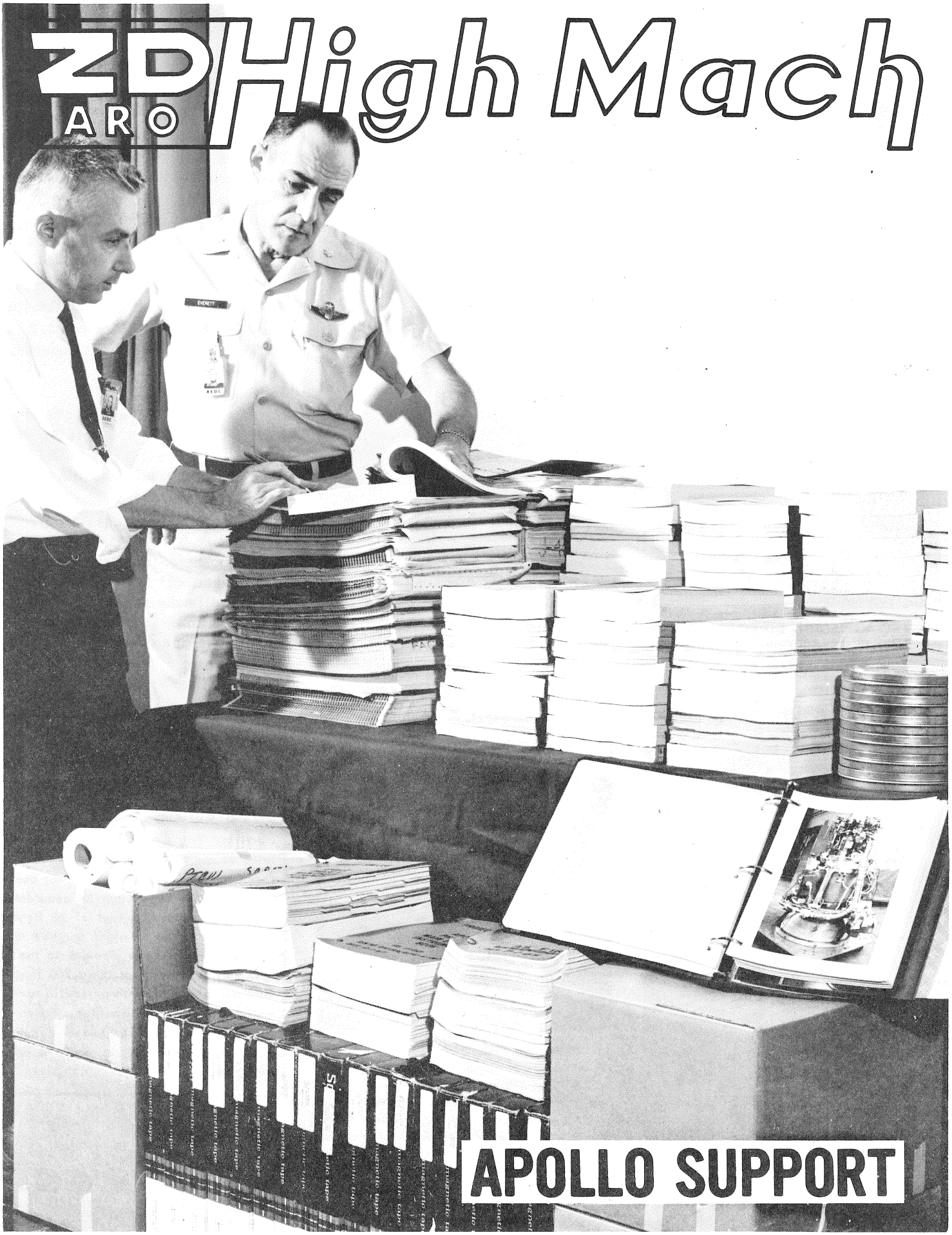
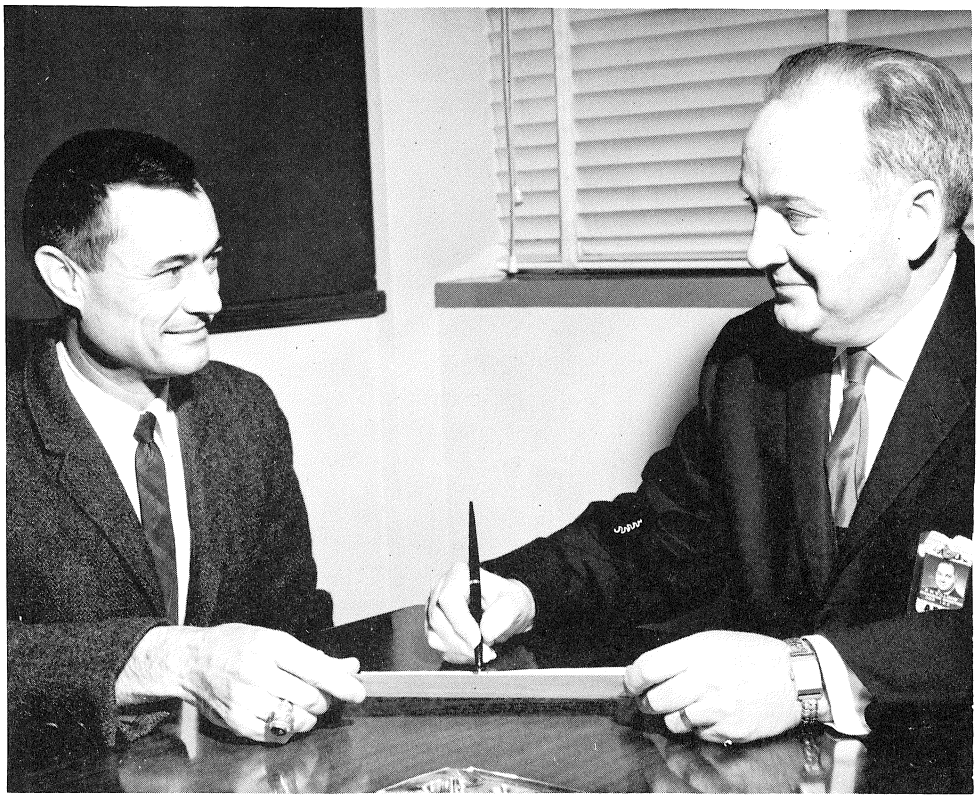
April 1966

ZD ARO High Mach



(See page 3)

F. Hughes Smith Receives Sixth von Karman Grant



ARO MANAGING DIRECTOR R. M. Williams extends his congratulations to Mr. Smith, the sixth von Karman Grant winner.

F. Hughes Smith, Jr., ESF mechanical engineer, has been selected to receive the sixth von Karman Grant awarded annually by ARO to assist in providing faculty members at the von Karman Institute for Fluid Dynamics near Brussels, Belgium. Outstanding engineers and scientists from NATO member countries make up the faculty and student body of the Institute.

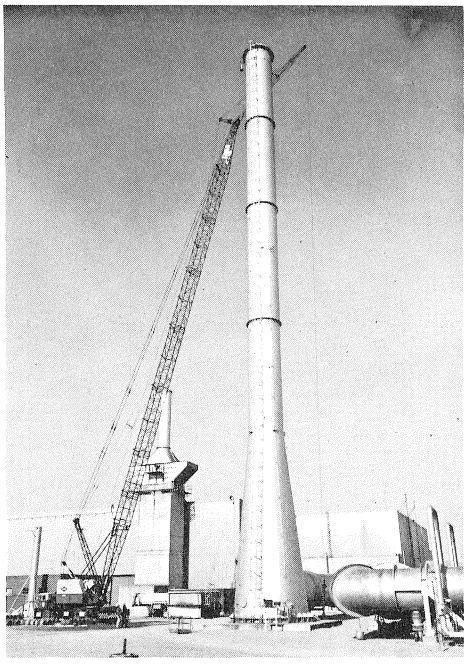
Previous recipients are Carroll E. Peters, who is currently at the Institute; Dr. James D. Haygood; J. A. van der Bliek; Kenneth E. Tempelmeyer, and Eino Latvala.

Joins ARO In 1954

Mr. Smith began his employment with ARO November 30, 1954, in the Engine Test Facility (now RTF). In December, 1962, he went with the Central Engineering Group.

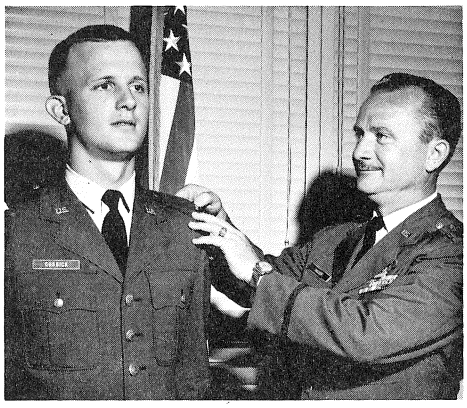
In congratulating Mr. Smith on his appointment, Mr. Williams said, "I know you recognize the importance and significance of this appointment and that you will make important contributions to the Institute, as have the other five recipients of the grant."

80-Ton Crane At Work



250 FT. HIGH CAPACITY is taxed to provide working device for ESF crew repairing warning lights atop the RTF exhaust stack.

Gen. Gossick Commissions Son



PINNING THE BARS of a 2nd Lt. on the shoulder of his 22-year-old son, Roger, is AEDC's Commander Brig. Gen. Lee V. Gossick. Gen. and Mrs. Gossick attended their son's graduation from USAF Officer Training School at Lackland AFB, Texas, on March 31, 1966. In the absence of General Hunter Harris, Commander of PACAF, Gen. Gossick "took the review" as 279 graduates marched in ceremonies marking their graduation. Roger has been assigned for flight training at Laredo AFB, Texas.

COVER –

APOLLO SUPPORT–Test data from one engine test is discussed by ARO project engineer George Schulz and Lt. Col. Bill Everett at the Rocket Test Facility. These reports, oscillographs, rolls of magnetic tape and motion picture film, still photos, instrument books and test data books can be considered typical for a single test of 20 firings for one of seven or eight engines in a test program. These firings, in the J-3 test cell, were part of the 1,700 firings supporting development of Apollo rocket motors thus far. (Photo Data–Taken by Phil Tarver, SA/MD, Speed Graphic, F-16 at 1/100th, Press Type B film, multi flash.)

