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Chapter 11

A 1946 Proposal for a Chinese Rocket Program*

Marsha Freeman†

Abstract

Today the world is well aware of the progress being made in China's space exploration program. Although Western observers often lament the seemingly slow pace of execution of China's space missions, these are part of a long-term effort, which China will carry out, at its own pace. But the history of Chinese space accomplishments might have been significantly different, if a proposal made at the end of World War II by two Peenemünde veterans, who had made important contributions to Germany's rocket programs, had been accepted by the Chinese military mission in Berlin. Krafft Ehricke and Friedrich Erdmann-Jesnitzer formulated a multi-phase proposal which would have capitalized on the German developments, and the expertise that was not being fully utilized. Had the proposal been implemented, China would undoubtedly have become a leading space power decades earlier.

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† *21st Century Science & Technology*, U.S.A.

Introduction

In the spring of 1946, while waiting for an offer from the United States to come to America to work on rocket technology and a hoped-for future civilian space program, German space pioneer, Krafft Ehricke, along with fellow Peenemünde veteran, Friedrich Erdmann-Jesnitzer, presented a comprehensive, 87-page proposal to the Chinese military mission in Berlin, for the development of a rocket program for China. Up until 1939, the Chinese military had had ongoing official collaboration with the German military.

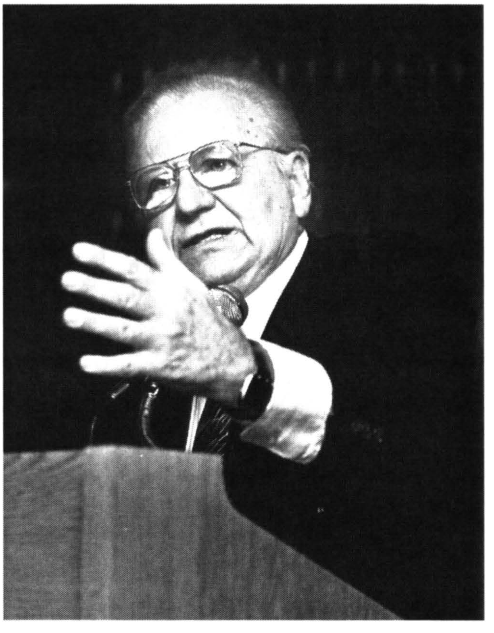


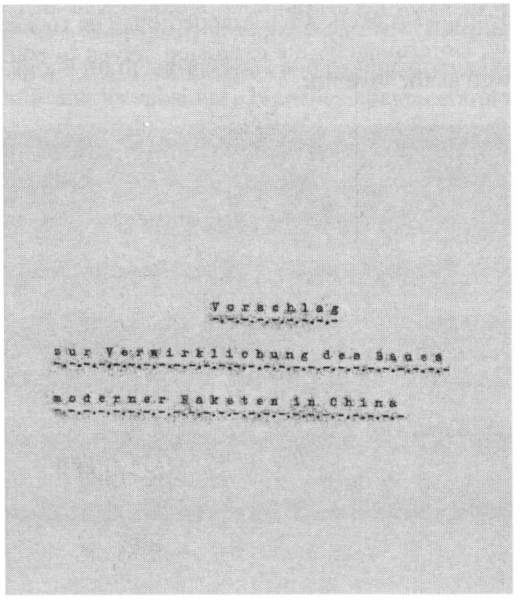
Figure 11–1: Krafft Ehricke 1917–1984, speaking in New York City, 28 November 1981. Credit: EIRNS/Stuart Lewis.

In order to bolster interest, and add some urgency to their proposal, the authors remind the Chinese military representatives that a number of other nations were also interested in German rocket experts and technology, including Yugoslavia, Argentina, Brazil, Switzerland, and Norway, in addition to the well-known interest of the U.S., Russia, England, and France.

The two Peenemünde veterans were well-placed to propose that they lead a rocket development effort for the Chinese. Erdmann-Jesnitzer had conducted research under the German Minister for Armaments and Weapons Production in metallurgy and new welding techniques, and during the war, was called to Peenemünde to work on the A-4 (V-2) rocket.

Krafft Ehricke, who had been intrigued with rocket technology from childhood, had been drafted into the German Army in 1940. Thanks to his having earlier filed two patents on rocket technology, he came to the attention of Army technical personnel, and was transferred to work at Peenemünde in 1942. Ehricke was assigned to work as an assistant to Dr. Walter Thiel, Director of Propulsion Development, and during the war, in addition to working on the on-going rocket research programs, at the request of Dr. Thiel, Ehricke investigated the potential use of nuclear energy for rocket propulsion.

