex-1007, 12:1-3. The starting point may similarly be "selected by the driver." Ex-1007, 11:63-67.

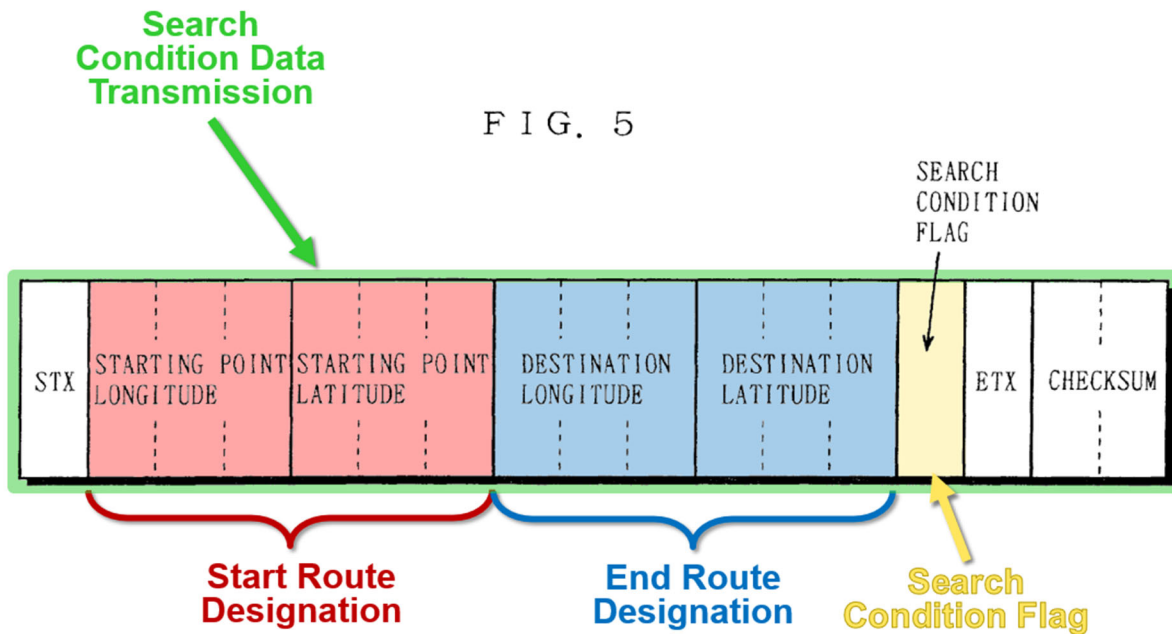
299. Input portion 2—used by the driver to set the starting and destination points, by navigating to positions on a map—"is realized by a body operational panel having a plurality of key switches." Ex-1007, 9:65-67. A POSITA would have understood that a panel having a plurality of keys corresponds to a "keypad," which could be used to enter alphanumeric characters. While Nakano discloses selecting locations by selecting points on a map, a POSITA would have been motivated to use Nakano's keypad to enter specific location names. Specifically, a POSITA would have understood that there are various ways to enter starting and destination points using a keypad, and that entering the addresses corresponding to those points (e.g., street numbers and names) was one such well-known method. A POSITA would have recognized that entering specific addresses (as opposed to selecting points on

a map) would improve the navigation process for the user by helping to ensure that the starting and destination points used by the server to calculate the route match (rather than approximate) the driver's intended selections. Further, a POSITA would have understood that an address will correspond to a specific point along a road link, while the same is unlikely to be true for an arbitrary point on a map. For such an arbitrary map point, the nearest road link must first be determined before a route to/from the point can be calculated (a process known as "map matching"). *See* Section VIII.B (Technical Background Section). Accordingly, a POSITA would have understood that using an address rather than a map point would consume less processing resources.

f. Claim 13: The method of claim 1, wherein said calculating step further comprises the step of reading user-specific data in calculating the optimal route.

300. Nakano-McGrath teaches and/or suggests Claim 13.

301. To request that Nakano's server perform route searching, the mobile device transmits user-specified search conditions (illustrated in annotated Figure 5, below) including "the starting point, the destination, and [a] search condition flag" to the server. Ex-1007, 12:12-16.



302. The search condition flag corresponds to a “condition at the time of route search (for example, giving a high priority to general roads or pay roads)” selected by the driver (Ex-1007, 12:7-12), for use by the server in identifying the optimum route (*id.*, 14:28-30). Because each of the starting point, destination point, and search condition flag are set by the user (Ex-1007, 11:63-12:12), and used by the server to calculate the optimum route (14:22-30), they correspond to “user-specific data” read by the server “in calculating the optimal route.”

g. Claim 14: The method of claim 1, wherein said computer network is the Internet.

303. Nakano-McGrath renders obvious Claim 14.

304. McGrath teaches that a “central navigation system” may be connected to the Internet. Ex-1006, 1:66-2:1. A POSITA would have been motivated to

connect Nakano's central server to the Internet, as taught by McGrath, to enable the server to "collect and updat[e]" the content of databases 10-12 from external sources storing such real-time information. Specifically, a POSITA would have understood that using the Internet to collect and update data, rather than a cellular network, may result in reduced telecommunications costs—a goal of Nakano. Ex-1007, 15:54-63.

