Speed and Consumption Issues

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Introduction

Speed and consumption disputes are probably amongst the most common arising under time charters. However, there is only limited judicial and arbitral authority as to the correct approach to the calculation of such claims and the exercise of calculating a vessel's underperformance over a single leg or course of a charterparty can itself be difficult, expensive and time-consuming.

This seminar will examine:

- The guidelines a marine expert follows when approaching a speed and performance dispute
- How the marine expert undertakes the performance calculations
- The marine expert's consideration of fuel consumption
- How the marine expert works with Marine Bureaux/weather experts on performance calculations
- The weather expert's role, including an outline of modern methods used for assessing weather, how weather is forecast and the latest technology used by Weather Bureaux
- Are all the legal issues now resolved?
- Evidential issues: logs versus Weather Bureau performance calculations
- Particular charterparty clauses

Part A

Graham Harris

Part B

Capt Nic Paines

Part C

Richard Stretch

Part D

Curricula Vitae
Part A

Graham Harris

Speed and Consumption Issues
(A written paper and a power-point presentation)
SPEED AND CONSUMPTION
Graham Harris
Partner
October 2014
Speed and Consumption

The printed form of most time charters provide for the speed and consumption of chartered ships. This is not a straightforward area because it is an area in which the purely legal and the practical clash head on, and even after 35 years of seeing such claims in arbitration, I do not think that there exists a universally agreed method of dealing with them.

I apologise if I touch on areas covered by other speakers, but I will try not to trespass too far into matters outside my competence and I think a legal perspective on some of the same issues is also of value.

A problem with such claims field of law is that almost all decisions are in arbitration, and very few of them survive the legal tests that justify an appeal, so they remain anonymous. Furthermore many such cases are relatively low value and cannot stand the level of resources that would need to be thrown at them to produce a proper scientific result, if such a thing were possible. Lawyers, experts and arbitrators struggle to provide a service at an acceptable cost and the presentation of most claims owe more to pragmatism than the law of evidence. I think there is a school of thought that applies a strict legal approach; and a school which believes that arbitrators are obliged to work with the evidence available and cost constraints to provide a pragmatic solution. And within this latter group are those who feel you have to work with what you have, and those who rebel at the rather formulaic mathematical approach to what they believe to be often unreliable data.

Some charters provide for the calculation of “average” speeds over the course of the charter or an individual year, and if properly worded there is no reason why this should not be done. However, there is a tendency to allow Charterers to claim by reference to individual voyages where this is possible as a matter of construction, such as in the GAZ ENERGY [2012] 1 Lloyd's Rep 211. In London Arbitration Award 3/12, the charterers said that in two voyages out of 17 during the charter period, the vessel had underperformed during periods of ‘good weather’, yet the Owner was able to demonstrate when good weather data across all 17 voyages of the charter was averaged out, the vessel did not appear to have underperformed. In this case, the charterparty contained a warranty “that the vessel shall be capable of maintaining and it shall maintain all sea passages from sea buoy to sea buoy, sea speed and consumption as per the vessel description”. Here the Charterer successfully argued that the reference to ‘all sea passages’ entitled it to select any of the voyages made under the charterparty and subject each to the warranty of speed and consumption.

The following extracts are from the NYPE forms, a dry cargo charter. Although the Baltime form uses very slightly different words, the principles are the same. I will not discuss tanker charters specifically as the applicable clauses are very much more varied and do tend to opt for a more mathematical approach, often excluding from the calculation altogether a number of the variables which trouble the calculation of dry cargo claims, such as weather up to BF8 or currents. It is perhaps an irony that many of the reported cases are tanker cases because tanker charters more often provide for the resolution of disputes in the High Court.

NYPE 1946

“and capable of steaming fully laden, under good weather conditions about … knots on a consumption of about … tons of … best grade of fuel oil fuel”.

NYPE 1993

Speed about … knots, fully laden, in good weather conditions up to and including maximum Force … on the Beaufort wind scale, on a consumption of about…

SETTING THE SCENE

These are examples of contractual undertakings from the Owner that the chartered ship is capable of a certain speed under certain consumption in certain conditions. They are normally intermediate terms, so the Charterer is entitled to damages for losses suffered as a consequence of a breach. It
would be rare for such a term to be a condition, or a breach of such magnitude as to go to the root of the contract entitling the Charterer to terminate the charter, unless it was expressed to be so or to be implied from the other terms of the charter: the AEGEAN DOLPHIN [1992] 2 Lloyd's Rep.178.

The next general issue is when the warranty takes effect, i.e. at what point in time does the vessel have to be capable of performing? For many years it was accepted that the warranty was only of the vessel's capability at the date it was given, namely when the vessel was fixed (Lorentzen v White (1943) 74 Li R 161) but the better view is that of Mocatta J in the APOLLONIUS [1978] 1 Lloyd's Rep 53, in which he said that there were “overwhelming commercial considerations” for applying the performance warranty as at the time of delivery into the charter service. This is consistent with other cases such as Isaacs v McAllum (1921) 6 LlR 289, which stated that there should be an implied term that the owners will not alter the ship so as to have an adverse effect on her warranted performance.

Strictly speaking, unless the warranty is expressed to be a continuing one, the warranty is only of the vessel's capability at that time and is not a continuing warranty. This is confirmed at First Instance, obiter at least, in the AL BIDA [1986] 1 Lloyd’s Rep. at page 150. However, one must not overlook the usual obligation on the Owners to maintain the vessel (NYPE clause 1) and the obligation to proceed on the voyage with due despatch (NYPE clause 8). However, such clauses do not convert the warranty into a continuing one as over a long period one might expect some deterioration in the vessel's performance, which falls short of triggering an obligation to exercise due diligence to maintain the vessel outside her regular dry-dockings, for example.

Having said all that, there is no reason why the warranty should not be amended to be a continuing one throughout the currency of the charter, such as in the IOANNA [1985] 2 Lloyd's Rep 681 or the PAMPHILOS [2002] 2 Lloyd's Rep 681, or as a guarantee of continuing performance as in the AL BIDA [1987] 1 Lloyd’s Rep 124 (the Court of Appeal reference).

“FULLY LADEN”

I do not recall seeing a discussion about the meaning of these words, but the odd case may arise when they become material. What if the vessel is only part laden, or not fully down to her summer marks in a winter zone? This is an example of where law and practicalities collide. A literalist may well argue in such circumstances that the warranty does not apply at all, yet there is something unsatisfactory from a practical perspective in such a literal approach, particularly if the practical effect on speed and consumption between strict compliance and the actual condition of the vessel were to be imperceptible.

This is a constantly recurring theme. One could of course add a page to each contract setting out a different warranty for every possible variation of the vessel's range of operating conditions. On the other hand one could argue that if the effect of a difference in condition were to be de minimis, one ought to be able to deduce how the vessel would have performed in the condition against which the warranty is given, so establishing whether it can comply with the warranty or not.

I have incidentally seen attempts to extrapolate from a fully laden warranty an improved warranty for a ballast passage. As a matter of fact one might expect a vessel in ballast to be more efficient than when laden, but I do not believe this is legally permissible. I believe that one ought to be able to say that the ballast warranty should be no worse than the laden warranty in most circumstances, and I think this is the usual position.

“AFTER”

“About”, when referring to speed, generally creates a window of performance, within which the vessel can be said to comply with the warranty. In the AL BIDA [1987] 1 Lloyd’s Rep 24, this implied a tolerance of 0.5 knots. However, the Court stressed that his was not fixed in stone and the exact allowance was for arbitrators to decide on a case by case basis based on the individual’s “configuration, size, draught and trim”.

Fortunately this has not been taken too literally, and by and large a 0.5 knot allowance will normally be given in the absence of special circumstances, such as a vessel of abnormally low speed or
abnormally high speed. Certainly the standard bulk carrier speed of 11 to 16 knots is unlikely to attract an allowance outside the norm.

One special circumstance might be where various speeds and consumptions are given in a table, say in steps of half a knot, which does rather strongly suggest that the word “about” is not intended to shift all the speeds in the table a full half knot in speed downwards.

The word “about” frequently qualifies also the consumption of the vessel. This is generally taken to be between 3% and 5% - nowadays tending to 5% - but generally the higher the daily consumption the more arguable it is that the larger allowance ought to be given.

