Journal of Maritime Research, Vol. V. No. 2, pp. 75-84, 2008

ISSN: 1697-4840

EXPERIMENTAL ANALISYS FOR APPLYING AIDDED SYSTEMS

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Received 7 February 2008; received in revised form 19 February 2008; accepted 7 July 2008

ABSTRACT

The work is aimed at creating an integrated system capable of receiving information from different systems of navigation through the communication protocol computing NMEA 0183 is also capable of using a computer algorithm to contrast the digital signal obtained by adapting a magnetometer (not fluxgate) the magnetic compass, signal receiver and Satellite validate these results for later use in the different teams of the bridge.

Taking as its main objective to obtain the full correction and the subsequent diversion of discrimination by applying the magnetic declination (although in principle it manually). Once developed the work could be adapted to Automatic Pilots as last generation equipment as ECDIS and AIS, resulting in a great help to the figure of the pilot or navigators in general.

Keywords: Magnetic compass, Deviation table, Fluxgate.

INTRODUCTION

Currently techniques for positioning and navigation satellites have evolved since its dizzying appearance, but do not offer the required absolute accuracy, perhaps due to its nature of gratuity, for the program to be developed. However, in the very near future, with the entry into service of the Galileo system, as well as the coexistence of Galileo with other systems such as GPS and GLONASS, CNSS, etc. Supported by

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the programs augmentation WAAS, EGNOS and MSAS, will determine the integrity required because of the contractual relationship, that are doing such a satellite receivers even more essential to what they are today (Berrocoso, 2004); (Corbasí, 1998); (Ropars, 1965).

EXPERIMENTAL DEVICE

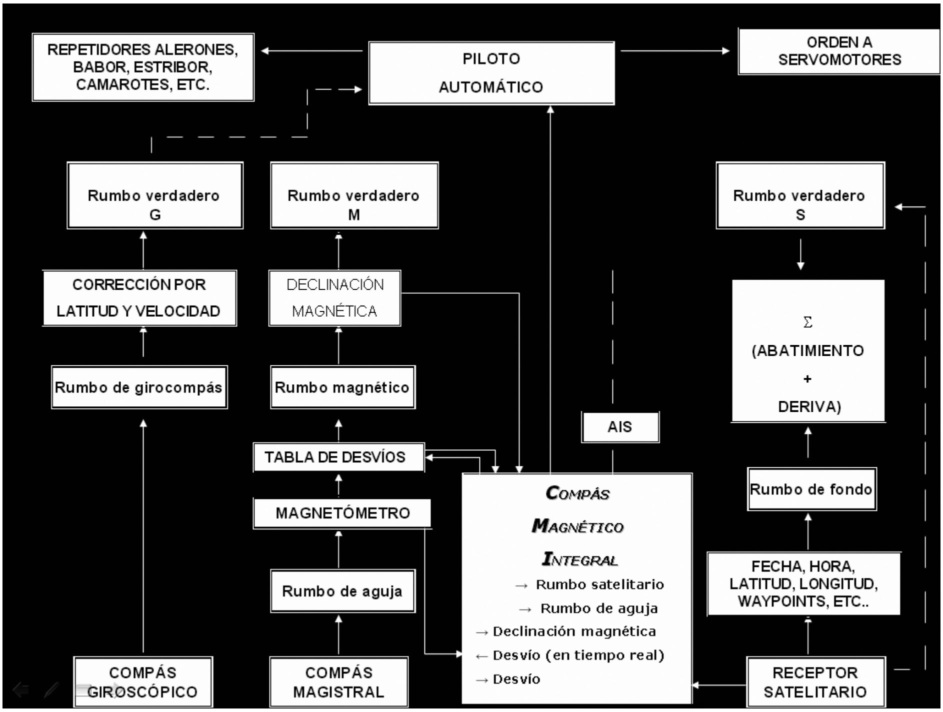

Figure 1. Block diagram of our experimental device.

The instruments used were:
That unlike conventional satellite receivers, which only provide data typical positioning, in its application to shipping, such as:

— Coordinates (latitude, longitude), Time – UTC.
— COG (Course Over Ground or Course background)
— SOG (Speed Over Ground or speed background)
— Waypoints or points of spell.

Resulting these scarce, while the compasses satellite (see figure 2), currently under development, offering a sign that more acceptable to be applied in the future to any autopilot, to be identical to that of a gyro compass, determinating virtually the true course, Moreu-Curbera and Martínez (1975); (Ropars, 1965).

