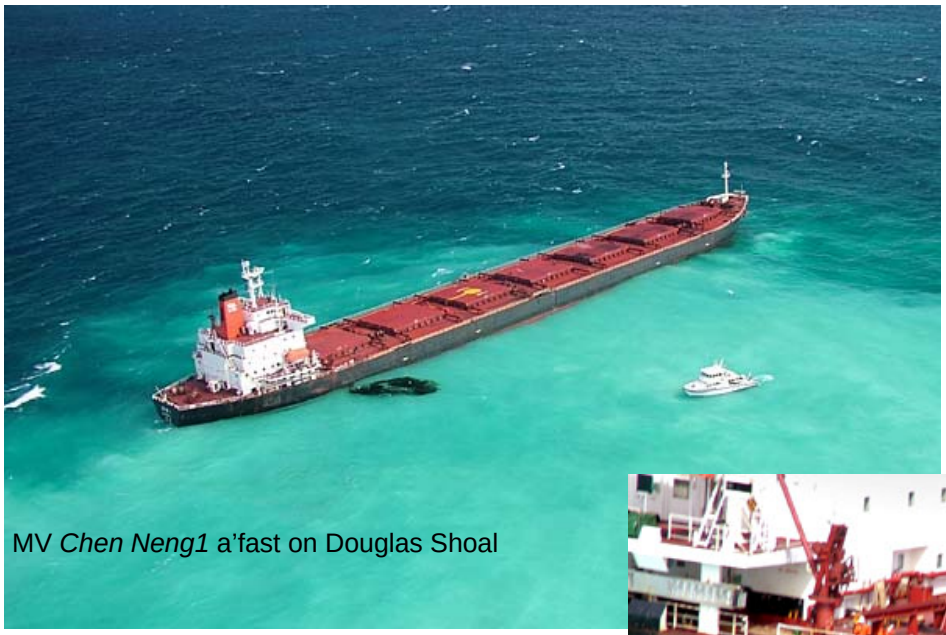
NAVIGATION

Newsletter of the Australian Institute of Navigation Incorporated

Volume 12 No. 60 January/February/March 2010

MV Shen Neng 1
How did she manage to get stuck in the Australian Great Barrier Reef Marine Park?



MV *Chen Neng1* a'fast on Douglas Shoal

No doubt that the inquiry being held from, 7 April 2010 will determine the reason why she was 15 nm off the recommended track.

Photos: Sydney Morning Herald

Oil slick on 6 April 2010

Some of our readers may not be aware of the incident, and for their benefit the 230m Chinese coal ship ran aground on Douglas Shoal about 70km east of Great Keppel Island early on Saturday 3 April 2010 spilling a quantity of oil into protected marine park waters. The ship was carrying 65,000 tonnes of coal from Gladstone Qld to China. Douglas Shoal is to the north of the Capricorn Group. One report has taken the view that the *Chen Neng 1* could have been taking a short cut during its passage to seaward. Another is that course was not altered to enter the channel between Douglas Shoal and North West Is.

The incident has raised cries for mandatory pilotage in areas near the Great Barrier Reef Marine Park. A spokeswoman from the Australian Maritime Safety Authority is said to have stated that

"the Authority would consider making pilots compulsory for any vessel over 70m on all parts of the Great Barrier Reef.. It was also considering expanding the Vessel Traffic Service, which uses sensors and radars to detect if ships ran off course"

Quote from the Canberra Times 6 April 2010

The Australian Institute of Navigation Incorporated (ABN 16 875 718 961)

Established 1949

Patron

Her Excellency Ms Quentin Bryce AC
Governor General of the
Commonwealth of Australia

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Meeting Schedule

General Meetings

are held on the second Wednesday of the month at the NSW Sports Club 10-14 Hunter Street Sydney,

1800 for 1830 dinner followed by 1930 General meeting with Guest Speaker. Please inform the Administrator if you are intending to have a meal.