4. Independent Claim 15:

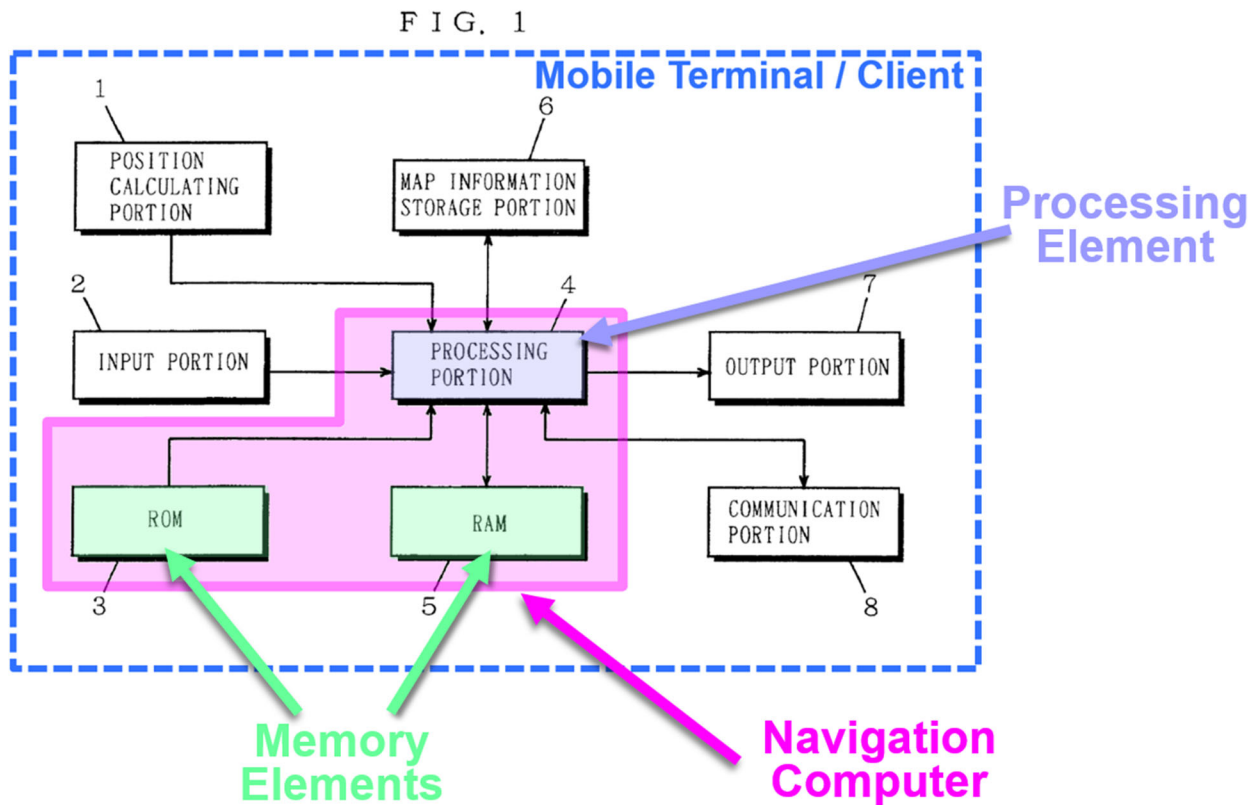
a. Element 15[pre]: A mobile navigation system comprising:

305. Nakano-McGrath teaches and/or suggests the preamble of Claim 15 for the same reasons explained for Element 1[pre].

b. Element 15[a]: a navigation computer;

306. Nakano-McGrath teaches and/or suggests Element 15[a].

307. The processing and memory elements within Nakano's mobile terminal, illustrated in annotated Figure 1, below, correspond to a "navigation computer" because "processing portion 4 controls the navigation system" according to software stored in the memory. Ex-1007, 10:6-13.

