

THIS SECTION of the E-2 mural shows the vivid colors and techniques used by TRW Artist John Desatoff in his portrayal of the "Quadrisciences." The mural depicts the four areas where TRW is advancing technology: space, air, earth and water. Fifty-one panels comprise the 16 by 31-foot mural and blend together into a single art work. None of panels exceeds four

by eight feet and the black wall behind the painting serves as part of the overall design. The 51 panels are painted on canvas, stretched over plywood panels and glued to the frames. Interlocking support for each of the panels permits independent movement of each of the 51 sections.

TRW
SYSTEMS GROUP

SENTINEL

monthly newspaper for employees

Special Edition

SENTINEL

September 23, 1967

Welcome To TRW Systems Group's Family Day

Souvenir Sentinel Commemorates Family Day, 1967

This special souvenir edition of the SENTINEL, TRW Systems Group's monthly newspaper, was prepared in observance of today's Family Day for employees, their families and guests.

The newspaper, which is distributed to all Systems Group employees, is sent each month to TRW's facilities at Redondo Beach, San Bernardino, San Juan Capistrano, Houston, Washington, Florida and TRW locations throughout the world.

Normally, SENTINEL contains information about the organization, its products, people and accomplishments. Today, we hope to summarize Systems Group, its projects, history and future. Certainly the past has been a brilliant one, as you will read in this issue. We're quite optimistic about the future.

How TRW is as a place to work will be explained, and we also will offer a chart describing how Systems Group fits into the total TRW Inc. picture.

Preparation of this special edition was accomplished by Employee Communication with support from Public Relations, Advertising, Art Services, and Still Photo.

Additional copies of this special edition may be obtained after Family Day by writing to: Employee Communication, Building 70, Room 304.

A Welcome from Dr. Mettler

It is with a great deal of pleasure that I welcome you to Family Day for Systems Group employees. I believe I can speak for all employees in saying that we are both pleased and proud to have our families with us at Space Park for what I believe will be a pleasant and informative day of informal visiting.

It is my hope that you will take the opportunity to show your family where you work and what you and your fellow employees do. I also hope you will visit other areas and buildings and see some of the other exciting new things we are doing. As you tour Space Park and see the many exhibits, displays, and demonstrations of equipment, hosts will be on hand at each location to describe the wide variety of research, development and manufacturing activities in which we are engaged.

Although we are justifiably proud of our facilities and equipment at Space Park, we are even more proud of the skills and talents of the 16,000 TRW people who contribute to the success of the Group. Our most important asset is the people, such as yourself, whose loyalty, skills and dedication for the past 14 years have made it possible for us to succeed as a business enterprise and to make important contributions to national progress.

I wish you a pleasant day and an enjoyable visit.

Ruben F. Mettler

TRW Aims for Billion Dollar Club

TRW Inc. reported that sales, net income and earnings per share for the first half of 1967 rose to all-time records topping all previous marks in the company's 66-year history.

J. D. Wright, TRW Board Chairman, announced that consolidated sales in the second quarter of 1967 rose to a record \$258.1 million, an increase of \$43 million or 20 per cent above the previous high of \$274.7 million reported for the same period last year.

TRW has jumped from \$400 million in sales in 1961 and is very likely to become a member of the exclusive "Billion Dollar Club" later this year. TRW's original goal several years ago had been to reach the billion dollar figure by 1970, but as sales increased, goals were adjusted upward.

FORTUNE MAGAZINE recently ranked TRW 93 among the nation's 500 largest industrials — (Continued on Page 6)

The "Scene" is here and now at the Space Park facilities as Family Day "show-and-tell" events are happening in nearly every building. Several off-site buildings are also open for employees who want to show their habitats to their families.

During the day-long open house, guests will be participating in a wide variety of way-out scientific phenomena, such as drawing their own art pieces with a harmonograph, cleaning their jewelry in a bath of sound waves, talking like Minnie Mouse after breathing helium, seeing themselves on TV via satellite (simulated), giving momentum to a shake test unit by voice vibrations, setting watches scientifically, measuring the thickness of a hair from their heads, and eating hot dogs.

Four-Hour Tour

The complete tour requires approximately four hours, not counting frequency of trips to the Building S cafeteria area where refreshments will be served.

One of the several unique features of this Family Day is that cameras are allowed. Therefore, it is anticipated that many visitors will return with such remarkable mementos as a picture of junior at father's desk, or perhaps in a handsomely appointed executive suite, or with a background of missiles, spacecraft, recovery vehicles, or the now famous mural in the E-2 lobby.

Varied Exhibits

Or, he could be holding a laser gun from the TRW Instruments display in the new R-5 patio, or sitting at the Security Electronic Control Board, watching other visitors enter and exit from the buildings.

Whatever "Junior" finds amusing, so will his parents, and much more. There are several areas where continuous movies may be (Continued on Page 5)

Special Services Prepared To Aid Today's Visitors

To insure your Family Day visit will be a safe, pleasant and convenient one, the Family Day Committee has arranged for some special services.

Approximately 75 hostesses and a large number of hosts will be available to answer questions, provide instructions, and generally assist with Family Day tours; additional Security Officers will be on duty to help with parking and special assistance; and dispensaries will be open in M-2 and R-2 for any first aid or emergencies.

Services Provided

Family Day Chairman Mike Korenich said, "We have tried to provide every service possible for our guests, and complete detailed instructions can be found on flyers which will be distributed in each lobby.

"Of course hot dogs, ice cream, coffee and soft drinks will be served in the Building S cafeteria patio, and coffee and soft drinks will be served in the M-Building snack bar where the vending machine owners will be demonstrating their machines."

A lost and found service will be provided in Building S, Room 771, and guests can call Ext. 68736 for lost articles.

Editorial

Why We Have Family Day

Today's Family Day will bring together approximately 20,000 TRW employees and their families for what we believe will be one of the most exciting events of the year.

What makes an event, such as Family Day, so particularly meaningful is the work which goes into it, and the enjoyment we hope our guests will receive from the many activities planned for the day.

During Family Day, employees will have an opportunity to visit other areas of Space Park which — through the nature of their jobs — they may seldom see during the normal working week.

As you tour Space Park today, we hope you will be able to see all of the attractions planned for your interest and enjoyment. We also hope you will be able to meet and talk with the many employees who have made this rapid growth possible.

