



**IAC-03-IAA.2.1.06**

**Re-Engineering the Vengeance Weapons:  
a Memoir on Jan W.H. Uytendogaart**

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**54-th International Astronautical Congress  
29 September – 3 October 2003  
Bremen, Germany**



# RE-ENGINEERING THE VENGEANCE WEAPONS: A MEMOIR ON JAN W.H. UYTENBOGAART

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## ABSTRACT

Much has been written about the German Vengeance weapons V-1 and V-2, in particular about the design and the designers of the V-2 rocket, which was preferably seen as the first engineering tool for reaching space. But they were meant to be weapons of war for massive destruction of civilians and property. Before the V-weapon offensive started, Polish underground agents had already provided valuable information to the UK and so did Swedish authorities. During the V-weapon offensive, first-hand knowledge especially about V-2 system properties, facilities, launch procedures, and firing timetables became urgently needed. As many V-2 firings took place on the Western coast of The Netherlands, the local underground intelligence around The Hague was called upon by London to help investigate.

The key person in the present saga is J.W.H. Uytendogaart, engineer and research manager, spider in a web. Results from his investigations have been summarized in the book "Ballistics of the Future", which also included substantial results from theoretical investigations carried out by J.M.J. Kooy. It was published in 1946. Documentation and interviews with surviving contemporaries created the picture of a remarkable, quiet, unselfish, crafty gentleman and unassuming hero. The present paper may well be the very first one to provide somewhat more than a glimpse of the secret life of this remarkable man.

## 1. ON THE TRAIL: SOME PERSONAL NOTES

These were the events that led to the present paper...

In high school I, this writer, was dreaming about jet-propelled aircraft and rockets, and about the wonderful noise and explosions they would create in war. I designed them on scraps of paper and in my school agenda during classes. At the prodding of an uncle I even wrote a letter to Von Braun, to ask his opinion about a rocket design that I had put together. Von Braun replied quickly and at length. I felt greatly honoured by his immediate and thorough interest and from then on I knew that I was going to be a rocket engineer.

To study for rocket engineer, I enrolled in 1961 in the Faculty of Aerospace Engineering at Delft University of Technology. There professor J.M.J. Kooy taught courses in rocket dynamics and rocket propulsion. He was also chairman of the Dutch Society for Space (NVR), one of the well-known early co-organizers of the International Astronautical Federation (IAF), and member of the International Academy of Astronautics (IAA). Somehow I found out that Kooy had co-authored a book with a certain J.W.H. Uytendogaart on topics of rocket dynamics and rocket propulsion with chapters on the V-1 and V-2 "Vergeltung" weapons (Vengeance weapons). The book "Ballistics of the Future"<sup>9</sup> had been published already in 1946. I managed to buy a copy from an antiquarian bookshop in 1961 at the cost of about five US dollar. Yet, who really was this co-author Uytendogaart?

At that time Uytendogaart had already retired from the BPM ("Bataafsche Petroleum Maatschappij"), a subsidiary of Shell. But he had retained his position of part-time professor in fibre and textile technology at Delft. His office and his laboratory were in the Faculty of Mechanical Engineering, where I was attending some classes. I had vaguely wanted to meet him; yet nothing came of it...

Thirty years later, in 1991, MIT's professor Theodore A. Postol analyzed the effectiveness of Patriot against Scud rockets during the Gulf War. In his first public and unsettling publication on the subject<sup>12</sup> he relates how the Scud has been derived from V-2 rocket technology and then states that the book "Ballistics of the Future" "contains a highly informed and very detailed description, including engineering drawings, of the V-1 and V-2 rockets...". I remember hearing later that the book had also been translated into Russian. And I learned that antiquarians in the USA were offering the book for much, much money.

Then, in 1997, a V-2 historian whose family had survived the bombardment of The Hague approached me. In early March of 1945 British planes had carried out a massive bombardment of a central residential part of The Hague in an effort to destroy stored V-2 rockets and their launch facilities. Through a navigation error there were huge losses of life and material, yet no loss of material related to the V-2 rockets. This man tried to comprehend the drama and tried to do so in part by collecting data on launch sites, successful launches and launch failures in The Hague and surroundings<sup>3</sup>. I

suddenly remembered that "Ballistics of the Future" contained those data and maps. In our subsequent conversations the question arose again: who really was Uytendogaart?

Later that year I joined the Section Engineering Mechanics of the Faculty of Mechanical Engineering and Marine Technology at the Delft University of Technology. It turned out that the research group of Uytendogaart and his successors had recently merged with my own new Section. One of my new colleagues turned out to have been a student of Uytendogaart. Soon afterwards I also came into contact with some former colleagues and acquaintances of Uytendogaart. I started searching archives. There was now a thin trail in evidence, and I was going to follow it – apparently "to go where no one had gone before". And today I would like to report to you about some of the facts that could be brought to light.

