INTERNATIONAL

The Birth and Early Rise of "Astronautics"
The REP-Hirsch Astronautical Prize 1928-1940

By Frank H. Winter

This year marks the 50th anniversary of the birth of the space age, commemorating the momentous launch of *Sputnik 1* on 4 October 1957. However, astronautics historians trace the foundations of the Space Age back far earlier and invariably invoke the names of the triumvirate founders of astronautics—Konstantin Tsiolkovsky, Hermann Oberth, and Robert H. Goddard. (Sometimes Robert Esnault-Pelterie is also considered a founder.) But there is another root of "astronautics" that, until now, has been overlooked. Indeed, it gave birth to the word "astronautics" and greatly stimulated the spread of the idea. This is the REP-Hirsch Prize of the 1920s-30s, also known as the REP-Hirsch Astronautics Prize, the world's first award offered for achievements toward the then embryonic field of spaceflight.[1]

Before relating this story that will also offer a new and unique window on the formative years of astronautics, it is necessary to provide a brief background leading to the REP-Hirsch.

The rocket probably originated in China about 1,000 years ago. Throughout the bulk of that millennium, the rocket was no more than a favorite firework device or, especially during the 19th century, a crude gunpowder weapon with limited range. But, its self-propelled behavior largely remained a mystery.[2]

It was only from the late 19th century that the rocket—or rather, rocket propulsion—was seriously considered as a potential means to escape Earth's gravitational pull and travel into space. The man who arrived at that milestone in human thought was the partly deaf Russian provincial schoolteacher Konstantin Eduardovich Tsiolkovsky. His first article on the concept was published in the May 1903 issue of the obscure Russian journal *Nauchnoye Obozreniye (Scientific Review)*. As translated from the Russian, the title of this article was "Exploration of Cosmic Space by Means of Reactive Devices." Here, he systematically presented mathematical calculations to show how the rocket could achieve escape velocity, how liquid oxygen and liquid hydrogen are the most efficient chemical propellants, how human life may be supported within the spacecraft, and how these crafts may be used to explore the Moon and planets.

But due to language problems, the limited circulation of *Nauchnoye Obozreniye*, and Tsiolkovsky's other early writings on spaceflight, plus the relative isolation of Russia from the West at the time, his work on spaceflight theory was simply unknown in the West and remained so until as late as the mid-1920s.

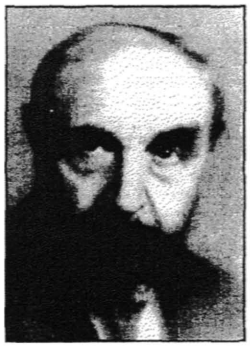
Next comes Goddard. His now classic treatise, *A Method of Reaching Extreme Altitudes*, published in 1919 by the Smithsonian but released on 12 January 1920, has been shown by the present author to have planted the seeds of the idea of the space rocket into the public consciousness—at least in the West.[3]

In the interim, Esnault-Pelterie presented a lecture on 15 November 1912 before the Société Française de Physique that was published in abbreviated form in the *Journal de Physique*, Serie 5, Vol. 3, March 1913, 218-230. This talk also covered the possibility of the rocket for spaceflight. Technically speaking, this was the second scientific presentation on spaceflight after Tsiolkovsky. But in order not to alarm his listeners and readers on the then outlandish notion of rockets into space, which would damage his reputation, he purposely downplayed the subject with the bland and misleading title of "Considerations Concerning the Results of the Indefinite Lightening of Engines." REP, as he preferred to be called, succeeded too well as this work too, like Tsiolkovsky's, went largely unnoticed.[4]

To Goddard too, must go the credit of initiating practical astronautics in conducting the world's first experiments with liquid propellant rockets that were theoretically far more powerful and practical than solids for spaceflight. On the other hand, Goddard was notoriously secretive. Even though he started his experiments with solids in 1915 and switched to liquid fuels in 1921 that led to his launching of the world's first liquid fuel rocket on 16 March 1926, he kept this momentous accomplishment to himself and a handful of people. Indeed, he implored them—including his financial sponsor, the Smithsonian—not to reveal details of his work on the grounds that it was "unfinished." (In truth, his work was never finished.) It was only on the publication of Goddard's second Smithsonian treatise, *Liquid Propellant Rocket Development*, on 16 March 1936, exactly ten years after his first liquid fuel rocket flight, did he reveal that he had made that first flight.[5]

Robert Esnault-Pelterie, also known as "REP," French aviation and astronautical pioneer, who co-founded the REP-Hirsch Astronautics Prize in 1927. Photo taken ca. 1913, soon after he began to develop his first theories about the possibilities of spaceflight.
Smithsonian photo 80-12314

Thus, it is ironic and little understood, even today, that while Goddard was the world's preeminent authority on rocketry and spaceflight at the time with countless newspaper and magazine articles appearing on him from the 1920s, in fact almost nobody knew the details of his work. The articles were



Left: André Louis-Hirsch (1899-1962), REP's friend who financed and co-founded the Prize. REP and Hirsch may have met as fellow members of the Société Astronomique de France (French Astronomical Society) as both were intensely interested in astronomy from their childhood.

Picture from the Société Astronomique de France

Right: J.H. Rosny Aîné (pseudonym for Joseph-Henri Boex, 1856-1940), the Belgian-born science fiction writer and originator of the term "astronautics." He first suggested it to REP on 26 December 1927. REP and Hirsch then readily adopted the term to the prize to describe the "new" science of the study of interplanetary navigation. Smithsonian photo 78-64

invariably written in the most sweeping generalities or were downright distortions about his work.[6]

The field was therefore wide open with Goddard now serving as somewhat of a spiritual leader of the rising spaceflight movement, yet operating strictly as a loner, save for his few handymen helpers who understood that their lips had to remain sealed, lest they lose their jobs.[7]

In the interim, the final "founder" of astronautics—Oberth—came to the fore with the publication of his seminal work, *Die Rakete zu den Planetenräumen* (*The Rocket into Planetary Space*), appearing in 1923. But whereas Goddard's *A Method* focussed on uncrewed, solid-propellant rockets, including a theoretical staged model that could go to the Moon, Oberth boldly described the feasibility of more powerful and controllable liquid propellant manned rockets that could fly into space. Yet he went further and touched on other prospects, like a crewed space station and space travelers with special protective space suits. Understandably, despite its heavy dosage of mathematics, Oberth's *Die Rakete* generated excitement and its impact was enormous.[8]

The 1920s—thanks more to Oberth than Goddard—thus became the period of the great "rocket fad" and co-existed with the international spaceflight movement. Characteristic of the craziness of the Flapper era, the fad saw a rash of rocket cars, rocket-powered gliders, rocket bicycles, boats, motorbikes, rocket ice sleds, rocket mail experiments, and other stunts. On the spaceflight side, there was a great outpouring of books and articles—too few of them in the scientific vein—on what was then called "interplanetary flight." The world of science fiction was also markedly affected by the movement and the serious scientifically-minded champions of spaceflight were often confused, or accused, of being wrapped up in science fiction "fantasy." But sometimes the two camps went hand in hand. This was the beginning of the founding of the first rocket and space travel societies but also the first realistic movie, *Frau im Mond* (*Woman on the Moon*), produced by the Ufa studios of Berlin in 1928, depicting spaceflight by rocket. The film (Oberth was its technical director) was so effective in conveying the possibilities of spaceflight that it was used in publicity by both the Verien für Raumschiffahrt (VfR, or Society for Space Ship Travel, but better known as the German Rocket Society) and the American Interplanetary Society.[9]

Such is the backdrop of the appearance of the REP-Hirsch. It is unfortunate that the bulk of the original documentation on the REP-Hirsch organization and how it was administered seems to have disappeared. The principals have passed as well. But it is possible to arrive at a historical sketch of the award and how its greatest legacy—establishing the word "astronautics"—first took hold in language and usage.

The REP-Hirsch Astronautical Prize—not surprisingly—was created in 1928, at the height of the international spaceflight movement and rocket fad.