Krafft Ehricke was not among the original group of German scientists who came to the United States under Operation Paperclip, because his wife, Ingeborg, was somewhere in Berlin at the end of the war, and he would not leave for America without finding her. It was not until December 1946, therefore, that Ehricke was offered a contract to work in the United States, joining the rest of the Peenemünde rocket team at Fort Bliss, Texas, in 1947. He went on to become the "father" of the liquid hydrogen Centaur upper stage, and one of the visionaries of the American space program. He considered space exploration not simply a series of technology projects, but nothing less than an Extraterrestrial Imperative for all mankind.



Vorschlag

zur Verwirklichung des Baues

moderner Raketen in China

Figure 11–2: "Proposal for the Development of the Construction of Modern Rockets," 5 April 1946.

The "Proposal for the Development of the Construction of Modern Rockets," dated 5 April 1946, and presented to the Chinese military in some fashion, built upon the revolutionary advances in rocket technology made in Germany, before and during World War II, most intensively at the German Army Experimental Station on the Baltic Sea at Peenemünde. This author is unaware of any extant copy of this proposal, other than the four copies found in Krafft Ehricke's personal files. Perhaps it has also been retained in the military archives in Taiwan, if, in fact, the proposal were delivered formally to the Chinese military mission in Berlin. Therefore, it is assumed this is the first presentation of the proposal in English. Sections of the proposal that are cited have been translated from the German by William Jones.

Why Rockets?

The authors state:

> Rocket technology comprises the newest branch of modern flight technology, although its use in the primitive form of simple powder rockets has been known for centuries. Chinese inventors, in particular, according to the historical record, were among the first to use rockets. In the year 1500 A.D. a mandarin, Wan Hu, made the first attempt at rocket flight. It was said that two giant kites were connected to a platform upon which was placed a chair. Underneath, 47 rockets were strapped on. The rockets were fired off simultaneously. Unfortunately, the explosion served to annihilate the entire apparatus as well as the inventor.*

Figure 11–3: Wan Hu and the rocket chair, depicted in an exhibit at the Beijing Science and Technology Museum. Credit: Marsha Freeman.

* See the Winter-Dougherty-Cosyn chapter in this volume for a skeptical analysis of the popular but possibly unsubstantiated story of Wan Hu's ill-fated effort. An entertaining modern attempt to "recreate" Wan's experiment can be seen at: http://www.youtube.com/watch?v=kmqK7yDyAs.

Evaluating the long history of rockets, the authors continue: "This experience, as well as several unsuccessful attempts in the Middle Ages, showed that mastery of rocket technology in all the simplicity of its basic construction, required a high degree of theoretical knowledge and practical experience," not then available. "Only modern technology, with physics and chemistry at its foundation, is equipped to solve the problem, and in such a way that a space ship has now entered the realm of a technical possibility."

Figure 11–4: The Chinese characters, Huo Jian, mean both "fire arrow," and "rocket." Credit: NASA Marshall Space Flight Center.

The authors then present their credentials:

> In the course of its development, German rocket research after the end of the First World War had taken a leading role. It was first and foremost, some 12 years ago, with the large-scale and technically well-equipped facility at Peenemünde and its subsidiary branches, that a central research center was created in which results were achieved in rocketry, unique in their nature and the speed with which they were developed.

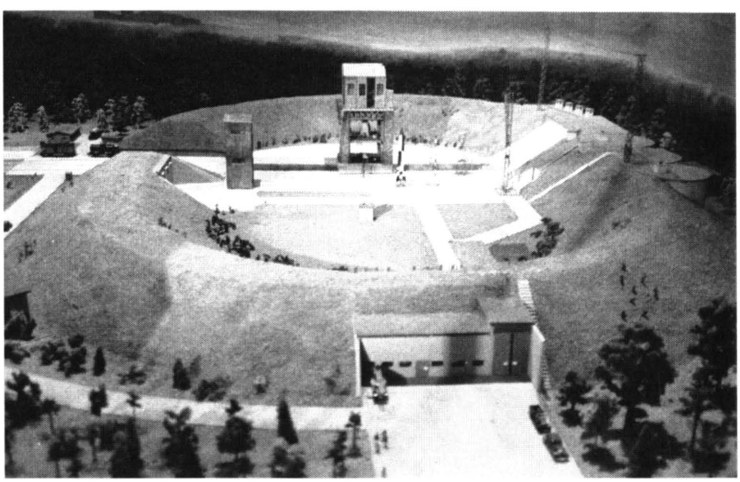


Figure 11–5: A model of Peenemünde Test Stand 7 at the Peenemünde Museum. Credit: Marsha Freeman.