An important issue is whether the Owner is entitled to the benefit of both “about”s, where both speed and consumption are so qualified. In other words does “about 12 knots on about 32 tons” really just mean a warranty of 11.5 knots on 33.6 tons? I think that the proper legal view is that the Owner is entitled in these circumstances to the benefit of both “about”s because one complies with a legal warranty if one meets its minimum requirement.

However this is controversial from a practical perspective for good reason. There is a “cubic law” that the power required to propel a given vessel varies directly in proportion to its speed by a factor of three, so if you increase the speed by a factor of two (i.e. double it) the power consumed will increase by $2 \times 2 \times 2$, i.e. a factor of 8. I recall a scientist who produced a computer model in the early 1980s to test the speed and consumption of about 750 vessels annually against warranty. As a by-product of this he demonstrated that the “law” was not perfect as mathematics is obliged to engage with nature, but the curve on the graph based on the “law” was very close indeed to the line created from the empirical data provided by such a large number of ships.

If one applied this “law”, it follows that as the speed of a vessel reduces so does its consumption, so many practical seamen find difficulty in accepting that the two “about”s both work against the charterer, when it seems obvious to them that where the speed is potentially variable, it follows that the consumption must be also, but in a rationale way. On their view in the warranty the second “about” is merely there to reflect the fact that consumption should decline in a proportion to speed, not to give the owners a double benefit.

However, I believe that this is an argument that has been lost over the years, and I think most arbitrators give the owners a double benefit.

‘WEATHER’

It is only under ‘good weather’ conditions that a vessel’s speed and consumption can be accurately measured.

Charters do often define good weather by reference to the Beaufort scale, which measures wind speed. Where a condition is express, I have certainly seen reference to Beaufort Force 5 and indeed Beaufort Force 3, but in the absence of an express indication, arbitrators usually accept that “good weather” does not exceed Beaufort Force 4. I was once told that this was for no more scientific reason than crew could easily tell the difference between Beaufort Force 4 and Beaufort Force 5, and I seriously doubt that there will be any practical difference between the effect of Beaufort Force 4 and 5 on a fully laden Capesize. Other factors can also impact.

The Owners have argued that it follows that the warranty only applies to good weather days, so days which do not qualify as good weather days have to be excluded entirely. So, on first glance, this ‘good weather condition’ might appear to serve the Owner’s interests: allowing the Owner to avoid any breach of warranty when a vessel fails to perform to its capacity in anything but good weather. However, since the DIDYMI [1987] 2 Lloyd’s Rep 166, it has been established that the good weather measurement is ‘the contractual yardstick’ by which performance will be measured. This was confirmed in the GAS ENTERPRISE [1993] 2 Lloyd’s Rep 352, with Roch LJ in the Court of Appeal adding that, had the Owner intended to warrant performance of the vessel only in good weather conditions, it should have expressly done so. Therefore under the terms of the standard warranty, if a vessel fails to meet its speed and consumption undertakings in good weather, it will be deemed to have underperformed to the same extent in bad during periods of bad weather. In this way,
underperformance can be calculated across the whole voyage, and the effects of bad weather “factored out”. However, one has to be a little careful about this as very bad weather or fog would justify a deliberate reduction in speed for sound navigational reasons, and such periods do need to be excluded altogether.

Of course, this broad brush approach is very far from perfect. If a vessel is one knot below her warranted speed in good weather, it does not follow necessarily that she performs below her capability in all-weather to the same extent. And there may in fact be cases where a vessel has performed beyond expectation in poor weather, but has failed to perform to her capability in good weather. Another issue with the ‘Didymi principle’ is that a relatively small portion of poor performance (albeit in good weather) could be applied across an entire voyage.

Importantly, there is simple input data inaccuracy, often caused by casual record keeping on board the vessel or either “averaging out” or “taking a view” about how to record the weather on a particular day, or recording the weather at noon only, which can be particularly distorting if you are trying to extrapolate from a very small window of good weather. I can think of a number of occasions in which a vessel's all weather speed has been a significant improvement on her so-called good weather speed, thereby demonstrating perfectly the disadvantage of seeking to rely exclusively on some purely mathematical approach to the calculation. However aside from this factor, an expert evaluation of the ‘bad weather’ performance would be required to persuade the arbitrator that it would not be reasonable to apply the ‘good weather’ data alone.

I am also aware that tides, waves and swell can in certain circumstances impact on a vessel’s speed and performance and can legitimately be taken into account when out of the ordinary. However, I will be trespassing too far from my own expertise if I get into a discussion on this. I will note only that more charters are being seen defining good weather by reference to Douglas Sea State 3 as well as by wind force.

**CURRENTS**

The introduction of the effect of current, in the absence of an express term in the contract that it should be taken into account, is controversial.

Logically I believe the effect of current should be taken into account as a matter of law. The warranty is that the vessel is capable of achieving a certain speed and I think that should mean “all things being equal”. On a single voyage there could be a four knot difference in speed over the ground between sailing against or with a current of two knots.

The problem is how, or indeed whether, one can calculate current with any degree of accuracy. Generally currents are neither constant nor reliable. Although there may be scientific measurements being taken in individual places, over the oceans traversed by a vessel one is more likely to be relying on Routing charts, but these are average currents, of uncertain variable strength and even of direction, and their effect on a vessel difficult to quantify unless they or directly ahead or astern even if they could be accurately measured. The parties in the DIDYMI excluded the effect of current altogether, but that was a five year charter for worldwide trading and it suited the parties, with the judge’s blessing, to say that the effect of current over that period would even itself out.

Whilst lawyers require an answer and experts do their best to produce figures to meet that need, the fact is that, except in exceptional circumstances, introducing the effect of current will often give rise to many assumptions in the calculations; in effect a margin of error. I do know some arbitrators who consequently prefer to ignore them altogether, unless the effect of current is clear on a particular voyage and gives a distorted result. The argument is that in a single voyage they are likely to produce a result, which does not stack up as legal proof due to the margin of potential error, and if there many voyages the argument is that the currents are likely to even themselves out anyway.

**MANOEUVRING IN CONFINED SPACES ETC**

At the risk of stating the obvious, manoeuvring in confined spaces or in heavy traffic ought conventionally to be excluded from any calculations.
GOOD WEATHER ANALYSIS

Here we move to evidential issues – namely, the practical problem of how good weather periods are to be established, especially when both current and wind are taken into account. The interaction of wind, waves, swells and currents means that their effect on a vessel is difficult to determine, micro-geographic and subject to quick change. There will often be a discrepancy between the weather conditions recorded in a vessel’s logbooks, and information from independent weather bureaus, and standard charterparty wordings are silent on which should take precedence. So how are inconsistencies between vessel log books and independent weather bureaus to be resolved?

Historically, the Master’s evidence has been preferred by mariners. The Master, by the nature of his work, is considered to be a trained observer by the World Meteorological Office, accustomed to making observations of the wind and sea as part of his daily routine and someone who witnesses the weather and sea continuously. He is also by definition the man on the spot.

However, in recent London Arbitrations 3/12 and 4/12, the Master’s view has been deemed, at times, heavily subjective. When analysing weather data, the Tribunal found that the vessel’s documents were over six times more likely to record the wind force as greater than it was in the independent bureau information. The Tribunal stated, “Log entries are at times made with half an eye on the charter warranties.” I am afraid this is all too often true. I recall a case in which during four years of worldwide trading the vessel sailed directly into a B5+ wind every single day regardless of location or season. That a Master would have an interest in inflating the conditions because he knows that the vessel is not performing according to the charter is difficult to dismiss, but we still remain in a position where, despite technological advances, independent data cannot give conclusive evidence of performance.

There is an increasing range of technology available on vessels themselves, but doubt is still cast on the accuracy of such tools. To give an example, an anemometer can record a wind speed of Force 4 in calm waters when there is absolutely no wind, simply because the vessel is sailing at 14 knots. Again, this is not my area of expertise so I have to be careful what I say.

On the other hand, the criticism levelled at satellite imaging has been that it only provides a snapshot of weather conditions, the effects of which can sometimes be extremely localised and, even then, it cannot determine the effect that currents are having on a ship. With performance measured by the distance a vessel covers over ground, rather its speed through the water, currents can distort performance data significantly.

