THE JOURNAL OF NAVIGATION (2010), **63**, 545–556.
doi:10.1017/S037346331000010X

Experiences with Compasses in the Mid-20th Century

John Kemp

(*With contributions from Norman Cockcroft*, *Sven Gyldén*, *Mirosław Jurdzinski*, *Peter Lyon*, *David Page*, *Tom Sellers and Søren Thirslund*)
(Email: prof.kemp@talk21.com)

This paper presents the thoughts and experiences of marine navigators of the mid-20th century in their use of compasses during the transition from magnetic to gyro compasses.

KEY WORDS

1. Gyro compass. 2. Magnetic compass.

1. INTRODUCTION. In the mid-20th Century, ships' magnetic compasses had hardly changed in design or construction since Victorian times. Gyro compasses, on the other hand, were comparatively new devices and were by no means installed in all ships, even relatively large ships. This paper is a collection of first-hand experiences in the practical use of compasses during the period in question. Old sailors' tales, if you like.

2. MAGNETIC COMPASSES. Magnetic compasses of the time were often mounted in shrines of teak and polished brass. The purpose of these binnacles was to support the gimbal system in which the compass bowl was slung, to provide lighting for night-time viewing of the compass card and to house the system of correctors. These included horizontal and vertical permanent magnets, a pair of soft iron spheres and a vertical, soft iron Flinders' bar.

Every few years, a compass adjuster would *swing* the ship to adjust the correctors and compensate for the deviating effect of the ship's steel structure on the compass. On leaving the ship, he would hand a *deviation card* to the captain, setting out the residual deviation on all headings of the ship. This would normally show that the residual deviation was zero on all headings except, perhaps, half a degree on south-west, to show that the compass adjuster was a mortal being despite the apparent magic he had performed. Mortal, he might or might not have been, but his deviation card would have no relationship with the real world whatsoever. However, it was routine for us to check the compass error by Sun or star bearings at least once on each watch, and more often if the ship made a significant change of heading, so we soon discovered what real deviations the adjuster had left us with.

In theory, it was possible, and desirable, that ships' officers should adjust the correctors as a voyage proceeded. In practice, the only thing that Merchant Navy officers remembered from the instruction they received on this subject was that it was a

hideously complicated process and that it was best to leave the things alone. My late friend John Klinkert was co-author, with George Grant (both early FRINs) of *The Ship's Compass* and he maintained that a shipmaster would take the binnacle keys from a compass adjuster as he was leaving the ship and lock them in the ship's safe on the grounds that, if anyone were to open the binnacle door, the devil would leap out.

British merchant ships of the period used both dry and liquid card compasses. Dry card compasses were thought to be more sensitive and were often used for the standard compass on the monkey island, with an all-round view to facilitate taking bearings. Liquid card compasses were thought to be more stable and were often used as steering compasses in the wheelhouse. In fact, liquid cards of the time were perfectly satisfactory for all purposes and the continued use of dry cards for standard compasses was probably a carry over from Lord Kelvin's powers of persuasion as a salesman in the previous century.

3. GYRO COMPASSES. Unlike the gyro-magnetic compasses carried by aircraft in the mid-20th century, a ship's gyro compass is north seeking in its own right. Although remarkable feats of precision engineering for their time, the suspension and control systems were crude by today's standards. This was compensated by the fact that the gyroscopes themselves were massive. Of the models usually carried by British ships, the Sperry compass had a rotor weighing 24 kilogrammes and even the much smaller Brown compass weighed 2 kilogrammes. The compasses would usually be housed in a special Gyro room, ideally situated somewhere near a ship's metacentre to minimise accelerations due to a ships' movement in a seaway. Control systems for sensing the gravity vector and providing north-seeking torques were liquid-mechanical and the follow-up systems which operated repeater displays on the bridge were electro-mechanical, needing frequent maintenance.

4. EXPERIENCES. It is hoped that the following sections will provide a flavour of the way compasses were used in merchant ships during the mid-20th century.

