KÁRMÁN Theodore

1957

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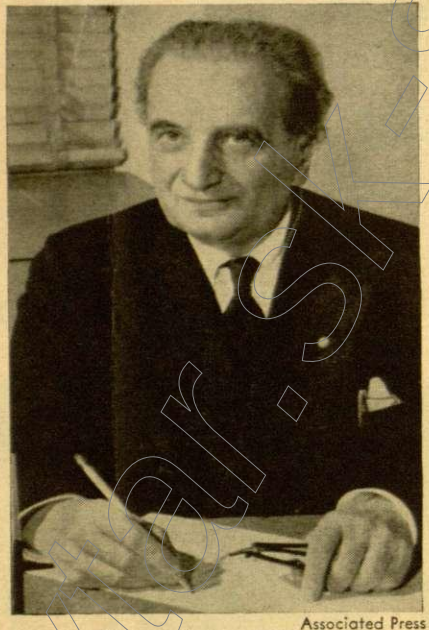
AVIATION

The Rocket's Red Glare

Back in the 16th century a Chinese scholar named Wan-Hu lashed 47 black-powder rockets to a bamboo frame, clambered aboard the contraption, and as 47 servants lit the fuses, so goes the legend, went on history's first rocket ride. Last week in Wall Street, the stocks of the modern rocket riders were whizzing up as fast as old Wan-Hu. Olin Mathieson Chemical Corp., a leader in rocket fuels, shot up 6⅝ points in three days to a new high of 54. Reaction Motors, 50% owned by Olin, has nearly doubled in value in the past year; so has General Tire & Rubber Co., which owns 95% of another rocket engine-maker, Aerojet General Corp. Thiokol Chemical Corp. has trebled



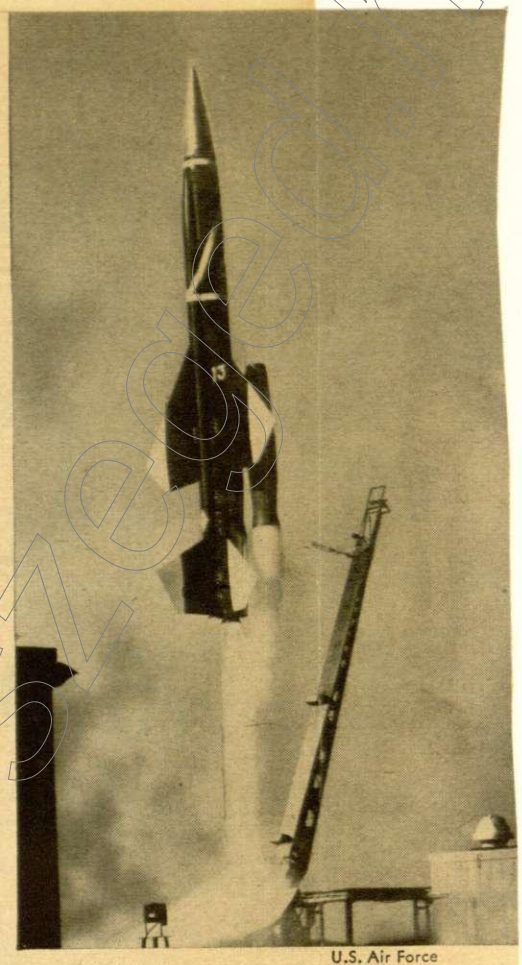
Associated Press

AEROJET'S VON KÁRMÁN
Out of submarines.

in value in a little over a year, hit $70.50 a share last week before backing off a bit.

Powered by military necessity, rocket engines have grown into a major industry with annual sales estimated at $450 million, a work force of 25,000-plus and a product line that ranges from small $50 JATO rockets to huge $250,000 missile engines producing the equivalent of 1,750,000 h.p. By the mid-1960s rocket engine spending will probably top $1 billion annually and go on climbing as the U.S. needs ever faster and higher flying weapons beyond the capabilities of conventional jet or ram-jet engines, like those on Boeing's Bomarc missile (*see below*).

