The Navigation of the *Nonsuch,* 1668-69

William Glover

An element of risk is a component of all venture capital. As investors today carefully analyze the nature of risk before taking part in a new start-up business, so it is reasonable to suppose that the backers of the 1668 voyage of the Nonsuch to Hudson Bay, that led to the charter of the Hudson's Bay Company, made their own form of risk appraisal. The proposal for the voyage was made by Mèdard Chouart Des Groseilliers and his younger brother-in-law, Pierre Radisson. Frustrated by regulations in New France that prevented them from trapping in what they were sure would be the fur-rich regions of James Bay, they made their way first to New England. There they met Captain Zachariah Gillam but were unsuccessful in getting to the Hudson Bay region by sea. Together, the three men went to England in search of backers. Economic historians of the fur trade, using period data of costs and prices, have made extensive studies of its profitability. Historians have, however, largely ignored one specific category of risk - the hazard of navigation. Although the actual record of loss would seem to support assumptions of the safe arrival of trading goods in North America and of the return of the furs for satisfactory sale, it is unfortunate for it trivializes the risk and the enormous human endeavour that was necessary to ensure those safe passages. Indeed, the first voyage of the Nonsuch under Captain Zachariah Gillam was much more a voyage into the unknown than is commonly supposed.

A study of the navigation of that 1668 fur trading voyage may conveniently be divided into three parts. First, what was the contemporary practice of navigation? While the original investors would not have considered this a part of undue risk, our appreciation of that standard in comparison with our modern knowledge serves to emphasize the actual achievement. Second, what was known of the area where the Nonsuch and her consort Eaglet were being sent? With our hydrographic information we are again well placed to make a more exact assessment of the seventeenth century risk. Third and finally, what do we know of the actual voyage? What does its record represent?

The navigation practice of late 1600s provides the context for study of the Nonsuch voyage. In the words of John Seller (fl 1658 - 98), a compass and instrument maker and Hydrographer to the King over three reigns,[1] navigation "consists of two *general Parts.*

1 E.G.R. Taylor, *The Mathematical Practitioners of Tudor & Stuart England,* (Cambridge, 1968), 244.

The Northern Mariner/Le marin du nord, **XI, No 4 (October** 2001) 49-63.

> *First,* That which may be called the *Domestick,* or more *common Navigation,* I mean Coasting or Sailing along the Shore. This imploys the Mariners *Compass* and *Lead* as the chief instruments;...
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> *Secondly,* That which may more properly bear the Name and principally deserves to be entitled the ART OF NAVIGATION, is that part thereof which guides the Ship in her course through the Immense Ocean, to any part of the known World; which cannot be done unless it be determined in what Place the Ship is at all times, both in respect of *Latitude* and *Longitude;* this being the principal care of a *Navigator,* and the *Master-piece* of *Nautical Science.2*

As may be readily appreciated, these two parts required substantially different methods and skills. Coasting was heavily dependent on personal knowledge. This had first developed in the oral tradition and after the printing press, came to be written down. The books of sailing directions were known as "waggoners' or "rutters."[3] In waters known by either the captain of the vessel or the master (a position of responsibility for navigation and frequently separated from command) the use of a chart was incidental. A ship's position was determined by visual reference to land, by the depth and nature of the sea bottom, or both. Incomplete or inaccurate knowledge of the coast and waters or an inaccurate assessment of position were obvious hazards.

Weather presented another danger. A modern writer, with good charts of a known coast and some access to weather information has described how changing weather can cause difficulties.

> On a coasting voyage one must always be prepared to be "caught" by bad weather at an exposed point, whether in open or at anchor. The essential thing is to decide quickly and definitively which of two policies to pursue, that of blue water or shelter. It is nearly always a nicely balanced choice of evils, but the choice must be made and maintained without vacillation. Otherwise you court unnecessary risks, from which only good luck can save you, such as embayment on a lee shore or a prohibitive surf on a harbour bar which you have reached too late. Working down the Channel, for example, along that inhospitable sixty miles of coast between Dover and Newhaven,

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John Seller, Hydrographer to the King, *Practical Navigation or An 1ntroduction to the whole Art,* (London, Fourth edition, enlarged, 1680), 1.

"Waggoner" is the English corruption of Wagenaer. Lucas Janzoon Wagenaer was the first person to provide books of sailing directions with charts. "Rutter" likewise is the corruption of *routier,* from *Le grant routier, a* book by Pierre Garcie (1520) that provided routes between destinations. D.W. Waters, *The Rutters of the Sea: The Sailing Directions of Pierre Garcie,* (New Haven, 1967), 30.

