CSIRO PUBLISHING

Historical Records of Australian Science, 2016, **27**, 70–80
http://dx.doi.org/10.1071/HR15012

Raymond John Stalker 1930–2014

Caroline Stalker[A] , *Richard Morgan*[B] *and Roger I. Tanner*[C,D]

[A]Architectus Brisbane, Level 2, 79 Adelaide Street, Brisbane, Qld 4000, Australia.
[B]Centre for Hypersonics, University of Queensland, St Lucia, Qld 4072, Australia.
[C]School of Aerospace, Mechanical and Mechatronic Engineering, University of Sydney, Sydney, NSW 2006, Australia.
[D]Corresponding author. Email: roger.tanner@sydney.edu.au

Raymond John Stalker was born in Dimboola, Victoria on 6 August 1930 and died in Brisbane on 9 February 2014. He had a distinguished academic career at the Australian National University in Canberra and at the University of Queensland. His work on hypersonic flow was universally recognized, and the 'Stalker Tube' facilities he pioneered were able to reach unprecedented flow speeds and were reproduced in many laboratories around the world.

Early Days

Raymond (Ray) John Stalker was born and grew up in Dimboola, population 1500, a country town roughly midway between Melbourne and Adelaide. The eldest of four children, his father Jack was an egg merchant, and his mother Dorothy a seamstress (Fig. 1). Ray's father was a carpenter by trade, but could not find work during the Great Depression so he entered into business with Dorothy's father, Carl Nettlebeck, pickling (as a preservative) and distributing eggs. This business was run from the home, and Ray grew up in the midst of the trucks, palettes and sheds stocked with packing crates.

Despite growing up during both the Depression and World War II, Ray recollected a happy childhood; 'During my childhood years I read Buck Rogers comics, and I made model aeroplanes and pottered with electrical machines, but the shortage of this type of material, due to the war, somewhat limited the scope for this type of recreation'.[1] During the Depression the egg business kept the family fed—often on the cracked eggs that could not be sold.

As a boy, Ray had talked of building a rocket ship to fly to Mars; in his adult life the search for a way to make space travel more accessible to the wider community became the primary purpose of his career.

Ray was awarded a scholarship to Geelong Grammar School, and he boarded there until completing his final year in 1948 (Fig. 2). During his first year at Geelong, he was tested

for career aptitude and it was strongly recommended he pursue a career in engineering or science. Ray recalls being a 'solid achiever' in sport and schoolwork, and he was proud to have rowed stroke in the second eight in 1948. Fortunately shortly before he left school a careers advisor suggested he try aeronautical engineering, and an interview was arranged with Sir Ivan Holyman, who was head of Australian National Airways (ANA) at the time. After negotiations between his father and ANA, Ray became an ANA cadet and enrolled in engineering at Melbourne University.

At the University of Sydney

After a successful year at the Mildura campus of Melbourne University studying engineering, Ray was able to enrol at the University of Sydney—the only Australian university offering aeronautical engineering at the time. He took a

Figure 1. The Stalker family: (front row) Jack and Dorothy (holding John Bennett, son of Lurline); (back row) Ray, Sandra, Lurline and Lawrence.

BSc in 1951 with the University Medal in Aeronautical Engineering and the de Havilland prize in Aeronautics. During his final year of aeronautical engineering in 1953 a new member of staff, Richard Meyer, gave a lecture course on supersonic aerodynamics that Ray found particularly inspiring. He decided to do postgraduate research in this area, and he enrolled in a Master of Engineering Science (Aerodynamics), which he completed in 1955. From there Ray moved on to a PhD, with Richard Meyer as his supervisor, completing this in 1957.

Ray met Judy Taylor, a nurse at the Royal Children's Hospital, first in 1951 and again later in 1953. To Judy, Ray was certainly 'the most interesting man around' at the time, who famously told her once that he had arrived to pick her up late 'because the tram had elliptical wheels'.[2] Judy and Ray were married in Newcastle in 1955. On completion of his PhD Ray paid off his debt to ANA and at the beginning of 1958 Judy and Ray went to Canada.