Krafft Ehricke continues:

> The "Society for Space Research," as Germany's official and sole representative for the promotion of world space travel and rocket technology, whose president and co-founder, chief engineer K. Ehricke, is a member of research group "R" referred to in this proposal, had many of its collaborators working on the Peenemünde research staff.

It appears that this "Society" functioned at this time as a collection point or gathering place for former Peenemünde specialists. In 1948, the Society was formalized, and the following year, along with other organizations, it called for the establishment of the International Astronautical Federation.

Explaining why their proposal should be accepted by the Chinese, the authors report:

> The fact that rocket technology has lately been accorded so much attention has several reasons. First of all, it provides new methods of flight and of scientific investigation of the atmosphere and space. Furthermore, from a military standpoint, rockets possess enticing properties.
>
> They can carry large charges, far greater than the largest artillery shell, and can reach practically any distance. The maximum range for artillery pieces [today], is, for rockets carrying the same explosive charge, the shortest distance. A range of 350 kilometers for the A-4, for instance, cannot be achieved by any artillery shell. Furthermore, the area it would occupy is not more than that required by a light field battery.

The introduction to the Proposal states:

> As the leaders of a special group of German professionals in the field of rocketry, we hereby submit to the Chinese Military Mission in Germany, a project for China to build and develop rockets for civilian and military purposes, on the basis of the newest and latest developments in Germany. We relate this to four, and later, five or more, practical proposals for the development of special types of vehicles.

The vehicles outlined in the proposal, state they "were effectively developed in Germany." For the Chinese rocket project, the German group "will use a series of innovations, including our own patents... Further projects and applications by us would be developed on the basis of specific instructions, as requested by China."

They continue that the 1945 German rocket development effort has stood the test of time, both "theoretically and with regard to its practical utilization" and that it is "in first place," in the world. The authors point out, however, that "foreign interest up to this point" has still not been such that their professional capabilities have "been utilized as a basis of employment."

In general outline, the authors state,

> the purpose, the goal, and the necessary premise for the project presented here for your most esteemed Government, is the introduction into China of rocket development, which would at first proceed under our scientific direction. For this purpose, all relevant available personnel and material capabilities of the Chinese defense and civilian industries, and of the technical research institutes and universities, will be requisitioned and utilized.

The first phase would be to bring Chinese specialists to Germany, for education and training. The second phase would involve the emigration of a team of German professionals, and their families, to China, to establish a large-scale rocket research and development capability, and a production industry. Finally, the Chinese rocket development program would be independent, to make further advancements indigenously.

As history records, the post-war political turmoil in China certainly delayed such a rocket development effort from being initiated. A significant number of the German specialists who were able to emigrate, including Krafft Ehricke, came to the United States, and this author is unaware of any Peenemünde veterans who did, indeed, go to China. Although this 1946 proposal to the Chinese military did not come to fruition, Krafft Ehricke and his colleagues were well aware of the contributions to science and technology historically made in China, and could see the potential of the future.

It is intriguing to imagine what the progress of rocket and space technology may have been in China, had this proposal been brought to fruition.

Bringing Chinese Cadre to Post-War Germany

First, in the immediate "pre-planning and transition period," the authors state:

> On the condition that China requires technical assistance, and that the highly esteemed Chinese Government is interested in obtaining [the assistance of] German technical personnel, we propose the construction in Germany of a liaison location, for this purpose. This location ought to be the point of contact for working together with those Chinese [people] assigned to each of the specialized tasks.
>
> The aim is to acquire as rapidly as possible the technical personnel best suited for the tasks, with the broadest scientific and industrial experience. This liaison office then takes charge of the personnel destined for China in all the technical fields.