High Mach

Room A-209 Ext. 617
Moncel A. Monts Editor

AEDC Assists Apollo Development -

More Than 1700 Rocket Firings ...2,000 Hours Of Wind Tunnel Testing

The U. S. Apollo program, designed to land man on the moon and provide for his safe return to earth, is nearing realization. Some say by 1970; others say after.

In any case, whenever this space age milestone is achieved by this country, the people of Arnold Center will know that their work helped make the success possible.

Most of the major test units at the Center, at some time during the past six years, have been involved in helping NASA and its many aerospace industry contractors develop the reliable components, sub-systems and major systems required for the mission.

An indication of the importance of AEDC's support for Apollo is found in the letter, published in an adjoining column, recently sent to Gen. Gossick by Dr. Robert R. Gilruth, director of NASA's Manned Spacecraft Center at Houston.

Tests Start In 1960

Tests supporting the development of the Apollo spacecraft and its Saturn launch vehicle began at the Arnold Engineering Development Center almost six years ago. First aerodynamic test was run on a proposed launch configuration model in the one-foot transonic wind tunnel on June 6, 1960. First propulsion system test involved base heating on a proposed Saturn launch vehicle configuration in T-1 on January 9, 1961.

Wind tunnel tests of Apollo models have required more than 2000 tunnel hours—about 20 percent of the entire wind tunnel effort sponsored by NASA—to develop an aerodynamically sound spacecraft and launch vehicle.

Total Saturn-Apollo rocket firings to date amount to nearly 1700—all of them conducted at simulated high altitude conditions. More are scheduled.

Emphasis on Propulsion

During the past three years, propulsion test efforts have been directed mainly toward development of the rocket engines for the three modules of the Apollo spacecraft—the primary and reaction-control propulsion systems for the Service and Command Modules and the Descent and Ascent stages of the Lunar Excursion Module.

The propulsion systems for all three of the Apollo modules are of a similar design although they are manufactured by different companies. The design is typical of the current trend in spacecraft propulsion system development, not only for Apollo, but in other applications such as the Transtage for the Titan IIIA and IIIC launch vehicles.

One characteristic of this type of engine is that it operates at a relatively low chamber pressure with the exhaust gases expanding through a high expansion ratio nozzle to a very low pressure.

Another characteristic is that the thrust chamber assembly is made of an

(Continued on page 10)

Brig. Gen. Lee V. Gossick, Cdr.
Arnold Engineering Development Center
Arnold Air Force Station, Tennessee 37389

Dear General Gossick:

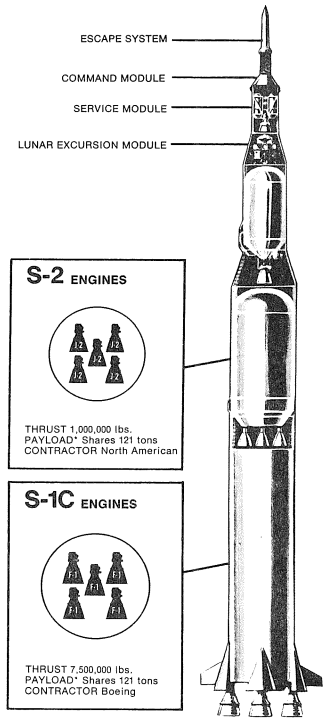
The Manned Spacecraft Center wishes to commend the Arnold Engineering Development Center for its outstanding performance in the recent testing of the Agena Target Vehicle for the Gemini Program and for its continual assistance in testing the Service Module and Lunar Excursion Module propulsion systems of the Apollo spacecraft.

The success of any rocket engine development program depends strongly upon the test organizations. The quality of Arnold Engineering Development Center personnel assigned to the Agena and the Apollo programs has been a significant factor in the successful and rapid completion of all phases of the testing undertaken to date. I wish to express my appreciation to all these Arnold Center personnel and, in particular, to the ARO, Inc., and USAF personnel assigned to the Rocket Test Facility.

It is gratifying to have the Arnold Engineering Development Center as a part of the manned space flight team, and it is hoped that this successful relationship can be continued during future Apollo propulsion system testing and other National Aeronautics and Space Administration programs.

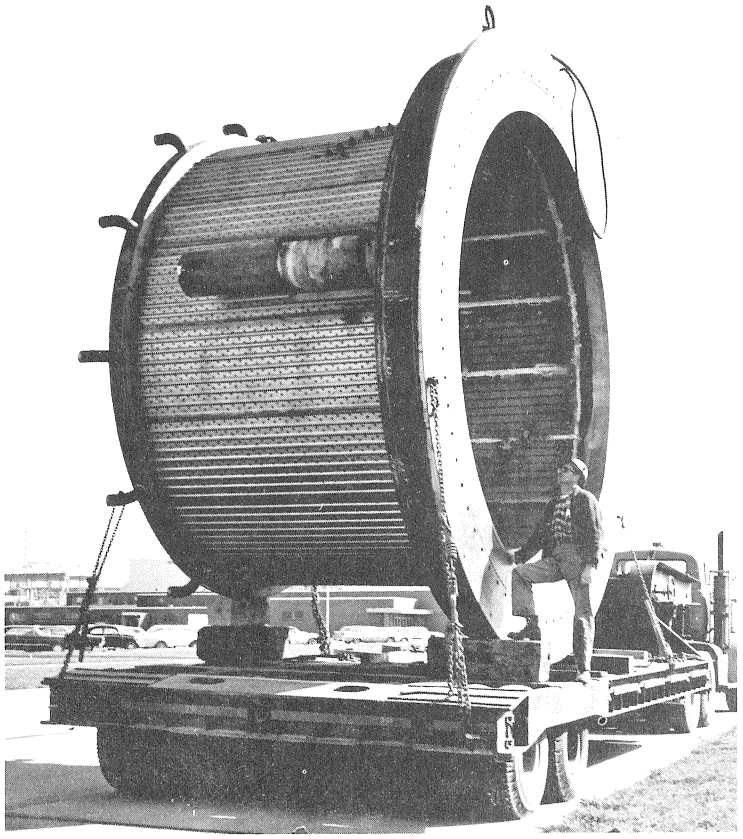
Sincerely yours,

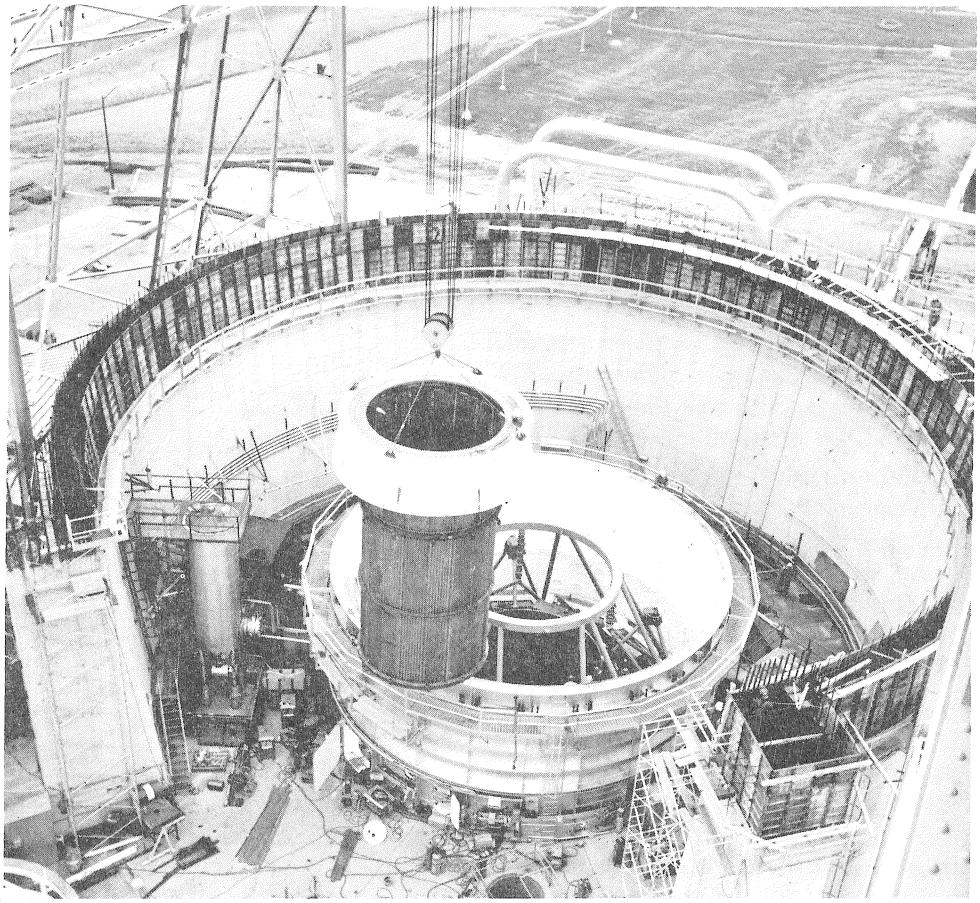
Robert R. Gilruth
Director



SATURN 5

Exhaust Gas Diffuser Insert Installed In Rocket Test Cell





PART OF THE PREPARATIONS being made to test-fire the 200,000-pound-thrust third stage of NASA's Saturn 5 Apollo launch vehicle in the Center's J-4 high altitude rocket test cell include installation of this 13-foot-diameter, 30-foot-long water-cooled diffuser insert being lowered into position in the cell's 250-foot-deep underground exhaust chamber. The special insert will capture the exhaust of the rocket engine and use it to maintain simulated altitude conditions of approximately 100,000 feet during the test later this year. It was designed and fabricated at the Center by the Engineering Support Facility. The special diffuser insert was made by welding together 54 curved, hollow, carbon steel panels. Each panel is 29 inches wide and 10 feet long.