Charterers nowadays routinely use services such as AWT to provide routing advice to Masters to avoid the worst of expected bad weather. However, it became common for the Master to report the vessel’s noon position, and bunkers consumed in the preceding day. From this the routing firms decided to provide an additional added-value service of analysing the vessel’s speed and performance against warranty. However they did not originally extrapolate from good weather days, but instead provided an overall voyage calculation in which the speed was adjusted by a detailed but completely unexplained “weather effect” and “current effect”. These were routinely disregarded by arbitrators precisely because they were unexplained, although the vessel’s log reports and the routing services’ estimates of the daily weather were compared. Generally the log books would be preferred if the results were not wildly different as the Master was the man on the spot, but resort might be had to other independent sources if there were unexplainable differences, even if these could never solve the uncertainties of current and possible localised weather effects.

No doubt the routing services’ analysis is becoming more sophisticated, and the presentation of their evidence now accords with the favoured approach of the arbitrators. However, mere assertion still does not qualify as evidence. For example it is not clear whether the weather reported on a particular day comes from a report from a vessel half a mile away from the subject vessel, or just from satellite analysis. I for one do not know how the effect of current is calculated, and I believe a claim put forward only on the basis of the unexplained analysis of one of these services cannot found a claim, without independent support, unless the arbitrator is directed by a clause in the charterparty to rely upon it.
This approach fits with a developing idea that the traditional approach of establishing good weather periods should be abandoned. For one, it is possible that the ‘good weather’ conditions necessary for performance to be measured will not occur over a voyage. If the approach here is one of strict legal construction, it would be impossible for a vessel to underperform. The second issue with the emphasis placed on ‘good weather’, is that the method for establishing periods qualifying as ‘good weather’ is suspect. Is the weather reported at noon to be taken as the weather for the whole day? Is a good weather day a day in which the weather was good for all day or for 51% of the day?

It seems that a practical approach and a legal one will never quite align, but it is worth saying that a legal approach, indeed because of its blindness to the complexity of the situation, may at least provide clarity for the Charterer and the Owner and help to avert the escalation of disputes, especially if small sums of money are involved and do not warrant a serious investigation. For this reason some arbitrators will still follow the formulaic approach, on the grounds that it makes the best of a bad job and within certain parameters gives a more certain result, which in turn ought to cut down the cost of disputes.

My own view is that, in the absence of clear wording in the charter directing the reader to adopt a more formulaic approach either to the evidence or the calculations, one needs to take a more holistic approach to this. Producing a calculation that shows a delay of 2.5 hours on a three week voyage based on three isolated days of good weather after the application of current-affected voyage does not strike me as a compelling claim. Equally one should not allow a manifestly underperforming vessel to avoid the consequences by pointing out that assessments can never be 100% guaranteed to be accurate and should therefore be disregarded. What is acceptable evidence is a matter for the experts. I believe other arbitrators follow this approach.

** DAMAGES FOR BREACH OF WARRANTY **

The loss of time is relatively easy to calculate, being an extrapolation of the good weather performance across the whole voyage, ignoring weather conditions, which would have obliged the vessel deliberately to reduce speed.

Generally speaking the claims are considered in isolation, although it may not be entirely impossible to claim a consequential loss as a consequence, for example missing the cancelling date for a fixture as a consequence of the vessel’s late arrival. Equally it may be possible to envisage a situation in which there is no loss of time in practice for some reason, for example because the vessel arrives in any event before the commencement of laytime, or the vessel was able to maintain a published schedule despite minor performance issues.

As far as excess consumption is concerned, the simple method is to work out how much time was lost on the voyage and multiply this by the permitted daily bunker consumption to ascertain the wasted bunkers. There are more sophisticated ways of assessing the performance of an engine against the known weather in a loaded condition, but a great deal of technical information would be needed before the exercise could be undertaken, without incorporating large assumptions.

However, the reality is that the slower the vessel goes, the fewer bunkers it consumes so there may be a “saving” of bunkers. Because we are considering a claim for damages there is in these circumstances no reason why the usual rule should not apply that credit should be given in a calculation of loss for any savings to the innocent party caused by the breach. This was confirmed in this context in the IOANNA [1985] 2 Lloyd’s Rep 164. However, the window of performance created by the word “about”, if applicable, should in my opinion work against the owners in such a calculation because the charterer should be entitled to say that the consumption of 31mt on a warranty of “about 32 tons” is as much within the warranted performance as a consumption of 33 tons – just because the owner may not be in breach, does not mean that he is entitled to claim that he has saved the charterers’ money.

Of course, the above comments apply to the consumption of fuel oil in the main engine. Consumption which is a function of time and not of speed, such as supplying generators and boilers, can be claimed by reference to the loss of time. The judge in the IOANNA went on to say that as an over-consumption claim covered both fuel and diesel oil, if there was a saving in fuel oil cost which exceeded the extra cost of diesel the effect would be to eliminate the claim.
Strictly speaking, a claim for damages could be excluded by a suitably drafted clause of the charterparty. However, the well-known Baltime clause 13 was held by the House of Lords in the TFL PROSPERITY [1984] 1 Lloyd's Rep 123 not to apply to misdescription claims. If the negligent trim of a vessel was a significant contribution to poor performance, then I suppose it might be covered by Article IV Rule 2(a) of the Hague Rules if a Clause Paramount were incorporated, although I have never been involved in such a case. This approach is, however, supported by the LEONIDAS [2001] 1 Lloyd’s Rep 573.

**BOTTOM FOULING**

I deal with this topic separately because it provides a particular incidence of factor which affects the performance of a vessel which can arise in different circumstances. One way is that it can accrue simply by the passage of time. The mere existence of bottom fouling does not automatically place the owners in breach of their duty to maintain the vessel: Tynedale v Anglo-Soviet (1936) 41 Com. Cas. 206. However they do have a duty to correct the problem within a reasonable time: Snia v Suzuki (1924) 17 Ll R 78.

I had an arbitration many years ago in which the owner had noticed a reduction in the vessel’s performance over time and asked the charterers’ permission to take the vessel out of service briefly to carry out underwater cleaning. The charterer refused to permit this on a number of occasions citing his tight scheduling, but the effect was finally to disentitle him from complaining about the vessel’s speed as his orders had prevented the owners from carrying out their maintenance duties.

A distinct issue is where the hull is fouled as a direct consequence of the owner obeying the charterers’ orders, for example an extended stay at anchorage in tropical waters upon charterers’ instructions. Where the cause of the breach is an abnormally long period which the vessel had spent waiting for cargo directly attributable to the charterers’ orders, the Court has held in the RIJN [1981] 2 Lloyd’s Rep 267 that the charterers cannot claim.

However, in the KITSA [2005] 1 Lloyd’s Rep 432, the Court held that a stay in a warm water port was as a result of a legitimate order of the Charterer as to the employment of the vessel, which was foreseeable and foreseen by both parties when the charter was made, and did not make the charter responsible for the consequent delay and costs of restoring the hull to a pristine state. This was contrasted with the RIJN where the delay here went beyond the reasonable expectations of the trading employment of the vessel. The approach of the courts has therefore been one of consideration and acceptance of risk.

The questions to consider then are: was the port within trading limits as provided within the charter; was the time spent at the warm water port usual and expected for the at time of year and for that vessel; were the loss and expenses incurred as a consequence of complying with the charterer’s legitimate and ordinary employment orders with the course of expected trade? As one can see, the Owner’s ability to deny its vessel going off hire is far narrower, as the circumstances to prevent a vessel going off-hire must be unforeseeable. If an Owner can show this, he is entitled to claim for hull cleaning costs and late delivery as a result of cleaning.

To deal with the consequent uncertainty, in October 2012, BIMCO introduced a new clause which sets out a mechanism for apportioning liability for hull fouling, with a trigger set at 14 days for a vessel in tropical waters and 25 days in non-tropical waters.