4.1. *Going Round in Circles*. (*John Kemp*). It was a soporific, black velvet night, such that there was no perceptible boundary between the sea and the sky, and one could only infer the position of the horizon as an indeterminate border above which there was a blaze of brilliant stars. We had cleared the Mozambique Channel, heading northwards from the Cape to the Persian Gulf. It was the middle watch, at about 0200, with visibility effectively unlimited (i.e. stars shining brightly near the horizon were many light-years distant). The sea was glassy calm and the nearest land, the Horn of Africa, was more than a day's steaming away on the port beam.

Outside the engine room, the only people even half awake were a lookout on the fo'csle head, a quartermaster on the wheel and myself as officer of the watch. I was out on a bridge wing, enjoying the peace and quiet. Deep in the water I could see spectacular flashes and whirling spirals of phosphorescence as myriads of photoplankton were disturbed by the ship's bow wave. Magical, I was thinking, but, despite my seeming lack of attention I would, like all watchkeepers, have been instantly aware of the appearance of the distant light of another ship or anything else that did not fit into the expected pattern of events.

And so it was that I suddenly became alert when, ahead of the ship, there appeared a line of breakers, marked by bright phosphorescence. It couldn't be a reef, I told myself, there was no shallow water within hundreds of miles. Then I looked up at the sky and was disconcerted to see that the stars were all rotating steadily in a clockwise direction about a point directly above my head. Dismissing my first thoughts that the universe might have become dysfunctional, I realised that the ship was turning to port and, in fact, had completed nearly 360 degrees while I had been dreaming the watch away. The line of phosphorescence ahead was our own wake.

Thoroughly awake by this time, I checked the gyro compass repeater in the wheelhouse and found that the card was steadily rotating in an anti-clockwise direction, click by click of its stepper motor. The quartermaster, meanwhile, had his eyes fixed on the heading as shown on the gyro repeater, and was quite oblivious of the fact that he had only been able to keep his lubber line against the set course by steering the ship in a circle. "*Steer on the magnetic compass*," I instructed him, as I put my cap over the offending gyro repeater. The ship subsided onto her proper heading, the heavens stopped spinning and all was right with the world again.

In those days the Brown gyro compass had a follow-up system actuated by the air pressure generated in the rotor case by the spinning gyroscope. The air was expelled through a jet on the side of the case. Two paddles were pivoted to the follow-up system and the stream of air impinged on one or the other of the paddles depending on the sense in which the follow-up system was misaligned with the gyro axis. The paddles controlled a two-way switch which caused the follow-up motor to drive the system towards alignment with the gyro axis. As a result, the follow-up system was driven alternately in one direction and then the other so that it oscillated continuously about the position of perfect alignment with the gyro axis. The air pressure generated in the rotor case was very light, and the constant electrical make-and-break caused sparking and pitting of the switch contacts. The system was somewhat fragile!

At 0200, on the middle watch, the paddles had stuck on one side of their travel and the switch completed a circuit which drove the follow-up motor continuously in one direction instead of oscillating. Of course, the steering repeater on the bridge faithfully followed suit.

The next morning, a drop of oil on the paddle pivot and a rub with some crocus paper across the contact points of the switch recovered the situation. I duly reported to the Captain that the gyro compass had failed during the middle watch and was now fixed. But I said nothing to him about having taken his ship through an unscheduled 360 degrees turn in the early hours of the morning. That was my secret. I don't believe even the quartermaster understood what had happened although he must have been aware that something odd was going on. He had blindly followed the compass repeater without looking out of the window.

A few years after this episode, gyro compass manufacturers began to use electronic follow-up sensors so that Brown's mechanical paddles and sparking make-and-break switches became redundant. The new gyro compasses required less maintenance and became more reliable. There was clearly room for at least one second mate to become more reliable too.

4.2. *Aground on a Coral Reef*. (*Norman Cockcroft*). In May 1950, after I obtained my 2nd Mate's Certificate, I joined the *Silverbriar* as third officer. The vessel's navigational equipment included radar, gyro compass and magnetic compass. At that time relatively few merchant ships were fitted with radar and the early sets tended to

be unreliable. None of the officers on that ship had received any training in the use of radar. Gyro compasses were fitted to most ships at that time but, in my experience, tended to be unreliable. The *Silverbriar* had an unusual feature. She had two funnels, the forward one of which was a dummy. This may have improved her appearance but a disadvantage was that the directive field at the standard magnetic compass was reduced in strength due to being closely surrounded by the steel plating at the top of the dummy funnel.

