JOHNSONITE

NEWS MAGAZINE OF THE JOHNSON SERVICE COMPANY/ FALL 1962

VOLUME 24, NUMBER 1

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About the Cover

Our future as a nation at peace depends on the "make-em-think-twice" power of an impressive team of intercontinental missiles. The Johnson team of people, products and service have a key role in this missile shield that is basic to their useful life.

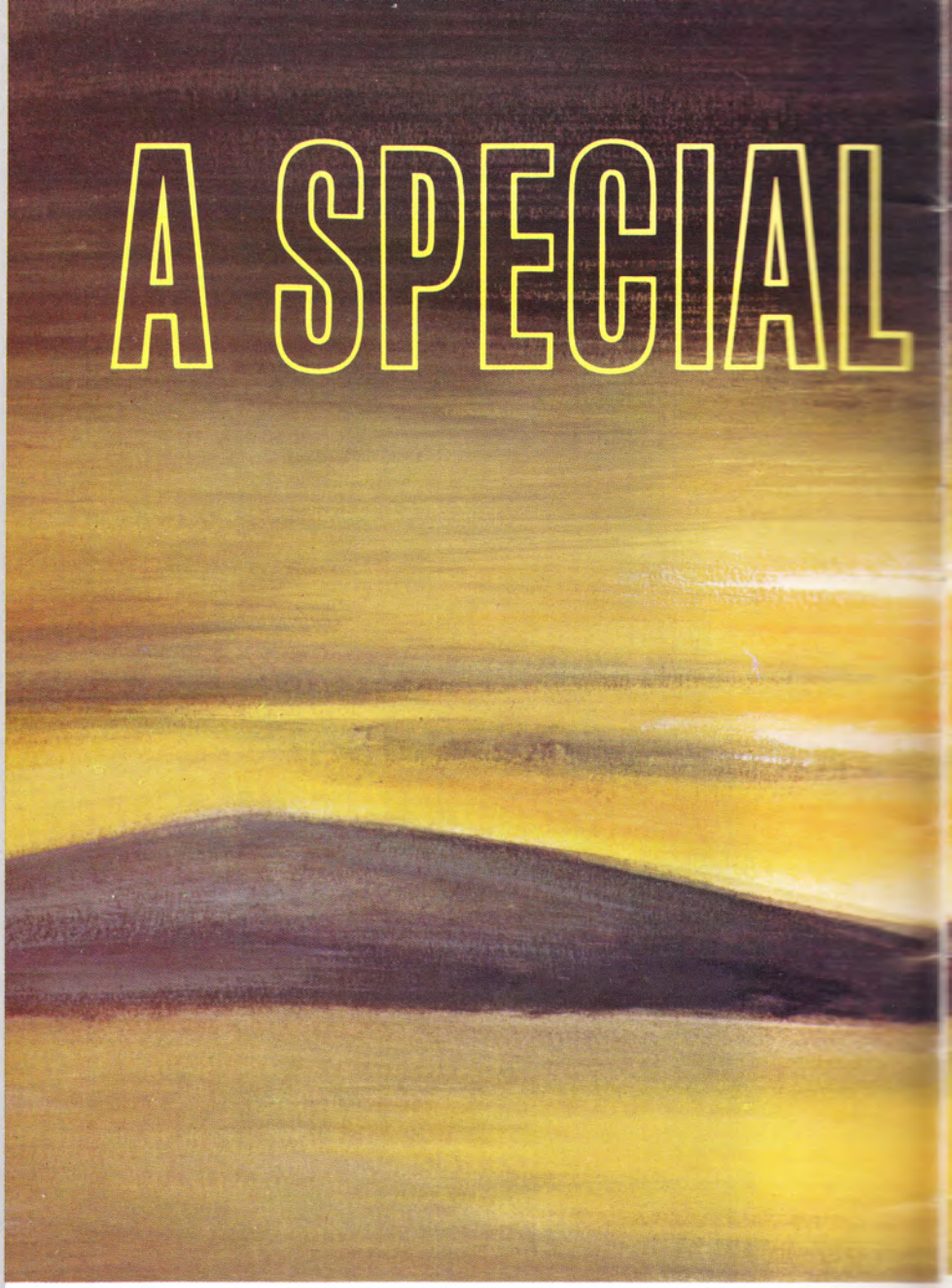
The JOHNSONITE

News Magazine of JOHNSON SERVICE COMPANY

Published in Milwaukee by and for Johnson Service Company employees everywhere

EDITOR — JIM BRUFLAT

Vol. 24 — No. 1 — Fall, 1962



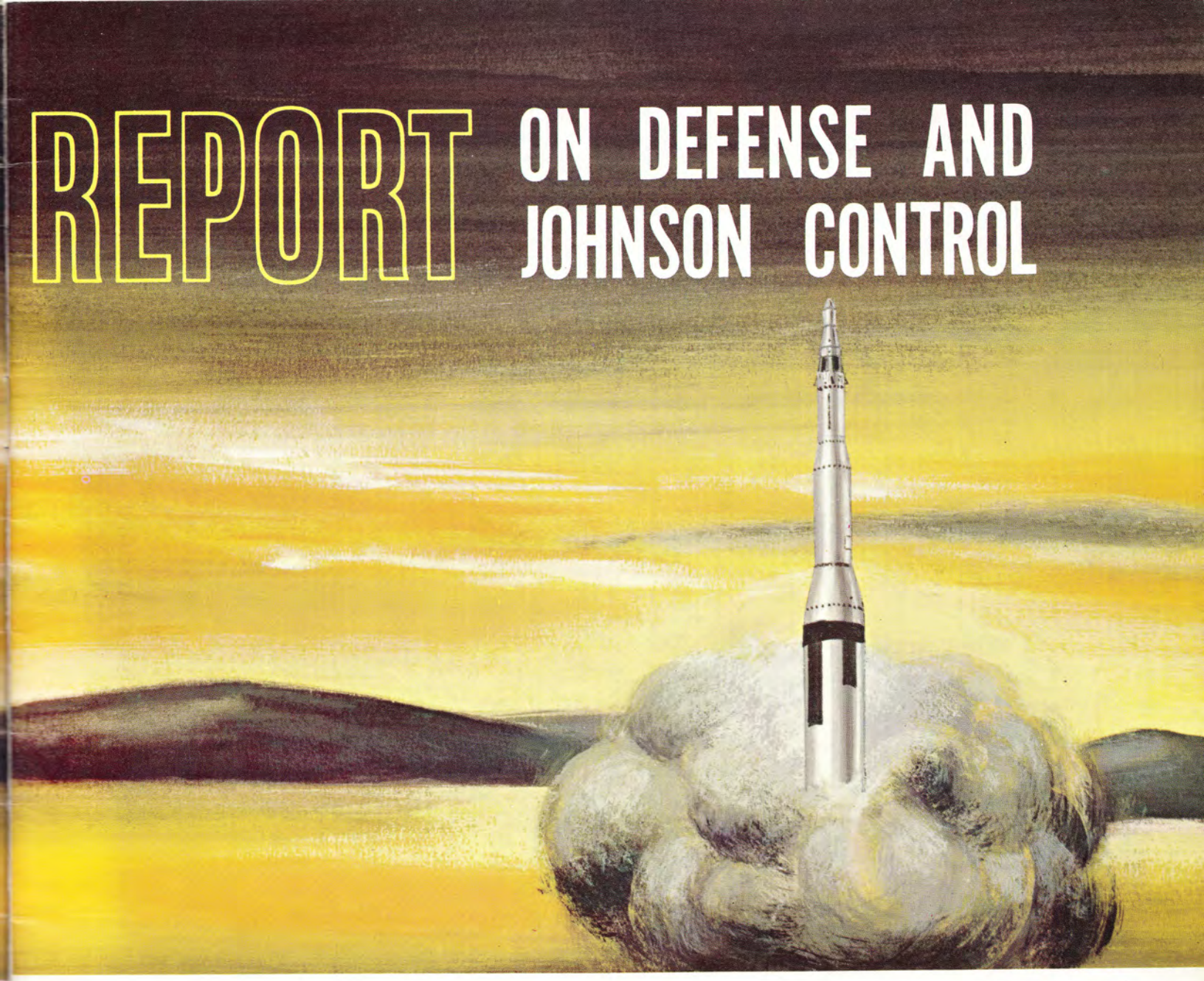
A whisper of soft yellow light lingers in the sky. The new night is a study in quietness. Yet there is tension, excitement everywhere. Men move briskly about, their speech careful, distinct monotones. Complex equipment is checked, double checked, and then checked again.

Moments later the stillness is pierced with a muffled roar as a Minuteman leaps from its hiding place within the earth. It strains skyward in a fiery burst of energy.

In seconds it is out of sight. Its journey is smooth and effortless as it streaks towards a simulated target.