The official founding date was 1 February of that year. Its creators were the famous French aviation and astronautical pioneer Robert Esnault-Pelterie (also known as REP) and his friend, the banker André-Louis Hirsch. REP, the son of a textile manufacturer, had built his first flying machine in 1904 and afterward became one of France's foremost aircraft designers and builders. He was especially known for his invention of the "joy stick" aircraft control.[10]

REP also became intently interested in the possibilities of spaceflight as early as 1908 but knew nothing of either Tsiolkovsky in Russia or Goddard. REP was astute enough to comprehend that the reaction propulsion of a rocket would work in the vacuum of space but he also knew that the rocket (then, as we saw, only a paltry firework) totally lacked the energy for a flight beyond Earth's atmosphere. REP saw more promise in atomic energy but had no idea how this energy was to be tapped. (Unbeknown to him, Goddard faced the identical dilemma regarding the potential of atomic energy for space propulsion.)[11].

André Louis-Hirsch was 18 years younger than his friend REP. The son of Baron Maurice de Hirsch, the German-Jewish financier and philanthropist, he very early showed a zeal for science and was a member of the prestigious Société Astronomique de France (the French Astronomical Society) at age 12. Although entering the banking profession, Hirsch remained devoted to science and may have met REP in 1925 through the Société.[12].

On 8 June 1927, REP delivered a widely acclaimed address on spaceflight before the Sorbonne in Paris. Hirsch may have been at this meeting. He was certainly at the follow-up meeting on the night of 26 December, held in the home of Andrée's mother at 47, Avenue d'Iena, in Paris. It was at this occasion that REP is said to have first suggested to the distinguished gathering of French intelligentsia the idea formulated by himself and Hirsch that an international prize should be established to foster the growth of the "new" science of space flight.[13]

Yet the science lacked a name. Fortunately, the imaginative and inventive Belgian science fiction writer known as "J.H. Rosny ainé" (J.H. Rosny Senior) was present. (This was a pseudonym; his real name was Joseph Henri Honoré Boex). It was Boex (aka Rosny) who supposedly then came up with a solution: "astronautics." It was a bit too ambitious a term as it literally meant "traveling to the stars," but it was adopted and stuck.[14]

Another account says that Rosny wrote the story *Les Navigateurs de l'Infini* (*The Navigators of Infinity*) in 1925 and at the same time wrote its sequel, *Le Astronautes* (*The Astronauts*) and this was therefore the true use of the word, or a form of it, for the first time although the sequel was not published until 1962. Even if this were true, it is possible Rosny still uttered the term in public for the first time and applied it specifically to "spaceflight" at the 26 December 1927 meeting.[15]

In any case, the award was duly named after its founders, REP-Hirsch, and amounted to 5,000 francs, to be donated by Andrée to be presented to the person of any nationality who had made the greatest contribution toward solving the "space flight problem."[16]

The award was officially announced in the February 1928 issue of the *Bulletin de la Société Astronautique de France*. On REP's advice, the new award was placed under the aegis of the Society, which soon formed a "Commission d'Astronautique" ("Astronautical Committee"), responsible for choosing the winners. REP and Hirsch were among the members, as were Rosny (i.e. Boex), and the French physician Dr. André Bing. (Bing has always been one of the unsung astronautical pioneers since he took out a Belgian patent, No. 236,377, dated 10 June 1911, for an "Apparatus intended to make possible the exploration of the upper regions of the atmosphere, regardless of how rarified the atmosphere may be." In essence, the otherwise unknown—and still mysterious—Dr. Bing had patented, before Goddard, a multi-stage sounding and space rocket that could use either "a solid, liquid, or gaseous explosive." His apparent purpose of this invention was to undertake the physiological testing of "living beings" at high altitudes. But he never followed up his extremely far-sighted idea and always remained a background figure in what became French astronautical circles.) The REP-Hirsch Astronautical Committee changed little during the years and the man who coined the term "astronautics," Boex (aka Rosny), remained a member throughout his life. He died in 1940.[17]

The two creators of the prize disqualified themselves from being awardees, although REP's own book, *L'Astronautique* (*Astronautics*) of 1930 and the first book ever to feature this newly coined word, was considered deserving. (*L'Astronautique* thoroughly covers the potential of the rocket as a mode of space transportation and Goddard's little 1919 treatise may be credited directly with convincing REP that the ordinary rocket, especially using staging and the de Laval nozzle besides high energy propellants, could be vastly improved to become a viable mode of getting into space. REP was to conduct his own liquid fuel rocket experiments, of which one explosion in 1931 cost him the loss of four fingers.)[18]

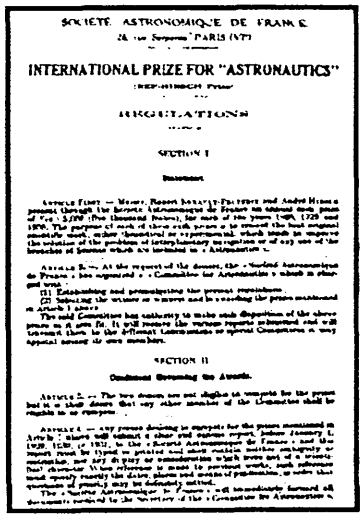
All submissions for the prize had to maintain a rigorous scientific standard and could be written either in French, English, German, Spanish, Italian, or the universal language of Esperanto. The prize rules were published in at least three of these languages and appeared in the *Bulletin* and announced in *Die Rakete* (*The Rocket*), the German Rocket Society's (technically, the VfR, or Verien für Raumschiffahrt, literally the Society for Space Ship Travel), the modest mimeographed *Bulletin of the American Interplanetary Society* and its successor publication. *Astronautics*, the *Bulletin of the British Interplanetary Society*; *Weltraum* (*Space Flight*), the journal of the successor to the VfR, the Gesellschaft für Weltraumforschung e.V. (Society for Space Flight Research); the French aviation journal *L'Aérophile*, and so forth.[19]

There were several worthy contenders for the first REP-Hirsch Prize. One was so outstanding that the committee doubled the award to 10,000 francs. The winning entrant was Oberth for the 1929 enlarged, 420-page version of his 1923 work now titled *Wege zur Raumschiffahrt* (*Ways to Space Flight*).[20]

According to REP-Hirsch press releases, Oberth had mathematically demonstrated, among other things, the possibility of raising exhaust velocities, which was of "prime importance" in considering a spacecraft; he had shown how to lower mass ratios; analyzed the most favorable velocities for interplanetary vehicles, examined the dangers of extreme heating during reentries; and designed a complete human-carrying liquid hydrogen-liquid oxygen space rocket. (His standard favorite propellants, however, were liquid oxygen and alcohol, which the VfR adopted, and as did the later A-4 or V-2.)[21]

The REP-Hirsch Committee officially announced its decision in the annual General Assembly of the Astronomical Society on the evening of 5 June 1929 in the plush Richelieu Amphitheater of the Sorbonne. REP also announced two honorable mentions, one to Walter Hohmann, city architect of Essen, Germany, for his groundbreaking *Die Erreichbarkeit der Himmelskörper* (*The Attainability of Space Flight*) of 1925 that mathematically described optimum propellant requirements, flight paths to Mars and Venus, and introduced a new term: the now famous Hohmann ellipse in which a spaceflight path was precisely planned to take into account the position of a planetary body by the time the spacecraft is supposed to reach it.[22]

The other honorary mention was the American John Noel Deisch who held a B.A. in mechanical engineering and was a resident of Washington, D.C. where he sometimes worked as a patent illustrator. Long interested in astronomy and a highly literate man, he had submitted a 172-page manuscript written in 1926 titled *The Navigation of Space*, that mainly focused on perceived life-support systems that would be needed for spaceflight. Among specific topics he covered were protection from solar rays, cooking space food



SOCIETE ASTRONOMIQUE DE FRANCE

INTERNATIONAL PRIZE FOR "ASTRONAUTICS"

REGULATIONS

SECTION I

SECTION II

First page of the rules of the REP-Hirsch Prize, also called the International Prize for "Astronautics." The 5,000 franc prize was to be awarded to the "best original scientific work...which tends to improve the solution of the problem of interplanetary navigation..."
Smithsonian photo 79-1745

in sealed vessels and dispensing the food through tubes, food refrigeration in spacecraft, artificial gravity, garbage disposal, air conditioning, production of oxygen by electrolysis, and thermostatic temperature controls. Despite his own amazing "firsts," only the first part of Deisch's manuscript was ever published," a brief history of spaceflight in fiction appearing in *Popular Astronomy* for February 1930.[23]

However, we know the names of nine other contenders for the first REP-Hirsch Prize. These included the Italian Luigi Gusasalli for his 1923 book *Si puo gia tentare un viaggio d'alla terra all Luna?* (*Should We Attempt a Voyage to the Moon?*), that hardly matched up to Oberth's 1923 work; and the Russians Nikolai A. Rynin, Konstantin Tsiolkovsky, and Alexander Boris Scherschevsky, but it is not known what they submitted. There were also the Austrians Max Valier and Franz von Hoefft, the latter submitting his collection of important series of articles in *Die Rakete* on flight paths to Mars, Venus, and Jupiter. A man by the name of Bourgeois was another entrant but he cannot be identified.[24]

REP tried to get Goddard to enter for the award and sent him the prize regulations, but he quibbled and finally decided, once more, that his work was not complete and he could not submit "fragments." Not until 1935 did REP again to try to get Goddard to enter.[25]

In the year 1929 no work worthy of interest was submitted and no award made.

