

Using the works of Nevil Shute in engineering education

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ABSTRACT: Developing the ability to write simply but effectively, understanding the interrelation of engineering and society, exposure to ethical aspects of engineering practice and understanding the difficulties that can arise when working in teams are important aspects of an engineering education. Generally, the best results appear to be achieved when these aspects are each dealt with in several conventional engineering courses. It is here proposed that many of the aspects of engineering education mentioned above can be dealt with by introducing a study of some of the literary works of the author Nevil Shute, an engineer, into the engineering education programme. Shute wrote 25 books, including an autobiography entitled *Slide Rule*. Although most of Shute's novels do not deal directly with engineering, they are all written in a style that clearly shows the influence of his engineering career and many deal in some way with responsibility to society and others. The book that most clearly deals with engineering is perhaps the novel *No Highway*, and this novel and Shute's autobiography, *Slide Rule*, can be used in an engineering education programme. Ways in which this can be undertaken are discussed in the article.

INTRODUCTION

Some important aspects of an engineering education are the development of the ability to communicate effectively, the development of some understanding of the interrelation of engineering and society, exposure to some of the ethical aspects of engineering practice and the development of an understanding of the difficulties that can arise when working with others in teams. While these aspects of an engineering education can be dealt with, to some extent, in separate specialised courses, the best results generally seem to be achieved when these are either partly or entirely dealt with in various ways in a number of conventional engineering courses.

One of the reasons that many engineering students seem to have difficulty writing effectively is that they have undertaken very little reading of non-technical books on their own and, as a result, have not developed a real appreciation for the power and beauty of good writing, as well as the effective use of language. As a result, they often do not communicate very effectively in either written or oral form.

It is proposed here that many of the aspects of engineering education mentioned above, including the ability to communicate effectively, can be dealt with in part by introducing a study of some of the literary works of the author Nevil Shute into engineering education programmes. In this article, the author is concerned with some of the ways in which this can be achieved.

NEVIL SHUTE'S LIFE AND WORKS

In order to fully appreciate Nevil Shute's books, it helps to have some knowledge of his life [1-3]. Nevil Shute Norway was born on 17 January 1899 in London, the youngest of two brothers. He suffered from a stammer that, at times, made school very difficult for him. At one point, he played truant for

several days, spending these days visiting the Science Museum in South Kensington and studying the mechanical exhibits and the aircraft models. In June 1915, his older brother, Fred, died of wounds received in Flanders during World War 1. Shute's stammer probably thwarted his attempts to obtain a commission in the army and then in the Royal Air Force. Therefore, he enlisted in the ranks of the Suffolk Regiment and was posted to the Thames Estuary for the last three months of the War. After the War, he secured a place at Oxford University where he studied engineering, graduating in the summer of 1922. While at Oxford, he started his connection with the aircraft industry by working in an unpaid position at de Havilland Aircraft and it was Geoffrey de Havilland himself who gave Nevil Shute his first experience of flying. His first full-time work started in January 1923 with the de Havilland company where he was employed as a performance calculator.

He started writing in his spare time, first poetry and then a novel. In addition, he learned to fly. He finished his first novel in 1923 and sent it to three publishers who all turned it down. A second attempt to write a novel followed in 1924 with the same result. Later that year, he left de Havilland to join the Airship Guarantee Co. in Yorkshire, a subsidiary of Vickers, as Chief Calculator on the R-100 airship project. The private enterprise R-100 would compete against a state built airship, the R-101, which was to be designed to meet the same specifications. Nevil Shute Norway's next attempt to write a successful novel produced *Marazan*. This novel was accepted and published in 1926. At this stage, he decided upon the pseudonym Nevil Shute, not wanting his writing to undermine his credibility as an engineer. As the R-100 project continued, he began to write another novel, *So Disdained*, which was published in 1928.

The R-100 airship was complete and ready for trials in 1930. By this time, Shute was Deputy Chief Engineer and effectively in charge of the project. The trials were successful, as was a

proving flight, on which Shute went, to Canada and back. The airship was then hangared while the testing of the competing government R-101 airship was supposed to be carried out. However, the R-101 actually underwent very little flight testing and, after undergoing a number of untested modifications, it set out on a proving flight to India. On the way to India, it crashed in France, killing 48 of the 54 passengers and crew, an event that led to the ending of airship development in England.

