Nine Pioneers' Stories

75

1940
2015

YEARS

AEROSPACE ENGINEERING

TU Delft

PIONEERS

TU Delft

Nine pioneers' stories

Written by Monique de Vries, De Taalfax
Photography: Guus Schoonewille
Layout and design: Debby van Vondelen, Media Solutions TU Delft

Nine Pioneers' Stories is a publication of the faculty of Aerospace Engineering at Delft University of Technology (December 2015)

A tribute to our pioneers

2015 was an anniversary year for the Faculty of Aerospace Engineering at Delft University of Technology. The year marked the 40th anniversary of the Faculty of Aerospace Engineering and it has been 75 years since the sub-department 'Vliegtuigbouwkunde' (Aeronautical Engineering) was founded at the Faculty of Mechanical Engineering.

Anniversary theme: pioneers

In honour of all the people who contributed to our faculty or still do so each and every day, we are publishing a short series of portraits of former professors and staff to mark the end of our anniversary year. They are most definitely not the only pioneers in our faculty, nor are they necessarily the most important ones. However, they have all been important to the faculty in their own way and in specific time periods – and they still are.

This anniversary publication is not complete by far. We do not want to sell anyone short in this. However, what we do intend to do is tell the stories of nine people from those exciting early years of our faculty.

Meet or reacquaint yourself with Jan Boeker, Otto Gerlach, Koos Jongenelen, Jaap Schijve, Egbert Torenbeek, Jaap van Ghesel Grothe, Jan van Ingen, Boud Vogelesang and Karel Wakker.

Their stories are wonderful. I hope you enjoy reading them!

With thanks to all,

Hester Bijl
Dean of the Faculty of Aerospace Engineering
Delft University of Technology

Jan Boeker

Mr Wind Tunnel himself

When you say “wind tunnel”, you’re saying Jan Boeker. He is personally very modest on his role in building this laboratory: “I just happened to get into it. After the war, I was studying aeronautical engineering in Delft when I got the offer to become assistant at the sub-department ‘Vliegtuigbouwkunde’ (Aeronautical Engineering). At the time, I thanked them for the honour but declined, because I did not consider the particular technical aspects of the job interesting. However, I did let them know that I was interested in aerodynamics. To my surprise, I was then offered the post of assistant for the tasks surrounding the wind tunnel that was under construction. I was given an office in the wind tunnel building that had just been completed. At the start, assistant J. van der Bliek and I were the staff of the wind tunnel under the lead engineer, J. Boel. After some time, Boel left for the National Aeronautical Laboratory (NLL, now NLR) and Van der Bliek left for the US after graduation. That left me as the most experienced person in finalising and commissioning the wind tunnel.”
Boeker became the supervisor on finalising and commissioning the low-speed wind tunnel. “This instrument needed to comply exactly to all aerodynamic requirements, so construction needed to be precise down to the millimetre. I had to reject a lot of contributions,” Boeker reminisces. “The design had been put on paper by the NLL during the war, where work had been shut down for the most part during the occupation. The wind tunnel had a test section of 1.25 m2 (h) x 1.80 m2 (w), making it considerably larger than its previous wooden predecessor (0.85 x 0.85 m2) and had a much higher flow quality. This had never been achieved in the Netherlands. However, the NLL had no budget for the implementation at that time. Van der Maas then recognised an opportunity and brought the design to Delft.”

Ground-breaking project

Boeker immediately felt right at home in the low-speed lab. However, soon another ground-breaking project loomed on the horizon: the construction of a suitable supersonic wind tunnel. This had been on the wish list of Professor Van der Maas for quite some time. “When he asked whether I wanted to try my hand at this project, it took me by surprise, because a lack of manpower had meant that this project still hadn’t progressed much beyond general studies. My interest was stirred though, so I said yes. I had to really get deep into the subject matter, and during the first years nothing tangible emerged. The department did have access to a small supersonic wind tunnel of their own design, built in the central workshop of the university. However, this small wind tunnel offered extremely limited options. Nevertheless, research was done under Bannink’s supervision and published internationally.”
There were some ideas, but we did not have the people who could develop them in detail. After meeting with the Swedish wind tunnel designer John Rosèn, everything suddenly sped up. He had developed an easy method to configure different Mach numbers in the test section of a wind tunnel by using a flexible collector. This method, tried-and-tested in Sweden, enabled a highly simplified method of construction of the wind tunnel. The assignment for the design was given to Rosèn. “For the next two years, Van Ghesel Grothe and I regularly travelled to Sweden to closely follow the design of the wind tunnel. The most

important components were built in the Netherlands, e.g. at Werkspoor Amsterdam and Stork Hengelo. That had been a requirement of Van der Maas from the very beginning, who insisted that Dutch aviation and industry should profit from the construction." Especially the test section was innovative, because of the adjustable throat. The supersonic wind tunnel was finally officially opened in 1969.

Job description forms

Ten years later, pressure from management duties started increasing. Boeker was elected by the staff of the faculty to be HR manager: a job that was created at the instigation of the university council to supplement the operational manager (the two positions used to be one job). "We struggled with a stagnation in staff careers; people just weren't being promoted. I did some pioneering in that area, if I do say so myself. I defined the pay scale for many job classifications and drew up the accompanying job description forms. Many of those forms from that time are still used today."

At age 65 (1989) Boeker had to retire. "Back then that was the rule, to make way for a younger generation. However, I was allowed to stay on contract until the age of 70 to sit on various committees and the board of ECATA (European post-university education in consultation with the industry). In that time, more international contacts were developing, especially in France.

It just so happened that I spoke good French because of my childhood years in the French-speaking part of Switzerland, so that was very convenient."

Involvement in national politics

Looking back, Boeker reflects on tumultuous but especially good times. "The sub-department 'Vliegtuigbouwkunde' (Aeronautical Engineering) didn't amount to anything much in those early years. When I started studying for my degree (1941), there were only sixteen students. Right after the war, the attitude of the Dutch government was uncooperative: supposedly there would not be a future for the Dutch aviation industry because of the huge head start that America had. Yet Van der Maas managed to get the government behind his plans. The lines of communication with the government were short: Van der Maas never hesitated to pick up the phone in order to arrange financing or other affairs, or to set up a meeting with a minister over coffee. Looking back, I can say that we were quite involved in national politics."

That independence was very valuable to the sub-department, Boeker remembers.

At a certain point in time, we were in a separate building, right at the edge of the campus. The idea that we should be there originated from Van der Maas: he believed that our faculty should stay far from the main building. He believed it provided more freedom and less checking up. In my opinion, that was one of his many accurate assessments."

Résumé in brief

Jan Boeker (1924) was one of the first students of aeronautical engineering at the TH Delft. However, he had to interrupt his studies during the war due to the demands that the occupying forces put upon the students (i.e. forced labour and a declaration of loyalty). He resumed his studies in 1946. He graduated in aerodynamics and was involved in the start of the low-speed wind tunnel (1953) – the first lab in the Wippolder – and the high-speed wind tunnel (1969). Later in his career (from 1979 to his retirement in 1989), he fulfilled his role as HR manager passionately. He was also the Dutch delegate on the board of the renowned Von Karman Institute (Belgium) and a member of the board of ECATA. For his accomplishments, he received the royal honour of Officer in the Order of Orange-Nassau in 1985.

