QUEENSLAND BRANCH NEWS

NEWSLETTER of the QLD Branch of the MARITIME UNION of AUSTRALIA

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To be truly radical is to make hope possible, rather than despair convincing - Raymond Williams **No. 122 – 16 March 2018**

Members Rally for Seafaring Jobs on Rio Tinto Vessels - Support for CFMEU – Thanks to Lynne Holland
Unmanned Vessels – Are We There Yet? - Stephen Hawking – Cartoon Corner

Terrific Demonstration Outside Rio Tinto but We Can Do Better!

ON THURSDAY 15 March 2018 many MUA seafarers, wharfies and supporters, including a great contingent from the ETU assembled and made strong our feelings about Rio Tinto's non-engagement with our union, both on a State basis and nationally over a 2010 MOU which guarantees 70% - 80% of all coastal trade be carried in vessels employing Australian crews.

Paul Petersen Qld Branch Organiser

Special thanks goes to our wharfies from all sections of the terminals and bulk and general for attending, in particular the good turn out from DP World and Hutchison members. Thank you.

We will continue protesting and fighting until we succeed but we need involvement from all members on this issue.

The head of Rio Tinto's shipping division based in Singapore has contacted your Branch Secretary and we are working out a time and place to meeting in mid April, so that is a positive.

The destruction of our nation's Merchant Fleet can be reversed but only if members are prepared to fight and participate. If this happens we can rise like a phoenix from the ashes with all the decent work opportunities that abound.

It would be remiss of me not to mention our resident revolutionary socialist and rank and filer, Mike Barber who spent three days and two nights in Brisbane working the phones to contact members. ***Bob Carnegie***

Article from: https://www.greenleft.org.au/content/mua-protest-seafarer-jobs

"AUSTRALIAN MERCHANT SEAFARERS demand and expect to have the right to work in their own country" read a letter from the Maritime Union of Australia (MUA) State Secretary Bob Carnegie to the general manager of Rio Tinto.

"Our resolve is strong and if necessary we will engage Rio Tinto in a long and tortuous public debate about how the second largest mining house in the world justifies employing foreign nationals at a pittance whilst skilled Australian merchant seafarers are forced onto the dole, selling their homes and feeling left out of this life... whilst Rio Tinto pulls in $8 billion dollars in profits per year," the letter read.

Authorised by Bob Carnegie, Maritime Union of Australia (MUA) Queensland Branch Secretary
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Carnegie made a point of emphasising to the crowd that the MUA protest is not in any way against "people from other nations".
"One of the things that we're most proud of in the MUA is that we're an internationalist based organisation" and that "an injury to one worker anywhere in the world is an injury to all workers everywhere in the world".

He introduced a "dear comrade" who has had more than 35 years experience in the industry who had attempted suicide the previous night. He has been out of work for more than two years and is expecting his house to be repossessed next week.

By contrast, the super exploited foreign workers on Rio Tinto ships are paid "$4 an hour" according to the union.

The union sent a delegation into the Rio Tinto office to present their demands and marched along Charlotte St blocking traffic in Brisbane city.

Solidarity messages were presented by Michael Clifford from the Queensland Council of Unions and representatives of the Electrical Trades Union. Other unions present included the Queensland Teachers Union, the Rail Tram and Bus Employees Union, the Construction Forestry Mining and Energy Union and the new Retail and Fast Food Workers Union. Also present were representatives from Socialist Alliance, Socialist Alternative and the Queensland Anti-Poverty Network. This action is part of an ongoing campaign for the MUA.

The Maritime Union Of Australia Queensland Branch
ABN 93 047 659 794

Bob Carnegie - Branch Secretary 0439 478996 I Jason Miners - Deputy Branch Secretary 0401 211866
Paul Gallagher - Assistant Branch Secretary 0408 494168 I Paul Petersen - Central QLD Organiser 0404 453869

15 March, 2018

Peter Mannion
General Manager Rio Tinto Group

peter.mannion@riotinto.com

The demonstration held today by The Maritime Union of Australia Queensland Branch members and their supporters, call upon Rio Tinto to engage immediately with the Maritime Union of Australia Queensland Branch and the Maritime Union of Australia National Office to implement the standard agreed in the 2010 MOU between Rio Tinto and our union.