Meetings for 2010 are scheduled as follows:

12 May, 9 June, 14 July, 11 August, 8 September, 13 October, 10 November, and 8 December.

Council meetings

are held in the Hunter Room commencing at 1600 and are scheduled for 2010 as follows:

9 June, 11 August, 13 October and 8 December.

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President's Report

Our year has begun with two very interesting and well attended lecture meetings. In February Derek Luxford, a Partner at Hicksons in Sydney, treated us to a very thorough story of piracy from its origins to the scene today. In March, we heard from Dr Elizabeth Bollen, Curatorial Assistant, Nicholson Museum, Sydney University. She gave us a wonderfully clear explanation not only of the mechanical features, but how the Antikythera Mechanism, an integrated system for tracking time, related to the culture of the time [2200 years ago]

At your Council's first meeting for the year we learned that our Administration Manager Jessica Wong had announced her resignation. She has accepted a new position in Singapore and this means another adjustment to the Institute's administration arrangements. It was great to have Jessica and her husband Sam as our guests at the March lecture meeting where we thanked her for her friendly and helpful management of our administration.

We are extremely fortunate that Elaine Doolan has generously offered to assist by running the administration side of our Institute.

As a result contact details will now be

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And remaining unchanged

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Our valuable contact with HMAS Watson continues and I will soon be presenting our prize to the dux of the next LONGNAV and INTNAV courses.

I look forward to catching up with Members, Fellows and Guests at a Lecture Meeting soon.

Best regards,

Ian Watkins
President

HMAS WATSON South Head, Port Jackson

The Inventor of the Global Positioning System (GPS)

On 4th May 1993, while accepting the 1992 Collier Trophy on behalf of the United States Naval Research Laboratory (NRL) for the creation of the Global Positioning System, Admiral Stan Arthur, Vice Chief of the United States Navy "made it absolutely clear to the audience that NRL led the way to GPS and took special note that NRL's Roger Easton actually "fathered" the idea." (Note 1)

The Collier Trophy is an annual aviation award administered by the U.S. National Aeronautics Association presented to those who have made the greatest achievement in aeronautics or astronautics in America with respect to improving the performance, efficiency and safety of air or space vehicles, the value of which has been thoroughly demonstrated by actual use during the preceding year.

The citation for the 1992 award of the Collier Trophy stated that the GPS team had made "the most significant development for safe and efficient navigation and surveillance of air and spacecraft since the introduction of radio navigation" fifty years earlier.

Roger L. Easton trained as a Physicist and in 1943 became an NRL employee helping efforts aimed at bringing World War II to an end. After the war, the possibility of using orbiting spacecraft for both scientific and military purposes was recognized and actively pursued by NRL; and by 1955, Roger Easton was contributing significantly to the laboratory's plan to use artificial satellites for geodesy.

Easton helped to develop the MINITRACK system which aimed to track satellites broadcasting on known frequencies; and he is credited with designing the Vanguard I satellite that was actively tracked by MINITRACK. This was launched into orbit on 17th March 1958.

When the Soviet Union launched the world's first manmade satellite into orbit on 4 October 1957, the United States of America had no means of detecting or tracking the orbit of this device. In searching for a solution, Roger Easton conceived the idea of extending the MINITRACK concept to undertake this task – and his proposal was taken up by the US Advanced Research Project Agency (ARPA).

This led to the construction of the U.S. Navy Space Surveillance System beginning in 1958. Initial operational capability was achieved in 1960 with full operational acceptance taking place in 1966. By then the system could detect, track and determine the orbits of all types of earth orbiting satellites, space vehicles and other orbiting objects.

The origin of Roger Easton's plan leading to the use of manmade earth orbiting satellites for navigation and precise time transfer was a scientific document of 13th April 1955 given the title "A Scientific Satellite Program." In it he conceived the idea of using synchronized clocks in manmade satellites while conducting a ranging and velocity experiment to enhance the capability of the US Navy Space Surveillance System. In 1963 he filed a patent that provided the basis for GPS passive ranging and the simultaneous synchronization of the navigator's clock with the satellite clock.

Roger Easton (left) supervising the placement of Vanguard 1 satellite atop the Viking launch vehicle (Photo Business Wire)

Many were then involved in getting satellites into orbit and in demonstrating and proving key GPS concepts. "The NRL designed and built Navigation Technology Satellites NTS-1 and NTS-2, provided the space qualification test for rubidium and cesium atomic clocks, the first broadcast of the GPS spread spectrum signal from space, verification of the relativistic clock effect for GPS, measurement of radiation effects, laser retro reflector tracking, longevity effects on solar cells, and initial orbital calculations. The two NTS spacecraft also demonstrated the worldwide transfer of time and validated the GPS error budget." (Note 2)

The instantaneous three-dimensional position determination capability of GPS results from Roger Easton's concept of using synchronized atomic clocks in the Navstar GPS satellites combined with simultaneous passive ranging measurements to four or more satellites. "Because of the inherent syntonisation provided by the atomic clocks, four or more simultaneous Doppler measurements provide a near-instantaneous measurement of velocity in all three components. In addition to the position, velocity, and passive time transfer capability of GPS, it is also possible to completely determine the navigator's attitude through the use of an antenna array that is the direct application of the Space Surveillance System interferometer type of measurement."