Never a Dull Moment

Social, Recreational Activities Insure Diversified Events for Employees

All work and no play is NOT the formula for Systems Group's employees. And to insure numerous and diverse recreational opportunities are available, a Systems Employee Association (SEA) Council plans and directs a myriad of activities from special interest clubs to the annual Children's Christmas Party.

SEA Council members are elected annually by Systems Group employees and derive their funds from the vending machines at Space Park. With these funds, SEA sponsors clubs ranging from the Aikido Club to the Travel Club which plans outings to such places as Hawaii, Las Vegas, Lake Tahoe and other places of likely tourist interest.

All-Employee Events

All-employee events such as special nights at the movies (usually first-run shows at reduced prices), TRW Night at Disneyland and special tours like the Universal Studio tour held last week, are part of SEA's fare.

On the sports scene, hundreds of TRW employees are active in intramural sports including softball, football, bowling, tennis, etc.

A Mutual Ticket Office, financed by SEA, is located in the Personnel Services Office. Through the Mutual Ticket Office, employees can place orders for tickets to events ranging from Civic Light Opera to the local recreation highlights in the Greater Los Angeles area. This service is available at no charge to employees.

Charity Organization

Systems Group's Employee Charity Organization (ECHO) is also an employee-sponsored activity. Each year, the ECHO committee sponsors a drive to gain new participants and increase donations. Employees may specify a particular charity from the master list of certified organizations and the committee then allocates the appropriate funds as indicated by the contributors.

Personnel Services

This program receives direct support and guidance from Personnel Services, a section of Industrial Relations.

The Personnel Services office, located in Building S, provides

Systems Group Pioneers 'People Technology' To Build a More Healthy, Efficient Organization

Systems Group is generally known as an organization which is on the frontier of many advanced technologies. But a "people" technology — one aimed at healthy organizational development — has emerged over the past several years which is placing the organization at the forefront of human relations.

Last year FORTUNE MAGAZINE cited Systems Group's work in human relations and described us as an organization "pioneering a people technology which is storming the barricades of the personal." While this statement may dramatize some of TRW's work in organizational development, it does not hide the fact that we are constantly striving to maintain the environment largely responsible for the company's growth.

Revealing Study

A study conducted several years ago by the National Science Foundation revealed there are several characteristics about TRW which make it a good place to work. A group of about 60 scientists and engineers were queried on what qualities are found within the organization that are most conducive to innovation and creativity.

Three of the characteristics most frequently mentioned were: openness, a freedom to express yourself and to deal openly with others; responsiveness, that is, if you look for help, you get it from your fellow employees; and informality, a feeling of freedom to cross organizational lines horizontally and vertically, so long as the reason is task-oriented.

Building Organization

TRW is trying to build an organization which has certain characteristics, and these characteristics have much to do with some of the assumptions we make about people. One of them is we believe people come to work here motivated, they want to do a good job and are professionally competent. We also believe they are looking for a challenge, they

seek out responsibility and want the professional freedom to do the job. We feel employees like to work with competent and congenial colleagues, that work can be, and should be fun.

In making these assumptions about people, we also make assumptions about some of the qualities found within a healthy organization. A healthy organization is one that, first, has a problem focus. It sees a job to be done, finds the people who can best do it and gets to work on it. In short, we attempt to structure ourselves around the task, we don't try to fit the task to the organization.

Healthy Confrontation

We also assume that a healthy organization is one which has a lot of confrontation; the reality has to be tested. We try to confront ourselves and others on how the job should be done. The key to confrontation in a healthy organization is that people here care about each other. We don't confront each other for the sake of confrontation, but rather to get the job done as well as possible.

We also believe a healthy organization is one that is introspec-

tive — can step out of its culture and look at itself as it is performing. Spontaneity is another quality we believe makes for a healthy organization. We try to do things new ways, innovate.

TRW is already innovative in many ways in human relations applications. Visitors are always astounded that there are no time-clocks at Space Park. They also remark about the lack of a "posted" list of rules and regulations which each employee must abide by. Most of TRW's written personnel policies are broad and general. They are designed so each case can be worked on its individual circumstances. It would be admittedly simpler to write a list of rules and "cast them in bronze," so to speak, but Systems Group feels employees are professionally competent individuals and should be treated as such.

"Not a Utopia"

Director of Industrial Relations Sheldon A. Davis says, "We don't pretend that we are a utopia, nor that we're about to become one. We do have some real and perplexing problems. But we are working on several important

(Continued on Page 5)



CONTINUING INTEREST on the part of Systems Group's management in the working climate of the organization is typified by last year's consultant meeting which brought together TRW's management and outside consultants. Topics ranged from "how we can maintain the personal environment" to 1968-75 personnel planning. Pictured from left to right are: Shel Davis, Director of Industrial Relations; President Ruben F. Mettler, Consultant Chuck Ferguson, and Bob Crowe, Personnel Manager for Space Vehicles Division.

SYSTEMS GROUP: How We Fit into the Corporate Structure

TRW ORGANIZATION

TRW Inc. is a diversified international company with sales in the billion-dollar range. It is comprised of four major centralized operating groups linked together by a growth-oriented base of advanced technology. TRW provides components, systems and services for electronics, space, aircraft, automotive, defense and industrial markets.

CORPORATE HEADQUARTERS

2355 Euclid Ave., Cleveland, Ohio 44117 (216) 383-2121

West Coast Offices

One Space Park, Redondo Beach, Calif. 90278 (310) 673-4711

Washington Offices

1875 Connecticut Ave., Washington, D.C. 20009 (202) 234-9330

AUTOMOTIVE GROUP

E. P. RILEY—Executive Vice President

Headquarters: 2355 Euclid Ave., Cleveland, Ohio 44117

A. K. Parrish—Vice Pres., Customer Requirements

A. W. Reynolds—Vice Pres., Aftermarket Operations

C. W. Robison—Director, Industrial Relations

Manufactures a broad line of engine and chassis parts, components and systems for use in automotive and industrial vehicles, marine and aircraft engines, machinery and electrical equipment. Major products include valves and valve train parts, pistons and piston rings, turbochargers, hydraulic and mechanical steering components and systems, ball joints and suspension parts, hydraulic motors, grey iron and ductile iron castings, antilock brakes.