A few months after I joined the ship she made a short overnight run between two ports on the north coast of Java. The radar was in use but the gyro compass was defective and had been shut down. The ship was being steered with reference to the steering magnetic compass. As the ship had not been on a westerly course in low latitudes for several months the master estimated the deviation based on values experienced in fairly high northern latitudes. Unfortunately the sky was overcast so it was not possible to take an azimuth of a star or planet to determine the compass error. As it was only a short overnight run the master decided it was not necessary to stream the patent log but as the ship was proceeding at reduced speed this made it difficult to estimate distance covered.

When I came to the bridge at midnight at the start of my watch the sea was flat calm. There were no echoes showing on the radar. The master then told me that he was very worried about the ship's position. A shore navigational light had been sighted at an unexpected time and place. A few minutes later the ship ran aground on a coral reef.

After some initial attempts had been made to refloat the ship the master told me to turn off the radar. Before doing so, I looked at the display and, to my surprise I found that echoes from the nearby island were now clearly shown. We were able to determine the position and it became apparent that the characteristic of the shore light had been changed from that shown on the chart. The magnetic deviation was obtained and found to be considerably different from the value estimated by the master.

After the ship was refloated we returned to our previous port to discharge cargo before going into dry dock. It was then that we received a Notice to Mariners to say that the characteristic of the light had been changed to be almost the same as the characteristic of the neighbouring light.

The master had been on the bridge for the whole time from leaving port until going aground. He cabled in his resignation and a new master came out to the ship a few days later. I felt very sorry for the master as he was the senior master of Silver Line and this was the end of a distinguished career. Luck was against him that night as the gyro had broken down, the radar was defective, it had not been possible to check the error of the magnetic compass and the characteristic of the light had been changed. How different things are now with satellite navigation!

4.3. *Entering a Minefield.* (*Norman Cockcroft*). On a voyage from Cuba to Japan in 1953 as we crossed the Pacific on a westerly course exceptionally bad weather was experienced due to encountering a series of vigorous depressions. Navigational equipment fitted included radar and gyro compass but the gyro was out of action for the final part of the voyage.

As we approached Tokyo Bay, course was altered to approximately due north to go through a narrow passage between two areas shown on the charts as being dangerous due to mines. Due allowance was made for magnetic variation and deviation as determined from being on the same course on previous occasions. However,

it soon became apparent from the radar that the vessel was not making good the course set and was passing through the danger area. Fortunately we were able to move quickly back to safe waters.

We had to spend two or three days at anchor waiting for a berth so the opportunity was taken to check the deviation of the standard magnetic compass as the vessel swung through northerly headings. It was found that the deviation was initially about 15° different to values previously experienced on the same headings. Over the next two days the deviation gradually got back to the previous amount. The master and officers were puzzled as to what had caused this change.

About two years later I attended the Sir John Cass College in London to prepare to take the examination for Master's certificate. John Klinkert, who was lecturing on magnetic and gyro compasses, told us about retentive error due to sub-permanent magnetism which may occur when a ship has been on the same course for a long time, especially if bad weather is encountered. I told him about my experience and this may have influenced him to include an explanation in the second edition of *The Ship's Compass*.

4.4. *Stranger in the Wheelhouse*. (*Peter Lyon*) The wheelhouse was full of men in bowler hats (standard uniform for Marine Superintendents) and ladies with clip-boards whose sole function seemed to be to ensure that I, as 3rd Mate should not keep the chair with arms in my cabin – such chairs were only for 2nd Mates and above. The occasion was the pre-voyage inspection in Birkenhead when the ship was handed back to the Captain and his officers.