At the end of the R-100 project, when he found himself unemployed and newly married, Shute decided to start an aircraft manufacturing company. Aviation was booming, and the backing of aviation pioneer and entrepreneur Sir Alan Cobham, the firm of Airspeed Ltd was formed. It held its first board meeting in 1931 with Shute as Joint Managing Director. Nevil Shute's next novel, *Lonely Road*, was published in 1932 and selling the film rights brought an additional welcome income. However, his next novel, *Ruined City*, did not appear until 1938, an indication of his concentration on the fledgling company.

Airspeed went on to design and develop a number of aircraft, including the Airspeed Oxford, a twin engined trainer that was used to train most Bomber Command pilots. A total of 8,751 Oxfords were built. Airspeed achieved success largely as a result of Shute's efforts, but this had been at the cost of little home life with his wife and two daughters. In 1938, with war brewing and orders for hundreds aircraft being placed by the Royal Air Force (RAF), the Board of the company dispensed with Nevil Shute's services, an action which he says in his autobiography, *Slide Rule*, was probably quite right – his forte was as a starter of companies and not as a runner of companies [2]. With a generous settlement from Airspeed, Nevil Shute was able to reassess his future.

Just prior to the outbreak of World War 2 in 1939, Shute's novel, *What Happened to the Corbetts*, was published. In 1940, Shute joined the Royal Naval Volunteer Reserve and was seconded to the Admiralty's Department of Miscellaneous Weapons Development (DMWD). The DMWD was a group of highly qualified scientists and technicians who evaluated numerous proposals for aiding the War effort, some highly successful and others less so.

Nevil Shute's novel, *No Highway*, published in 1948, covered the problems of metal fatigue and the sudden in-flight failure of structures in aircraft, almost as if he had prior knowledge of the Comet disasters of the 1950s [4]. This was followed by the novel, *Round the Bend*, in 1951.

After the War, Nevil Shute and his family settled in Australia and his later novels reflect this change of domicile. Probably his most famous is *A Town like Alice* published in 1950.

In all of his books, Nevil Shute draws on his personal experiences, whether in the aircraft industry, during wartime or when sailing. However, these are only the background settings. His real greatness as an author stemmed from his natural ability to tell a story, to build characters that are sympathetic and to write in a way that grips and holds the reader.

Nevil Shute spent most of his adult life working very long days. Such a pace would wear down even a physically fit person, but he had a long history of heart problems that finally caught up with him. He died on 12 January 1961 at the age of 61 years.

BOOKS RELATED DIRECTLY TO ENGINEERING

Nevil Shute's *No Highway* is his only novel that is, more or less, directly concerned with the practice of engineering [4]. It tells the story of Theodore Honey, an engineering researcher employed by a government laboratory and undertaking work on metal fatigue. Honey has a theory about how metal fatigue failure occurs and has predicted that fatigue failure of the tail of the Reindeer, the most technically advanced airliner of the day, will occur after about 1,400 hours in the air. He is in the process of carrying out a test on an actual tail from a Reindeer to determine the accuracy of his ability to predict when fatigue failure will occur. During a tour of the facilities, the new director of the laboratory is given a description of Mr Honey's work. He is upset and asks Mr Honey about contacting the company that makes the Reindeer concerning his predictions. The company ignores him. Mr Honey is not unduly concerned because he believes that no Reindeer aircraft has enough flying hours to be near its fatigue limit. However, it turns out that this may not be true. Mr Honey is sent off to Canada to investigate the wreckage of a Reindeer that has mysteriously crashed. On the flight to Canada, Mr Honey, who is pretty oblivious to his surroundings, discovers that he is flying in a Reindeer and a few questions to the crew reveal that this particular plane has a total flying time of just about 1,400 hours. He tries to get the crew to abandon the flight but this advice is ignored. When the aircraft lands on the east coast of Canada, he again tries to have the flight ended. Again, no-one takes him seriously, so Mr Honey retracts the landing gear while the aircraft sits empty on the tarmac (a fault in the system makes this possible) destroying the machine in the process. Ultimately, Mr Honey's actions are justified. The tail under test in the laboratory fails at close to the predicted time and clear evidence is found that fatigue failure caused the crash of the Reindeer in Canada.

One of the most fascinating aspects of the novel, *No Highway*, is that it was published in 1948 when the jet airliner, the de Havilland Comet, was in the final design stages. The first aircraft company that Nevil Shute had worked for was de Havilland, this being in the 1920s. Starting about a year after it had entered service, three Comets crashed over about a one-year period. The third Comet crash involved an aircraft that exploded over the Mediterranean. An examination of the recovered remains from the third crash and an extensive test programme revealed that the Comets had crashed as a result of fatigue failure, the same fate as that suffered by the Reindeer in Shute's novel.