Ray was characteristically optimistic about the future of space travel during this period, and his career was developing in parallel with the nascent American, European and Soviet space programs. This was a time when propeller driven and reciprocating engine powered flight had reached its theoretical limits, and the rapid development of rocket and gas turbine propulsion systems was opening the skies for supersonic and hypersonic flight, for intercontinental mass transport and, ultimately, for space travel. There was an urgent need for research into high speed flight, and in particular for laboratory facilities for creating hypervelocity flows. Ray made a bet in 1955 with close friend Mick Hall that there would be a man in space within ten years, with the loser having to wear a space suit to work for a week. In 1961, when Titov completed the first orbit Mick, by then working in Britain, duly hired a space suit from a costumier and wore it to his office in Farnborough as agreed. This was an early example of Ray's perceptive ability to fully comprehend the status and limitations of technology of the day, and to plan ahead for the requirements of the future.

Canada and England

In 1958, the then Dr Stalker and Judy moved to Ottawa in Canada for a posting in the Gas Dynamics Laboratory at the National Research

Figure 2. Aged 18 at Geelong Grammar, June 1948.

Council; it was there that he became involved in shock tubes. Daughters Jennifer (1958) and Sandra (1960) were born in Ottawa; lifelong friends were made during these years.

Judy and Ray left Canada in 1960 so that Ray could start to work as a Senior Research Fellow at the National Physical Laboratory, Teddington, UK. The Teddington shock tunnel group was gaining an international reputation and Ray was keen to join them. More lasting friendships were made, particularly with Professor John Stollery at nearby Imperial College and his family. The trips to Canada and England would become the foundation of a worldwide network of friends and colleagues that both Ray and Judy treasured throughout their lives.

Return to Australia

In 1962, the family moved back to Australia, where Ray took up a post as a Lecturer in Physics at the Australian National University (ANU) in Canberra. By 1967, he was Senior Lecturer and was promoted to Reader in 1968. His third daughter, Caroline, was born in 1964. He worked with a highly effective team who also became lifelong friends. In 1965, he was joined by then Dr John Sandeman, and in 1966 by then Dr Hans Hornung. During this time Ray refined his shock tunnel designs and oversaw the construction of the first Stalker tubes.

For Ray it was the wider possibilities of the application of the technology that excited and drove him. In 1968, he was quoted in the *Canberra Times*; 'I think its imperative for men to venture as far as they can. I suppose the first thing is to look around the solar system and then try to find how to get to other systems, and then, if it's on, do it'.

In 1969, the family lived in Sweden for a year while Ray took sabbatical leave. On their return Ray's research work stepped up in intensity, and the shock tunnel research gained further momentum.

On leave again in 1975 he took Judy, Sandra and Caroline (Jennifer was completing her final year at Ballarat at Queens Grammar School, Ballarat) to Switzerland so he could spend a year in an industrial research laboratory in Lausanne. During that year the family had a holiday in Italy. Ray remembered one day in Rome 'as one of the great experiences of my life when on a bright Sunday day, my two youngest daughters and myself walked from the Roman Forum to the Pantheon, visiting all the museums we could find on the way'. Ray inspired a great love of learning and engagement with history and politics in all his daughters.

In 1977, Ray and the family moved to Brisbane so that he could take up the position of Professor in Mechanical Engineering at the University of Queensland (UQ). Ray and the family settled quickly, with the daughters completing their schooling, followed by degrees at the University of Queensland. In the 1980s, Judy also took a position in the Department of Music at UQ, and the Stalker family life became centred on the University for many years. This period was particularly productive for Ray and his research team, and the profile of the group's work within UQ and the wider community grew over the years.

In 1992, he had a debilitating stroke whilst in the USA. Ray applied the same determined perseverance to his recovery that he applied to his work and, in time, contrary to his physiotherapists' expectations, he went back to

Figure 3. Queensland Governor Quentin Bryce presenting Ray with the Order of Australia, 2003.

work, although not quite at the same pace as before.

Ray Stalker received a plethora of accolades and honours during his career including the Order of Australia (Fig. 3). On being inducted as one of the few Australian Fellows of the American Institute of Aeronautics and Astronautics (AIAA) Ray said ‘I am most interested in space planes. If they come good, it will change the world’ (Fig. 4).