Another successful test firing has just been made. Americans everywhere feel certain that another step in this country's never-ending race to develop an undefeatable deterrent to surprise attack has been made.

REPORT ON DEFENSE AND JOHNSON CONTROL



Every successful test firing of a missile brings a sense of relief, no matter how short-lived. The confidence of taxpayers, who bought the missile's one-way ticket and, in fact, the missile itself, is renewed. Technicians, scientists, engineers, construction specialists, and administrators who nursed the project along feel a new spark of enthusiasm. The nation's most respected manufacturers roll their sleeves even higher to develop the best possible components and know-how and thus assure the continued success of our vitally important defense program.

A roll call of these manufacturers, who have an unprecedented responsibility to the nation, would be most impressive indeed. Names like Boeing, General Dynamics, Martin, North American Aviation, and Johnson Service Company stand out on an honored list.

This issue of the JOHNSONITE is a special report on the important role Johnson Service Company plays in our nation's defense picture.

It is a big story, an important story, one of serious concern to everyone, one that deserves to be told in detail. It covers a lot of ground and a lot of water and a *lot* of air. It ranges from radiosondes and echo boxes of 1943 vintage to environmental control systems for Minuteman sites still on the drawing boards. But most important, it is the story of our people . . . of our Company . . . and their combined efforts.

It is this story you are about to read.

MISSILES FROM ATLAS TO ZEUS ! ! !

Since the dawn of the space age, missiles and rockets have made their bow at a fantastic rate, in all sizes and shapes with a multitude of purposes.

Today, in the arsenal of the United States alone, there exist missiles powered by liquid fuel, solid fuel, or both. Their flight missions range from surface-to-surface, surface-to-air, air-to-air, and air-to-surface. They can whoosh along for distances ranging from as little as five miles to as much as nine thousand miles. They are guided by radar, inertial guidance or by one of the complex systems designed for a particular missile to meet a particular problem.

And rockets! Rockets have already been developed that can streak through and beyond the atmosphere at better than 25,000 miles per hour and travel to the moon and beyond. There

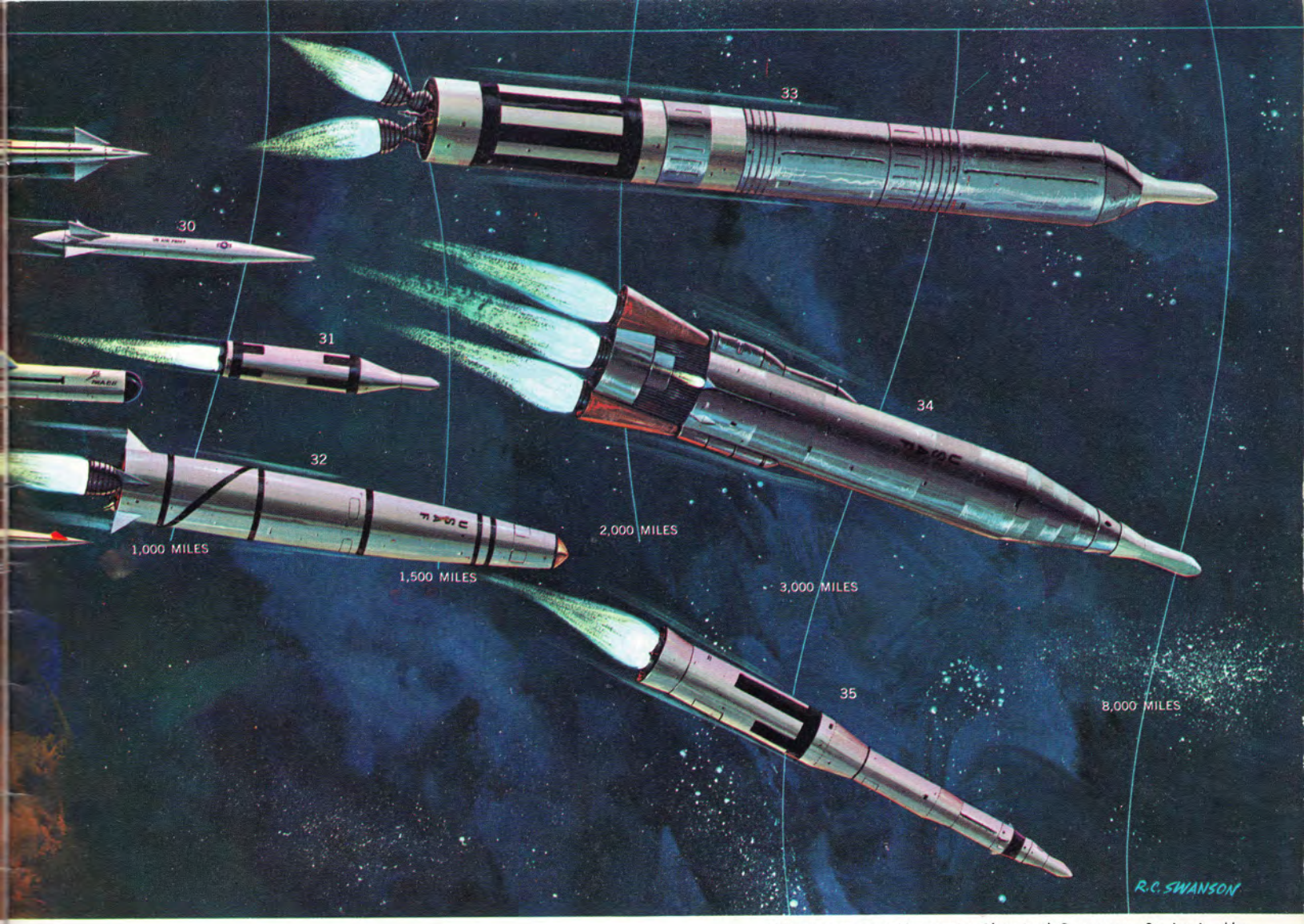


Chart courtesy Monsanto Chemical Company, St. Louis, Mo.

America's missile arsenal, created to defend peace and freedom, with each member specially designed for specific missions. All shown in relative scale except No. 27, Pershing, which is half size for space reasons. Vertical lines show respective ranges.

1 — RED EYE, Army, surface-to-air
2 — ENTAC, Army, anti-tank
3 — SIDEWINDER, Navy-Air Force, air-to-air
4 — MAULER, Army, surface-to-air
5 — DAVY CROCKETT, Army, surface-to-surface
6 — GENIE, Air Force, air-to-air
7 — FALCON, Nuclear, Air Force, air-to-air
8 — FALCON, infra-red guided, Air Force
9 — FALCON, radar guided, Air Force
10 — LA CROSSE, Army, surface-to-surface
11 — ASROC, Navy, surface-to-underwater anti-sub
12 — SUBROC, Navy, underwater-to-underwater
13 — SPARROW III, Navy, air-to-air
14 — BULLPUP, Navy-Air Force, air-to-surface
15 — HONEST JOHN, Army, surface-to-surface
16 — LITTLE JOHN, Army, surface-to-surface
17 — HAWK, Army, surface-to-air
18 — TARTAR, Navy, surface-to-air
19 — SERGEANT, Army, surface-to-surface
20 — TERRIER, Navy, surface-to-air, surface-to-surface
21 — TALOS, Navy, surface-to-surface
22 — NIKE-HERCULES, Army, surface-to-air
23 — NIKE-ZEUS, Army, surface-to-air
24 — BOMARC B, Air Force, surface-to-air
25 — MACE, Air Force, surface-to-surface
26 — TYPHON, Navy, surface-to-air
27 — PERSHING, Army, surface-to-surface
28 — QUAIL, Air Force, air-launched decoy
29 — HOUND DOG, Air Force, air-to-surface
30 — SKYBOLT, Air Force, air-to-surface
31 — POLARIS, Navy, underwater or surface-to-surface IRBM
32 — THOR, Air Force, surface-to-surface IRBM
33 — TITAN II, Air Force, surface-to-surface ICBM
34 — ATLAS F, Air Force, surface-to-surface ICBM
35 — MINUTEMAN, Air Force, surface-to-surface ICBM

are rockets 23 feet high and some 111 feet high. Even the X-15 is a rocket, though it is controlled by a human pilot.

What part do Johnson Service Company and 4,000 Johnsonites play in the Buck-Rogers-type epic unfolding daily before us?

To put it simply: Johnsonites have the skill and Johnson Service Company has the product to provide environmental control for: a) the manufacturing plants where space vehicles are produced; b) the engineering laboratories where they are created; c) the actual silos, control buildings, or what have you; and d) control centers where guidance computers and actual firing controls are located, that absolutely demand the best possible environmental control for maximum safety and efficiency of operation.

