The 'NASA principle': the 'crash program'

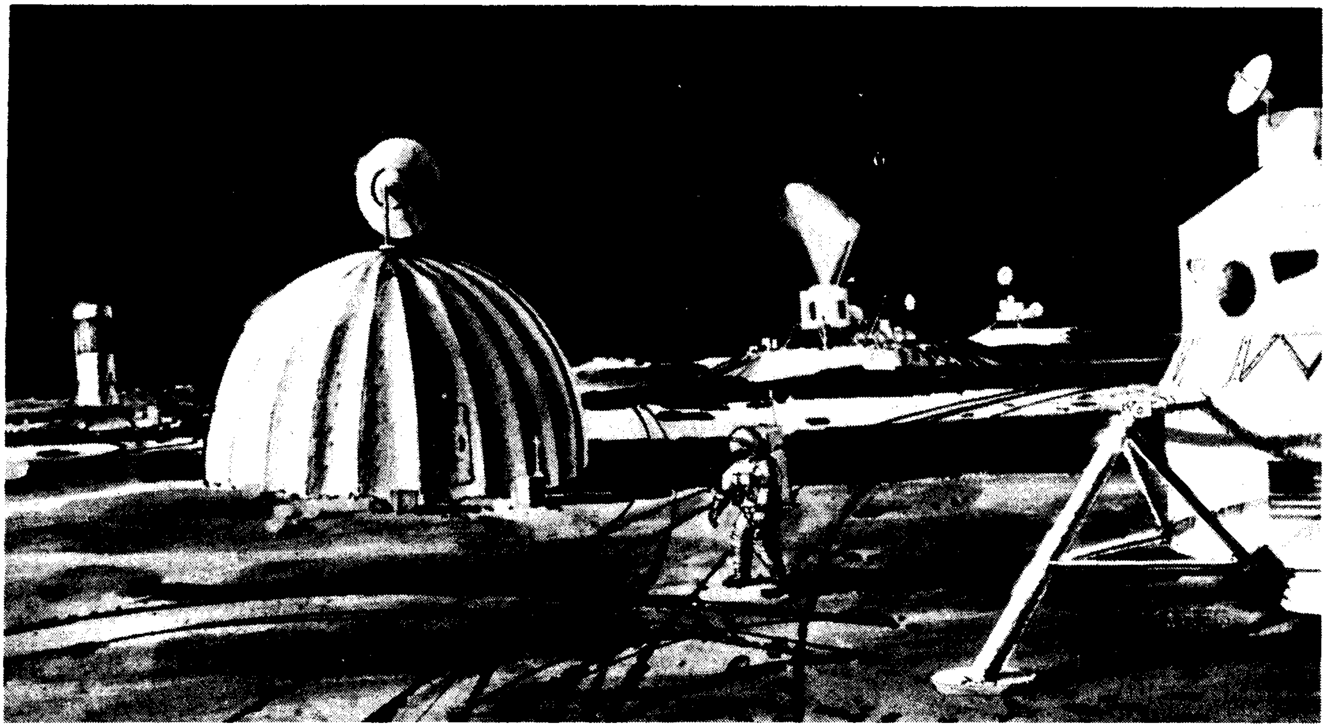
by Lyndon H. LaRouche, Jr.

Even long after the Johnson administration began the process of tearing-down U.S. research and development institutions, advances in technologies spilling over into our civilian economy from NASA's first ten years of work were a principal contribution to our republic's technological progress. Although NASA's contribution to the civilian economies of the world is specific and somewhat unique in particular features, no one who studies the economic history of the United States from as early as ten years prior to the 1776 Declaration of Independence ought to be surprised at the success of a crash program of the type NASA's initial period of research and development represented.

If we put our minds to it, we could do it again beginning right now, and do it much bigger and better, with far greater benefits than we gained from the NASA work of the 1960s. In that light, let us look very briefly at four related topics. First, let us list the leading "crash programs" of U.S. economic history, and compare these with three comparable cases in the history of Europe during the same period. Second, let us compare the long swing of general U.S. economic recovery, 1939-66 with the takedown of the U.S. economy during the 1967-83 period. Third, glance ahead at the new technological breakthroughs in space now awaiting us, and note some of the enormous benefits those breakthroughs will have for life on Earth. Finally, we identify the most important features of a new crash program of this type to be set into motion immediately today.

Dr. Benjamin Franklin's genius

Since Mary W. Shelley's Malthusian science-fiction novel attacking Dr. Benjamin Franklin, *Frankenstein*, and continuing through the false propaganda of the Newcomen Society during the 19th century, there has been a persisting effort to misrepresent the founder of the United States as a "hayseed womanizer" and "backwoods tinkerer." These are not merely lying insults against one of the greatest intellects of the past 250 years; whoever believes such falsehoods renders himself incompetent to explain how the United States was created. Without Dr. Franklin's contributions as a leading, internationally recognized scientist of the 19th century,


NASA

An artist's conception of a manned lunar base, around the turn of the 21st century.

the American Revolution could never have been won, nor the federal constitutional republic established in 1789. Franklin, among his other vital contributions to the existence of our republic, organized the first "crash program" in our nation's history, a "crash program" which shaped our republic's character as a growing, technologically progressive power through the 19th century.

A few general remarks on Franklin and his work put the larger picture into focus.

The English colonies in North America were, in the largest part, established during the 17th century by the English Commonwealth Party, the republican opponents of a combination of Venetian, Genoese, and Swiss financier interest which had taken over and looted Britain beginning 1603, behind their puppets, the Stuarts. The root of this project was a program developed by the English Erasmians around Sir Thomas More, a colonization project formulated by the great Tudor political figure Robert Dudley. The initial colonization of New England and Pennsylvania was based on Dudley's design: to transfer some of the best parishes of Europe to North America, to create new republics whose successful growth would tip the strategic balance in favor of the republican cause throughout Western European civilization as a whole. From the beginning, the leaders of the Commonwealth Party were allied philosophically with the republicans of France, Italy, and Germany, including the political heirs of the author of the *Six Books of the Commonwealth*, France's Jean Bodin.