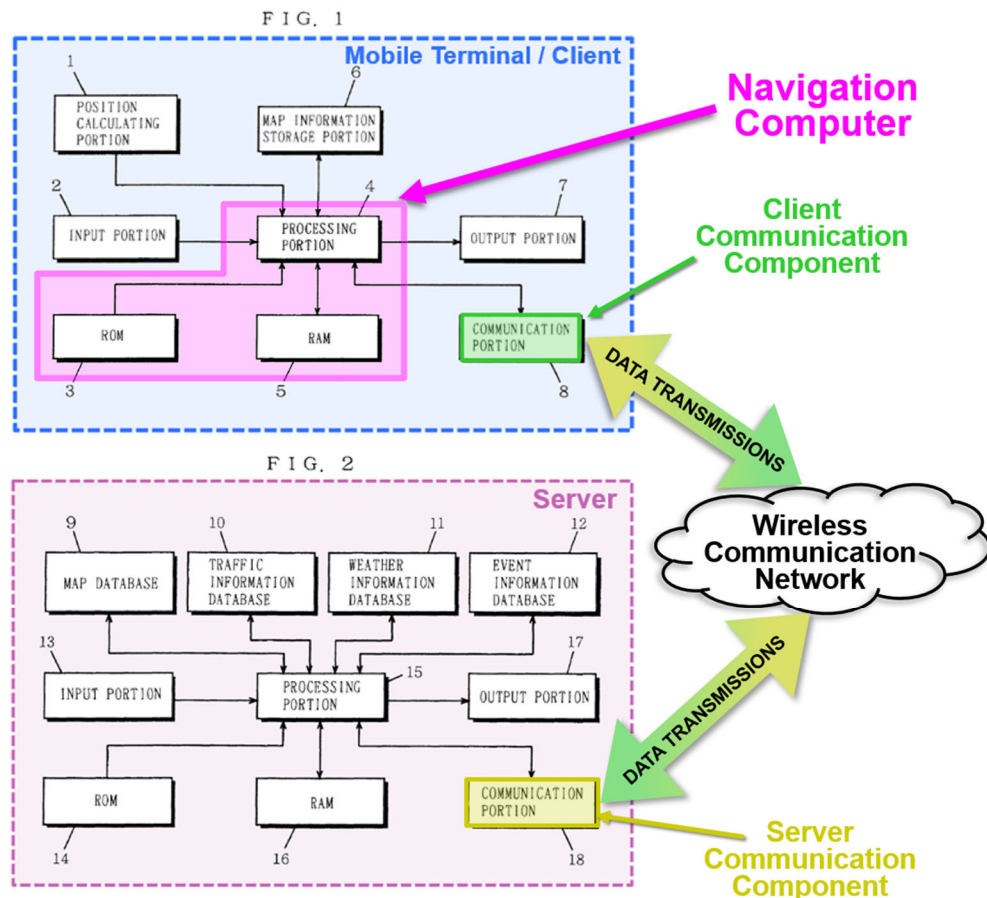


- c. **Element 15[b]:** a wireless transceiver coupled to said navigation computer for connecting with a navigation server, said navigation server for calculating optimal routes based on real-time information, said optimal routes being formatted using a non-proprietary, natural language description;

308. Nakano-McGrath teaches and/or suggests Element 15[b] for the same reasons discussed for Elements 1[pre]-1[a], and 1[c]-[e], and the additional reasons below.

309. The “communication portion 8” of Nakano’s mobile terminal corresponds to a “wireless transceiver” because it communicates data over a wireless network, and it is coupled to the “navigation computer” that comprises the

processing and memory elements shown in annotated Figure 1 below. Nakano explains that each of the mobile terminal and the server includes a “communication portion” to “transmit/receive data” to/from one another over a “telecommunications” network (Ex-1007, 15:46-48), as illustrated in annotated Figures 1 and 2, below. Ex-1007, 10:18-21 (mobile terminal), 10:60-65 (server).

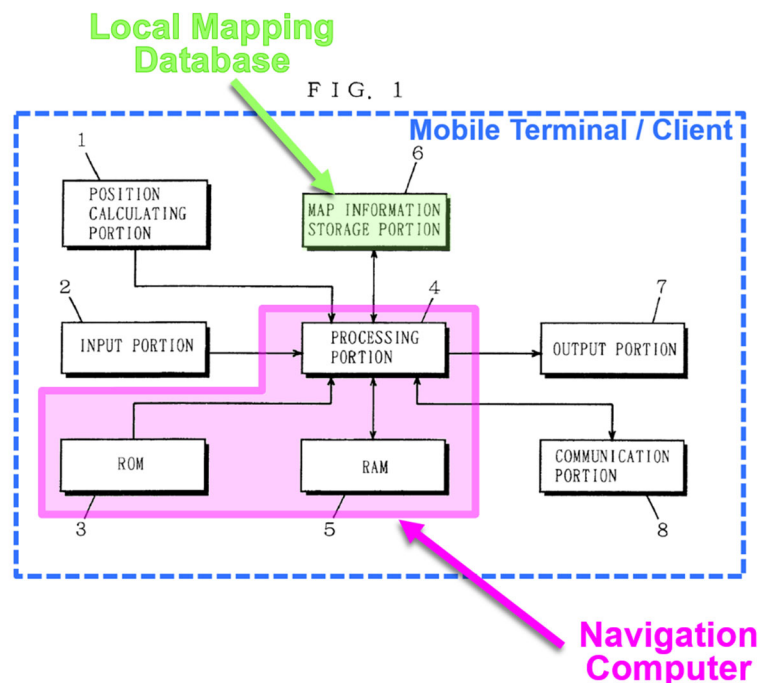


310. Nakano’s mobile terminal’s communication portion may be constructed of “a cellular phone and a data communications modem.” Ex-1007, 10:18-23. A POSITA would have understood that a cellular phone includes a transceiver.

- d. **Element 15[c]: a mapping database coupled to said navigation computer for reconstructing said optimal route from said non-proprietary, natural language description; and**

311. Nakano-McGrath teaches and/or suggests Element 15[c] for the same reasons explained for Element 1[g], and the additional reasons below.