JOHNSON in our world of defense

The corporate organization of the Johnson Service Company is built around a simple concept — to design, manufacture, install, and service automatic temperature and air conditioning control systems. This is the concept of *complete responsibility.*

Our *product* is a control system backed by the multitude of skills, the wealth of knowledge and experience and the dozens of specially designed devices that go into its creation and application.

Defense systems today are highly complex and efficient (and must be to protect us from all possible aggressors). They demand total reliability from beginning to end, as explained on page 12 and in the story of the Minuteman.

Complete responsibility, as defined at JSC, *means* total reliability of the part the Company has in the defense picture.

The concept and the course of its development date back to principles laid down by Professor Warren S. Johnson. He was deeply concerned about the quality of performance his systems gave each customer. To make sure Johnson control systems would satisfy the customer, he set up the service arm of the Company, and refused to sell any products that would not be installed and serviced throughout their lives by that arm. That policy is still very much in force.

These simple facts, obvious but important, explain how JSC fits into the defense picture from a request for 12 echo boxes to a one and a half million dollar missile base contract.

In both instances Johnson has the people and the organization to meet the terms of the contract.

Here are a few of the dozens of examples that came to light recently:

problem:

The guidance system of one of the missiles in operation with our armed forces is a very hot-headed gadget and threatened to burn itself up before its job was done.

Johnson, through its branch engineers, designed and installed special controls for a cooling system that cools its fevered brow in storage and through firing.

problem:

Guidance controls for some of our fancier weapons have infinitely small parts. Bearings the size of a speck of dust, springs finer than hair, vents and valves that might be a tight squeeze for a germ. All to make superfine adjustments in the flight of a missile where a tic of error would land the warhead miles off its target.

These controls are built in "white-white" rooms, many times cleaner than the most sterile operating room. The air in the rooms is filtered many times, and modulated exactly by Johnson controls, of course. The controls are so precise they register and allow for the effect of body temperature and perspiration of the workers.

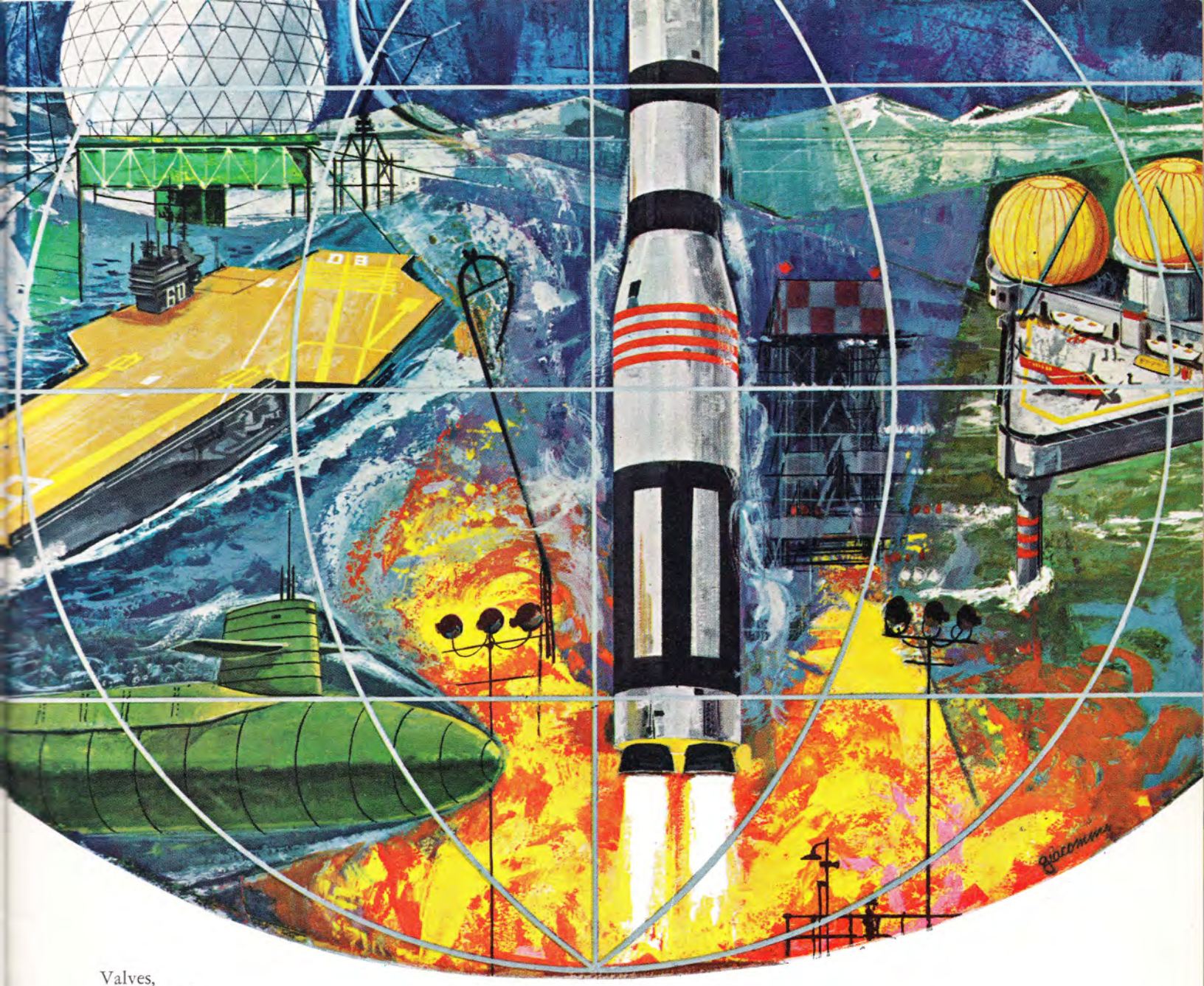
From the beginning of the super-clean, carefully controlled manufacture and assembly rooms, Johnson engineers have designed and technicians have installed controls to meet the most rigid requirements.

problem:

To prove that Johnson control components could stand the strain of a missile firing or the shock of a near-miss nuclear blast aimed at a missile site.

Johnson's test laboratory engineers tackled and solved this problem in short order.

The engineers built a framework of springs and mounts and scales that duplicates, as nearly as possible, the jarring thump of an atomic explosion.



Valves,
controls and
other components
are mounted on the device and jolted repeatedly to get positive data on their ability to "stand the gaff."

The result: rare proof that Johnson products (all parts used in missile site construction must be standard production items) are as durable as they come.

problem:

The huge scanning radar stations that sweep the northern sky to give precious minutes of warning in case of a sudden missile attack. They are set in a lonely unfriendly land with weather as foul as any on earth, the men at the stations testify.

Yet inside the domes protecting the scanner the air must be warm and dry and clean through the worst nor'easters the Arctic can brew. More vitally, the face of the scanner rooms — the "window" the scanning eye must "see" clearly through must be wiped clear of condensation and ice at all times.

The "window wipers" operate like the defroster on an auto. Huge blowers bathe the face of the room, melting ice and sucking away moisture.

The sensing devices and the control center that operate the systems were engineered and installed by Johnson through its Seattle and Syracuse branches.

problem:

The government needs somebody with a bit of a sleuth in him, and a passion for having things just right, not to mention the patience to check the same system repeatedly just to make sure.

His job: to check and test control systems at missile launching sites, both in the preliminary development stages and at operational bases.

The men for the job so far have turned out to be Johnson technicians from our branch offices. In the early days of the missile program, these men were found to have the know-how to do the job properly without going through long and tedious training.

Although most of this work has centered around Vandenberg AFB, served by the Los Angeles branch, other branches have become involved as sites were chosen in their territories.

No Johnson products have been involved in this work, but JSC engineers have gained valuable experience in working with military organizations and in meeting their most rigid specifications.

TO SERVE...

A LIVING COMPANY CHANGES AND GROWS

Defense of a nation in the missile age is a complex activity covering much of the continent, and a good deal of the water around it.

Compare it, if you will, to your body and its nervous system. The senses alert the brain to dangers which are approaching. The brain, in turn, decides what action to take, and co-ordinates the defenses or sets up offensive action if necessary.

The senses of our nation's body are the DEW line, BMEWS, SAGE and the Texas Towers and other warning systems, all with direct lines to defense control centers. Defense centers, the brain, are manned and equipped to evaluate the threat, and to mobilize the action against it.

They have available a growing network of defensive weapons — missile busters and interceptors — to ward off attack, and of retaliatory weapons which are scattered and protected from attack, ready to return the blow. (Some of these are shown on the preceding page.)

A peaceful man, or country, hopes the defenses will never be used, but knows they must be ready and able to meet all threats, or an attack will surely come.

The organization of Johnson Service is similar to the nervous or defense system, except that its goal is to provide and service controls for many applications.