Australian merchant seafarers demand and expect to have the right to work in their own country, and be respected and acknowledged by employment on the vessels Rio Tinto owns and operates and charters on the Australian coast.

Our resolve is strong and if necessary we will engage Rio Tinto in a long tortuous public debate about how the second largest mining house in the world justifies employing foreign nationals at a pittance whilst skilled Australian merchant seafarers are forced onto the dole, selling their homes and feeling left out of this life (of which we only have one) whilst Rio Tinto pulls in $8 billion dollars in profits per year.

The ball is now in Rio Tinto's court.

Bob Carnegie
Queensland Branch Secretary

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Support for Oaky North Miners

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8 March 2018

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Oaky North Lock Out

Dear Comrades,

The MUA Queensland Branch at our recent February monthly meeting voted unanimously to send a message of support and thanks to your brave rank and file who, for 230 plus days, stood tall against all odds for trade unionism everywhere.

Steve and Chris, our unions go back a long way and we hope the solidarity my membership have shown in support of your struggle means that unionised coal miners will never be alone in a battle whilst the MUA still has a fighting breath in its body.

Once again, fellow workers, your battle has inspired us to all be better union men and women.

Stay Strong!

In Solidarity,

Bob Carnegie
Queensland Branch Secretary
Maritime Union of Australia

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Thanks to Lynne

Paul, Hannah, Kerri, Bob, Lynne, Carol, Jason

THE BRANCH WOULD like to say a huge thank you to Lynne Holland, our National Membership Coordinator, for her tireless efforts in training at the Queensland Branch. Lynne has recently been back to the Branch office to help with training for all staff and in particular, Hannah, our latest addition to the Queensland Administration team.

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Unmanned Ships – Are We There Yet?

https://worldmaritimenews.com/archives/247204/interview-unmanned-ships-are-we-there-yet/

THE DEVELOPMENT OF the remote and autonomous (R&A) shipping has become one of the hottest topics in the industry over the past couple of years.

The maritime industry has seen an ever growing number of stakeholders assuming an active role in the development of technological solutions that aim to bolster security and bring cost efficiency for ship owners by fine-tuning onboard systems for autonomous operation.

The integration of unmanned ships is not expected to be "smooth sailing", taking into account that some of the key industry majors are skeptical about allowing ultra large containerships, tankers or cruise ships to sail without a crew on board. Nevertheless, there are various sectors that are expected to be early adopters of the trend, one of them being workboats.

World Maritime News met up with Oskar Levander, Senior Vice President of Concepts and Innovation, Digital & Systems of Rolls-Royce, one year after our previous interview, to see what is the current state of play with regard to the development of autonomous ships. Mr. Lavander will be speaking at Asia Pacific Maritime 2018 conference, which takes place 14-16 March 2018.

Commenting on the major breakthroughs in autonomous shipping for Rolls-Royce since our interview in April 2017, Levander pointed to the demonstration of the first remotely controlled commercial vessel carried out in cooperation with Svitzer in Denmark.

"We showcased how we can safely operate a tug (the Svitzer Hermod) from a remote-control station location in the Svitzer office. This is a major step on the road towards R&A shipping," Levander said.

"Another recent step is the release of our Intelligent Awareness system. This is a spin-off product from the development of R&A ship technology that has the potential to benefit all existing ships. It can enhance the captain's awareness of what is happening around his or her vessel by fusing together the information from different sensors, such as camera, radar, AIS and LIDAR, and by applying intelligent object detection. This will greatly improve the safety of ship operation."

What types of ships will go crewless?

The ongoing push toward automation of ships is not likely to result in crewless containerships anytime soon, according to Mr. Soren Skou, the CEO of the world's largest container shipping company, Maersk Line.

Skou believes that giant containerships would not be

allowed to sail without humans on board, mainly because there would be no driver of efficiency behind such a move.

Commenting on the matter, Levander supported the view, saying that ultra large container vessels (ULCV) will most likely not be unmanned in the near to mid-term future.

"The benefit of unmanned operation is quite different for different ship segments and ships of different size. The potential economic saving by going for unmanned operation in an ultra large container vessel is quite marginal, only a few percents. Crewing cost represents only a couple of percent of the total cost structure for a ULCV and the potential fuel savings by removing deckhouse and systems serving the people are also small compared to the consumption. So the economic incentive is not as strong to make these giant vessels unmanned," he explained.