Also, the magnetic compass Geomar Madrid No. 0082, Ø165mm. (see figure 3) Manufactured in Madrid Autronic-trepat with No. Registration of the mark helm 162101 / EC0735/6211/002/05/0062 Filling with liquid Geomar Ref. ISO 350.

It is for the magnetic compass or magnetic needle, which Course get the needle and the resulting chart Turnout by comparison with the magnetic Going once applied magnetic declination at Course true, (Gaztelu-Iturri, 1999); (Vila, 1994).

It represents the most autonomous and indispensable on board, the information that you provide.

The AUTONAUTIC INSTRUMENTAL company, Barcelona, with whom we worked from the outset, adapted at the bottom of the mortar that beat the magnetometer which is detailed below (see figure 4) , once achieved revises 9600 4800 bauds by its manufacturer in England to our request, precisely to coincide with the 4800 bauds on GPS and we allowed such synchronization, introducing the signal to the computer through a cable 20 meters 2 * 2 * 0.50 shielded; to enable the capture of signals from two corresponding hyperterminals one at the entrance to the beat Satellite JRC-JLR10T through a cable CFQ_ NMEA-6560 and the other a magnetometer of the mark FLUXGATE WORLD model A4020 subsystems OEM FLUXGATE COMPASS, in the version of November 2006.

Figure 2. Elements of Satellite Compass of JRC model 10T JLR.

Figure 3. Magnetic Compass Autronic-trepat Ø165mm.

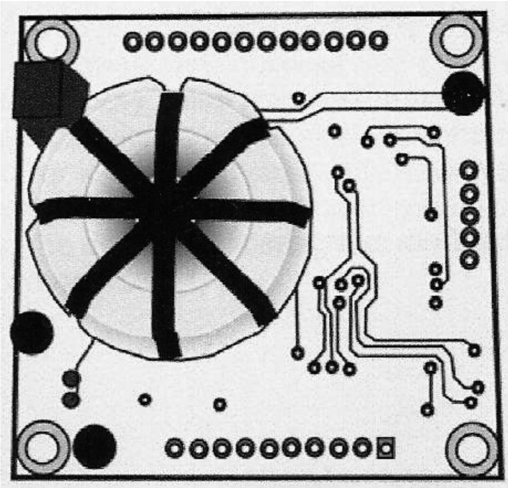

Figure 4. Magnetometer Fluxgate World Model A4020.

While conducted in Labview software (see figures 5 and 6), we could see the outlines of such a program for a graphical form, were making modifications with different programmes, making up one that was able not only programming but a rapid implementation more agile. Resulting from the latter in its real basic version 2006 (see figure 1).

The first phase of all, took place on the bridge under the School of Marine Bilbao in Portugalete, installing the double antenna of the compass satellite, cable antennas that both delimited longitudinal line bow-stern hung up the processor unit setting in the physical laboratory on second floor in Nautical School, that unit left the cable NMEA which is at the end of it, fixed a DB9 with a pin to USB adapter for the PC. This processor was fed with a transformer 24V XA Once connected both teams to check signals, we appreciate that not obtained any signal in the magnetic compass hyperterminal, we impossible the implementation of the programme, due to not being able to shut the loop, said program became crazy looking for that second figure.

In the second phase, once adapted the magnetometer to the bottom of the magnetic compass, in a more effective way, the teams were tested on the boat LAU-A "on a voyage from the Elantxobe port to Lekeitio, conducting within this Finally

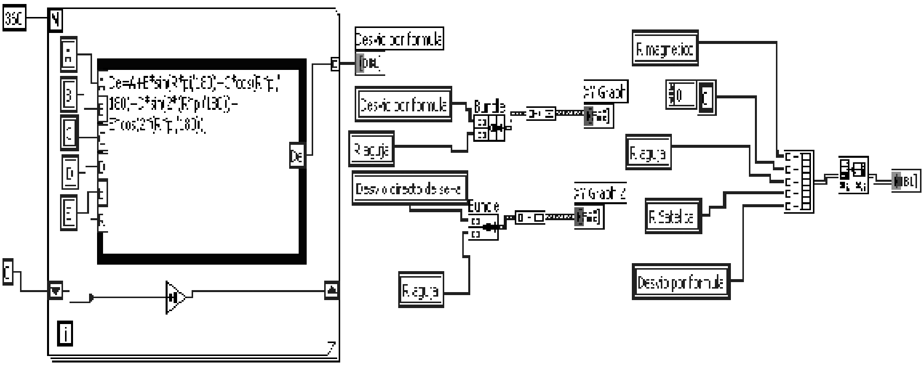

Figure 5. Deviation calculation from coefficients.