Both the central plant and branch network have provided the flexibility to meet defense needs, just as the dependability and adaptability of Johnson Controls have made them the preferred equipment in missile installations.

Managers and sales engineers in many branches have served as "senses" for JSC, seeking out defense projects in their territories and nailing down contracts.

Several departments of the central office provide the "brains" in defense projects. Most deeply involved, perhaps, is the General Sales office, which is at once responsible for co-ordinating the work of the branches to eliminate unnecessary duplications, and to steer them toward new projects; and for bringing in other departments involved.

Early defense contracts were handled in this way, much as any contract for Johnson Con-

johnson and the

As missiles have become the front line of defense, open space, the moon, the planets and beyond have become our most exciting and challenging frontier.

The pioneers who are exploring the fringes of this frontier use huge rockets and complex space vehicles as tools. Most of them work out of the sprawling National Aeronautics and Space Administration installation at Huntsville, Alabama.

The NASA facility is called the George C. Marshall Space Center and is the nation's most complete establishment for the development of large rockets.

Latest project is the Saturn, a multi-engine giant towering more than 160 feet on the launch pad. This rocket will be able to place the three-man Apollo spacecraft in earth orbit.

Johnson Controls are very much in evidence at the center. James Gaynor, Construction and Service Supervisor, Birmingham branch, reports that Johnson has had well over a hundred contracts for buildings at the installation. All types of buildings are Johnson-controlled, from the four million dollar central laboratory, under construction, to assembly buildings and motor test stands for the huge Saturn.

Again, the dependability and adaptability of Johnson Controls have put them at the service of our country.

Photo at right shows the first flight configuration of the giant Saturn C-1 rocket in the fabrication and assembly engineering division at George C. Marshall Space Flight Center. This building along with most others at the sprawling NASA headquarters is equipped with Johnson controls.

trols, and for a time, the system was adequate.

However, problems developed as weapons and their installation became more diversified. Projects began springing up in remote sections of the land, in places where the nearest Johnson branch might be small and not equipped to handle large jobs.

The solution was a new department, Systems Engineering and Construction Division. SECD was set up specifically to deal with and to engineer and supervise special projects which do not fit into the usual pattern of branch work.

Head of the new department is R. L. Schroeder, formerly branch manager of Portland, Oregon. He established headquarters with the San Francisco region in Sausalito, California, near missile development headquarters at Vandenberg AFB.

SECD is brought into special projects by request of regional managers, to carry out engineering, organization and construction. It coordinates planning for projects that may be installed by a number of branches.

Typically, a SECD construction engineer will be assigned to a branch office to head up a project team. He will be responsible for the installation of Johnson systems, and will train local technicians who will service the installation under direction of the branch manager.

Now celebrating its first birthday, and growing fast, SECD is second only in volume to the New York office.

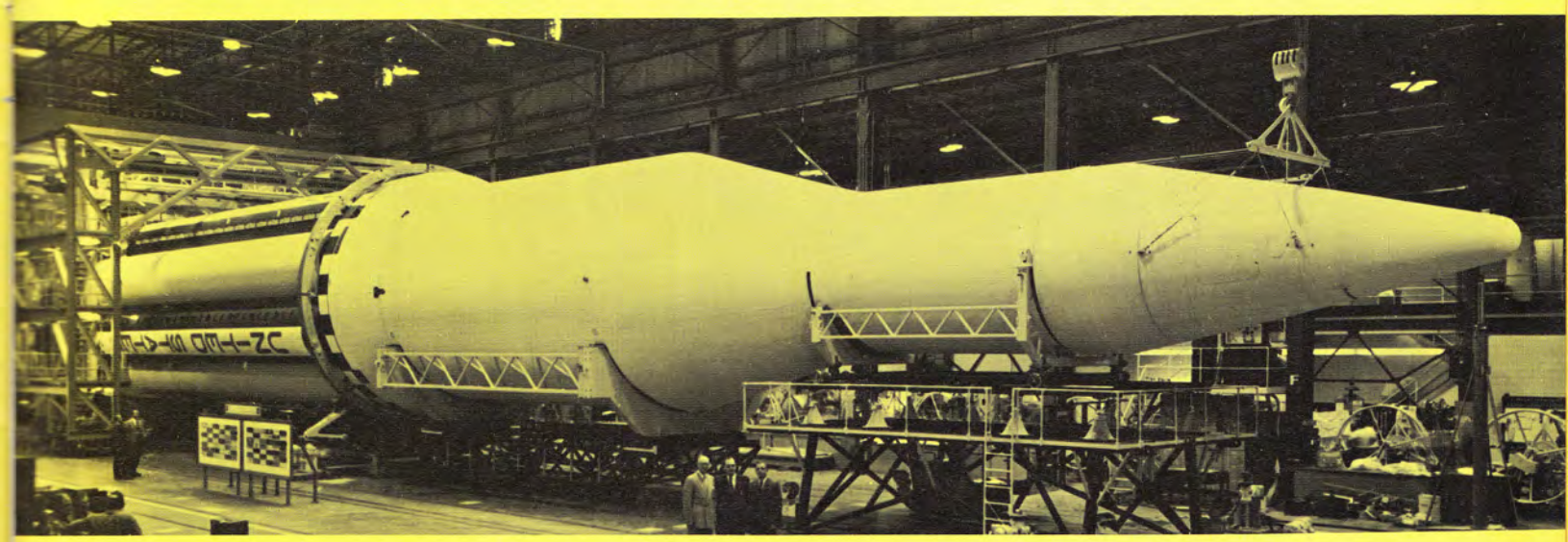
Though it is a division of the General Sales Department, SECD is headquartered in California to provide on-the-spot consultation on prototype projects at Vandenberg AFB, California, through Norman Lamb, base superintendent.

In Milwaukee, the team which provides overall co-ordination between SECD, the branches and in-plant departments includes: Sales, E. C. Doyle; Application Engineering, N. J. Janisse; Program Scheduling and Expediting, W. D. Hochuli; Quality Control, E. Sobczak; Product Engineering and Reliability, K. L. Holmes; and Production Planning, R. Kubal.

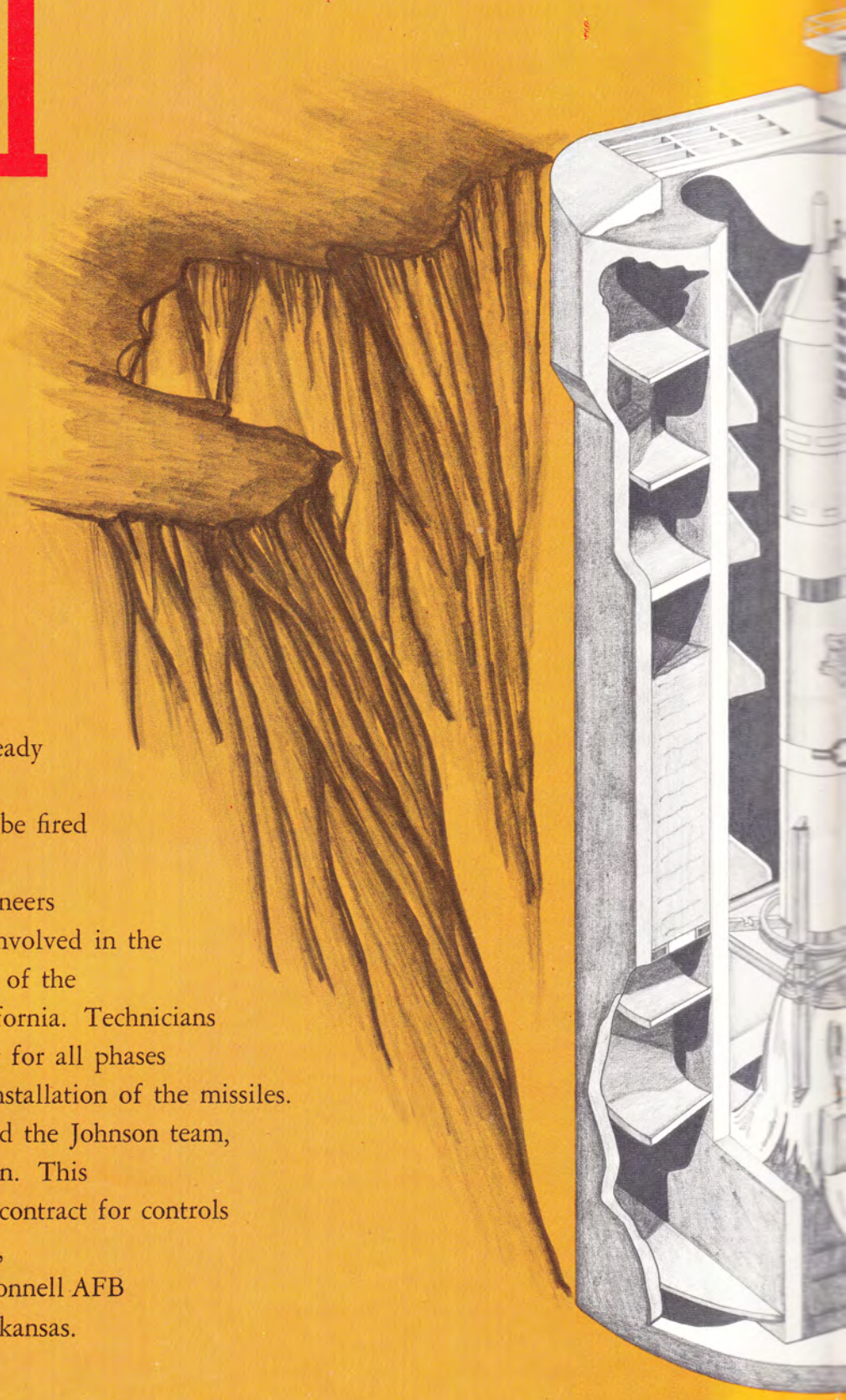
The coming of SECD was not the beginning of Johnson's defense work in the missile age. Branches in all parts of the country had already obtained and completed important contracts, up to and including TITAN I sites at Larson AFB, Moses Lake, Washington. Installation at this base was made by Bill Oakley, who has since been transferred to SECD and assigned to the TITAN II sites at Davis-Montan AFB, Tucson, Arizona. Other missile-experienced branch engineers have also joined SECD and are at work in many locations.