Franklin, a product of the republican faction of New England, was obliged to flee the anger of the tory faction in New England as a youth, and migrated to Philadelphia, where family connections placed him under the patronage of William Penn's secretary and collaborator, Jonathan Logan. This connection located Franklin within conspiratorial circles of a branch of international Freemasonry known as Free and Accepted Masons, a Freemasonry strongly opposed to the Scottish Rite, or speculative mysticism freemasonry of the royalist faction of Britain, and allied with the Grand Orient form of free and accepted masonry in France. The American Revolution was, in a very meaningful and dominant sense, a "Freemasonic war," opposed by both the Scottish Rite Freemasons and the Scottish Rite's higher-ranking "mother organization," the Priories of St. John Hospitaller steered from Venice. Without understanding these Freemasonic connections, it is impossible to understand how the American Revolution was organized, and by what means Franklin organized the first "crash program" predecessor to NASA's.

From Philadelphia, Franklin worked increasingly under the influence of the writings of the great European scientist, Gottfried Leibniz, the Leibniz who created modern economic science beginning with his own 1671 essay, *Society and Economy*. Franklin's work followed Leibniz's design for an 18th century worldwide network of academies, academies modeled upon Plato's Academy at Athens. As part of this, Franklin educated a mass of American citizens for the coming Revolution through such means as a network of newspapers and other publications, and performed a leading role in promotion of knowledge of science and technology. Not only was he internationally recognized as a major scientific thinker during the 18th century: Immanuel Kant described him as the

"18th-century Prometheus," and Franklin's collaboration with Dr. Joseph Priestley is a crucial part of the history of development of chemistry in France and Germany. At the point Britain's Lord Shelburne and Adam Smith launched an effort to destroy the economies and political semi-autonomy of the English colonies, in 1763, Franklin was the acknowledged political leader of the republicans in North America.

In this capacity as political spokesman, Franklin traveled to Britain in 1766, delegated to lay the American case before the British Parliament. His experience there, combined with his discussions with leading republicans in Britain, persuaded Franklin that it was impossible that the Americans continue under the same government as the subjects of Britain: the moral and philosophical separation between American *citizen* and British *subject* had become a virtually unbridgeable gulf; these had become two peoples of fundamentally different conceptions of man and the universe, divided by a common language. Thereupon, Franklin employed his "cover" as a leading scientist worldwide to begin organizing conspiratorial networks on the continent of Europe that same year. In the ensuing period, Franklin's vast, transatlantic conspiracy reached from the Petrograd Academy which Leibniz had founded in Russia, through the court of Spain's King Charles III, into the republican circles of Spanish and Portuguese colonies in the Western Hemisphere.

It is exemplary of Franklin's influence in Europe, that his Paris-centered circles recruited Germans such as the composers Wolfgang Mozart and Ludwig van Beethoven, and the Freiburg-Jena-Weimar German classical circles led by Friedrich Schiller, and, later, the Humboldts, Freiherr vom Stein, and Scharnhorst. The French, German, and Polish officers who served the American Revolution were a reflection of this.

To fight the inevitable war with Britain, Franklin understood, the Americans required not only political and military organization, but also an explosion of technologies and corresponding development of the basic economic infrastructure of the colonies. The principle source of industrial and related technology was France, then the most advanced industrial and scientific power in the world. From France, the future United States acquired the technologies of cannon-making and gunpowder, among many other things—the Du Pont firm is a direct outgrowth of this.

The lack of federal cooperation and national-banking policies needed to continue this program during the 1780s was the principal goal for Franklin's conspiratorial assembly of the 1787 Constitutional Convention. That Constitution, especially Article 1, Sections 8-9, created a new kind of federally regulated system of currency, banking, credit, and tariff-protection arrangements, which was completed by three policy papers—on the subjects of credit, banking, and manufactures—issued by Treasury Secretary Alexander Hamilton on behalf of the administration of President George Washington. Hamilton named this anti-Adam Smith economic policy "the American System," and the name stuck throughout the 19th century, with the American System imitated successfully in the 19th-century industrial development of Germany (Friedrich List, et al.), and the Meiji Restoration's industrial development of Japan under the counsel of the American economist E. Peshine Smith, as well as the industrial development of northern Italy under the leadership of Cavour and his collaborators.

Under the two administrations of President George Washington, an explosive economic development of the United States was set into motion, centered around the development of economic infrastructure in such forms as canals and roads. This was later wrecked under the administrations of Presidents Jefferson and Madison, largely through the influence of the Swiss Jacobin Albert Gallatin and the influence of a treasonous crew associated with Aaron Burr and the New England "Essex Junto." However, through the influence of Franklin's earlier close collaborator, Mathew Carey of Philadelphia, and Henry Carey, in 1815, the United States launched a new crash program in development of military, scientific, and industrial capabilities, in collaboration with military and other specialists associated with another former Franklin collaborator, France's great Lazare Carnot. During that period through the 1820s under James Monroe and John Quincy Adams, this new "crash program" was centered in the rejuvenated West Point under Commandant Sylvanus Thayer. All was done in close collaboration with Gilbert Marquis de Lafayette, who had succeeded President Washington as head of the American freemasons—in Ibero-America as well as the United States, and as head of the military branch of the free and accepted freemasons, the Society of Cincinnatus. From the aftermath of 1815 until his death, Lafayette headed the U.S. secret-intelligence service abroad. It was Lafayette who brought the gifted German economist Friedrich List to the United States in 1825, and who aided in making the scientific technology of France available to the United States during that period.