However, the situation is completely different for smaller container vessels or other cargo vessels. According to Levander, for a smaller containership, general cargo vessel or a bulker, the total transport cost saving can be 10-22 pct by switching to unmanned operation, so there is a clear economic driver for R&A ships.

For the purpose of reference, a 20 pct transport cost saving is the same or more than cutting fuel consumption by 50 pct.

"One should keep in mind, that these ULCV represent only a very small number of the total fleet of ships in the world. The large volume markets for cargo vessels are for bulkers, general cargo vessels and smaller container vessels," Levander added.

Despite the fact that ULCVs would not opt for full automation they are likely to adopt many parts of R&A technology to boost efficiency and safety, such as Intelligent Awareness systems, autonomous navigation, collision avoidance, and health management systems for all ship systems.

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Tanker and cruise shipping companies are also among the sectors not supporting the unmanned shipping approach for the future. Levander agrees that cruise ships will never be unmanned.

In addition, the oil and gas sector is not likely to remove crews from tankers and LNG carriers amid risks to safe operation. But in the same way as for ULCVs, both cruise ships and tankers are expected to adopt R&A technology to make the operation safer and more efficient.

Early adopters of R&A technology are tugs and other workboats

"These are actually likely first movers for technologies such as Intelligent Awareness and collision avoidance. These are shipping segments that put a lot of focus on safety, and there is a big interest to reduce the likelihood of an accident. Knowing that most marine accidents are caused by human errors (75-95 pct) and the major parts of these errors are caused by fatigue or crew not concentrating, the potential safety improvement with automatic watch keeping and autonomous navigation solutions is very large," Levander said.

Rolls-Royce launched its first R&A product, the Intelligent Awareness system this week at the Seatrade cruise ship convention in Ft Lauderdale, because cruise ships are one of the early potential markets.

Other early adopters of R&A technology are tugs and other workboats working in coastal waters. In addition, road ferries are also a very interesting market for near future remote and automated operation, followed by coastal cargo vessels.

How can the owners be persuaded to invest in autonomous ships?

According to Levander, there is a high interest in the technology, therefore, there should be no problem in attracting enough customers to invest amid anticipated cost savings which could reach up to 30 pct for some ship types.

"The R&A technology open up totally new business models that are not feasible before the new technology becomes available. These models have the potential to disrupt the existing markets and players will need to adapt to stay in the game.

"What is interesting to note, is also the increasing interest from the cargo owners for R&A shipping. If the ship owners' own customers see the potential for lower cost and new business models, it is a great indicator that the industry will move in this direction," Levander concluded.

World Maritime News Staff; Image Courtesy: Rolls-Royce

Stephen Hawking

IN THIS WEEK'S Branch News there is an extensive obituary on the loss of the renowned physicist and humanitarian, the amazing and great Stephen Hawking.

I am just a grade 10 educated dirt bird with an IR's ticket. (Merchant seafarer who works in the engine room) but Hawking's life transcended all that and helped people, like myself, dream of the cosmos. For 30 years he sat in Newton's chair at Cambridge, he wrote a book, A Brief History of Time, which sold over 10 million copies but probably only a few dozen people in the world understood.

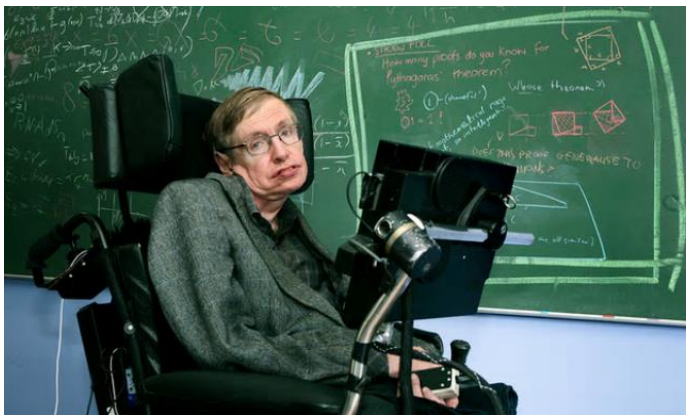
His immense will to live and to participate fully in life inspired and helped me (and so many others) in my darker moments. No public figure in my lifetime has had such a significant effect on how I should live my life.