Through the short but hectic history of Johnson's defense work the team concept has always been applied. It has been, and we are sure will be, a dedicated team.

space pioneers!



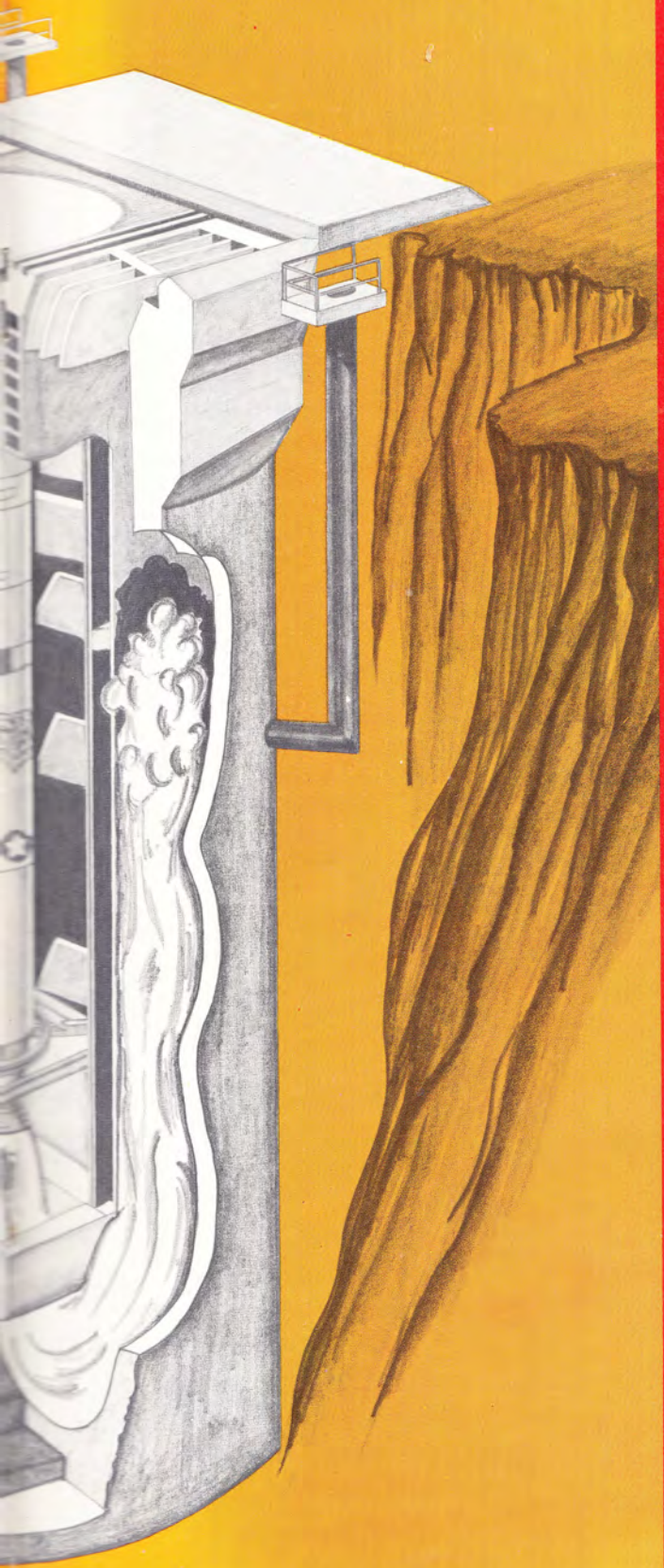
TITAN II ON THE LINE!



It was on this improved liquid fuel missile program that Johnson really moved into high gear in the defense program.

Titan II was developed to go into hard sites, underground, fueled and ready to fire after a moderate countdown. It was the first of the missile team to be fired directly from its "silo."

Here again through its branch engineers and technicians Johnson was deeply involved in the development of environmental control of the prototype at Vandenberg AFB in California. Technicians also provided Controls System Testing for all phases of the development and operational installation of the missiles. By this time, too, Johnson controls, and the Johnson team, had proved themselves beyond question. This hard won reputation brought JSC the contract for controls at all three operational Titan II bases, at Davis-Montan base in Arizona, McConnell AFB in Kansas and Little Rock AFB in Arkansas.



MINUTEMAN

ace in the hole

Minuteman, the fourth distinct ICBM developed by this country, is the United States' ace in the hole. With only minutes notice this formidable piece of rocketry can strike with lightning-like speed, delivering a devastating nuclear payload with unbelievable accuracy on targets thousands of miles across the horizon.

Hidden snugly in a bomb-proof silo, it already is regarded as the most convincing addition to the U.S.'s nuclear deterrent arsenal.

Minuteman is the first solid-fueled missile and it owes its great readiness chiefly to this fact. Less than a minute is needed from decision to actual firing.

So highly-regarded is this program that specifications for every component and all support equipment and facilities, without exception, have never been more rigid. In oversimplified terms, complete reliability is a must. In fact, it has been the key guide factor in every phase of the Minuteman program.

"Minuteman provided our Company with an opportunity to prove what we have known for years, namely, that Johnson has the equipment and manpower to provide the most reliable control system available anywhere in the world," said E. C. Doyle, Assistant General Sales Manager.

"At the very beginning," Doyle explained, "Space Technology Labs, the government agency responsible for specifications, decided that Minuteman would require the highest reliability factor yet assigned to any U.S. missile program.

"These specifications included, of course, the automatic temperature and air conditioning control system, more important than ever with the delicate, complex equipment required at the site. Electric controls could not meet the

(Continued on page 19)

johnson meets the challenge of

The complete responsibility concept mentioned on earlier pages, and the near-total reliability formula as illustrated at right, are missile-age ways of saying the old axiom, "A chain is no stronger than its weakest link."

Or, to put the goal still another way, the quality or reliability of Johnson Control systems in missile sites or any other application, can be no better or higher than the quality each Johnsonite builds into the parts he works on, or the care that goes into installation of them.

Happily, Johnson's chain of responsibility was forged many years ago at a level which so far has been above the most rigid specifications laid down by the missile builders.

Other systems fell by the wayside when their built-in limitations kept them from meeting the demands of the missile era. *(Continued on page 14)*

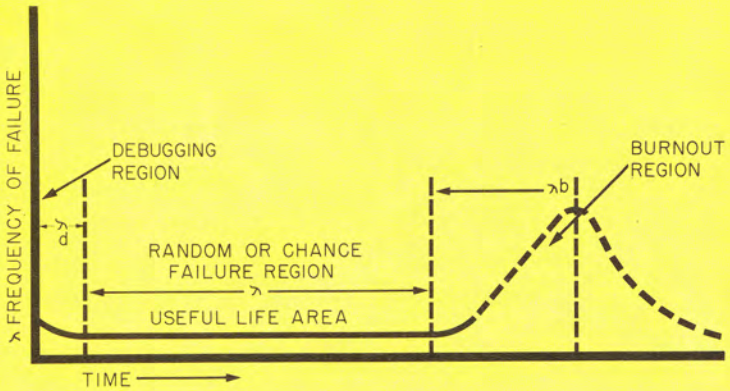
Getting JSC on the job starts with the sales engineer, working out of the branch office in the home city of the agency which controls the missile work.