The authors designate the research group to be led by the German experts as "Group R." This group will be part of the weapons section, with the personnel divided according to their technical specialties. So as to achieve a smooth transition between phases of the project, the authors suggest that the German members of research group "R" "be intermingled with the majority of those scientists earmarked for [transfer to] China." Not to overlook the difficult situation faced by the former Peenemünde specialists, now without employment, it adds, "a further important goal of this proposal is the financial assistance for the transitional period, until shipping out to China."

Well aware of the unique circumstances under which their proposal is being made, the authors state:

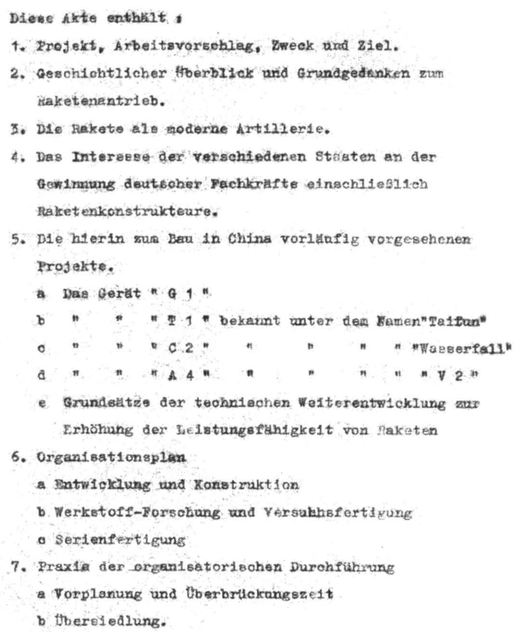
> The premise for employment in China for a determined period of time, is that the engineers receive contracts as independent scientists and practitioners, and be employed here and in China without exceeding the conditions and corresponding duties placed on Germany by the Reparations Agreements. The entire project retains its independence until firm contract negotiations are concluded.

During this first, transition period, the Chinese could construct a small factory "in the British [occupied] western sector of Germany, in the vicinity of a harbor." The personnel eventually destined for China "could be employed, first of all, as permanent employees, engaged immediately in production." In addition, there would be "an affiliated staff of independent professionals living nearby, who are employed to collect and provide the necessary documentation" for the future rocket program. "Here," the authors advise, "it seems we need to have the basic approval of the present British commander." They also propose that the "acquisition and transport costs" be obtained as soon as possible, to secure the German specialists' commitment to the Chinese rocket project, rather than to that of another country.

In addition, the proposal states:

> The Chinese side should be aware of the possible immediate, or, if so wished, delayed, transfer of families, in which there are generally one or two children. Some of the women are technically schooled, and can be of scientific and practical assistance, during the initial period.

This insistence that families be kept together, was also a "demand" of the German rocket team members who came to the United States.



Diese Akte enthält :

1. Projekt, Arbeitsvorschlag, Zweck und Ziel.
2. Geschichtlicher Überblick und Grundgedanken zum Raketenantrieb.
3. Die Rakete als moderne Artillerie.
4. Das Interesse der verschiedenen Staaten an der Gewinnung deutscher Fachkräfte einschließlich Raketenkonstrukteure.
5. Die hierin zum Bau in China vorläufig vorgesehenen Projekte.
   a Das Gerät " G 1 "
   b " " " T 1 " bekannt unter dem Namen "Taifun"
   c " " " C 2 " " " " " "Wasserfall"
   d " " " A 4 " " " " " " V 2 "
   e Grundsätze der technischen Weiterentwicklung zur Erhöhung der Leistungsfähigkeit von Raketen
6. Organisationsplan
   a Entwicklung und Konstruktion
   b Werkstoff-Forschung und Versuchhsfertigung
   c Serienfertigung
7. Praxis der organisatorischen Durchführung
   a Vorplanung und Überbrückungszeit
   b Übersiedlung.

Figure 11–6: The contents page of the proposal for a Chinese rocket program.

From Field Artillery to Near Space

In the proposed Chinese rocket program, four specific vehicles, of increasing size and complexity, are outlined, based on the accomplishments of more than a decade of research, development, and testing in Germany. An included fifth category is simply designated: "further developments."

The list of projects, detailed below, indicates that the authors consider, first, that the Chinese program, with German expertise, would complete some of the rocket and missile vehicles that were in development before the end of World War II.

Second, that the experts could make significant, if incremental, improvements in what the Peenemünde pioneers had successfully developed, to include incorporating new patents by the Germans. And third, that there would be the opportunity to bring in to being revolutionary new rocket capabilities, which were in the minds and on the drawing board of the advanced projects office at Peenemünde, but which were unable to be developed during wartime.