> you are assailed by a sou'wester between Hastings and Eastbourne. To go on or go back? Make your resolve and stick to it. If you harden your heart for a stiff thrash round Beachy Head, reef down and tackle the job with dash and tenacity. But the current round the Head may be adverse or the race too formidable. If you must turn, turn at once. Short of the Downs and Ramsgate the coast offers few alternatives: Rye, on an angle of a bay, approachable only at high water and highly perilous even then; Dungeness East Road, an open anchorage, exposed to any shift of wind south of sou'west; Folkestone, the last place for a small yacht; and Dover, a perfect refuge once gained, but in heavy weather presenting a most dangerous entrance to small craft owing to the violent currents and backwash. You cannot afford to hesitate over these alternatives. Rye is a question of minutes, an error may leave you stranded or embayed, and Dungeness is eighteen miles - say, nearly three hours - from Dover, time enough to make the difference in the practicability of the latter harbour.4

Several observations may be made. First, when Gillam took the Nonsuch into Hudson Strait he left astern the local knowledge essential of coasting which in European waters had developed over centuries. Even on the Grand Banks fishery and parts of the Newfoundland shore local knowledge had been accumulating for over a century. Ahead of him lay hundreds of miles of largely unknown and potentially inhospitable coast. Second, the discussion of time and distance in relation to the various options neatly emphasizes the increased risk weather poses to the mariner unable to rely on a engine to get him out of trouble. Today, few of us have any significant experience in a boat without even a small auxiliary engine. In assessing risk we must not overlook the need of the sailing master, moving perhaps at four knots, to anticipate a problem and take early avoiding action. Third, the writer was able to base his assessment of options in part on a very good knowledge of tides. He also had a very good knowledge of each of the possible refuge harbours and their liabilities. The risk to navigation of weather on inadequately known coasts is forcefully demonstrated by Gillam's own death. In 1683, off Port Nelson on the west coast of Hudson Bay, his ship dragged her anchor in a storm and was lost at sea with all hands.[5] Could this be attributed in part to a lack of knowledge on which an informed decision could have been made? We will never know. However modern sailing directions do say "a berth suitable for small vessels is charted off Port Nelson. Anchorage can be obtained ... in an area known as York Roads. Both anchorages are exposed to NE gales *which are frequent during the navigation season."6*

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[4] Hugh & Robin Popham (editors) *A Thirst for the Sea: The Sdiling Adventures of Erskine Childers,* (London, 1979), 49.

G. Andrews Moriarty, "Gillam, Zacarhariah," *Dictionary of Canadian Biography,* vol1, (Toronto, 1966), 338.

Sailing Directions Labrador and Hudson Bay, (Ottawa, sixth edition, 1988), 423. Emphasis added.

Clear of coasts, the second part of navigation presents a completely different set of problems. This demands Seller's ART OF NAVIGATION to find the latitude and longitude and so determine the position of a ship. Of the two, latitude is easily found by the observation either of the sun at noon when it is directly over head (the meridian passage) or at twilight by taking the altitude of the north star. Both the technique and the mathematics for each of these observations were well known by 1668. However, a modern navigator familiar with reflecting instruments such as the sextant (and with the widespread and cheap availability of hand held global positioning systems such a person may well be an endangered species) might be dismayed by the range of instruments available to Gillam for his voyage. John Davis, the great Elizabethan navigator after whom the northern strait is named, wrote that "the instruments necessary for a skilfull Seaman are a Sea Compasse, a Crosse Staffe, a Quadrant, an Astrolaby, a Chart, an Instrument magneticall for the finding of the variation of the Compasse,[7] an Horizontall plainesphere,[8] a Globe,' and a paradoxall Compasse ... but the Sea Compasse, Chart and Crosse Staffe, are instruments sufficient for the Seamans use: the Astrolabie and Quadrant being instruments very uncertaine for Sea obseruations."[11] To this list must be added the back staff developed by Davis himself.[12] One might ask why was it necessary to have so many different types of instruments, all for the same purpose of observing the altitude of a heavenly body? Each had their own strengths and weaknesses. For example, while a back staff was the most accurate and convenient instrument for a sun sight, depending as it did on shadow it would have been useless for taking Polaris. For sun sights, a cross staff could be, quite literally, a blinding experience:[3] For star sights at mid-latitudes, the cross staff scale was larger and, therefore, potentially more accurate than an astrolabe, but at high latitudes (and therefore altitudes of Polaris) the astrolabe would have been preferred if stars were visible. [m]An older instrument was not immediately superceded and cast aside simply because a new and potentially better instrument was available. Although the first

'7 This was an instrument to assist in determining the true azimuth of the sun. The difference between that and the compass bearing of the sun was the variation.

'8 Used for plain sailing, following a parallel of latitude across an ocean.

9 A globe was then the easiest way of determining the true distance and angle between places.

[10] Paradoxal navigation was sailing a rhumb line, a line that cuts all meridians at the same angle.

[11] John Davis, The Seamans Secrets, (London, 1633), p B [reverse].

[12] See the list provided by Thomas James in his The Dangerous Voyage of Captain Thomas James in his intended Discovery of a North West Passage into the South Sea, printed 1633 and reprinted 1740, (Toronto, 1973), 127.