During President Jackson's second term, the accomplishments of the preceding period were largely torn down, leading into the disastrous monetary chaos of the Panic of 1837—a consequence of destroying the national-banking system of the United States, in favor of a "free trade" policy.

The sudden, and suspicious deaths of two Whig Presidents, William Henry Harrison and Zachary Taylor, prevented the United States from resuming a policy of technological progress until the war of 1861-65. President Abraham Lincoln, a "Clay-Carey Whig" deeply committed to the American System of Leibniz, Franklin, Hamilton, the Careys, and List, applied the principles of the American System to launch a "crash program," effecting the industrial revolution on which U.S. world-power has rested ever since.

Unfortunately, Lincoln's assassination was followed by a reversal of his policy for rapid economic development of the southern states: the New York and New England crowd represented today by our "Eastern Establishment" unleashed the "carpet-bagger" looting of the defeated states, from which those states did not truly begin to recover until World War II and its aftermath. With the passage and implementation of the 1876-79 U.S. Species Resumption Act, the United States (unconstitutionally) surrendered its sovereignty over currency, national debt, and national credit to a cabal of bankers centered in Switzerland, London, and New York City, who manipulated U.S. currency, debt, and credit to buy up the most valuable real estate and other valuable assets at auction-prices. The republican constituencies of the United States—entrepreneurial industrialists, progressive farmers, and skilled laboring men, the constituency-forces of Henry C. Carey's Whig-Republican doctrine of "Harmony of Interest"—were pushed into second place as a political power in the nation beginning the events of 1871-79. Entrepreneurs, farmers, and labor, were set against one another during the titanic social crises of 1871-86. From that, we have never fully recovered since.

Yet, over the century which followed Lincoln's assassination—into 1966-68, the shift in power at the top of the pyramid of U.S. political power and wealth only weakened but did not dare to challenge more directly the deeply embedded commitment to basic democratic-republican philosophy within the population generally. Under conditions of perceived grave national crisis, as during World War I and from 1939 onward during World War II, the underlying political culture of our people asserted itself, as those people were called upon to make a great national exertion in the form of economic "crash-program" mobilizations for war. The "post-Sputnik" policies launched by President Dwight Eisenhower and continued more or less energetically by President John F. Kennedy, have been the most recent expression of that same underlying reality. The NASA research-and-development of the 1958-66 period is the most recent typification of that "crash program" tradition of our republic.

Three comparable cases

The three "crash programs" most appropriately compared with U.S. experience are the crash programs set into motion by Gottfried Leibniz, the work of Lazare Carnot and his associates of the Ecole Polytechnique during the 1793-1815 period, and the post-1815 development of Germany set into motion by the combined influence of the earlier work of France's Ecole Polytechnique and the establishment of the American System in the United States. We shall describe these summarily now, and turn at the conclusion of this foreword to the principles to be learned for today's practice from the example of the Ecole Polytechnique. We begin now with some brief remarks on the history of "crash programs" in Western civilization more generally: Leibniz did not begin from a blank slate.

The first well-documented "crash program" in the history of Western civilization was that of Alexander the Great. The conception was perhaps not originally Alexander's; throughout the period of his seizure of power, his military campaigns, and his administration of his new empire, Alexander was steered jointly by the Academy at Athens and that Academy's ancient patron and ally, the Cyrenaic temple of Ammon. These influences, and the traditions of the Golden Age of Egypt under the rule of Ammon, certainly shaped Alexander's policy throughout.

The next great "crash program" in the history of Western civilization is that launched by Charlemagne and his advisor Alcuin—the Rhine-Danube canal-system projected then is not quite completed to the present day. This is of signal significance to us today, as the first large-scale political outgrowth of the influence of the work of St. Jerome's great convert, St. Augustine, in giving specific shape to the culture we identify as the republican culture of Western Christendom to the present date. There is, similarly, the influence of the work of Abelard of Paris on the Salier emperors, and the building-programs of the Staufer emperors from Friedrich Barbarossa through Friedrich II's death in 1250 A.D.

The most immediate general predecessor for the "crash programs" of France's Jean-Baptiste Colbert, the 1672-76 patron of Gottfried Leibniz, was the 15th-century Golden Renaissance.

The period from the death of Friedrich II through the close of the third quarter of the following century, was the greatest "dark age" Europe suffered following the collapse of the Roman Empire. In the midst of this, a single titanic intellect, Dante Alighieri, forged a new program for civilization, a program continued by such successors as Petrarch at Avignon, which began to be implemented in such forms as establishment of the Brothers of the Common Life at the close of the 14th century. Out of this rebirth came the Golden Renaissance in Italy, a renaissance dominated by the gigantic intellect of Cardinal Nicholas of Cusa and Cusa's most famous successor in scientific work, Leonardo da Vinci.

Unfortunately, even most Ph.D.s and D.S.s of today are utterly ignorant of the work of Cusa, and therefore ignorant of the most essential features and implications of the work of Leonardo and the School of Raphael after him. This is a matter of no casual importance, since the conception of the modern sovereign, constitutional republic was elaborated by Cusa, and it was also Cusa who singlehandedly established the foundations for the entirety of progress in physical science during the recent five hundred years. Without familiarity in Cusa's work in laying the methodological foundations of modern science, it is impossible to comprehend the internal history of science rationally from Cusa and Leonardo through such figures as Kepler, Gilbert, Desargues, Leibniz, Euler, the Carnot-Monge Ecole Polytechnique, Gauss, and Alexander von Humboldt's German-science protégés through the 1850s.