## 2. EARLY SUBSTANTIAL FIELD-INTELLIGENCE REPORTS

The first substantial intelligence report reaching London from the field was the so-called "Oslo report". It was sent by an unknown "German well-wisher" to the British naval attaché in Oslo in late 1939. Reference was made to many new weapons, including rocket-powered glide bombs (leading to the later V-1 "Vengeance" weapon), rockets (leading to the later A-4, better known as the "Vengeance" weapon V-2) and the Peenemünde experimental establishment. The report was received by British Intelligence and was studied with interest - but its contents was not taken serious at that time. Could it be a ruse? And could those strange weapons be feasible? It took time to the spring of 1943 before the British started to become convinced of the objectivity of the report.

The second substantial intelligence report reaching London came from Poland. After the bombing in Peenemünde in August 1943 most V-2 flight-testing activities were moved to the Blizna area in southern Poland. There, Polish resistance militiamen were searching for debris, be it from impact or from (regularly occurring) airburst a few thousand feet above the target area. Radio transmissions and microfilms were sent to London, to inform about observations of tests. Hardware was inspected and analyzed in Warsaw by experts, often professors at the Warsaw Polytechnic Institute. In May 1944 an entire V-2 landed near the town of Sarnaki, south of the river Bug, in a riverside marsh. The slightly damaged weapon was hidden, later taken apart and parts were finally taken to Warsaw. There it was picked up in July by a British plane, taken to liberated southern Italy, and from there on to London for further analysis.

The third substantial intelligence report reaching London came from Sweden. In June 1944 a special

radio-controlled version of the V-2 launched at Peenemünde was accidentally steered into the direction of southern Sweden and exploded in the air near the town of Bäckebo. About two tons of wreckage could be collected and was transferred to Stockholm. The remains were studied and then flown to Farnborough in July 1944 for further analysis.

These are apparently the three main "packages" of intelligence from the field on the Vengeance weapons. One package had been prepared before the war; the two other packages had been prepared during the flight-testing period and contained real data and real hardware. This gripping story is recounted in the books "The Rocket Team"<sup>11</sup> and "The Secret War"<sup>6</sup>. However, what about information about V-weapons from the field of combat, from the firing line itself? Such information would naturally come slowly, in parts, and in even greater secrecy. Indeed, substantial information on the vengeance weapons from the field during actual combat would be provided in that way, and the central person in the web turned out to be a highly respected engineer and research manager: prof.dr.ir. J.W.H. Uytendogaart.

## 3. V-WEAPON OFFENSIVE FROM THE NETHERLANDS

In June 1944 the V-1 weapon offensive started. These flying bombs were being launched from ski ramps in Northern France aimed at London. Launch rates grew during the summer. But the Allied breakout from Normandy effectively stopped those launches by the end of August. Captured documents gave also additional information on the V-2 weapon and how it was to be launched from massive, fixed, concrete bunkers in north-west France. With Allied progress in France the V-1 and V-2 threat to London seemed to have come to an end. At least, such was the Allies' hope.

Then, in the morning of September 8, 1944 the first successful operational launch of the V-2 weapon took place and its target was Paris. Its mobile launch site was located ten miles south of the Belgium village of Houffalize. The rocket impacted in the city of Paris, 180 miles away. Damage was modest. And in the evening of the very same day the second successful operational launch took place from the middle of the quiet Dutch garden town of Wassenaar, making town dwellers truly believe that Hell itself had broken loose. A tandem of two V-2 rockets made its way upward and then across the coast, racing towards London over a distance of about 320 km. One rocket impacted in the town of Epping, with minor damage. The second rocket came down in Chiswick, a suburb of West-London. There, damage was considerable. The V-2 campaign had truly begun.

Massive launches of V-1 and V-2 weapons were to take place from several sites in The Netherlands, in addition to sites in Belgium and Germany (Fig. 1). But

the coastal region of Wassenaar, The Hague, Rijswijk, Loosduinen and further down to Hoek van Holland was to be the main launching area for V2 rockets to London. From other sites in Belgium, The Netherlands and Germany V-2 rockets were fired at the cities of Paris, Liège and Antwerp – and to many more cities in France and Belgium and to the Dutch city of Maastricht<sup>3,15,16</sup>.

From December 1944 on, ski ramps for launch of the V-1 flying bomb were being constructed all over The Netherlands. This included Delft and the military airfields Ypenburg and Ockenburg near The Hague. Some ski ramp launch sites were being constructed in the town of Wassenaar near The Hague, but Spitfires quickly took these out in February 1945. Perhaps less known is that V1's were also launched from the twin-engined bombers Heinkel He-111 and Dornier Do-217. Air launch would take place at about 200 km from the target, therefore above the North Sea. Up to January 1945 the planes would take off from various airfields in The Netherlands.

Let us now focus on the V-2 campaign from the Dutch coastal region towards London. Relocatable launch sites were positioned at many locations within the city of The Hague and the municipality of Wassenaar. Often right in the centre of a highly populated neighbourhood. Clearly the concept of "human shield" was already in full application well before the name reached the headlines in the context of the later 1991 Gulf War. Mobile launch sites would be erected preferably near trees, so as to make the launch preparations difficult to detect from the air. Even so, any type of Allied bombing would be virtually out of the question, as there might result high direct civilian losses or indirect civilian hardships.