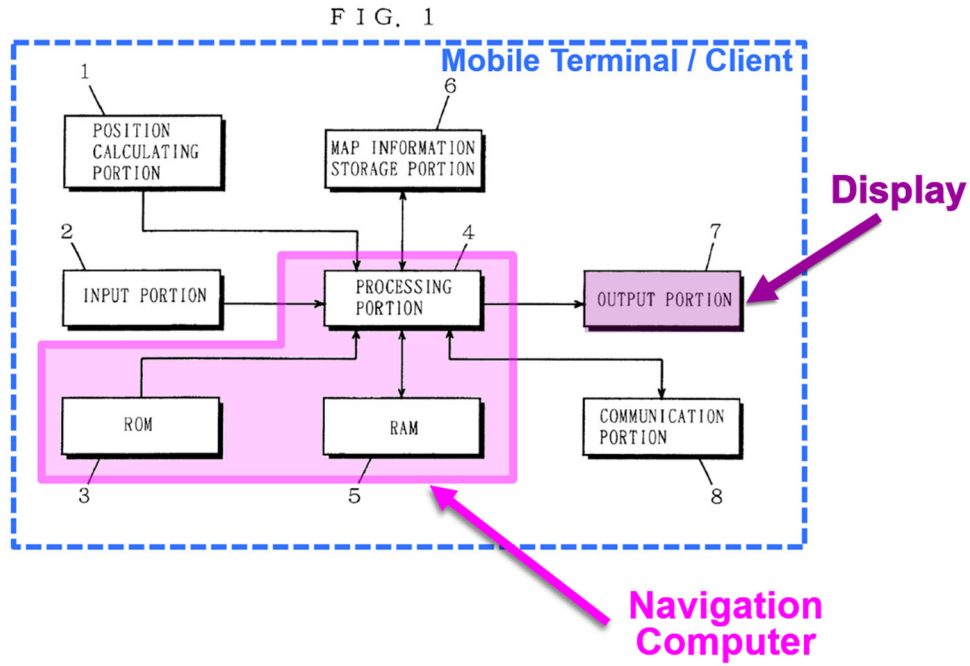
312. The “map information storage portion 6” of Nakano’s mobile terminal corresponds to a “mapping database” (see Section XIII.F.2.h), and it is coupled to the “navigation computer” as illustrated in annotated Figure 1 below.



- e. **Element 15[d]: a display screen coupled to said navigation computer for displaying said optimal route using said mapping database.**

313. Nakano-McGrath teaches and/or suggests Element 15[d], for the same reasons explained for Element 1[h], and the additional reasons below.

314. Display 7 is coupled to the “navigation computer” as illustrated in annotated Figure 1 below.



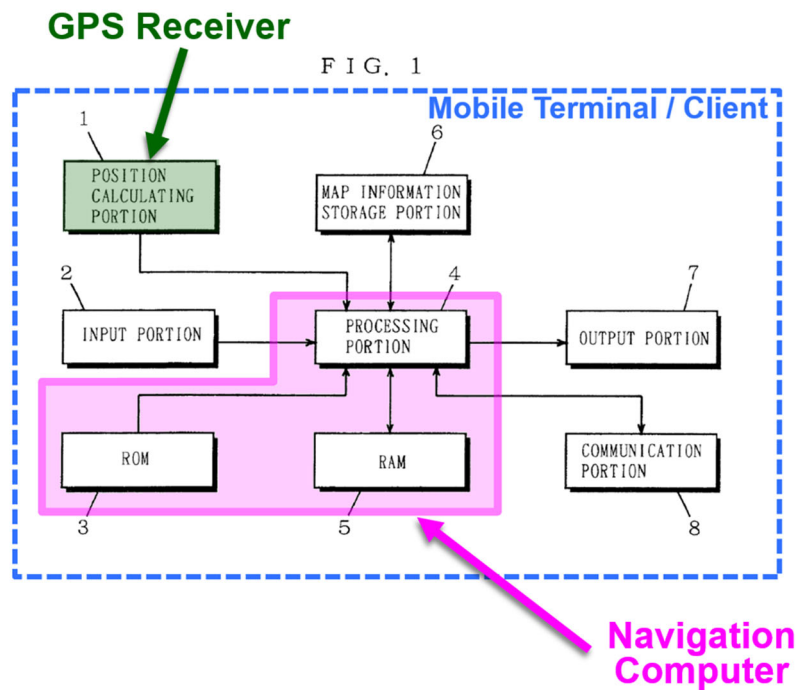
5. Dependent Claim 16:

- a. Element 16[a]: The mobile navigation system of claim 15, further comprising: a GPS receiver coupled to said navigation computer for monitoring position;**

315. Nakano-McGrath teaches and/or suggests Element 16[a].

316. Nakano’s “position calculating portion 1” corresponds to “a GPS receiver coupled to said navigation computer for monitoring position.” Nakano explains that “position calculating portion 1 calculates a present position of [the] vehicle” by “receiving radio waves from a GPS satellite.” Ex-1007, 9:56-64.