'[3]A cross staff could blind in two ways. First, one end of the staff was rested immediately below the eye. Some navigators shaved the end of the stick to a point in an attempt to reduce parallax error, thus increasing the risk of eye injury. Second, the sun was observed directly. Contemporary instructions spoke of "blinking rapidly" to avoid staring at the sun. This experience, necessary for taking the sun's altitude before the development of the back staff, and repeated almost daily on an ocean passage might be contrasted with the repeated warnings we are given today about not observing an eclipse directly.

[14] David W. Waters, The Art of Navigation in England in Elizabethan and Early Stuart Times, (London, 1958), 146.

reflecting instruments were being developed about the time of the ***Nonsuch*** voyage,[15] back staffs were still being made a hundred years later.'

With one's instrument of choice, what accuracy could be expected in the resultant latitude? Not surprisingly, it varied. D.W. Waters, the expert on Elizabethan navigation, has suggested that with these instruments "observations ... by even the most skilled navigators were rarely more accurate than to within half a degree [or thirty nautical miles]."" On the other hand, both John Ross and Edward Parry, who following the end of the Napoleonic Wars were among the first to explore Davis Strait since Davis, were impressed with the accuracy of his recorded latitudes.' It is important to remember that Davis was most emphatically a " scientific navigator" fully acquainted with the use of instruments, the mathematics of sight reduction, and the need for accuracy.

The other component of a position - longitude - was much more difficult for any navigator to establish. Before chronometers or lunar distance calculations, both dating from the later 1700s, dead reckoning was the method of determining a position in mid ocean. The master kept a careful record of course and distance made good and used this to estimate his distance and bearing from the known position of his point of departure. Traverse tables were used to convert the distance and bearing into an estimate of longitude. Simple perhaps to describe, it was fraught with difficulty. First, there was the matter of determining the course made good. It obviously depended on the ability of a helmsman to maintain an ordered course, and of the officer of the watch to gauge the ship's leeway. Although the problems of the magnetic compass were not finally sorted out until the late nineteenth century, in the 1660s variation was certainly understood and commonly allowed for. Distance made good is a function of speed. That was determined by streaming the log line. It was knotted at specific intervals, and the number of knots that were run out in thirty seconds or a minute provided a ratio for the number of miles run in an hour. Samuel Pepys, the seventeenth century diarist and Secretary of the Admiralty, has left us a vivid account of the problem of dead reckoning from his voyage to Tangier with the English fleet in 1684.[19] Pepys "did pray my lord [Dartmouth, the admiral] to cause a strict account to be demanded of all in the ship that did keep a reckoning, before they come to see land and expected to see it." When, three days later, land was sighted within three leagues "it appears that not one [master] by my lord's hand draught [chart], which he carried with him and was admitted for a good one, were by their reckoning within so little as twenty-five leagues of it ... Others' differences did amount to from thirty to seventy leagues." In other words, when within nine or ten miles of land, (one league

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Charles H. Cotter, A History of the Ndvigator's Sextant, (Glasgow, 1983), 104.

[16] I am indebted to Mr G.P. Fitzgerald of the Science Museum, South Kensington, London, for showing me a back staff , item 1912-392, "made by Jonathon Gilbert, Tower Hill London for Henry Tyndall, January 20, 1759."

[17] Waters, Art of Navigation, 52.

[18] Thomas Rundall, Narratives of Voyages towards the North-West in Search of a Passage to Cathay and India, 1496 to 1631, (New York, reprinted 1970), 39n.

[19] Edwin Chappell (ed), The Tangier Papers of Samuel Pepys, (Navy Record Society, 1935), 126-9.

was three miles), some masters thought they were more than 200 miles away. The solution hardly furthered the cause of accurate navigation. "And accordingly they did take it upon them to condemn my lord's [chart], and rectify it by a Dutch printed one, all concluding that that was the rightest, but it was plain they never thought of this till their reckoning by the other was found so erroneous."[20] Davis had required *a* chart, not a selection from which the most convenient might be chosen. The chart was almost certainly in error by today's standards, but there were other problems.

Two difficulties immediately come to mind. The first was the understanding of ocean currents. In the seventeenth century, there was no knowledge of currents and, therefore, no allowance could be made in the dead reckoning. Real scientific work on the nature and rate of ocean currents would wait over a century. The second question was 'how long is a mile?" Davis wrote "a mile is limited to bee 1000 paces, euery [sic] pace 5 foote, euery foote 10 inches, and euery inch 3 barley comes dry and round ... so by these rates of measure you may proue that a degree is 20 leagues, or 60 miles, a minute is a mile or 5000 feet This measurement was derived from the mile of the Roman empire. Thomas Blundeville, (fl. 1560 - 1602), a mathematical tutor and well known in navigation circles, writing in *His Exercises* said that a fathom was *five* feet, and an English league was 2500 fathoms, as distinct from a Spanish league of 2857 fathoms. A degree was 17½ Spanish leagues. This meant that a mile, either one third of the English league or one minute of a degree, was 4166 feet.[22] Richard Norwood, writing in 1636, argued that a degree was 367200 "of our English feet" which would mean a minute "vulgarly called a mile" was 6120 feet. However, he went on:

> But because (as I have before shewed) the ship's way is commonly more than by the *Log-line* it appears to be, and every Man desires to have his Reckoning something before his Ship, that he fall not with a Place unexpected; for these, and such other causes and for the Rotundity of the number, if any Man think it more safe and convenient in Sea-Reckoning, he may abate one in 51, and so assign to a Degree only 360000 Feet, and consequently to a Mile 6000 English Feet.23

William Oughtred, (1575 - 1660), a highly respected mathematician and instrument maker, writing in his *Circles of Proportion*[24] "doth there propose that 66% Statute miles to answer

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20In the seventeenth century there was some discussion about the relative merits of hand drawn versus printed charts. See Thomas R. Smith, "Manuscript and Printed Sea Charts in Seventeenth Century London: The Case of the Thames School" in Norman W. Thrower, (editor), *The Compleat Plattmaker Essays on Chart, Map and Globe Mdking in England in the Seventeenth and Eighteenth Centuries,* Berkeley, Los Angeles and London, 1978.

21Davis, p D (reverse) "What is a degree?"

22M. Blundeville, *His Exercises,* sixth edition "corrected and augmented",(London, 1622), 704.

23Richard Norwood, *The Seaman 's Practice,* (London, 1636), 3, 40.

24 First published 1632, one of several subsequent editions was published in 1660.

to one degree upon the Earth, each containing 5280 feet, so that according to his computation there is 349800 English feet in one degree."' The contribution to this discussion by Captain Charles Saltonstall (fl. 1627 - 1665), a sea captain and professor of mathematics, was no more helpful. He wrote condemning the Davis mile "then which there is nothing more false, for it will not yield the measure, according to the reall truth that is contained in 20 leagues, when it must answer the proportion of one Degree in the Meridian ..." He then continued,

> Mr *Norwood* by his experimentation made in *England,* saith, 6000 foot is in one mile, and 60 of those miles makes one degree in the Meridian, to which proportion the *Spanish* accompt concurreth within a small matter; amongst these diversities of opinions, I suppose the practical Sea-man doth not yet apprehend or make use of the true quantity belonging to one degree in the Meridian: For Mr *Norwood* and the *Spanish* accompt would have them allow but 68 of our Statute miles to make one Degree, which truly I have found by many practical! observations, and precise calculations, may be some-thing too great a proportion; Yet our Degree according to Statute measure is much too little. Therefore I shall now joyne my Judgement with learned *Oughtred's* opinion in this matter, which I suppose will be the best mean proportion amongst so many several opinions, who saith that 66 of our English Statute miles, after the rate of 5280 English feet to each mile will make one Degree in the *Meridian,* which I conclude is the very best and neerest rate of all the others and according to that proportion have now calculated all my Tables, allowing 1000 paces of 5 4/5 foot to make one mile, and 60 of those miles to make one Degree in the *Meridian;* So that now one of those miles will contain 5808 feet, and 60 of those miles will make one Degree in the *Meridian26*

From this discussion alone the options for the length of a mile were: Davis, 5000 feet; Blundeville, 4166 feet; Norwood, 6120 feet or for convenience, 6000, and finally Saltonstall himself, 5808 feet. The publication dates of the works cited and the years of their subsequent editions make it clear that this debate about the length of a mile was very current in 1668. The suggestion that "the practical Sea-man doth not yet apprehend or make use of the true quantity belonging to one Degree in the Meridian" is remarkable and an interesting observation on the practical seaman versus the scientific, and therefore on Saltonstall's assessment of the standard of navigational practice. Luke Foxe, the Hudson Bay explorer of 1631, happily called himself a practical seaman as distinct from his contemporary, "the book-learned" Thomas James. Yet he was certainly better informed of navigation that Saltonstall's comment

n John Seller, *Practical Navigation,* first published 1661, (London, Fourth Edition, Enlarged, 1680), 224.

[26] Captain Charles Saltonstall, *The Navigator shelving dnd explaining all ye chiefe principles dnd parts both theorick and practick,* (London, third edition, 1658), 93-94.

would suggest. Saltonstall as the author a book on navigation was unfairly advancing the merits of the scientific sailor, but perhaps only a scientific sailor could sort out the confusion Saltonstall was sowing.

Saltonstall went on directly to discuss marking a log line. Obviously the mariner had to know how long the mile was that he wanted to use for measuring his distance. That Saltonstall explicitly said that he was calculating his traverse tables on the basis of his definition of a mile raises the question, did mariners know if their log line was knotted for the tables they were using? Whatever length the master thought a mile was, did he have his log line measured to the correct proportion? The answer is probably not. The general preference of the day seems to have been to use a short measure for the mile that would thus give a higher reading of distance run than was actually the case. "Keeping the reckoning ahead of the ship," as it was called, was thought to be a safe and prudent practice for the mariner making a landfall would begin to look for land early.