Ray’s life work laid the foundations for a respected Australian presence in hypersonic aerodynamics. ‘I think it will change the future of the human race’, Ray said, on being awarded an ATSE Clunies Ross National Award in 2008. ‘On earth we’re clearly beginning to run into limits on the amount of energy we can use … out in space there’s all the energy you want and the small contribution we’ve made … is a help along the way.’[3]

During the last few months of his life, Ray was awarded an Honorary Fellowship of the Royal Aeronautical Society (UK); ‘The world’s highest distinction for aerospace achievement awarded only for the most outstanding contributors to the aerospace profession’.[4]

Ray worked tirelessly, constantly, building the research and the research group, teaching and consulting. He travelled frequently and was often at work. He valued highly the contribution to his career made by his wife Judy who always backed him up and provided the framework for his work. On his retirement in 1993 Ray—by then much awarded— presented Judy with her own award; a specially made brooch inscribed with the words ‘for wifemanship’.

Ray was dedicated to his field, known for incredible focus and stamina. He was ambitious for Australia, ambitious for engineering; a visionary, but not a zealot. His ideas were always delivered in a down-to-earth Dimboola style.

At home, Ray was deeply interested in our political culture, in policy, society and in history, and this fed all of his family’s interest in those areas. Dinner table conversations were often enriched with his very erudite knowledge, as he read extensively. In both public and private forums Ray occasionally expressed impatience with how little Australians thought of themselves on the world stage. He felt that as a nation we could aim higher, be a cleverer country,

Figure 4. 25 June 2001—American Institute of Aeronautics and Astronautics award.

be stronger world leaders in many areas, but particularly in technology and science.

With all of this he was not a grandiose person. He was very humble, and in the many accolades he received for his work he never stood on the shoulders of others, but was always very quick to accept the honours on behalf of his team.

After a valiant and determined struggle with Parkinson's Disease and the after-effects of his stroke, Ray passed away on 9 February 2014 with the loving support of his wife Judy, and daughters Jennifer, Sandra and Caroline.

His legacy is both personal and professional. His life's work showed the value of determined perseverance to the realization of a 'Big idea'. His humour and humility demonstrated that great achievement can come without hubris.

Research at Sydney University

Ray Stalker's career, like that of many engineers, was determined in part by a series of happy accidents. First, as mentioned above, a school careers adviser fortunately suggested he was well equipped to study aeronautical engineering, and this led to him becoming an Australian National Airways cadet, and hence to study at the University of Sydney. Second, the period he was in Sydney (1950–57) coincided with an exceptionally productive research time in the Department of Aeronautical Engineering. The small department contained W. H. (Bill) Wittrick, John J. Mahony, and from 1953 Richard Meyer. All of these three became Fellows of the Australian Academy of Science (FAA). In the final year for his BE degree Ray took an inspirational course on supersonic (faster than sound) flow given by Meyer. In his joint obituary of Meyer, Ray Stalker said 'Richard was an excellent lecturer … as an undergraduate lecturer he was stimulating but thorough'.[4]

Richard Meyer (FAA 1956) had left Germany in 1937 to study in Switzerland at the ETH (Technical University) in Zürich. His mentor there was Professor Jakob Ackeret, a pioneer in supersonic flow. Meyer wrote his doctoral thesis on high-speed flow in cascades of aerofoils and then went to England in 1945. After a short time with the Ministry of Aircraft Production he went to Manchester University to do theoretical work on supersonic flow, which had become an important area of research. In 1953, he joined the University of Sydney, in time to enthuse Ray about supersonics, and to build a research team working both experimentally and theoretically on high-speed flows. In 1957, Richard Meyer left Australia and remained in the USA for the rest of his life.

Meyer supervised Ray for both his Master's Degree (1955) and PhD (1957). In Meyer's obituary,[4] Ray said that 'as a post-graduate supervisor he was a gifted mentor'. Ray wrote a Master's thesis entitled 'Wing-Body Interaction on Missiles at Supersonic Speeds'. Supersonic, and subsequently hypersonic flight, turned out to be a lifelong passion. During this work Ray made innovative use of surface flow visualization in a supersonic wind tunnel, and completed an analytical study of lift generation in the presence of wing–body interactions. The themes of the thesis were a set of carefully planned experiments targeting regions of theoretical uncertainty, the development of appropriate instrumentation for the specific application, and a theoretical analysis that encompassed the dominant physical processes involved whilst remaining amenable to analytical solution. This approach was to serve him well for the rest of

Figure 5. In the supersonics laboratory at Sydney University, 1956, with colleague.

his professional career. The topic of Ray's PhD thesis was three-dimensional boundary effects in supersonic flows (Fig. 5).