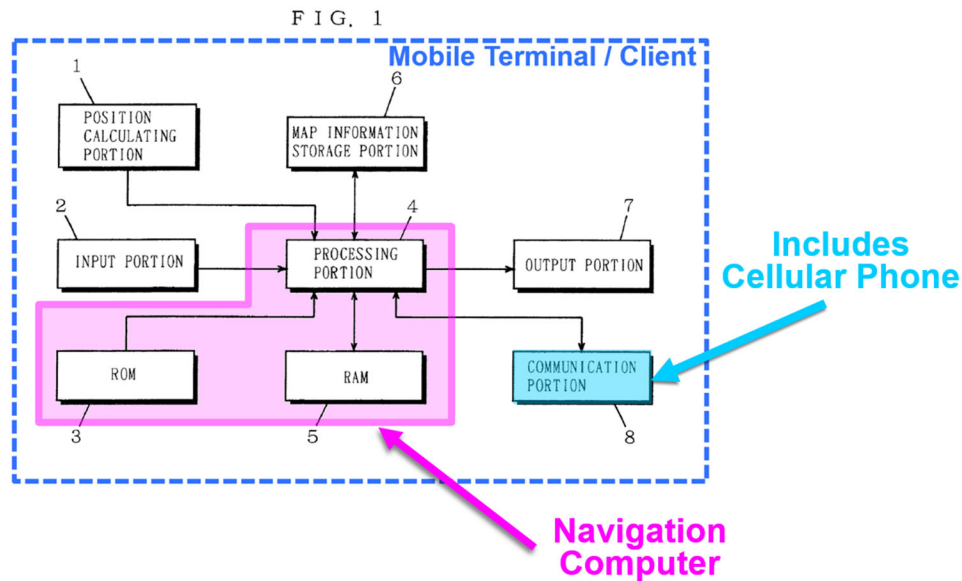
317. Position calculating portion 1 is coupled to processing portion 4 that is part of the “navigation computer” (as illustrated in annotated Figure 1, below).



- b. Element 16[b]: a telephonic device coupled to said wireless transceiver and said navigation computer for making and receiving telephone calls; and**

318. Nakano-McGrath teaches and/or suggests Element 16[b].

319. As explained for Element 15[b], the claimed “wireless transceiver” corresponds to the transceiver of a cellular phone (i.e., “a telephonic device for making and receiving telephone calls”) that is included within Nakano’s mobile terminal’s communication portion 8. Ex-1007, 10:18-23 (system includes “cellular phone”). The transceiver is a component of the cellular phone, and is thus coupled to the other components of the phone. Because the cellular phone is a component of communication portion 8, it is also coupled to processing portion 4 that is part of the “navigation computer” (as illustrated in annotated Figure 1, below).



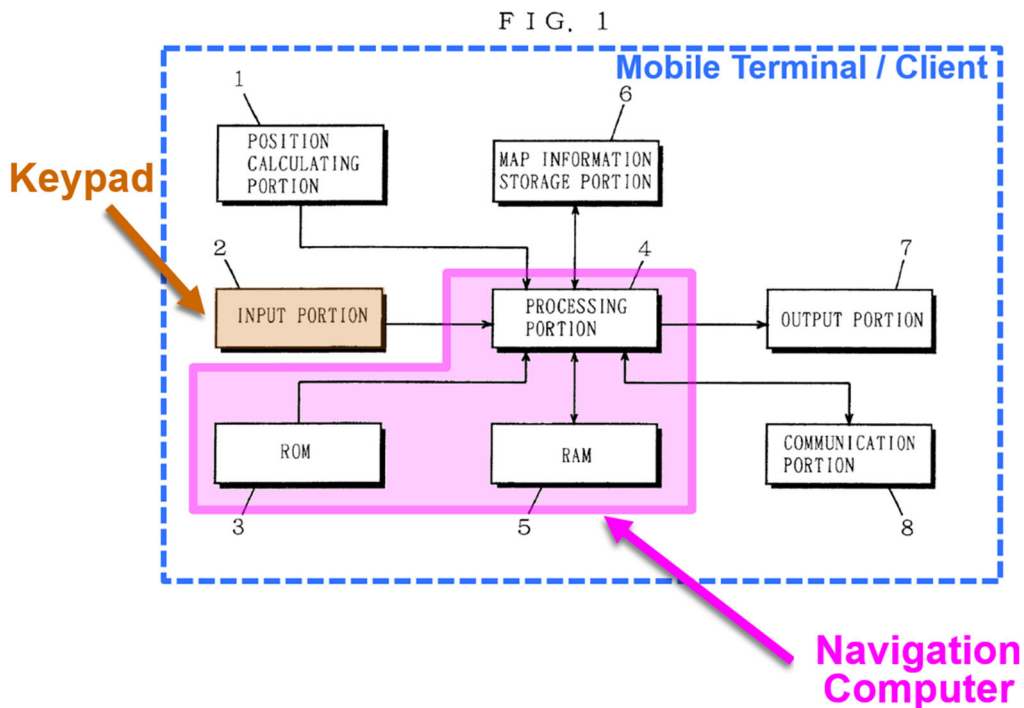
320. A POSITA would have also understood that a wireless transceiver, such as that used in a cellular telephone, must contact the cellular telephone service to which it is assigned, and must provide an appropriate number identifying the destination of the phone call. This is the case even if the communication is only data. As a result a POSITA would have understood that Nakano's Communication Portion, would have included the necessary "telephonic" components to originate a telephone call to any given telephone destination (i.e., phone number), and would have included a telephone number assigned to it by the cellular service provider, and this telephone number could be used to identify the terminal point of an incoming call. Thus a POSITA would have recognized Nakano's Communication Portion to include the claimed telephonic device coupled to the navigation computer and the wireless transceiver for making and receiving telephone calls.