When the log was streamed it was timed with a sand glass.' A "short glass" of 14 seconds was used for speeds over 5 knots and a "long" glass of 28 seconds for speeds less than 5 knots. (The extra seconds were allowed for turning the glass.) In the seventeenth century, the two bulbs of a sand glass were blown separately and bound together with ribbon at the neck. A thin piece of pierced brass was placed between the two halves with the sand draining through the hole. The joint between the two bulbs was not air-tight and, therefore, moisture could enter, thus affecting the rate of flow of sand and therefore accuracy. In museum conditions, some sand glasses did not flow at a consistent rate.' Was this the case at sea two or three centuries ago? Probably yes. Was the error always noticed? Probably not. So in short, the effects of unknown ocean currents, the question of how long was a mile and how the log line was knotted, and the ability to measure precise time all combined against accurate assessments of distance traveled. A practical seaman's dead reckoning for longitude could have seldom been accurate. A scientific navigator did not necessarily fare any better as the 1699 experience of Edmund Halley, a future Astronomer Royal, shows." The risk of stranding a ship was a part of every day navigation in the seventeenth century that historians should not overlook.

When the Nonsuch and the Eaglet set forth from England for Hudson Bay, what would the sailing masters have known of their destination? Given the high social standing of many of the backers, and the fact that Eaglet was loaned by the Royal Navy at the direction

[27] It is a pleasure to acknowledge the assistance of Mr Peter Fitzgerald and Mr David Roon of the National Museum of Science and Industry, South Kensington, London, England, who showed me the extensive collection of sand glasses the museum holds beyond that which is on display. The following paragraph relies on that opportunity of first hand study.

[28] National Science Museum item 1991-240, described as a 30 second glass was timed at 28:35:30:35:31 seconds on successive turns. Thus, in one direction it did not flow at the same rate twice, and in the other direction it was consistently 7 seconds longer than the "long" glass. Item 1991-206, described as a 15 second glass was timed 21 seconds one way and 18 the other.

[29] Alan Cook, Edmond Halley: Charting the Heavens and the Seas, (Oxford, 1998), 273.

of King Charles II, it is reasonable to surmise that they were better rather than less well prepared.' The question may therefore be answered by looking more generally at what was known about Hudson Strait and Hudson Bay in 1668. The record of exploration in the area begins with Henry Hudson's voyage of 1610-11. After the return of the mutineers, it was followed with voyages in 1612 under Thomas Button, in 1614 under William Gibbons, and in 1615 under Robert Bylot and William Baffin. They made a second voyage in 1616. The Danish expedition of 1619 under Jens Munk may be set aside as the account was not published in English, and was little known outside Denmark. William Hawkeridge led an expedition in 1625. Then, in 1631, there were two expeditions. Thomas James, financed by Bristol merchants, wintered at Charlton Island in the bay that now bears his name, and returned in 1632. Luke Foxe, backed by London financiers, safely returned in 1631. These were the last English voyages until Gillam set off in 1668. It is important to note that all of these voyages were looking for a northwest passage that would take them on the China. Their primary intent was not to explore and chart Hudson Bay. Most of these voyages produced written accounts of some sort. These were assiduously collected and edited for publication by Samuel Purchas in 1625. His Hakluyt Posthumous or Purchas His Pilgrimes remains today an important source for early exploration over many parts of the globe. For example, the Hudson expedition is known to us today only through Purchas.[31] The backers of the Nonsuch voyage would almost certainly have had it, and Gillam would have studied it closely. Both James and Foxe also published accounts on their return.[32] An editor of James's work has described it as of little geographic value but suggested that his account of suffering when he wintered on Charlton Island provided inspiration for Coleridge's Rime of the Ancient Mariner.[33] North-West Fox is particularly useful because the first part of Foxe recounts all the previous voyages. For most of them he acknowledged his debt to Hakluyt, but accounts of three voyages survive today only through Foxe. This record of earlier voyages occupies the first 170 pages of his book. By comparison, his own journal runs to only 70 pages, thus

3° The provision of Eaglet was directed by Charles II to James, Duke of York, February 7, 1667/8, cited in Grace Lee Nute, "Radisson and Groseilliers' Contribution to Geography", Minnesota History, XVI, 419. The signatories of the instructions were: Prince Rupert, grandson of James I and first cousin to Charles II; George Monck, 1' Duke of Albermarle, described by Sir George Clark as "the strongest man in the kingdom" at the time of the restoration; William, Earl of Craven, a staunch royalist; Sir George Carteret, a former Treasurer of the Royal Navy; James Hayes, private secretary to Prince Rupert and man of affairs, and Sir Peter Coleton, Bart., courtier and financier. ibid, 423.

'Reprinted in twenty volumes, Glasgow, 1906.