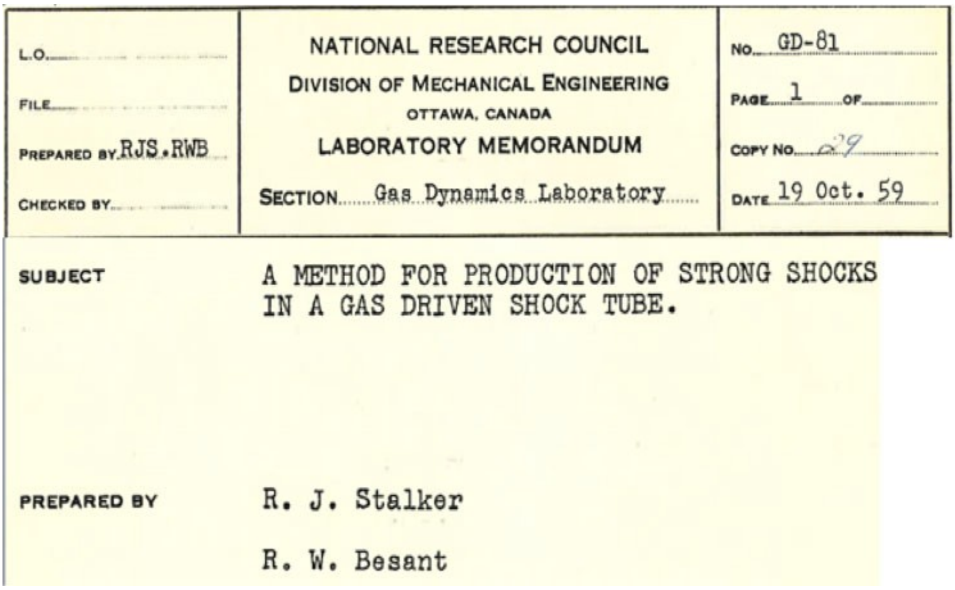
Canada and England: Genesis of the Stalker Tube

The move to the National Research Council (NRC) in Ottawa was a defining period in setting up Ray's research interests in very high-speed flows. It was here that his interest in hypersonic flight developed, and realizing the limitations of current ground testing facilities, he began to investigate new techniques for driving very high-speed shock tubes.

The NRC Report by Stalker and Besant (Fig. 6) seems to be the first reference to the free-piston devices now known as Stalker tubes.[5] The report contained the basic theory of the device and a proof of concept.

We received the following email from Emeritus Professor Robert Besant on the origin of the Stalker tube. We believe this makes clear Ray's dominant part in the research.

> What a surprise to learn about Ray Stalker. We were friends and colleagues at the Gas Dynamics Laboratory at NRC Ottawa Canada in 1959. I was there from May to the end of August 1959 while he was there over a two year period. Ray's wife, Judy, and mine, Joyce, had baby and birth stories to share. We went on summer picnics together (e.g. to Lac Philippe in the Gatineau Provincial Park, just north of Hull PQ and across the Ottawa River and NRC) where I learned some new verses to Anglican hymns and why Australians had the advantages over favors other colonials did not get because they were sent out to the colonies by England's finest judges. It


L.O.

FILE

PREPARED BY RJS.RWB

CHECKED BY

NATIONAL RESEARCH COUNCIL
DIVISION OF MECHANICAL ENGINEERING
OTTAWA, CANADA
LABORATORY MEMORANDUM
SECTION Gas Dynamics Laboratory

NO. GD-81
PAGE 1 OF
COPY NO. 29
DATE 19 Oct. 59

SUBJECT A METHOD FOR PRODUCTION OF STRONG SHOCKS IN A GAS DRIVEN SHOCK TUBE.