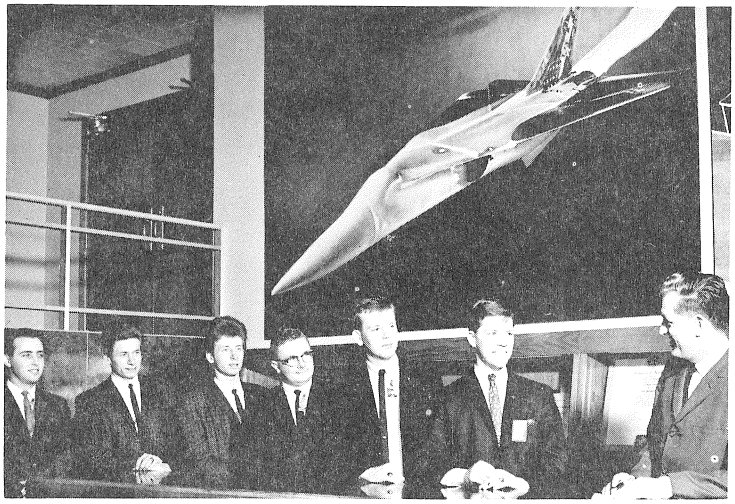
Helping Hands

CO-OP ENGINEERING STUDENTS at the Center took on a voluntary project for the Community Guidance Council by painting the interior of the council's building in Tullahoma. In the working party are, front row, Larry Davis, Leonard Tieman, Dan Mills, Nick Munn, Steve Chunn and Barry Donald. Back row, David Erickson, Sydney Sexton, Howard Hayes, Steve Goldberger, Jim Mayfield, Ricky Smith, Ron Wenzel, Rick Munger, Jay Germain and Bob Lackey.

Paying Attention — To Teacher

TRAINING OFFICE SECRETARY Karen Everett introduces the new CO-OPS to A&E lobby displays. The CO-OP students are Stephen Goldbergh, Mass. Institute of Technology; R.D. Wengel, Georgetown University; T.A. Glaze, Georgia Tech; M.A. Smith, Auburn University, and T.L. Creason, Auburn University.

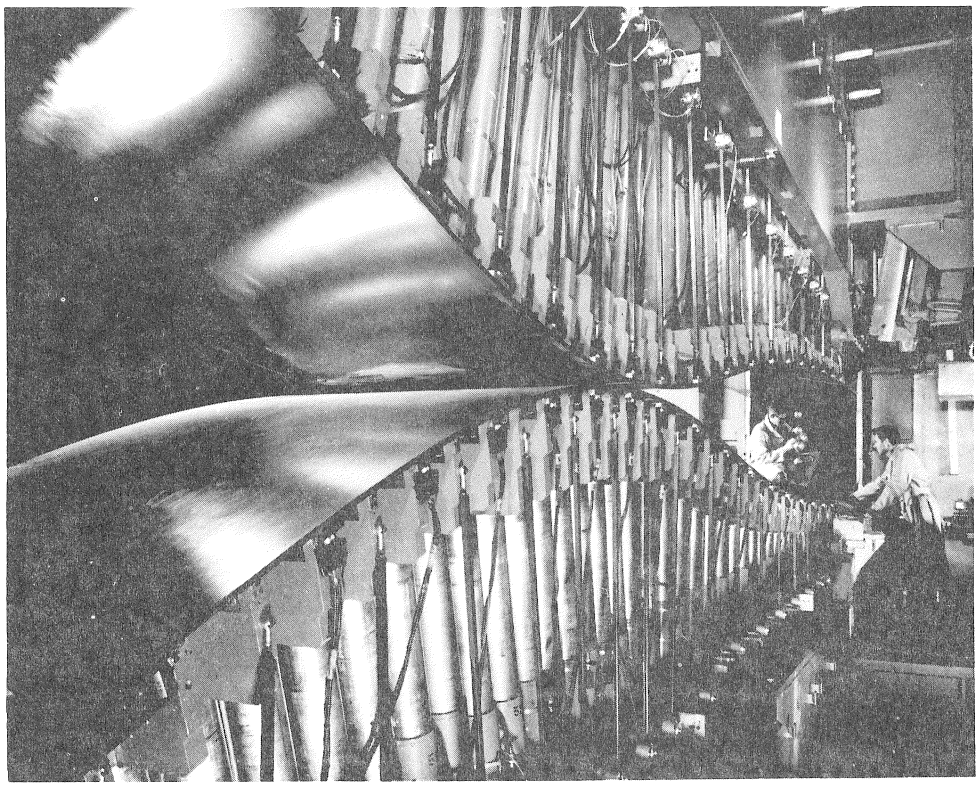
Last Industrial Assignment



COOPERATIVE ENGINEERING STUDENTS are shown discussing their final assignment at ARO before returning to their schools to complete their studies. Frank E. Lewis of the ARO Training Office talks to the students (from the left): Charles J. Neir, University of Michigan; Douglass H. Wurst, University of Michigan; Clifford W. Wurst, University of Michigan; Bruce L. Nebergall, University of Florida; H. Jack Robison, Auburn University; and Robert P. Lackey, University of Michigan.

Spare Nozzle Plate Fabricated In vKF

BIG JOB, HIGH PRECISION—Grouped around the spare flexible nozzle plate recently completed by the von Karman Facility Shop are the men responsible for the job: (from left) J.B. Baker, J.M. Johns, E.M. Yother, J.L. Parker, R.O. Angel, Jr., W.J. Gravlee, G.L. Cleveland, J.L. Wiseman, K.J. Ramsey, N.H. Smith, W.D. Brackman, E.W. Pross, E.K. Wood, J.E. Rogers, J.E. Brazelton, Lavoy Kilgore and R.G. Watts.



SUPERSONIC SQUEEZE—The two original flexible plates which make up the variable nozzle of the von Karman Facility's 40-inch supersonic wind tunnel are shown with the tunnel sidewall nearest the camera pulled back. Note the electrically-driven hydraulic jacks which adjust the contour of the nozzle to produce the desired airflow in the test section.

Wind tunnels, like automobiles, needs "spares". Without them a damaged component can shut down the tunnel causing costly delays in getting test information required by aerospace manufactures.

An example is the additional flexible steel nozzle plate which the von Karman Facility Machine Shop has just fabricated. It's on standby in case either one of the two flexible plates which regulate the Mach number of the airflow (Mach No. 1.5 to 6.0) passing through the 40-inch test section of the vKF Supersonic wind Tunnel is damaged.

By bolting 296 precisely aligned lugs to the back of the plate—instead of machining the whole assembly from one piece of plate—vKF was able to build the spare for $74,024 instead of the $250,000 original cost.

The stainless steel plate is 30 feet long, 40 inches wide and 0.437 inches thick. Electrically driven actuators connected to the lugs bend the plate into the accurate nozzle contours required for regulating the airflow.

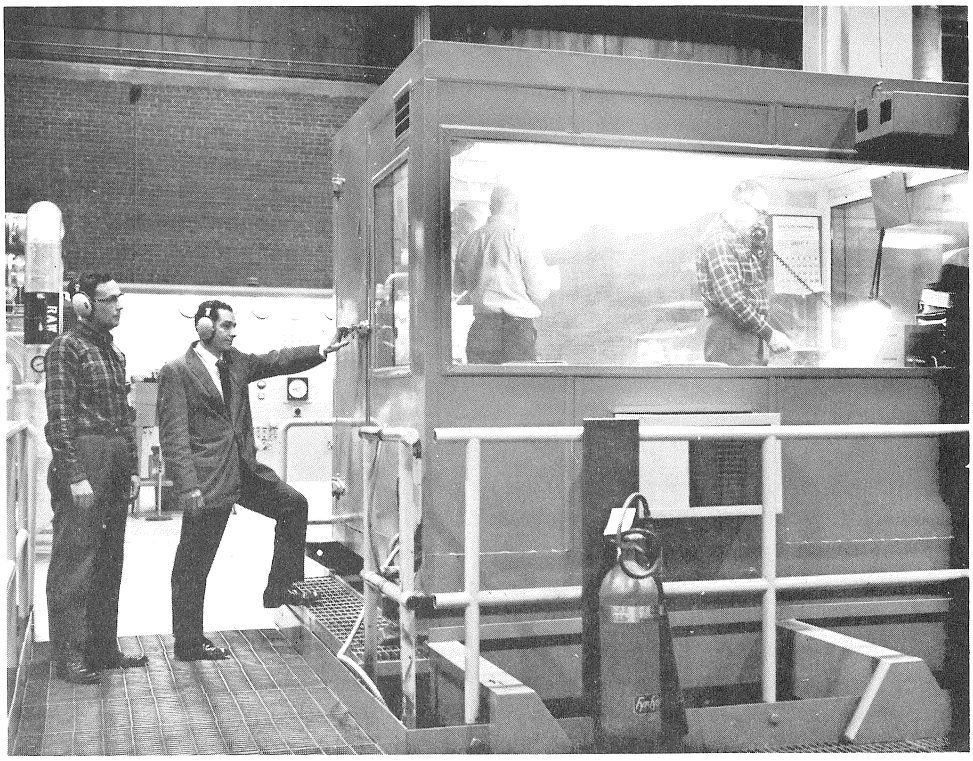
The flexible plates are exposed to very high bending stresses. Several years ago one was fractured and the tunnel had to be shut down for 8½ weeks, while it was being repaired.

Time For Imagination

Your imagination should quickly open possibilities to you. In fact, the future is always decided by those who put their imaginations to work, who challenge the unknown, and who are not afraid to risk failure in order to test their ideas. The world has an ample supply of people who can always come up with a dozen good reasons why a new idea will not work and should not be tried, but the people who produce progress are a breed apart. They have the imagination, the courage, and the persistence to find solutions instead of merely discussing the problem. These are people who take the position that, "Just because no one else has solved this problen, doesn't mean that I can't." Such people are vital to our continued progress and the full use of the opportunities which science and technology offer.

Gen. B. A. Schriever
Commander, AFSC

Modification Savings



SOUNDPROOF BOOTH provides operators with adequate view of operating equipment in high noise level areas of the Air Force Arnold Center's Rocket Test Facility. Six such booths recently were modified to provide required additional glassed area to assure constant visual surveillance of vital machinery. Modification costs were only $6,474 compared with a $36,000 price for the procurement of new booths. Total savings – $29,526.