Rest in peace Stephen Hawking, your life meant so much for so many people. ***Bob Carnegie***

'Mind Over Matter': Stephen Hawking – Obituary by Roger Penrose

Theoretical physicist who made revolutionary contributions to our understanding of the nature of the universe- Stephen Hawking dies aged 76
First published on Wed 14 Mar 2018 15.10 AEDT
https://www.theguardian.com/science/2018/mar/14/stephen-hawking-obituary?CMP=Share_iOSApp_Other

Stephen Hawking at his office at the department of applied mathematics and theoretical physics at Cambridge University in 2005. Photograph: Murdo Macleod for the Guardian



THE IMAGE OF Stephen Hawking – who has died aged 76 – in his motorised wheelchair, with head contorted slightly to one side and hands crossed over to work the controls, caught the public imagination, as a true symbol of the triumph of mind over matter. As with the Delphic oracle of ancient Greece, physical impairment seemed compensated by almost supernatural gifts, which allowed his mind to roam the universe freely, upon occasion enigmatically revealing some of its secrets hidden from ordinary mortal view.

Of course, such a romanticised image can represent but a partial truth. Those who knew Hawking would clearly appreciate the dominating presence of a real human being, with an enormous zest for life, great humour, and tremendous determination, yet with normal human weaknesses, as well as his more obvious strengths. It seems clear that he took great delight in his commonly perceived role as "the No 1 celebrity scientist"; huge

audiences would attend his public lectures, perhaps not always just for scientific edification.

The scientific community might well form a more sober assessment. He was extremely highly regarded, in view of his many greatly impressive, sometimes revolutionary, contributions to the understanding of the physics and the geometry of the universe.

Hawking had been diagnosed shortly after his 21st birthday as suffering from an unspecified incurable disease, which was then identified as the fatal degenerative motor neurone disease amyotrophic lateral sclerosis, or ALS. Soon afterwards, rather than succumbing to depression, as others might have done, he began to set his sights on some of the most fundamental questions concerning the physical nature of the universe. In due course, he would achieve extraordinary successes against the severest physical disabilities. Defying established medical opinion, he managed to live another 55 years.

His background was academic, though not directly in mathematics or physics. His father, Frank, was an expert in tropical diseases and his mother, Isobel (nee Walker), was a free-thinking radical who had a great influence on him. He was born in Oxford and moved to St Albans, Hertfordshire, at eight. Educated at St Albans school, he won a scholarship to study physics at University College, Oxford. He was recognised as unusually capable by his tutors, but did not take his work altogether seriously. Although he obtained a first-class degree in 1962, it was not a particularly outstanding one.

He decided to continue his career in physics at Trinity Hall, Cambridge, proposing to study under the distinguished cosmologist Fred Hoyle. He was disappointed to find that Hoyle was unable to take him, the person available in that area being Dennis Sciama, unknown to Hawking at the time. In fact, this proved fortuitous, for Sciama was becoming an outstandingly stimulating figure in British cosmology, and would supervise several students who were to make impressive names for themselves in later years (including the future astronomer royal Lord Rees of Ludlow).

Sciama seemed to know everything that was going on in physics at the time, especially in cosmology, and he conveyed an infectious excitement to all who encountered him. He was also very effective in bringing together people who might have things of significance to communicate with one another.

When Hawking was in his second year of research at Cambridge, I (at Birkbeck College in London) had established a certain mathematical theorem of relevance. This showed, on the basis of a few plausible assumptions (by the use of global/topological techniques largely unfamiliar to physicists at the time) that a collapsing over-massive star would result in a singularity in space-time – a place where it would be expected that densities and space-time curvatures would become infinite – giving us the picture of what we now refer to as a "black hole". Such a space-time singularity would lie deep within a "horizon", through which no signal or material body can escape. (This picture had been put forward by J Robert Oppenheimer and Hartland Snyder in 1939, but only in the special circumstance where exact spherical symmetry was assumed. The purpose of this new theorem was to obviate such unrealistic symmetry assumptions.) At this central singularity, Einstein's classical theory of general relativity would have reached its limits.