Easton first registered his embryonic GPS patent in 1974 calling it a *Navigation System using satellites and Passive Ranging Techniques* and noting that it was based on a *time based navigational system with passive ranging, circular orbits, and space borne high precision clocks synchronized to a master clock.*

Roger Easton was awarded the United States National Medal of Technology by President George W. Bush and more recently has been inducted into the US National Inventors Hall of Fame.

1. Web site www.gpsinventor.com/
2. Ibid.

Global Navigation Satellite Systems – An Update

Global navigation satellite systems continue to proliferate and it is anticipated that in the coming years four main systems will be operational. The current status of these navigation systems and expectations are as follows:

GPS (Global Positioning System) operated by the USA. At present this is the only fully operational global navigation satellite system. It consists of up to 32 satellites spread between several orbital planes and with this space craft in orbit about 20,000 km above the earth. The system has two main modes of operation, one for military users and the other for all others.

GLONASS (Global'naya Navigatsionnaya Sputnikovaya Sistema) operated by Russia. As at 30 March 2010, GLONASS has 23 satellites in the constellation of which 21 are operational. The system requires 18 satellites for continuous navigation services covering the entire territory of the Russian federation and 24 satellites to provide services worldwide.

Russia claims its aim is for GLONASS to work hand-in hand with GPS rather than being a direct competitor. The head of the Russian Federal Space Agency is reported to have said his country had chosen to go down the path of integrated compatibility with the global positioning system operated by the USA. He said “we now use a two-signal receiver that supports both GPS and GLONASS” because “in the northern latitudes getting a GPS signal is problematic.”

He added that GLONASS is also vital for Russia’s national security and that it is essential in times of tension or conflict such as occurred during the Russia-Georgia war of August 2008 when other global positioning systems might not be available or reliable.

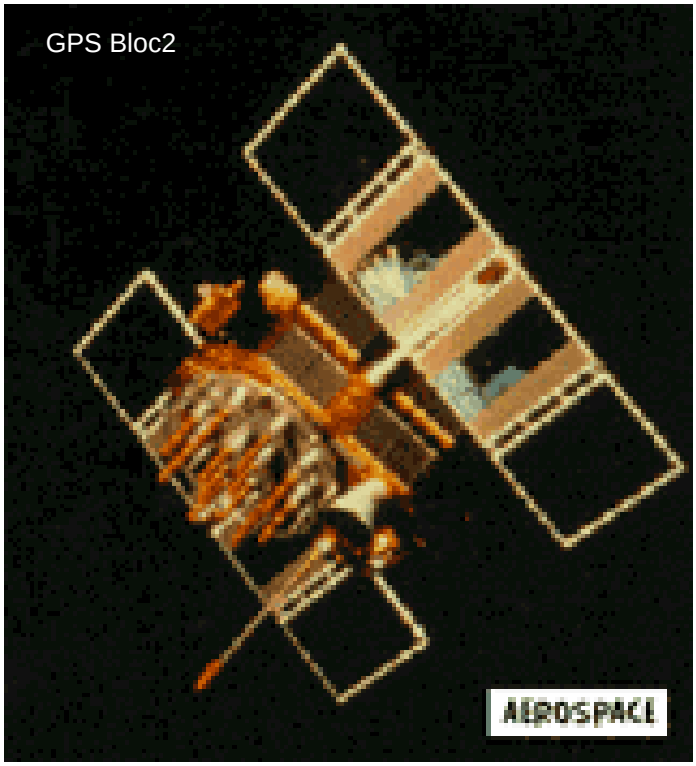
GALILEO is named for the Italian astronomer Galileo Galilei and is sometimes described as the *Galileo positioning system***.** It is being brought into operation by the European Union. The project is an alternative to the US and Russian systems and is aimed at providing an independent positioning system upon which European nations can rely even in times of war or political disagreement during which Russia or the USA could deny the use of their national systems to others by encryption.