**OFF HIRE**

Unlike the Baltime that does not deal with off hire, the NYPE form deals expressly with speed and performance in the off hire clause:

“...and if upon the voyage the speed be reduced by defect in or breakdown of any part of her hull, machinery or equipment, the time so lost, and the cost of any fuel consumed in consequence thereof, and all extra expenses shall be deducted from hire.”
Not every speed claim places the vessel automatically off hire, as it is necessary to establish a cause of delay within the wording of the clause, such as hull fouling or an engine problem. Furthermore the off hire element is confined to the total delay on a voyage; one cannot pick off a shorter period of underperformance if the vessel makes it up elsewhere, unless of course for a period when a vessel is completely stationary due to an engine breakdown: the IOANNA [1985] 2 Lloyd’s Rep 164.

There are two important consequences of this. Firstly, the off hire ends when the delay ends so consequential loss of time will not be included, nor will an argument that the charterer has not lost any time at the discharge port after the vessel’s arrival be possible. The second is that the off hire clause entitles the charterer to deduct over-consumed fuel, but is silent as to crediting savings in fuel. The effect therefore is that if the charterer can bring his claim within the off hire clause, no credit for savings in fuel need be given.

October 2014
Speed & Consumption Claims

Graham Harris - Partner
October 2014
**Speed & Consumption**

**NYPE 1946**

“and capable of steaming fully laden, under good weather conditions about ... knots on a consumption of about ... tons of ... best grade of fuel oil fuel”.

**NYPE 1993**

Speed about ... knots, fully laden, in good weather conditions up to and including maximum Force ... on the Beaufort wind scale, on a consumption of about...
What is the nature of the warranty?

- “AEGEAN DOLPHIN”

When does it apply?

- on delivery
- can be continuous if so expressed
- tanker charters
• How does it interact with the Owners’ duty to maintain?

• Bottom fouling
  - the “RIJN” & the “KITSA”
  - BIMCO clause (14 days for tropical, 25 days for non tropical)
  - When Charterers orders prevent maintenance
Speed & Consumption

- Common amendments
  - Delete the “about”s
  - Add an improved warranty for sailing in ballast
  - Define good weather
  - Add a continuing warranty
  - Define what evidence is admissible to test the warranty
The elements in the warranty

• “About”
  - usually 0.5 knots for speed
  - usually 5% for consumption
  - are the warranties cumulative for the owners’ benefit?

• “Fully laden”
  - sailing in ballast?

• Good weather
  - Beaufort Force 4
  - Douglas Sea State?
Speed & Consumption

- Effect of bad weather
- Effect of current
- Effects of tides, fog or extremely bad weather
- Exclusion of periods where potentially manoeuvring at slow speed or with frequent changes course
Speed & Consumption

Usual Evidence
• Deck and engine log
• Log abstracts
• Master’s noon reports
• Weather routing reports
Speed & Consumption

• The usual calculations
  - extrapolate from good weather days, adjusted for the effect of current.
• But is current calculation reliable?
• Is the underlying data reliable?
• Legal v pragmatic approach to evidence
• Formulaic v holist approach to evidence
Speed & Consumption

Damages

• Loss of time
• Extra bunkers consumed
  - Main engine
  - Ancillary services
• Credit for bunkers saved
• Consequential delays or losses or irrelevance of delay on voyage
Speed & Consumption

Off hire

- Clause 15 has a special provision
- Has to be a defect or breakdown
- Excludes consequential losses
- No credit for bunker savings
Worldwide Locations

Abu Dhabi, Hong Kong
Beijing, Houston
Beirut+, Jakarta+
Berlin, La Paz+
Birmingham, Lima+
Bogotá+, Los Angeles
Bratislava, Kyiv
Brussels, Leeds
Bucharest+, London
Budapest, Madrid
Buenos Aires+, Manchester
Caracas+, Miami
Cleveland, Moscow
Cincinnati, New York
Columbus, Northern Virginia
Dallas, Palo Alto
Denver, Paris
Doha, Panamá+
Dubai, Perth
Frankfurt, Phoenix

+ Independent Network Firm
Part B

Capt. Nic Paines
SPEED AND PERFORMANCE
• Captain Nic Paines is a Master Mariner, formerly in command of bulk and forest product carriers

• Upon leaving the sea he joined a London Marine Consultancy, where he first learned the dark art of “Speed and Performance Calculations”.

• After some nine years in London as a Consultant he joined the offices of a Dutch Ship Owner as Marine General Manager before becoming Managing Director of a ship management company.

• Captain Nic Paines is currently a Director with Newman Giles Paines & Company Limited
- PRESENT GUIDELINES
- UNDERTAKING CALCULATIONS
- CONSIDERATION OF FUEL CONSUMPTIONS
The present guidelines on how we should approach the calculation of speed and performance were first set out in the Court of Appeal Didymi Judgement in 1987.
These guidelines were later underlined in a second Court of Appeal judgement in the case of EXMAR N.V. -v- BP SHIPPING LTD (THE "GAS ENTERPRISE") IN 1993
<table>
<thead>
<tr>
<th>Beaufort Number</th>
<th>General Description</th>
<th>Beaufort's Criterion</th>
<th>Sea Criterion</th>
<th>Probable height of waves in metres*</th>
<th>Probable maximum height of waves in metres*</th>
<th>Limits of Velocity in knots</th>
<th>Average Velocity in knots</th>
<th>Equivalent pressure in mb</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Calm</td>
<td>Calm, just sufficient to give pleasant walks.</td>
<td>Sea like a mirror,</td>
<td>0</td>
<td>0</td>
<td>Less than 1</td>
<td>0</td>
<td>0.001</td>
</tr>
<tr>
<td>1</td>
<td>Light breeze</td>
<td>That in which a well-conditioned man-of-war with all sail set and a 'clean fill' would go in smooth water.</td>
<td>Small waves, well short but more pronounced. Currents have a glauzy appearance and do not breach.</td>
<td>0.1</td>
<td>0.3</td>
<td>10 to 15</td>
<td>2</td>
<td>0.004</td>
</tr>
<tr>
<td>2</td>
<td>Gentle breeze</td>
<td>3 to 4 knots.</td>
<td>Large waves. Crosses begin to break.</td>
<td>0.1</td>
<td>0.6</td>
<td>30 to 40</td>
<td>5</td>
<td>0.013</td>
</tr>
<tr>
<td>3</td>
<td>Moderate breeze</td>
<td>3 to 6 knots.</td>
<td>Small waves, becoming larger; fairly frequent strong waves.</td>
<td>0.6</td>
<td>1.5</td>
<td>10 to 15</td>
<td>7</td>
<td>0.028</td>
</tr>
<tr>
<td>4</td>
<td>Fresh breeze</td>
<td>Royals, etc.</td>
<td>Moderate waves, taking a more pronounced long form. Some white wash is formed.</td>
<td>1.0</td>
<td>2.5</td>
<td>10 to 15</td>
<td>10</td>
<td>0.064</td>
</tr>
<tr>
<td>5</td>
<td>Strong breeze</td>
<td>Single-ended topsails and square topsails.</td>
<td>Large waves begin to form, the white bars are more extensive everywhere. Probably some spray.</td>
<td>2.0</td>
<td>3.0</td>
<td>10 to 15</td>
<td>15</td>
<td>0.084</td>
</tr>
<tr>
<td>6</td>
<td>Near gale</td>
<td>That in which the sea could just carry away the flags and bell.</td>
<td>Sea waves up and white foam from breaking waves begin to be formed in streams along the direction of the wind.</td>
<td>3.0</td>
<td>5.0</td>
<td>15 to 20</td>
<td>20</td>
<td>0.17</td>
</tr>
<tr>
<td>7</td>
<td>Gale</td>
<td>Doubled-ended topsails, jibs, etc.</td>
<td>Moderately high waves of greater length.</td>
<td>5.0</td>
<td>7.5</td>
<td>20 to 25</td>
<td>25</td>
<td>0.26</td>
</tr>
<tr>
<td>8</td>
<td>Strong gale</td>
<td>Close-ended topsails and courses.</td>
<td>High waves. Dense streaks of foam along the direction of the wind.</td>
<td>7.0</td>
<td>10.0</td>
<td>25 to 30</td>
<td>30</td>
<td>0.37</td>
</tr>
<tr>
<td>9</td>
<td>Storm</td>
<td>That to which she could scarcely bear with close-ended mainsail and mizzen fore-topsail.</td>
<td>Very high waves with long overhanging crests.</td>
<td>10.0</td>
<td>15.0</td>
<td>30 to 35</td>
<td>35</td>
<td>0.50</td>
</tr>
<tr>
<td>10</td>
<td>Violent storm</td>
<td>That which would force her to storm staysail.</td>
<td>Exceptionally high waves (mamouths in which the sea is somewhat like a frost)</td>
<td>15.0</td>
<td>20.0</td>
<td>35 to 40</td>
<td>40</td>
<td>0.75</td>
</tr>
<tr>
<td>11</td>
<td>Hurricane</td>
<td>That which no canvas could withstand.</td>
<td>The air is filled with foam and spray, etc., completely white with driving spray; visibility very seriously affected.</td>
<td>15 or over</td>
<td>6.5 and over</td>
<td>40 to 45</td>
<td>45</td>
<td>1.07</td>
</tr>
</tbody>
</table>

* These columns are added as a guide to show roughly what may be expected in the open sea, remote from land, in enclosed waters, or where near land with an offshore wind, wave heights will be smaller and the waves steeper.