Otto Gerlach

Engineer and pilot navigating academic arenas

A small angular speedometer is on proud display on the table. The instrument, its inner workings visible, immediately puts a sparkle in the eyes of its owner, Otto Gerlach, and then the stories start flowing. This is hardly surprising, as the emeritus engineer and pilot took the academic approach to test flights sky-high during his career. It was due in no small part to Gerlach's contribution that the Netherlands had some measure of importance in this field in the world.

At a young age, Gerlach had already made a solemn promise to his parents: he wanted to attend Delft exclusively to learn how to build planes, not how to fly them. Things worked out quite differently, however: "In 1947, the third year of my studies, we had the opportunity to take some flying lessons.
This was made possible by Professor Van der Maas, who was an engineer and pilot himself. I thought it would be wonderful, so I took to the skies. I obtained my light aircraft pilot's license and received permission to attend the advanced programme at the National Aviation School in September 1948, provided that I would have achieved sufficient flight hours by that time. In pursuit of that goal, in the summer of 1948 I flew almost non-stop with the trusty De Haviland Tiger Moth."

Test flights

The combination of brains and piloting brought Gerlach into the field of test flights and measurements. It was an ideal stepping stone for his vast interest in aircraft kinematics. "Shortly after the war, we spent years running test flights in an FK-43, built in 1934 in Frits Koolhoven's factory, located at the Waalhaven inner harbour in Rotterdam at that time. In this plane, we learned first-hand how to measure things like altitude and speed during flight. I personally graduated cum laude on the assessment of the flight characteristics of this plane. I was also preoccupied in that time with updating Professor Van der Maas' lecture notes to the post-war state of knowledge, as per his instructions. Printed notes for students were not provided back then. Students had to make their own summaries during lectures, although they did receive hand-outs containing the relevant illustrations. Those were drawn inimitably by Koos Jongenelen."
One of the major issues of that time was the question of what was more important to a pilot: the position of the stick or the force the pilot had to exert on that stick. "Van der Maas was convinced of the first answer. But post-war literature almost exclusively discussed the steering force. An explanation for this difference was found thanks to the FK-43. It is a bit of a technical story, but it had to do with the lack of ball bearings in the steering mechanism of the FK-43. They used sliding sleeves, which were lighter and cheaper but produced substantially more friction. This way the steering force provided the pilot with far less information about the aerodynamic forces on the rudder. That is why the steering position was more important back then. After the war, ball bearings were always used. That is how we found the explanation."
The emergence of highly accurate measuring instruments in the fifties, such as the angular speedometer and the accelerometer, significantly sped up the execution of test flights. "Back then, this small instrument was literally worth its weight in gold", Gerlach shows, demonstrating how the instrument is operated. "With this, we could measure angular speeds at an accuracy of 1 to 10,000. That was

unparalleled precision in those days. What we did in the sixties with these types of instruments is still incredibly valuable today.
NASA used part of our methods as a basis for their programme to extract details from the data in a plane's flight recorder after an accident. Apparently, a lecture that my successor, Professor Bob Mulder, had given in America in the 1960s was the basis for that."

Flight simulation

After many test flights, Gerlach believed it was time for another challenge: the development of flight simulation for research purposes. In the early 1990s, under the guidance of Professor Mulder, this activity led to the realisation of the SIMONA multi-purpose research simulator, but when Gerlach was there, it was still in its very early stages. "Our aim was to be able to simulate all circumstances in flight as accurately as possible. But that took a lot of thought. One day, I received a call from Professor Viersma at the department of Mechanical Engineering. He told me about air bearings which he had developed at Philips. This proved to be the crucial element. Based on those air bearings, he could create a hydrostatic bearing, which enabled the piston to 'float' in the cylinder without any friction, which used to be the problem. In short: with these hydraulically driven cylinders we could now have the simulator make the same smooth movements as in reality! This also spread the realisation that more could be accomplished with simulation than had previously been imagined."
In 1971, another new world opened up for Gerlach: he succeeded Professor Van der Maas as chairman of the Netherlands Aerospace Centre (NLR). "I had been asked to become chairman of the NIVR (former Netherlands agency for aerospace programmes) before, but I did not see any benefit in becoming an intermediary between government and industry. The Netherlands Aerospace Centre was very appealing, however, for a number of reasons. This appointment brought me into a completely different league than I was used to, though. I visited every capital of the NATO countries at that time where aviation research took place, and regularly went to the Pentagon too. In addition, I was also the national delegate to NATO for AGARD, the Advisory Group for Aeronautical Research and Development. This is where the people who were responsible for the allocation of available funds for aviation research in their countries met. These contacts in AGARD, but also earlier in the same context at a working level, taught me much."

Free system

In spite of his distinguished achievements in several fields, Gerlach does not consider himself a pioneer. He is actually grateful for all the opportunities that he had the good fortune to participate in. "In the 1950s and '60s, research funding was substantially less restricted than the current system. No extensive and detailed research proposals, as is common practice nowadays, were needed in order to get started. Van der Maas was an ace at acquiring funding from the government and all of us were very happy with that. We were able to do all the research we wanted. Often the results were disappointing, but sometimes we accomplished some ground-breaking developments. I often think of those days with pleasure."

Résumé in brief

Professor Dr.Otto Gerlach (1928) graduated from the TH Delft 1951 as an engineer and pilot with a degree in aeronautical engineering. He developed into an expert in the field of stability and control. In 1959 Gerlach became a lector at TU Delft. In 1964 he completed his doctorate cum laude on the subject of measuring characteristics of aeroplanes in flight, followed by his appointment as professor of aircraft dynamics (1965 to 1989). In addition, Gerlach was chairman of the Netherlands Aerospace Centre (NLR) during the 1970s and '80s as well as the national delegate to AGARD. Some 200 students graduated under him.

Koos Jongenelen

Philosopher in overalls

In 1940, at just 16 years old, Koos Jongenelen was appointed as an apprentice draughtsman at the newly established department 'Vliegtuigbouwkunde' (Aeronautical Engineering) in Delft.
His extraordinary talent for drawing took him to the position of Head of the Drawing Office and made him the illustrative bedrock on which all the professors built their graphic supplements. His considerable sense of humour and his witty remarks made him quite memorable. "People called me the philosopher in overalls."

Open any textbook on aeronautical engineering, for instance the 'Torenbook', and you will undoubtedly come across sketches made by Koos Jongenelen. He entered the profession by happenstance, when he was discovered by three gentlemen from the Netherlands Aerospace Centre, including Professor Van der Maas. "I was visiting some acquaintances at Aeronautical Engineering and they happened to notice some drawings I had made for fun. Van der Maas asked me if I would like to come work for them. If I would take some drawing lessons, it would be a good way to make some money. Well, my interest was raised of course."
Initially, the war disrupted those plans considerably. "There were hardly any students left. Often we had police roundups, even one time during lectures. Still, we had some people hidden in the basement. In the attic we had a radio which allowed us to follow the latest messages from the Allied forces. Moreover, Professor Van der Maas was also a wanted man. That is why he went into hiding until after the war. I did some odd jobs at the university myself. For instance, delivering mail to professors' homes. When the time came when I would have been forced to sign the declaration of loyalty to the Germans, I went into hiding myself, at home under the floorboards."