Meanwhile, Hawking had also been thinking about this kind of problem with George Ellis, who was working on a PhD at St John's College, Cambridge. The two men had been working on a more limited type of "singularity theorem" that required an unreasonably restrictive assumption. Sciama made a point of bringing Hawking and me together, and it did not take Hawking long to find a way to use my theorem in an unexpected way, so that it could be applied (in a time-reversed form) in a cosmological setting, to show that the space-time singularity referred to as the "big bang" was also a feature not just of the standard highly symmetrical cosmological models, but also of any qualitatively similar but asymmetrical model.

Some of the assumptions in my original theorem seem less natural in the cosmological setting than they do for collapse to a black hole. In order to generalise the mathematical result so as to remove such assumptions, Hawking embarked on a study of new mathematical techniques that appeared relevant to the problem.

A powerful body of mathematical work known as Morse theory had been part of the machinery of mathematicians active in the global (topological) study of Riemannian spaces. However, the spaces that are used in Einstein's theory are really pseudo-Riemannian and the relevant Morse theory differs in subtle but important ways. Hawking developed the necessary theory for himself (aided, in certain respects, by Charles Misner, Robert Geroch and Brandon Carter) and was able to use it to produce new theorems of a more powerful nature, in which the assumptions of my theorem could be considerably weakened, showing that a big-bang-type singularity was a necessary implication of Einstein's general relativity in broad circumstances.

A few years later (in a paper published by the Royal Society in 1970, by which time Hawking had become a fellow "for distinction in science" of Gonville and Caius College, Cambridge), he and I joined forces to publish an even more powerful theorem which subsumed almost all the work in this area that had gone before.

In 1967, Werner Israel published a remarkable paper that had the implication that non-rotating black holes, when they had finally settled down to become stationary, would necessarily become completely spherically symmetrical. Subsequent results by Carter, David Robinson and others generalised this to include rotating black holes, the implication being that the final space-time geometry must necessarily accord with an explicit

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family of solutions of Einstein's equations found by Roy Kerr in 1963. A key ingredient to the full argument was that if there is any rotation present, then there must be complete axial symmetry. This ingredient was basically supplied by Hawking in 1972.

The very remarkable conclusion of all this is that the black holes that we expect to find in nature have to conform to this Kerr geometry. As the great theoretical astrophysicist Subramanyan Chandrasekhar subsequently commented, black holes are the most perfect macroscopic objects in the universe, being constructed just out of space and time; moreover, they are the simplest as well, since they can be exactly described by an explicitly known geometry (that of Kerr).

Following his work in this area, Hawking established a number of important results about black holes, such as an argument for its event horizon (its bounding surface) having to have the topology of a sphere. In collaboration with Carter and James Bardeen, in work published in 1973, he established some remarkable analogies between the behaviour of black holes and the basic laws of thermodynamics, where the horizon's surface area and its surface gravity were shown to be analogous, respectively, to the thermodynamic quantities of entropy and temperature. It would be fair to say that in his highly active period leading up to this work, Hawking's research in classical general relativity was the best anywhere in the world at that time.

Hawking, Bardeen and Carter took their "thermodynamic" behaviour of black holes to be little more than just an analogy, with no literal physical content. A year or so earlier, Jacob Bekenstein had shown that the demands of physical consistency imply – in the context of quantum mechanics – that a black hole must indeed have an actual physical entropy ("entropy" being a physicist's measure of "disorder") that is proportional to its horizon's surface area, but he was unable to establish the proportionality factor precisely. Yet it had seemed, on the other hand, that the physical temperature of a black hole must be exactly zero, inconsistently with this analogy, since no form of energy could escape from it, which is why Hawking and his colleagues were not prepared to take their analogy completely seriously.

Hawking had then turned his attention to quantum effects in relation to black holes, and he embarked on a calculation to determine whether tiny rotating black holes that might perhaps be created in the big bang would radiate away their rotational energy. He was startled to find that irrespective of any rotation they would radiate away their energy – which, by Einstein's E=mc2, means their mass. Accordingly, any black hole actually has a non-zero temperature, agreeing precisely with the Bardeen-Carter-Hawking analogy. Moreover, Hawking was able to supply the precise value "one quarter" for the entropy proportionality constant that Bekenstein had been unable to determine.