Notes—(a) It must be realized that it will be difficult at night to estimate wind force by the sea criteria.
(b) The lag effect between the wind setting up and the sea increasing should be borne in mind.
(c) Fetch, depth, reef, heavy seas and cold air must be considered when estimating the wind force from the appearance of the sea.
• Very simply what we are guided to do is first assess from the Charter Party what is to be deemed “Good Weather”, for example the Charter Party may include a phrase such as:-

• “In good weather maximum Beaufort Force 4 and/or Douglas Sea State 3, or below”

• We then need to study the voyage from the vessel’s Deck Log Book, Voyage Abstract or other data source in order to determine which days meet the “Good Weather” criteria as set out in the phrase above.

• Once it has been determined which days meet the “Good Weather” criteria the voyage needs to be plotted on the appropriate Admiralty Routeing Chart
• In the Didymi judgment it was determined that you should simply ignore current as it was thought that over the period of the charter beneficial currents would be balanced by adverse currents.

• In my opinion and experience this was incorrect as rarely, even in liner trades, do currents cancel each other out in this way.

• The Charter Party may itself contain guidance as to how currents are to be treated.

• For example when setting out the “Good Weather” criteria the Charter Party may stipulate “no adverse currents”.
• Where that phrase appears in a Charter Party it is necessary to calculate the effect of adverse currents on the admissible days in order to negate that effect, whilst giving the Owner the benefit of any beneficial currents.

• Other Charter Parties may contain no such guidance in which case it is necessary to calculate the effects of both adverse and beneficial currents on all admissible days in order to negate all currents.

• The key here is that the Charter Party must be studied, and the person undertaking the calculation must be guided by whatever provisions are given.
• The Admiralty Routeing Charts cover the world’s Oceans showing month by month the dominant currents, their direction, rate and probability or constancy. The latter being expressed as a percentage of the likelihood of the current flow.

• When the voyage has been plotted it has to be studied to determine which of the admissible “Good Weather” days are not barred from the calculation for other reasons such as being in the vicinity of river outfalls, within the effects of tidal flow, heavy traffic concentrations, etc.

• Such days are in my opinion and experience barred from a speed and performance calculation as they may affect a vessel’s speed to an incalculable degree.
• On the previous slide, which I will return to in a moment, I have plotted the vessel’s daily positions and shown the current effect on one of the plotted positions.

• On that day the current had a moderate probability of between 50% to 75%, and was flowing at a rate of half a knot encountering the vessel’s course at an angle of 124°.

• Such a current would enhance the vessel’s speed by 0.17 knots, and therefore that amount would have to be deducted from the average speed achieved that day in order to determine the vessel’s current corrected speed.
• Once all the admissible days have been plotted, and the current effect considered in accordance with the Charter Party criteria it is then possible to calculate the vessel’s current corrected “Good Weather” speed.

• The next slide shows a full speed and performance calculation for a voyage from Ventspils to Zhoushan. You will see on this that days in tidal waters have been discounted as have the days when weather conditions were in excess of the Charter Party “Good Weather” criteria.

• In this particular Charter Party the “no adverse currents” provision appeared and therefore I have given the Owner the benefit of the beneficial currents, whilst negating the effect of the adverse currents.
**M.V. "HAPPY"**  
**PASSAGE: WENTWORTH TO ZHUOZHUAN**

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<th>Noon Position</th>
<th>Distance (Nautical Miles)</th>
<th>Hours Run</th>
<th>#FD</th>
<th>MIO</th>
<th>Wind Resultant Force</th>
<th>Wind Resultant Hours</th>
<th>Rate (kts)</th>
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<th>Bearing (°)</th>
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<td>324.7</td>
<td>24.4</td>
<td></td>
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**OCEAN CURRENT CORRECTIONS**

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**GP WARRANTIES**

ABOUT 15% SHORTS ON ABOUT 32 GMT FLO: LUCON (Clause 11. "6 DEGREES ABOUT")
Not less than 300 nautical miles, therefore a certain speed of 13.30 kts.

Good Weather, against wind, therefore a certain speed of 13.30 kts.

**Checklist for M.V. "HAPPY"**

1. Check all the headings and courses.
2. Check the wind and current conditions.
3. Check the speed and direction of the vessel.
4. Check the distance and time of the voyage.

Good weather conditions of the vessel are not exceeding the forecast. The vessel is on a straight course and has no adverse current and no negative influence of swell.

Wentworth to Zhuozhan: 1106.7 km

**WENTWORTH TO ZHUOZHUAN**

1106.7 km
• I should note that there have been two recent London Arbitrations Awards, which I believe were summarised in LMLN 3/12 and 4/12, that have considered that where such wording appears in a charter party one should not give the benefit of favourable currents to Owners, but should negate them.

• I have to say I disagree with that view and consider the view taken in London Arbitration 15/07 to be correct.

• In negotiating the fixture the Brokers have expressly agreed to “no adverse currents” which clearly shows that it is only adverse currents that are to be taken into account when considering is the warranty was or was not met.
• The Charter Party will provide a warranted speed, for example 14.0 knots.

• Most Charter Parties will qualify this warranted speed with the word “about” either directly or with an all embracing qualification of the descriptive clause that “all details are about”.

• In London Arbitration it is widely accepted that the effect of such a qualification is that an allowance of half a knot is made against the warranted speed such that the warranted speed of 14.0 knots equates to a certain speed of 13.5 knots.

• So where in the previous example a current corrected “Good weather” speed of 12.94 knots was calculated this would equate to an under performance in terms of speed of 0.56 knots.
• Once the vessel’s speed in the periods of “Good Weather” has been calculated this speed is then projected, in accordance with the DIDYMI guidelines, over the voyage distance to calculate the under, or indeed over performance. The latter being primarily applicable to Tanker Charter Parties
• Having calculated the current corrected “Good Weather” speed of the vessel, and thus her over or under performance, it is then necessary to consider the IFO consumption during the voyage.

• There are a number of ways in which consumption can be considered, all however must by necessity to a certain extent be theoretical.

• In my opinion the most practical way to consider consumption is to examine what the vessel’s actual consumption was during the admissible periods of “Good Weather”.

• If we have access to the Engine Room Log Book which should contain either daily flow meter readings or other records of daily consumptions this will provide an accurate daily record.
• Care must be taken to ensure that the figure in the Engine Room Log Book is the actual consumption, and not as often is the case simply the warranted Charter Party consumption.

• Once it has been established that the figures are indeed the daily consumptions then the daily consumptions during the periods of “Good Weather” can be totaled to calculate the consumption during these periods.

• The next step is to calculate what the certain consumption should have been during the “Good Weather” period.

• The Charter Party will contain a warranted daily consumption.
• As with the speed this warranted consumption will be either directly, or the clause as a whole will be, qualified by the word “about”.

• It is generally accepted in London Arbitration that this qualification has the effect of giving the Owner an allowance on the warranted consumption of between 3% and 5%.

• Thus a warranted consumption of “about 32.0 mt of IFO daily” equates to a certain consumption of 33.60 mt of IFO daily with an allowance of 5% against the word “about”. I shall return to this allowance in a few moments.

• This figure is then used to calculate the warranted certain consumption during the “Good Weather” periods.
• Thus for example if the periods of “Good Weather” totaled 19.45 days the warranted, certain IFO consumption would be 19.45 x 33.6 = 653.52 mt.