PREPARED BY R. J. Stalker

R. W. Besant

Figure 6. The original 1959 National Research Council Report on the Tube.

> seems, however, that only Napoleon got free rent though for his South Seas villa. As you note, Ray often had his tongue in his cheek. He appears to have retained this sense of fun in some of his Univ. of Queensland writings.
>
> Ray's career and mine had some similarities … I returned to the NRC Gas Dynamics in May. That's when I met Ray. And, as noted above, the rest is history except for the fact that Ray was the driver behind his research and I played a minor role in the research; however, I benefited from Ray's generosity because he added my name to his NRC publication …

On completing his work in Ottawa, Ray was employed as a Research Fellow at the National Physical Laboratory, at Teddington in England. Here he diversified his knowledge of shock tubes and gained useful experience in instrumentation for transient phenomena, hypersonic aerodynamics and alternative driver types.

Principle of the Stalker Tube

The driver is a critical component of high-speed shock tubes, with the primary requirement being for the generation of a volume of gas at high pressure and with a high speed of sound from which to initiate the shock wave. High sound speeds require the use of high temperature gases with low molecular weights, and hydrogen and helium are generally the preferred choices for high performance facilities. Established heating techniques included electrical resistance heating, electric arc discharge, inductive heating and a variety of detonative and deflagrative combustion processes. They all have disadvantages in regard to cost, safety or performance, and Ray was targeting a versatile technique that would be appropriate and productive for university-based research groups, and with the ability to cover a wide range of the hypervelocity flight envelope.

The technique he hit upon involved the isentropic compression of the driver gas by means of a 'free' piston, which was launched by compressed air into an initially cold, low pressure slug of driver gas, usually helium. The compression process served the dual purposes of increasing both temperature and pressure over a very short time scale, removing the need for extended storage of hot high pressure gas. When the appropriate pressure is reached, catastrophic failure of a diaphragm initiates the shock driving process. After compression, the volume of compressed gas is relatively small, leading to the risk of rapid pressure decay and shock attenuation after diaphragm rupture. Ray overcame this problem by imparting enough velocity to the piston to maintain post rupture pressure

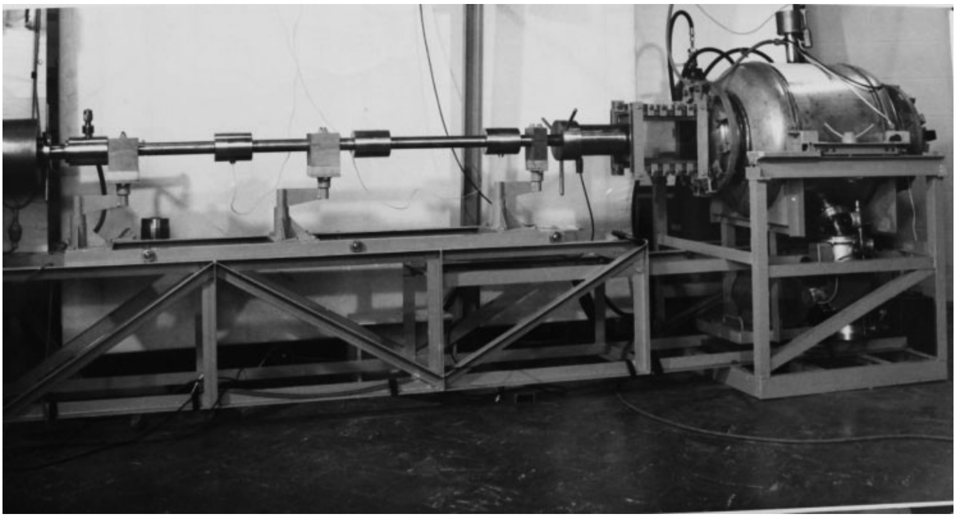


Figure 7. T2 reflected shock tunnel.

approximately constant for the time scales (milliseconds) required.

The dynamics of this process was quantified in a simple non-dimensional plot, which is still used as a design and operating guide in free piston driven facilities to this day.