Topouts

APPRENTICESHIP PROGRAM TOPOUTS, Ronald E. Darden and J.N. Smith, both of GS, are handed their certificates by W.F. Harris, GS, ARO Joint Apprentice Committee member, as committee members H.D. Taylor, vKF; J.M. Hinton, ERD, apprentice supervisor, and F.D. McLaurin, vKF, observe.

NASA Expands Work Of ARO Ames Division

Officials of NASA's Ames Laboratory have revised their contract with ARO's Ames Division to include operation of two additional wind tunnels.

Division Engineering Manager R.S. Dick reports that the group will now conduct tests as required in the laboratory's 14-foot transonic wind tunnel and six-foot supersonic wind tunnel. The larger unit has a 110,000 h.p. compressor drive system which can operate at more than 130,000 h.p. levels for periods of one hour or less. The supersonic wind tunnel has a 60,000 h.p. compressor drive system.

Since March 29, 1965, ARO personnel have been under contract to NASA to manage, operate and maintain the 12-foot pressure wind tunnel (150-600 m.p.h.) at the research center about 40 miles south of San Francisco.

The additional work will require the immediate employment of approximately 10 more people and the shifting of the work-force from tunnel to tunnel according to the priority of the tests. There are currently 32 in ARO's Ames Division, including 12 who moved there from the Arnold Center.

In Memoriam

Marvin E. Hintz

1904 – 1966

Center Historian

At the time of his death, Mr. Hintz was serving his second tour of duty as historian at the Arnold Engineering Development Center. A retired Air Force master sergeant, he was the Center's historian from July of 1961 to November of 1962 when he became historian of the 13th Air Force in the Southeast Pacific and Asia. He returned to Arnold Center in December of 1964.

FROM VIETNAM TO SPACE STUDIES - UTSI Student Decorated Combat Pilot

"PROVIDER" MISSION PILOT AND FRIENDS—On the landing strip at Phuoc Vinh Capt. Jones is joined by trio of Vietnamese waifs. "Provider" missions frequently required landing the giant C-123, with 20,000 pounds of cargo, on 1500-foot strips literally carved out of the jungle.

It's a big step from the hot, dirty war in Vietnam to space science studies at the University of Tennessee Space Institute...and it's been a rapid one for U.S. Air Force Capt. Ray Jones.

Less than six months ago, he was winding up his second tour of duty in Vietnam, roaring into the sky several times each day in a prop-driven A-1H Skyraider on hazardous close-support missions for Vietnamese and U.S. troops.

150 Missions

An indication of how he flew these missions is found in the nine decorations he was awarded recently for more than 450 combat missions in both Skyraiders and the fat, lumbering C-123 "Provider" assault transports (two DFC's, The Bronze Star, five Air Medals and an AF Commendation Medal).

On two occasions he earned the Air Force's Distinguished Flying Cross for "heroism and selfless devotion to duty."

To see how he earned one of these, take a look at the mission report dated last July 29.

PILOTED BY CAPT. JONES—This shot of an A-1H fighter bomber over the mountains west of Da Nang was made from the C-123 "Provider" cargo aircraft for which Capt. Jones was flying escort en route from Da Nang to a forward landing strip at Ashau.

Capt. Jones rolled in on a strafing pass at Viet Cong trenches. Intense small arms fire cracked his windshield and dented his prop. He continued the attack, unmindful of the aircraft's vibrations. On the second pass his Vietnamese wingman was hit and his hydraulic system was lost.

Ray escorted the damaged aircraft back to a safe landing at Da Nang; and, then, despite intense hostile ground fire, returned to the battle scene and continued strafing runs until he was out of ammunition.

Seeks M.S. Degree

Today, Ray, his wife and two small sons live in a comfortable house in Tullahoma, Tennessee. Instead of flying strafing and bombing missions or landing troops and supplies on crude jungle airstrips, he probes the intricacies of astronautics, celestrial mechanics, space propulsion and the other exotic fields of science that are prerequisites for a master's degree in Aerospace Engineering.

For the next 18 months, he'll be involved in achieving another step on the ladder of a professional military career which already includes the noteworthy accomplishment of being an aeronautical engineer, rated pilot, combat veteran, husband and devoted father and amateur chef. All these factors go to make up the personality of one particular student at the University of Tennessee Space Institute adjacent to the Arnold Center.

Raymond L. Jones, captain, United States Air Force, is a 32-year-old career officer with a pair of piercing brown eyes, medium cropped dark hair and a yen for knowledge that is destined to take him far in this era of rapidly advancing progress in space adventure.

A native of Detroit, Capt. Jones is the son of Mrs. Harry L. Jones and the late Mr. Jones, He attended public schools there where his father was a production foreman in the automotive industry.

The Space Institute is a graduate school, an integral part of the University of Tennessee, but separate from the main campus at Knoxville. The Insti-

tute's own physical plant is located at the U.S. Air Force Systems Command's Arnold Engineering Development Center. Its classroom and study complex, with a commanding view of Woods Reservoir, source of cooling water for the Center's wind tunnels and high altitude rocket test cells, is located on a 360-acre tract provided by the Air Force.

Part of A.F.I.T. Program

Capt. Jones is one of seven USAF career officers currently assigned to the Space Institute as full-time students under a graduate study program of the Air Force Institute of Technology.

Although pleased to have been selected for such an assignment, he is quick to admit that the master's degree he is now working toward represents an academic accomplishment far beyond his originally planned intentions.

As far back as he can remember, Ray Jones wanted to be an Air Force pilot.

With just such determination, armed with a diploma from Detroit's Cass Technical High School and a private pilot's license (paid for by a variety of part-time jobs), he enrolled in 1952 as a pre-engineering student at the University of Michigan.

His intention then was to complete only the two years of college work required for enlistment in the USAF Cadet Training Program. Thus, at the end of his first year of college when the cadet program was opened to high school graduates, he enlisted immediately, made the grade in pilot training and in 1955 was commissioned a second lieutenant in the U.S. Air Force.

Flight Test Engineer

Capt. Jones is no stranger to the business of aerospace research and development. Following his first three-year tour as an Air Force officer at Selfridge AFB, Mich., he returned as a First Lieutenant to his alma mater, University of Michigan, under the Air Force Institute of Technology. He was graduated in 1961 with a bachelor of science degree in aeronautical engineering.

After AFIT training, he was assigned as a flight test engineer at the Aerospace Research Pilot School, Edwards AFB, California.

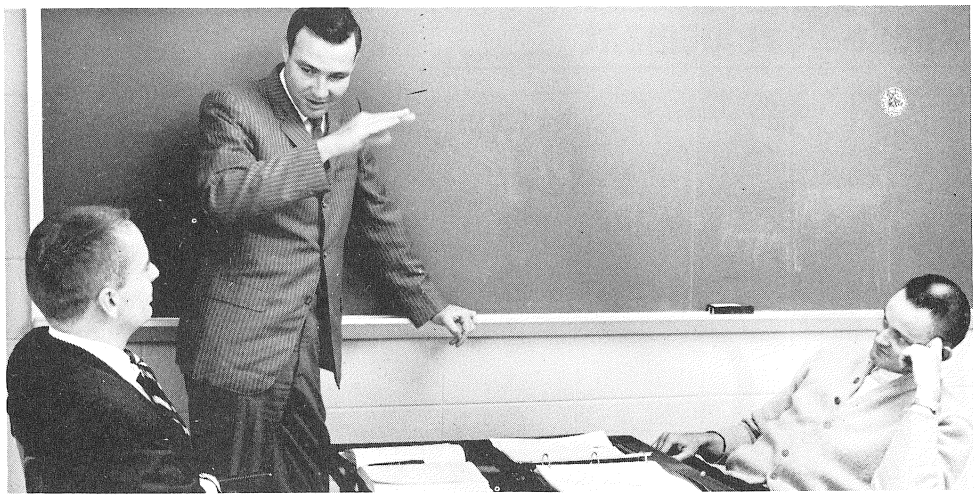
On reassignment to Nellis AFB, he volunteered for duty in Vietnam and after two months training was assigned TDY as a C-123 pilot with the 309th Air Commando Squadron.

Flying provisions into forward battle zone locations often required landing the twin-engine cargo aircraft, with loads as great as 20,000 pounds, on 1,500 foot dirt strips which had been hurriedly (and almost literally) carved out of the jungle.

Volunteers Second Time

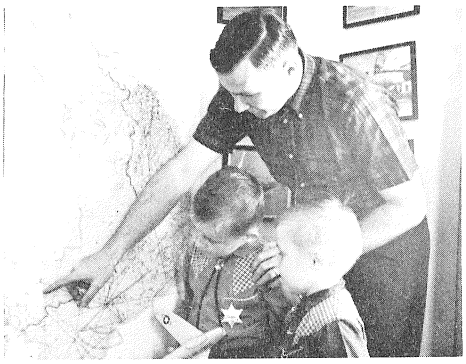
Returning from his first overseas assignment, Jones was again stationed at Nellis AFB, near Las Vegas, where he was a gunnery instructor to foreign students under the U.S. Military Assistance

(Continued on page 15)



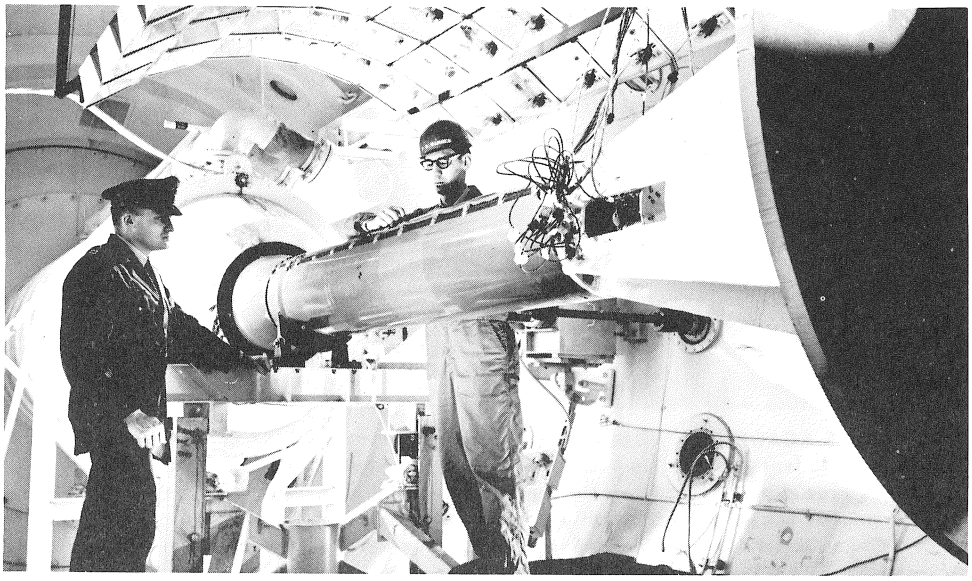
DISCUSS ACADEMIC PROBLEM – In a typical between-class discussion with two of his fellow students at the University of Tennessee Space Institute Capt. Raymond L. Jones gestures a point. Hearing him out are Lowell Shultz, attending the Institute under sponsorship of his employer, North American Aviation, and Capt. Charles Chase. Like Jones, Chase is working toward a masters degree in aerospace engineering under the Air Force Institute of Technology graduate study program. They are among seven career Air Force officers currently assigned as full-time students at the Space Institute.