But in the following year the recipient was the Frenchman Pierre Montagne, assistant to Professor Pierre Jolibois of the School of Mines, for his paper, translated as "A Study of Gaseous Mixtures Utilizable in the Propulsion of Rockets." Montagne's paper was deemed a "purely theoretical work on the [chemical] equilibriums and temperatures of gases within a combustion chamber" but was regarded important enough that REP subsequently sought and obtained his collaboration in his (REP's) own rocket experiments.[26]

No REP-Hirsch prizes were awarded for 1931 and 1932, but Montagne was bestowed with the first prize for 1933 for a similar study, although "without allocation" (i.e., minus the cash award). For 1933, the REP-Hirsch Astronautics Committee also saw fit to present a special 2,000 franc "Prize of Encouragement" for the paper *Initiation à la Cosmonautique* (*Introduction to Cosmonautics*) by Ari Shternfeld.[27]

Shternfeld, born in Seradze, Poland, in 1905, was a graduate of the Electromechanics Institute of Nancy, France, and had chosen to remain in the country. His submission was obviously a popular treatment to the new science and the Committee found that while it was "considerable," it did not comply with the rules as being an original theoretical, experimental, or other scientific contribution. Nonetheless, it was recognized in its day for both its educational and inspirational value; from the etymological standpoint, this was one of the earliest uses of the term "cosmonautics" preferred by eastern Europeans over "astronautics" adopted in the West.[28]

From this period, REP and Hirsch and the rest of the committee favored experimental contributions. Not only were there now more experimenters submitting entries for the prize—reflecting the rise of the experimenters—but REP and Hirsch had personally visited the German Rocket Society's famous Raketeflugplatz (literally, "Rocket Flying Place") in a Berlin suburb. REP himself had begun his own experiments by 1932.[29]

On 17 September 1935, REP again wrote to Goddard to convince him to enter the award competition. (Goddard's entry would have also considerably bolstered the prestige of the REP-Hirsch Prize as he was then the world's most eminent if unreachable rocketeer.) But for the second time, he stubbornly refused on the same grounds that his work was not yet finished.[30]

The main 1935 REP-Hirsch entrant was thus a lesser light. He was Louis Damblanc, the 45-year old editor of the French journal *Vie Aérienne* (*Aerial Life*) who had submitted a report of his extensive experiments with black powder rockets he had conducted at the Aeronautical Institute of St. Cyr. Performances of standard signal, coast guard (life-saving), and "anti-hail" rockets were measured on a revolving recording drum on his proving stand. (The latter rockets seeded clouds with chemicals to prevent hail and were therefore highly valued by vintners.) Damblanc was innovative, however, and took among the first motion pictures of his tests and worked out exhaust velocities.[31]

But because Damblanc was seeking to improve commercial and meteorological rockets rather than make any genuine advances to astronautics, the REP-Hirsch Committee gave him their "Prize of Encouragement" of 1,000 francs.[32]

The following year, 1936, saw the awarding of an ex aequo (co-equal) REP-Hirsch Prize to Alfred Africano and the American Rocket Society for the former's paper "Design of a Stratospheric Rocket," that was "the result...of a year of participation in the rocket motor tests of the American Rocket Society's Experimental Committee." "In addition," Africano added in his introduction, "it represents about four years of previous study of the leading French, English, German, and Italian works, and some of my own original investigation."

Interestingly, the Africano/ARS paper represented a shift away from purely spaceflight to rockets for stratospheric (upper atmospheric) exploration. But it was generally believed at this point that stratospheric exploration, especially by rockets, was a necessary preliminary step toward the final goal.[33]

Africano, an assistant engineer with the New York City Interboro Rapid Transit Company, was vice-president of the ARS. One of the few bona fide engineers during the earliest years of the Society, Africano had graduated from the Stevens Institute of Technology, Hoboken, New Jersey, in 1929, with a degree in Mechanical Engineering and had begun with the Transit Company the same year, principally working on rail stress and had proposed a new theory of rail expansion using long continuous welded rails. Africano was confident his REP-Hirsch paper was "a combination of sound basic theory" with "data from actual [liquid fuel] rocket motor tests and took...months of really arduous labor with the method of numerical integration, quite comparable, I feel, to that required in Dr. Goddard's work."[34]

In the meantime, in early October 1935, Goddard himself had unexpectedly surfaced and had then decided to enter the REP-Hirsch competition since his second Smithsonian report was expected to be published soon. (According to the REP-Hirsch rules, the entry had to be submitted by the first of January, for it to be excepted, although an abstract of the work to be published was also acceptable.) But on 16 November, Goddard wrote back to REP, saying that "after thinking the matter over I feel that I should not compete for the Prize at this time." His rationale this time was that the Smithsonian paper was only a progress report "and not a complete description of my work since 1919."[35]

Goddard's so-called second Smithsonian report, *Liquid-propellant Rocket Development*, finally appeared in the *Smithsonian Miscellaneous Collections*, 95-3, bearing the publication date of 16 March 1936. Perhaps by the sheerest coincidence, the date marked exactly a decade since Goddard's first liquid-propellant rocket flight. Liquid-propellant *Rocket Development* also marked the first time Goddard had mentioned in print that he had launched that rocket. In any event, Goddard did not submit this publication for the next (1937) REP-Hirsch Prize.[36]

Both Africano and the American Rocket Society made full use of both the award and money they received for the 1936 prize. The story was carried by *The New York Times*, *New York Herald Tribune*, and other papers across the country with an abstract in *The Scientific American* that helped their cause while the Society's share of the money went toward further experimental and "educational" (publicity) work. Africano reportedly applied his half towards a course at the Guggenheim School of Aeronautics (New York University), eventually leading to a master of science degree with a thesis on rocket propulsion. (Later, Africano recalled that he received "no plaque, certificate, or statuette that came with my 1936 REP-Hirsch Prize Award—just the letter of citation...transmitting the check.")[37]

No REP-Hirsch awards were made in 1937 for work done in 1936. Then in July 1938, the *Bulletin de la Société Astronomique de France* reported that the committee was giving a Prize of Encouragement to Giovanni Serragli, professor of aerodynamics of the Faculty of Science of the University of Florence, Italy, for his paper. As translated, this was *Researches on Slow [rocket propellant] Powders and their Usage for the Exploration of the Upper Atmosphere.* However, a notice appearing in Weltraum for January 1939 says he only received a mention, no money.[38]

The 44-year old Professor Serragli was obscure in astronautical or rocketry circles

Left: Front. Right: Obverse of REP-Hirsch Prize bronze medal bestowed belatedly to the Czech-born American rocket pioneer Dr. Frank Malina at the 9th International Astronautical Congress in Amsterdam (25-30 August 1958); about 20 years after he had won the award in 1939. He was the last recipient of the REP-Hirsch because of the outbreak of World War II. Smithsonian photo 79-5694

outside his country although he had written on reaction-propelled vehicles since 1928. By contrast, Frank Malina, who was to become an internationally acclaimed rocketry pioneer and exert profound influence on its development in the United States, was the 1939 and last winner of the REP-Hirsch Prize.[39]