A remarkable feature of this early work is that after arriving in Ottawa as a young post-doc in 1958, within eighteen months Ray had produced an original concept, published a definitive paper and completed proof of concept studies on what was to be a revolutionary technique for the study of hypervelocity gas dynamics. In doing so, and in overcoming the numerous technical difficulties to the practical implementation of free piston drivers, he established a platform for laboratory study of hypervelocity flight that has been copied worldwide, and which has created an ongoing niche for Australia in the field of space engineering.

On completing his work in Ottawa, Ray was employed as a Research Fellow at the National Physical Laboratory (Teddington, UK). Here he diversified his knowledge of shock tubes and gained useful experience in transient instrumentation, hypersonic aerodynamics and alternative driver types.

Research at the ANU, Canberra

In 1962, Ray returned to his native country, taking up an academic position at the ANU in Canberra, where he was to remain until moving to Queensland in 1976. Here he revived his interest in free piston drivers, and set about addressing the practical challenges that had to be overcome in order to make shock tunnels suitable for aerodynamic testing, which was his primary interest. In his earlier work in Ottawa, he had set up the facility in a ‘non-reflected shock tube’ configuration that demonstrated and validated the shock driving technique, but which does not produce hypersonic flows suitable for aerodynamic testing. Such flows may be achieved by restricting the downstream end of the shock tube so that a reflected shock and stagnated flow is created, and attaching a nozzle through which the heated test gas may be expanded to hypervelocity conditions. Such facilities are colloquially known as ‘reflected shock tunnels’, and their study formed the major single focus of Ray’s career.

Thus Ray began to develop the ‘T’ series of free piston driven reflected shock tunnels that are now universally known as ‘Stalker tubes’. T1 and T2 were small shock tunnels developed with internal ANU funding where Ray demonstrated that the piston dynamics could be safely controlled, and that useful hypersonic flows could be achieved and aerodynamic flows could be simulated (Fig. 7). The issues concerning the piston were that it had to achieve sufficient velocity that the post-rupture pressure stayed sensibly constant, and that the piston could be safely stopped by aerodynamic forces before hitting the end

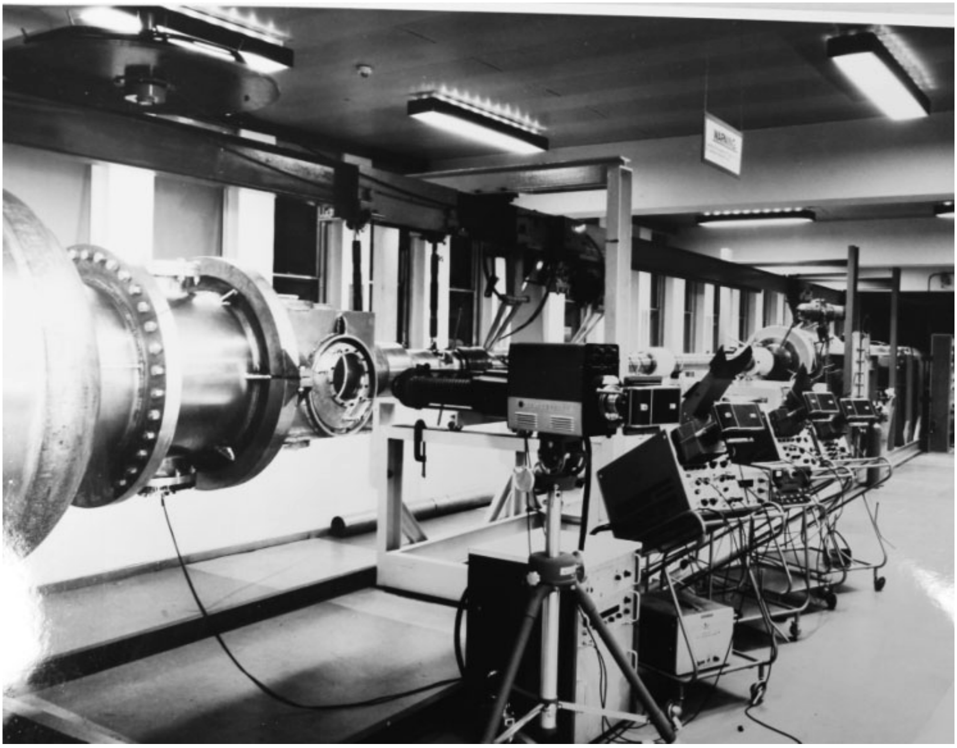


Figure 8. The 'T3' Stalker tube at the Australian National University *c*. 1970.