• From studying the Engine Room Log Book it is established that the actual consumption during the same 19.45 days of “Good Weather” was 670.50 mt.

• Comparing these two quantities shows that during the periods of “Good Weather” the vessel has consumed more than the warranted, certain consumption of 653.52 mt of IFO.
• There are a number of ways in which a vessel’s “Good Weather” consumption can be assessed.

• In so far as I am aware there is no legal precedent as to how this task is to be gone about.

• As a consequence of this there are a number of accepted ways in which the calculation can be undertaken

• In my experience the two most widely accepted are the “Ratio Method” and the “Good Weather All the Way” methods.

• I shall first consider the “Ratio Method”
• The excessive “Good Weather” consumption that we calculated a few moments ago can be expressed as a percentage of the warranted, certain consumption thus:-

• \[ 670.50 = x \] therefore \( x = 2.59\% \) overconsumption
• \[ 653.52 \quad 100 \]

• Therefore during the periods of “Good Weather” the vessel overconsumed IFO by 2.59%.

• Following the same logic that the DIDYMI guidelines give in relation to speed it can be assumed that this overconsumption would have been the same throughout the voyage had the entire voyage been in “Good Weather”
• The next step is to calculate the warranted, certain consumption for the entire voyage.

• Thus if the voyage was 11,464.2 nm in length at the warranted, certain speed of 13.5 knots the voyage duration would have been 35.38 days.

• The warranted, certain daily consumption was 33.60 mt.

• Over a voyage of 35.38 days the vessel should therefore have consumed 1,188.77 mt of IFO.
• It has been established that during the periods of “Good Weather” the vessel overconsumed IFO by 2.59%.

• The overconsumption for the entire voyage can therefore be calculated from the ratio as follows:-

  \[
  \frac{x}{1188.77} = 2.59/100
  \]

• Therefore the overconsumption, x, equals 30.79 mt.
• If the vessel is warranted to consume diesel or gas oil at sea in the auxiliary engines a similar exercise must be undertaken to ascertain whether there has been any over or underconsumption against the warranted, certain consumption.

• When considering diesel or gas oil consumptions care must be taken to ensure that if the Charter Party specifies that such oil may be consumed in the main engine whilst maneuvering or in congested waters any such consumption is removed from the voyage consumptions prior to undertaking the calculations.

• The diesel or gas oil “Good Weather” consumption should be calculate by the same methodology as has been used for the IFO “Good Weather” consumption.
• That was the calculation following the “Ratio Method”.

• The other method commonly used is the “Good Weather All the Way” method.

• Under that method we use the following formula:-

  \[
  \text{Voy Dist} \times \text{Gd WX Cons} \times \text{Voy Dist} \times \frac{c/p \text{ cons}}{24} \]

  \[
  \text{Gd Wx Av Spd} \times \text{Gd Wx Time} \times \frac{c/p \text{ Speed}}{24}
  \]

• In which the left hand side of the equation is the “Good Weather” consumption and the right hand side the charter party consumption
If we input the values I have used previously into that formula the calculation will appear as follows:

- \[11,464.2 \times 670.50 - 11,464.2 \times 33.60\]
- \[12.94 \times 466.80 - 13.50 \times 24\]
- \[1,272.56 - 1,188.88\]

Which is therefore an overconsumption of 83.68 mt

This it will be noted is somewhat different to the overconsumption of 30.79 mt computed by the “Ratio Method”
The two methods produce different answers. Which is correct?

The answer to that is that neither is necessarily correct nor incorrect.

What is being calculated is a fictitious “Good Weather” consumption.

The simple bottom line is that both methods have their champions amongst arbitrators and all one can do is hope, unless you happen to know a particular arbitrator’s current favourite, that the method you have used finds favour with your arbitrator that day.
• When I first started to speak about consumption I said I would return to the +5% allowance in relation to the word “about”.

• Until very recently is was generally accepted that the word “about” conferred a benefit to the Owner. The only argument was whether that benefit was in increase in the warranted consumption of +3% or +5%.

• However in a recent judgment – the “GAZ ENERGY” – it was held that you should do an initial calculation giving the Owner the benefit of the +5% increase.

• If however that calculation resulted in an underconsumption a second calculation is to be done with an allowance of -5%
• Should that second calculation still result in an underconsumption then the Owner is entitled to recompense for that lesser quantity of underconsumed fuel.

• If however the second calculation results in an overconsumption, which in my experience to date it invariably does, the neither Owner nor Charterer has any benefit.

• I should note however that there are dissenters in the ranks in who are of the opinion that the GAZ ENERGY related to a tanker charter party and is therefore not applicable to disputes centred around a NYPE or other bulk carrier charter party format.
• So that is how a Marine Consultant approaches a speed and performance calculation following the guidelines set out in the “DIDYMI”, the “GAS ENTERPRISE” and latterly the “GAZ ENERGY” judgments.

• However we are not the only people purporting to do these calculations. The various Weather Bureaux such as AWT, DMI, WNI and others also produce calculations that they say show a vessel’s speed and performance.

• I understand that a later paper will consider the position of the Weather Bureaux.

• I shall therefore not consider the matter further.
In summary:

1. Read and be guided by the Charter Party;
2. Calculate the vessel’s “Good Weather” speed;
3. Project that speed over the entire voyage in order to calculate by comparison with the warranted certain voyage duration the under or overperformance;
4. Establish the vessel’s actual “Good Weather” consumption;
5. Compare that consumption with the warranted certain consumption in the same period to establish a percentage under or overconsumption;
6. Apply that percentage to the warranted certain voyage consumption to calculate the voyage under or overconsumption;
Part C

Richard Stretch
Contents

• Legal: Role of expert witness
• Forecasting Waves
• Marine weather hindcasting
• Expert witness: court attendance if required

• Post event analyses global marine for the legal profession: usually a dispute between cargo charterers and ship owners

• Post event analyses: high profile cases: M5 / Christmas Island.

• Reports: Thai Rainfall JBA consulting / Severn Trent water

• Marine climate analyses for oil / gas / wind farms
Legal role of Marine Consultant

Preparation of legal reports for Lawyers acting on behalf of:
Ship owners or Charterers (those who commission the ship to carry cargo) in respect of:

- Ship loss, delay or collision
- Vessel performance: heavy weather damage
- Personal injury
- Cargo damage or loss
- Acting as ‘expert witness’ at court or in arbitration hearings
MSC Napoli: Listing to starboard
18 Jan 2007

Hull fracture

MSC Napoli following the structural failure
Main task of Experts in Litigation

- **WRITTEN REPORT**, to use as evidence and to assist the court in deciding the dispute

- **WRITTEN QUESTIONS**, to answer written questions on the report

- **PRE TRIAL DISCUSSION**, to attend pre trial discussion with expert from the other party, to narrow areas of disagreement

- **ORAL EVIDENCE**, to give oral evidence at court
Role of Expert Witness

- **Overriding objective**: Duty to the court: not to those paying you

- To express scientific evidence concisely and in layman’s terms: provide unbiased and objective opinion within limits of expertise

- Never judge the facts

- To inform the ‘mind’ of the jury through cross examination process
Facts and Opinions

- **FACT**: can be proved to be correct
  
  (i.e. When smoke interacts with fog there is a marked reduction in visibility)

- **OPINION**: a subjective statement; based on the result of an individual interpretation
  
  (i.e. On a foggy night, a firework display 200 metres from a motorway ended 8 minutes before a multi vehicle crash. Clearly, firework smoke was the main cause of the crash, because ..................)

- Both can be expressed in a report, but OPINIONS should be qualified
Atmospheric forecast models go to drive 3 wave models: climate 50 km / global 35 km / Euro 8 km

Developments to the resolution of our three major models
Over the last 4 years, we have consistently out-performed five of the major operational Numerical Weather Prediction centres. The verification results are plotted as a difference to ECMWF (European Centre for Medium-Range Weather Forecasts). ECMWF is an intergovernmental organisation that provides non-operational weather forecast data, products, and supercomputing facilities to the meteorological organisations of its Member States. The Met Office optimise ECMWF data in our BestData blend alongside our own in order to gain benefits from both models.
Wave basics

Wind wave: wave generated by interaction of wind at sea surface. Growing wind sea will start off with short period which will increase with time and increasing wind speed.