In total 1300 V-2 rockets were launched from the Dutch coastal region towards London. Of those, 1039 rockets were launched from mobile sites in The Hague and immediate vicinity. But many launches failed, not only during the earlier test period (Fig. 2) but also during operations<sup>3,15,16</sup>. In the coastal region of The Hague 87 rockets failed at take-off. Failure at take-off also meant destruction of lives and property of those living around the launch sites. This too is collateral damage, inflicted by the launch operation itself. It has been severe. Furthermore, in early March 1945 the British Air Force attempted to bomb rockets and launch facilities in the wooded central park of The Hague, the "Haagse Bos". A navigation error led to destruction – not of the V-2 sites, but rather of a large part of the adjacent Bezuidehouth residential neighbourhood.

In London both the British Secret Intelligence Service (SIS) and their colleagues at the Dutch Bureau Intelligence (BI) under major dr. J.M. Somer were extremely eager to learn about the operational

characteristics of the V-2 weapons and about the launch activities of the responsible German batteries. The Bureau wanted to receive military details of the V-weapons, such as nature and positioning of the firing batteries, supply transportation routes and schedules, manufacturing sites, and so on. For these reports a broad and active intelligence network was already in place. However, the entirely new nature of those weapons created confusion and fear. Details were urgently needed.

The Dutch Bureau Intelligence then contacted the local Dutch intelligence through the "Packard" group. "Packard" was one of the very active and successful intelligence radio transmission groups in the coastal region and later elsewhere in the country. The original role of "Packard" was to transfer meteorological information to London by short-wave radio transmissions. This role was significantly broadened to include transmission of a variety of information – including information on V-1 and V-2 operations.

Contact with the Dutch intelligence group "Packard" was established on the very same day that the first V-2 weapons were launched to London. Subsequently A.J. Houck of the Packard group contacted Uytendogaart. (Uytendogaart placed the date in August 1944.) Houck had already worked with Uytendogaart since March 1944, by transferring results from Uytendogaart's early personal studies on rocketry to London. In addition, Uytendogaart had provided advice on the use of equipment, materials, food and medicines for underground agents.

Uytendogaart was to play the leading role in the coordination of V-weapon intelligence gathering and ultimately in the re-engineering of the design and characteristics of both the V-1 and V-2 weapons. These activities took place at great personal peril during the entire period of the V-weapon offensive, ending in March 1945.

#### 4. UYTENBOGAART AT WORK

Johannes ("Jan") Wilhelmus Huybert Uytendogaart was born in Utrecht in February 1897. His father was an electrical and chemical engineer. He was proud of being able to count two prominent eighteenth century painters in his parental ancestry: Isaac Uytendogaart (1767-1831) and his son Abraham Uytendogaart (1803-1865).

Uytendogaart had graduated cum laude in 1921 in chemical engineering at the Delft University of Technology. He had received his Ph.D. degree in 1927, also in Delft. Subsequently he led the chemical laboratory of the First Netherlands Rayon Industry ENKA in Ede. In 1930 he became Scientific Director of the Consolidated Rayon Industries (Vereiniged Glanzstoff Fabriken) in Berlin. He undertook additional design, construction and operation tasks for new rayon production facilities in various sites in Germany and in the USA.

During his stay in Germany Uytenbogaart had witnessed the frenzy of the nation and its course set towards war. In 1938 he decided to return to The Netherlands. There he found employment with the BPM in The Hague, in its Department of Chemical Industry.

In 1941 he was appointed part-time professor in synthetic fibre technology and mechanical technology (the latter implying the technology of production and further processing of fibres) at Delft University of Technology, with appointments in the Faculty of Mechanical Engineering and in the Faculty of Chemistry. His work involved all aspects of properties, production and preservation of fibres, rayons, textiles, and paper.

During the period 1941-1945 Uytenbogaart had been assigned to the Netherlands Organization for Applied Scientific Research TNO ("Toegepast Natuurwetenschappelijk Onderzoek") as director of its Technical Department. Much of his work at TNO involved keeping engineers and scientists from being drafted into military production lines in Germany, coordinating the development of alternative chemical products in circumstances of scarcity, and coordinating the development of new energy concepts for transportation, industrial production, and home use. Also, he was appointed director of the Central Institute for Industrialization CIVI and technical advisor in two Dutch Ministries.

Active interest and investigations of Uytenbogaart concerning rocketry dates back to the second part of 1943, shortly after the bombardment of Peenemünde in August 1943. However, he stated that his interest had already been stirred during his years in Berlin where he became aware of German rocket experiments dating back as far as 1926. In order to be able to communicate with the Dutch Bureau Intelligence in London about his private investigations on the subject of rockets, he took the initiative in March 1944 to establish contact with A.J. Houck of the Packard group. He prepared and sent many telegrams and drawings.