First lecture notes

Immediately after the war, Jongenelen attended courses in drafting for civil engineering and machine engineering at his own expense at night school. After that he took several more written courses at exam institute PBNA, including one in calligraphy. In the meantime, his work in Delft as a jack-of-all-trades continued. "I had to register newly acquired books and take dictation on letters for Professor Van der Maas, which I would then type on a typewriter using one finger. I also wrote hand-written letters for the engineers, in type letters. Later on I drew drawings for publications and illustrations for the first lecture notes. This was the beginning of the technical illustration department."
The introduction of lecture notes, complete with drawings, was a huge improvement for the students back then. "In those times there were no textbooks yet. The students had to take down their own notes and copy the drawings from the board themselves. Some students were more proficient in it than others, so that was far from ideal. Using so-called Volgnummers – over 1200 in total – we started to put all drawings on paper in order to provide them to students. We had a separate room for this type of drawing, also known as the 'shed shop'. This was a room filled with boxes on the wall containing all the drawings according to their sequential numbers."

Jack of all trades

Each drawing was preceded by an extensive briefing from the relevant professor. "Some were very precise. Sometimes you would have to do a drawing five times.

As an illustrator, you had to be a kind of jack-of-all-trades. You needed to know something about fluid mechanics, materials science and overall mechanics. Only later did you have separate departments for that. In hindsight, I learned quite a bit from that.

The hardest thing I have ever drawn was the instrumentation of an old Koolhoven. I also had some difficulty with the diagrams for fluid mechanics. Every time I was stuck, I had to go back to the relevant professor. Maddening, that was. However, my motto was: if you fail, try and try again. Those who persevere will win!"

The tools of an illustrator at the university consisted of just a drawing board and two triangles. Yet these tools were used to make the most difficult diagrams. Later on, the drawing table and drawing machine were introduced, followed in the 1970s by the computer. Jongenelen: "Our work was increasingly taken over by the PC, but that was not my thing. I prefer old-fashioned hand-made drawings and I prefer drawing freehand. Caricatures, with plenty of humour, are my favourites. I have made quite a few of those for my colleagues, for instance for festive occasions. That was always good for a laugh. A joke can challenge even the most delicate matters and I love doing that."

One big family

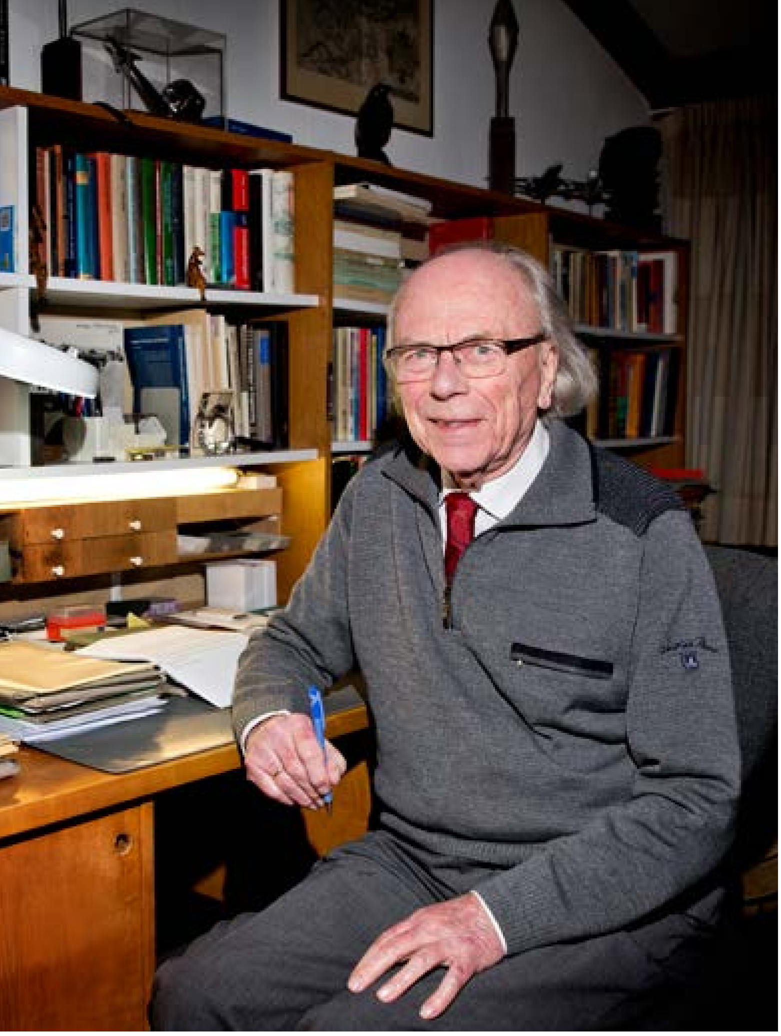
Jongenelen went through the entire career ladder, from draughtsman C to Head of the Drawing Office. He took his work seriously, but he considered some occasional fun just as important. Precisely because of the camaraderie in the workplace, there was room for that. "We were birds of different feathers, from different parts of the country, but we made Aerospace Engineering great together. If anything needed to be done, whether it was assembling packets or moving some chairs, everyone pitched in: the lector, the engineer, the janitor. We were one big family. I remember that we regularly went flying. Well, the cleaning lady went along just like the rest of us."

On his 40th anniversary in October 1980, Jongenelen received both the golden torch (an honorary pin from the university) and the honorary Golden Medal in the Order of Orange-Nassau – a commemoration (requested by Jan Boeker) bestowed upon him for all his contributions to education. Jongenelen: "When he was pinning the golden torch on me, the member of the Executive Board said to me: 'I need to pin this a little higher, because I have something else as well'. The fact that I then received a royal commemoration as well was a huge and wonderful surprise for me!"

The awarding of the golden torch was a perfect indication of the good relations between staff, the illustrator says: "In the past, only academic staff received the golden pin; support staff received a silver version. Thankfully that difference in rank was already a thing of the past then. We had a voice as well; you were taken seriously. I considered that very important: your job is akin to a marriage of sorts after all." At his departure in 1989, Jongenelen emphasised once more how important that good atmosphere had been for him. "During my time at the university, I made a lot of friends at all levels of the organisational hierarchy. Those contacts were the ones that still make me proudest."

Résumé in brief

Koos Jongenelen (1924) was the very first member of staff of the sub-department VTH. In 1940, at the age of 16, he started as an apprentice draughtsman. Starting as draughtsman C and moving on to B and A, he eventually worked himself up to chief draughtsman and finally Head of the Drawing Office. He was one of the founders of the technical illustration department of the VTH. His drawings have taken education in Aeronautical Engineering to higher levels and are widely acclaimed. Jongenelen retired in 1989.