Depends on:
1) Wind speed at sea surface
2) Duration of wind at that speed
3) Unobstructed distance of sea / FETCH

\[ H_{\text{sig}} = 0.0163 \times (\text{fetch distance in Km})^{1/2} \times \text{wind speed at 10 metres} \]

Formulae for sig wave, period, energy, speed are derived by assuming that waves are grown by the wind energy from a flat surface: linear theory.

In reality waves are inherently non linear and growth can be achieved from interacting wave trains. We start from an almost flat surface.
Wave Basics: wave energy spectrum

Sum of individual wave trains
caused by local winds
and distant swells
= total sea state (the spectrum)

Each sinusoidal component is
defined in terms of its energy (amplitude)
frequency and direction of travel.
The spectrum at any point in time is a 2D property.
Wind generating waves (wind sea)

Within the model we define the wind-sea as..

that part of the sea-state directly receiving energy from the local wind field

Wind-seas are characterised by a broad spread of energy in both frequency
and direction space

wind-sea fields are often
‘confused’, particularly in the
early stages of growth, but
become more organised as
duration increases and
wind-waves ‘age’
Swell from distant storm (20 sec waves will reach shore before 10 sec waves as they travel faster)
Wave record sample + Draupner inset
Wave distribution diagram

Rayleigh Wave Distribution for Buoy 42040 During Hurricane Ivan

Most frequent wave height
Average wave height

Significant wave height

Average height of highest 10%

Wave Height (feet)

What a marine observer will perceive as the average height of a sea state
Significant wave height

- Significant wave height: the mean height of the 1/3 of the highest waves in a time series.
- OR the average measurement of the highest 33% of waves
- Sig wave = $\sqrt{(\text{wind wave}^2 + \text{swell wave}^2)}$ metres
Before models: WMO Nomogram:
estimating wind wave from wind speed

1. Determine fetch - select 50nm
2. Select wind speed (30 knots)
3. Follow axis for duration of wind (up to 3 hours)
Wind Wave Height builds to 2.0m.
4. Follow axis for additional duration of wind (up to 6 hours)
Wind Wave Height rises to 2.8m.
5. Follow axis for additional duration of wind (up to blue line - fetch limitation)
Wind Wave Height reaches a limit of 3.2m.
Wave energy balance equation

Wave energy remaining per grid point

\[
\text{local } (dE/dt) + \text{ advected } (\text{group velocity} \times \text{Grad } E) = \text{ wind input energy } + \text{ non linear interactions } + \text{ dissipation (whitecapping) energy } + \text{ shallow water effects}
\]

- Wind input is a function of wind speed, duration and fetch
- Non linear interactions are those between waves: two interacting waves trains will generate a third train with transfer of energy.
- Energy is lost as waves steepen and break (whitecapping)
How are waves modelled? By describing the distribution of energy in the spectrum. \( H_s = \sqrt{(4m_0)} = \sqrt{(4E)} \)
Energy / frequency v direction

2.5-25 secs (25bins) V 15° (24 bins)

Plan & spectral views
Writing a marine hindcast

• Work out route from noon local positions
• Work out 3 or 6 hourly UTC positions w.r.t time zones
• Extract model data: wind and seas and current if required
• Tabulate
• Extract ships data along the route
• Evaluate bias and SDs of model background against observations
• Tweak tabulated values
• Write up report with methodology, opinion and conclusion
WMO code 3700 (a return to the 1874 sea disturbance code + heights. Douglas scale abandoned in 1940)

### SEA STATE – WMO Code 3700

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Height in metres</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Calm – glassy</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Calm – rippled</td>
<td>0.1 or less</td>
</tr>
<tr>
<td>2</td>
<td>Smooth – wavelets</td>
<td>Over 0.1 to 0.5</td>
</tr>
<tr>
<td>3</td>
<td>Slight</td>
<td>Over 0.5 to 1.25</td>
</tr>
<tr>
<td>4</td>
<td>Moderate</td>
<td>Over 1.25 to 2.5</td>
</tr>
<tr>
<td>5</td>
<td>Rough</td>
<td>Over 2.5 to 4.0</td>
</tr>
<tr>
<td>6</td>
<td>Very rough</td>
<td>Over 4.0 to 6.0</td>
</tr>
<tr>
<td>7</td>
<td>High</td>
<td>Over 6.0 to 9.0</td>
</tr>
<tr>
<td>8</td>
<td>Very high</td>
<td>Over 9.0 to 14.0</td>
</tr>
<tr>
<td>9</td>
<td>Phenomenal</td>
<td>Over 14.0</td>
</tr>
</tbody>
</table>
Data / Info: trawling for evidence

Modelled Data
Wind and Waves

Measured Data
MAWS – Marine Automatic Weather Stations
(Wind, Waves etc)
ASCAT satellite wind radar

Estimated Data
Ship Observations 1854-NOW
(Wind, Waves, Weather etc)
Wave climate model res: 50 km
Global operational: 35 km
Validation against VOS and ASCAT
Table 5.13  Marine Weather table of wind and seas

Refer to Appendix A for Beaufort Force (BF) and qualitative wave ranges and definitions.

<table>
<thead>
<tr>
<th>Year</th>
<th>Time / point</th>
<th>Location</th>
<th>Wind</th>
<th>Sig Wave (model)</th>
<th>Wind Wave (model)</th>
<th>Swell Wave (model)</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>°S °W/E</td>
<td>dir</td>
<td>10 metres</td>
<td>BF</td>
<td>height</td>
<td>Qual</td>
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<tr>
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<td>true kts</td>
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<tr>
<td>00</td>
<td>47</td>
<td>36.57</td>
<td>-0.72</td>
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<td>23</td>
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<td>Moderate</td>
</tr>
<tr>
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<td>11</td>
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<td>1.0</td>
<td>Slight</td>
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<tr>
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<td>6.94</td>
<td>295</td>
<td>13</td>
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<td>0.9</td>
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</tr>
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<td>2</td>
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<td>353</td>
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</tbody>
</table>

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Voyage hindcast customers: last 12 months

Brookes Bell LLP, Liverpool and Singapore
DNV, Norway
Fednav International, Montreal
Howes Williams Bowers, HK
Jackson Parton, London
Marubeni Corporation, Tokyo
Reed Smith LLP London
U Ming Shipping, Singapore
Webster / Allianz, London / New York
Zhenua shipping, Shanghai
PART D

Curricula Vitae
JULIAN WILKINSON – Consultant at Moore Stephens LLP

Julian Wilkinson is a consultant in the Shipping Group of Moore Stephens LLP, and acts as an expert witness specialising in the quantum of maritime claims. He is a member of The Academy of Experts. Julian has extensive experience of loss of profits claims and other commercial disputes. He has provided numerous expert reports for High Court and Arbitration proceedings and given evidence in Court in the UK and overseas. He acted as an expert witness in the Arkin v Borchard Lines Ltd & Ors. claim and several alleged scuttling claims. He is a director of the London Shipping Law Centre.

SPEAKERS

RICHARD STRETCH

Richard Stretch is currently employed as a Senior Scientist in Weather Analytics within Weather Science at the UK Met Office. The work includes post event marine weather analysis for the global marine market, involving marine casualty, cargo loss, personal injury and voyage marine hindcasting for vessel performance, with a view to appearing at arbitration tribunals if required. Recently, he has appeared in court as ‘Expert Witness’ for high profile cases, such as the M5 motorway crash and the Christmas Island 1958 H Bomb test veteran’s appeal.

He became a forecaster in the organisation in 1978 after completion of the Applied Meteorology Course (post grad) at the Met Office College. From 1982-1985 and 1986 to 1988 he was employed by IAL in the Gulf. In the United Kingdom, his forecasting career was spent in the Met Office, specialising in marine forecasting at Aberdeen & London for North Sea Oil operations 1985-86. From 1988-1998, whilst forecasting at Southampton, he provided international team briefings for the Admiral’s and Commodore’s cup at Cowes IOW. From 1999-2004 he acted as a forecaster at the International Forecast Unit in Bracknell and Exeter, providing forecasting services to the global marine market. Between 2001 and 2004 he specialised in compiling the United Kingdom Shipping Forecast and the Atlantic High Seas Forecast. He is also a Fellow of the Royal Meteorological Society.
Graham D. Harris

Partner, London, UK
T +44 207 655 1214
graham.harris@squirepb.com

Practice Focus
- Litigation
- Energy & Natural Resources
- Financial Services Litigation
- Insurance
- Insurance-Driven Litigation
- International Dispute Resolution
- Transportation, Shipping & Logistics

Education
- University of Oxford, J.D., 1981
- University of Law, London, J.D.