Having received the urgent request from London in September 1944, Uytenbogaart had to take a crucial decision. Considering his interest and experience in chemical and mechanical technology, his research management qualities, his many contacts, his position at TNO, his drive and integrity, and his sense of moral responsibility, he would indeed be the right person to lead the investigations. He recognized his duty, his possible contributions, and the risks involved. He accepted. Now Uytenbogaart would be truly in the heat of it all.

Uytenbogaart organized and coordinated a large group of active aides that collected information specifically about weapon system transportation by rail and by truck to the The Hague region, about exact locations of production, storage and assembly facilities, about launch sites and launch

characteristics, and about (the many) launch failures with their associated collateral damage. Damage to housing was assessed. Debris from failed launches was to be collected as fast as possible, ahead of the certain and rapid arrival of German personnel. The group of Uytenbogaart involved a variety of citizens, including police, students, engineers, marine personnel, and young men and women. Members of the "Packard" and "Peggy" intelligence groups gave additional support. Uytenbogaart was everywhere if he could. He obtained even original launch manuals and launch diaries straight from German personnel, through deals involving trading for gin.

Debris could be obtained if one were quick and daring enough. There were many launch failures throughout the offensive. Some rockets blew up while still on the launch site – killing and injuring personnel. Other rockets climbed up, remained hanging in the air or scurried aimlessly over the city, then crashed onto the ground and blew up – killing and injuring civilians. Or blew up in mid air. Or fell into the nearby North Sea. Citizens caught with debris in their possession, or those displaying too much curiosity by coming too close to launch sites or debris sites, could and often would be executed summarily. They were warned through yellow posters on display in the general launch area of The Hague, Wassenaar, and Hoek van Holland. These announced that taking away debris, but also even a close approach to V-launch sites would be punishable by death by the bullet. Police records testify that the threat and the executions were real. In the group of Uytenbogaart alone, twelve people would die as a result of their intelligence activities.

All materials obtained for further study – handwritten notes, photographs, debris – were taken by Uytenbogaart to his villa in Wassenaar. The villa was located virtually right under the nose of the nearby headquarters of the two V-2 artillery batteries. On top of that, a German spy lived in the villa right next to him. Uytenbogaart managed to keep the nature of his work hidden even for his wife. In the villa all material was taken to a hidden room in the attic for further study. The door to this room was fully camouflaged and reinforced by sheets of steel. Even during a house search by German soldiers the room was not discovered. After the war neighbours referred to it as the "Jewish room", in the knowledge that something secret had been going on in the house, in the mistaken belief that he had hidden Jews from persecution, yet never informed by Uytenbogaart about his true and perilous activities for the Allied cause.

Uytenbogaart took and analyzed the data and the debris and thereby built up a coherent picture of the nature of both V-weapons. On the basis of his measurements of debris accurate engineering drawings were made by trustworthy staff at his office (e.g., Figs. 3, 4). Often, his staff was not clearly aware of the significance of their drawings and they knew when to ask no further questions – as Uytenbogaart testified after the war. All information was analyzed and

synthesized by him also in order to obtain a better insight into the design, operation and performance of those weapons. Findings were then radioed to London, by Packard or by his own radio transmitter in the hidden room in his villa. Microfilms and debris were sent to London through the southern route, via the already liberated cities of Eindhoven and Brussels. At the end of the war he presented his complete reconstruction of the V-1 and V-2 weapons to British Intelligence officers.

He also analyzed the results of British pre-emptive bombardments of storage and launch facilities and he advised them about the nature and precise location of targets for new strikes. This advice was especially valuable as the weapons were often stored, assembled and launched in areas under cover of foliage, and therefore hard to detect. Observed activities near railroad stations, on roads, and launch preparations were also radioed to London, in order that Spitfire squadrons could hasten across the Channel to take aim. Needless to say, in spite of the good intentions of air crews there would be plenty of collateral damage.

Observing launch activities was never without danger. There was the well-known risk of being shot. However, there was also the risk of rocket explosion on or just above the launch site. One day in November 1944 he was hiding for heavy rain during observations of V-2 launchings. He saw a V-2 go off course and approach him. At the same time a large truck with personnel and cargo stopped nearby and all "18 soldiers and a Feldwebel" got out and scurried away. Uytendogaart reasoned that hiding under the truck would be his best option and ran towards it. After the nearby V-2 impact several of the soldiers were found dead. Uytendogaart had survived and the Feldwebel congratulated him ("Sie haben Glück gehabt"), as the military truck had been crammed with boxes with grenades... (In "The Rocket Team"<sup>11</sup> this event is attributed to Kooy instead of Uytendogaart. However from an unpublished manuscript of J.F.A. Boer the mistake in interpretation is clear.)