Born in the small town of Brenham, Texas, in 1912, of Czech parents, Malina lived in his parent's homeland from the age of eight to thirteen (1920-1925). He became smitten with the spaceflight "bug" when he read a Czech edition of Jules Verne's classic novel *From the Earth to the Moon*, originally published in 1860. In 1936, while a student at the California Institute of Technology, and former parttime team member of the GALCIT (Guggenheim Aeronautical Laboratory) ten-foot wind tunnel at Caltech, he was able to obtain permission to form the GALCIT Rocket Research Project. Along with other gifted students and non-students, the group worked toward the scientific design of a high altitude sounding rocket, either liquid or solid-propelled.[40]

In November 1937, Malina received a letter from a relative in France about the REP-Hirsch Prize. Writing home, Malina excitedly told his parents that he contemplated sending the paper "Rocket Performance," dated 15 April 1937 he had undertaken with GALCIT Rocket Project member Apollo Milton Olin Smith, otherwise known as "AMO Smith. But his enthusiasm was soon dampened when he found a similar paper, "Les Fusées volantes météorologiques" ("Meteorological Sounding Rockets"), in *L'Aérophile* for October 1936. The authors were actually the two recently expatriated Germans and former members of the VfR, Willy Ley and Herbert Schaefer. (Ley afterward became one of the most prolific popularizers of rocketry and spaceflight.)[41]

Malina therefore did not give thought to the prize again until the fall of 1938. The time seemed more propitious anyway. By now, the GALCIT team had accomplished a great deal both theoretically and practically with their extensive static tests with a gaseous oxygen/methyl alcohol rocket motor. Besides, more funds were needed.[42]

On 3 October 1938, Malina wrote to his parents that he had now decided to "compete for the French rocket prize." On 10 December he shipped his manuscript to Paris but Malina lamented that the Chinese member of the group, "[Hsue-shen] Tsien really should have had his name on it as he helped with many of the ideas. He is truly a brilliant fellow." (Tsien's story is a long one but he eventually went back to his native China and reportedly became a major player in the People's Republic space and missile programs.)[43]

June 1939 passed without word from the REP-Hirsch Committee. This was the designated month when the Prize winner was announced. Malina could only assume he did not win.[44]

Meanwhile, the paper was forwarded to the respected *Journal of the Franklin Institute*. It was subsequently published in the October 1940 issue as "Characteristics of the Rocket Motor Unit Based on the Theory of Perfect Gases." The paper dealt with Malina's mathematical analysis of the rocket motor and Tsien's calculation on the effect of the angle of divergence of the exhaust nozzle on thrust of the motor.[45]

The article prevented Yale Rocket Club Secretary and Yale University metallurgical student Merritt A. Williamson from submitting his own comparable study of the thermodynamics of the rocket motor for the REP-Hirsh Prize. (Williamson's manuscript was written in 1938-1939 and presumably would have been entered late in 1939 or in 1940.)[46]

In 1939 war came.

On 13 June 1940, two days before the French Astronomical Society was to hold its customary Annual General Assembly, the Germans occupied Paris. However, the Assembly went forward. Malina was announced as the winner although because of hard times he was to get a vermillion medal while the secondary award, a silver medal, was named for Nathan Carver of New York City, an ARS member for his work on a concentric-feed liquid-propellant rocket motor.[47]

The Russian-born Alexandre Ananoff and later founder of the first International Astronautical Congress, afterwards complained that these medals were "illegal." That is, they only took the place of the usual monetary award. Besides this, he contended, the REP-Hirsch Committee had actually met for the last time in 1936, and the 1939 awards (and presumably Serraglio's Prize of Encouragement) were not really "official."[48]

In any case, the state of affairs in Paris was so dire with the opening of the war by the end of the year that neither Malina nor Carver were ever informed directly of the decision of the French Astronomical Society. Only a brief notice was buried in the pages of the *Bulletin de la Société Astronomique de France* for July 1939. After this, it was no longer possible for the REP-Hirsch Prize to be given out. Hirsch himself left for the front in September 1939 and was taken prisoner although miraculously survived the war.[49]

Not until the autumn of 1946 did Malina first learn of his REP-Hirsch honor. By then, one of the foremost experts in rocketry and one of the founders of both the Jet Propulsion Laboratory and the huge rocket manufacturer Aerojet-General—both spin-offs from his modest GALCIT Rocket Research Project—Malina had been sent on a rocket fact-finding mission to Europe for the U.S. Ordnance Department.[50]

Based in the office of the Military Attaché in the U.S. Embassy in London, Malina had taken a two-week holiday to visit relatives in Prague. On arriving at the Prague Airport, he was met by meteorologist Jaroslav Picha who married into the family and congratulated him upon receiving the REP-Hirsch Prize of 1939 as he had read in the *Bulletin*.[51]

The final chapter of Malina's REP-Hirsch award took place 20 years later, in 1958, a year after the launch of *Sputnik 1*. "In about 1957," Malina later recalled, "I met the banker André Louis-Hirsch...and I told him I would like to have the medal." He agreed but said the medal would now be in bronze!

Then, at the 9th International Astronautical Congress, held in Amsterdam during 25-30 August 1958, Hirsch bestowed the final REP-Hirsch Award.[52]

As a postscript, Nathan Carver, whose real name was Nathan Karabalnik, became the forgotten man. He was born in Vilna, Poland, in 1906, came to the United States at the age of ten months with his family and settled in New York. A largely self-taught engineer, the eccentric Carver was an early member of the American Rocket Society's Experimental Committee and conducted crude rocketry

experiments of his own at his one-man Reaction Research Laboratories of America. Most notably, he made the motors and small rocket planes for the so-called Greenwood Lake (NY) rocket mail attempts of 1936. However, his concentric-feed system merited his REP-Hirsch secondary award although he had originally began developing this motor back in 1932, when he first joined the then American Interplanetary Society and was member No. 58.[53]

Not until as late as 1978 was Carver informed by Frederick C. Durant III, assistant director, Astronautics, of the National Air and Space Museum, of his winning the second prize, while obtaining biographical information on him for the museum. But Carver never received a medal, especially as REP had died in 1957 and Hirsch in 1962. Carver passed away in 1988.[54]

Carver's unfortunate story aside, the REP-Hirsch Astronautical Prize indeed represents a unique window to the history of the formative years of astronautics and the related role of rocketry up to the opening of World War II. The late Andrew G. Haley, one of the founders of Aerojet and a pioneer in space law, credits the REP-Hirsch Prize as playing the specific role as the "first serious gesture—of international cooperation" in rocketry and astronautics.[55]

Unfortunately, Haley did not elaborate on this thesis but in retrospect, his definition was too simplistic and idealized. In short, it was wishful thinking on his part that there was genuine "cooperation" (i.e., sharing or pooling of knowledge) among the contestants and winners of the REP-Hirsch Award toward an established common goal. Rather, the competitors for the prize were completely independent researchers. The REP-Hirsch was simply a competition open to all who fervently shared and attempted to contribute toward a common interest.

Of course, the huge technical advances in rocketry that inevitably did lead to the development of true launch vehicles, namely the A-4 or V-2, developed during roughly the same period of the REP-Hirsch awards, was conducted in top-secrecy by the German Army. But the REP-Hirsch kept the dream of spaceflight alive and thus played its role.

In sum, this is the story of an idealistic, if not entirely successful attempt, to "legitimize" the then newly created science of "astronautics." It was to also serve as a catalyst to further its progress and inculcate astronautics among all concerned as an international endeavor and noble cause for the ultimate benefit of world science.

Yet the REP-Hirsch story is not properly ended without a brief examination of the early dissemination and final acceptance of the term "astronautics" into the language and usage. In this way, we can see how the REP-Hirsch experience became relevant to ourselves.