Admissions
- England and Wales, 2014

Listed in the 2014 edition of Chambers UK as a leading individual.

Graham Harris’ practice focuses on maritime, international trade and insurance fields. He has extensive experience in international arbitration under many different regimes in London and regularly deals with international conflicts of law, worldwide asset attachment and enforcement.

His experience in the shipping industry ranges from handling issues arising under charterparties and bills of lading to groundings, fires and cargo claims. He also advises on marine and non-marine insurance disputes, as well as ship sale and purchase, and building disputes. Graham has acted in many cases in the English courts, and has been heavily involved in leading cases in the United States and South Africa. He is a recognised expert in his field and a regular lecturer on maritime issues.

Prior to joining Squire Sanders, Graham led the shipping practice of a major international firm specializing in maritime, trade and finance law.

He obtained a First Class Honours Degree in Jurisprudence from Oxford University and qualified as a Solicitor of the Senior Court in 1981.

Graham is a member of the International Bar Association, a supporting member of the London Maritime Arbitrators’ Association and sits on the Steering Committee of the London Shipping Law Centre.

Graham is the author of the chapter on international maritime arbitration in International Commercial Arbitration Practice: 21st Century Perspectives, published by LexisNexis.

REPRESENTATIVE EXPERIENCE
- Representing the owners in a leading case on withdrawal, waiver and charterers’ liability for “blocking and trapping” insurance.

- Representing the owners in a leading case on owners’ delivery obligations under a long-term time charter.

- Successfully defending on behalf of the buyers a claim for repudiation of a contract for the sale of liquefied petroleum gas (LPG).

- Representing the buyers in a case relating to quantification of a loss arising out of the shutdown of a petrochemical
refinery consequent upon the supply of contaminated cargo under a contract for the sale of LPG.

- Representing buyers, guarantors and shipyards in numerous shipbuilding cases dealing with technical disputes and with claims under both performance and refund guarantees.
- Acting both for and against P & I Clubs on disputes relating to cover and the interpretation of Club rules.
- Representing the owners on a tort claim by an onboard casino for loss of income consequent to the notorious grounding of a well-known passenger.
- Representing owners and charterers in numerous unsafe port cases.
- Representing owners in a number of piracy cases relating to Somalia and Nigeria.
- Representing owners and cargo interests on cargo claims involving cargo fires, disputed general average, delay, damage or contamination, both against but primarily on behalf, of owners.
- Representing owners on a number of claims relating to the quantification of losses on passenger ships due to the cancellation and delay of cruises.
- Negotiating a PFI project for the replacement by the British government of the supply vessel for the British Antarctic Survey.
- Representing the owners in leading cases in South Africa regarding sistership arrest and sovereign immunity, and in the United States on the incorporation into a bill of lading of a London arbitration clause in a charterparty.
- Advising (jointly) on a joint venture between the Through Transport Mutual Insurance Company and SWIFT on the development of an electronic trading and private commercial Internet platform called Bolero.
- Advising a state shipping company in relation to abuse of court proceedings in numerous jurisdictions in pursuit of a fraudulent claim by cargo interests.
- Representing the owners claiming a constructive trust over funds advanced to an insolvent agent.
- Representing the owners in a case involving the total loss of a vessel off the Shetlands involving loss of life, cargo claims and limitation issues.
CURRICULUM VITAE

NAME
PAINES, NICHOLAS CHARLES HAMAR

NATIONALITY
British

DATE OF BIRTH
15.06.54

QUALIFICATIONS
Master Mariner (Foreign Going) Class 1
Certificate : Maritime Assessor/Lead Assessor (ISM/ISO 9002)
Certificate : Company Security Officer ISPS
Certificate : Electronic Chart Display and Information Systems, MCA approved

MEMBERSHIPS
Associate Fellow of the Nautical Institute
Member of the Honourable Company of Master Mariners
Fellow of Society of Consulting Marine Engineers & Ship Surveyors
Fellow British Association of Cargo Surveyors
Member Royal Institute of Navigation
Member ICHCA ISP
Supporting Member London Maritime Arbitrators’ Association

EMPLOYMENT HISTORY

2011 – Date
Newman Giles Paines & Company Limited
- Director

2004 – 2011
Newman, Giles & Company Limited / Gordon Giles and Company Limited
- Associate, Surveyor and Consultant
Marine consultant and expert witness covering groundings, collisions, navigational disputes, ISM related disputes, timber deck cargo losses, claims relating to steel cargoes, speed and performance disputes, various bulk cargo disputes, unsafe port claims, disputes involving fixed and floating object damages, disputes relating to cargo gear (cranes, derricks and cargo lift systems), new building disputes and personal injuries. Expert evidence given in UK (Court and Arbitration), PRC (Tianjin), Canada (Montreal) and USA (New York).

1998 – 2004
Confidence Shipmanagement Co BV
Managing Director – Bulk Carrier, Tween Deck and Container Feeder fleet
Including operational control of company reporting directly to share holders. Overseeing implementation of ISM and ISPS codes. Vetting sea staff with personal responsibility for all Masters and Chief Engineers. Overseeing preparation and implementation of budgets. Preparing specifications for and overseeing scheduled and repair dry dockings with full responsibility for financial outcome. Negotiating SHIPMAN/CREWMAN contracts with Owner’s. Developing and maintaining senior staff training programmes. Developing and overseeing on board training programmes Handling all Insurance claims relating to vessels and crew. Oversaw new building project, including eventual Arbitration over a dispute that arose.

1996 - 1998
Orient Shipping Rotterdam BV
Marine General Manager – Bulk Carrier and Tween Decker Fleet
Including operations, technical overseeing of 3rd party vessels, pre purchase and pre hire surveys of vessels. Port Captain and Supercargo loading timber, logs, sulphur, grains and wet ores amongst other bulk and break bulk cargoes. Assessing suitability of cargoes proposed by Charterers. Assisting Post Fixing department in processing claims. Acting to protect Owner’s interests in disputes with Trade Unions and the ITF.

1986 - 1995
TMC (Marine Consultants) Ltd
Staff Consultant & Surveyor, Director

1983 – 1986
Jardine Ship Management Co Ltd
Master – Bulk Carriers, bulk and forest product carriers. Cargoes included grains, forest products, steel products, cement and cement clinker, kaolin, sulphur, ores, etc.

1979 – 1983
Indo – China Steam Navigation Co (Hong Kong) Ltd
Chief Officer – Bulk Carriers, bulk and forest product carriers. Cargoes included grains, steel products, forest products, cement and cement clinker, kaolin, sulphur, ores, etc.

1978 – 1979
Indo – China Steam Navigation Co (Hong Kong) Ltd
Second Officer – Bulk carriers

1978
Townsend Car Ferries Ltd & Hoverlloyd Ltd
Seasonal Second Officer on cross channel car ferries and hovercraft
1975 – 1978  P&O General Cargo Division
Sea going officer - General cargo, reefer and heavy lift vessels

1972 – 1975  British India Steam Navigation Co. Ltd and P&O General Cargo Division
Deck Cadet - General cargo, reefer and heavy lift vessels

PAPERS PRESENTED

Presentation of papers at seminars held by Lloyd’s Maritime Academy, the Nautical Institute, IBC UK Conferences Ltd, Ship Owners, P&I Clubs and Law Firms.

PUBLICATIONS

Contributor to publications including The Nautical Institute’s “Bulk Carrier Practice”
The Standard P&I Clubs – “Standard Cargo – Bulk Carriers – Hold preparation and cleaning”
Various ICHCA publications
Member of ICHCA working group on re draft of Code of Safe Practice for Ships Carrying Timber Deck Cargoes 2011 (2011TDC)