[32] Thomas James, The Ddngerous Voyage of Captain Thomas James in his Intended Discovery of a North West Passage into the South Sea, first published London, 1633, reprinted Toronto, 1973; Luke Foxe, North-West Fox; or Fox from the North-West Passage beginning ... , first published London, 1635, reprinted Miller Christy (ed) The Voyages of Captain Luke Foxe of Hull and Captain Thomas James of Bristol in Search of a North-West Passdge in 1631-32, two volumes, Hakluyt Society, 1894.

33 Christy, vol 1, clxxxi, clxxxix - cxciii.

The chart illustrated opposite is an actual size reproduction of the Hudson Bay portion of Hessel Gerritsz's map. *National Archives of Canda/NMC 113483*

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making it shorter than James's account.' The value of his running descriptive commentary is deceptive. While the armchair sailor may feel he is given a true picture of the region, there is very little guidance for the man on the spot.

One of the accounts that is unique to Foxe is that of Button's voyage. As he wintered at Port Nelson, off which Gillam was later to lose his life when his ship dragged in a storm, it is interesting to read what Foxe reported of Button's account. It is an example of the sort of information that was available for later navigators:

> ... enduring a grievous storme [he] was put to Southward and constrained to looke for harbour the 13 of August, to repair some losses. After which time, came on the new Winter, with much stormie weather, [so] as he was constrained to winter there in a small Rile or Creeke on the North side of a River in Lat. 57d.10, which River he named Port Nelson after the name of his [sailing] Master (whom he buried there), putting his small Ship in the foremost and Baracadoe them both (with Piles of Fine and earth) from storme of Snow, Ice, Raine, Floods, or what else might fall.
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> He wintered his Ship and kept 3 fires all the Winter, but lost many men, and yet was supplied with a great store of white Partridges and other Fowle, of which I have heard it credibly reported that this company killed 1800 dozen in the Winter season.35

This description provides no information about water, identifying geographic features, or sailing directions that might guide a later mariner. Indeed, the bulk of Button's account is given over to courses and distances between various features with their latitudes, weather conditions and the courses he made good. Where depths of water and/or prominent features are mentioned in the text, a position that would help identification is not provided.

In addition to the printed accounts, there were, of course, maps. Hudson's map was first published by Hessel Gerritsz in Amsterdam in 1611. The long east/west axis of the map (211/2 inches) emphasized that it is meant to portray the route from Europe to China. The area from Digges Island at the northeast corner of Hudson Bay to the bottom of James Bay and from the East Main (the Quebec shore) to the west coast was squashed into the bottom left

[34] I was able to examine an original copy in the John Carter Brown Library, Providence, Rhode Island. The account of Foxe's own voyage begins on page 173 and continues to page 244. That is followed by his apologia, " To whom it may concern" written after his return explaining why he came home rather than winter in the Bay.

Christy, vol 1, 166-7; It is interesting to note that the Sailing Directions: Labrador and Hudson Bay, (Ottawa 1988), give position of Port Nelson as 57°05'N, 92°24W. The latitude error was minimal.

corner of the map, as though to say, "as you proceed west there will be a very large bay to your south. You probably do not want to go into it." G.M. Asher, Hudson's important biographer, has suggested that

> When we apply the standard of Hudson's time instead of our own, we find this chart to be far superior, and decidedly the facile princeps of all the then existing delineations of the arctic regions. The elementary state of geographical science, the imperfections of the instruments, the entire want of any previous data, the fogs, the storms, and the ice of those inhospitable regions, fully explain the unavoidable defects of the work.'

One lasting influence of this chart was the peninsula dividing James Bay. It is perhaps 100 miles wide, and about 210 miles long." Another legacy is that Cape Henrietta Maria was 300 miles too far north at approximately 60°N.[38] The chart has generated considerable comment and opinion for it raises many questions. The important one for us is the problem of accuracy. How could it be that Hudson Strait through which he sailed only once is comparatively so accurate, and yet the south, where he is presumed to have wintered is so inaccurate? Perhaps the most satisfactory explanation is that the map, as drawn by Hudson, was incomplete, and that his draft and notes were interpreted by at least Gerritsz, if not one or more others as well. Inconsistencies in the material they had were made to fit. This was certainly not uncommon for the practice of the day.

Theoretical geography got an important boost with the map drawn by Henry Briggs (1561 - 1630), a famous mathematician instrumental in the popularization of logarithms and the first Gresham professor of geometry.' Drawn for Purchas's great work of 1625, this map is best known for the first depiction of California as an island. However, between Port Nelson where Button wintered and Cape Henrietta Maria no coastline is shown, thus providing room for speculation on the northwest passage. James Bay has grown considerably. The east and west shores, separated by the large peninsula, are now more than 300 miles apart. The

G.M. Asher, Henry Hudson the Navigator, (London, 1860), xlvii.

3' It extends from approximately 50°N to 53°30'N. Unless otherwise indicated, all measurements are taken from original copies of the maps.