Through the crowd of very important people could be seen a large and strange looking structure, shrouded in a canvas cover, standing behind the compass binnacle. The 2nd Mate asked the most junior Superintendent what this unfamiliar structure might be. The Superintendent, looking a little shocked by being approached by a mere 2nd Mate waved towards the chartroom and said "*The manual is in there, read the instructions*" as he hurried off the bridge, anxious not to be left behind or to invite any further question. Once the bridge was clear of the shore party, the 2nd Mate and I undressed the structure, uncovering a brass confection of wheels and levers and identifying itself as a Sperry Automatic Pilot. My priority was then to retrieve my chair with arms while the 2nd Mate discovered a large wrapped parcel on the settee in the chartroom addressed to the Master which, in due course, turned out to be the manual. The Captain ordered the 2nd Mate to find a home for the manual in the chartroom; to leave the Sperry structure alone, cover it up and not to make any further investigation until we were in open waters clear of Ushant.

Curiosity ensured the manual had been thoroughly read, if not understood, by the time we were in the Bay of Biscay and the first tentative trials of the auto-pilot were made, with all hands keen to see how this apparatus might work. Perhaps it was due to the quartering swell, but the auto-pilot seemed most reluctant to maintain a reasonably constant course and at times seemed determined to turn us beam on to the swell. Trials were quickly abandoned until we had calm seas and the quartermaster returned to the wheel, clearly unimpressed with his robot substitute.

Eventually we gained self-taught confidence in the auto-pilot, despite complaints in the early trials by the 2nd Engineer that we would wreck the steering motor. Nevertheless the quartermasters stood their watches by the helm for the remainder of the voyage and the manual gained a single sheet of paper describing how to operate the stranger.

4.5. *The Off-Course Alarm*. (*Peter Lyon*) An altogether too common problem with the marriage of the early auto-pilots to the gyro compass was that a failure of the gyro could result in the auto-pilot taking the ship on a circular tour of the sea (see section 4.1). Clearly some system whereby this failure could be quickly notified, if not remedied, was necessary.

On a later pre-sailing inspection, a large ring was discovered, placed over the steering compass in the wheelhouse, which, when an appropriate switch was found and activated, caused a blue light, if I remember correctly, to shine on the compass card. Tracking down a Superintendent I was advised this was an *Off Course Alarm* and, yes, the manual was in the chartroom. Indeed the device turned out to be wonderful in its simplicity. It could be set to warn if a given deviation from course took place by reading the magnetic compass heading and sounding an effective audible alarm should the gyro and magnetic headings differ by more than a set value.

As we soon discovered however, the steering compass suffered from a lack of proper damping, with the result that in almost any conditions of rolling or pitching, the steering compass would oscillate so much that the off course alarm was almost continuously buzzing. Having just gained my Master's Certificate and even having some of my compass correction notes with me, I cautiously approached the Captain and offered to demonstrate how I would dampen the oscillations. My offer was, somewhat too firmly I thought, refused and the off course alarm was switched off for the rest of the voyage. The Bridge Orders were amended to emphasise that watchkeepers' must make sure the proper course was being steered at all times.

(The unreliability of the magnetic steering compass did not seem to be a particularly unusual matter. Some years later, as a VTS Duty Officer, a pilot drew my attention to his bringing a ship into the Thames estuary with a lifeboat compass strapped to a chair in the wheelhouse. The gyro had failed and the steering compass oscillated too much to be of any practical use.)

4.6. *A Lightning Strike*. (*Mirosław Jurdzinski*) In January 1952, I was sailing onboard an Empire type[1] vessel of 10 000 dwt, with a shipload of sugar to China (Chingwantao). I kept the 20.00–24.00 hour watch as a lookout. The vessel was navigating through the Malacca Straits in deteriorating atmospheric conditions. Squalls, rain, lightning and thunderstorm restricted the visibility as we were approaching a difficult passage off the One Fathom Bank. We could see the flashes of the lighthouse on a relative bearing of 15 degrees to port. Suddenly lightning struck the vessel's foremast, and the top light on the foremast went out. The pouring rain restricted visibility and the flashes from the lighthouse could no longer be seen.

After a while, when the rain became less intense, I noticed the flashes from the One Fathom Bank some five to ten degrees to starboard, although the helmsman had maintained a steady compass course of 100 degrees. The third officer notified the Master who was in the chartroom. The course was immediately altered to starboard so that the vessel safely passed with the lighthouse on the port side.