Titan & Atlas. So far, most of the production—and most of the profit—has gone to two giants in the field: General Tire's Aerojet subsidiary and North American Aviation's Rocketdyne Division, both of which got in on the ground



U.S. Air Force

BOEING'S BOMARC INTERCEPTOR
Up to the bombers.

floor and today account for almost 75% of all the rocket-engine business. Founded in 1942 by Theodore von Kármán, who now acts as a consultant, and a group of scientists at California Institute of Technology, Aerojet plodded along until 1945 when General Tire bought up 50% of its stock for a bargain $75,000, later increased its holdings to 95%. Since then, by pouring in funds for research and development, General Tire has helped Aerojet land contracts for a family of 15 rocket engines. At its two California plants, Aerojet makes engines for the Titan ICBM, each of which produces an estimated 250,000 lbs. of thrust (*v.* some 20,000 lbs. for the biggest conventional jet), also has contracts for a series of smaller engines ranging from the Navy's 1,500-mile submarine-launched Polaris missile to the Army's Nike Ajax anti-aircraft rocket.

At North American rockets are becoming an increasingly big percentage of the company's total business. By spending an initial $1,000,000 right after World War II on its Rocketdyne Division, pumping in another $26 million since then for five plants and test facilities, North American won contracts for the Atlas ICBM power plant, the engines for the Thor and Jupiter intermediate missiles. From a start of five men in 1945, North American's Rocketdyne Division has expanded to 10,500 employees, and its sales of some $165 million (18% of North American's total) last year led the industry. Aerojet General is

running a close second, sold $145 million worth of rocket engines last year, and figures to do even better in 1957 with $415 million in orders on its books.

Rubber & Research. Behind the two leaders range a dozen other big and little companies. Some pioneers:

¶ Thiokol Chemical Corp., which started out in 1929 as a producer of synthetic rubber, is now No. 3 in the industry, specializing in solid-fuel rockets. By adding an oxidizing (*i.e.*, oxygen containing) agent to its synthetic rubber compounds, Thiokol turned the rubber into a highly concentrated fuel, ideal for such weapons as the Army's Nike, Hercules and Lacrosse missiles, the Air Force's Falcon air-to-air missile and the three-stage Lockheed X-17 research missile, which recently shot 600 miles above the earth. With two more stages, say Thiokol engineers, the X-17 might even reach the moon. The company's business is already headed that way. From sales of $13 million in 1955, it grew to more than $21 million in 1956, will probably grow at least another $8 million this year.

¶ Reaction Motors, which has concentrated heavily on research since its founding in 1941, is just getting into mass production. Reaction made the first 350-lb. thrust engine for World War II's experimental Gorgon flying bomb, built the liquid fuel engines for Bell's X-1 series rocket planes. Currently, Reaction is at work on a rocket booster for a U.S. Air Force plane, has a contract to produce rockets with 500,000 lbs. of thrust for supersonic Air Force test sleds. Another project: the rocket engine for North American's piloted X-15 rocket plane, which is scheduled to fly at altitudes of up to 100 miles and speeds of 5,000 m.p.h. Reaction's backlog: $10 million last year, $24.1 million this year.

Liquid *v.* Solid. Watching the figures soar, dozens of big companies are hurrying into the field to share the bonanza. General Electric, after a start in small rockets, is now producing the big (100,000-lb. thrust) first-stage rocket for the Vanguard earth satellite. Curtiss-Wright is producing small antitank rockets for the Army, is working on a throttle-equipped rocket engine for planes and missiles. Bell Aircraft, Hercules Powder, Phillips Petroleum, General Motors and many others are developing new engines and materials to fuel them.

How far and how fast the rocketmen fly depends on how soon they learn to produce better fuels to power their engines. The great debate in the industry today, much like the old argument over air-cooled *v.* liquid-cooled engines, is over solid rocket propellants *v.* liquid rocket propellants. Most big rockets, including both Intercontinental and two of the three Intermediate-Range missiles, now use liquid fuels with an oxidizer such as nitric acid or hydrogen peroxide. Liquid systems have produced the highest thrust-weight ratio (80 lbs. for each 1 lb. of weight), but they require an enormously complex system of tanks, valves, pumps and generators. To feed and control its monster engines North American must have pumps capable of 8,000 gal. per minute (enough to empty a 20 ft. by 40 ft. swimming pool in less than five minutes), gas generators which have the power of a nine-ton diesel locomotive. Solid propellants such as Thiokol's rubber-base fuels are far simpler and safer to handle. Yet the trouble with solid fuels is that they do not have the power of liquid fuels, cannot be relied upon to burn at a constant rate.