The other book by Nevil Shute that is largely concerned with the practice of engineering is his autobiography, *Slide Rule: the Autobiography of an Engineer* [2]. There are three main sections in this book. The first deals with his early life up to the point where he leaves de Havilland to work on the R-100 airship project. The second deals with his time working on the R-100 and with the different approaches adopted by the industrial team working on the R-100 and the government team working on the R-101. The third main part of the book deals with Nevil Shute's experiences in starting his own company, Airspeed, and of the difficulties he faced in raising financing and in dealing with the often opposing needs of his investors and his workers. The Great Depression set in shortly after Shute and his collaborators started Airspeed and this made keeping the company afloat even more difficult.

The second part of the book is filled with many fascinating engineering discussions. The R-100 airship was commissioned

by the British Government in 1924 as the first of what was hoped would become a fleet of swift airships linking the British Empire. The task was given to Vickers, which had built airships during World War 1. However, a new government later decided that two competing airships would be built, the *capitalist* R-100 and the R-101, designed and constructed by the government itself.

The R-100 project was entrusted to Barnes Wallis, a gifted and inspired engineer. With a small crew (including Shute), he designed and built a great airship, within cost and schedule, which flew in 1930 from England to Montreal and back with Shute aboard. The builders of the R-101, meanwhile, enjoyed generous support and much better facilities. But there was a down side too, because bureaucrats meddled with the specifications, and government managers proved sloppy in the design and all too lax with tests and inspections. The engineers at the bottom of the pyramid had no say and the schedule was pushed from above even when it became known that a poor choice of materials had weakened the canvas cover of the airship.

The end was a tragedy. An inadequately tested R-101 took off for a test flight to India. After crossing the English Channel, it crashed in France. That ended Britain's involvement with airship development and the R-100 never flew again and was broken up for scrap.

The third part of the book describes how, with some collaborators, Shute formed the aircraft company that he called *Airspeed*. Throughout the years that Shute spent developing the company, the majority of his time was devoted to raising capital and securing orders, more of his time thus being spent on business activities than on the design of aircraft. Just prior to World War 2, when Britain began arming itself, Airspeed was able to stop worrying about sales. It built bombers during the War and was ultimately swallowed up by its competitor, de Havilland. As already mentioned, the board of directors of Airspeed dispensed with Shute's services in 1938, just as orders for hundreds of aircraft for the RAF began to pour in.

SHUTE'S BOOKS IN ENGINEERING EDUCATION

Shute's books can be used in a number of different ways in an engineering education programme. However, before discussing this, a consideration of some aspects of the books *No Highway* and *Slide Rule* that have implications for engineering education are presented.

No Highway

This book raises many questions concerning engineering ethics and the social responsibility of engineers. Among these are:

- Was it irresponsible of Honey not to more strongly pressure the company that made the Reindeer to withdraw it from service and redesign the tail?
- Was Honey ethically correct in destroying the Reindeer, rather than letting it continue to fly and so risking the lives of all on board?
- When the wreck of the Reindeer was located in Canada, what would be looked for to prove that fatigue failure had occurred?
- What changes were made to the Comet after the cause of the accidents was identified in order to allow it to re-enter service?

Slide Rule

This book deals with a much wider range of engineering problems than *No Highway*. Some of these are listed below together with some questions that can be used in engineering education:

- When he played truant from school due to problems arising from his stuttering, Shute went to the Science Museum and studied the engineering exhibits there. Is his interest in engineering exhibits at a relatively young age an indication that good engineers are born that way?
- Shute provides a comparison of how their group approached the design of the R-100 and how the government group approached the design of the R-101. Are there lessons to be learned from this comparison? Was the government team unethical in some aspects of its approach?
- Shute provides a discussion of the method used in some of the structural calculations for the R-100. He also discusses how long it took to carry out such calculations using slide rules.
- It is often said that a good engineer is always prepared in some way for every eventuality. Is Shute's discussion of his thoughts on getting out of the R-100 in the event of an accident an indication of an engineer's preparation for all eventualities?
- Some discussion of the general views that existed at the time about diesel and gasoline engines is given in the book. Were these views valid then and are any still valid today?
- Shute gives a description of what it was like to walk along the walkway on top of the R-100 and how, even when the airship was cruising at maximum speed, if one bent down one did not feel a strong wind blast. Was this a boundary layer effect?
- Both the R-100 and R-101, like all other European airships, used hydrogen rather than helium, the gas that was in most American airships. Why was this? Shute also gives some figures relating the total gas bag volume to the load that could be carried by an airship. Show how these load values are arrived at.
- Shute makes a number of interesting comments on changes in commercial aircraft that occurred in the 1930s. List the major changes in commercial aircraft design that occurred in this period.
- Shute discusses the change from wood to metal as the material from which most aircraft were constructed that occurred during the 1930s. What were the reasons for this change?
- Shute's discussion of the founding of Airspeed and of the ongoing problems of financing shows the mixing of engineering, business, personnel responsibilities and political considerations that can occur in industry. Discuss these and indicate whether they were particular to the time or are still relevant today.
- Shute's discusses his feelings of responsibility to both his investors and his workers, and of how these two responsibilities could indicate the need for conflicting actions. Discuss the justifications for these feelings of responsibility to the two groups.