On 30 November 2007 the European transportation ministers reached an agreement that GALILEO should be operational by 2013 but subsequent information suggests 2014 is more likely. The plan for the mature system is for two ground operations centers, one near Munich, Germany, and another in Fucino, 130 km east of Rome.

The intention is that GALILEO will provide more precise measurements than available through GPS or GLONASS including height above sea level, and better positioning services at high latitudes. Like the GPS, use of basic (low-accuracy) GALILEO services will be free and open to everyone. However, the high-accuracy capabilities will be restricted to military usage.

BEIDOU/COMPASS is to be operated by China. The new system will consist of a constellation of 35 satellites, with 5 in geostationary orbitand 30 in medium Earth orbit thereby offering complete coverage of the globe. Like other global positioning systems, COMPASS will have two levels of positioning service, one open to all and the other restricted for military usage.

Frequencies for COMPASS are allocated in four bands: E1, E2, E5B, and E6 and overlap with GALILEO. Overlapping could be convenient for receiver design but may result in inter-system interference, especially within E1 and E2 bands allocated for GALILEO’S publicly-regulated service. However, under International Telecommunications Union (ITU) policies, the first nation to start broadcasting in a specific frequency will have priority to that frequency, and any subsequent users will be required to obtain permission prior to using that frequency, and otherwise ensure that their broadcasts do not interfere with the original nation's broadcasts. If COMPASS satellites start transmitting in the E1, E2, E5B, and E6 bands before GALILEO satellites China may have primary rights to these frequency ranges.



(Continued on page 5)

(Continued from page 4)

Although almost nothing has yet been officially announced by Chinese authorities about the signals of the new system, it is understood that the launch of the first COMPASS satellite provided independent researchers with an opportunity of studying the general characteristics of the signals.

QZSS (**Quasi-Zenith Satellite System)** is a proposed three-satellite regional time transfer system and enhancement for the Global Positioning System receivable within Japan. The first satellite is currently scheduled to be launched in 2010. Full operational status is expected by 2013.

The system was authorised by the Japanese government in 2002 but work on the concept has suffered some setbacks. QZSS is targeted at mobile applications, to provide communications-based services (video, audio, and data) and positioning information. QZSS will provide only limited accuracy on its own and is not currently required in its specifications to work in a stand-alone mode. As such, it is viewed as a global navigation satellite system augmentation service.

The plan is to place the satellites in a periodic highly elliptical orbit. These orbits will allow the satellite to dwell for more than 12 hours a day with an elevation above 70° (meaning they appear almost overhead most of the time) and give rise to the term "quasi-zenith" for which the system is named.

IRNSS (Indian Regional Navigation Satellite System). This is being developed by the Indian Government which approved the project in May 2006. The aim at that time was to have the system completed and operational by 2012. A goal of complete Indian control has been stated, with the space segment, ground segment and user receivers all being built in India.

The proposed system will consist of a constellation of seven satellites and a support ground segment. Three of the satellites in the constellation will be placed in geostationary orbit and will be located at 34 East 83 East and 132 East longitude. The plan is for them to orbit with a 24,000 km apogee and 250 km perigee inclined at 29 degrees. Two will cross the equator at 55 East and two at 111 East. Such an arrangement would mean all seven satellites would have continuous radio visibility with Indian control stations. The satellite payloads are likely to consist of atomic clocks and electronic equipment to generate the navigation signals.

The navigation signals are likely to be transmitted in the S-band frequency (2–4 GHz) and broadcast through a phased array antenna to maintain required coverage and signal strength. The satellites would weigh approximately 1,330 kg and their solar panels generate 1,400 watts.

IRNSS is intended to provide an absolute position accuracy of better than 20 meters throughout India and within a region extending approximately 2,000 km around it.

CT Systems releases Renewed Maritime Navigation Software

In mid June 2009 CT Systems released “a completely renewed version of their Viking navigation software. The new version is targeted for use in all professional maritime areas where accurate positioning and navigation is demanded.”

“The most important innovations in the new version are the renewed user interface, support for CAD, ASCII and Excel files, local chart projections, and the worldwide navigation charts database from Navionics.”

“One of the main objectives during the development of the new Viking software was, and still is, its use friendliness. Despite the fact that the internal workings of Viking are highly complex, the software itself remains very easy to use.”