First, REP may be credited with being the first in the world to use the term as the title of a book, his *L'Astronautique* (*Astronautics*), published in 1930. The book itself was a highly original and major contribution to the astronautical literature and a worthy contender for the REP-Hirsch Prize had not REP probably disqualified himself as one of the founders of the award. Like Oberth's classic *Die Rakete*, the 248-page (plus appendices) *L'Astronautique* was encyclopedic in its treatment of the subject. REP's biographer says it was based on his thorough knowledge of celestial mechanics, astrophysics, ballistics, chemistry, and physiology. Among other aspects of spaceflight, *L'Astronautique* covered the potential guidance, navigation, and piloting devices for a space ship, life support systems, the combustion of a rocket in a vacuum and in the air, the density of the upper atmosphere, "interplanetary exploration," and a historical retrospective of progress made thus far in the new science. Fittingly, the first appendix of *L'Astronautique* was a set of the rules of the REP-Hirsch Prize.[56]

Another, though lesser-noted milestone was reached in May 1932 when the American Interplanetary Society's modest mimeographed *Bulletin of the American Interplanetary Society* was transformed into their proud, new offset printed journal, *Astronautics*, the first magazine bearing this word.[57]

In the same year, a young Argentinean chemistry student Ezio Matarrazo formed perhaps the earliest space travel group in Latin America, called somewhat clumsily, the Centro de Estudios Astronáuticos "Volanzan," or "Volanzan" Center of Astronautical Studies. ("Volanzan", also the name of their journal, is a peculiar Spanish acronym, meaning something like "launched flight.") Clearly, however, the term "astronautics" had spread very widely not too long after it had been coined in France.[58]

In 1937, Britain's Manchester Interplanetary Society created their mimeographed journal, *The Astronaut*. In this case, the idealistic teenage founders of the group, headed by the late Eric Burgess, did not have "space travelers" in mind, but anybody devoted to the study and possible realization of "space travel." Nonetheless, it was probably the second journal with a form of the word.[59]

In England, in 1938, the Combined Astronautical Society was formed by Burgess and Kenneth Gatland, as an amalgamation of the Manchester Astronautical Association and the Astronautical Development Society, created a few months earlier. Also in 1938, Sir James Jeans, the famous British astronomer, initiated an "Astronautical Section" in his Junior Astronomical Association, although it was short-lived.[59]

But it was across the English Channel, in France, that the Russian-born Alexander Ananoff may be said to have been the most effective and far-reaching single agent in disseminating the term and spirit of "astronautics."

According to Ananoff, the REP-Hirsch Prize Committee consisted of about 20 distinguished scientists and scholars whose sole purpose was to convene a few times a year to decide who was deserving of the honor of the annual REP-Hirsch award. This group, he maintained, did not constitute a true astronautical or rocket society and he therefore set about independently creating the first such group in France.[60]

Before this, he was successful in obtaining an exhibit room, he called the "Astronautical Hall," as part of the Astronomy Division of the 1937 International Exposition held at the Palais de Découverte (Palace of Discovery) in Paris. Here were displayed examples of international rocketry activities of the time, like Friedrich Schmiedl's mail rocket stamps and Ernst Loebell's rocket motors of the Cleveland Rocket Society. (In this sense, "astronautics" encompassed all aspects of rocketry, whether for terrestrial or spaceflight applications.)[61]

A close friend of REP and fellow member of the Société Astronomique de France, Ananoff was finally able to form, on 9 May 1938, a "Section Astronautique" of the Astronomical Society. He therefore achieved his goal, regarding the "Section" as France's first spaceflight society that eventually amounted to 150 members.[62]

Ananoff had great ambitions for the group and began corresponding with fellow spaceflight enthusiasts from other countries, including Germany. On 20 October he wrote to space writer Willy Ley that, "Sometime in March or April of 1939, I plan to launch a rocket in the vicinity of Paris, at Saint Cyr, on a two-kilometer strip...This experiment will also be a real spectacle for the general public, in order to give some importance to the Astronautic Section." But this plan came to naught and for a variety of reasons, including the specter of war on the horizon, the Astronautic Section itself quickly expired.[63]

Despite this sudden blow and the war-

time hardships that followed, Ananoff's dedication to astronautics remained fervent. (During his captivity by the Germans, he managed to hold several meetings on astronautics in his prison camp!) Long a prolific writer on the subject, he continued to write during the war. At war's end, he greatly renewed his efforts and by 1950 had amassed enough material that he produced his own substantial book of some 498 pages, similarly titled *L'Astronautique*, like that of his friend, REP 20 years before. It was also in 1950 that he reflected on a letter that André-Louis Hirsch had written to him back on 19 November 1937: "To organize an international astronautical congress is an impossible task to realize and in any case the obstacles are innumerable, I assure you."[64]

Yet, Ananoff took up this huge challenge in 1950 and almost single-handedly created the International Astronautical Federation (IAF) whose first congress was held that year in Paris.[65]

Today, approaching 60 years of tradition, the annual International Astronautical Federation (IAF) Congress is the premier event in the international spaceflight community, attracting thousands of participants worldwide and representing hundreds of countries and aerospace organizations and companies. Indeed, many of the international spaceflight societies featured the term "astronautical" or "astronautics" as part of their titles. In 1960, as a spin-off of the IAF, the International Academy of Astronautics was founded and is the most prestigious organization in the global space community; its elected members are all highly distinguished pioneers of the science.[66]

The opening of the space age saw the term "astronautics" firmly established and fully part of the language. The legacy of the word, bestowed by the modest REP-Hirsch Award was manifest. Moreover, the term "astronautics" was in perfect balance with its Russian counterpart—"cosmonautics"—as well as "aeronautics" for that matter. A new ARS journal, *Astronautics* (not to be confused with its 1930s ARS forebear) began in 1957, and other astronautics magazines, books, articles, and organizations just as suddenly sprung up everywhere.[67]

A short time after, in 1963, the American Rocket Society merged with the Institute of the Aerospace Sciences in 1963 to become the American Institute of Aeronautics and Astronautics (AIAA), and is now the largest professional organization of its kind. Imperfect and idealistic though it was, the REP-Hirsch Award more than left its mark. "Astronautics," in word and spirit, had become an indelible part of world culture.[68]

About the Author

Frank H. Winter is the curator for rocketry at the National Air and Space Museum of the Smithsonian Institution. He joined the Smithsonian in 1969 and became a curator in 1982. He has written numerous articles and presented many papers on the history of rocketry and the early spaceflight movement of the 1920s-1930s. In addition, he is the author of several books, including *Prelude to the Space Age: The Rocket Societies 1924-1940* (Smithsonian Institution Press, 1983); *Comet Watch: The Return of Halley's Comet* (Lerner Publications, 1986); *The First Golden Age of Rocketry: Congreve and Hale Rockets of the Nineteenth Century* (Smithsonian Institution Press, 1990); *Rockets into Space* (Harvard University Press, 1990); with Robert F. van der Linden, *100 Years of Flight—A Chronicle of Aerospace History* 1903-2003 (AIAA, 2003); and with Dominick A. Pisano and F. Robert van der Linden, *Chuck Yeager and the Bell X-1* (Harry N. Abrams, Inc. 2006)

Notes

1. The oft-used term "space age" was dubbed by the media, following the launch of *Sputnik 1*.

Among these studies of astronautics of the 1920s-30s is the still indispensable *Rockets, Missiles, and Space Travel* by Willy Ley (published in various editions from 1944 to 1969 by the Viking Press). Ley himself helped make part of this history as one of the founders and leaders of the Verien für Raumschiffahrt (literally, Society for Space Ship Travel, or VfR, but better known as the German Rocket Society, founded in 1927. Ley may also be considered as the earliest known chroniclers of the space flight movement of the 1920s-30s. Other works are: Frank H. Winter, *Prelude to the Space Age—The Rocket Societies: 1924-1940* (The Smithsonian Institution Press: Washington, D.C., 1983); Tom D. Crouch, *Rocketeers and Gentlemen Engineers A History of the American Institute of Astronautics and Astronautics...and What Came Before* (American Institute of Aeronautics and Astronautics: Reston, VA., 2006); Asif A. Siddiqi, "First Contact: Robert Goddard and the Soviet 'Space Fad' of the 1920s" *Technology and Culture*, Vol. 20, June 2004, pp. 97-113; Michael J. Neufeld, "Weimar Culture and Futuristic Technology: The Rocketry and Spaceflight Fad in Germany, 1923-1933," *Technology and Culture*, Vol. 31, Oct. 1990, pp. 725-752. Besides works such as these, are numerous individual IAF and other papers on specific technical developments of rocketry and space flight theory of the time.