OUT FOR A STROLL – Young Brian and Craig Jones, with mother and daddy in tow, take advantage of Tennessee's early spring weather. In the right background is their home at 300 Yeager St. in Tullahoma.

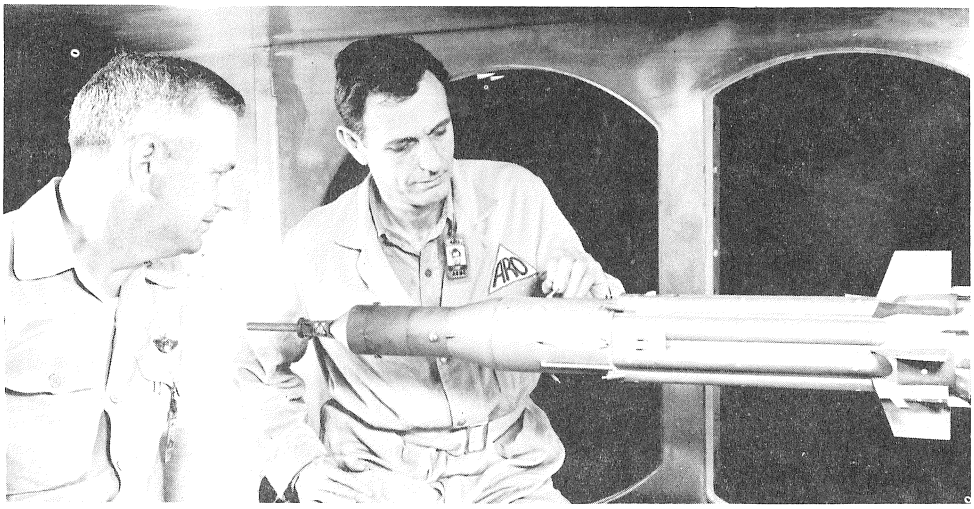


GEOGRAPHY LESSON–This pair of young deputy marshalls, Brian and Craig Jones, are learning about such far-off places as Da Nang, Saigon, Ashau and and Phuoc Vinh. Their dad, Capt. Raymond L. Jones, twice a volunteer for duty in Southeast Asia, flew more than 450 combat missions in the Vietnam battle zone.

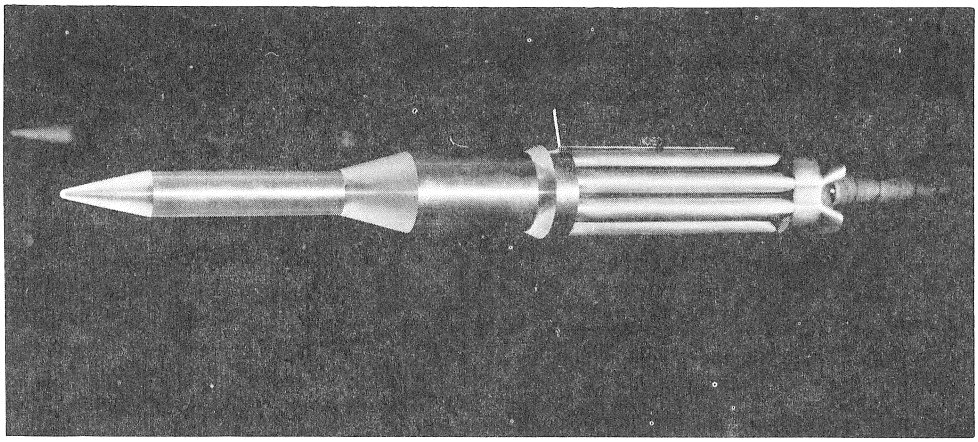
Apollo Development (From page 3)



SATURN RETROROCKET – for the first stage of Saturn 5 installed in Large Rocket Facility's J-5 test cell. Capt. E.H. Chartrand and ARO technician Phil Barnes check a pressure transducer attached to combustion chamber. Solid propellant rocket generates a thrust of 100,000 pounds for one second.



COMPLETE LAUNCH CONFIGURATION – was tested in 1962 in the 40-inch supersonic wind tunnel at the von Karman Facility. Maj. John Brown, then the assistant AF facility rep., and ARO technician T.K. Goodier discuss model.



EARLY TRANSONIC TEST – conducted in 1960 involved scale model of complete Saturn launch configuration in Propulsion Wind Tunnel's 1-foot transonic test section.

ablative, fiberglass-reinforced material, as opposed to metals used in other systems which are regeneratively cooled.

In order to obtain high nozzle expansion ratios with the least weight penalty, many of the current spacecraft engines are fitted with nozzle extensions made of very lightweight, comparatively fragile metallic materials and are, therefore, radiatively cooled rather than regeneratively or ablatively cooled.

Service Module Engine Tested

Initial activity at Arnold Center in support of development of propulsion systems for the Apollo spacecraft modules involved an exploratory program using a one-third-scale primary engine for the Service Module—the propulsion unit for the vehicle which will remain in a parking orbit around the moon while a separate lunar excursion vehicle transports two astronauts to the moon's surface.

Program objectives of the firings, performed at simulated altitude conditions exceeding 100,000 feet, were to:

1) Evaluate engines produced by several different manufacturers.

2) Evaluate operation and structural integrity of ablatively cooled thrust chamber assemblies.

3) Evaluate the concept of lightweight metallic, radiatively cooled, high-expansion nozzle extensions of various shapes and made of various materials to determine an optimum configuration.

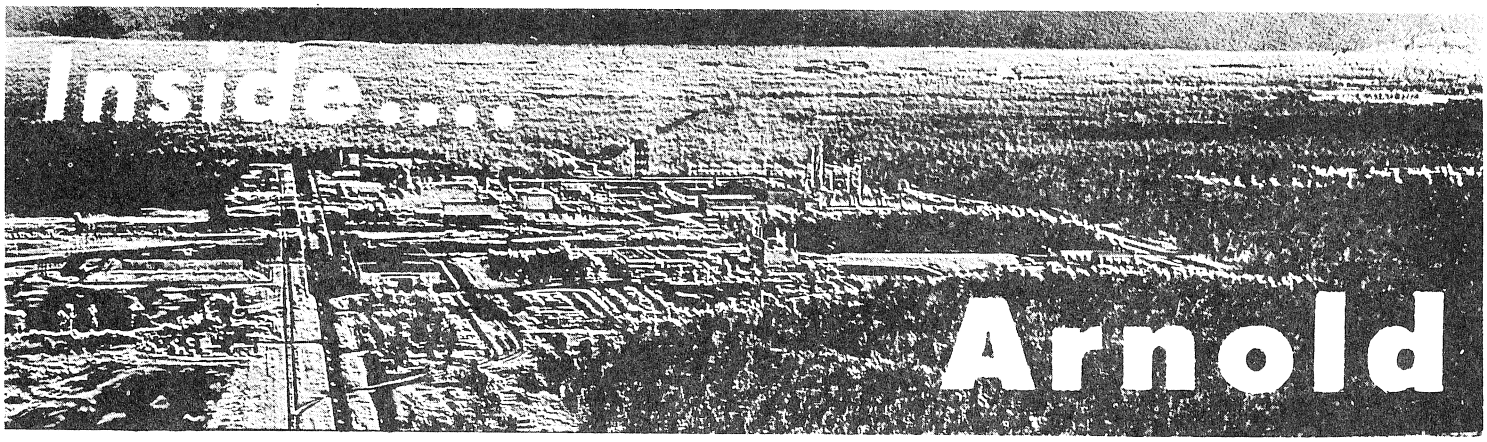
4) Evaluate the ballistic performance of low-chamber-pressure, high-expansion-ratio engines in a low pressure environment.

Results of the program helped NASA in selection of a thrust chamber assembly made by Aerojet-General Corporation and also led to the selection of an optimum radiatively cooled nozzle extension.

Subsequently, in August of 1963, a series of tests was initiated using the full-scale Service Module primary propulsion system and related equipment. The overall development and flight qualification program for this 21,000-pound-thrust engine is still in progress.

New Test Capabilities

A large portion of initial testing in this program was devoted to develop-



von Karman Gas Dynamics Facility ....Jane Durand

Hats off! -- to Dr. I. T. Osgerby who performed splendidly in the Community Playhouse's production "Send Me No Flowers." Understand lots of girls adore that British accent.

Hypersonic Branch enjoyed a farewell dinner at Fayetteville's Angus Restaurant honoring Clark Fitch, a transfer to Scientific Computing, Jim Rippey leaving for NASA in Houston and Carol Phelps awaiting the stork.

Betty McCrary and Pearl Trenchi honored Carol Phelps with a stork shower and breakfast. Pearl and Betty made all the biscuits, sausage and sweet rolls themselves and even baked a cake for the "left-out" engineers. Carol received several lovely things to help welcome the forthcoming addition to their family.

Good-byes were said to Connie Darnell, Supersonic Branch, going to Nashville. The gals gave her a farewell party and presented her with several gorgeous gifts--the most practical of which is the can opener (electric, of course) for her new ultra deluxe apartment. (She'll be surprised when we all take her up on her invitation to visit and join her for a swim in the apartment pool with CARPET on the bottom!

Who, we are wondering, in vKF has the beautiful new green Mustang with the decorated fenders? Twice altered in the same place yet!