- c. **Element 16[c]: a keypad coupled to said navigation computer for entering start and end route designations.**

321. Nakano-McGrath teaches and/or suggests Element 16[c].

322. As explained for Claim 7, input portion 2 of Nakano's mobile terminal corresponds to "a keypad" "for entering start and end route designations," because it "is realized by a body operational panel having a plurality of key switches" (Ex-1007, 9:65-67), and is used by the vehicle driver to enter both a starting point and a destination. Ex-1007, 12:1-3 (destination), 11:63-67 (starting point).

323. Input portion 2 is communicatively coupled to processing portion 4 that is part of the "navigation computer" (as illustrated in annotated Figure 1, below).



6. Independent Claim 21:

a. Element 21[pre]

324. Nakano-McGrath teaches and/or suggests the preamble of Claim 21, to the extent it is limiting, for the same reasons explained for Element 1[pre].

b. Element 21[a]

325. Nakano-McGrath teaches and/or suggests Element 21[a], for the same reasons explained for Element 1[a].

c. Element 21[b]

326. Nakano-McGrath teaches and/or suggests Element 21[b] for the same reasons explained for Element 1[b].

d. Element 21[c]

327. Nakano-McGrath teaches and/or suggests Element 21[c], for the same reasons explained for Element 1[d].

e. Element 21[d]

328. Nakano-McGrath teaches and/or suggests Element 21[d], for the same reasons explained for Element 1[e].

f. Element 21[e]

329. Nakano-McGrath teaches and/or suggests Element 21[e], for the same reasons explained for Element 1[f].

7. Independent Claim 22:

a. Element 22[pre]

330. Nakano-McGrath teaches and/or suggests the preamble of Claim 22, to the extent it is limiting, for the same reasons explained for Element 1[pre].

b. Element 22[a]

331. Nakano-McGrath teaches and/or suggests Element 22[a], for the same reasons explained for Element 1[a].

c. Element 22[b]

332. Nakano-McGrath teaches and/or suggests Element 22[b], for the same reasons explained for Element 1[b].

d. Element 22[c]

333. Nakano-McGrath teaches and/or suggests Element 22[c], for the same reasons explained for Elements 1[d]-[f].

e. Element 22[d]

334. Nakano-McGrath teaches and/or suggests Element 22[d], for same the reasons explained for Element 1[g].

f. Element 22[e]

335. Nakano-McGrath teaches and/or suggests Element 22[e], for the same reasons explained for Element 1[h].

G. Ground 7: Claims 7-9 Are Obvious Over Nakano-McGrath In View Of Geiser (Ex-1008)

1. A POSITA would have been motivated to combine Nakano-McGrath with Geiser and would have had a reasonable expectation of success

336. As explained in Section XIII.F.1, a POSITA would have been motivated to combine Nakano with McGrath. A POSITA would have been further motivated to combine Nakano-McGrath with Geiser, as explained below.

337. Nakano discloses a navigation system in which a driver uses a mobile terminal to select a starting point (Ex-1007, 11:60-63) and a destination (*id.*, 12:1-6) for a requested route. In Nakano's system, a driver may set a starting point or destination by using a keypad to navigate to "an arbitrary point on the map" and "select[ing]" that point. Ex-1007, 12:1-3.

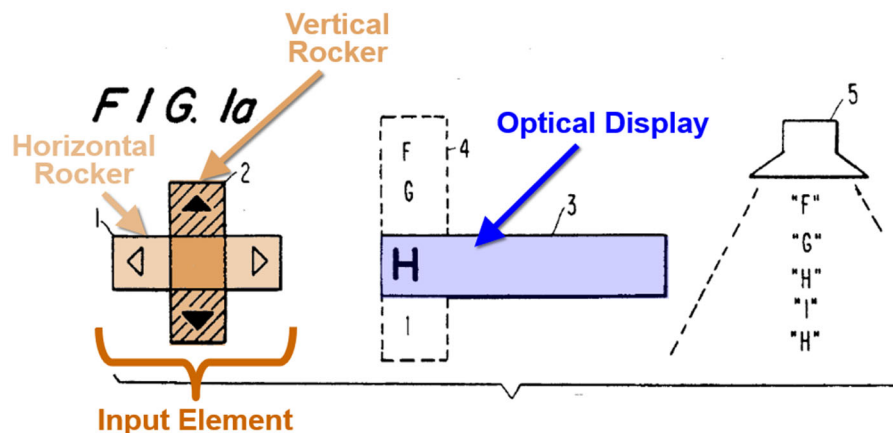
338. As detailed in Ground 2, Section XIII.B, Geiser similarly discloses a method for entering locations into a navigation system. Ex-1008, 1:55-58. Geiser's method uses an "input element" (Ex-1008, 2:43-45) to enter an alpha-numeric location name (e.g., "place, street and street address") (*id.*, 3:61-64), by making "stepwise" selections of alpha-numeric characters (*id.*, 3:43-59).

339. A POSITA would have been motivated to include Geiser's location-entry method in Nakano's mobile terminal to improve the location-entry process in Nakano. In Nakano's mobile terminal, a user enters a location by using a keypad to navigate to and select point on a map. Ex-1005, 11:63-12:6. A POSITA would have

recognized that, for a location with which a driver is unfamiliar, the driver may have difficulty identifying the location on a map and/or may select the wrong point on the map, despite knowing the address of the location. Thus, enabling the driver to directly enter the address, as taught by Geiser, may save the driver time and avoid driver error in the location-selection process.