of the tunnel. Achieving the right mix requires the correct combination of shock tube dimensions, piston mass and operating pressures. Ray developed the associated theory and analysis techniques, and by 1967 was ready to apply these principles to the design of a major test facility. He received one of the first ARGC grants to develop 'T3', which was a 75 mm diameter shock tunnel, utilizing a piston of 92 kg mass, and designed for rupture pressures up to 250 MPa (Fig. 8).

This facility was extremely successful, and it ushered in a new era of hypersonic experimentation in Australia, led by Ray and well supported by his two inspirational colleagues John Sandeman and Hans Hornung, and a growing number of research students. Ground breaking work was done on T3 in the 1960s and 1970s in the area of reacting and non-equilibrium flows, combining the analytical abilities of Hornung with the optical diagnostic skills of Sandeman and the test facilities and all round capabilities of Ray Stalker. It was a time of rapidly developing interest in Space in Australia with the establishment of the Woomera rocket range and the associated activities of the European rocket program (ELDO), and the team at ANU were doing pioneering work at a critical time in the history of space travel.

Research at the University of Queensland

The group at ANU split up when Ray left to take up the Chair of Mechanical Engineering at the UQ in Brisbane. His initial work in Queensland was focused on the locally topical sugarcane industry, and in particular the problems of processing the bulky waste from the crushing mills ('bagasse') into a more compact pelletized form that would be amenable for storage and transportation as a practical fuel. He designed a transient compression device to do this (in a machine that looked remarkably like a free piston driver), and also set up a shock tube to study the ignition characteristics of the raw material.

In due course he redirected his attention back to hypersonics, and in 1980 he received Australia's first grant to study Scramjets from the Australian Research Council (ARC successor to the ARGC). (The scramjet, or supersonic combustion ramjet, is an air-breathing propulsion concept that extends the flight envelope over which air-breathing combustion is viable, and which by using atmospheric rather than on-board oxygen has potential performance advantages over rocket propulsion.) This was a topic in which Ray had had a long-standing interest, and he was convinced that the free piston shock tunnel would be a suitable and economic platform on which to test them. The early experiments were performed on T3, which had remained at ANU. These experiments demonstrated that steady combustion and useful data could be obtained within the short flow duration of a pulsed facility, and several configuration options were investigated on T3, including wall and in-flow fuel injection schemes, inlet injection and shock induced ignition, fuel additives for ignition enhancement, and the effects of combustion chamber length and pressure. Several of these concepts first investigated by Ray now feature on the advanced scramjet engines being developed today.

By 1984, it had become apparent that an improved shock tunnel was needed with higher performance designed specifically for the study of scramjet propulsion. Together with UQ colleagues John Simmons and Neil Page, he obtained one of the first ARC 'program grants' in 1984 to develop T4, another free piston driven Stalker tube. This facility was configured with a larger driver 'L/D' ratio to address previously disappointing pressure recovery in the earlier facilities. Commissioned in 1987, the facility has been extremely successful and to date has performed more than 11,000 shots and more scramjet experiments than any other facility in the world. The 1980s was a period of rising international profile for Ray, and he received strong financial support from NASA in a series of research grants, and several major Stalker tubes were commissioned including HEG at DLR Göttingen, T5 at Caltech and HIEST at JAXA (Japan). In addition, the RHYFL facility, which is the biggest Stalker tube ever designed, was built for Rocketdyne, but unfortunately it was never commissioned due to the collapse of the US National Aerospace Plane Program (NASP) in 1993. Both T5 and RHYFL were designed by WBM Stalker, a consulting firm set up by Ray and Brisbane-based engineering consultant Russ Morrison to market Australian technology overseas.