Many years later, when I was giving lectures in navigation to students at the Gdynia Maritime University (Academy), I understood that a sudden, large change of compass deviation had occurred as a result of electromagnetic induction in the

[1] The term "Empire Ships" covers a wide range of vessel types, many, including those to which Miroslaw refers, being hurriedly built in WWII. During the war, Empire Ships were usually owned by the UK Ministry of War Transport, but managed by established shipping companies.

foremast. The helmsman had maintained the given compass course, but the true course had changed considerably after the lightning strike. Induction in a vertical steel rod or bar (like the foremast) causes semi-circular deviation which would have been nearly maximum on the course of 100 degrees. The old Empire type vessel was equipped with only two compasses (the standard one and the steering one), a Thompson echo sounder, a chronometer and sextants. Navigation was very difficult, particularly in restricted visibility.

4.7. *Magnetic Cargo*. (*Mirosław Jurdzinski*) Also in the 1950s, the Polish Ocean Lines were sending vessels to the Gulf of Bothnia to load cargoes of iron ore at the port of Lulea in the north of Sweden. The carriage of iron ore started in the spring when the ice situation allowed for safe navigation in these regions. A considerable amount of high quality iron ore was transported on the route from Lulea to Gdynia. Unfortunately, the iron ore cargo had unpredictable effects on the deviation of the ships' compasses.

The shipowner had a series of old Empire type vessels of 10 000 dwt at his disposal, but they were equipped with very poor navigation instruments. The s/s *Tobruk*, on which I was sailing as deck assistant, was one of these vessels. On completion of loading iron ore at the port of Lulea, and with a draft of 10·50 metres, the vessel, with a pilot on board, left the port for the Lulea roadstead. Within the port area there were leading marks which allowed the pilot to establish the compass deviation, but only on southerly courses, because Lulea is in the northern part of the Gulf of Bothnia. The deviation was thus established on compass courses of 170 degrees, 180 degrees and 190 degrees. The pilot wrote them down on a piece of paper, handed it to the Master and subsequently left the vessel.

The problems with deviation started when the vessel was manoeuvring on other courses in the area of South Kwark, leaving the Gulf of Bothnia and entering the open (Baltic) sea. At that time of the year the sea was still covered with pack ice and the area was not marked with buoys. Navigation in this area required frequent, large changes of course, for which the compass deviations were unknown. The only method available for fixing position was by means of three bearings of selected landmarks (including the lighthouse). This gave two horizontal angles which did not depend on knowing the deviation. The vessel's position, free of errors, was then plotted on the chart using protractors. After passing South Kwark, the vessel resumed southerly courses and reached Gdynia safely.

4.8. *Expect the Unexpected*. (*Mirosław Jurdzinski*) During World War II, the waters of the North Sea and the Baltic Sea were full of mines. The mine clearing operations, started after World War II, resulting in partial clearance of the main shipping routes which were from 0·5 to 2 miles wide and were marked with buoys. While sailing on board vessels without a gyro compass, it was necessary to establish precisely the magnetic compass deviation so that the vessel could reach the next buoy on a given course in restricted visibility. The British Admiralty Hydrographic Office published NEMEDRI in which magnetic mine-free shipping routes and approaches to port areas were described.

At that time (1951–1952) I was sailing on board the s/s *Hel* (a general cargo carrier) on routes between Gdynia and other European ports. On one particular occasion, the value of deviation was observed to be changing rapidly. It was difficult to follow the designated narrow route without a constant, known compass deviation. The reason for the rapid changes in deviation was a soot fire in the funnel of the steamship.

The burning soot reached very high temperatures and caused the outside coat of paint on the funnel to fall off. This very high temperature in the funnel changed the structure of the steel to such an extent that the main magnetic compass, which was located near the funnel, was showing false courses due to the changes of deviation. Fortunately, we did not strike any mines.