"Thompson" and "Telco" replacement parts are distributed through 41 warehouses and 10,000 outlets in the U.S. 400 replacement outlets distribute "MORC" antifriction bearings. 125 warehouses and 5,000 outlets distribute the "Ramon" piston ring line.

TRW MICHIGAN DIVISION

G. W. Chry—Vice President and General Manager

Headquarters: Warren, Michigan 48092

Plants: Warren, Detroit and Portland, Mich.

MARLBOROUGH DIVISION

R. S. Kennerly—Vice President and General Manager

Headquarters: Jamestown, N.Y. 14701

Plants: Jamestown and Falconer, N.Y.

ROSS GEAR DIVISION

F. H. Davis—President

Headquarters: President and General Manager

Headquarters: Lafayette, Ind. 47902

Plants: Lafayette, Ind., Lebanon, Tenn.

TRW VALVE DIVISION

R. E. Cummings—Vice Pres. and General Manager

Headquarters: Cleveland, Ohio 44113

TRW REPLACEMENT DIVISION

C. L. Hall—Vice President and General Manager

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The TRW Challenge: Yesterday, Today, Tomorrow

Challenge: Since 1953, the technological supremacy of the United States—and the national security it brings—has been challenged twice. First by the threat of Soviet ballistic missiles. Second by Sputnik 1.

In answer to the first challenge, TRW Systems Group, helped bring the Atlas, Thor, Titan and Minuteman ballistic missiles into the national arms inventory.

TRW's answer to the second challenge was the Pioneer 1 spacecraft.

And TRW's response to future challenge is an ever-expanding technology represented by a broad spectrum of evolving spacecraft, space communications and space propulsion systems, and an ever-widening range of systems engineering, integration and analyses services for industry, the Department of Defense, National Aeronautics and Space Administration and other elements of the Government.



BALLISTIC MISSILES
ICBM Systems Engineering

Challenge: Create weapons to discourage a potential aggressor from launching an attack on the U.S.

Verification in 1953 that the Soviet Union would soon be able to launch hydrogen bomb-tipped missiles across intercontinental distances created a national emergency. The United States had to respond quickly or face the inevitable threat of being technologically unprepared and militarily inferior.

Ballistic missile technology, itself, was a challenge. There were few precedents—very little experience—and virtually no experimentation. But this was the only background available, and from it TRW helped develop detailed specifications for missile systems capable of striking, with devastating speed and accuracy, targets half across the world. TRW assisted the Air Force in supervising and directing their development, Test, and Production, along with the Scheduling of delivery to U.S. Air Force launch sites across the U.S. and in Europe.

Our first intercontinental missile, the Atlas, was successfully test flown less than three years after TRW entered its unique relationship with the Air Force. It is now fully operational and, furthermore, has propelled America's first astronauts into space. An intermediate range missile, the Thor, was developed simultaneously with the development of the Atlas. It was deployed at advance bases in Europe in late 1959. And four follow-on generations of intercontinental ballistic missile weapon systems, Titan, the solid-fueled Minuteman I and II and Titan II, have been delivered to U. S. Air Force launch sites according to schedule.



ICBM SITE ACTIVATION
ICBM Site Planning and Installation

Challenge: Design and build vehicles to orbit Earth, Sun and Moon.

When the Soviet Union again challenged American technology by launching the world's first man-made satellite on October 4, 1957, industry received a new assignment: build spacecraft—quickly.

TRW Systems Group responded. Within a year after Sputnik 1, and less than nine months after the U.S. Army matched the Russian feat by orbiting Explorer I, TRW became the nation's first industrial organization to launch a spacecraft of its own design. The NASA-sponsored vehicle, Pioneer I, was launched by a U. S. Air Force Thor missile on October 11, 1958. It reached 70,000 miles into space, which was the deepest penetration to that time.



SATELLITE
Pioneer, Explorer, ERS, OGO

TRW has since designed and manufactured many types of U. S. spacecraft including such historic vehicles as Explorer VI (1959), first to transmit a television photo of the Earth from space; Pioneer V (1960), the first successful interplanetary probe; and the Able series of spacecraft (1958-1960), the first designed for lunar orbit missions.

Other spacecraft now being produced at TRW facilities include: the U. S. Air Force's Vela nuclear detection satellites, NASA's series of Orbiting Geophysical Observatories, Environmental Research Satellites, NASA's series of new interplanetary Pioneer spacecraft, and the Communications Satellite Corporation's INTELSAT III global communications satellites to be orbited in 1968.

TRW's engineers and scientists have been, and are deeply involved, in the nation's manned space programs: Gemini and Apollo. They are also making detailed studies of solar probes, manned space laboratories, manned missions to Mars and Venus, and a broad array of "application" satellites (communications, research, arms control etc.) for the nation's space programs in the next decade and beyond.



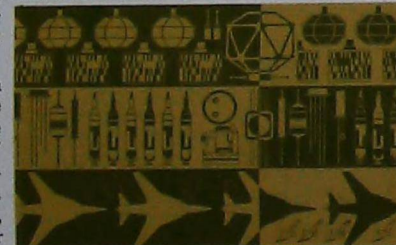
GUIDANCE & CONTROL SYSTEMS
ICBM and satellite eyes, ears and brains

Challenge: Communicate with spacecraft 90 million miles away.

The Space Age required the development of a new generation of electronic systems to locate our spacecraft in orbit, to track them, to send instructions to them, and to receive data from them. Pioneer I, launched by Systems Group for NASA when that agency was less than two weeks old, carried many examples of advanced electronics technology. The communications equipment designed and built for Pioneer I by TRW Systems Group successfully withstood the rigors of an environment never before experienced.

TRW also designed and activated SPAN, the first global network of tracking, telemetry, and command stations used in U.S. space projects. The network included ground stations at Los Angeles, Cape Kennedy, Jodrell Bank, England, Singapore and Hawaii.

A year after the launch of Pioneer I, TRW completed the nation's first spacecraft equipped for two-way communications with the earth from extreme distances in space. The spacecraft, Pioneer V, was launched toward a Venus orbit on March 11, 1960, and entered a solar orbit around Venus and Earth. Transmissions of scientific information received from Pioneer V about four months after launch and from a range of almost 22,500,000 miles established a remarkable record.