Jaap Schijve

Energetic fatigue expert

His name is linked to Arall and Glare and he published a leading textbook: Jaap Schijve, an expert in the field of fatigue phenomena in constructions and materials. At 88, this professor can still occasionally be found behind the electron microscope of Aerospace Engineering, perusing samples for aspects of fatigue in materials. Indomitable curiosity drives him ever forward in the quest for new insights.

Why do things happen the way they do? And how do they happen precisely? And how can we understand that? As a child, Jaap Schijve already had an irresistible curiosity. "I asked myself questions about the how and the why. I investigated everything that I could find in my parents' house, even in places where I was really not allowed to poke around. I believe that my academic fascination was basically already present even then, and was enhanced by my tendency to avoid fallacies, a tendency towards perfectionism.
Schijve chose to study aeronautical engineering and even before his graduation (1953) was offered a job with the Netherlands Aerospace Centre (NLR), in the department of Construction and Materials. After a number of years he was put in charge of managing that department. His job was perfect for him, as he could focus on research and interpreting various problems that can occur in aeroplanes. Problems involving a large number of stresses on a structure can lead to dangerous fatigue phenomena. Those problems occupied a central position in many research studies conducted by Schijve. The facilities for experiments in the laboratory of the department increased, leading to new research. "The first fatigue machine was a resonance machine, which worked on high frequency. It was difficult to regulate the stress you wanted to apply to a test piece. This changed dramatically when fatigue machines could be regulated through digital signals of computers which were developed in the 1960s. Many of my contemporaries dropped out when PCs appeared, but I realised I needed the computer. In those early days, I followed a televised course together with my wife. On Saturday mornings, both of us went to the laboratory in Delft to work out our homework for that course."

Didactics

After twenty years at the Netherlands Aerospace Centre, Schijve accepted an appointment as professor of aircraft materials at Delft University of Technology – a position he had already held as a part-time professor for some years. "In addition to doing research, it was of course also part of my duties to pass on knowledge and insight to students. I have always considered that of the utmost importance and have done so with passion. In the early 1970s, the Bachelor's degree was followed by two more years before graduation. That graduation period was loosely set up at first, but I made fundamental changes to that. I introduced the requirement that students needed to execute two substantial assignments with an obligatory report and a presentation on both – which had to be practised beforehand with an audience of their own choosing. The hypothesis also needed to be well defined: why do I do this research and who will gain from it? This led to good presentations and the students enjoyed their newly acquired presentation skills. The defence of their work improved considerably. And we always reached the questions of whether we learned anything, whether anyone of us profited by it, and if so, who did."

Teaching

When the position of dean of the faculty was up for change, Schijve was sought out to become the new dean. "But I did not feel like attending all sorts of meetings. Don't take me away from my students. As compensation I became chairman of the Education Committee. In 1986 I had to deal with the 'coup' initiated by Deetman, the Minister of Education at that time. All five-year studies had to be shortened to four years. Everyone was against it, especially the students themselves. They posited that the quality of the programme had to remain at the same level. Try to arrange that with your fellow professors! In the end, it did change back to a five-year programme again." Educating students into engineers with the proper attitude towards solving problems is what Schijve considers an important bit of pioneering on his part. "I at least believe that I have worked towards that with the roughly 130 graduates and 17 PhD candidates with whom I was involved, directly or indirectly."

Patent on Arall

Doing material research remained Schijve's driving passion during his tenure as professor. He was closely involved with the development of the very first fibre metal laminate – Arall – which was finished in the mid-1980s. The first patent on this new construction material with excellent fatigue characteristics was registered to Schijve, Boud Vogelesang (his successor) and graduate student Roel Marissen. "We had gained a name at the STW Technology Foundation because of our interesting reports on fatigue. STW granted us funding, which we used to conduct a great deal of advanced research. Research on the application of Arall also flourished." Schijve also collaborated on Glare, a new fibre metal laminate and successor to Arall. "The idea behind fibres in laminates was not so much the avoidance of the first micro fractures that start the fatigue process. But once there is a fracture, the fibres remain intact and keep the fracture from widening, so it can hardly grow any bigger. Their strength is that they can stop the fracture process, like growth inhibitors."

Schijve retires

for students and PhD candidates. He now also had time to write articles for journals and contributions to books. And finally, he also authored a comprehensive book on the wide diversity of fatigue issues that can occur in constructions, entitled Fatigue of Structures and Materials (2001). Schijve also incorporated his vision on didactics in the book. The chapters do not end in conclusions, but rather with a line of thinking that was developed in them. Read that and you will know whether you have gained the insight of that chapter or not. The book received the prestigious Textbook Excellence Award from an American association in 2010. According to its current publisher, Springer, over 5,000 copies have been sold. In 2014 a Chinese translation was published.
A small book by Schijve was published by Springer in 2015 as a SpringerBrief entitled Biaxial Fatigue of Metals, The Present Understanding. "A substantial number of publications including experiments and theory have been published on this topic. Almost nobody discusses the questions of why we do this research, for whom we do it, and what we can do with it. There have been vague suggestions on the biaxial fatigue phenomenon and we have in fact sufficient understanding to say that predictions are not possible. This means that it is of no use to the industry. In my opinion, practically all papers on biaxial fatigue are a waste of energy."
Schijve considers himself a privileged man. "I have been lucky in so many things, like getting a grant and Professor Van der Maas permanently appointing me at the Netherlands Aerospace Centre. But also with colleagues and staff, the club feeling for life, and the workshops in the laboratory that made things for my research. And of course with my successors as professor – Boud Vogelesang, Ad Vlot and Rinze Benedictus – and 'my' students and PhD candidates. Last but not least, with Janine, my wife, who always knew what occupied my mind and asked me questions about it. It is too much to mention really. And finally there is that endless curiosity. No, I am far from finished!"

Résumé in brief

Professor Jaap Schijve (1927) graduated in 1953 from the TH Delft and immediately started working at the Netherlands Aerospace Centre (NLR), where he rose to head of the department of Constructions and Materials. He completed his PhD in 1964 and became a professor of aeronautical materials in 1973. Schijve retired in 1992, but still works regularly for the specialist group on aerospace materials. He has received various commendations for his work.
Jaap Schijve was General Secretary of the International Committee of Aeronautical Fatigue (ICAF). At the biannual ICAF Symposia, the Jaap Schijve Award, established by the Netherlands Aerospace Centre and Delft University of Technology, is awarded to a talented young scientist. Jaap Schijve has collaborated on various national and international courses.

Egbert Torenbeek

Aeroplane designer to the core

Einstein once said: “If you have insufficient knowledge about a subject, you should write a book about it.” Those words were the inspiration for Egbert Torenbeek to write his book Synthesis of Subsonic Airplane Design (1976). This book, known affectionately as the “Toren book” is iconic in the world of aeroplane design.