The first project that is recommended for the Chinese rocket effort, which had been designated the G-1 by the Germans, and is listed as "5a" in this proposal, is a small powder rocket, described as a "rocket grenade," to be used by light field artillery, in close combat.

Next, would come the Taifun anti-aircraft rocket, designated "5b" in the proposal. At a little less than 2 meters in length, and with a weight just short of 30 kilograms, the Taifun was the smallest and simplest rocket developed at Peenemünde. This surface-to-air missile had a late development start, as anti-aircraft capabilities only became a priority for the German war effort, in response to Allied bombings. The design was a by-product of the on-going development of the larger Wasserfall anti-aircraft rocket. Unlike the Wasserfall, however, the Taifun was not a guided missile; but rather designed to be launched in a barrage of 45 missiles at a time. Its maximum altitude was to reach an impressive 15 or so kilometers, with a burning time of three seconds, using hypergolic propellants. The warhead would consist of 500 grams of high explosives, and its range was about 15 km. The Taifun was designed to be mass-produced, and reportedly some thousands were manufactured at Peenemünde, but its development was not finished. After the war, the Loki (a Taifun derivative) was developed in the United States by the Bendix Corporation in New Jersey.

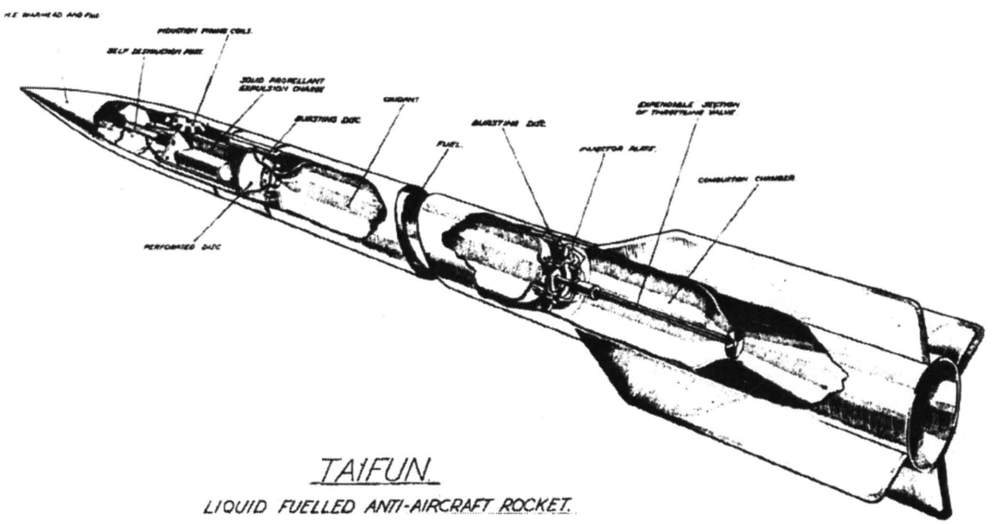


Figure 11–7: The anti-aircraft Taifun rocket. Credit: Defense Technical Information Center.

In order to manufacture this anti-aircraft rocket, the proposal to the Chinese military advises the construction of a test stand, a block house, a propellant manufacturing plant, the provision of required materials, and cameras and telescopes for guidance. An inventory must be carried out, they instruct, to determine what is available for these capabilities in China.

The medium-sized C-1 or Wasserfall, designated "5c" in the proposal, would be next on the Chinese rocket agenda. This anti-aircraft missile, like the Taifun, was not brought to operational deployment before the war's end. Although 1,220 technical people worked on the Wasserfall, estimates were that it could not be operational before 1946. Before the cessation of hostilities there had been about four dozen test launches, with only one in four, successful.

The Wasserfall was modeled on the space-capable A-4 (V-2), at about one half to one third its size, but using hypergolic fuels, rather than liquid oxygen and alcohol. The engine was to burn for 40–45 seconds. It was nearly four times the length of the Taifun, and had a takeoff weight two orders of magnitude larger, at about 3,800 kg. The Wasserfall was designed for a 26-km range, carrying a 150-kg warhead, reaching a maximum altitude of more than 18 km.