Back among the clan is Lena Stooksbury, hospitalized eight days with pneumonia. During her absence Jane Durand took over and, in turn, fought with, spoke harshly to, and finally became accustomed to Lena's Selectric typewriter!

Welcome to Co-ops Bill Richey from Virginia Tech and Joe Gilbert from Auburn U. who are newcomers in Aerophysics Branch. Returnees include Chris Beatty, James Sherlock and Don McFalls.

Welcome to new employes: Gayle Bowden, a recent Tullahoma High graduate, secretary in Supersonic Branch; J. D. Reid, N. J. Patterson, W. C. Grimes, Jim J. Houston, C. F. Bell and J. L. Russell, all in Testing Operations Branch; T. R. White, H. A. Lay and R. T. Herrman in Plant Operations Branch and Randall McBee in Aerophysics Branch.

Finance Division

It's good to see Claudia Stone able to be back at her desk after spending several days in the hospital.

Bill Laumann is looking forward to giving up his walking cane and getting back to his golf clubs. A painful knee and the need to favor it caused him to make the switch -- briefly, we hope.

Ruth Duncan, Jim's wife, is at home and recovering nicely from surgery.

Early vacationers getting a head start on spring are Wayne Rigney visiting relatives in Arkansas, Fred Moore hunting in Canada, Bud Schell camping in Florida and Pat Hutchins with plans unknown.

Rocket Test Facility ....Mary Williams

Our sympathy to T. E. Green on the death of his brother-in-law; to D. F. Belvin on the death of his father-in-law.

Barbara Brannon is bidding us farewell on April 15 to await the event of that all-important occasion, the arrival of the No. 1 son or daughter.

We welcome Nita Gretzinger to the T-Testing Operations Branch. Nita hails from McMinnville, Tenn. Welcome back to Jim Perdue, Ned Clapp and Jim Daniel, who have returned from temporary duty at LRF.

Joel Ferrell, Bud Barnes and L. F. Webster were the fortunate ones to be at the Cape during the Gemini/Agena Launch. They attended the launching by invitation from NASA.

Bud Barnes was in New Orleans March 8-10 attending a National AIAA Technical Committee Meeting. While in New Orleans, this group also toured the Michoud Test Facilities.

Congratulations to B. H. Patrick who was elected vice president of Arnold Center Shooters Club at a recent meeting. The Club's program will include several skeet-shoots, high-powered rifle matches and small-bore competition.

Peggy Henley flew to Dallas, Texas, for a week's vacation.

Delmon Ashcraft, who recently came to us from Pine Bluff, Ark., got "skunked" fishing the third week he was here. Guess our Tennessee skunks are not too friendly to strangers.

"J" Instrument Branch welcomes new employes Don McCaig and Jack Smith.

Kathy Fagg vacationed in Florida. Roy McDuffee has returned from a fishing trip to Daytona Beach.

If hangar flying time could be counted, Bob Ansley and Ken Farrow just logged 2,000 hours in their (new to them) Luscombe Silvaire.

Aerospace Environmental Facility ....Miriam Nichols

In AEF we heard about -- "Chet" Cheshire hanging his head in shame. He came home from the bowling tournament empty-handed, but his son, Ricky, proudly displays four trophies which he won. Congratulations, Ricky. Whatsa matter, Dad? -- Bob McCullough leaving finger impressions in the dentist chair arms. -- Bob

Hickey following a strict diet of jello and water. -- Dave Hill changing his pastime from girls to baseball, or was it baseball to...? -- Dick Warner bringing his "little red mule" home from Virginia. Say it's a winner, Dick? -- Bobby Welch keeping his new golf clubs unmarred 'til he left for the Master's Tournament in Augusta, Georgia. He warns all golfers to be "on guard" as he picked up quite a few helpful pointers from the pros. -- Bob Brown, Gene Rayfield and Bob Wood going fishing at Center Hill. Why didn't you catch any, Wood?

Congratulations to Katherine, daughter of E. K. Latvala, on winning first prize in the Plant Biology competition of the Tullahoma Science Fair. Congratulations to Teresa, daughter of R. E. Klautsch, on winning first prize in the 4-H Club bread baking contest.

Get well wishes to Patricia Cooper, Barbara Walker, Cindy Westjohn and Ernestine Moody.

Farewells to Maurice Hale, Wally Burke, Ron Wenzel (back to school) and Carolyn Wilkinson (resigned to stay at home with her little family).

Welcome back to L. W. Shallenberg from the Lone Star State where he spent several weeks.

Vacationers: D. E. Anderson and family to New Orleans, Harold Miller and wife to Texas and Sterling Ansley to Florida.

Sincerest sympathies to A. J. Mathews on the death of his mother.

Welcome newcomers: Co-ops Charles Dean, Johnny Ruble, Frank Lee, Keith Roberts and Hugh Hilliard; and R. E. White, C. C. Wiseman, E. B. Duncan, G. A. Sims, P. H. Whitfield, G. B. Johnson, C. G. Harrison, F. L. Talley, C. H. Colbert, W. E. McGregor, George Lewis, K. E. Jones, C. R. Lowe and Nancy Featherston. We enjoyed having Lt. Randall Hurlbut on his brief assignment in the AF Rep's Office.

Technical Staff ....Barbara Rowe

Technical Staff extends sincerest sympathy to Andy Lennert on the loss of his son.

Welcome to Mike Farmer (Co-op).

Best wishes to Mrs. Ken Haley (Pat Elrod - ER).

Several of our prominent (?) athletes have joined the UTSI softball team.

Materials Division ....Kathy Kiningham

"Gamester" Templeton recently enjoyed the dog races in Florida. How much, "Woody"??? Tom Hopkins was in New Jersey on business, Robbie Frame in Florida, Bob Shaw at Lake Seminole fishing and Dan Sargent is back from his rendezvous in SEBU.

New Employes: R. L. "Rob" Jones, J. L. Graves, W. L. Mann, W. H. Beck in Central Storage and Billy Brown in Salvage Yard.

Bradley Brake transferred from Inspection Branch to vKF.

Ralph Bratton reopened the pheasant season with a real BANG! Pretty expensive hunting. Next time it would be cheaper to use a gun rather than a car grill.

Be careful where you park your station wagons. "Titlebaum" Hill is bad about transporting them across the state line.

Edna & Curley Broyles may become a two plane family since Edna has moved Curley over and started flying again.

Congratulations: "Lightening" Hickerson has a new bride, the former Rachel Parsons of Alabama. Mary Prowse's son, Sammy, recently married Rebecca Nance, and we have been hearing rumors that Clara Trussell may be taking the big step soon.

Propulsion Wind Tunnel ....Gladys Clark

Joe Freeman is off for a vacation to all points South; Larry Pittenger to Bradley Creek catching lots of fish; Frank Sanders bass fishing at Center Hill again; Richard Higgins fishing in his "secret spot" caught a $7\frac{1}{2}$ lb. blue cat. Reece Green went to the Boat Show in Nashville recently to see the Hester battery display. Some charge!

Nice to have Marcia Jacquess back with us after extended illness. Best wishes and a big Hi to Jim Nichols' son Bobby, recovering from a broken arm.

We discovered that Bob Daniel is another engineer who can't read important signs!

Ray Robinson has moved into his new house on Tullahoma Lake. Now the work really begins, Robbie.

Holy Bowling Ball! That dynamic quintet of Don Baker, John Coile, Frank Jackson, Joe Milillo and Capt. Dave Reichenau took off to Dayton, Ohio, to try big time bowling last week. Unfortunately, no one will ever remember anyone who won 3000th place! But, there's always next year, fellows.

General Services Division ....Virginia Smith

Welcome to new employes Howard Bailey, W. J. Quick and J. W. Singleton.

Our deepest sympathy to the family of G. T. Reed and to the family of W. H. McBee; to A. G. Marshall on the loss of his father; to N. W. Kemper on the loss of his father-in-law and to Paul Adams on the loss of his brother.

Farewell and good luck to J. E. Hardin and D. L. Rohde who terminated to enter Military Service, to W. A. Reid who accepted other employment and to F. L. Talley who transferred to AEF.

Jim Gebault and Bill Palmer are enjoying quiet rides in new cars. Joe Watson vacationed in Florida -- mode of transportation, new car, of course. Jo Anne Burkhart is getting "broke-in" to a new house.

Congratulations to Cecil Lance on celebrating his 25th wedding anniversary.

Get well wishes to J. M. Gray's wife who underwent an emergency operation and to our own sick J. C. Henson and E. F. Brown.

"Off with the new and on with the old" badge that has been kept in escrow at Security for a year for D. M. Bean. Welcome back, Mr. Bean!

Heirborne: vKF -- Jerry Hahns - boy
-- Hank Hemkens - boy
-- R. E. Allens - girl
PWT -- Jack Robertson - girl
-- Harry Kaupp - boy
Technical Staff -- C. T. Ash - boy

ing a facility capability to test the geometrically large, low-chamber-pressure, high-expansion-ratio engine. Techniques had to be developed to provide a vacuum pumping capability in excess of that required for previous test programs and in excess of the predicted requirement for this program.

Without this capability, it would have been impossible to fire the engines without damaging or destroying the fragile nozzles.

The first two types of nozzle extensions tested crumpled during motor firings. A total of nine different configurations were tested before selection was made of an optimum lightweight nozzle.

A later phase of this program was a continuation of the development testing combined with pre-qualification testing of the engine as an integral unit of a simulated Service Module.

This phase initially was directed toward obtaining information on five engines to obtain a large statistical sample of ballistic performance. However, failure of the combustion chamber during testing of the fifth engine led to extending the program to include seven engines. This required an additional three and a half months. Data obtained by use of the new measuring techniques were exceptionally good and represent substantial advances in the state-of-the-art of testing liquid propellant rocket engines.