There are also biographies of some of the notable pioneers of the period such as: Milton Lehman, *Robert H. Goddard – Pioneer of Space Research* (Da Capo Paperback: New York, 1988), originally published as *This High Man: The Life of Robert H. Goddard* (Farrar, Strauss, and Company: New York, 1963); and David Clary, *Rocket Man – Robert H. Goddard and the Birth of the Space Age* (Hyperion: New York, 2003); Hans Barth, *Hermann Oberth: Leben – Werk – Wirkung* (Uni-Verlag: Feucht. [West Germany], 1985]; B.F. Tarasov, *Nikolai Alekseevich Rynin* (Nauka: Moscow, 1990); Karl Werner Günzel, *Die fliegende Flüssigkeitsraketen – Raketenpionier Klaus Riedel* (Hüpke & Sohn: Weserland, [German, ca. 1988]; and others.

The REP-Hirsch Prize story itself is only mentioned in passing in the standard histories of rocketry and space flight. The exception is the chapter titled 'Le Prix REP-Hirsch" in the autobiography, *Alexandre Ananoff. Les Mémoires d'un Astronaute ou l'Astronautique Française* (Libraire Scientifique et Technique: Paris, 1978), pp. 18-32. However, this work is in French and is a difficult book to procure in the U.S. Moreover, it is not a comprehensive treatment of the REP-Hirsch. Up to now, the closest there is to an overall history of the award in English is: "The History of the REP-Hirsch Award" translated by James H. Wyld from an unnamed source and appearing in *Astronautics* (the early journal of the American Rocket Society), No. 34, June 1936, pp. 6-7, 13, which, of course, cuts off its treatment too early. See also the note in Ley's *Rockets, Missiles, and Space Travel* (1957 edition, p. 123, and repeated in other editions.

In actuality, a space-oriented award had preceded the REP-Hirsch Prize. Known as the Guzman Prize, it was founded by the wealthy Cuban-born widow Anne-Émilia-Clara Goguet Guzman (1804-1891) and named in honor of her only child, Pierre Guzman who died in 1886. She bequeathed, in her will dated 30 July 1889, the sum of 100,000 French francs for a prize "to the first person who finds the means of communicating with a star" ["astre"]." Her strange bequest was made more bizarre with the stipulation that the prize was to "exclude the planet Mars because it is sufficiently well known." Furthermore, she added, "If the solution [to communicating with star] is not obtained, the interest is accumulated [on the money] during five years and forms [a secondary] prize, always given out under the name of my son, to a...scientist who makes substantial and serious progress towards the intimate knowledge of the planets of our solar system...by means of physical or optical instruments...or by other means."

Mme. Guzman left the money and the responsibility of establishing the prize to the French Academy of Sciences. (Her husband had been a Frenchman and she spent most of her years in his country.) Because Mme. Guzman's bequest was so unusual, it took some time for the Academy to interpret it. The Guzman Prize was not established until 1900. As for the winners, nobody, of course, was able to find a way to communicate with a star. (Mme. Guzman's exclusion of Mars could be attributed to the "Mars furor," starting from the 1870s in which a great deal of attention was placed upon Mars and many astronomical studies made of the red planet centering around the possibility of life existing there.) But there were several winners of the Guzman secondary prizes, mainly to astronomers who had advanced the optical and other means of planetary observations. However, the main Guzman Prize was finally awarded in 1969 to the crew of *Apollo 11* after they had returned from their lunar mission. It seems that "communication with a star" could also be interpreted to mean communicating with another heavenly body. In this broad sense, the astronauts had not only reached another heavenly body but had conducted communications between the Moon and Earth via radio and TV transmissions. In any event, nobody challenged the rights of the astronauts to receive the award although by 1969, inflation had severely affected the value of the franc and the Guzman prize money was now valued at a mere $180! Thus, in lieu of the cash each of the astronauts received a Guzman medal. Technically speaking, however, the Guzman Prize had not been set up to honor those who had advanced a means of achieving or advancing the cause of space flight as did the REP-Hirsch Prize. It had only focussed upon a way to "communicate" with another body in space, albeit lacking a definition of exactly what this meant.

2. The 19th century was undoubtedly the first "golden age of rocketry" in that rockets saw their most extensive use world-wide and the greatest number of technological improvements than in any previous century—albeit the rockets were still propelled by gunpowder. These improvements also entailed new applications including the lifesav-

ing rocket, whaling rocket harpoons, camera carrying rockets and others, and suggestions for the use of rockets for propelling aircraft as and the introduction of machinery to manufacture rockets. There were also numerous mathematical studies of *external* rocket dynamics. For a brief survey on this largely unstudied phase of early rocketry history, titled "Scientific Inquiry," see Frank H. Winter, *The First Golden Age of Rocketry: Congreve and Hale Rockets of the Nineteenth Century* (Smithsonian Institution Press: Washington. DC, 1990), pp. 225-227.

3. Frank H. Winter, "The Silent Revolution: How R.H. Goddard Contributed Towards the Space Age," paper presented at the 51st International Astronautical Federation (IAF) Congress, Vancouver, Canada, 4-8 Oct. 2004, Paper IAA.6.15.1.

4. Winter, "The Silent."

5. The best biographies on Goddard are: *This High Man —The Life of Robert H. Goddard* by Milton Lehman (Farrar, Straus and Co.: New York, 1963), re-issued as *Robert H. Goddard—Pioneer of Space Research* (Da Capo Press: New York, 1988); and *Rocket Man - Robert H.Goddard and the Birth of the Space Age* by David A. Clary (Hyperion Books: New York, 2003). The latter book contends, however, that Goddard was not secretive and that there are other myths about Goddard. It is not within the scope of this article, however, to examine and comment on these premises.

6. The best work on technical details of Goddard's work is the three volume *The Papers of Robert H. Goddard* edited by Esther C. Goddard and G. Edward Pendray (McGraw-Hill: New York, 1970) .

7. Winter, "The Silent."

8. There have been numerous historical papers and article on Oberth but no scholarly work as yet in English. See, for example, Hermann Oberth, "My Contributions to Astronautics," in Frederick C. Durant III and George S. James, eds., *First Steps Toward Space – Smithsonian Annals of Flight Number 10* (Smithsonian Institution Press: Washington, DC, 1974), pp. 129-140. See also the biography, *Hermann Oberth—Leben—Werk—Wirkung* (Uni-Verlag: Feucht, [Germany], 1985).

9. For a history of the rocket societies, consult Frank H. Winter, *Prelude to the Space Age: The Rocket Societies 1924-1940* (Smithsonian Institution Press: Washington, D.C., 1983).

10. "Le Prix REP-Hirsch," *L'Aérophile*, 37 Anneé, 15 June 1929, p. 176; "The History of the REP-Hirsch Award,"*Astronautics*, No. 34, June 1936, p. 7; Lise Blosset, "Robert Esnault-Peltere," in Durant and James, eds., *First Steps*, pp. 5-11.

11. As an example of REP's attitude toward the rocket for spaceflight during this period and how he favored atomic energy, see Waldemar Kaempfert and A.J. Loraine, "Hurling a Man to the Moon," *Popular Science Monthly*, 94, April 1919, pp. 69-72.

12. Henri Moureau, "André Louis-Hirsch (1899-1962)," *Revue Française d'Astronautitique*, Nouvelle Series, Jan.-Feb. 1963, p. 3.

13. Blosset, p. 9.

14. Woodford A. Heflin, "Who Said It First? 'Astronautics,'" *Aerospace Historian*, Vol. 16, Summer 1969, pp. 44-47; "Astronautics," *New York Times*, 8 March 1928, 24.

As to when the word "astronautics" first appeared in the English language in its modern connotation, we know at least that a lengthy editorial, titled simply "Astronautics," appeared in the *New York Times* for 8 March 1928. Therefore, this may have been the introduction of the word in America. It appeared in England in the *Journal of the British Astronomy Association* in 1929. The *Times* editorial extolled the founding of the REP-Hirsch Prize and the lofty aims of its founders. The same editorial credits J.H. Rosny for "felicitously" arriving at the term "astronautics—the art of voyaging from star to star."