"Having thus left the latitude of 52°, where they had wintered, and having sailed up to 60°, along the western shore of their bay, they fell in with a wide sea and a great flood from the north-west." Asher, from "The Summary Printed on the Back of the Chart", 182.

" Gresham College was established in 1598 with the bequest of Sir Thomas Gresham to provide a school of navigation in London, probably modeled along the lines of Spanish education for their pilots.

The illustration opposite is an actual size reproduction of Thomas James's map of Hudson Bay. James provided an enlargement of James Bay from Cape Henriette Maria south. That axis is 4 3/4 inches long, and the east/west axis is 6 inches. National Archives of Canada/NMC 7288.

peninsula itself is close to 300 miles long and more than 200 miles wide.' The area devoted to Hudson Bay is smaller than that of the Gerritsz map.

The next map of the area was drawn by Thomas James. Although he wintered in the Bay and returned home the year after Foxe, his shorter book was the first to be published, and with it a map. It was called "The Platt for Sayling for the discoverye of a Passage into the South Sea 1631,1632." Again, because the focus was the route to China, and not Hudson Bay, the region is squashed into the bottom left corner between a portrait of James and the title cartouche.' Although James was only in what he believed to be the western part of the bay, he portrays the peninsula dividing the two halves as approximately 180 miles long and a uniform 60 miles wide. Unlike the Hudson/Gerritsz version that depicted the peninsula on a north/south axis, with each half extending to the same southern latitude, James put the peninsula on a NNW/SSE axis, with the eastern section extending farther south. Cape Henrietta Maria is accurately placed at 55°N. Two years later Luke Foxe published his account and map. It closely resembles the James map for the depiction of James Bay but on a smaller scale.

Two observations may be made. First, amongst the charts available there were three versions of the region - Gerritsz, Briggs, and James, with important differences between them, and each with their followers. Had the backers of the Nonsuch voyage made a careful collation and comparison of what was then known, it would have revealed uncertainty and contradiction that ought to have been translated into risk. Second, the actual dimensions of the paper devoted to a map of Hudson Bay are important when one considers the needs of a navigator. What had been produced to date was more properly called a map, meaning a representation of land, rather than a chart of water. The navigator needs information about water with an accurate representation of the coastline, all drawn to a size that he is able to mark his position on it at least daily. To the end of the last voyage of exploration before Gillam set off on a commercial voyage no chart had been produced. That was soon to change. In 1646-7, Sir Robert Dudley, a navigator and mathematician, produced the first English sea atlas, the monumental Arcano del Mare.[42] This included a chart of Hudson Bay . The work was sufficiently popular to warrant a second edition in 1661. It is, therefore, reasonable to assume that Gillam had a copy with im on board Nonsuch. The engraving of the charts in this atlas are widely regarded as works of art. Its size certainly comes much nearer to being a useful size for a navigator. Variation is recorded, as are some depths of water and one anchorage is shown. It is, however, nothing more than an elaboration of Hessel Gerritsz's work. James Bay extends as far north as 59°N. The peninsula dividing James Bay is approximately 200 miles wide at the north end, at 52°N. The error of plotting such

[40] These distances, necessarily approximate, are from Briggs's latitude scale.

41 The space measures approximately 5 3/4" x 7'/2". In the top right corner of the map James has provided a detail of the bottom of the bay. This measures 5"x6i/2". This is the largest scale of any of the maps discussed here.

[42] 1Z.V. Tooley, Maps and Map-Makers, (New York, reprinted 1990), 21, 52.

prominent features as Cape Wolstenholme or Digges Island is about 50 miles. Given the practice of navigation, this was probably inconsequential.

In all, the charts and accounts did not provide very much information on which to despatch two ships for a trading voyage. In reality, given the discrepancies and gaps in information, the voyage was almost akin to a passage into the unknown. The attendant risk must not be ignored. Obviously Radisson and Groseilliers had some geographic information, but that was almost certainly derived from overland sources. While it may have been useful for determining what to expect on arrival, it could not have helped with the voyage there. The brothers-in-law had set out from New England between 1662 and 1668 for Hudson Bay, but it is generally thought that they did not got beyond the eastern entrance to Hudson Strait. They were thus unable to provide first-hand information of the area.

What do we know of the Nonsuch voyage itself? No picture of the ship exists, but on the basis of surviving descriptions and pictures of similar ships, a modern version was built for the tercentenary of the Hudson's Bay Company and is now on display in Winnipeg. This vessel is 37 feet long on the keel and perhaps 50 feet long overall. It is 15 feet wide, and displaces about 45 tons. The total crew may have been as small as seven or eight.' The captain, Zachariah Gillam, was from New England and learned his navigation on that coast. He met Groseilliers and Radisson when they came to Boston looking for backers for a Hudson Bay enterprise. Together, they went to England to find support and so the voyage was launched. The most complete surviving record of the voyage is "A Breviate of Captain Zechariah Gillam's Journal to the North-West, in the Nonsuch-Catch, in the Year 1668" that was included in the first chapter of The English Pilot: The Fourth Book. It is only four folio size pages.