It is relevant to mention the account<sup>14</sup> of major dr. J.M. Somer, head of the Dutch Bureau Intelligence (Bureau Inlichtingen der Nederlandse Regering) in London in the period 1943-1945. He writes about the strong emotions, pioneering spirit and passion of the first group of Dutch secret agents, much touted in the media in later years – undoubtedly to his chagrin. Then, he writes that there followed a new phase with a new breed of Dutch secret agents, trained under his leadership, operating more efficiently and professionally. In this phase the "Packard" intelligence and communications network plays a key role, under the guidance of the highly successful "fourth" secret agent Louis d'Aulnis. The Packard group supported Uytendogaart greatly. Dr. Somer writes: "This quiet professor followed the

'Fear of Wassenaar' and its surroundings like a shadow. Through his daring and professional work his name inspired great gratitude amongst the British Intelligence. He performed first-class work ... And therefore it is important to place these quiet workers ... (*here, Uytendogaart is mentioned explicitly*) on the stage in front of Dutch society. They operated in silence, so much so that they became virtually untouchable for the enemy. While others were hit and hurt ... they produced achievements that may be called truly unique in war intelligence."

Uytendogaart has been supported by Ms. L. ("Louise") W.E. Böeseke, chemical engineer, born in 1900. She was the daughter of the famous J. ("Jacob") Böeseke at the Delft University of Technology, professor in the field of organic chemistry and one of the three former Ph.D. thesis advisors of Uytendogaart. Ms. Böeseke was the personal assistant of Uytendogaart at BPM before the war and again after the war until his death in 1964. During the period of April 1943 through September 1945 she was formally a non-active employee at BPM, but she remained on the payroll. It allowed her to dedicate herself fully to intelligence work under the direction of Uytendogaart. It is known that she was a truly fearless lady, a key figure in charge of coordination and direction of various activities related to the V-weapon investigations.

## 5. BALLISTICS OF THE FUTURE: THE BOOK

At the end of the war the achievements of Uytendogaart became known to the H. Stam Publishing Company in Haarlem, a well-known publisher of technical literature. This company was in the process of publishing a series of six textbooks on aeronautical engineering (title of the series: "Luchtvaarttechniek"). During the war Mr. Stam was already in contact with Kooy about the publication of a textbook in this series on the subject of dynamics of rocket motion.

J.M.J. ("Johan") Kooy was born in Rotterdam in July 1902. In 1927 he received the degree of electrical engineer at the Delft University of Technology. In 1936 he received the Ph.D. degree in mathematics and physics at Leiden University. From 1938 on Kooy was co-director of the Netherlands Aeronautical Institute in The Hague, a vocational technical school for training of aeronautical engineers. There he taught in the fields of aerodynamics, engineering mechanics, mechanical systems, and mathematics. In the second part of 1944 Kooy had stayed home with long-duration sickness leave. With his home in The Hague as base he witnessed many of the V-2 launchings as well as V-2 failures. He photographed launchings (some of his photo's show condensation trails) and material damage to housing due to launch failures. Then he went to the central area of the Veluwe to hide from the German razzias (raids) in The Hague aimed at capturing men and boys for forced labour in Germany. In a small village on the Veluwe he continued writing his

theoretical treatise on the dynamics of a rigid body, on systems with many degrees-of-freedom, on the motion of a rocket as a material point and as a massive body, relative to a flat Earth and to a spherical Earth, and on aiming a rocket towards a target on the Moon – a visionary topic considered as totally foolish by most engineers worldwide at that time and for a long time after.

While Kooy was writing his book on the theory of rocket motion, Uytendogaart had also started writing a book about the technical results of his own investigations of the V-weapons. Publisher Stam saw advantages in combining the theoretical material of Kooy with the material of Uytendogaart on "real rockets with real impact" – literally and figuratively speaking. Collaboration was agreed upon: the material of Kooy and of Uytendogaart would be merged into a single book. Kooy then used the findings of Uytendogaart to revise his own manuscript. The secretary of Uytendogaart at BPM, Ms. A.W. Schörn, would cast it into typewritten form. Kooy also contributed to the analysis of the electrical systems (facilitated by his background in electrical engineering and physics) and quite possibly to part of the thermodynamic analysis. And Kooy contributed at least some of the photos in the book – those showing V-2 launch site clearings and V-2 impact sites in the city of The Hague.

The book<sup>9</sup> was published in 1946 (Figs. 5, 6). Of particular interest are chapter X entitled "The German robot plane V 1 (Vergeltung Eins)", covering 19 pages with seven detailed technical drawings and in addition four large technical fold-out drawings, and chapter XI entitled "The German giant rocket V 2 (Vergeltung Zwei)", covering 121 pages with many technical drawings and in addition four large technical fold-out drawings.

This elaborate work on rocket dynamics and rocket design served as a standard textbook on space flight dynamics in many countries in the period after the War. As the British rocket scientist A.V. Cleaver wrote in his 1948 review<sup>4</sup>: "Surprisingly, the first comprehensive technical work on rocket projectiles has come from Holland. Our Dutch friends are to be congratulated on the extreme thoroughness with which they have carried out their project ... Both chapters (on *the V-1 and the V-2*) ... include complete descriptions of the autopilots, electrical control systems and other ancillary equipment; the many excellent diagrams included will be of great interest to engineers concerned with such subjects." And in a eulogy<sup>17</sup> at the occasion of the death of Kooy in 1983, his successor at the Royal Military Academy in Breda wrote: "Im Anfangsstadium des Entwicklungsprozesses in der Raumfahrt war dieses Buch massgeblich".