Qualification Testing

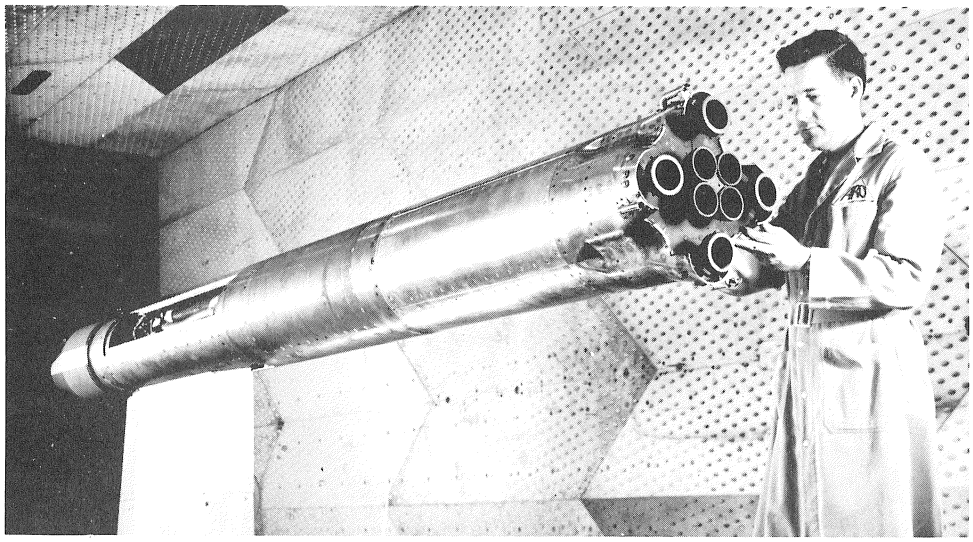
The next step was to perform qualification testing—to qualify the engine for the lunar mission throughout the various possible mission duty cycles. However, the results of earlier testing clearly indicated the engine was not ready to be qualified for the complete lunar mission duty cycle without additional redesign and high altitude development testing.

Thus, last Fall the test plan was amended with the objective of qualifying the present engine design for the initial three Apollo sub-orbital and earth orbital flights for which a less severe mission duty cycle is required.

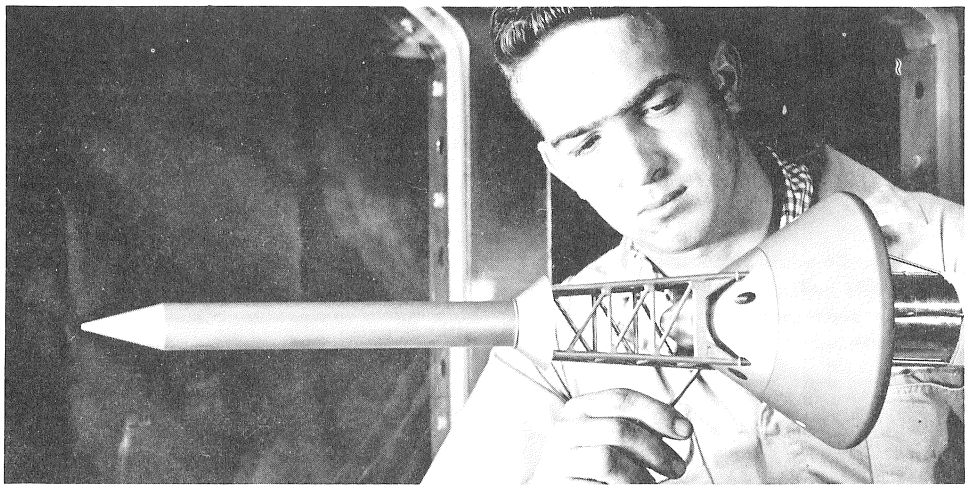
Lem Ascent Engine

During a four-month period which began in May of 1964, an accelerated development test program on the 3500-

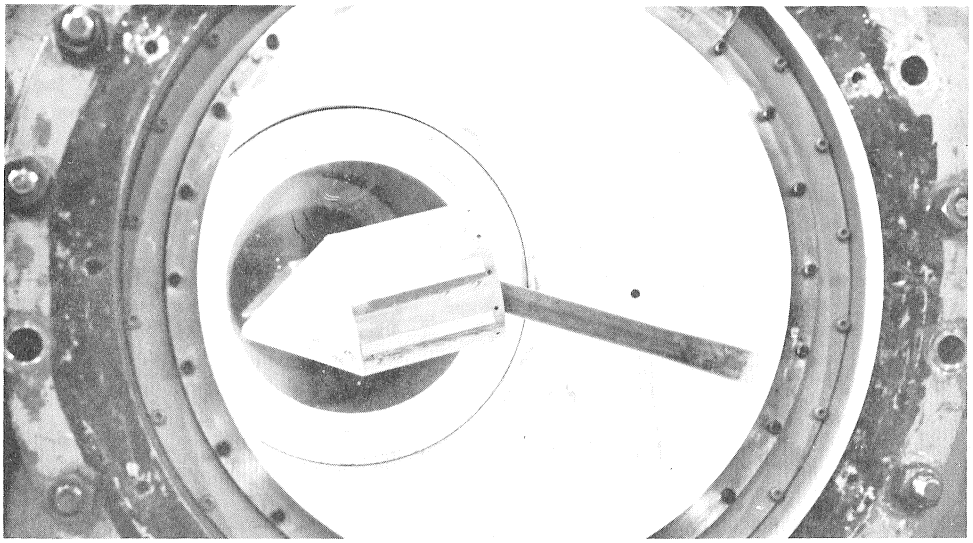
(Continued on page 12)



BASE HEATING DURING LAUNCH – was test objective for 1961 test of a "hot rocket" Saturn launch vehicle in the Propulsion Wind Tunnel's 16-foot transonic test section. Turbine exhaust ports were changed as a result, substantially reducing base heating. Test crew member is D.W. Radford.



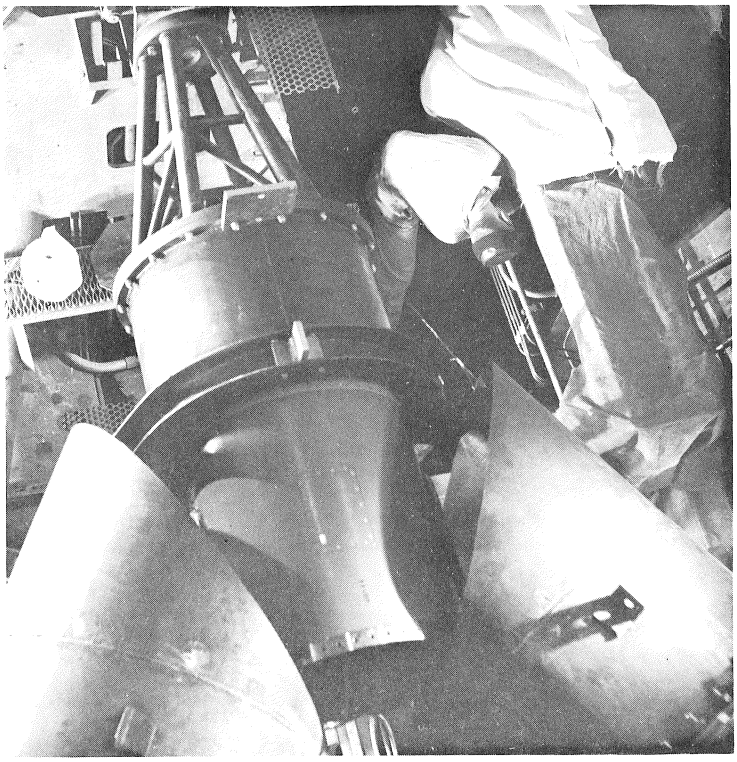
SUPERSONIC TEST FOR ABORT CONFIGURATION – scale model of Apollo three-man capsule, with escape tower and jettison rocket attached is prepared for test in von Karman Facility's 40-inch supersonic tunnel by E.N. Shelton. Later tests established need for canard control surfaces at apex of escape rocket.



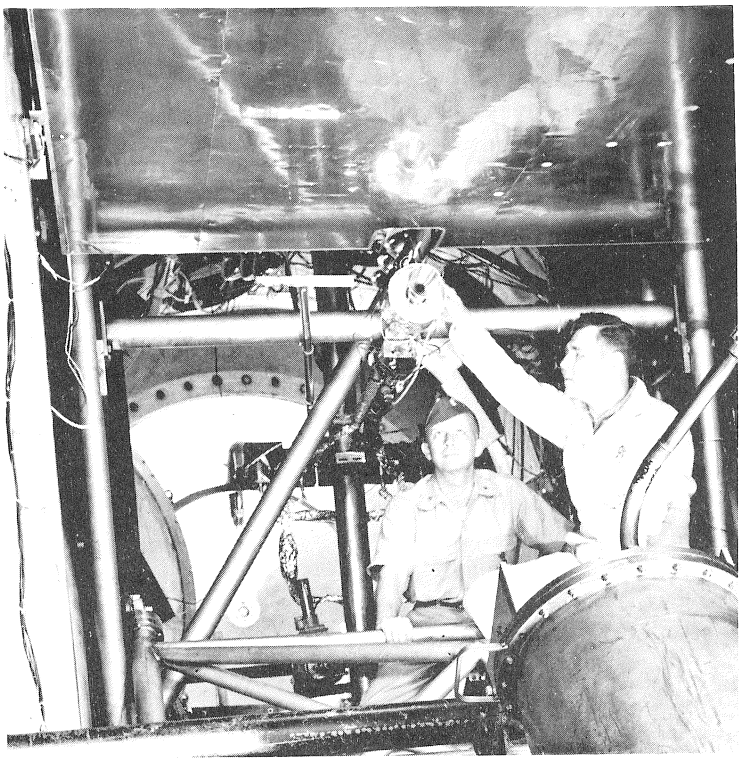
MACH 8 TESTS of scale model of Apollo command and service module was one of early tests conducted in the 50-inch hypersonic wind tunnel in the von Karman Facility.