He visits the agency to sell Johnson and Johnson products, aiming to have them specified in the contracts for the sites. As an engineer, he can visualize the problems posed by the silo and support building designs, and suggest reasonable solutions. And he can demonstrate that pneumatic controls by Johnson offer the most advantages over other systems.

The sales engineer can speak with confidence and sure knowledge of the capabilities of Johnson products, for he has at hand the results from two departments. One is responsible for providing the most advanced units their tremendous talent can devise and design. It is this department — research and development — which puts "blue sky thinking" and bright ideas to work, continually improving and re-vamping the well-proven devices they created over the years.

The test laboratory at once proves the practicability of the ideas born in research and development, and provides the sales engineer with the facts he must have to get the contract. Here too, tests for unusual requirements, such as shock resistance, are worked out and conducted on production samples of equipment.

the BATHTUB CURVE...



Designing an effective environmental control system that will meet all tests takes know-how, ingenuity and patience. It takes background, too, to choose the best part and the best ways to use it in entirely new situations. The application or field engineer has the qualities needed to work with the contractor and the sales engineer to translate ideas and promises into drawings.

The job now gets down to brass tacks, as production engineering refines the plans for the system and dovetails the project into the plant schedule.

The "bathtub curve" is the nickname for the graph of a typical reliability formula. It shows the expected useful life of a part, such as a valve or thermostat, sandwiched between curves representing the production period or birth of the part, and its projected breakdown or old age.

The first segment of the "tub," the production stage, dips sharply as quality materials and workmanship, attended by vigilant quality control, "debug" the part. Careful attention in the plant all but eliminates the hazard of "accidental" breakdowns which would shorten the useful life of the product.

The bottom of the "tub," the useful life segment, graphs the average failure rate through the time the part is to be used. This rate and the part's expected life are the basis of the reliability factor. On Minuteman projects the rate must be zero failures for a minimum of three years. (However, some Johnson installations have recorded a near zero rate for more than forty years — an astronomical reliability factor.)

All of us, and all working parts, begin to fall apart sooner or later, and the rate of breakup goes higher as time marches on. This is shown in the back or end slope of the "bathtub," the burnout region, where extensive repair or replacement can be expected.

JOHNSON MEETS THE CHALLENGE

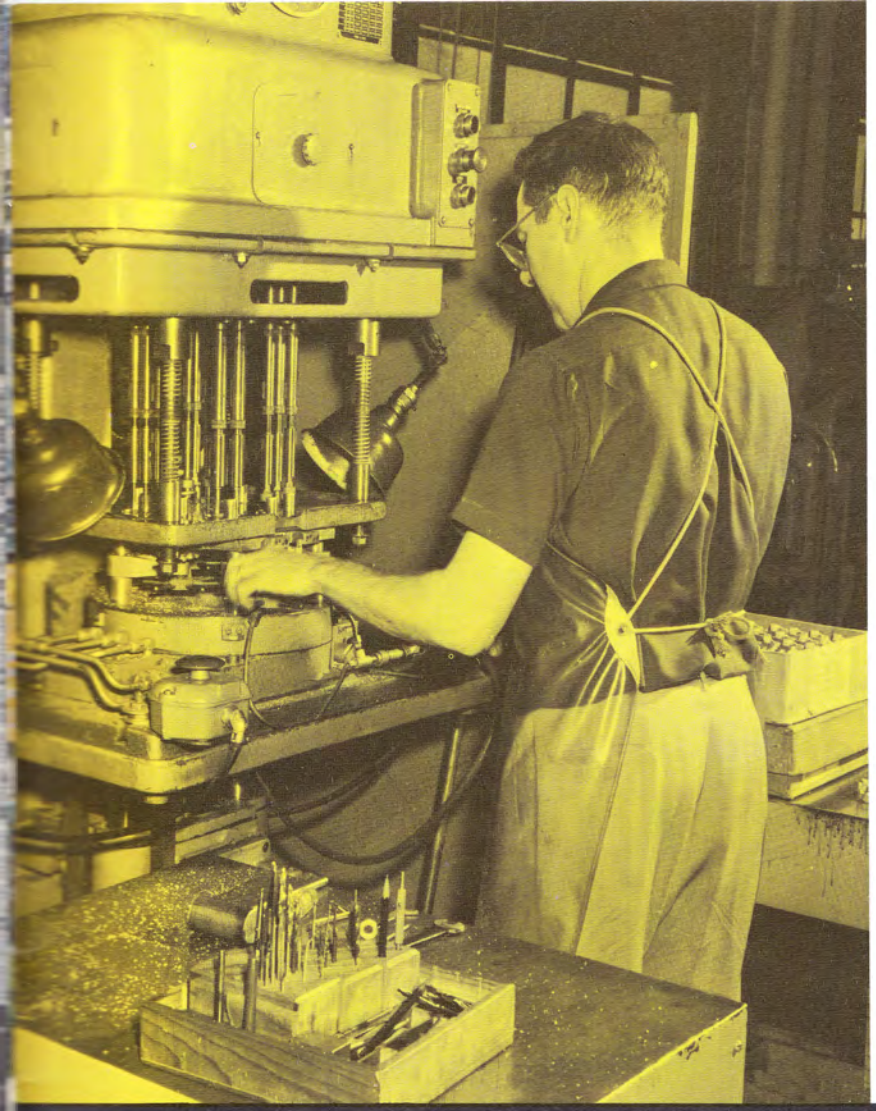
(Continued from page 12)

The links of the chain are really members of a team moving toward a goal of even higher standards of quality and reliability.

From the first person on the job to the last, each has measured up admirably to the challenge of the missile age simply by doing as well as possible the job he or she was chosen and trained to do.

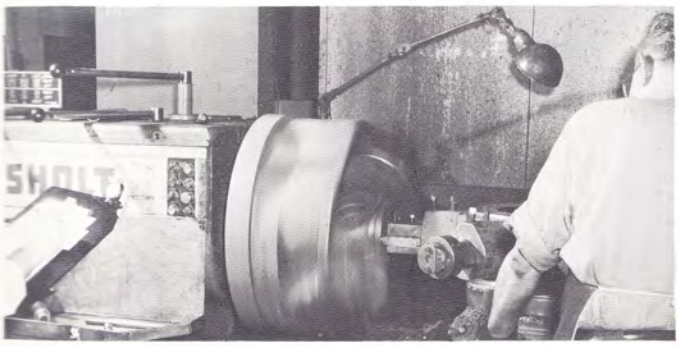
It is this day-by-day reliability that brought Johnson into the defense business, just as it has kept the company strong and growing throughout three-quarters of a century.

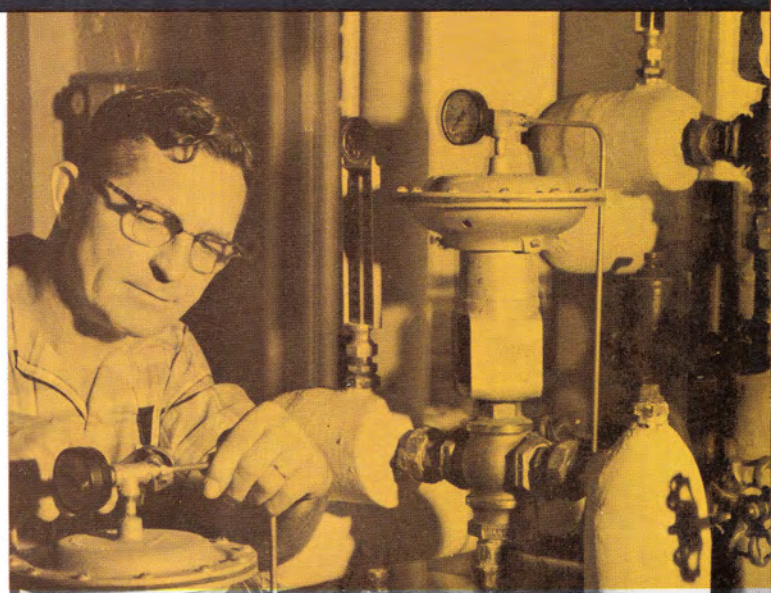
Handymen of the production engineer are the time study and methods experts who tally and chart each move that goes into the manufacture of Johnson products. Using their figures, production planners can schedule product assembly for a Minuteman site between, say, orders slated for a school in Connecticut and an office building in Georgia, all in 1963!



In the shipping department, missile site parts do receive extra attention, for they must be specially packaged, just so, to suit the particular tastes of the government agencies. All Johnson products are packed to survive the rigors of shipment and arrive on the job "Factory-Fresh."

In time, "the missile job" begins moving through the plant, side by side with parts for schools, hospitals, office buildings and plants. At this point it can be identified for what it is only by order number. Each part receives the same meticulous care in forging, machining or assembly no matter what its destination.