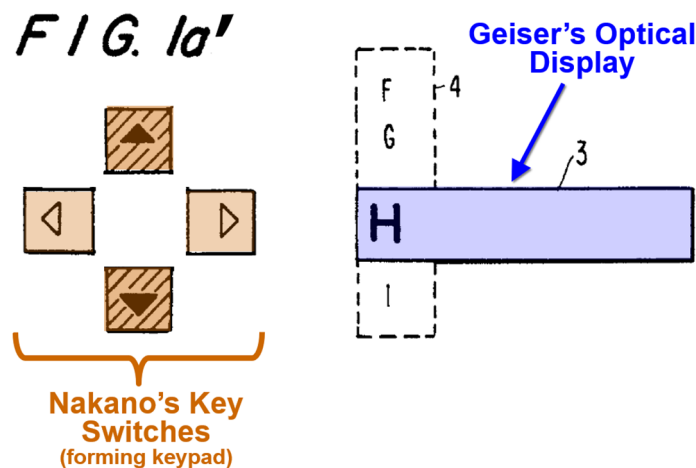
340. A POSITA would have had a reasonable expectation of success in implementing Geiser's location-entry method in the combined Nakano-McGrath system. In Geiser's system, as illustrated in annotated Figure 1a, below, location entry is performed using "a two-dimensional input element" consisting of "two rockers which are perpendicular to one another," where horizontal rocker 1 "serves for the stepwise selection of the letter position," and vertical rocker 2 "serves for running through the letter alphabet." Ex-1008, 2:43-59.

341. The characters selected using Geiser's input element are displayed in "optical display 3." Ex-1008, 3:26-29.



342. Geiser expedites the location entry process by narrowing the available characters from which to select, based on the already-entered characters. Ex-1008, 1:68-2:3, 3:10-35. That is, reducing the set of selectable letters based on the next sequential letter for any items in the database that match the already entered letters.

343. For Nakano's mobile terminal, location entry is performed using input portion 2 (Ex-1007, 12:1-3), which takes the form of "a body operational panel having a plurality of key switches" (*id.*, 9:65-67). A POSITA would have understood that Nakano's keys would include at least two keys to move left/right and two key to move up/down on Nakano's display, to enable the user to use the keys to select a point on a map. A POSITA would have understood that configuring Nakano's input portion 2 for Geiser's location entry could be accomplished in a straightforward manner using four of Nakano's keys to perform the functions of Geiser's input element (as illustrated in modified Figure 1a', below), and adding Geiser's optical display.



2. Dependent Claims 7-9:

- a. Claim 7: The method of claim 1, wherein said transmitting step includes the step of entering into a keypad data entry field, said start and stop route designations including a name for one or more of: a city; a state; a country; and a street.**

344. The Nakano-McGrath-Geiser combination (“Nakano-McGrath-Geiser”) teaches and/or suggests Claim 7.

345. As explained in Section XIII.F.3.e, Nakano-McGrath teaches the use of a keypad for entry of a starting point and a destination into Nakano’s mobile terminal, for subsequent transmission to Nakano’s server.

346. To the extent Nakano-McGrath does not fully teach using a keypad to enter a “name for one or more of: a city; a state; a country; and a street” Geiser teaches a method for location entry in a navigation system (Ex-1008, 1:55-58) in which the locations entered include a “street address” (*id.*, 3:61-65). As explained in Section XIII.G.1 (motivation to combine Nakano-McGrath with Geiser), in the combined Nakano-McGrath-Geiser system, Nakano’s “key switches” (*id.*, 9:65-67) would be used for entry of alphanumeric location addresses, such as street names, as taught by Geiser.

b. Claim 8:

- 1. Element 8[a]: The method of claim 7, wherein said step of entering comprises the steps of: comparing data entered into the keypad data entry field with a database of allowable entries;**

Element 8[b]: determining a set of conforming data items associated with said entered data;

347. Nakano-McGrath-Geiser teaches and/or suggests Elements 8[a]-[b].

348. Geiser teaches Elements 8[a]-[b] for the reasons explained in Section XIII.B.2.a.

349. As explained in Section XIII.G.1 (motivation to combine Nakano-McGrath with Geiser), in the combined Nakano-McGrath-Geiser system, Geiser's optical display would be added to the input portion of Nakano's mobile terminal and used for displaying the alphanumeric characters entered using Nakano's key switches, as modified to perform the functions of Geiser's input element. In the Nakano-McGrath-Geiser system, Geiser's optical display corresponds to a "keypad data entry field," because it displays the alphanumeric data (Ex-1008, 3:26-29) entered using Nakano's key switches ("keypad").

2. Elements 8[c]-[d]

350. Nakano-McGrath-Geiser teaches and/or suggests Elements 8[c]-[d].

351. Geiser teaches Elements 8[c]-[d] for the reasons explained in Section XIII.B.2.b.

c. Claim 9

352. Nakano-McGrath-Geiser teaches and/or suggests Claim 9, for the reasons explained in Section XIII.B.3.

H. Ground 8: Claims 10 and 11 Are Obvious Over Nakano-McGrath-Geiser In View Of Watanabe (Ex-1009)

1. Dependent Claims 10-11:

a. Claim 10: The method of claim 8, wherein said criterion defines a data item in said set of conforming data items that is used most frequently.