## 6. AFTERMATH

After the war Uytendogaart relinquished his position as Director of the Technical Department of TNO and returned to his former employer BPM, now in the position of head of the Department of Chemical Industry. The time had come to help rebuild his ravaged country. He took up additional responsibilities, advising various chemical and mechanical industries, the Patent Office, and the Ministry of Economic Affairs. And he continued teaching on fibre and textile technology at Delft University of Technology.

Uytendogaart did not have time for, nor an overriding interest in the promotion of his V-weapon exploits. He hardly mentioned them and if so, then in private only. As a result, very few people knew about his achievements in those agonizing times. Moreover, he did not continue his work in the field of rocketry. He had done what he – in his opinion – had to do for his country and for a free Europe.

In August 1947 he was made Fellow of the British Interplanetary Society. In February 1951 Queen Juliana awarded him the highest order for "especially heroic and discrete (*i.e., wise, tactful*) acts of resistance": the military Order of the Bronze Lion. The Ministers of War and of Marine stated that, through his analyses and thorough scientific investigations, Uytendogaart "had rendered highly important services to the Allied warfare and the Dutch government". In 1959 he was appointed Officer in the Order of Orange Nassau.

In March 1957 Uytendogaart had reached the age for retirement at BPM (Fig. 7). He became director of the Industrial Liaison Office in The Hague. In 1961 he helped create the national Central Laboratory for Research on Objects of Art and Science, where his fine former student and colleague Johan Lodewijks became the first director.

He died in December 1964, after a long illness resulting from an infection contracted during a visit to an Asian country. He left his wife J.C. ("Jo") Blankwaardt behind. They did not have children. At his cremation several moving eulogies were presented: by representatives from Shell, from TNO, and from Delft; and by his writer-friend Leonard Huizinga. One of the directors of Shell<sup>13</sup> referred to the important scientific and management work that Uytendogaart had carried out during the war, and he pointed out that Uytendogaart had done so with great personal courage and dedication. He was a man of great intelligence and character, and an impressive personal style. People respected him greatly. The speaker, Shell director dr. L. Schepers, referred to both the official work carried out at TNO during the war and the simultaneous intelligence work on the V-weapons carried out with the assistance of his many couriers and helpers.

There are several aspects that give the story of Uytendogaart special interest and value: Uytendogaart was called upon to render an essential service to his country and indirectly to the people of oppressed



Europe. He was already doing his share in his position as Technical Director of TNO. Yet, by deciding to take on coordination, analysis and synthesis of the threat of the V-weapons he did much more than his share. He pursued those weapons almost without sleep and almost without rest, and with the greatest ingenuity. Thereby he chose to put his own life at direct risk. Also, Uytendogaart did not simply perform some jobs underground in his spare time. Rather, he had chosen to make maximal use of his great engineering experience and capabilities. It is also this combination that made his contributions so valuable to the Allied forces. And his book constituted the first important source of information and inspiration for rocket engineers outside of the German V-2 community.

A few of those people who knew him personally are still alive today. They speak with great warmth and respect about this remarkable, quiet, well-mannered, somewhat distant, and unselfish man. The head of the Dutch Intelligence Bureau in London, dr. Somer, remarked that during the war Uytendogaart [and his colleagues] had worked in silence, effectively, and successfully, and in addition had the skill to survive the war in that troubled country. Dr. Somer said that because of the great secrecy of their work the Dutch nation might not know much about them, but it did owe much to them. With the publication of the book "Ballistics of the Future" the public at large could learn for the first time about the technical aspects of those Vengeance weapons - and for the distribution of that knowledge the public in addition to the engineering community owes much to that master in re-engineering those fearful mystery weapons: prof.dr.ir. Jan W.H. Uytendogaart.

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## ACKNOWLEDGEMENTS

Throughout the investigations much valuable information, support and encouragement has been received from the Dutch Ministry of Defence (through its Central Archives Depot, Rijswijk), Shell International BV (through its Department Real Estate Netherlands, The Hague), TNO (through its Department Corporate Communication, Delft);

from K.F.van Eijk, A.H.J. Nijhof and D.J. Rixen (Delft University of Technology), J.A. Borsboom (Foundation V2Platform, Almere), L.J. van der Drift and R.C. van de Graaff (Delft), P.-L. baron d'Aulnis de Bourouill, R. Luijendijk and Ms. W.J. Nieuwenhuysen (The Hague), Ms. A.W. Schörn, H. Wittenberg and B. Tent (Rijswijk), G.D. Versteeg (Voorburg); and from J.P.B. Vreeburg (Leiden).