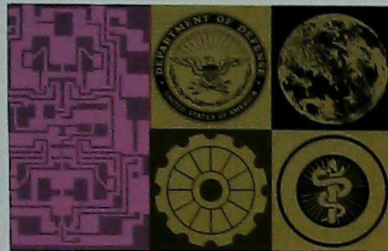


MANUFACTURING
Serial Production of Spacecraft and Components for Missiles and Aircraft

TRW scientists and engineers are also responsible for many significant research and engineering contributions in fields such as solar power, miniaturized computers, and in the design of instruments used to gather data from space.

They designed one of the first spacecraft which used the Sun's energy to recharge its batteries in flight, one of the first digital computers carried aloft in a spacecraft, and many of the instruments first used to study phenomena such as the Van Allen radiation belt, solar plasma, and the Earth's magnetic field in space.

Unusually diversified in electronics, TRW now manufactures a broad range of equipment for use on the ground as well as in space, including systems for tactical warfare. Spaceborne electronic equipment, especially, meets the increasing demands for high reliability, radiation resistance, versatility, and greater data capacity. In addition, considerable effort is being applied in such new fields of microelectronics and laser technology.



MICROELECTRONICS
For Space, Defense, Industry and Civil Systems

Challenge: Explore the scientific world of the unknown.

TRW Systems Group is conducting advanced research in fields nonexistent only a few years ago. Many of these are space-oriented, but because they deal in the fundamentals of nature they have wide applications in many other scientific disciplines.

Quantum mechanics, for instance, is a method of explaining the motion of planets, stars and satellites, as well as the elemental nature of the atom. TRW scientists are deeply involved in the most advanced studies of nuclear particles and their interactions within the nucleus.

What happens when an ash-sized micrometeoroid strikes a spacecraft—or an astronaut? A special linear accelerator has been developed by TRW that uses fine iron dust to simulate micrometeoroid bombardment. The results of these studies will have a decided effect on the selection of materials to be used inside and outside spacecraft—as well as in the clothing an astronaut wears.

But micrometeoroid collisions are not the only space dangers which must be studied so that man can one day make safe journeys to distant destinations. TRW scientists are studying the phenomena of solar radiations of all types — including plasma, cosmic, ultra-violet, x-rays—and developing the instrumentation that will measure them.



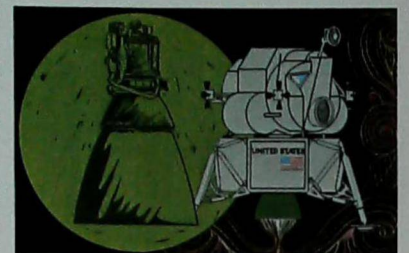
VOYAGER
Precursor to Manned Flight to the Near Planets

Space phenomena occur at fantastic speeds, and experimenters try to simulate these speeds in their earth-bound laboratories. One research project resulted in the development of the TRW Image Converter Camera, a high-speed instrument that can make up to 20 million exposures a second, and "stop" action in as short as five-billionths of a second. The camera is now used commercially, and is being used as a laboratory tool in laser research, hyperballistics, plasma physics, cancer research, and many other scientific projects.

Other TRW research projects range from special studies in oceanography, the science of undertaking the cast region of "inner" space that covers more than three-fourths of our planet, to the development of a new chemistry for converting moon "rock" and

other non-living materials into the life-giving food, oxygen, and water man needs for long missions far from the Earth.

Challenge: Build rocket engines for landings on the Moon and for maneuvering in space.



LM ENGINE
Descent Engine for Apollo Lunar Module

TRW has long been a pioneer in the development of small propulsion units used to control spacecraft in flight. One of the first small propulsion systems capable of being stopped and re-started in space was designed by TRW. Used in the Able-series spacecraft, which were launched on lunar orbit missions in 1959 and 1960, the system was capable of being re-started as many as six times to control the speed of the vehicles and inject them into lunar orbits.

The center of TRW's propulsion activities is its Capistrano Test Site. It is located in a mountainous area near California's famous San Juan Capistrano Mission, just 65 miles from Los Angeles. Here engineers are developing engines for midcourse correction, rendezvous, docking and lunar landings.

TRW is investigating low-thrust engines which use radio-isotopes to provide heat for accelerating the fuel. The NIMPHE (Nuclear Isotope Monopropellant Hydrazine Engine and POODLE—a radio-isotope-heated hydrogen engine weighing 25 pounds—have already been developed. Extensive studies and experiments are being conducted on ion engines—low thrust devices that promise to make travel to the far reaches of our Universe closer to reality—and on gas reactor engines.



APPLIED RESEARCH
Stepping Beyond the State of the Art

Challenge for tomorrow: Land astronauts on Mars.

Today, before the first in a series of unmanned Apollo launches, TRW is preparing for manned flights hundreds of millions of miles into space. TRW scientists have made comprehensive studies of the flight trajectories equipment and hardware needed for manned and unmanned missions to Mars. They consider the likelihood of such journeys a possibility within the next decade.

The entire journey, including the stopover on Mars and the fly-by of Venus, would last between 419 and 436 days. This is half the time it took Magellan to circumnavigate the world 300 years ago.

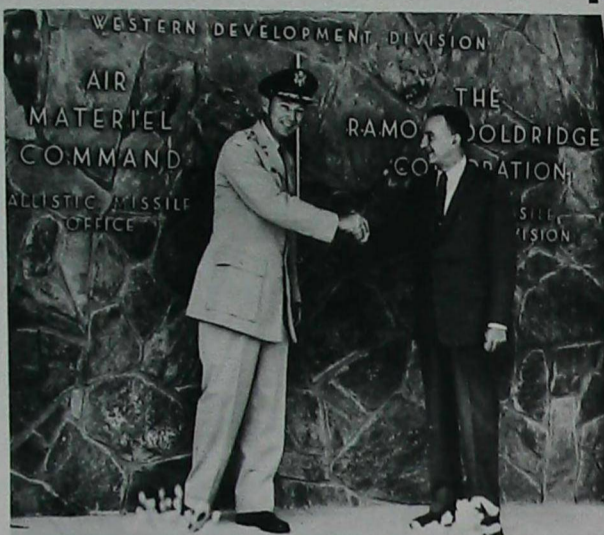
With what data are now available, manned missions to other planets in our Solar System are not contemplated. However, unmanned missions to Jupiter and Pluto are well within our technology. We are unable to forecast what changes in all aspects of our lives the data from these and other missions will bring about. But we are certain of one thing: the opportunities and challenges of space exploration are—as space itself—limitless.