4.9. *Making Do*. (*Sven Gyldén*) While I was at sea as a second officer in the m/s *Nebraska* of Gothenburg, I experienced trouble in the power supply of our Brown gyro compass. The three mercury rings around the top spindle of the master compass started to leak and thus did not supply the rotor with its three phase current. The only remedy at hand was to replenish the mercury. It turned out to be a quite an exacting and exciting task to watch the fire-works, as inevitably a few drops of mercury were spilled in the midst of a North Atlantic gale. However, I managed to keep the system in working condition until we could get a proper service on the top spindle of the master compass.

Another instance of compass unreliability occurred when I had started piloting, some time in the beginning of the 1980s. I was assigned to take a Cuban ship of about 10,000 dwt from Uddevalla on the Swedish west coast to Brixham near Tor Bay in Devon. After leaving the local pilot at Marstrand I took over and proceeded on the voyage. The master mentioned briefly that the gyro compass had a tendency to wander a bit and asked me to keep an eye on it.

The equipment of the ship was rather poor, the X-band radar was entirely dead and the S-band radar could only pick up the North Sea drill rigs at a distance of about 7 miles. The RDF showed very doubtful readings. I stayed on the bridge until we had cleared the lighthouse of Hanstholm in Denmark and had quite a long distance to go to the start of the deep draft route through the southern North Sea. Then I took the opportunity to turn in for a couple of hours, after first having warned the mates of the doubts about the compass reliability and to call me instantly if needed and not later than at 4 o'clock, when I expected we should be approaching the deep draft route.

I was duly called at 0400, and made a quick comparison of the magnetic compass and the gyro and found out straight away that the gyro was playing up. I immediately asked for a deviation card for the magnetic compass, and the only one they could produce was 8 years old and consequently of very limited use. Anyway, just before sunrise I saw Venus bright above the horizon and got out my HP 49 CV which I always carried with me. I managed to find the magnetic compass error on the actual course by observing the azimuth of Venus, so at least I knew in what direction we were travelling.

When the sun rose high enough to see the horizon, the sky was overcast, so I could not observe any stars or planets. After a while I saw a large tanker on a parallel course, so we kept on going on the same course, and to my relief I recognized, on the radar, the well known pattern of the drilling rigs at the start of the deep draft route. We kept on going like that through the rest of the North Sea and the English Channel and eventually arrived off Berry Head, where I could leave the ship's crew to their own devices. They were bound for Havana, and I do not know how they got there, if they did! At least I was happy to see them safely disappear round the Berry Head.

4.10. *The Human Factor*. (*Tom Sellers*) The larger of our Company's ships had the Sperry Mark XIV fitted but we had some smaller ships trading to the Baltic and Continental ports which had Sperry Minor compasses. These were certainly a boon

particularly in the Baltic, although they suffered from poor reliability and had to be checked constantly. I sailed on the North Atlantic on two ships fitted with magnetic compasses only. I can support John's remarks in section 2 about the deviation card the adjuster presented to the Master.

In the late 1950s I attended a Gyro-compass Course at the Glasgow Technical College. This concentrated mainly on the Sperry Mark XIV which we took to pieces and put together again under the eagle eye of the instructor, whose name I think was Kennedy. He had a novel way of expressing himself. I was making a very awkward attempt to remove the transmitter. He came round behind me and placed my left hand under the transmitter, then guided my right hand with the screwdriver into a proper angle. Then he said "*the purpose of the left hand is to defeat gravity when the screw comes out*".

On the final morning of the course, I said I would be sailing with a Sperry Minor and would he give some information about that. He walked over to the small compass, opened the two little doors on the front, switched it on and closed the little doors again. "*Now*", he said, "*you know as much about it as I do*".

In 1957 I joined a new ship which had been built for the Company in Rotterdam. She was fitted with a Sperry Minor gyro-compass, which resembled an earlier form of Dalek. At that time, the compass was not designed with a transmitter, so had no repeaters and was used solely as a steering compass. We sailed from Rotterdam bound for Hamburg. I came on watch at midnight when we were north of the Frisian Islands following the NEMEDRI route. The Third Mate showed me where we were and indicated the next NEMEDRI buoy about half a point on the port bow. He then left the bridge. I walked from the middle of the wheelhouse to the radar and found the buoy to be about a point to starboard. I told the helmsman to watch his steering. He said he was having difficulty following the compass and thought there was something wrong with it. I told him to steer magnetic, and checking the gyro found that it was wandering all over the place.