Attention is now turned to the some of the ways in which Shute's books can be utilised in an engineering education programme. It is important in an engineering programme to tie together the work carried out in different courses in order to

emphasise the fact that the practice of engineering usually involves the simultaneous application of a wide range of knowledge and skills. It is also important to constantly remind students of the practical applications of the material being taught. Shute's books can be used for these purposes. The discussion here is very broad because each instructor can utilise the material in a different manner in order to complement his/her own style of teaching.

Communications

As already mentioned, one of the reasons that some engineering students have difficulty in writing and speaking effectively is that they have undertaken very little reading of non-technical books on their own and, as a result, have not developed a real appreciation for the power and beauty of good writing. Nevil Shute's straightforward and relatively simple style of writing, as well as the subjects that he writes about, often appeal to engineering students, including those who have not previously engaged in much reading. Therefore, assigning reading from *No Highway* and *Slide Rule*, and having students write discussion papers on aspects of these books, as well as having them engage in discussions about the books with other students, can be very beneficial.

Discussions about Honey's character, ethical responsibilities and behaviour in *No Highway*, plus discussions about how closely related the story of the Reindeer is to the Comet saga, are often good bases for this type of work. *Slide Rule* is an even richer source of material that can be used as the basis for such discussions. Students can enrich this discussion by describing their own experiences. Shute's preparation for a possible R-100 crash can be used as the basis of a discussion of whether the behaviour of a good engineer in all aspects of his/her life is different from that of others. Shute's discussion of his sense of responsibility to both his investors and his workers can also be utilised as a discussion topic.

Engineering Science Courses

Examples that illustrate the application of material covered in some engineering science courses can be obtained from *Slide Rule*. For example:

- In fluid mechanics courses, the boundary layer thickness on the R-100 can be calculated and its implications for those on the top walkway can be discussed. The reduction in the drag on an aircraft that results from using a retractable undercarriage can be evaluated and the consequences of the result discussed;
- In thermodynamics courses, the validity of the fears about using gasoline in countries with high temperatures can be evaluated, as well as a discussion about the relative advantages and disadvantages of diesel and gasoline engines, can be explored;
- In materials courses, the consequences and reasons for the change from wood to metal in the construction of commercial aircraft in the 1930s can be discussed. The change from metal to composite materials that is presently

taking place can be compared to the earlier change from wood to metal;

- In structures courses, the method described to evaluate the strength of the R-100 structure can be critically evaluated and compared to how it could be carried out today.

Business Related Courses

Shute's experiences in starting Airspeed and then keeping it financially afloat, plus the steps that had to be taken to procure orders for their aircraft, can be used in discussions of the relationship between engineering and business activities.

Courses Concerned with Ethics

Both *No Highway* and *Slide Rule* involve situations in which ethical decisions have to be made and can be used as the bases for written or oral discussions of the ethically right thing to do in these situations. Honey's decision to retract the undercarriage of the Reindeer, Shute's concerns about the conflicts he feels between doing what is right for his investors and doing what is right for his workers, and Shute's views in *Slide Rule* that those charged with designing and constructing the R-101 behaved unethically in their approach, can all be used as the basis for discussions of ethical aspects of engineering.

The above are just a few examples of how the writings of Nevil Shute can be used in the teaching of engineering. Many other aspects of his works can also be used for this purpose.

CONCLUSIONS

Nevil Shute's novels and his autobiography contain many ideas and stories that can be incorporated into a programme of engineering education in variety of ways. They can, for example, be used to illustrate the connection between various subjects studied as part of such an education, to illustrate the application of material being covered in engineering science courses, to illustrate the ethical and moral aspects of engineering practice, and in the teaching of communication skills. The Nevil Shute books that can most easily be used in such a way are discussed here and some of the ways in which they can be used in the education of engineers are also discussed.

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