Viking is available in multiple versions, including a lightweight version providing the basic necessities and an offline version for the preparation of maps and projects.”

“Also new to Viking is the modules interface, which enables the programme to gain specific functionality. The Anchoring Module, for example, has been developed for, and in cooperation with, several large offshore companies for the planning and executing of complex anchoring plans. In addition the Gridding Module enables dredging vessels to accurately deposit stones on the sea floor.”(Note 1)

1. www.offshore-technology.com/contractors/computer/stsystems/press2.html

Some 25 million air passenger bags lost in 2009

AFP - Some 25 million bags went missing in the world's airports in 2009, costing the airline industry some $2.5 bln, according to data released by air transport electronics group SITA

Just over half of these bags, 52 percent, were misplaced during aircraft transfers, while another 16 percent did not arrive at the destination on time as they were not loaded on planes, luggage tracking data showed.

Other problems included ticketing errors, mishandling at the arrival point, and tagging problems, said SITA.

It was citing data from the World Tracer luggage tracking database, which is co-sponsored by the company and airline industry group IATA.

The most of the missing luggage was traced and returned within 48 hours.

But 3.4 percent of the total -- 850,000 items -- either remained unclaimed or were stolen, added SITA, which makes luggage handling systems.

Single European Sky Air Traffic Management Research Programme (SESAR)

The management of air traffic over Europe continues to challenge mankind not least because of the need to accommodate commercial air traffic, private air operators and military air control needs by many nations.

For the first time in European air traffic management history, an air traffic management improvement programme is involving all the main players – legislators, civil and military operators and the aviation industry in its broadest context. All are committed to defining and implementing a pan-European air traffic management system and supporting the Single European Sky legislation.

The SESAR objectives are to eliminate the fragmented approach to air traffic management, transform the European air traffic management system, synchronise the plans and actions of the different partners and federate resources. The aim is to achieve these objectives in three phases, the first of which, the Definition Phase, was completed in 2008. Phase 2 now underway, the Development Phase runs until 2013 and the final phase, the Deployment Phase is to run from 2014 to 2020.

The development phase will produce the required new generation of technological systems and components as defined in the definition phase. For this phase the European Commission has proposed the creation of a joint undertaking, based on the GALILEO model, which will federate public and private funds (Community, Eurocontrol, industry and third countries) and guarantee a single management structure for the project, as well as a governance model associating all involved including both public and private entities.

The deployment phase will seek to build the new air traffic management infrastructure at a wide scale both in Europe and in partner countries. This will be carried out under the responsibility of the industry without further public funding.

The transition to the new air traffic management system will pose many challenges and place additional reliance on global navigation satellite systems. One author suggests the from 2020 the navigation baseline will be predominantly founded on satellite based navigation as the primary means for aircraft positioning for all flight phases. It is suggested there will be reliance on multiple frequency satellite constellations with ad-hoc augmentations. Another notes a particular challenge in ensuring compatibility between civil developments and published military plans in the area of navigation and landing systems.

Australia begins new climate change satellite programme

"Curtin University of technology is heading up a new $8million space technology partnership that will address the issue of climate change with the use of its Global Navigation Satellite System research Laboratory."

"The lead scientist in this new endeavour is Dr Peter Teunissen, who heads up Curtin University's Global Navigation Satellite System Research Laboratory."

"Along with the Curtin University of Technology, whose main campus is in Perth, Western Australia, the $8 million project also includes RMIT University, the University of New South Wales, the Bureau of Meteorology, Electro Optics Space System, GPSat Systems Australia Pty Ltd, National Space Organisation, Taiwan, and NOAA's World Data Centre for Meteorology."

" According to the Curtin University media release (CD056/10) dated March 16, 2010, entitled *Satellite technology to monitor climate change,* the funding for the programme is coming from the Australian Government through the Australian Space Research Programme."

"Dr Teunissen, who is a professor within the Department of Spatial Sciences (West Australian School of Mines), is leading this three year project to develop the next generation global navigation satellite system (GNSS) through the development and ;use of new methods and algorithms."

"Such advanced GNSS technology will include the ability to model atmospheric and climate conditions and to track operational satellites and inoperable human-made objects (commonly called "space junk")."