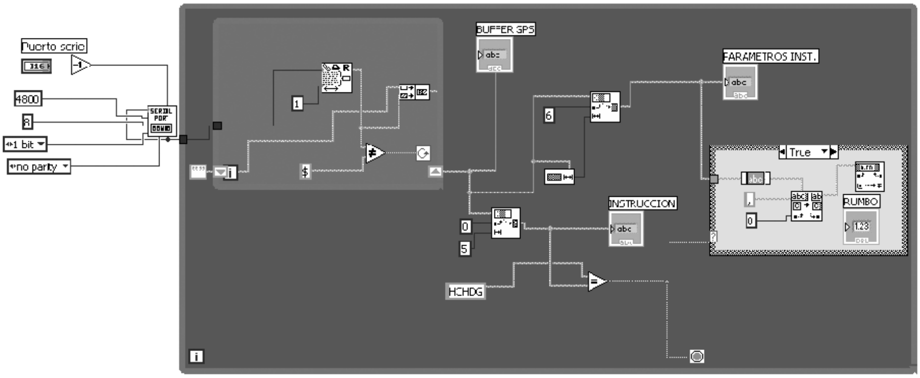

Figure 6. Information acquisition from serial ports.

port one complete revolution, which got some very satisfactory results, except for a few peaks in the graph near North and directions that corresponded to the program, not discriminated against the judgement to remedy equivalencies between the 360th and 000th causing very few data in disparate directions coming to them.

With this program, and after checking on several occasions that executing judgments adapt to the hyperterminals, in an optimal way, in addition to allowing us to create a simulation.

We embarked on board the superferry "SOROLLA" Trasmediterranea Company, which belongs to ACCIONA Group, in its journey Barcelona Palma de Mallorca-Barcelona, in order to meet our goals in this third phase, checking on a real similarity between effectiveness and signal going from the true compass and gyro compass Satellite reference.

In all tests, respected the conditions laid down the administration for the purpose of installing the magnetic needle on board, putting a meter on the deck, on a support antimagnetic, such as PVC pipe (see figure 7) of the starboard wing of the ship "SOROLLA."

Likewise, regardless of how the program works in real time, it went all the judgments NMEA0183 storing data that we were a great help as we saw later in the power readjust data for the compilation of the curves, since both at the entrances and exits of the port, it is not coming to complete all the cardinal directions, or 5 cours-

Figure 7. Magnetic Compass Integral "SOROLLA" on board.

es for the calculation of coefficients (see figures 8 and 9). Having to do the same in different tests.

This third phase of the experiment was carried out in 4 tests.

— The first appropriation to the second overall, was conducted in the ship maneouver in his departure from the port of Barcelona on Friday, June 15, 2007 at 23:00. While he was the ship docked at the station Maritime port of Barcelona, checking on the same alignment of the dock 005º until the end of the maneouver once surpassing Sierra buoy, making course to the Mallorca Island to 189º.
— The second times took place during the departure from the port of Palma de Mallorca on Saturday, June 16, 2007 at 13:30 hours.

  On this occasion was also found in the letter navigation defeat, the alignment of Peraires dock in the port of Palma de Mallorca, where the ship is docked.
— The third and rather special and meaningful was accomplished thanks to the cooperation by both the Headquarters Company Trasmediterranea fleet in the Mediterranean area, as Captain of the boat at that moment, to carry out an exercise of Man Overboard starting to (+2) 18:36:26 GMT in a situation latitude 41º11078 N, Longitude 002º13097 E up (+2) 18:43:02 GMT in a situation latitude 41º11049 N, Longitude 002º12843 E. And that allowed us during this evolution curve data storage requirements for evaluation and further study of the items.

From these tests, we note that in principle we do not consider relevant compensation for the needle since the first objective was to obtain signals from both hyperterminals, contrasting them and generate a graph that approximate real-time curve Turnout may be adapted later with the recorded data. It was considered for subsequent study, the relevance of their compensation or not, once produced and adapted the prototype Integrated Magnetic Compass physical way, the software developed.

Another factor that changed was the synchronization ranges, some of the 4800 bauds as a transfer rate of the received data (bits per second)

$ = 8 bits in the ASCII code = 1 character.

0,6 Kbits per second = 533 characters per second.