By the end of my watch, it had steadied up. I told the Mate when he came up about this, and advised him to keep a close eye on the gyro. At breakfast time he said the gyro had been fine throughout his watch. In any case, I reported the matter to the Master and when we arrived in Hamburg he had the Sperry technician check it. He found nothing wrong.

We sailed from Hamburg to Antwerp. At midnight I came on watch and we were following the NEMEDRI route in the opposite direction. Again, just after midnight the gyro was found to be wandering, and had just about steadied up at 4.00 AM. Again I reported this to the Master and again we had the Sperry technician come in Antwerp. He also could find nothing wrong.

We sailed from Antwerp for Belfast and when I came on watch at midnight we were passing through the Dover Strait. As it happened, I had come up rather earlier than usual and was on the bridge about 10 minutes before midnight. The Third Mate was filling out the log-book including such items as wind and weather and the air temperature. The thermometer was on the starboard wing of the bridge, with a light just above it. Behind the helmsman was an electrical panel with switches for every light and every piece of equipment on the bridge. Rather than get a flashlight, the Third Mate went along the lines of switches, switching them up and down until the required wing light came on. In doing this he also interrupted power to the gyro-compass. The loss of electric current was only for a split second, but it was enough to

set the gyro off on another 4-hour wander. At least I had found the reason. I will not repeat what I said to the Third Mate, but first thing next morning the 2nd Engineer and I devised a brass plate which we screwed over the gyro switch, and this prevented any recurrence of the problem.

4.11. *High Latitudes*. (*Søren Thirslund*) I was second mate on an old steamer. The chief officer and I could never get the same deviation when we observed the Sun. Naturally he could not admit that his bearings were wrong, but then I suggested that we should take the observation of the Sun together. He agreed, but then I noticed that when he leaned over the azimuth mirror the compass card moved. Not surprisingly, since he had placed a steel ring in his cap to make it look better. With his cap hanging on the rail, we could suddenly agree on the deviation.

As to magnetic variation my first experience came about when I was an ordinary seaman. With the four-masted schooner *Sværrdfisken* we had a voyage to Thule in northern Greenland. My fellow sailors in the forecastle and I could not understand how we could steer almost East on the compass, when going North along the coast. Many years later I was in the area again, now as chief officer, and we had a magnetic variation of 100 degrees West.

In 1948 I was second officer on a steamer. We had in England loaded coal for Greenland, and the captain had decided we should follow the great circle route from Fair Isle to Cape Farewell. Here I noticed that the course steered on our magnetic compass was the same (or almost the same) all the way crossing the North Atlantic. The reason was that the magnetic variation increased so that, despite the constant magnetic heading, the course made good was very nearly the great circle.

My first experience with the gyro compass was bad. I took over a tanker in Rotterdam, and there had been service on the instrument. Already after leaving port and sailing down the river we found out that something was wrong. The compass was wandering very slowly, and on the voyage to the West Indies and back to Rotterdam we had to navigate on both magnetic and gyro compasses. Returning to Rotterdam the service agent was called, but when he heard about the problem, he had to call a colleague to assist him in repairing the compass.

After that I have been favourably impressed by this wonderful instrument, which is now onboard almost any ship, even some yachts.

In a case history in the files of an insurance company I found how important it is that the duty officer regularly compares the gyro- and the magnetic courses. An American tanker had discharged in New York. She was going back to Venezuela, so after having dropped the pilot, the captain laid his course on 175 degrees. The ship was equipped with a gyro compass and auto pilot, so the mate switched this on, and the captain went down. The night was calm, so the mate was only watching for other ships. After some time the vessel ran aground, and nobody could understand what had happened until they found out that the gyro had stopped, and thereby also the autopilot, so the ship had very slowly turned to port and was now aground on Long Island east of New York.

I kept this awful story in mind when setting my own rules for my officers: Always check the difference between the gyro- and the magnetic reading, and note it in the log book. The magnetic compass only fails if iron or steel is placed in the vicinity, or in places with magnetic disturbance.