In 1992, whilst attending a conference in Florida, Ray suffered a stroke that left some physical impairment, but his cognitive abilities and creativity remained unimpaired. After a brief return to teaching duties, he resigned his academic position in 1993, and continued with his research activities in the role of Emeritus Professor. By this time he had gained a very good understanding of the physical processes involved in scramjet propulsion, and had validated basic design principles through the extensive experimentation performed on T3 and T4 since 1980. He believed he was by then in a position to achieve what had never been done before (according to the openly published literature) and build a complete scramjet powered vehicle that could produce more thrust than drag. Working with UQ colleagues Allan Paull and David Mee, in 1993 he 'flew' a multi-combustor scramjet in T4, complete with on-board hydrogen fuel supply and mounted on an instrumented 'stress wave force balance'. This vehicle did indeed produce more thrust than drag, and gave the first demonstration that scramjet powered flight could be a practical reality.[6]

For more than two decades following his stroke he continued to work part-time and provide inspiration and encouragement to his colleagues at UQ. He took great satisfaction in seeing the group that he had founded grow and come to lead the world in a wide range of related activities. These included the extension of the scramjet research activities to flight testing through the HyShot, HiFIRE and Scramspace sounding rocket programs, the development of super-orbital expansion tubes, which used the Stalker free piston driver concept to extend the operating envelope of pulsed facilities to higher speeds and the study of entry into all the planetary atmospheres, and the development of a large network of international partners spanning five continents.

Ray had always been a dedicated educator, with his style being based on giving a good grounding in fundamental principles and analytical techniques, applied in exciting applications and backed up by experimentation in world-class laboratories on the cutting edge of science and engineering. Recognizing that full participation by Australia in the growing space industry would require special skills, he started introducing space-related material into the Mechanical Engineering undergraduate program at UQ in the 1980s, enabling the students to identify a space engineering 'stream' on their certificates. In 1993, this concept was extended to the introduction of a formal Mechanical and Space Engineering degree, based on the core Mechanical Engineering program but with the 'electives' replaced by space-related specialized courses. The logic here was that the market in Australia would not at the time support large numbers of dedicated 'space engineers', but the primary skills required would be those of a high quality mechanical engineer with some specialized knowledge of the particular considerations required for space-related activities. The graduates of this program were well qualified to work in any conventional mechanical engineering situation in Australian industry, and would form the backbone on which a space industry could be built.

In 1997, the hypersonics group at UQ was transformed into the 'Centre for Hypersonics', and has become recognized as one of the leading hypersonics research groups in the world. Since 1986, 115 higher degrees by research students have graduated from the group established by Ray, forming the biggest alumni group in the field worldwide, and making a major contribution to his ambition to raise the high technology skill level of the country.

He continued to participate in the activities of his colleagues at UQ until prevented by ill health very close to the end, and he was, and remains, an ongoing source of motivation for his many former students and colleagues. He leaves an enduring legacy to Australia and the scientific community in the Stalker tube facilities, through the large body of scientists and engineers who have interacted with and learned from him, and in the archives of his published works. On a personal level, he was forthright, loyal and inspiring, quick to appreciate the abilities and limitations of his colleagues, and capable of motivating us to achieve more than we believed to be possible. He believed in constructive criticism of brutal honesty when required, and would respectfully acknowledge positive accomplishments at any level. He would gain equal pleasure from seeing a simple job done well in the workshop as he did from the execution of an advanced piece of analysis, and was totally inclusive of all members of his teams.

Bibliography

A full bibliography of scientific publications by Raymond John Stalker is available online as Supplementary Material to this paper.

Endnotes

1. Recollections of Ray Stalker, collected by Professor John Sandeman—unpublished transcript, 2013.
2. Ray Stalker personal recollections—source—Caroline Stalker.
3. Citation for the Australian Academy of Technological Sciences and Engineering Clunies Ross National Award 2008.
4. R. J. Stalker and E. Nicole Meyer, 'Richard Ernst Meyer 1919–2008', *Historical Records of Australian Science*, 21 (2010) 75–89.
5. R. J. Stalker and R. W. Besant, 'A Method for Production of Strong Shocks in a Gas Driven Shock Tube', *National Research Council Report GD-81*, (1959) Ottawa, Canada.
6. A. Paull, R. J. Stalker and D. J. Mee, 'Experiments on Supersonic Ramjet Propulsion in a Shock Tunnel', *Journal of Fluid Mechanics*, 296 (1995) 150–183.