This radiation coming from black holes that Hawking predicted is now, very appropriately, referred to as Hawking radiation. For any black hole that is expected to arise in normal astrophysical processes, however, the Hawking radiation would be exceedingly tiny, and certainly unobservable directly by any techniques known today. But he argued that very tiny black holes could have been produced in the big bang itself, and the Hawking radiation from such holes would build up into a final explosion that might be observed. There appears to be no evidence for such explosions, showing that the big bang was not so accommodating as Hawking wished, and this was a great disappointment to him.

These achievements were certainly important on the theoretical side. They established the theory of black-hole thermodynamics: by combining the procedures of quantum (field) theory with those of general relativity, Hawking established that it is necessary also to bring in a third subject, thermodynamics. They are generally regarded as Hawking's greatest contributions. That they have deep implications for future theories of fundamental physics is undeniable, but the detailed nature of these implications is still a matter of much heated debate.

Hawking himself was able to conclude from all this (though not with universal acceptance by particle physicists) that those fundamental constituents of ordinary matter – the protons – must ultimately disintegrate, although with a decay rate that is beyond present-day techniques for observing it. He also provided reasons for suspecting that the very rules of quantum mechanics might need modification, a viewpoint that he seemed originally to favour. But later (unfortunately, in my own opinion) he came to a different view, and at the Dublin international conference on gravity in July 2004, he publicly announced a change of mind (thereby conceding a bet with the Caltech physicist John Preskill) concerning his originally predicted "information loss" inside black holes.

Following his black-hole work, Hawking turned his attentions to the problem of quantum gravity, developing ingenious ideas for resolving some of the basic issues. Quantum gravity, which involves correctly imposing the quantum procedures of particle physics on to the very structure of space-time, is generally regarded as the most fundamental unsolved foundational issue in physics. One of its stated aims is to find a physical theory that is powerful enough to deal with the space-time singularities of classical general relativity in black holes and the big bang.

Hawking's work, up to this point, although it had involved the procedures of quantum mechanics in the curved space-time setting of Einstein's general theory of relativity, did not provide a quantum gravity theory. That would require the "quantisation" procedures to be applied to Einstein's curved space-time itself, not just to physical fields within curved space-time.

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With James Hartle, Hawking developed a quantum procedure for handling the big-bang singularity. This is referred to as the "no-boundary" idea, whereby the singularity is replaced by a smooth "cap", this being likened to what happens at the north pole of the Earth, where the concept of longitude loses meaning (becomes singular) while the north pole itself has a perfectly good geometry.

To make sense of this idea, Hawking needed to invoke his notion of "imaginary time" (or "Euclideanisation"), which has the effect of converting the "pseudo-Riemannian" geometry of Einstein's space-time into a more standard Riemannian one. Despite the ingenuity of many of these ideas, grave difficulties remain (one of these being how similar procedures could be applied to the singularities inside black holes, which is fundamentally problematic).

There are many other approaches to quantum gravity being pursued worldwide, and Hawking's procedures, though greatly respected and still investigated, are not the most popularly followed, although all others have their share of fundamental difficulties also.

To the end of his life, Hawking continued with his research into the quantum-gravity problem, and the related issues of cosmology. But concurrently with his strictly research interests, he became increasingly involved with the popularisation of science, and of his own ideas in particular. This began with the writing of his astoundingly successful book A Brief History of Time (1988), which was translated into some 40 languages and sold over 25m copies worldwide.

Undoubtedly, the brilliant title was a contributing factor to the book's phenomenal success. Also, the subject matter is something that grips the public imagination. And there is a directness and clarity of style, which Hawking must have developed as a matter of necessity when trying to cope with the limitations imposed by his physical disabilities. Before needing to rely on his computerised speech, he could talk only with great difficulty and expenditure of effort, so he had to do what he could with short sentences that were directly to the point. In addition, it is hard to deny that his physical condition must itself have caught the public's imagination.

Although the dissemination of science among a broader public was certainly one of Hawking's aims in writing his book, he also had the serious purpose of making money. His financial needs were considerable, as his entourage of family, nurses, healthcare helpers and increasingly expensive equipment demanded. Some, but not all, of this was covered by grants.