Teunissen state in the Curtin article '*The new space technology programme is which we will be involved is a vital step towards improving our understanding of climate change in Australia and will play a critical role in the way we cope with changes to our environment."* (Note 1)

1. www.offshore-technology.com/contractors/computer/stsystems/press2.html

Photo; EUROCONTROL

The Possibility of an Increase in Groundings due to Navigational Chart Errors

"Grounding incidents due to *navigational chart errors* may increase over the next few years, warns Maritime Accident Casebook in its latest broadcast at MaritimeAccident.org, The Case of the Unwatched ZOCs. The prediction is based on more vessels, especially passenger vessels, entering areas poorly surveyed areas, and overconfidence in ECDIS displays.

The programme tells the story of the grounding of the German-flagged Pacific Challenger on an uncharted reef in April 2008 while en route to Oro Bay, Papua New Guinea, from Rabaul, New Britain. The vessel was under charter to Swire Shipping.

Says writer and narrator Bob Couttie: "There is good reason to expect this sort of incident to increase in numbers, ranging from cruise ships looking for more exotic and unusual destinations, the development of offshore wind farms and merchant vessels entering less well-known areas to reduce costs.

"It's often forgotten that large parts of the world are unsurveyed or were surveyed using rudimentary equipment like leadlines more than a century ago. Add to that the fact that seismic activity can radically alter seabed profiles in some places, many of which have not been surveyed in many years. As ECDIS becomes more and more common there is a risk of accepting electronic charts as more accurate even though they may be derived from paper charts with old or inadequate survey data."

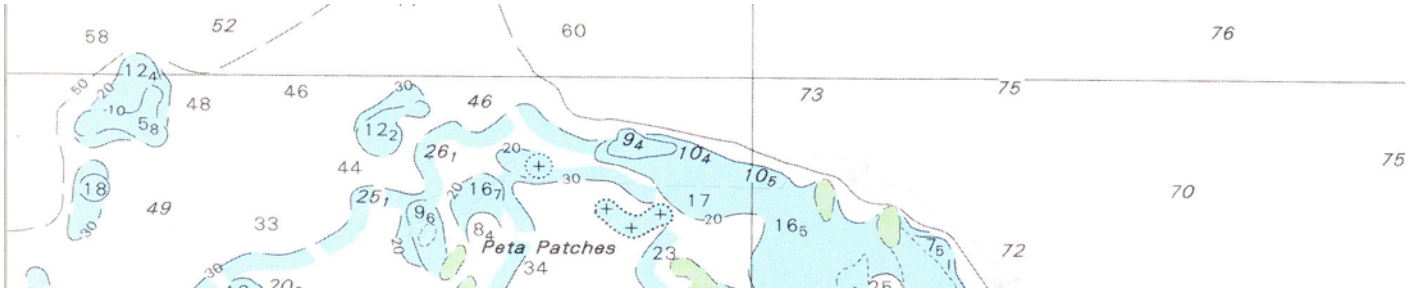
Pacific Challenger hit a reef in an unsurveyed area, the jack-up barge Octopus grounded off the Orkney Islands in 2006 while under tow in depths that had not been surveyed since the 1840s. Sea Diamond, a cruise ship, hit a rock in 2007 that was wrongly positioned on the official charts. These incidents can be very serious, Sanko Harvest grounded on an uncharted reef off Australia in 1991 and caused what was then the country's biggest oil spill. The stone-carrier Rocknes hit a rock and capsized off Norway with the loss of 18 crew.

Both Britain's Maritime Accident Investigation Branch, MAIB, and Germany's BSU have expressed concern over the issue.

Says Couttie: "If you go through an an area which is poorly surveyed or unsurveyed then, regardless of what's shown on the chart, you really have to think whether you should be there at all. If you do, then it's important to check the chart source data diagram or Category Zones of Confidence, CATZOCs, to see just how reliable the chart, whether paper or ECDIS, actually is. ECDIS isn't necessarily going to be more accurate than paper."

Like all Maritime Accident Casebook podcasts The Case of the Unwatched ZOCs draws on a real-life incident to enhance safety awareness aboard ship and help make seafarers, their ships, and the seas safer. Now in its third year, Maritime Accident Casebook,remains a free resource for seafarers and others concerned with safety management and awareness training, is supported by donations and services to the industry". (Note 1)

1. http://gcaptain.com/maritime/blog/case-unwatched-zoc-vessel-grounbdings/



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