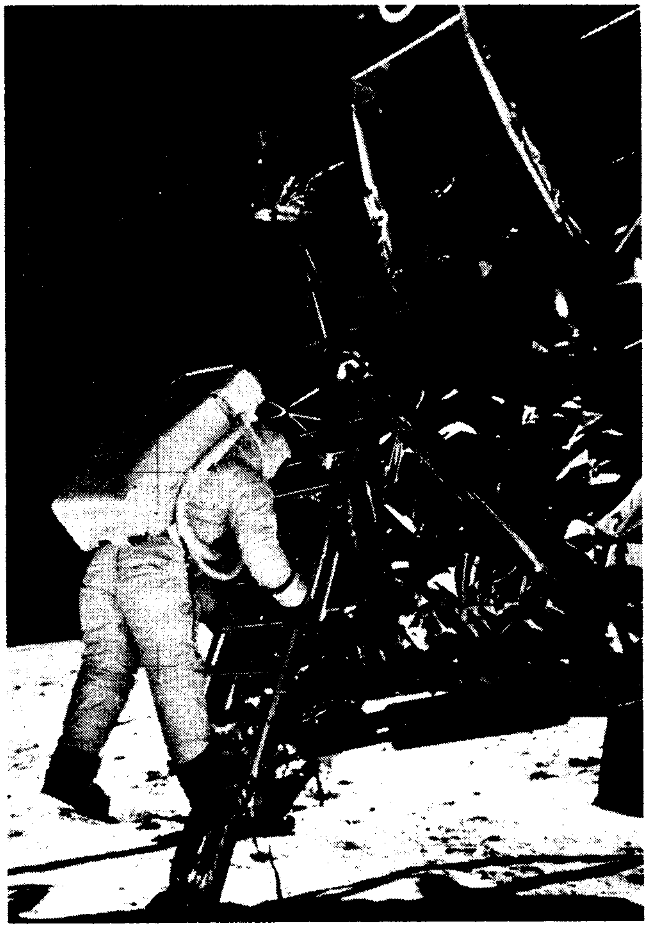
From the beginning, especially Cusa's refinement of Dante Alighieri's program for rebuilding civilization, the rudiments of what is recognizably economic science and physical science generally were treated as one and the same. The leaders of the Golden Renaissance started, as did Cusa, from the moral ordering of human affairs—and government—required implicitly by St. Augustine's formulation of the *Filioque* doctrine and the famous injunction of the Biblical Book of Genesis, that mankind must "Be fruitful and multiply, and fill the earth and subdue it." These two, complementary, Biblical injunctions prescribe a rigorously defined conception of the lawful composition of the universe, and of man's proper place and function within that universe. These leaders focused upon man's obligation to comprehend ever more perfectly the lawful ordering of the universe, so that man might better fulfill the injunction of Genesis, and that man might bring his practical will into greater conformity with the lawful ordering of creation. So, physical science and economic policy were situated under the rule of moral law as 15th-century Christian humanism—and also the Judaism of Philo of Alexandria—define the notions of universal, rationally knowable moral law, or Judeo-Christian "natural law."

A "crash program" signifies a mobilizaton of a people to great work in service of those principles, the work of changing the ordering of human affairs to the effect of increasing man's performance in accord with universal moral law.

Informed by the work of Cusa, partly through his collaboration with Luca Pacioli, Leonardo da Vinci effected a range of fundamental scientific breakthroughs in the course of his work dedicated to "crash programs" for the economic development of Italy. These included the founding of the modern science of hydrodynamics to a degree which is truly modern in respect of certain leading features of included accomplishments. It included preliminary mastery of the morophological characteristics of growth and function of living processes, including functions of the human body. It included a revolution in the geometrical principles of perspective, which has been in fact the foundation for the later development of "non-Euclidean" geometry. It included preliminary establishment of the principles of machine-design later perfected by the Ecole Polytechnique under Carnot and Gaspard Monge. It included revolutions in the principles of composition of painting, architecture, and music.

The work of Dante, Cusa, and da Vinci radiated throughout civilized Europe, exerting a direct influence on specific leading features of later scientific progress through the late 17th century—at which latter point specific discoveries by Leonardo appear in the writings of Leibniz's collaborator, Christian Huyghens. This was continued within Italy by the School of Raphael, and by the Naples school associated with such influential figures as Tommaso Campanella. It was Campanella's school of political-economy which exerted the most direct and important influence on the economic thinking of Europe during the 17th century and into the 18th in such forms as the 25-year Colbert "crash program" (1665-81).

This legacy informed the view of economic science developed by Leibniz. He established academies such as the university at Freiberg—where Alexander von Humboldt was educated, a center which greatly influenced the economic development of the United States and Japan, among other instances—and personally established also the university at



Astronaut Edwin Aldrin, Jr. leaving the Lunar Module to walk on the Moon during the 1969 Apollo mission.

Göttingen and the Academy of Peter I's Petrograd in Russia. Leibniz's most spectacular success was his crash program for the economic development of Russia, submitted to the Emperor Peter I. During the 17th century, the mining and industry of Russia outpaced that of Britain in both scale and quality, until this collapsed through reversal of Peter's sweeping reforms under successors such as Elizabeth and Catharine's Prince Potemkin, after which Russia subsided back into serfdom and near-barbarism until the rebuilding efforts launched by Czar Alexander II, Abraham Lincoln's war-time ally against France and Britain.

Leibniz's economic science was taught in Germany as "physical economy" under the program of cameralism provided as the education of Germany's elite, and was promoted in France through the Oratorian teaching-order with which Gaspard Monge and Lazare Carnot were associated. It was Leibniz's work in economic science, and the institutions he founded according to his model for a network of academies, which informed the great, later "crash programs" in Europe and the Americas into the 19th century. In fact, it was Leibniz's work on the heat-powered machine, as well as physical science generally, which designed the 18th and 19th centuries' industrial revolution, including the design of the first successful steam-engine by Leibniz's collaborator Denis Papin at the beginning of the 18th century.