4800/8 = 600

NONE = WITHOUT PARITY = not have control digit

1 STOP = 101001, 9 para 1 (stop) o 0

NMEA 100 characters per line

From 4 to 5 lines per second

As a fourth and final phase of tests to be carried out, the computer program was implemented in the version presented here, on board of "LAU-A" boat, closed to the port Elantxobe last September, at 18:25 hours getting some desired results, allowing this modified version of the programming, making it manually calculating the curve turnout by coefficients.

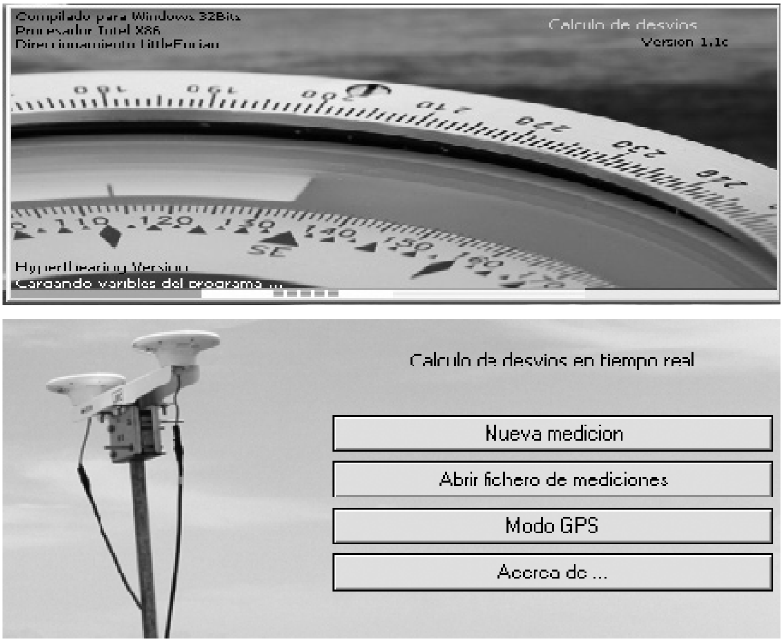

Figure 8. Presentation initial lead of the programme.

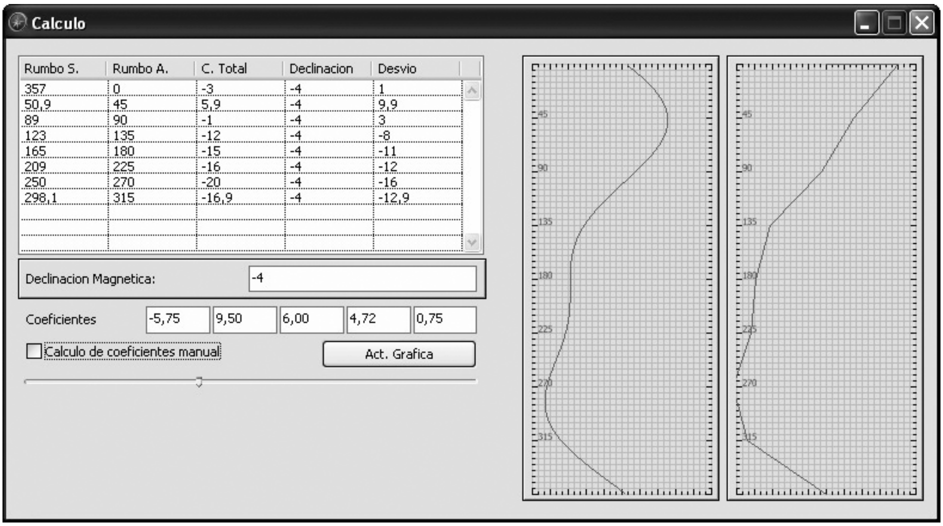

Figure 9. Lead of programme in function.

CONCLUSIONS

Following the completion of the work, we intend to complete and may present a prototype consisting of a device containing such integrated programme which will enable us to get these differences between the signals from different directions for subsequent use, having reached the following requirements:

1. Develop a computerized algorithm for the development of the diversion of the magnetic needle in real time, allowing thanks to a control system in its closed loop used in subsequent applications.
2. Establish a program that complies with the parameters of error required by the international administration IMO (International Maritime Organisation), would be able to ensure proper output signal to autopilot.
3. Achieve develop a single program that included both the development of the tablet Turnout, as the necessary signal for a given value and onward transmission through the Automatic Identification System, as well as the option to have a database of parameters earned.
4. The development of an integrated system, fully compact, offering a guarantee not only of maintaining avoiding manipulation by unqualified personnel, but to adapt to new models of satellite receivers that can be developed in the future, depending on Systems Global Navigation Satellite which are in service, not being restricted to one, if not possible adaptation of other systems that operate on open, thus ensuring the upgrade. Being easily applicable improvements in the elements of the circuit.
5. Finally, it will create a "chip" through integration of algorithmic calculations, which provide the necessary correction to the magnetic Course, for the final signal to be sent to any autopilot any type of vessel, regardless of the true Course.