That Torenbeek would choose a career in aerospace engineering was already clear at a very young age. “As a six-year-old boy I saw the bombers from England flying over in 1945. It was so fascinating that I watched the sky all day. Now and then I saw an explosion and one time I even saw paratroopers. Then I realised that aircraft could also crash. And that is how I got infected with the aeroplane virus. So, after secondary school there was only one thing that I wanted: to get to Delft as soon as possible. That sentiment was even stronger when I read about Professor Van der Maas and his Siebel test plane in AVIA Vliegwereld.”

PhD in applied science

Torenbeek finished his studies successfully, went to Cranfield, England, for a year and then came under the wings of Professor Hans Wittenberg, professor of aircraft design (1963). “I was an academic civil servant when Wittenberg encouraged me to do a PhD based on the book I was writing in the small hours of the night. That was quite unique for the time, as back then it was only possible to prepare a doctorate on fundamental scientific research. And my book was on applied academic work, meant to provide methodologies for designing aeroplanes.”
Writing the book was an act of necessity: “There was no up-to-date handbook, and that is quite troublesome when you have to supervise a laboratory course, at least that was the way I experienced it.”
It took Torenbeek five years to complete it. The content came from all the information on designing aeroplanes that had been published up till 1970. Torenbeek: “That was quite a bit in itself, but it was mainly about pre-war aeroplanes. And this was in an age when jet planes like the DC-8 and the Boeing 707 were already operational and Concorde had already had its first flight. Therefore one of the challenges was gathering the latest information on design.”
The accompanying drawings were also painstaking work. Koos Jongenelen, draughtsman at the TU, took his fair share of the work, but Torenbeek did quite a bit himself. “Back then we used to use that old-fashioned dry transfer lettering! And there was also the matter of typing the text. The formulas were particularly tricky to write with a typewriter, but fortunately our secretary, Corrie van Niel-Wilderink, was especially delft at that. An uncle of mine literally compared the typed manuscript to the hand-written original. We received a compliment later in an English review that the book did not contain a single typographical error.”

The definitive aeroplane design book

To Torenbeek’s amazement and great satisfaction, the world embraced his brainchild as the definitive aeroplane design book, because it integrated all the relevant engineering disciplines. Originally written in English, the book has also been translated into Russian and Chinese. Nowadays, 40 years after the first edition, this book is still used in many countries as a basic textbook for aircraft design and design education. A few dozen copies are still sold annually. The nickname “Torenbook” originated from the brain of Professor Van Ghesel Grothe. “He saw the book and said: ‘So this is the Torenbook.’”

In the 1980s, the way aeroplanes were designed changed dramatically. Most of the manual work was taken over by computer-assisted design (CAD). Torenbeek was a pioneer in its development because it raised his field to the next level. The 1990s were a harder decade. “It looked like Fokker would go bankrupt (which did in fact happen in 1996), so there were dark clouds gathering around the faculty in Delft. However, there was a highlight in the assignment from the German company Extra Flugzeugbau to make a predesign (‘advance design’) for a corporate plane. In 1996 this lead to the maiden flight of the EXTRA-400, the first 100% synthetic production aeroplane ever. I’m still very proud of our team from back then.”

Taking a risk

In 2000 Torenbeek received an honorary doctorate in Moscow and the Aircraft Design Award from the American Institute of Aeronautics and Astronautics (AIAA) – a lifetime achievement award for his pioneering role in education in the field of aircraft design. However, he sees it differently: “I consider predecessors such as Van der Neut, Gerlach and Wittenberg to be the pioneer generation of the faculty. When I was appointed in 1961, things were already in order for me to do my work. I only took a risk with my very first book. That could have been a complete failure, as some people warned me back then: ‘Don’t think you will ever sell this in America!’ Worst-case scenario, it would have cost me five years of family life, but it all turned out okay.”

Einstein always remained his big source of inspiration, as well as Spinoza and Darwin. “My mottos in life – ‘always pursue the sublime’, ‘adapt to your environment’ and ‘try to explain what you cannot understand’ – have taken me far. I have every reason to be satisfied. Together with my colleagues, especially Hans Wittenberg, I have had the privilege of experiencing the golden years of Dutch aviation. Half a century of aeronautical engineering in all its glory! I have had some wonderful years.”

Résumé in brief

Egbert Torenbeek (1939) graduated from Delft Institute of Technology in 1961 with a degree in aeronautical engineering. He became a professor of aircraft design (1980) and wrote the world-renowned book Synthesis of Subsonic Aircraft Design (1976). In the three years prior to his retirement in 2000, he was vice-rector of the university. In the year he retired, he received an honorary doctorate from the Moscow Aviation Institute, followed in 2013 by the prestigious Design Award from the AIAA. His latest book, Advanced Aircraft Design (Wiley, 2013), was received by the trade press as “an essential reference book for students, researchers, aircraft designers and analysts”. He sent his honorary doctorate back to Moscow as an act of protest immediately after the MH17 disaster in 2014. He will receive the Ludwig-Prandtl-Ring in 2016.

Jaap van Ghesel Grothe

Passionate and dedicated engineer

He graduated as aeronautical engineer number 32, and Professor Van der Maas actually wanted him to go to the Rijksluchtvaartdienst (then: Dutch Civil Aviation Authority). However, Jaap van Ghesel Grothe had different plans and stayed in Delft. He had the opportunity to spread his wings as manager and became a dedicated engineer pursuing his passion.

The entire global aviation community marvels at the state-of-the-art facilities that are currently at the disposal of TU Delft's faculty of Aerospace Engineering. Van Ghesel Grothe laid the foundation for this. "When I was studying aeronautical engineering (1940 and 1945-1949), there was hardly anything available. We were located in the attic at Mechanical Engineering. To take measurements, we had a laboratory plane, an old Koolhoven FK43. Only when the programme became more popular did the need grow to have our own buildings and laboratories. I was given the distinct honour of working on this."
Initially, Professor Van der Maas had an assistant to set up the new construction wish list, but after a year he decided to appoint Van Ghesel Grothe as provisional custodian. "That turned out to be not so provisional: in the end I have worked as an engineer for the faculty for 40 years. That used to be the case quite often – once you said yes to Van der Maas, you had a position for life." He had to get used to his new role, though: "Van der Maas sent me, as an assistant, to the Board of Deans on behalf of Aerospace Engineering, at a meeting where they were discussing education. There I was, suddenly surrounded by professors who all wanted to have a new building for their department too… A new world opened up for me."

Mr. Fix It

Van Ghesel Grothe turned out to be the go-to person in Aerospace Engineering to arrange things. He became the man responsible for the equipment and the design of the building – in other words, he was the manager. "For instance, we needed wind tunnels urgently: first a low-speed wind tunnel and later on the high-speed laboratory, designed by an engineering firm in Sweden. I also organised the realisation of the buildings on Kluyverweg." Purchasing the required equipment sometimes took quite some effort, especially in the period right after the war. "For instance, we were in dire need of very scarce and specific electrical components for our wind tunnel. During a work visit to Cranfield, we found out that the Royal Navy in London had exactly the things we were looking for. However, obtaining them was not an easy task. It took several trips to England to get these highly coveted components. But we did manage to get them!"
In between his management tasks, Van Ghesel Grothe held the positions of lector, vice-rector and professor. "I used to teach classes in elementary aeronautical engineering, which wasn't exactly popular amongst colleagues. It was a first-year course and by Christmas many students had already dropped out. So there was not much glory to be gained from it. Yet I taught those lectures with great enjoyment for ten years."