The greatest "crash program" ever launched was that associated with the work of Lazare Carnot and Gaspard Monge over the period 1793-1815. Although echoes of this Ecole Polytechnique program are found in the Manhattan Project and NASA research-and-development effort, and to a significant degree in the work at Peenemünde under Prof. Adolf Busemann in the Göttingen tradition, these 20th-century cases lack the stress upon fundamental breakthroughs and education featured in the work of the Carnot-Monge Ecole Polytechnique.

It began as Lazare Carnot, a former collaborator of Dr. Franklin, assumed a key position in the military command of France in 1793, the vantage-point from which Carnot organized the overthrow of the Jacobin Terror. Carnot began with a mandate for reorganizing the army of France in face of threatened conquest of France by the combined forces deployed by Britain and Venice. Starting with a revolution in development and deployment of massed fire of mobile field artillery, Carnot revolutionized warfare.

The victories of Napoleon Bonaparte have been employed to create a myth of Napoleon's genius, to the point of obscuring the fact that it was the military instrument created by Carnot which enabled Napoleon to achieve victories. Napoleon, a well-trained French artillery officer, educated in the most advanced doctrine of fields of fire existing in the world prior to Carnot's work, understood Carnot's principle of warfare well enough to demolish repeatedly the hayfoot-strawfoot Austrian army, and to destroy the greatest military power of the continent, that of Prussia, in a single day in 1806. However, it was said aptly during that period that every French soldier carried a field marshal's baton in his knapsack; anyone with a grasp of the principles of Carnot's revolution in warfare could have led the French forces to victory over the cabinet-warfare-doctrine forces of Europe during that period. Exemplary, when Napoleon was defeated by the alliance in 1814, Europe trembled as Carnot resumed command of French military forces—out of fear of the superior genius of Carnot, a Europe which had defeated Napoleon abandoned its plan to dismember defeated France.

Napoleon could be defeated only by a force which was intellectually superior to Napoleon, a force which understood the work of Carnot: the German reformer followers of Friedrich Schiller, Wilhelm von Humboldt, Freiherr vom Stein, and General Scharnhorst. Napoleon would have crushed Russia easily and decisively if the Russian commanders had followed their policy and instinct. It was the Prussian reformers who, by persuading the Czar to permit them to direct the war, prevented the Russians from attempting more than an indecisive delaying-action, to let Napoleon into Moscow, where the weakness of his logistics could be used to destroy him. The reformers used Schiller's studies of the 1618-48 Thirty Years' War to bait and close the Russian trap, and to fall upon Napoleon's retreat before he could reach France to raise new armies to destroy them all. A Gen. Douglas MacArthur would readily understand this, but, unfortunatly, no one trained in "systems analysis" could.

The military genius of Carnot—already recognized internationally during the 1776-80 period—depended in practice upon his transforming the French economy with he aid of such economists as Ferrier, Chaptal and C. A. Dupin. New metal-working industries were created almost overnight to produce the mobile field-artillery on which French victories depended. An in-depth system of logistics and administration was created. The only comparable cases on this point since have been Lincoln's mobilization of 1861-65 and Roosevelt's of 1939-43.

These military and economic programs were subordinated to two other leading features of the work of the Ecole Polytechnique. As Karl Gauss at Göttingen was beginning to establish the foundations of 19th-century German science on the basis of Kepler and Leibniz, the Ecole Polytechnique under Carnot and Monge was already engaged in following Leibniz's work to the point of creating thermodynamics and the theory of functions. They were occupied not merely with important advances in existing scientific knowledge, but with effecting revolutions in scientific knowledge. That is an important point of distinction between the work of the Ecole then and the Manhattan, Peenemünde, and NASA research and development programs later. Also, Monge most emphatically attacked the problem that the Jacobin Terror had butchered the ranks of French scientists—the case of Lavoisier is exemplary. France had far too few scientists for the work being undertaken. The leading feature of the internal work of the Ecole was Monge's program for producing "brigades" of new scientists through a rigorous training in geometrical methods. This produced the work of Sadi Carnot and others in thermodynamics, of the great pioneer of the theory of functions, Legendre, the great revolutionary in geometry, Poncelet, and numerous others of more or less comparable stature, such as Fourier, in the internal history of modern science.

Rather than limiting the assigned tasks of the "crash program" to specific targets of military and economic accomplishment, the Ecole Polytechnique aimed to revolutionize scientific knowledge, rejecting entirely the absurd presumption that any distinction exists between fundamental and applied research. Later "crash programs" did produce important discoveries, of fundamental importance in terms of experimental physics, but the focus of the effort was deficient by comparison with the integrated view of education and both fundamental and applied research adopted and practiced by the Ecole.

At the 1815 Congress of Vienna, directed by the Venetian Count Capodistria, and Capodistria's puppet, Prince Metternich, the Prussian Hohenzollerns betrayed the German nation and the great reformers who had saved Prussia from destruction by Napoleon. Metternich and the Hohenzollern court conducted a witch-hunt against the influence of Friedrich Schiller, the figure who had been the leading inspiration of the German Liberation War against Napoleon. The noble passions of the German citizens of 1813-14 were plunged into despair and the influx of wicked Romanticism during the 1815-19 period, and the wicked agent of Metternich, Prof. G. W. F. Hegel, became the Prussian "state philosopher."

Yet, all was not destroyed. Around the two Humboldt brothers, the principles of Schiller's circles were advanced within narrowed channels of educational policy and scientific progress. Wilhelm von Humboldt, the former collaborator and student of Schiller, pressed forward with educational reforms and related concerns. Alexander von Humboldt entered into collaboration with the exiled Lazare Carnot, then living in Germany, to launch the German science-revolution of the early 19th century. Since great Göttingen was under the capricious influence of the British monarchy, the university of Berlin was chosen to become the new center of scientific work.

In effect, Carnot and Humboldt brought the work of the Ecole Polytechnique into thriving exile within Prussia, under the patronage of the Prussian general staff, and fused this new initiative with the work of Karl Gauss and others at Göttingen. So, from 1849 into 1859, as the center of German science was shifted from Berlin to Göttingen, Gauss's Göttingen emerged as the world-center of scientific progress into World War I.