Finally, on the missile site, the branch technician installs the complete system. Trained himself by Johnson engineers who have been in on the design of the site from the drawing board stage, the technician in turn trains military personnel in the operation and maintenance of the system before turning it over to them. In the months and years ahead he will return again and again to service the system, keep it up to par and further extend the base of the bathtub curve.

FAMILIAR STORIES . . . That

Defense today is big business. Hundreds of companies are involved, thousands of American workmen toil daily to meet the terms of defense contracts, and billions of taxpayer dollars are being spent.

A few of these companies have actually been born of defense work; they did not exist as few as nine years ago. Many others have diversified into the field in recent years.

Johnson Service Company has been directly involved in defense work since 1943, the date a contract was signed with the government for echo boxes. In the 19 years since, up to the present missile base contracts, the Company has been involved in at least a dozen defense-related projects including Ballistic Missile Early Warning System (BMEWS), Distant Early Warning (DEW), Semi-Automatic Ground Environment (SAGE), Mid-Canada Line, Missilemaster, Pine Tree Line, radiosondes, echo boxes, Texas Towers, atomic submarines, nuclear aircraft carrier, and support ships.

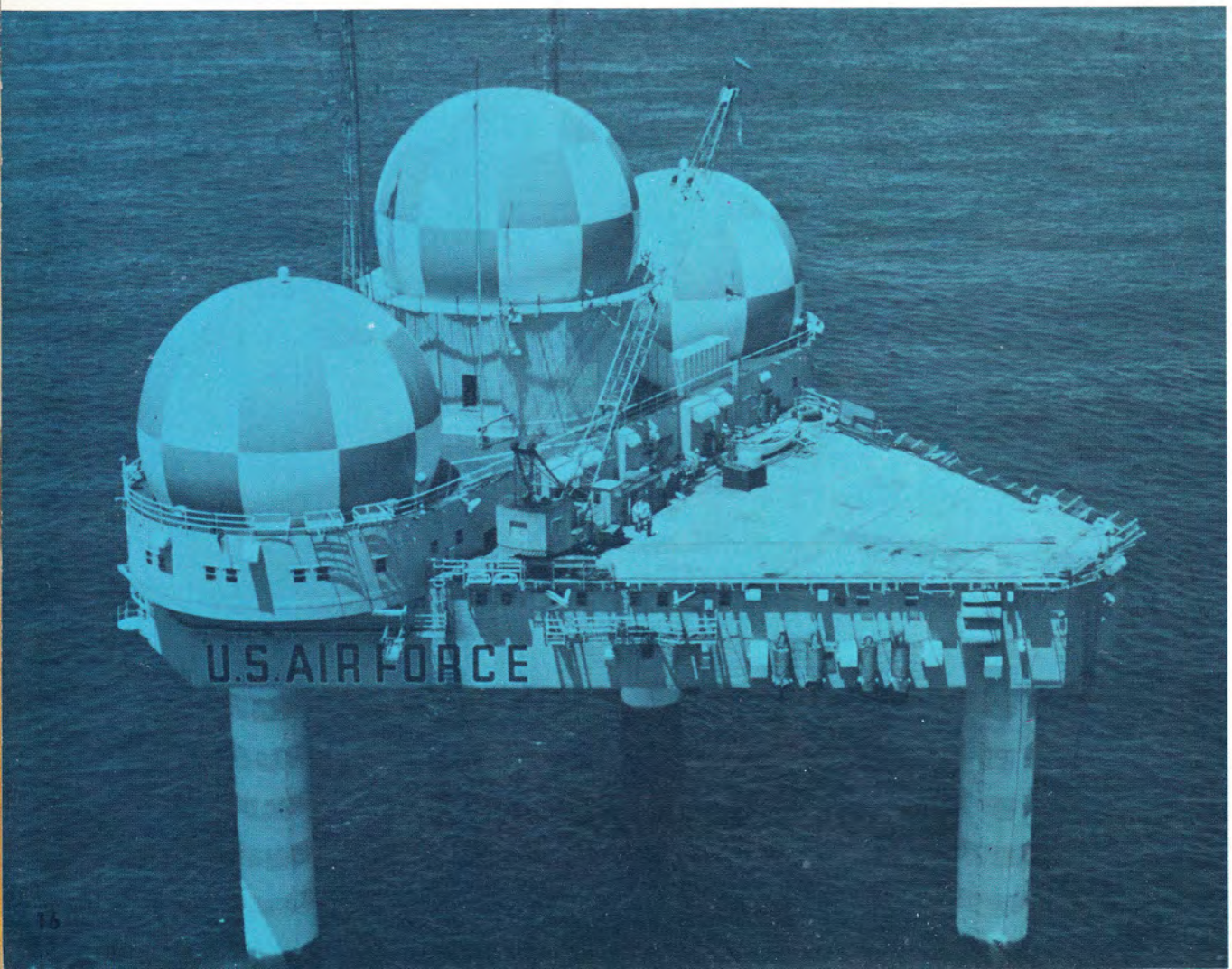
TEXAS TOWERS The idea of Texas Towers (so named because of their resemblance to off-shore oil drilling rigs) was originally conceived to meet a need for early warning detection of aircraft. In a sense they are to the east coast of the United States what the DEW Line is to our northernmost borders.

These lonely sentinels in the sea are "home" for complex radar equipment and for the men that make it work.

The Texas Tower Johnson control system installations proved to be some of the most unusual and adventuresome undertaken by the Company. Many eastern Johnsonites will back this up.

Though more than 90 per cent of the installation could be made in drydock, as a shipboard installation, in the 10 per cent or so made at sea lies a real experience.

Philip Quagge, Service Salesman in Boston, describes the saga of Johnson and the Texas Towers.



Deserve Re-Telling

"Perhaps the most difficult problem was transportation once the towers were located at sea. Our men would journey to the site either by boat or helicopter, work seven twelve-hour days, and then head back.

"By boat the trip was quite exciting. Very few of the men escaped seasickness on the trip which on at least one occasion took 65 hours. Once the boat reached the tower, a line was dropped from the deck by crane. The currents and tides had to be just right to transfer the men from the deck of the boat to the tower. With his passengers seated in a doughnut-shaped affair similar to a large inner tube with a floor, a skilled crane operator would lift the men from the moving boat to the top of the stationary tower, 90 feet straight up."

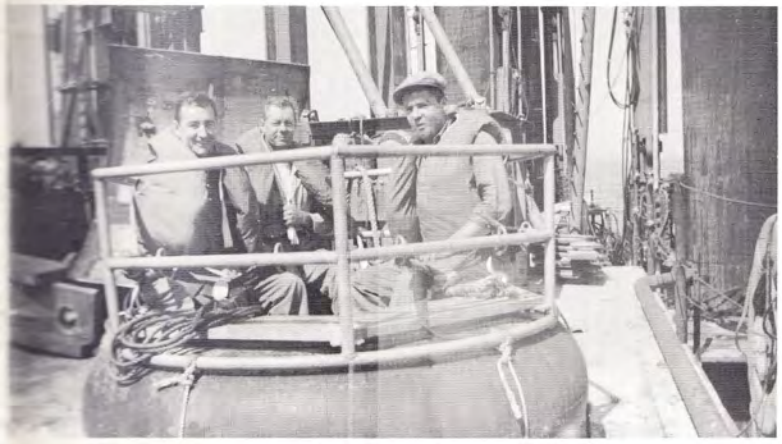
Also according to Quagge, working on the towers was like being back in the service. The men shared the living compartments of the military personnel "aboard."

The Johnson installation itself was basically for control of direct radiation, heating, and ventilating units, chilled water control, and control of exhaust fans. The work was complicated a little by the fact that the entire structure was made watertight, floated to sea, and then erected.

This meant that all the bulkheads (partitions) had to be watertight, requiring bulkhead fittings wherever the tubing ran through them. The tubing was hung with tubing clips, but the mechanics were required to drill and tap for each clip that was hung, with all tubing exposed.

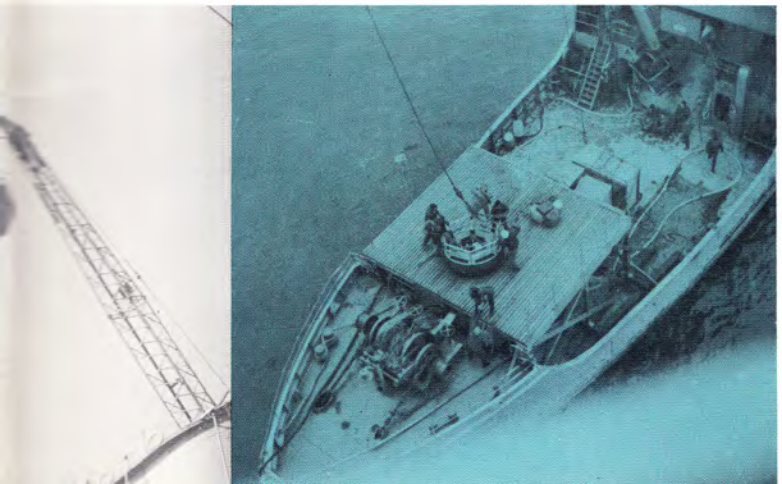
Great improvements in ground-based detection equipment have over-shadowed the need for the towers. Nevertheless they have fulfilled a vital function by adding important minutes to warning time of any attack aimed at our shores.