Esnault-Pelterie, Hermann Oberth, Franz von Hoefft, and "Max Velier" (i.e. Max Valier) are also mentioned as pioneers in the new field. "To these poets of the [space flight] machine," waxed *The Times* editorialist, "the solar system becomes a playground where man vies with the meteors. Venus, Mars, [and] Jupiter are scarcely more distant to the astronautical imagination than was half-mythical Cathay to Columbus. Undaunted, the astronauts draw plausible plans for reaction motors to kick hermetically sealed projectile-like cars off the Earth on the rocket principle...Who knows what may spring from these engineering flights? Out of alchemy came chemistry; out of astronautics may came a: least the reaction engine, a new method of generating energy."

15. www.coolfrenchcomics.com/navigation.com/navigateurs.htm; Ron Miller, *The Dream Machines – An Illustrated History of the Spaceship in Art, Science and Literature* (Krieger Publishing Co.: Malabar, Fla., 1993), pp. 59-60, 91; George Locke, *Voyages in Space A Bibliography of Interplanetary Fiction 1801-1914* (Ferret Fantasy Ltd. [printed by Kingprint Limited, Richmond, Surrey. U.K., 1975), pp. 31-32; Ley, *Rockets, Missiles*, pp. 42-43; *The Oxford English Dictionary* (Clarendon Press: Oxford, 1989), Vol. I, p. 734, Vol. III, pp. 985- 986; Linda K. Cleaver, ed., *National Geographic Encyclopedia of Space* (National Geographic: Washington. D.C., 2005), p. 227.

Technically speaking, the word or name "astronaut" appeared earlier. British writer Percy Greg (1856-1889) used it as a name for his fictional spacecraft in his two-volume novel, *Across the Zodiac: The Story of a Wrecked Record* (1880). The craft itself operated on "apergy," a fictional form of anti-gravity. But Miller, in his *Dream Machines*, says that Greg did not use the word "astronaut" in the modern sense. Rather, he contends that Greg merely adapted the name from the ancient Greek fictional sailing vessel, Argo, in Homer's *Oddesseus*, used in the search for the Golden Fleece.

During January-June 1900, *Pearson's Magazine* serially ran the collection of "Stories of Other Worlds" by British author George Griffith, a pseudonym of George Chetwynd Griffith-Jones (1856-1906). In these stories, that were subsequently published as the novel, *A Honeymoon in Space* (C. Arthur Pearson Ltd.: London, 1901) with black and white illustrations, Griffith's literary couple undertook voyages throughout the solar system in their space yacht called the Astronef. This vehicle, that used an anti-gravity "R-force" for propulsion, is the second and only other known instance of an early form of the word to denote a spacecraft. *A Honeymoon in Space* was republished in 1975 by the Arno Press, NY.

The Russians and other Eastern European peoples have always preferred the term "cosmonautics" to "astronautics." The former is technically more correct in defining space flight as it literally means "traveling" (or navigating) in space vs. "astronautics" meaning "traveling (or navigating) among the stars." However, it is more problematic to trace the etymology of "cosmonautics" but there is no question the term pre-dates "astronautics." The root word "cosmos" is Greek and means order, world, or universe and was so-called by Pythagoras and his disciples "form its perfect order and arrangement." The Oxford English Dictionary cites several examples back to the 16th century of the term "cosmos" meaning "order" or a "harmonius system." Insofar as space flight is concerned, Tsiolkovsky used the term in the title of his booklet, *Raketa v kosmicheskoe prostranstvo (The Rocket in Space)* in 1924 and from this period—before the REP-Hirsch—it became more standard in Russia. The phrase "Mezhplanetnye puteshestviya" ("Interplanetary voyages") was also popular. The Russian term "cosmonaut" (as opposed to "astronaut"), for "traveler in outer space," was used before Yuri Gagarin's flight of 1961. For example, according to Ari Shternfeld in his *Soviet Space Science* (1959), "Naturally, cosmonauts could leave an artificial satellite and move in outside space." Presently, the Chinese prefer the term "taiknauts" for "space traveler.

16. Heflin, pp. 46-47; Alexandre Ananoff, Les *Mémoires d'un Astronaute or l'Astronautique Française* (Albert Blanchard: Paris, 1978), pp. 19-21.

17. "Le 'Prix REP-Hirsch' et les Problemes de l'Astronautique," *Bulletin de la Société Astronautique de France*, Vol. 42, Feb. 1928, p. 59; Heflin, op. cit.; Andre Bing, Belgian Patent No. 236,377 of 10 June 1911, "Appareil destiné à permettre l'exploration des hautes régions de l'atmosphère, si rarefiee que soit cette atmosphère."; Letter to the author, Faculté de Medicine, Université de Paris, 22 Dec. 1978, in "André Bing" file, National Air and Space Museum (NASM).

18. Blosset, pp. 11-20.

19. Société Astronomique de France, International Prize for 'Astronautics,' REP-Hirsch Prize Regulations, English, French, and German editions, in "REP-Hirsch Prize" file, NASM; "News from Abroad," *Bulletin of the American Interplanetary Society*, No. 2, July 1930, [p.4.]; Le Prix REP-Hirsch," *L'Aérophile*, Vo. 37, 15 June 1929, p. 17.

20. A. Hamon, "Assemblée Générale Annuelle de la Société Astronomique de France," *Bulletin de la Société de France*, Vol. 43, June 1929, pp. 300-301; "Der REP-Hirsch-Preis Professor Hermann Oberth zuerkannt," *Die Rakete*, Vol. 3, 15 June 1929, p. 75; Blosset, p. 7.

21. Hamon, op. cit.

22. Ibid; Robert Esnault-Pelterie, *L'Astronautique* (Imprimerie A. Lahure: Paris, 1930), p. 228.

23. Willy Ley, *Rockets, Missiles and Space Travel* (The Viking Press: New York, 1959), p. 123; Letter to the author, Catholic University of America, 12 March 1976, in "Noel Deisch" file, NASM, and other documents in this file; Noel Deisch, "The Navigation of Space in Early Speculation and in Modern Research," *Popular Astronomy*, Vo. 38 Feb. 1930, pp. 73-88; Noel Deisch, "The Navigation Of Space," *Bulletin of the American Interplanetary Society*, No. 11, Aug. 1931, pp. 4-10.

24. "Der REP-Hirsch-Preis"; "Le Prix REP-Hirsch"; "Les Recherches Astronautiques et l'Etranger," *Bulletin de la Société Astronomique de France*, Vol. 44, July 1930, p. 322. For Gussali's work, see Michael Ciancone and Diana Motta Rubagotti, "Luigi Gussali Italian Spacefight Visionary (1885-1950)," paper presented at the 53rd International Astronautical Congress, Houston, Texas, 10-19 Oct. 2002, paper IAC-02-IAA.2.P.01.

25. Goddard and Pendray, *The Papers, Vol. II*, pp. 646-647, 651, 737, 931.

26. Ley, op. cit; *Bulletin de la Société Astronomique de France*, Vol. 45, July 1931, p. 312; "Le Prix REP-Hirsch," *Bulletin de la Société Astronomique de France*, Vol. 46, July 1932, p. 342; "Prize Awarded for Study of Rocket's Strength," *Bulletin of the American Interplanetary Society*, No. 10, p. 3.

27. Ley, op. cit.; *Bulletin de la Société Astronomique de France*, Vol. 48, July 1934, pp. 325-326.

28. Letter to the author, Service des Archives, Academe de Paris, 26 Feb. 1979, in "Ari Shternfeld" file, NASM; Ananoff, p. 27; Edward L. Crowley, et. al., eds., *Prominent Personalities in the USSR* (The Scarecrow Press, Inc.: Metuchen, N.J., 1968), p. 570; Letter, with

enclosures, to the author, École Nationale Superieure d'Electricité et de Mechanique, Nancy, France, 22 March 1979, in "Ari Sternfeld" file, NASM.