The realization of the gains of German science was accomplished through the leading role of Friedrich List during the 1830s and early 1840s. Shortly after assuming U.S. citizenship in 1830, Friedrich List returned to Europe, serving as a U.S. secret-intelligence operative for the circles of John Quincy Adams et al., and playing a leading role in the campaign to effect the industrial development of Germany on the basis of the principles of the American System of political economy. Under the Hohenzollerns and Bismarck, this was possible only to the extent that Germany viewed such scientific and industrial development as strategically imperative, as the history of the rise of the "smokestack barons" of the Ruhr and Silesia, for example, illustrates. It was List's text, *The National System of Political Economy* (1844), first published as a series of essays circulated earlier, and List's leadership in designing and installing the German Custom's Union (Zollverein), which made possible the explosion of industrial development which occurred in Germanay from the 1840s onward. These measures were accompanied by a program of infrastructure-building, centered around water transport and railroads, and led into the development of agricultural chemistry, as later imported into President Lincoln's establishment of the U.S. Department of Agriculture as an instrument for fostering this agricultural revolution within the United States.

In these instances, taken together with experience from our own national history, we see illustrated the point that all significant progress in science and the economy in Western civilization to date has centered around "crash programs" of more or less the sort we associate with the research and development of NASA.

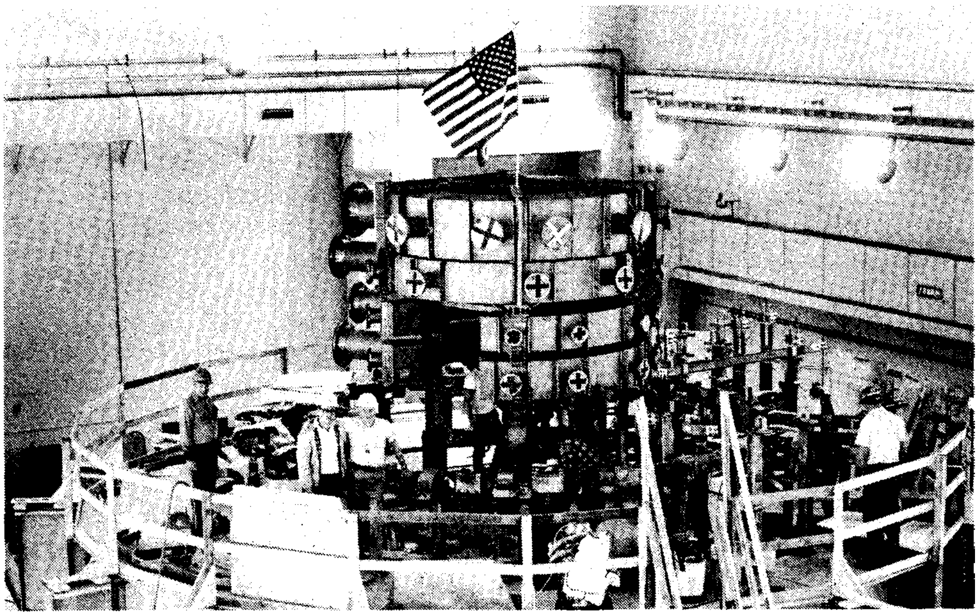
U.S. ups and downs: 1939-83

Not everything President Roosevelt did during the 1933-38 period was exactly useless or a failure, of course. Despite the jokes about WPA and PWA, jokes not lacking in some justification, important development of infrastructure occurred. Without the TVA and related projects, we would not have been situated to mobilize adequately for World War II. Without rural electrification and related programs, the U.S. agricultural revolution launched during the war, could not have been possible. Otherwise, it was not useless by any means to ameliorate the potential social crisis fostered by the debacles of 1929 and 1931. All that granted, the United States remained locked in what appeared a permanent economic depression until the economic mobilization of 1939-43 began to show early results during 1940 and 1941.

Looking back, it is clear that similar measures of reforms in monetary and banking practices could have caused a general economic recovery at any time during the 1933-38 period, measures which could have succeeded under peacetime conditions without the inflationary consequences of massive war-expenditures. The cruel fact is that such measures were either not politically possible, or at least were not perceived to be politically tolerable, in that they were taken in the name of preparations for a new world war. The same is broadly true of the 1949-52 mobilization for the Korean War—and whatever more to which that might then lead, and was true of the "post-Sputnik" programs, including NASA, launched by the Eisenhower administration and fostered by President Kennedy. It was also true, to less spectacular extent in the case of the World War I mobilization. The political problem of our republic during the past hundred years is that we never seem able to mobilize ourselv to do anything right in this direction unless we do so under threat of general warfare.

If the Washington, D.C. and Palo Alto "systems analysts"—we say "systems analysis" since "operations research" earned the reputation of a dirty word—had their druthers, they would wipe the memory of the 1939-1943 U.S. mobilization from our recollections. At the beginning, it was a mess. Broadly, we said to all sorts of citizens: "Find a machine tool someplace on the junk-heap. Make it work in some shack or loft you find rotting and abandoned, and run that machine with the labor of some grey-faced, unskilled fellow recruited from either the unemployment lines or even Skid Row." If such a citizen-entrepreneur could find a sub-sub-contract somewhere, he could receive a low-cost loan and get into production. By 1943, we had mobilized a wrecked economy to levels of sophisticated output which astonished the world and overwhelmed the Nazis.

This writer remembers very well. One personal incident stands out. One day during that period, he was offered purchase of a nearly abandoned but fully-equipped machine-shop located in an old brick loft building down on Broad



NASA

The Tokamak Fusion Test Reactor (TFTR) at Princeton Plasma Physics Laboratory.