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SISTEMA PARA APLICACIÓN A INSTRUMENTOS DE AYUDA A LA NAVEGACIÓN

Debido a la evolución tan vertiginosa en las técnicas de posicionamiento y navegación desde su aparición, en los sistemas globales de navegación por satélite (GNSS) que aunque actualmente americanos y soviéticos, con gps y glonass, son los únicos en servicio, se pretende en adelanto a futuros sistemas en un plazo relativamente corto, como el europeo galileo o el chino cnss, apoyados por sistemas de aumentación como waas, egnos, msas, etc… un aprovechamiento de los mismos, ya que nos ofrecerán tanto la precisión como la integridad necesaria para la ejecución de dichos programas (Berroso, 2004) (Corbasí, 1998).

En esta investigación se desarrolla y utiliza la combinación de los mismos con las ventajas que presentan los diferentes programas informáticos.

Por otra parte se pretende, no solo la integración de dicho sistema informático para una posible sustitución de los imanes de compensación, si no que dando el valor absoluto al imán como elemento de medida, evitaremos cualquier tipo de rozamiento al sustentarse la rosa con dicho imán, únicamente en líquidos de diferentes densidades, obteniendo dos tipos de lecturas, una visual directa próxima al timón y otra mediante un lector óptico de la que saldría la señal digital del rumbo de aguja según protocolo NMEA.

Así tendremos una memoria visualizada mediante un “lead” con la ***tablilla y curva de desvíos correspondiente a dicho compás en tiempo real,*** además de su posible adaptación tanto a Pilotos Automáticos como a equipos de última generación como E.C.D.I.S. y A.I.S.

A diferencia de los receptores satelitarios convencionales, que únicamente proporcionan datos característicos de posicionamiento, en su aplicación a la navegación marítima, como:

Coordenadas (latitud, Longitud),
Hora UTC,
C.O.G. (Course Over Ground o Rumbo de fondo),
S.O.G. (Speed Over Ground o Velocidad de fondo)
Waypoints o puntos de recalada.

Resultando estos escasos, mientras que los compases satelitarios, actualmente en desarrollo, ofrecen una señal mas que aceptable para ser aplicada en un futuro a cualquier piloto automático, al reproducir casi de forma idéntica su señal a la de un compás giroscópico, determinando así el rumbo verdadero (true course).

Corresponde al compás o aguja magnética, de la que obtenemos el Rumbo de aguja y la consiguiente tablilla de desvíos por comparación con el Rumbo magnético una vez aplicada la declinación magnética al Rumbo verdadero, (Delgado, 1979); (Gaztelu-Iturri, 1999).

Representando este al elemento más autónomo e indispensable a bordo, por la información que nos proporciona.

Mientras un software realizado en Labview, nos permitía visualizar los esquemas correspondientes de dicho programa de una forma gráfica, se fueron realizando modificaciones con diferentes programas, hasta confeccionar uno que fuese capaz no solo de rápida programación sino de una ejecución más ágil. Resultando este último el de real basic en su versión 2006.

Tras la realización del presente desarrollo, pretendemos concluir pudiendo presentar un prototipo consistente en un dispositivo que contenga dicho programa integrado el cual nos permita obtener dichas diferencias entre las señales de los diferentes rumbos, para su posterior aprovechamiento, alcanzado como exigencias mediante el funcionamiento en tiempo real gracias a un sistema de control en lazo cerrado mediante un algoritmo computerizado, la elaboración de los desvíos de la aguja magnética en tiempo real, para permitirnos su utilización en posteriores aplicaciones.

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- ☐ Abstract, which is to be no longer than 200 words, and should have no spaces between paragraphs.

- ☐ Key words (between 3 and 5) which will be used for computerised indexing of the work, in both Spanish and English.
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- ☐ Introduction or Problem
- ☐ Methods
- ☐ Development (application and results)
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- ☐ Endnotes
- ☐ References. Only those included in the article in alphabetical order.
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The body of the article is to be divided into sections (bold, upper-case), subsections (bold, italics) and optionally into sub-subsections (italics), none of which are to be numbered. Insert line spaces before and after the title of each section, subsection and sub-subsection. Symbols, units and other nomenclature should be in accordance with international standards.

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