Claim 11: The method of claim 8, wherein said criterion defines a data item in said set of conforming data items that is used most recently.

353. Nakano-McGrath-Geiser-Watanabe teaches and/or suggests Claims 10-11.

354. As explained in Section XIII.C, Watanabe teaches Claims 10-11.

355. A POSITA would have been motivated to combine Nakano-McGrath with Geiser, as explained in Section XIII.G.1. A POSITA would have further been motivated to combine Nakano-McGrath-Geiser with Watanabe. Watanabe is in the same field of art as Nakano, McGrath, and Geiser, disclosing a vehicle navigation system with a “city name selection accelerator” that is designed to “simplify input operations of city names.” Ex-1009, Abstract.

I. Ground 9: Claim 12 Is Obvious Over Nakano-McGrath In View of Knockeart

1. Claim 12: The method of claim 1, wherein said downloading step comprises the step of compressing said natural language description.

356. Nakano-McGrath-Knockeart teaches and/or suggests Claim 12.

357. Nakano discloses the use of modems to establish the communication link between Nakano's server and mobile terminal. Ex-1007, 10:18-23.

358. Knockeart also discloses the use of modems to establish a data connection between an in-vehicle system and a server. Ex-1005, 28:18-33. As Knockeart explains, "[t]ypical modems carry out a negotiation phase in which compatible modulation, *compression*, and error correcting protocols are selected." Ex-1005, 28:27-29. Accordingly, when transmitting a route from the server to the client, the route "is downloaded ... using a *compressed format*." Ex-1005, 29:24-25.

359. A POSITA would have been motivated to configure Nakano's modems to compress transmitted data (including data for the optimal route), as Knockeart describes compression as a "typical" feature of modems and because it would reduce the amount of data that needs to be sent, thus lowering bandwidth requirements and telecommunication costs. Indeed, Nakano highlights telecommunication costs as a concern in transmitting data from client to server. Ex-1005, 15:59-63. Accordingly, a POSITA would have been motivated to search for references, such as Knockeart,

disclosing ways to further reduce telecommunications costs. Knockeart is analogous art to Nakano, as both discloses client-server systems for vehicle navigation. *See* Sections XII.A, C. A POSITA would have had a reasonable expectation of success in configuring Nakano's modems to compress transmitted data, as taught by Knockeart, because it corresponds to the use of a "typical" well known technique (i.e., data compression in modems described by Knockeart) to improve similar devices (i.e., Nakano's modems) in the same way.

J. Ground 10: Claims 17 and 18 Are Obvious Over Nakano-McGrath In View Of Nunokawa

1. Dependent Claims 17-18:

- a. Claims 17-18: The mobile navigation system of claim 15, wherein said display screen is used to display the mapping database in a head [right/left] configuration.**

360. Nakano-McGrath-Nunokawa teaches and/or suggests Claims 17-18.

361. As explained in Section XIII.D, Nunokawa teaches displaying a route/map in a head right or head left configuration on a display screen of a mobile navigation unit.

362. A POSITA would have been motivated to implement Nunokawa's head right/left configurations in Nakano's mobile terminal, when the display of the output portion of the mobile terminal (Ex-1007, 14-18) is wider than it is tall. In particular, a POSITA would have understood that displaying the reconstructed route in a head right/left configuration on the display of Nakano's mobile terminal's output portion,

as taught by Nunokawa, when that display is wider than it is tall, will improve the “operability” and increase the amount of travel information displayed on Nakano’s mobile terminal, in the manner expressly taught by Nunokawa (Ex-1011, ¶26).

K. Ground 11: Claim 19 Is Obvious Over Nakano-McGrath In View Of Endo

- 1. Claim 19: The mobile navigation system of claim 16, further including a clock coupled to said navigation computer, wherein said navigation computer is programmed to set said clock to an accurate local time in accordance with a time from said GPS receiver and a current time zone.**

363. Nakano-McGrath-Endo teaches and/or suggests Claim 19.

364. As explained in Section XIII.E, Endo teaches Claim 19.

365. A POSITA would have been motivated to implement Endo’s date/time correction method in Nakano’s system. Nakano and Endo are analogous art, as both references are directed to vehicle navigation systems. *See* Sections XII.C, G. A POSITA would have recognized that navigation systems often display date/time information together with a route. A POSITA seeking to include such data/time display in Nakano’s mobile terminal would have turned to Endo for implementation details. In particular, a POSITA would have recognized that implementing Endo’s clock correction method within Nakano’s mobile terminal would provide the expected benefit of automatically correcting the remote terminal’s time in a “convenient” and “simple” manner. Ex-1013, ¶¶5-6.

XIV. CONCLUSION

366. For the reasons set forth above, I believe that Claims 1-19 and 21-22 of the '743 Patent are unpatentable in view of the prior art.

367. In signing this declaration, I recognize that it will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place in the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

368. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner raises and to take into account new information as it becomes available to me.

369. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Respectfully Submitted,



Date: 7/17/2024