An innovation of the Wasserfall was its use of radar for tracking and maneuverability, to enable the missile to hit a moving target. Two radars were to be deployed: one to track the hostile aircraft, and one to send commands to the missile to maneuver into position for a direct hit. Development of this double radar system was not completed before the war's end, and in the tests that were conducted, the missile tracking and steering was done by a ground operator. Although Wasserfall was not brought to completion at Peenemünde, the authors believe that "no new innovations" were needed for the Chinese to complete the project.

Figure 11–8: A test of the anti-aircraft missile, Wasserfall, on 23 September 1944. Credit: Bundesarchiv.

In order to incorporate a Wasserfall vehicle into the Chinese arsenal, the authors advise that a new wind tunnel would be needed, for aerodynamic and stability testing. At the present time, they report, a subsonic 0.8 Mach wind tunnel is available in China, but in order to test the missile at supersonic speeds, a new Mach-3-capable laboratory would be required. A guidance and measurement laboratory, a "ballistics division calculating machine," and geodetic measuring instruments would also be needed. A fuel development laboratory should be created, and a test stand for static engine testing is also required. The authors include a specific note, to determine the manpower that would be needed for the project.

Reaching Outer Space

As rocket development work proceeded haltingly at Peenemünde, politically buffeted between being assigned "priority" status, and being starved of needed resources, the scientific and technical teams continued to develop a vehicle that they knew could open the space age. The first successful test of an A-4 rocket was achieved on 3 October 1942. (The A-4 was morphed in to the V-2 by the Nazis, as Hitler's weapon of retaliation for the bombing of German cities.) For the first time in history, a rocket had reached a height of 85 kilometers, touching the bounds of space.

Project "5d" in the proposal is production by the Chinese of the A-4. Just as the rocket had been used for atmospheric and meteorological investigations at Peenemünde and later in the U.S., so could such scientific research continue in China.

But the A-4 was still a developmental project when the war ended, and Krafft Ehricke and Friedrich Erdmann-Jesnitzer proposed to the Chinese an extensive list of improvements, to increase the range and fuel efficiency and applications of the rocket, and to reduce the weight of the carrier vehicle, in order to optimize its payload-to-weight ratio. These are listed under the final group of proposed projects, under "5e."

The pressure in the combustion chamber could be "increased, by introducing new techniques for the atomization of the liquid fuel." The higher temperature could be compensated for by additional cooling, they propose. The volume of the chamber could be reduced by changing its shape, thereby reducing its weight.

More advanced fuel would be a key to improving the rocket. Instead of alcohol, which was used in the A-4, hydrocarbons such as benzine, gasoline, and organic catalysts could be used. Liquid oxygen is not the "most useful" oxidant, they state, and mention nitric acid, among others.

Other steps that are recommended in order to reduce the weight of the rocket are improvements to the internal structure, including reshaping the space between the fuel tank and combustion chamber. In addition, more advanced materials could reduce weight, and redesign could lead to "better mechanical and thermodynamic properties and stability."

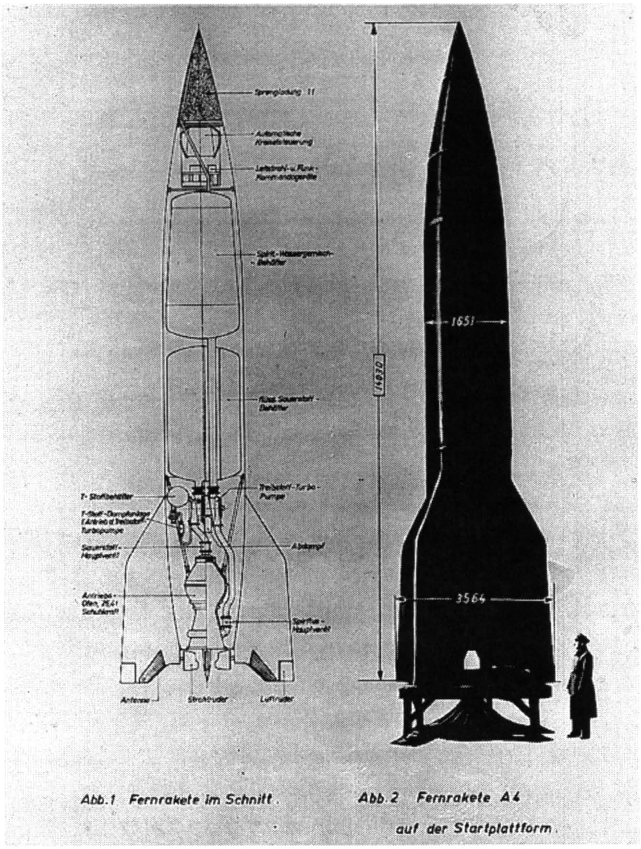
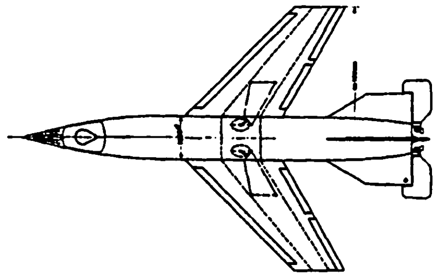