Fig. 1 The V2-weapon offensive in the period from September 1944 until March 1945 (sketch after Ref. 15)



Fig. 2 Launch personnel arriving at a debris site<sup>8</sup>

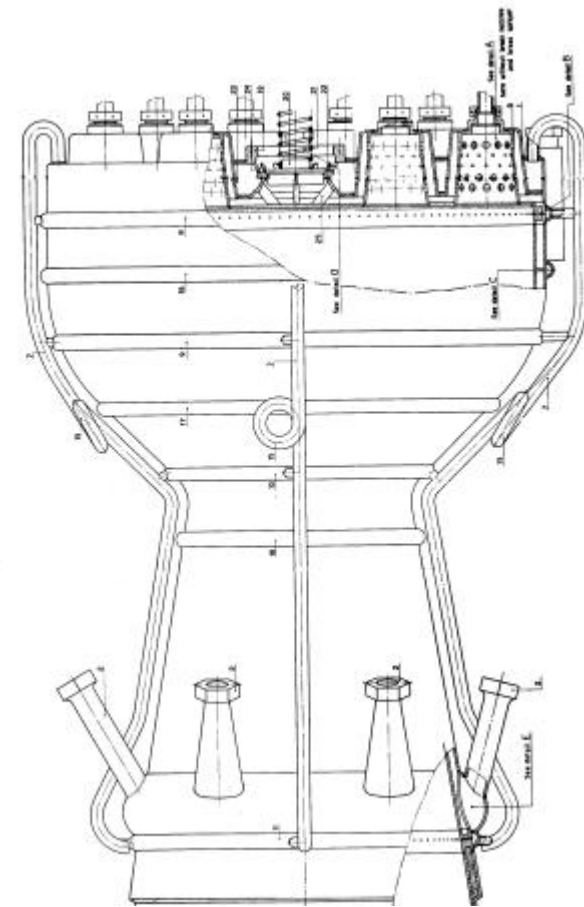


Fig. 3 One of the sketches by Uytenbogaart of the V-2 main engine, derived from his analysis of debris<sup>9</sup>