Eventually, rocketmen are sure that they will solve the problems with both types. Olin Mathieson and Callery Chemical Co. are both building multimillion-dollar plants to produce secret exotic new liquid fuels, based on boron (TIME, April 1), with twice the power of present fuels. Other companies are betting on plastic-like nitro-polymers as solid propellants, hope to reduce rocket-engine complexity by 50% while doubling reliability.

Around the Moon? To date, the industry's biggest customer is the U.S. Government. No one knows how much of a peacetime market there will be for the new industry. Some rocketeers see a multitude of uses for rockets in oil drilling, as braking power for railroad trains and auxiliary starters for heavy industrial machines. And some time within the next two decades, rocketmen predict, the U.S. will see supersonic rocket airliners carrying passengers across the U.S. in less than 70 minutes.

Many planemakers already have plans for experimental rocket transports on their drawing boards. Some are even aiming at the solar system. Says George P. Sutton, head of Rocketdyne's preliminary design section: "The rocket engines we have today appear to make flights around and to the moon, Mercury, Venus and Mars theoretically feasible. And the multiple-stage devices being conceived make it theoretically possible to fly missions to Jupiter and Saturn."

Bomarc on the Line

For 20 years, the name Boeing has been synonymous with big bombers, from World War II's B-17 to today's 650-m.p.h. B-52. Last week Boeing won a $7,109,195 Air Force production contract—and the promise of more—for a new aircraft calculated to give any bomber crewman the shakes. The craft: Boeing's deadly Bomarc guided missile, whose mission is to knock down atom-bomb-carrying planes like Boeing's own B-52.

The first long-range missile interceptor

TIME CLOCK

PORK PRICES will hit three-year high this summer, then drop below last year's by next winter, Agriculture Department predicts.

SMALL BUSINESS Administration will be given permanent status by Congress this year, and its lending limit will be raised beyond current $230 million. Eisenhower Administration is stumping for boost to $450 million, but chances are good that Congress will go farther, set $500 million limit.

FIRST ATOM POWER PLANT in U.S. using natural uranium as fuel, instead of more expensive uranium enriched with U-235, will be built near Tampa by three Florida utilities. Florida Nuclear Power Group is expected to get AEC subsidy for $40 million plant that will have capacity of 136,000 kw. when it is finished in mid-1962.

LOW-COST HOUSES for Puerto Rico will be built by Rockefeller brothers and David Dubinsky's International Ladies Garment Workers Union. Union will buy $2,600,000 in U.S.-backed mortgages on 400 San Juan houses to be built by Rockefeller brothers' International Basic Economy Corp. Rockefellers will build more than 5,000 units, sell three-bedroom house for $7,000.

U.S. ENEMY ASSETS SALE will dispose of Hugo Stinnes' German mining and shipping empire, whose $67 million assets make it second richest wartime-seized enemy property still held by Government (first: General Aniline & Film). In deal expected to bring around $20 million, Justice Department is taking bids on its 53% interest in Stinnes, for first time will allow aliens to bid for seized property.

RENT-A-PLANE service will be started this fall by Hertz Corp., which expects to have 50 rental air stations doing $2,500,000 business in its first year. At airports throughout U.S., car-rental company will franchise Cessna Aircraft Co. distributors to rent planes to private pilots. Rental for fly-it-yourself four-passenger Cessna plane: $1 an hour plus 15¢ a mile.

TVA FIGHT is heating up between public- and private-power proponents for control of Tennessee Valley Authority's three-man board. Term of Truman-appointed Dr. Harry A. Curtis has expired, leaving board without public-power majority for first time in 24-year TVA history. Top candidates to fill vacancy: Tennessee Republican Congressman Howard Baker, former TVA Engineer Adolph Ackerman, both of whom favor President Eisenhower's "partnership-power."

FREE TRADE PLAN of President Eisenhower for U.S. to join Organization for Trade Cooperation stands no chance of passage this year. Support is dwindling in Congress, and President would have to wage tremendous battle to push bill through, gives no indication he intends to do so.

COLOR TV PRICES will stay high "for a long, long time," says Radio Corp. of America President John L. Burns, who sees no scientific breakthrough for lower-cost color for "several years."