Back on earth, TRW people are applying these sophisticated advanced technology techniques to requirements of what we call Civil Systems. Mass transportation, water resources, land utilization and medical systems are some of the areas where TRW experts are applying the advanced techniques to make sure—that while we're solving many of the problems in space—that our own immediate social problems are also solved.

Systems Group's Growth: From a Barber Shop to a Giant



A CONVERTED BARBER SHOP in Westchester was a pretty unlikely place to start a new organization, but Dr. Simon Ramo, left, and Dr. Dean Wooldridge, right, did just that thing. When the two scientists opened the doors of the Ramo-Wooldridge Corporation, it consisted of an office, one telephone and one secretary, Mrs. Aimee Joy.



THE MEN who directed the building of the nation's first intercontinental ballistic missile force, General Bernard A. Schriever, and Dr. Simon Ramo, congratulate each other at the unveiling of the headquarters plaque of the first Ramo-Wooldridge building.



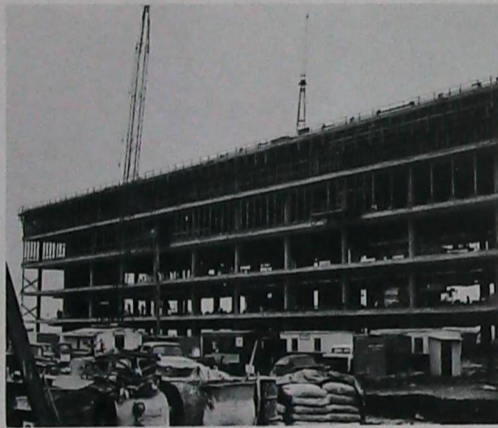
GROUNDBREAKING for Building S took place in early 1962. Dr. Simon Ramo turns the first spaceful of earth as Frederick W. Hesse, third from left, and Robert A. Burgin, second from left look on approvingly. Herbert C. Ball, left, General Manager for Twaits-Wittenberg Company; and Craig Sturm and Karl Klokke, of Albert C. Martin and Associates, also attended the groundbreaking.



VISITORS TODAY will have difficulty identifying what building this is. It's M-1, Space Park's first manufacturing facility.



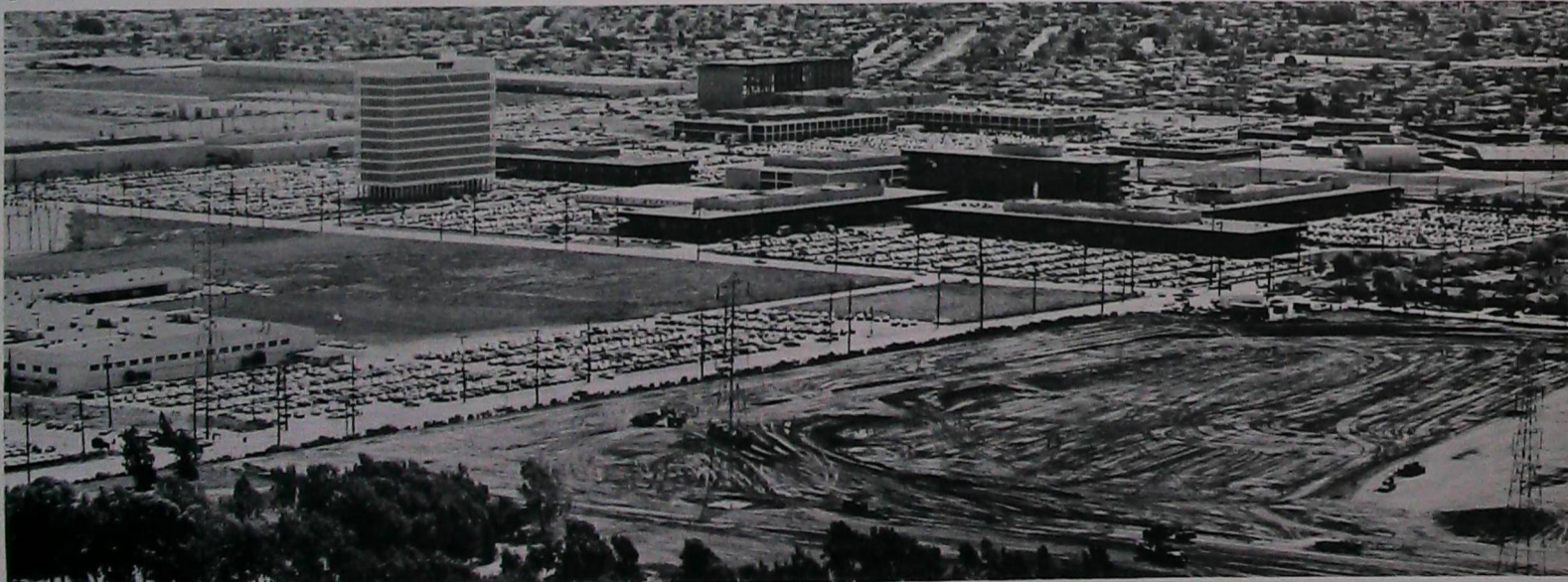
THIS DESOLATE looking corner, Compton and Aviation Boulevards, is now the scene of TRW Systems Group's dazzling Space Park complex. As pictured, there was no parking problem in 1960, and there was little traffic at that time.



PROVIDING A PROFESSIONAL environment for engineers and scientists was one of the first concepts of the Ramo-Wooldridge Corporation. That environment started to become a reality with the construction of Building E.



WHEN THE BASIC complex of Space Park was started, construction on new buildings soon followed. Pictured here is the beginnings of Building S. TRW employees have adjusted to the fact that construction is an on-going activity.



WITH THE PRESENT construction on Building M-3, the Space Park complex will soon be completed. However, just across the street in Manhattan Beach, lower right part of the photo, the initial 40 acres of what could be potentially a 150-acre facility for Systems Group is being prepared for building. Plans are being developed for the site which will house Electronic

Systems Division and Systems Engineering and Integration Division. The announcement of TRW's expansion into Manhattan Beach was made in May at a reception hosting city officials from Redondo Beach and Manhattan Beach. At that time, President Ruben F. Mettler disclosed plans for the new site.

Attractions . . .