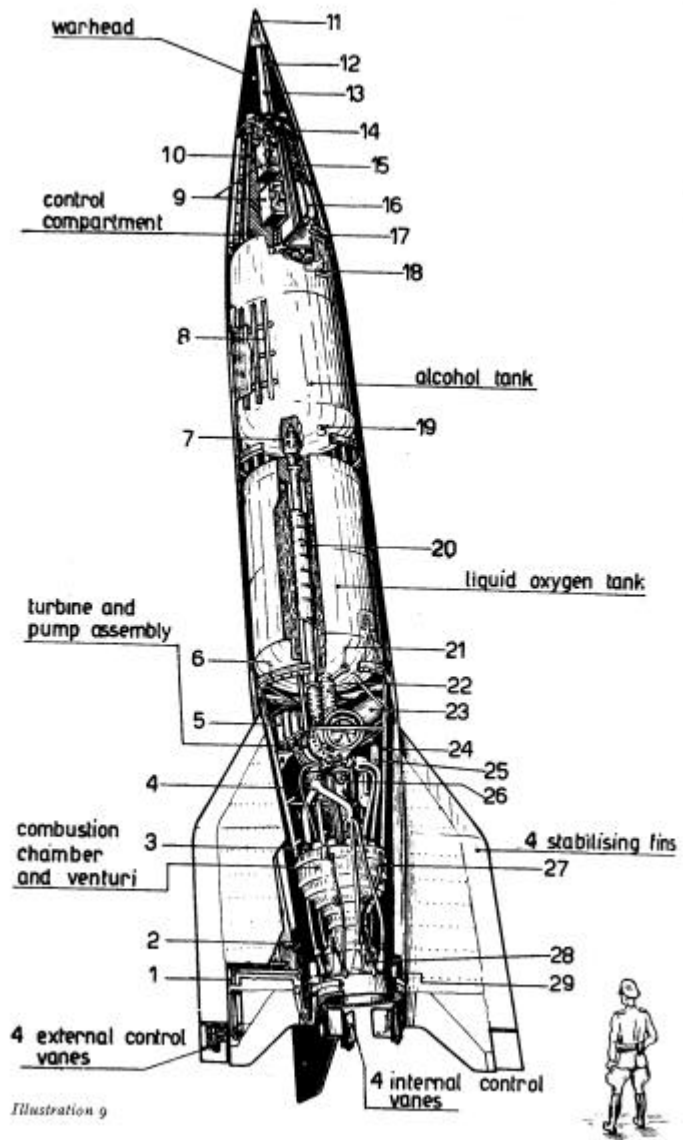


Fig. 4 General reconstruction of the V-2<sup>9</sup>

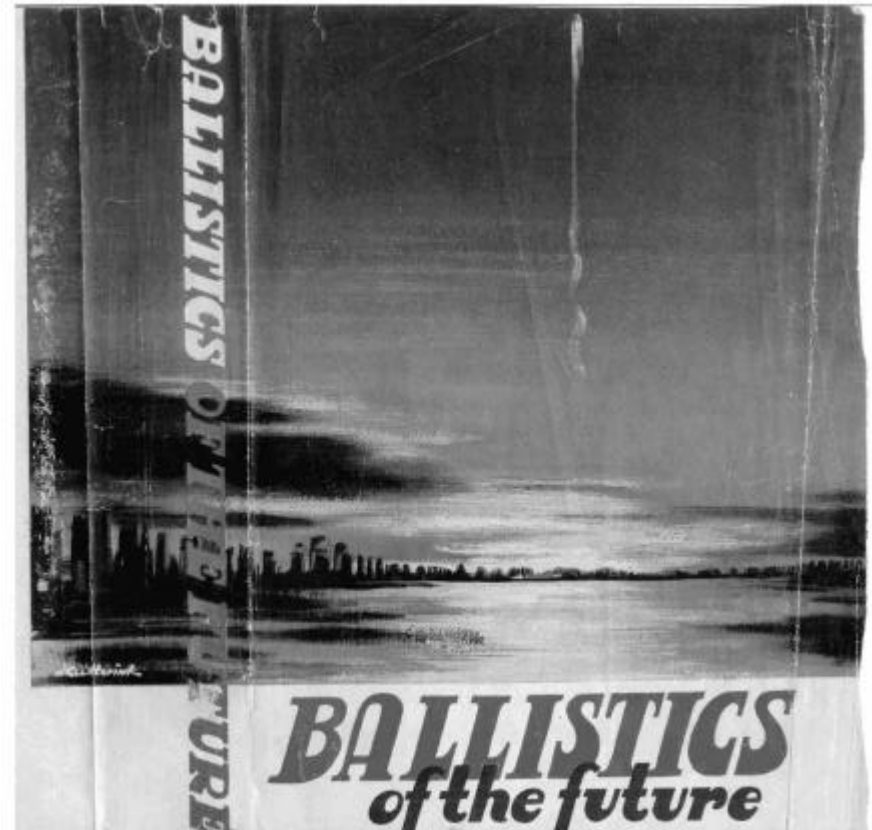


Fig. 5 Ballistics of the Future: dustcover of the book<sup>9</sup>

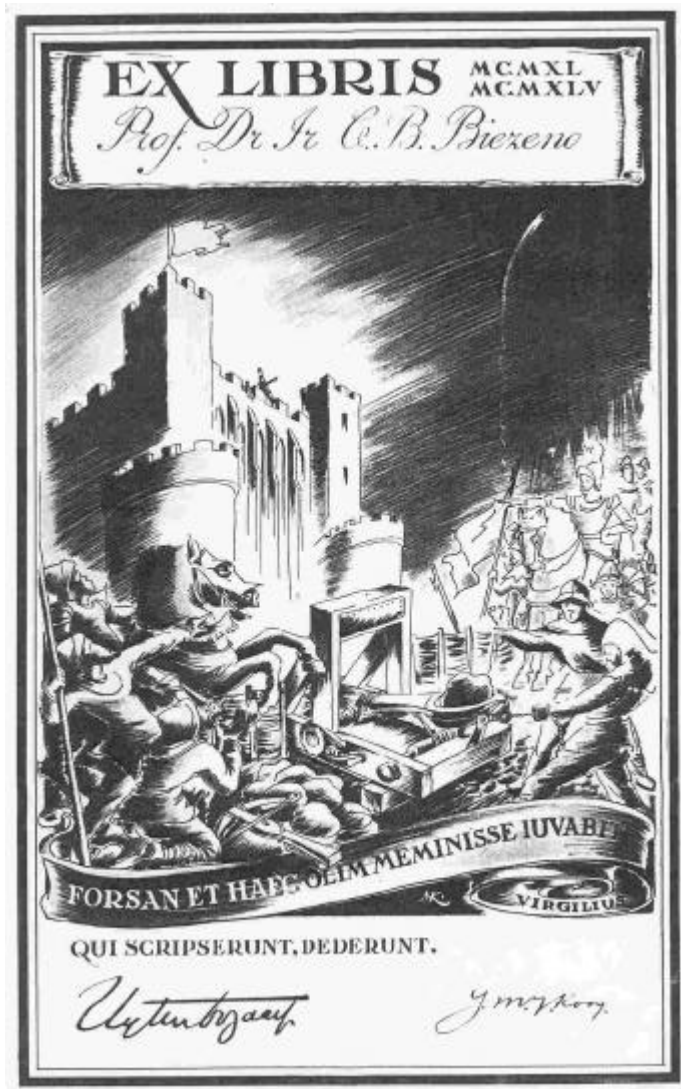


Fig. 6 Ex Libris inserted in personal copies of "Ballistics of the Future"<sup>9</sup>. This one belonged to prof. C.B. Biezeno, colleague and beacon of light at Delft University of Technology.



Fig. 7 Johannes Wilhelmus Huybert Uytenbogaart (from his personal BPM farewell book, March 1957)