Flourishing times

Management remained the main responsibility for Van Ghesel Grothe, even after he became dean in 1977. “Due to a lack of time, Van der Maas increasingly allowed me to run things. To be honest, I loved that, even though it was not easy to manage a group of professors. Still, I have always tried to keep the group as close-knit as possible.
We went through flourishing times: aerospace engineering was an established field, Fokker had risen from its ashes, and they designed and sold a few excellent aeroplanes. Of the Fokker F27, which was introduced in 1977, for instance, almost 800 were delivered. That might be small volumes by today’s standards, but for that time it was a spectacular achievement! We were back on the map again!”
During his career, Van Ghesel Grothe was in touch with many managers. “I had good contacts at Fokker, the Netherlands Aerospace Centre (NLR) and KLM, and did a great deal of business with the executive board of the university. And I was fortunate enough to have met members of the Royal Family. A nice anecdote is when Prince Bernhard had attended the 1967 farewell lecture by Professor Van der Maas in the auditorium. He had parked his helicopter right behind the auditorium. In those days that was still possible.”

International connections

He also travelled extensively to set up international relations. “We had good contacts in Cranfield and Sweden, and we also made contacts in Indonesia, which really wanted to develop its aviation industry.
I travelled to Indonesia a total of ten times, including for meetings with Minister Habibie. As a result, we trained a couple of hundred Indonesian people in Delft. Back then, I was one of the first who started teaching lectures in English. Until that time, the language of instruction was still Dutch.”
1986 marked a forced retirement for Van Ghesel Grothe. “I regretted that, but at the same time I realised I was still young enough to go out and do things with my wife. I have always done my job with pleasure. I had a huge interest in engineering, and I still do.
The atmosphere at Aerospace Engineering was incredible, especially in the early years. We were the pioneers.
A great deal still needed to be built and we did that in collaboration. The couple of times that we moved, everyone helped with moving things, the professors just as much as anyone. The solidarity was huge. It was our thing, that was how we felt.”

Résumé in brief

Prof. J.A. Jaap van Ghesel Grothe (1921) came to Delft in 1939 to study mechanical engineering. In 1940 he switched to aeronautical engineering. After a hiatus during the war years, he resumed his studies in 1945, graduating in 1949 with a specialisation in boundary layers. Van Ghesel Grothe then took up the position of assistant engineer, and subsequently engineer. He also held the position of lector, vice-rector and professor. From 1977 till 1986, he fulfilled the position of dean. Interesting fact: Van Ghesel Grothe attended Professor Van der Maas’ very first lecture (1940) as well as his farewell lecture (1967). In 1977 he was appointed an Officer in the Order of the Dutch Lion.

Jan van Ingen

Ground-breaking pioneer in boundary layer flows

The Wall of Fame in the lobby of the Aerospace Engineering building dates from 2007. The red disk symbolises the huge amount of innovative work which Jan van Ingen has done for Aerospace Engineering, such as publishing the e^N method and the implementation of the Design/Synthesis Exercise. It also honours his deanship during the bankruptcy of Fokker. Van Ingen managed to guide Aerospace Engineering through these turbulent years successfully.

Jan van Ingen was born in Puttershoek. It was there that his interest in airborne equipment was born during the war years: he was very impressed with the planes passing over and the roaring of the German V-1s, launched from a platform close to his parental home. Then there was also his mother's biscuit tin, showing a picture of the Melbourne Race. "But it was also the books I read in my teenage years, by Jules Verne and others, that really appealed to my imagination. My interest was especially raised with regard to the technical aspects. Because I showed aptitude in studying, I was allowed to go to Delft. Aeronautical engineering seemed logical, even though it could easily have been something else."

In 1952 Van Ingen was stationed as a student assistant at the brand-new low-speed wind tunnel. "Professor Van der Maas told me to become proficient there in theoretical and experimental research on boundary layer flows. I personally consider setting up the research in the low-speed laboratory to be my most distinctive pioneer work. Shortly after my graduation in 1954, I had to teach lectures on boundary layer flows in 1956. You were actually only authorised to do that if you were a lector or professor. But with special permission from the Board of Curators, I was authorised to teach. My wife typed up the notes for me at home and Koos Jongenelen provided the drawings."

Plenty of scope

Van Ingen considers Professor Van der Maas a genius. "If he had faith in you, he would give you plenty of scope. Through his efforts, I was soon allowed to attend conferences abroad. In 1959, I took a six-week tour of America to get informed at NASA (then NACA) and universities such as MIT. After the defence of my doctoral dissertation on boundary layers in 1965, I even had the pleasure of spending a sabbatical year (1966-1967) in the US at the research lab of Lockheed Georgia. The pioneered with computer graphics there, the first attempts at interactive computer operation using a monitor. I started to apply this principle on designing wing profiles and that went extraordinarily well."

Back in the Netherlands, Van Ingen became a lector and introduced his findings from the US at Aerospace Engineering. In 1970 he was appointed professor, later becoming dean. "That was during extensive management reforms (prompted by the University Governance Reorganisation Act or WUB), combined with increased protests by left-wing students. We had quite some discussions with their departmental action groups." The first dean under the WUB regime was Professor Spies, but when he had to face health problems, Van Ingen was asked to complete his term. When that term of office was completed, Van Ingen stayed on as a professor, to spend his time on teaching and research, and to step down as dean. It was not until 1991 that he took up the position of dean again. "With six years to go before retirement, I considered it the right time. Relevant factors included the emergence of accreditation. Our dilemma was that we were the only Aerospace Engineering faculty in the Netherlands, so how could you compare qualities? At our invitation, the American accreditation agency ABET collaborated in the review. The results were excellent: if we had been based in the US, we would have been accredited

at the highest level.
A second priority was a reorganisation. “The number of first-year students, usually around 300, declined dramatically in 1993. That meant we had to make serious cuts. When Fokker’s bankruptcy also became reality, in March 1996, the end seemed near. Journalists were asking me: ‘With Fokker’s bankruptcy, your faculty will surely follow?’ But my reaction invariably was: ‘Not a chance!’” In January 1996 there were 150 students who had pre-enrolled for the Aerospace Engineering programme. They needed to be saved and a rescue attempt turned out to have positive effects: “We invited all candidates and their parents and showed them that aerospace engineering is a much wider field than just building planes. Graduates can go all sorts of places! Finally, only two candidates dropped out. Yet, alas, we did have to go ahead with our reorganisation. That was very painful, but after that we only kept growing.”