Street in Lynn, Massachusetts. If this writer had chosen to leave his studies at the time, he would have become very soon one of those war-mobilization-period entrepreneurs. It would have succeeded, because everything like that succeeded in those days.

A "crash program" is a mobilization of every human and other resource, including what might be salvaged from scrapheaps. We learn from early mistakes, and being determined to correct such mistakes quickly, we do better quickly. The process accelerates.

The way such "crash programs" succeed is asthetically distasteful to the Harvard Business School experts in corporate mismanagement and the "systems analysis" types generally, but not to an old-line production manager or the veteran of the World War II Seebees. A "crash program" begins as that sort of effort steered by bold thinking from the relative handful of scientists and engineers who can be assembled for the effort. If we were to repeat such an effort today, we would be obliged to assemble a mixture of retired veterans of the 1939-45, 1949-52, and NASA experience, to inject their memories of "how to do it" into direction of the process.

Granted, the massive ratio of war-expenditures to total output during the 1939-45 period was inflationary War-materiel is chiefly economic waste, in the sense one can not (or should not) attempt to eat it, nor is it particularly efficient to use a combat tank for ploughing fields or other purposes of production. Yet, long after the war, the investment in productive capacity and upgrading of labor-force skills made the U.S. economy strong. The 1949-52 mobilization, and the "post-Sputnik" programs of 1958-66 reenforced the beneficial economic aftermath of World War II.

At about the same time that the "post-Sputnik" programs were being launched, cronies of the late Bertrand Russell had assembled for back-channel negotiations with the Soviet government, centered around the Pugwash Conference-series. Nikita Khrushchev brought to Russell a proposal to divide the world into two world-empires, using the doctrine of Nuclear Deterrence as a way of making this scheme permanent. Gradually, the Malthusian doctrines negotiated between Russell's cronies and the Soviet government were slipped piecemeal into U.S. and NATO policy. By the time accomplice McGeorge Bundy left President Johnson's National Security Council, the worst damage was done. Traditional U.S. military policy had been junked, and was being liquidated in McGeorge Bundy's War in Vietnam; McNamara's and Kissinger's doctrines had taken over. By 1966-67, the Soviet government's accomplices were positioned to impose the doctrine of destroying the economies of the United States and Western Europe upon the Johnson administration—the so-called "post-industrial society" or "technetronic society" doctrine.

The "Great Society" package was launched as a bit of political demagogy to cover over the fact that the research and development potentials of NASA were being torn down. Then came the monetary crisis of March 1968, at which President Johnson and Federal Reserve Chairman William Martin began the process of tearing down the U.S. dollar. Over the winter of 1969-70, with Kissinger as head of the National Security Council, the "environmentalist" movement was launched simultaneously in the U.S.A. and Western Europe, rallying the readymade anti-technology forces of the New Left and Russell's peace movements around left-wing social democrats to create a battering ram against, first, nuclear energy production and DDT, and then against everything else which had made us strong in the past.

What had given us economic strength up into 1966 had been the combined effects of the World War II agro-industrial mobilization, the 1949-53 mobilization, and the post-Sputnik R&D effort, combined with a steady increase in improvements of basic economic infrastructure. R&D began to be taken down in 1967. Infrastructure building slowed that year, and peaked, before beginning to collapse in 1969. We are now a rotting "post-industrial society," with an unpaid bill estimated at between $3 and $4 trillions for repair of rotting basic economic infrastructure in transportation, water management, energy production and distribution, and urban infrastructure.

Gloating over this weakening of our muscle and political will, and the demoralized collapse of the economies and political will of Western Europe, the Soviet leadership is now embarked upon an orchestrated thermonuclear showdown with the United States during the period immediately ahead. They rely on our backing down, a backdown which they are confident will be helped greatly by the circles of the Eastern Establishment allied to W. Averell Harriman and Democratic National Chairman Charles T. Manatt and the pro-Soviet moles of the U.S. churches.

Unless we rebuild our economic strength rapidly, reversing every policy change instituted by McNamara, Kissinger, and other Pugwash Conference accomplices over the past 20 years, we face either thermonuclear war or the doom of Western civilization by other, slower, but not less effective means. Only a new "crash program" can provide us that mobilization of material and political strength to prevent the Soviet leadership from daring to continue on the course toward early thermonuclear war.

So, the thoughts of every patriot turn to memory of the first decade's achievements of the NASA research and development "crash program."

A three-pronged crash-program offensive

The first step toward such a needed turnabout was set into motion by President Ronald Reagan on March 23, 1983, in his televised address announcing a new U.S. strategic doctrine. The Soviet leadership is howling, mostly lies. The real reason the Soviet leadership has rejected the President's generous offer of a new basis for durable peace is twofold. The Soviet leadership knows that the President's strategic doctrine will succeed exactly as outlined; anything they say to the contrary is simply outright lying. They object to the fact that they have calculated that if the President launches a "crash program" to implement the doctrine, that this will cause an economic boom in the United States—such an economic recovery of the United States they are determined not to tolerate. They also object to the fact that such a policy means U.S. survival as a world power, at a time they have their hearts set upon early destruction of the United States' position as a world power.

The scientific-technological fact underlying the President's change in U.S. strategic doctrine is that we presently either have or can quickly develop defensive weapons systems capable of destroying thermonuclear ballistic missiles—and other missiles—in mid-flight. Moreover, it is a matter of scientific principle, that these technologies can destroy missiles in flight much more cheaply than an adversary can construct and launch such missiles. In other words, as Dr. Edward Teller has emphasized, the economic advantage in strategic combat has shifted scientifically to the decided advantage of the defense. We have in reach the development of a total strategic ABM system, using these technologies, by means of which we can destroy between 95 percent and 99 percent or more of all thermonuclear ballistic missiles which might be launched against the United States.