(Continued from Page 1)

seen, as well as closed circuit TV, one of which shows a Pioneer spacecraft in a simulation chamber.

There is the glass-blowing demonstration, a tornado maker, spectrographs, and a brew furnace which is capable of reaching temperatures up to 3,000 degrees Fahrenheit.

The computer area is demonstrating "on-line" computers, and from the S-Trailers North, a remote hook-up with the CDRC area is solving "small" problems.

A strobe-scope shows how waving objects appear to stop-start and move backward. A laser beam is used to make holographic pictures of a high-speed object, and compounds change color when exposed to intense light, absorbing the whole visible spectrum. Water is running uphill, and complex waveforms are being separated.

Light spectrums can be seen, heard, and reproduced graphically. Liquid nitrogen is being used to show the effect of extreme cold on various materials, X-ray is detecting metallic elements in an infinitesimal matrix, while a new Electron Beam Micro-analyzer is performing a complete chemical analysis on even smaller samples.

In contrast, there is the structural loading of a 100,000-pound specimen. A mill is programmed to cut metal parts of a complex pattern, and these parts will be used for strength testing demonstrations.

More stationary exhibits include a monopropellant engine; the Anechoic Chamber, open for visual inspection for the first time; various stages of HYSTL, a plastic invented by Systems Group; microelectronic components; earth and solar sensors; weapons systems; lasers; models of spacecraft; hardware and software, and two 16-inch projectiles. Also on display are an Orbiting Geophysical Observatory, INTELSAT III, Mercury, and the Lunar Module Descent Engine.

TRW People . . .

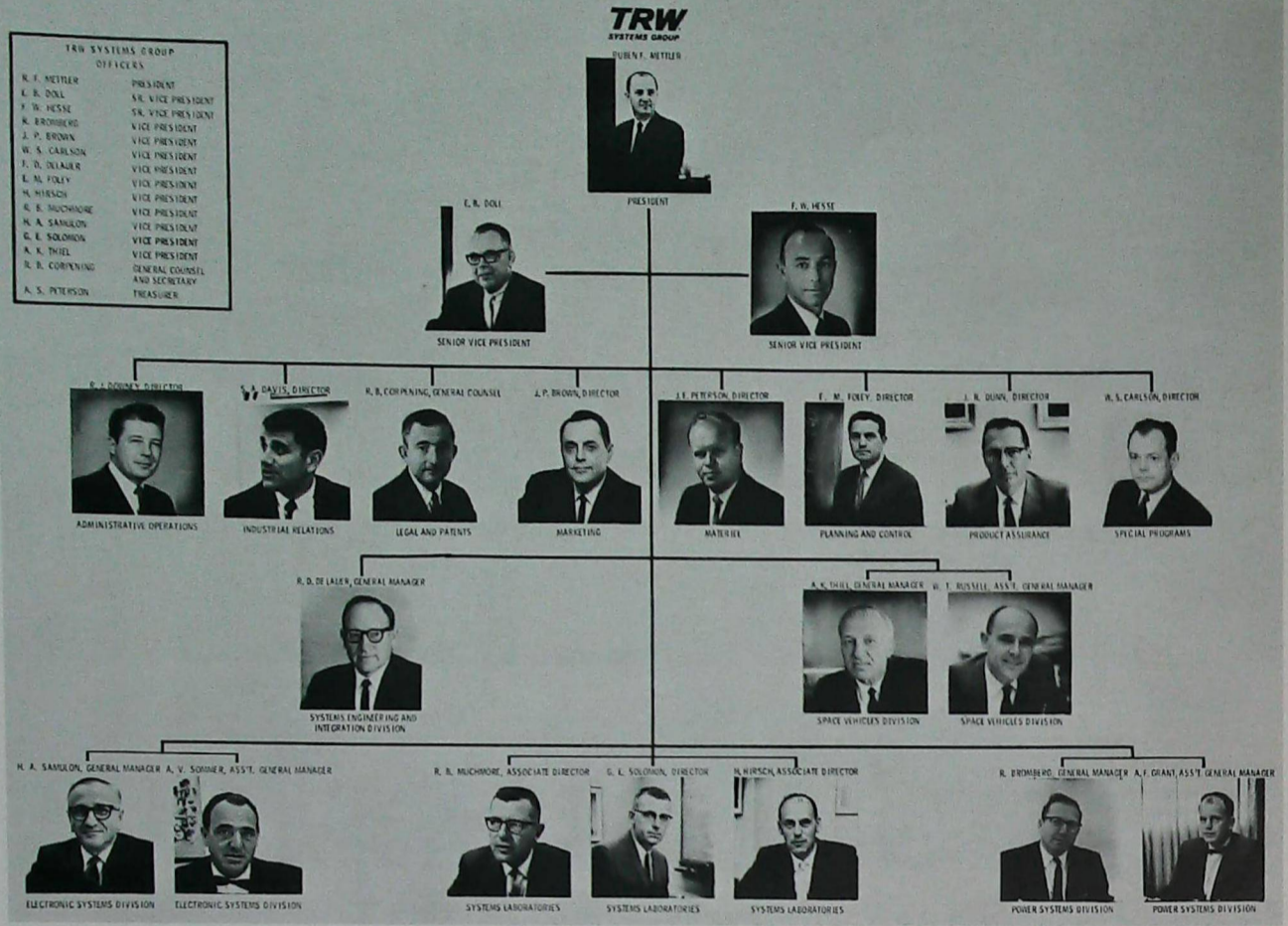
(Continued from Page 2)

projects which relate to the future of the organization and how we want it to be. I think it would be reasonable to say that much of what we are today, we decided to become several years ago.

"For example, we've just completed our 1968-75 plan which will largely determine what kind of an organization we intend to become. From an Industrial Relations point of view, we are very much concerned how we can maintain some of those characteristics which have made us as successful as we are, and how we can improve on them. We feel that in reality, if we merely keep pace with the type of growth we are experiencing, in the long run, we are actually losing ground.

"We've grown from 6,083 employees in 1962 to more than 16,000 this year. Obviously that's a lot of growth in five years. And to keep up with this type of growth requires a lot of effort and a lot of planning.

"As the organization gets bigger, you can lose a sense of personal contact, and that can be a dangerous thing if you don't structure yourself properly and prepare for it. As we enter the last quarter of 1967, one of the key problems on which we are focusing is 'how we can absorb this, and continued growth and still maintain a personal environment.' The answer isn't an easy one, but we haven't achieved many of our successes by working easy problems."