Design/Synthesis Exercise

Van Ingen has noticed often that other aerospace engineering faculties envy the wonderful facilities at Aerospace Engineering in Delft. “We have to thank Van der Maas for all of that. Since 1940, students have been able to study aeronautical engineering with us from their first year. At other universities, that is often only possible after several years of mechanical engineering. Our approach enables TU Delft students to start working on their Design/ Synthesis Exercise at the end of their third year already. They then need to prove that they are able to design a piece of hardware, a system or a mission in the field of aerospace within a multi-disciplinary group. The success of this exercise is proven by the fact that the participants develop themselves from Bachelor’s students into budding engineers in just ten weeks.”
Since his retirement in 1997, Van Ingen has been working to optimise his e^N method, which he first published in 1956. This method predicts the transition, from laminar (smooth) to turbulent (eddying) flow on a wing profile. “There have been theories about this ever since the beginning of the twentieth century, but the usability in practice had never been proven. In 1956, after months of calculations, I came to the conclusion that the transition point must lie between the calculated N factors of 7.8 and 10. When I presented my first scientific publication that year during an aeronautical engineering conference, Professor Schlichting, the expert in this field, was in the audience. He had high praise: ‘sehr gut und doch so jung’, he is quoted as having said.”
Later on I found out that Schlichting had seen an almost identical presentation from someone from Douglas. “Luckily, my report dated from July and his from August!” The e^N method is used in many renowned computer programmes for the design and analysis of wing profiles. “When my method had been around for 50 years, a CD-ROM was published that went all across the globe. The Springer publishing house has asked me to write a book about it. I intend to do so, but first I am going to make the calculation method even more efficient.”

Résumé in brief

Professor Jan van Ingen (1932) graduated cum laude in Aeronautical Engineering in 1954. In 1965 he also received his PhD degree cum laude on a thesis on various theoretical and experimental researches in the field of boundary layer flows. Closer research into the accuracy and practical usability of his e^N method played an important role in this. During his career, he held the positions of lector (1966), professor of aircraft aerodynamics (1970) and dean (1972-1974 and 1991-1997), ultimately retiring in 1997.
In 1995 he was appointed a Knight in the Order of the Dutch Lion by Her Majesty the Queen. In 1996, the great honour was bestowed upon him to be jointly asked by GAMM (Gesellschaft für Angewandte Mathematik und Mechanik) and DGLR (Deutsche Gesellschaft für Luft- und Raumfahrt) to present the 39th Ludwig Prandtl Memorial Lecture, entitled: “Looking back at forty years of teaching and research in Ludwig Prandtl’s heritage of boundary layer flows”. Since 2007 he has had a place on the Wall of Fame in the building of the Faculty of Aerospace Engineering. In 2010 he was elected a Fellow of AIAA (the American Institute of Aeronautics and Astronautics). He still participates in EU projects in the field of aerospace engineering.

Boud Vogelesang

Advocate of the academic workplace (and inventor of GLARE)

In the aviation world, he is seen as the inventor of the ground-breaking aircraft material Glare. However, Boud Vogelesang does not consider that his most important contribution to Aerospace Engineering. He prefers to talk about the establishment of the academic workplace in his laboratory. “Glare is my baby, but it wouldn’t have been born without our academic testing ground.”

Seated at his kitchen table at home, the retired professor first produces the speech he gave when accepting his professorship in Aircraft Materials in 1993. The booklet is entitled “The university laboratory as a technical research workspace for the industry”. Only until much later, nearly at the end of our interview, does he demonstrate some prototypes of Glare. He emphasises again the importance of the correct order in which we have to view his pioneering work.
But let’s return to the beginning. When Vogelesang graduated in Delft (1967), he immediately started working with the Design and Materials group headed by Professor Spies. Here the young academic could specialise in materials and their constructive applications, a subject he was captivated by from a young age. “When I started working with Spies, there was hardly a laboratory to work in. Since that time, we have grown to become one of the biggest labs in the university. I felt right at home and have spent all of my career there. ‘My hangar’ is what I used to call the laboratory.”

Testing ground for collaboration

Vogelesang had an extraordinary vision for the construction of the laboratory. “A university of technology must be involved in academic research as well as designs and products. If you want to bring both aspects into practice, then collaboration with the industry is key. With that philosophy in mind, we founded the academic workspace in 1984 as a testing ground for close collaboration between our laboratory, PhD students, companies and parties such as the Adhesion Institute. We created the ideal environment for research with a substantial applied-science component. It was the best of both worlds: on the one hand we were able to educate well-versed academic and practical engineers in a multi-disciplinary team, while on the other hand Dutch businesses had access to a source of technological knowledge and creativity which had heretofore remained unused.”
Vogelesang’s decision to accept external funding initially led to heavy criticism from the university. “Collaboration with the industry was not encouraged at all. In fact, it was even considered a danger to academic freedom in research. The beauty of it was, however, that our lab was fully self-supporting financially, yet at the same time remained independent – after all, the business community needed us as much as we needed them. I personally consider the integration of academic education with research and development as the most important result of my career. Thankfully, recognition came later, especially with the achievement of big successes, such as with the Glare super-laminate.”

Glare

The ideas for development of Glare came after meetings with KLM. “We were constantly on the lookout for issues to solve in the academic workspace and KLM had an urgent matter to solve: the maintenance costs of their aircraft, which took up a third of their immediate operational costs. They would love to have a solution for that! Maintenance costs mainly resulted from repairing fatigue fractures and damages (for instance due to the influence of the weather) and remedying corrosion. Ideally that called for the development of a no-repair structure, which would not be affected by fatigue or corrosion and would be impact-resistant as well."

Improving on aluminium or carbon fibre composites seemed the logical way to go, but each of these materials had its own characteristic disadvantages. Besides, "everyone" was already doing research on it. "We then came up with the idea of marrying both materials, by using high-quality glue to alternately stack sheets of 0.3 mm thick aluminium and thin fibreglass layers. That insight led to a breakthrough. We were absolutely convinced, even when everyone thought we were crazy. In the end it took us 25 years to bring our ideas to fruition, but the result was spectacular: Glare is lighter than aluminium and one and a half times stronger than steel. And the best part is, Glare was developed by students and the Airbus A380 now flies with it!"

The coffee table

Vogelesang often remembers the "coffee table" in the laboratory, where the best ideas saw the light of day, such as the ones for Glare. The table occupied a prominent place in the lab and provided students with the opportunity to exchange and discuss ideas over coffee. Later the big challenges of the academic workspace were also discussed here. "I introduced the coffee table because I believed students needed to feel at home in the lab. I also believed that they needed to learn how to communicate, for instance about the tests they were working on. This taught them the importance of collaboration and team spirit, which are very important for a technical engineer."

Vogelesang is grateful for the opportunities he has been given in his career. "I have always enjoyed working with my predecessor Jaap Schijve, who is an expert in the field of fatigue phenomena in structures and materials. I also immensely enjoyed the collaboration with young, highly intelligent people. Things always went smoothly. Of course I also have had to endure my fair share of criticism, but I have always managed to set my own course. And so much was achieved as well! Sometimes colleagues from other faculties asked me how we managed to convince so many companies to work with us. One of the keys to success is that we were always able to show prototypes of a material during important meetings. That way we had tangible proof of what we were doing and it became instantly clear that we were not on a fool's errand."