Figure 11–9: A cut-away drawing of the A-4 (V-2) rocket, the first vehicle to touch the bounds of space. Credit: NASA Marshall Space Flight Center.

Also under the general heading of "further development," the authors propose to the Chinese to take the design work that had been underway at the "Special Projects" office at Peenemünde, for the generations of space vehicles that could one day take man into space, and bring these vehicles to realization. While adding wings, for example, to the basic A-4, they state, would add a half-ton of weight, it would increase the distance the vehicle could fly from 190 km to between 400–450 km.

While the Peenemünde rocketeers were still working to complete development of the A-4, the A-9, a winged vehicle, was on the drawing board. It would be carried aloft by the larger A-10 rocket, which was to have ten times the thrust as the A-4, but was never fully developed during the war, because it could not be justified as a military weapon.



A-9 PILOTED & GUIDED MISSILE
TOP VIEW - SCALE 1:100

Figure 11–10: Some versions of the A-9 glider replaced the warhead with a man and landing tricycle. Credit: "Peenemünde East through the Eyes of 500 Detained at Garmish," 1945, Smithsonian Institution Libraries.

The A-9 was an unpowered glider and would have had little application as a bomb delivery system. The element of surprise was the A-4/V-2's greatest asset, since it made a silent arrival at its target. But a glider that was subsonic would give a noisy early warning, providing the opportunity for interception. In some of the drawings of the A-9, a pressurized cockpit for a crew replaced the warhead, and there was also a tricycle landing gear, clearly for manned operations. Such suborbital flights, if pursued in China, might conceivably have offered a stepping-stone to the Space Age, perhaps years before Yuri Gagarin's flight.

Less than a year after this proposal was made, and one can assume, presented to the Chinese military representative in post-war Berlin, however, Krafft Ehricke was on his way to the United States. This author was unable to trace the fate of Friedrich Erdmann-Jesnitzer, but it may well be possible to do so through source material in Germany. It would also be most interesting if there were a record of any Chinese response to this proposal.

The world space community is certainly aware of the current stage of development of the Chinese space program. Had China taken up the offer by these former Peenemünders, to bring the fruits of the most advanced rocket program in the world to their country, it seems almost inevitable that space history would have been written quite differently.

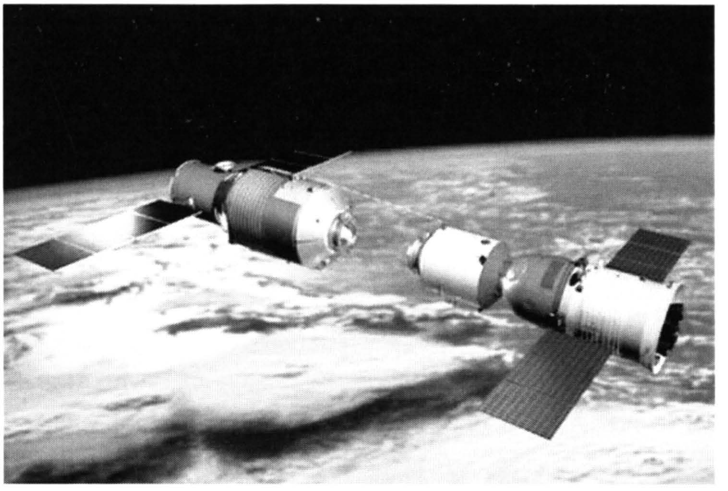


Figure 11–11: A drawing of the Tiangong-1 rendezvous with the unmanned Shenzhou-8 spacecraft. The actual docking took place on November 3, 2011. Credit: China Manned Space Engineering.

Acknowledgments

The author would like to give special thanks to Mrs. Ingeborg Ehricke for making Krafft Ehricke's personal files available.

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