The Breviate is set apart from all earlier accounts at the very first glance. It provides coastal views of some of the important shore lines. Given the difficulty of determining position, this must be considered an important step forward. Against that, however, significant gaps in the record must have reduced its utility. Gillam's account begins on 3 June when the Nonsuch and the Eaglet weighed from Gravesend in the Thames. By the 14 June they were off Orkney. The next entry is for 1 August. The storm and return of the Eaglet have been omitted. On 5 August Gillam was off Resolution Island at the entrance to Hudson Strait. His position, "Resolution bearing NW 6 leagues ... being in a great Race of Tide" is almost on top of the annotation on today's chart, "strong overfalls & tidal rips."[44] By 9 August he was "92 leagues and a half' from Resolution, which is around Charles Island in Hudson Strait. If that estimate is correct, his entry for 11 August that Cape James is 62°57'N must be wrong." The latitude recorded for 16 August, 62°51'N, is almost the mid-latitude of the passage between Digges Island and Nottingham Island. That is where he should have been, given his estimate

" ***Nonsuch,*** (Hudson's Bay Company, 1972), 5.
Canada, "Hudson Strait", Chart 5450.
[45] There is a Cape James on the south shore of Baffin Island, 64°20N 74°09W.

of distance from Resolution.' The coastal views in the text of Digges and Nottingham would seem to confirm that position. On 21 August he anchored on the south shore of Nottingham, and gave his latitude as 63°26'N. That is about 22 miles north of the southern tip of the island, and well inland. An island described on 28 August by length and latitude is easily recognized as Smith Island.' The next entry is for two days later and 176 miles farther south. Although he said he was three miles off a small island, the recorded latitude is half way between the Macropeet and Sleeper Island groups. The observation of islands at 57°29'N is accurate for either the Sleeper Islands or, to the east, the smaller King George Islands. The islands at 56° 32N are clearly the Belcher Islands that extend from 55°39'N to 56°57'N. The observation cannot, therefore, be used as a check on Gillam's accuracy. However his recorded depths are greater than those indicated on modern charts. The entries for 5 and 6 September cause problems. There is no ledge of rock or even an island in 55°17'N and the greatest depth in those latitudes near the mouth of James Bay is 84 fathoms, considerably less than "no ground at 100 fathoms." The next (and last) recorded latitude is 52°04[1]N, a significant distance from the mythical ledge. His position was west of Charlton Island. The remaining account does not provide useful position information. The drawings of the bays he provides are not easily recognized. On one of them there is not even an indication of direction. On 29 September he found his wintering location. There is an entry on 1 October and then nothing until 9 December, by which time the river was frozen. The next entry, for "April 1669," noted that " the cold weather almost over, the Indians begin to resort to them." The next and last entry dated "June" said that they "began to work on their vessel... and now only wait for Wind and Tide to carry then down the River and over the Shoals." So ends the Breviate.

The accuracy of Gillams's positions almost has a "hit or miss" quality to it - half of them can be easily identified. This should not, however, occasion surprise. The nature of his instruments and their accuracy, and the contemporary standard of navigation, must be considered when making an assessment of his accuracy. Gillam should be commended. It is difficult to be critical of his record because it was published two years after he died. The original is lost and so we do not know what was edited out. Suffice it to say that while the coastal views represented a tremendous development, the quality of the descriptions, while perhaps in keeping with the standard of the day, were less helpful. Considering the room for positional error, both in the Breviate and by a later navigator, they can not have been of great use. For example, Cape Warwick on Resolution is named as having been sighted. Given that it is "a conspicuous steep red cliff unlike any other on Resolution' some comment would have been both easy and helpful. That there was none says much about the expectations of navigators.

[46] This entry is the last time Resolution is used as a reference. It is interesting that neither Nottingham nor Digges Islands, both well known, were subsequently used as references for leagues sailed. Instead latitudes are given.

[47] Canada, "Hudson Bay Northern Portion" Chart 5449.

[48] *Sailing Directions, Labrador and Hudson Bay*, 303.

In sum, on the basis of what we know of Gillam's voyage, of what was then known of Hudson Bay and of the practice of navigation, the 1668 voyage of the *Nonsuch* must be regarded as a great achievement. Over one hundred years later in 1794, although the importance of the navigational information must have waned by then, the Breviate was included in the last edition of *The English Pilot: The Fourth Book*. The annual voyages of the Hudson's Bay Company following Gillam and the *Nonsuch* would lay the basis for developing local knowledge and expertise. Uncovering those accounts and tracing the evolution of the practice of navigation as the challenges of determining position were resolved, will be a fascinating record of human endeavour and achievement. It is a start to understand that Gillam's voyage was essentially a voyage into the unknown full of risk and, therefore, a great achievement. The remainder is waiting to be told.