To invite Hawking to a conference always involved the organisers in serious calculations. The travel and accommodation expenses would be enormous, not least because of the sheer number of people who would need to accompany him. But a popular lecture by him would always be a sell-out, and special arrangements would be needed to find a lecture hall that was big enough. An additional factor would be the ensuring that all entrances, stairways, lifts, and so on would be adequate for disabled people in general, and for his wheelchair in particular.

He clearly enjoyed his fame, taking many opportunities to travel and to have unusual experiences (such as going down a mine shaft, visiting the south pole and undergoing the zero-gravity of free fall), and to meet other distinguished people.

The presentational polish of his public lectures increased with the years. Originally, the visual material would be line drawings on transparencies, presented by a student. But in later years impressive computer-generated visuals were used. He controlled the verbal material, sentence by sentence, as it would be delivered by his computer-generated American-accented voice. High-quality pictures and computer-generated graphics also featured in his later popular books The Illustrated Brief History of Time (1996) and The Universe in a Nutshell (2001). With his daughter Lucy he wrote the expository children's science book George's Secret Key to the Universe (2007), and he served as an editor, co-author and commentator for many other works of popular science.

He received many high accolades and honours. In particular, he was elected a fellow of the Royal Society at the remarkably early age of 32 and received its highest honour, the Copley medal, in 2006. In 1979, he became the 17th holder of the Lucasian chair of natural philosophy in Cambridge, some 310 years after Sir Isaac Newton became its second holder. He became a Companion of Honour in 1989. He made a guest appearance on the television programme Star Trek: The Next Generation, appeared in cartoon form on The Simpsons and was portrayed in the movie The Theory of Everything (2014).

It is clear that he owed a great deal to his first wife, Jane Wilde, whom he married in 1965, and with whom he had three children, Robert, Lucy and Timothy. Jane was exceptionally supportive of him in many ways. One of the most important of these may well have been in allowing him to do things for himself to an unusual extent.

He was an extraordinarily determined person. He would insist that he should do things for himself. This, in turn, perhaps kept his muscles active in a way that delayed their atrophy, thereby slowing the progress of the disease. Nevertheless, his condition continued to deteriorate, until he had almost no movement left, and his speech could barely be made out at all except by a very few who knew him well.

He contracted pneumonia while in Switzerland in 1985, and a tracheotomy was necessary to save his life. Strangely, after this brush with death, the progress of his degenerative disease seemed to slow to a virtual halt. His tracheotomy prevented any form of speech, however, so

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that acquiring a computerised speech synthesiser came as a necessity at that time.

In the aftermath of his encounter with pneumonia, the Hawkings' home was almost taken over by nurses and medical attendants, and he and Jane drifted apart. They were divorced in 1995. In the same year, Hawking married Elaine Mason, who had been one of his nurses. Her support took a different form from Jane's. In his far weaker physical state, the love, care and attention that she provided sustained him in all his activities. Yet this relationship also came to an end, and he and Elaine were divorced in 2007.

Despite his terrible physical circumstance, he almost always remained positive about life. He enjoyed his work, the company of other scientists, the arts, the fruits of his fame, his travels. He took great pleasure in children, sometimes entertaining them by swivelling around in his motorised wheelchair. Social issues concerned him. He promoted scientific understanding. He could be generous and was very often witty. On occasion he could display something of the arrogance that is not uncommon among physicists working at the cutting edge, and he had an autocratic streak. Yet he could also show a true humility that is the mark of greatness.

Hawking had many students, some of whom later made significant names for themselves. Yet being a student of his was not easy. He had been known to run his wheelchair over the foot of a student who caused him irritation. His pronouncements carried great authority, but his physical difficulties often caused them to be enigmatic in their brevity. An able colleague might be able to disentangle the intent behind them, but it would be a different matter for an inexperienced student.

To such a student, a meeting with Hawking could be a daunting experience. Hawking might ask the student to pursue some obscure route, the reason for which could seem deeply mysterious. Clarification was not available, and the student would be presented with what seemed indeed to be like the revelation of an oracle – something whose truth was not to be questioned, but which if correctly interpreted and developed would surely lead onwards to a profound truth. Perhaps we are all left with this impression now. Hawking is survived by his children.

• Stephen William Hawking, physicist, born 8 January 1942; died 14 March 2018, aged 76.

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Cartoon Corner

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