Systems Group Organized into Five Operating Divisions; Seven Supporting Staff Functions

To understand TRW Systems Group's organization, a basic understanding of its divisional structure is needed. Systems is organized into five operating divisions and seven staff functions. Electronic Systems Division, Power Systems Division, Systems Engineering and Integration Division, Systems Laboratories and Space Vehicles Division comprise the "operating" divisions.

Marketing, Administrative Operations, Industrial Relations, Planning and Control, Materiel, Quality Assurance, and the General Counsel are administrative staff functions—each headed by its own director.

Highly Interdependent

Systems Group, though organized by division, functions in fact, as a highly interdependent organization. On any given project, it is possible, and indeed probable, for experts from each division to be called upon to lend their particular discipline to the project. We call this a "matrix" organization whereby the people and their talents are organized around the job to be done.

To describe each of the divisions and their many complexities would be nearly impossible. Hardly any of them are constant and new disciplines and capabilities are being constantly added.

Largest Division

Electronic Systems Division, the largest of the five operating divisions, provides a central source of advanced electronics engineering and manufacturing capabilities to support the needs of Systems Group. Equally important is its role as a business sponsor to develop major electronic sub-systems and equipment.

There are four primary product lines: Guidance and Navigation, Communications, Electronic Data Systems, and Electronic Warfare. Each of these product lines broadly encompasses both hardware and software, as well as various categories of technologically different but functionally re-

lated products. A very broad base of technological skills is further provided by the other areas of supporting research and development capability including Microelectronics, Electric Power, Ground Support Equipment, and Product Support and Logistics, serve to complement and support the product lines.

Product Engineering, Product Integrity, and a comprehensive electronic manufacturing operation complete a well-rounded capability for Systems Group as well as the division. Henry A. Samulon is Vice President and General Manager of ESD.

Power Systems Division

Power Systems Division, with a population of approximately 1,000 persons, is located mainly at Space Park with its management and engineering organizations in Building O-1, test facilities in Capistrano and Inglewood, manufacturing assembly and test facilities in M-1 and M-2, and laboratories in O-1 and Capistrano.

Its main fields of interest and endeavors lie in chemical, electrical and nuclear propulsion, chemical research, analysis and process development, energy conversion, and materials research. Products and capabilities include propulsion systems and subsystems including rocket engines, reaction

control systems, ion engines, and radioisotope engines, nuclear engineering, chemical engineering, and related fields.

One of TRW's most important contributions in the propulsion field is the Lunar Module Descent Engine for NASA's Apollo Program. This throttleable descent engine will soft-land the astronauts on the surface of the Moon. PSD is headed by Dr. Robert Bromberg, Vice President and General Manager.

SEID Widespread

Systems Engineering and Integration Division is working in the application of systems engineering and system integration to large systems or programs as assigned. Particularly in civil systems, weapon systems, manned systems, launch systems, or elements which have major systems engineering content.

SEID is made up of operations in Washington, D.C., Houston, San Bernardino, Florida, Los Angeles, Vandenberg AFB, Calif., and Hill AFB, Utah.

Major programs include support to Minuteman Operation for the Air Force, Anti-Submarine Warfare Programs for the Navy, High Speed Ground Transportation for the Department of Transportation, and support to the Apollo Program for NASA. SEID is headed by Dr. Richard DeLauer, Vice President and General Manager.

Systems Lab

The mission of Systems Laboratories is to provide engineering support and service functions to the other divisions, to conduct research on advanced technologies, and to take the lead in developing new business areas.

In its supporting role to other TRW Systems Group Divisions, Systems Lab provides the following centralized services; Computation and Data Reduction, Reentry and Launch Vehicle Aerodynamics, Trajectory Design and Analysis, Mechanical Hardware Design and Manufacture, Modeling and Simulation of Systems, Applied Physics, Heat Transfer

Role Expands International Ops Broadens Base in Foreign Markets

An important part of TRW Systems Group growth during the past few years has been its expansion into overseas markets. Currently, the Group has operations in more than a half-dozen countries ranging from France to Australia. It is also gaining footholds in Latin America and Southeast Asia.

Worldwide Program

One of its biggest international projects in terms of scope is INTELSAT III, the global communications satellite system which TRW is building for the Comsat Corporation to provide a worldwide telephone and television network in 1968. For this program, TRW has selected a team of eight European and Japanese contractors to manufacture subsystems and components. Thus the satellite system, designed for worldwide use by the 58 member nations of Comsat's Interim Committee, is being built by a multinational TRW contractor team.

TRW has two joint venture companies at opposite sides of the earth. One is MATREL, formed with the French company Engins MATRA, and it is now under contract to CNES, the French Space Agency. The other is Mitsubishi TRW Company, Ltd., formed with Mitsubishi Electric Corporation to design and build earth stations for the global communications satellite system and to conduct space activities in Japan. Just this month, MTRW was selected by the Mexican government to build, with Nippon Electric Company, the first earth station in Latin America in time for live telecasting of the 1968 Olympics in Mexico City.

Contract Won

Recently, TRW formed a team of European licensees to bid on a major program for the European Space Research Organization (ESRO). This team won the competition for a \$22 million contract to build an unmanned scientific satellite series called TD-1 and TD-2. TRW also supported Hav-

SPECIAL THANKS

Several System Group employees contributed significantly in the preparation of this Family Day, 1967, edition of SENTINEL.

We wish to thank Jim Riehman, Manager of Advertising, for his assistance in color preparation; Tom Branigan of Public Relations, for technical guidance; and Frank Warren and the Art Services group for their support and interest.

Special thanks should also go to Bob Crowe, Personnel Manager for Space Vehicles Division; and Joe Reubel, Personnel Manager for Systems Laboratories; for their advice and guidance in this, and in all, editions of SENTINEL.

(Continued on Page 6)

(Continued on Page 6)



FISH EYE VIEW of Space Park "quad" shows the reflection pool, and E-2 off in the background. Taken from R-2, this photo shows System Group's campus-like atmosphere which is considered among the best in industry.

Systems Group Photographer Bob Young photographed this section of Space Park with a special fish eye lens which has been added to the Still Photo Lab. The picture has appeared in several prominent places including the recent Redondo Beach Chamber of Commerce brochure.