Theoretically, a few missiles might get through such a screen. However, any adversary which did sneak a few through would be relatively helpless, strategically disarmed against counteraction taken by the power it attacked. Therefore, a 95 percent defense is already a total defense in principle.

That said, let us shift our attention to the implications of such defensive weapons technology for the work assigned to NASA: the exploration and conquest of space. What effect would these same technologies have for space exploration, and what will be the benefits of such space exploration and related undertakings for the conditions of life here on Earth?

The kinds of defensive weapons systems corresponding to the President's doctrine cover two of the three major frontiers for fundamental scientific and technological advances over the coming 50 years and longer. The three areas are: 1) Development of "commercial" controlled thermonuclear fusion as a principal energy source for a broad range of applications. This is not only a technological breakthrough, but brings our work into the area of revolutions in mathematical physics. 2) Development of improved methods of energy transport, centered upon high-energy directed-beam technologies. 3) Fundamental research into the processes of living organisms, to guide work in biotechnology. All three of those areas are indispensable for advances in the exploration and conquest of space.

Taken together, these three areas of work on the frontiers of knowledge today represent not only great advances in technology, but the most fundamental breakthroughs in fundamental scientific knowledge in more than a hundred years.

Once we have developed commercial qualities of controlled thermonuclear fusion, this technology shifts the exploration of space from present rocket-ballistic modes to continuously powered space flight. This brings the exploration and prospective colonization of Mars within reach. It is reasonable to project that a second generation of commercial fusion-energy systems could enable us to generate energy at about 10 times or more the present energy-flux density, perhaps as high as between 500,000 and 1 million kilowatts per square-meter energy-flux density. If such energy-flux density can be efficiently channeled through laser-like devices and related techniques, not only is every productive technology on Earth revolutionized to a degree presently beyond the imagination of both, but these technologies make practicable the creation of artificial Earth-like environments on the Moon, Mars, and so forth.

Extended space flight and colonies on nearby solar bodies require breakthroughs in biotechnology generally, both as matters of medical science and in providing food supplies and organization of environments in strange circumstances.

Even before the close of this present century, the use of laser-like technologies developed as a byproduct of research and development for beam weapons means a revolution in productivity to the effect of increasing the per capita output of operatives by between two and three times present levels. The great benefits which NASA's R&D contributed to the civilian economy in the past are small relative to the benefits of a similar program attacking the indicated frontiers of science and technology.

In addition to the need for an anti-missile defense and the benefits of space exploration for life on Earth, the side effect of conducting such research and development is a leap upward in the conditions of the life of the average individual on the surface of this planet.

There is also a profound moral benefit to space exploration. Once we begin to define mankind in terms of mankind's prospects for colonization of the Moon and Mars, for example, and realize that it is within our reach to project growing forests on Mars, for example, we think of ourselves and our neighbors in a new way. We think of mankind as an instrument within God's creation, mankind destined to go anywhere in the universe useful work is required of mankind. We lift our noses from squabbling in the mud of this planet, and gain a moral sense of mankind as developing on this planet to fulfill some higher, if yet unknown duty in the universe around this planet.

Perhaps, such tasks will cause humanity to grow up at last.

The time has come, between strategic crises and growing misery on this planet, for the United States to launch a new great effort modeled appropriately on the work of the Ecole Polytechnique under Carnot and Monge. For the work we have indicated, we have presently far too few scientists and engineers, and too little education of our youth. We are a ruined relic of our former national self, and can arise from the misery, ruin, and demoralization of our present condition only by mobilizing ourselves as a people as we did once before during the 1939-43 period of economic mobilization. What we require for this great undertaking now we lack except in the tiniest part; we must create what we lack as we go along, using the crash programs of space exploration and beam-weapon defense as a great school, such that those caught up in that work produce "brigades" of new scientists and engineers as well as operatives with new kinds of skills, and cause the lessons learned from this "crash program" effort to spill over copiously into the life of our national generally.

Let us, therefore, look back to the more glorious days of NASA's past, and view what was accomplished then as a first step—a halted first step—which we must resume today. Let us resume the dedication of NASA from that period, and add to that dedication the broader duties of fundamental research and education needed to replicate the genius of the Ecole Polytechnique.

NASA at 25 years: on the frontiers of space

by Marsha Freeman

October 1 marks the first quarter-century of space exploration by the United States, carried out under the leadership of the National Aeronautics and Space Administration. These twenty-five years represent the fulfillment of mankind's oldest dream—to place his intelligence, his scientific instruments, out above the Earth into the cosmos, and then to go there himself.

Over this quarter-century, NASA has sent probes that will visit all of the solar system's planets, save one; it has sent instruments into space to examine the sun, stars, and galaxies through windows of wavelengths that man could not see, were he to go himself; it has proven that the human species can sustain space flight and accomplish important and useful work in space, and that mankind can bring his human intelligence, in vitro, to a celestial body beside the Earth.

Scientists have learned things about the giant planets of this solar system that challenge the most tenaciously-held beliefs of astronomy and physics. The Voyager missions showed us, for example, that the rings of Saturn cannot be explained by Newtonian physics. No linear calculation of interactions among billions of ring particles can explain the rings' stable yet highly complex geometry and self-developing character. Jupiter's atmosphere, similarly, disobeys the laws that we use to try to explain the weather on Earth, challenging basic assumptions of hydrodynamics.

Over the past twenty-five years explorers have gone out into space and landed on Earth's nearest neighbor, laying the basis in science, technology, and engineering to reshape this dead world into a new home for man. Tentative views from Mars have shown us that there is at least one other nearby body which could be terraformed for intelligent life.

To carry out these programs, NASA became the nation's largest science and technology agency, whose only goal is the increase of human knowledge and technology for the benefit of all mankind. Through budgetary ups and downs, the agency has maintained a core of scientific and engineering expertise, and dreams for the future.

The accomplishments of this first twenty-five years of space exploration are a reflection of the boldest dreams of