29. Blosset, pp. 10-11, 13-14.

30. Goddard and Pendray, eds. *The Papers, Vol. II*, pp. 931, 933, 940, 947.

31. Ananoff, pp. 22-23; Louis Damblanc, "My Theoretical and Experimental Work from 1930 to 1939, Which Has Accelerated the Development of Multistage Rockets," in Durant and James, eds., *First Steps*, pp. 49-55;

32. *Bulletin de la Société Astronomique de France*, Vol. 49, July 1935, p. 344; Ananoff, p. 28; Louis Damblanc, "I razzo autopropulsive ad explosivo," *Rivista Aeronatica*, Vol. 7, Jan. 1936, pp. 87-100; "News of Rocketry," *Astronautics (Journal of the American Rocket Society)*, No. 33, March 1936, pp. 16-17. For more on Damblanc's work, see Louis Damblanc, "les Fuseés autpropulsives à explosifs; essais au point fixe; Application des resultants, experimentau a l'etude du mouvement," *L'Aérophile*, Vol. 43, July-Aug. 1935, pp. 205-209.

33. Letter, Alfred Africano to the Société Astronomique de France, 16 Dec. 1935, in "Alfred Africano" file, NASM; *Bulletin de la Société Astronomique de France*, Vol. 50, July 1936, p. 313; "Miscelanies of Rocketry," *Astronautics*, No. 35, Oct. 1936, p. 17; Letter, Robert Esnault-Pelterie to Alfred Africano, 17 June 1936, copy in "Alfred Africano" file, NASM; Letter, André Louis-Hirsch, to Alfred Africano, 22 June 1936, in "Alfred Africo" file, NASM; *American Rocket Society, Supplement Bulletin* No. 2, 1 July 1936; "French Rocket Award Goes to American Group," *New York Herald Tribune*, 29 June 1936.

34. "French Rocket Award Goes to American Group," *New York Herald Tribune*, 29 June 1936; "Rocketeers of America---They Are Rewarded for Service to Astronauticcal Science," *New York Times*, 29 June 1936; "Prize Winning Paper on Rocket Design, *Scientific America*, Oct. 1936, pp. 218-219; "Prize Winning Paper on Rocket Design," *Journal of the British Interplanetary Society*, Vol. 4, Feb. 1937, pp. 6-9; "The Design of a Stratospheric Rocket," *Journal of the Aeronautical Sciences*, Vol. 3, June 1936, pp. 287-290.

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41. [Frank J. Malina], *Rocket Research and Development —Excerpts from Letters Written Home by Frank J. Malina Between 1936 and 1946*, unpublished monograph, NASA Historical Archives, pp. 14, 23-45; Willy Ley and Herbert Schaefer, "Les Fusées volantes Météorologiques," *L'Aérophile*, Vol. 14, Oct. 1936, pp. 228-232.

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49. Letter, Malina to the author, 24 Jan. 1979.

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51. Letter, Malina to the author, 24 Jan. 1979.

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56. Blosset, 11-12; Robert Esnault-Pelterie, *L'Astronautique* (Imprimerie A. Lahure: Paris, 1930), passim.

57. Frank H. Winter, *Prelude to the Space Age – The Rocket Societies: 1924-1940* (Smithsonian Institution Press: Washington, D.C.), p. 80.

58. Winter, *Prelude*, pp. 107-108.

59. Winter, *Prelude*, p. 94.

60. Winter, *Prelude*, pp. 109-110.

61. Winter, *Prelude*, pp. 109-110.

62. Winter, *Prelude*, p. 110.

63. Winter, *Prelude*, p. 110.

64. Winter, *Prelude*, p. 111.

L'Astronautique was not Ananoff's first book on rocketry and space flight. In 1935 he wrote the booklet, *La Navigation Interplanétaire* (a copy of which is in the Ramsey Rare Book Room of the National Air and Space Museum). In 1946, he had produced another work titled *Navigation Interplanétaire*, of 63 pages, while in 1947 he had written *Des Premièrs Fusées au V-2 (From the First Rockets to the V-2)*, also of 63 pages. It appears that the latter work led him to write *L'Astronautique* which is a comprehensive and encyclopedic history of rocketry, especially as it applies to space flight. It contains, as mentioned, some 498 pages with 155 illustrations. Apart from this book, Ananoff had already contributed towards spreading the name and cause of astronautics within the scientific, or at least the astronomical community. For example, there was his article "L'Astronautique et son evolution" ("Astronautics and its Evolution"), in the *Bulletin de la Société Astronautique de France*, Vol. 49 (1935), pp. 379-380.

65. Winter, *Prelude*, p. 117; Ananoff, *Les Mémoires* [My Endnote No. 1], pp. 109-146; Hervé Moulin, ed., *IAF The First 50 Years The Spirit of Astronautics* (International Astronautical Federation, Print Impimerie Escourbiac: Paris, 2001), pp. 9, 14, 16

66. Moulin, passim.

67. F.C. Durant III, *The International Astronautical Federation 1959-1960* (printed in behalf of the American Rocket Society by the Research and Advanced Development Division, Avco Corp.: Wilmington, Mass., Aug. 1960), passim; "First Czechoslovak Conference on Rocketry and Astronautics: A Report," *Astronautics*, Vol. 5, July 1960, pp. 58-59; "Canadian Aeronautical Inst., Astronautical Society Merge," *Astronautics*, Vo. 6, Dec. 1961, p. 91; Eugene M. Emme, ed., *Aeronautics and Astronautics An American Chronology of Science and Technology in the Exploration of Space 1915-1960* (National Aeronautics and Space Administration: Washington, D.C., 1961), p. 167; "Astronautical Exposition Scenes," *Astronautics*, Vol. V, July 1960, p. 50.

Among the early spaceflight groups of the IAF were: the Bulgarian Astronautical Society (founded 1957); Astronautical Society of Canada (1958); Canadian Astronautical Society (1957); Astronautical Society of the Republic of China (1958); Commission of Astronautics, Czechoslovakia Academy of Sciences (1959); Dansk Astronautisk Forening (Denmark, 1949); Egyptian Astronautical Society (1953); Association pour l'Etude et la Recherche Astronautique et Cosmique (France, 1949); Société Français d'Astronautique (France, 1955); Deutsche Astronautische Gesellschaft (Germany, 1948); Hellenic Astronautical Society (Greece, 1957); Magyar Asztroantikai Egyesulet (Hungary, 1958); Indian Astronautical Society (1957); Iranian Astronautical Society (1959); Israel Astronautical Society (1958); Associazione per le Scienze Astronautiche (Italy, 1956); Japan Astronautical Society (1953); Norsk Astronautisk Forening (Norway, 1951); Polskie Towarzystwo Astronautyczne (Poland, 1956); Centro de Estudios Astronáuticos (Portugal, 1958); Grupo Português de Astronáutica (Portugal, 1957); Agrupacion Astronáutica Española (Spain, 1953); Schweizerische Astronautische Arbeitsgemeinschaft (Switzerland, 1951); and the American Astronautical Society (1954). In 1961, the Canadian Aeronautical Institute (CAI) and the Canadian Astronautical Society (CAS) merged to form the Canadian Aeronautics and Space Institute (CASI) while similar reorganizations took place elsewhere.

In addition, there were events like the First Czechoslovak Scientific Conference on Rocket Techniques and Astronautics that took place near Prague during 22-23 April 1960. Other manifestations of the term were the ARS's Astronautics Award, created in 1954 and Astronautics Engineer Achievement Award, initiated in 1959, not to mention the emergence of the field itself of "astronautical engineering." There were also new corporate entities created during this period like the Convair-Astronautics Company. Moreover, the huge exhibits that were becoming part of the IAF congresses were sometimes referred to as "astronautical exhibits" or "astronautical expositions."

The second ARS journal titled *Astronautics* was started in 1956 and retained this title until 1962, then became *Astronautics and Aerospace Engineering*. In 1964 it was re-named *Astronautics and Aeronautics* while in 1984 it changed its name again, to *Aerospace America* and still retains this title.

68. Winter, *Prelude*., p. 85; Irving Michelson, "Careers in Astronautics," *Astronautics*, Vol. V, July 1960, p. 16, and other columns; "In Print" [Book review, *Careers and Opportunities in Astronautics*], *Astronautics*, Vol. 7, Sept. 1962, p. 55.

Interestingly, the term "astronautics" was so solidly established that from July 1960, *Astronautics* ran the periodic column "Careers in Astronautics" by Irving Michelson of Pennsylvania State University. Other issues of this column appeared in the journal for Aug. and Oct 1960, and March, July, and Sept. 1961. In 1962, there was published the book *Careers and Opportunities in Astronautics* by Lewis Zarem (Dutton, 1962).