Part of 186th Anniversary Observance

Space Park Architecture Judged Among Best In The Greater Los Angeles Area Competition

TRW Systems Group's dazzling Space Park architecture was judged among 36 buildings in the Greater Los Angeles area representing the best in post-World War II architecture.

Mayor Sam Yorty initiated the competition as a feature of Los Angeles' 186th anniversary observance on September 4. Names of the selected buildings and their architects were revealed at a formal banquet of the Southern California Chapter, American Institute of Architects, at Century Plaza.

Jury Comments

In its critique, the architectural jury commented:

"Los Angeles is both a beautiful and ugly city, so large that any overall adjective may apply, depending on your point of view at the time."

Judges in the competition were John Merrill, chairman, from the San Francisco architectural firm of Skidmore, Owings & Merrill; Sam Hurst, Dean of the USC School of Architecture and Fine Arts; George Dudley, Dean of the UCLA School of Architecture and Urban Planning; Kenneth Ross, General Manager of the Municipal Arts Department; and Art Seidenbaum, Los Angeles Times columnist.

Award Winner

Space Park was also the recipient of one of the Los Angeles Beautiful Community Awards by the Los Angeles Chamber of Commerce last year.

TRW was one of 40 selected from more than 400 nominations. Criteria for determining the award included landscaping, planting of trees, maintenance, and the general effect the buildings have on the surrounding area.

Architects for Space Park are Albert C. Martin and Associates; general contractors are Swinerton and Walberg Company; and Phil Shipley is the landscape architect.

Emergency Numbers

Three nurses and one doctor will be on duty during Family Day should an emergency arise. They can be reached by calling the Emergency Number, Ext 64141.



SPACE PARK ARCHITECTURE was recently selected among the 36 buildings in the Greater Los Angeles area representing the best in post World War II architecture. The competition was initiated at the suggestion of Los Angeles Mayor Sam Yorty. This dramatic photo of E-2, TRW's 11-story high rise, illustrates why the facility has won awards for its architecture. (Photo by Gary Kious)

Systems Group Employment History

	January 26, 1958	
Total	.....	1,822
	December 28, 1958	
Total	.....	2,928
	December 27, 1959	
Total	.....	4,685
	December 25, 1960	
Total	.....	4,376
	December 24, 1961	
To Aerospace	.....	2,290
Total	.....	4,647
	December 30, 1962	
To Aerospace	.....	1,489
Total	.....	6,083
	December 31, 1963	
Total	.....	7,182
	December 31, 1964	
Total	.....	7,779
	November 7, 1965	
Total	.....	10,282
	December 30, 1966	
Total	.....	12,971
	August 18, 1967	
Total	.....	15,280

New Sculpture Scheduled for Reflection Pool

The reflection pond in front of the patio area of the new R-5 building may soon contain the sculpture now occupying the pond in the center of the Mall. Representing the solar system, this creation is the work of Ben Mayer of Los Angeles.

It depicts flight into space, with the center being Earth, the Sun is the red wing, and the Moon, the blue wing. The Rebus Band in the center represents infinity.

The sculpture also symbolizes the fourth dimension in time, with the size and location of all the planets shown except Pluto. The area is not large enough to show the correct location of Pluto in relation to the other planets.

Plans are in progress for a new sculpture to be designed for the reflection pond in the Mall. Designs are being submitted by Ben Mayer, and by Jerry Kirk, sculptor, formerly Personnel Manager for Power Systems Division.

International . . .

(Continued from Page 5)

ker Siddeley Dynamics and Engins Matra in the design and construction of the ESRO-II satellite.

Said Howard Sachar, Director of International Operations: "An important aspect of our success in international activities is the fact that we have affiliated ourselves with the best companies in the world. Our partners and licensees, such as Hawker Siddeley Dynamics, Engins Matra, Erno, SAAB and Mitsubishi Electric Corporation, have the technical capabilities and reputations in their countries that we have in ours. It has been our objective to affiliate ourselves with the leaders, and so far we have been able to do this."

Billion Dollars . . .

(Continued from Page 1)

an increase of 14 places over last year's rating. TRW also ranks 37th as industry's largest employer with 60,000 employees in 200 worldwide locations.

In a recent article about TRW, TIME MAGAZINE said, "Big and diversified as it has become, TRW refuses to consider itself a conglomerate for the simple reason that its product lines are so compatible."

Organization . . .

(Continued from Page 5)

and Fluid Dynamics, and Structures and Dynamic Analysis and Testing.

The Physical Research Center provides the control organization and facilities for both basic and applied research, both important to the future of Systems Group. It is working in the fields of Space Physics and Instrumentation, Exobiology, Electronics and Solid State Physics, Thermodynamics and Aeroscience.

Systems Lab also takes the lead in the development of new product lines for Systems Group. This includes the examination of new and unfamiliar areas of the business spectrum to whether or not Systems Group's capabilities can be profitably applied.

The major product lines of Systems Lab are: Mission Analysis and Simulation, Reentry Systems, Space Instrumentation and Experimentation, and the Environmental Research Satellites. Dr. George E. Solomon heads Systems Lab.

Space Vehicles Division

Space Vehicles Division, headed by Dr. A. K. Thiel, Vice President and General Manager is responsible for program offices for system design and management of all TRW's spacecraft. Current programs are OGO, the interim defense communication satellite, and three classified spacecraft, TRW's organization facility for assembling and integrating and testing the spacecraft is also a part of SVD. In addition, the division undertakes major system studies that prepare the way for future spacecraft, such as the Navigation Satellite Study now being conducted for NASA.

Staff Functions

Management feels that certain functions are best performed by locating staff representatives who are assigned to and working with divisions directly. Marketing, Planning and Control, Materiel, Quality Assurance, Product Assurance, and Contracts have offices in each major division.

Also in line with this decentralized staff approach, Industrial Relations assigns Personnel Managers, a Wage and Salary and Personnel Placement Representative to each division. Also, the resources of Career Development's Training Staff is available to the divisions to meet technical, managerial and interpersonal needs.

Administrative Operations has five major areas which include many vital functions which "keep the organization moving." They are Public Relations and Advertising, Technical and Administrative Services, Civic and Governmental Relations, Real Estate and Facilities, and Industrial Engineering.

SENTINEL

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