Résumé in brief

Professor Boud Vogelesang (1938) went to the TH Delft to attend the Aeronautical Engineering programme. After graduation (1967), he immediately started working with the Design and Materials group headed by Professor Spies. He helped set up the laboratory at the Kluyverweg and specialised in materials and their constructive applications. He introduced the concept of the academic workshop and stood at the cradle of external sources of funding. In 1993 he was appointed professor of Aircraft Materials. In the world of aviation, he is mostly known as the inventor of the aircraft material Glare. In 2003 Vogelesang received a royal commendation for his work on Glare.

Karel Wakker

Trailblazing in trajectory calculations

As a young graduate, Karel Wakker was fascinated by satellite trajectories. Working with Professor Wittenberg, he had the opportunity to explore this academic territory, which had so far remained uncharted in the Netherlands. His career took off spectacularly. Wakker became famous all over the world with his satellite trajectory calculations and put aerospace solidly on the map as a full-fledged subject within the faculty of Aerospace Engineering in Delft.

A "space freak" is what he calls himself. "In 1957, the very first satellite was launched by the Russians. I was in high school at the time and was totally captivated by space. I was collecting space cards and articles and writing letters to the Russians. Of course I also wanted to study space flight. That was possible at the TH Delft, but only in the fourth year of the Aeronautical Engineering programme. I wasn't particularly interested in aircraft, but I was more than willing to take three years of aeronautical engineering for it. Along the way I did develop an interest in aeroplanes, but I really did just attend for space flight."

Fortunately for Wakker, Professor Wittenberg also had a passion for space flight. He taught extracurricular evening classes for space flight enthusiasts. "Wittenberg's class" had roughly twenty loyal fans. After Wakker graduated, he became the professor's assistant. "Wittenberg did not tell me what to do, but asked me what I wanted to do. When I told him about my fascination with satellite trajectories, he simply said: 'Mr Wakker, then that is what you should do.'" Intuitively, Wakker felt there was a market for accurate trajectory calculations. "The field of classic celestial mechanics – a combination of mathematics, physics and astronomy – was more or less finished. Satellite trajectories would be more interesting in my opinion, because satellites move relatively close to earth and are therefore sensitive to the earth's influences, such as deviations in the gravitational field and aerodynamic drag. I was thinking that if I applied celestial mechanics to satellites, interesting things that we had no clue about yet were bound to pop up. And that did indeed prove to be the case."

Opportunities

In Delft, you had plenty of opportunities. "For example: Wittenberg was on every national committee about space flight. One day, he put me forward as the trajectory calculator for the first Dutch satellite, the ANS. That was an amazing challenge for me! Wittenberg gave you plenty of room, but he also pushed you at the same time. At that time I had two members of staff assigned to me: Boudewijn Ambrosius and Heert Piersma. Together we were a solid team. We spent two and a half years making trajectory calculations for the ANS, with the results output on punch cards. Based on these results, astronomers at the University of Groningen were able to point the ANS precisely at the stars. I recently heard that the punch cards are still called the 'Wakker cards' in Groningen."
After that Wittenberg came up with another golden find. He put Wakker in touch with Professor Aardoom at the Geodetics department. Aardoom was in the process of building a laser system for accurately measuring the distance to a satellite. "For that, the trajectory of the satellite needed to be calculated with an accuracy up to a few dozen meters, which was exactly what my colleague Ambrosius and I wanted to develop. After that, Aardoom was our springboard to other countries. Thanks to his laser, he was in touch with the top geodetics experts in America and at NASA – in short, with the world in which big satellite projects were conceived and developed. And we entered that world with him!"

New markets

Over time, his group was extended, and from 1980 to 2000 Wakker was the lead researcher on trajectory calculations for seven ESA and NASA satellite missions. His research group participated in many contract studies for NASA, ESA and the European aerospace industry. "Whereas we used to work at an academic scale, we now had an entire world open to us.

Whenever there was a new satellite project, we would be called to ask whether we wanted to participate. That was a highly privileged luxury position to be in." Wakker was one of the first who had the courage to enter markets with his group that lay beyond the territory of Fokker, Netherlands Aerospace Centre (NLR) and the faculty. "In aviation, this was the golden triangle, but with regard to space flight the situation was different. For funding, we approached ministerial departments, which increasingly realised that space flight was important."

Wakker's appointment as full-time professor of Space Engineering was the crowning achievement in his (and Wittenberg's) endeavours to provide solid ground for space flight technology within the faculty.

"In those days every specialist group was engaged in space flight in some way, but Wittenberg was set on creating one space engineering group. That did provoke some resistance, because everyone was mainly aviation-minded. They considered space flight merely as an extension of aeronautical engineering. Personally I have a different view. Space technology is a combination of electrical engineering, physics, mechanics and IT and therefore has a different origin."

Administrative turmoil

In 1993 Wakker was asked to become the Rector Magnificus. Ambrosius took over for him during that time. "I was under the illusion that I would be able to combine my work as rector with teaching lectures and leading my research group. But I soon found that I had to play on two chessboards at the same time, with completely different problems." Wakker was confronted with huge administrative turmoil, such as the transition from the classic university model to what is known as the presidential model, and the implementation of the Operational Committee – and with it the emergence of professional deans. "There was a great deal of confusion, not just in Delft but at all the universities in the Netherlands."

After four years as rector, Wakker returned to the best job there was, in his opinion: professor in the aerospace engineering faculty. Yet within a year, Wakker had already been asked to accept the rectorship yet again, with Ambrosius appointed as his successor and professor. Another difficult time (1998-2002) followed. "The developments as sketched, continued and the loyalty among professors steadily decreased. Managers and professional administrators were on the rise and the influence of professors declined. At least, that is how I look back on that period."

The cycle is complete

Partly on Wittenberg's recommendation, Wakker finally took the position of managing director of SRON, the national institute that builds instruments for astronomical satellites. "With that, the cycle was complete for me. When I started out, space flight and astronomy were my hobbies. In Delft I learned everything about satellite trajectories, I became a professor in space engineering, and I embarked on an administrative career. And now, at the end of my career, I returned to my hobbies once more thanks to an institute that is active in astronomy and space engineering. It doesn't get any better than this – my childhood dream has become reality."

By now Ambrosius has been succeeded by Pieter Visser as professor, and within the group Bert Vermeersen has also been appointed as professor. "They have firmly anchored the group that I started in the international space world and have started research lines that I did not even dare dream of in the past. I am extremely proud and satisfied when I see which themes that group now covers."

Résumé in brief

Professor Karel F. Wakker (1944) graduated cum laude in 1967 from the department of Aeronautical Engineering at the Delft Institute of Technology. He specialised in satellite trajectories and was the first full-time professor in space engineering, appointed in 1985. Between 1993 and 2002 he was appointed Rector Magnificus two times. In 2003 he became managing director of the SRON Netherlands Institute for Space Research. Since his retirement in 2009, Wakker has been affiliated with Delft University of Technology as a part-time professor. In 2010 NASA named an asteroid after him.