Then too, they have provided a dramatic episode in the lives of Johnsonites and Johnson Service Company.



Johnson technicians await their sky lift to the deck of a supply ship in cushioned bucket.

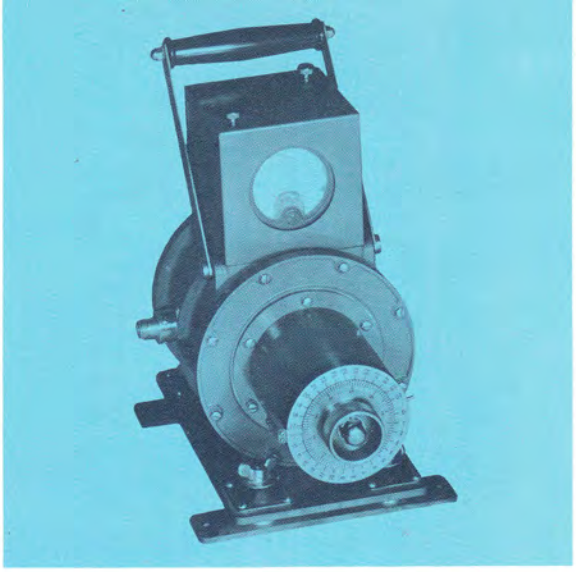
Getting to and from the Texas Towers provided constant adventure for Boston Branch men. The fastest way was by helicopter. At right, Philip Quagge is well bundled for the trip.



Far left, up they go and out over the tossing sea, to the deck of the bobbing ship, left, as the first leg of the trip home is safely completed. Gauging the wind, tide and waves took all the skill of an experienced crane operator.

FAMILIAR STORIES

Defense Work Began During World War II



RADIOSONDES The armed forces called on Johnson Service Company and two other manufacturers in 1944 to produce radiosondes, a sensitive piece of equipment used in weather forecasting. It is carried aloft to a height of over 15 miles by a free balloon, to broadcast by means of precise tone signals, information on the humidity, temperature, and pressure at higher altitudes. The instrument is then dropped by parachute and recovered to be used again.

Although radiosonde requirements have dropped off, JSC is now involved in other work important to "weather" and its relationship to national defense. The radiometersonde, for example, is used to determine solar and ground radiation.

ECHO BOXES One of the Company's earliest defense efforts was the manufacture of echo boxes, a portable, self-contained piece of test equipment that is used to check the over-all performance of a radar set.

In 1943 Johnson, in co-operation with Massachusetts Institute of Technology, became involved in the research and development aspects of this equipment. Before long JSC became the major development and production source for echo boxes in the country and even in today's highly competitive market is the main source of this test equipment.

A recent report on current work in this area stated, "We are just finishing a development project for the Navy that called for a tapered echo box which can operate over the entire X-band (8500-9600 megacycles). This has created quite a stir in the industry for it had never been done successfully before. This box can do the work that up until this time required at least two boxes."

MINUTEMAN

(Continued from page 11)

rugged 'specs'. Electronic controls would require costly and awkward shielding to minimize interference with guidance equipment. Only Johnson pneumatic control could measure up to the so-called 'bathtub curve'.

"However, don't get the impression that our success in the first phase of the expanding Minuteman program was really that simple. Competition for this type of contract is always fierce. It required a good deal of effort to show the right people that we had the product and team to do the job," he said.

Everything used in conjunction with the Minuteman installation is assigned a reliability factor. This factor compiled according to the bathtub curve is expressed in a number. Just how rigid are these specifications? Here is a good indication: all systems and equipment must stand up 14,000 hours, about three years, maintenance free.

To prove our product beyond a doubt, new tests (shock testing, for example) were developed and many existing methods improved. Additional proof of Johnson reliability, and some of the best proof we could offer, was that many old installations are still in first class condition after as many as 40 years of continuous operation.

These cutaway views, reproduced through the courtesy of AVIATION WEEK and Space Technology Magazine, *show the details of a Minuteman site. Johnson controls are centered in the environmental control room at left of the silo proper, bottom view.*

What specific part do we play in the Minuteman program? Johnson Service Company is providing a completely automatic temperature and air conditioning control system for the missile silo, control buildings, and all support facilities of which many are required. JSC is also involved in instrumentation checkout throughout the first phase.

Existing Johnson products (T-800, D-251, R-317, and R-870, for example) can meet specifications and are used with very little modification.

When the next phase of the Minuteman program is ready to be bid, Johnson Service Company once again will be called upon to prove that we have the hardware and the team to produce a system that meets the most rigid specifications from the word "GO."

TITAN I
MINUTEMAN
ATLAS
TITAN II
JOHNSON CONTROLS

JOHNSON AND ATLAS The U.S.'s first Intercontinental Ballistic Missile, Atlas provided the initial opportunity for a temperature control manufacturer to enter the ICBM field.

Johnson received and successfully completed a large contract for check out of propellant loading system and piping and instrumentation.

Contracts came to JSC because of reputation, especially in service field. Except in control buildings, no products were involved, only the people who did Control System Testing (CST).

JOHNSON AND TITAN I JSC again was called on for CST. Titan I is second ICBM; it "rests" in a hole or silo known as a hard site, but must be raised to be fired. At Lowry AFB, Denver, Colorado; Mt. Home AFB, Mt. Home, Idaho, and at Larson AFB, Moses Lake, Washington, Johnson provided environmental controls including complete installation and check out.

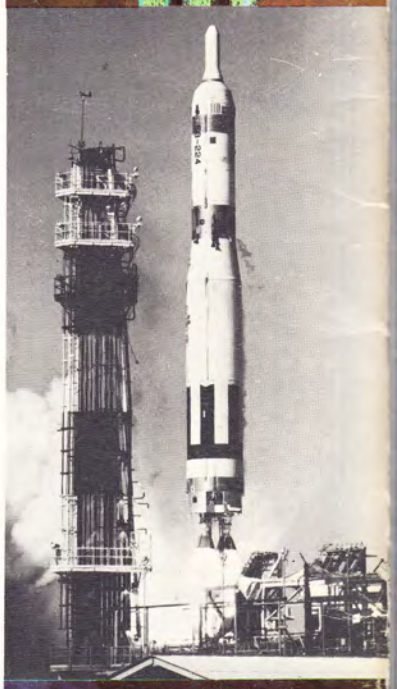
Johnson was awarded Titan I contracts on a three-to-one preference over competition.

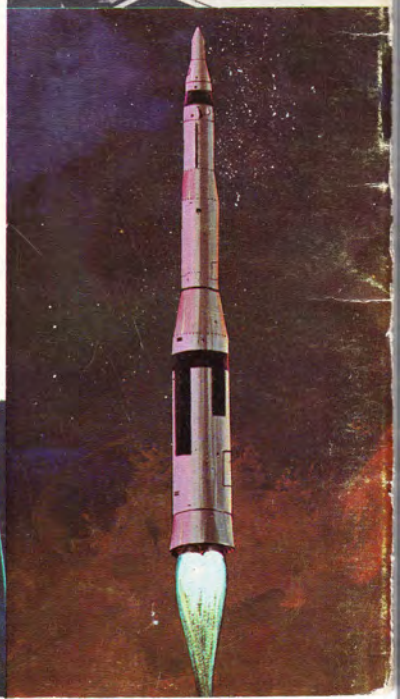
JOHNSON AND TITAN II Prime contractors and government agencies were impressed with Johnson capabilities. JSC was awarded all Titan II sites including prototype constructed at Vandenberg AFB, Lompoc, California. The Company is providing complete installation and CST works at Davis-Montan AFB, Tucson, Arizona; McConnell AFB, Wichita, Kansas, and Little Rock AFB, Little Rock, Arkansas.

JOHNSON AND MINUTEMAN Until this time contracts were awarded to the lowest competent bidder. With the advent of the Minuteman program, Johnson received contracts on the basis of capabilities of the organization and reliability of the product. The Minuteman is the fourth type developed and still the most recent ICBM in the U.S. arsenal.

The Minuteman program represents what is possibly the biggest responsibility ever assigned to JSC under the national defense program.

(See Titan II and Minuteman stories on pages 10 and 11)





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