4.12. *On the Positive Side*. (*David Page*) In the mid-fifties, in my experience, it was standard practice for magnetic and gyro compasses to be compared at least

hourly and the compass error checked by azimuth or transit at least once every watch. Also, on being relieved the OOW checked the bridge repeater(s) against the master gyro.

Company built ships were normally provided with a Sperry Mark XIV Gyro compass and liquid card magnetic standard and steering compasses. The steering gear was electric and the traditional wheel consequently required little physical effort. However, some vessels were purchased elsewhere and we brought one back across the Atlantic from Havana in winter with a skeleton crew and learned much about life without a gyro compass, dry compass cards, telemotor steering gears and windage.

I experienced only one gyro failure in ten years This was with a Sperry Mk XIV, when northbound in the Gulf of Suez and was probably due to a break in the power supply. When settled down again the equipment worked perfectly.

My favourite gyro has to be the simple Brown B Gyro that I sailed with in the same ship on three occasions. This compass had been fitted to assist in replenishment at sea, during WW II, when the ship was used to re-supply convoy escorts with fuel and depth charges. Provided with emergency battery power this equipment proved to be very reliable.

In all, it would seem that, in the period in question, both the magnetic and gyro compass served us well. The main complaint seems to have been that we would have appreciated more *hands on* technical instruction. This was available, but seldom given. At least it discouraged the *fiddlers* amongst our number.

5. FINAL WORD. The above short collection of experiences provides a small window to the way we used, or misused, compasses in merchant ships in the mid-20th Century. We trusted equipment such as gyro compasses, autopilots and magnetic compasses because we had to, but, as David Page points out, we checked them frequently. And, in overcast, foggy conditions when astro or landmark checks were unavailable, there was no option but to rely on them implicitly.

A related matter was that, although the gyro compass and, later, the auto-helm were key instruments, the training in their use and maintenance was woefully inadequate. Gyro compass maintenance courses were available at nautical colleges, as noted by Tom Sellers in section 4.10, but attendance was voluntary and only a small percentage of ships' officers took advantage of them. Otherwise, as Peter Lyon relates, the training policy for technical equipment, even in a top-class company like Blue Funnel, was contained in the phrase, *The Manual is in the Chartroom*.

As far as magnetic compasses were concerned, a considerable amount of time was spent on magnetic compass theory in the courses for a Master's Certificate and the BoT examination included a demonstration by each candidate of correcting a model *deviascope*. This was a simple compass simulator in which the examiner could set up deviating magnetic fields and the candidate was given half an hour to identify these fields and to apply the appropriate correctors.

Despite this hands-on testing technique, as noted in section 2, magnetic compasses were seldom touched at sea. This was a pity because, although deviation is straightforward to allow for if one knows its value, a poorly corrected compass is unsteady in a seaway, leading to inefficient course keeping and difficulty in observing bearings. Simply raising or lowering the heeling error magnets by trial and error in order to achieve a steady compass would have been a useful exercise, particularly after a large

change of magnetic latitude. However, as Peter Lyon recounts in section 4.5, ship-masters, with Pandora's experience in mind, generally preferred the inconvenience of an unsteady compass to the fear of what might be irretrievably released if they opened the binnacle door.

Overall, it has to be said that, in the mid-20th Century, our approach to the use of compasses left something to be desired. We were somewhat less casual than Captain Bligh who, reportedly, kept his pistols in the binnacle of HMS *Bounty* but, as Søren Thirslund relates, a steel hatband was not that much less casual. Of course, by hook or by crook we mostly managed to make successful voyages but, as Norman Cockcroft reminds us in section 4.2, even that was not guaranteed. Perhaps those of us who did not have accidents were the lucky ones.

Finally, on a sad note, I have to record that Captain Sven Gyldén who contributed section 4.9 has since died, as has Captain Charles Koburger who contributed to our previously reported experiences in the use of soundings for navigation (see Vol. 61, page 629).

https://doi.org/10.1017/S037346331000010X Published online by Cambridge University Press