Apollo Development

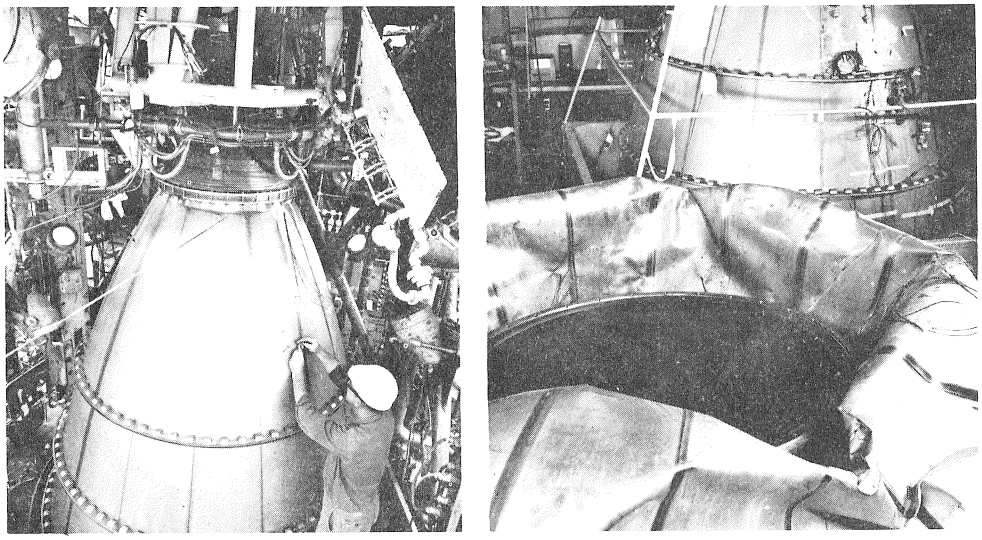
(From page 11)



FULL-SCALE ESCAPE ROCKET TESTED AT 96,000 FEET – This Rocket Test Facility program checked the ignition reliability of the 35,000-pound-thrust solid rocket which is designed to jettison the command module if an abort during launch is necessary. Special preparations had to be made to provide a twin diffuser system with a 60-degree supersonic turn to test the motor which has twin nozzles canted outward at 30 degrees.



SPACE MANEUVERING ROCKETS – which will control Apollo's flight in space were tested in simulated altitudes of more than 80 miles in the Rocket Test Facility's J-2A cell. Maj. John Hitchcock discusses test setup with ARO test crewman H.R. Wenzel.



EARLY NOZZLE FAILURE – A lightweight nozzle extension initially proposed for the Apollo service module's rocket engine is installed for test in the Rocket Test Facility's J-3 cell. Post-fire view (right) shows how nozzle crumpled when fired at simulated 120,000-foot altitude. Test data helped in developing subsequent nozzles which withstood test firings.

(From page 11)

pound-thrust LEM ascent engine was conducted at pressure altitudes near 135,000 feet at ambient temperatures. This is the engine which will lift the lunar vehicle off the moon on its way to return the astronauts to the vehicle orbiting the moon.

Objectives and results of the four-phase program were:

- Evaluation of thrust chamber assemblies produced by two manufacturers. Performance and structural integrity were determined and one manufacturer selected to provide additional chambers.
- Ballistic performance determination of several propellant injector head configurations with chambers of different volume in a modified parametric study program using a boilerplate, water-cooled engine to simulate the flight-weight version.
- Evaluation of the prototype flightweight engine to define ballistic performance and structural integrity.
- Simulation of launch of the LEM ascent stage from the descent stage on the lunar surface to define additional impulse which might be produced and to evaluate the structural integrity of the engine operating under these adverse conditions. The LEM ascent engine was fired 18 times—for 650 milliseconds each time—with a six-foot-diameter flat plate mounted aft of the nozzle exit plane at several distances and angles to simulate the top of the LEM descent stage.

(Continued on page 13)

MACH 20 RE-ENTRY TEST – for a scale model of the Apollo command module was conducted in the 100-inch hypervelocity wind tunnel in the von Karman Facility. ARO technician J.W. Helton adjusts the model support.

ASCENT ENGINE – for LEM module being prepared for high altitude test in Rocket Test Facility. Capt. E.C. Westwood watches ARO technician D.L. Easley make final adjustments.

Apollo Development (From page 12)

Although this last phase was not initially planned, the preparations and completion were accomplished within a two-week period.

The value of such propulsion system testing is indicated in a letter sent at the conclusion of the last phase to the Arnold Center Commander from the Manager of the Apollo Spacecraft Program Office, Dr. Joseph F. Shea, NASA.

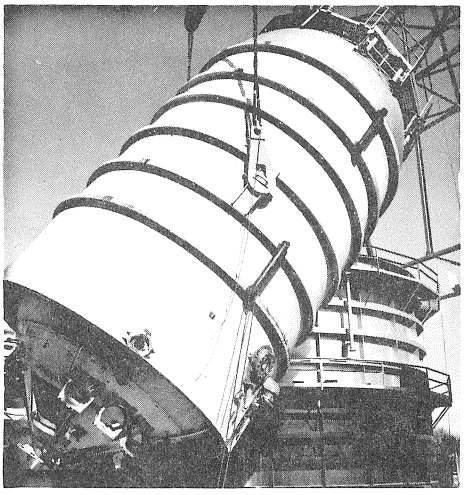
"Our special thanks...to the test personnel who accomplished the remarkable task...within a twenty-four hour period. As a result of these tests, the Ascent Engine Program has received information for design that would not have been available for another seven months, and in addition, the effort at White Sands will be reduced by over 50 percent."

Lem Descent Engine

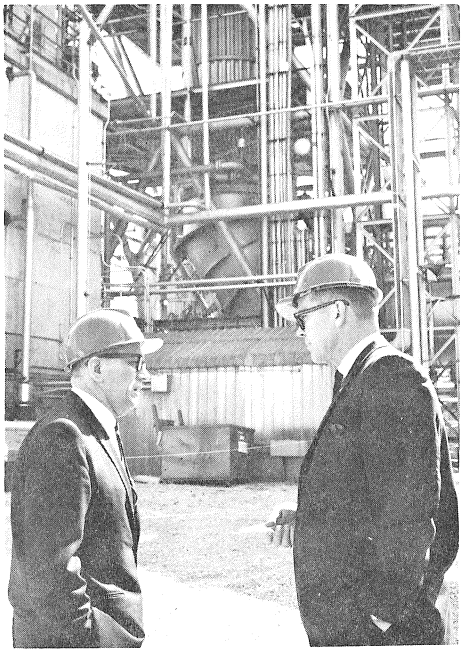
Preparation for development testing of the 10,000-pound-thrust LEM descent engine was started at Arnold Center in May, 1965. This is the engine which decelerates the two-man capsule to a soft landing on the moon.

The engine has a radiatively cooled, high-expansion ratio nozzle extension designed to crumple and collapse upon lunar landing, taking the contour of any obstruction or surface protrusion encountered. This extension is therefore even more fragile than

(Continued on page 15)

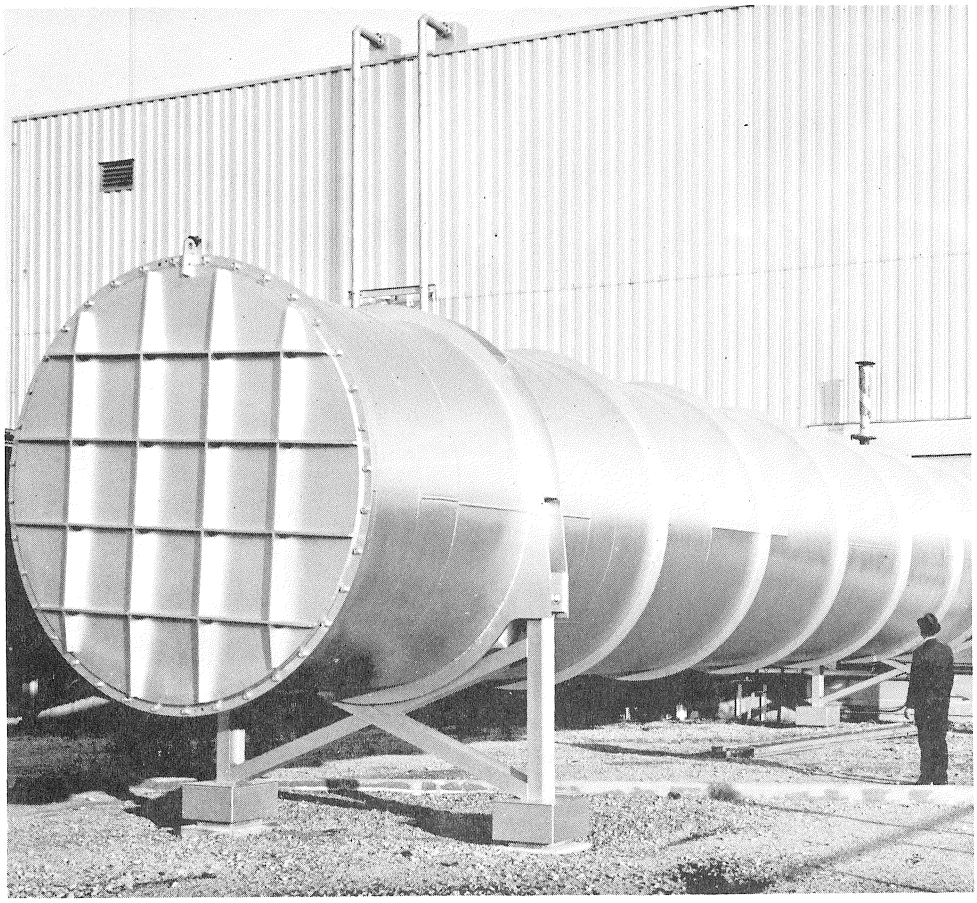


BIG ONE COMING UP—The "battleship" tankage (i.e. not flight weight) for the 200,000-pound-thrust third stage of NASA's Saturn 5 Apollo launch vehicle is hoisted into position near the J-4 test cell of the Large Rocket Facility now undergoing extensive preparations for firing the complete stage at simulated high altitude conditions later this year. The tankage is 21 feet in diameter, 58 feet long and weighs 70 tons.



NASA OFFICIAL VISITS CENTER – Mr. Katonchick, deputy manager of the Apollo Spacecraft Office, Houston, discusses current testing of service module engine with Rocket Test Facility Chief, Joel Ferrell, Jr. (right).

Tunnel F Modification



ADDITIONAL LENGTH increases vKF run time, provides longer period of usable flow; thus, more data from a single firing.

Company Safety Record Praised By Mr. "Span" Asst Dir/Eng 1956-61

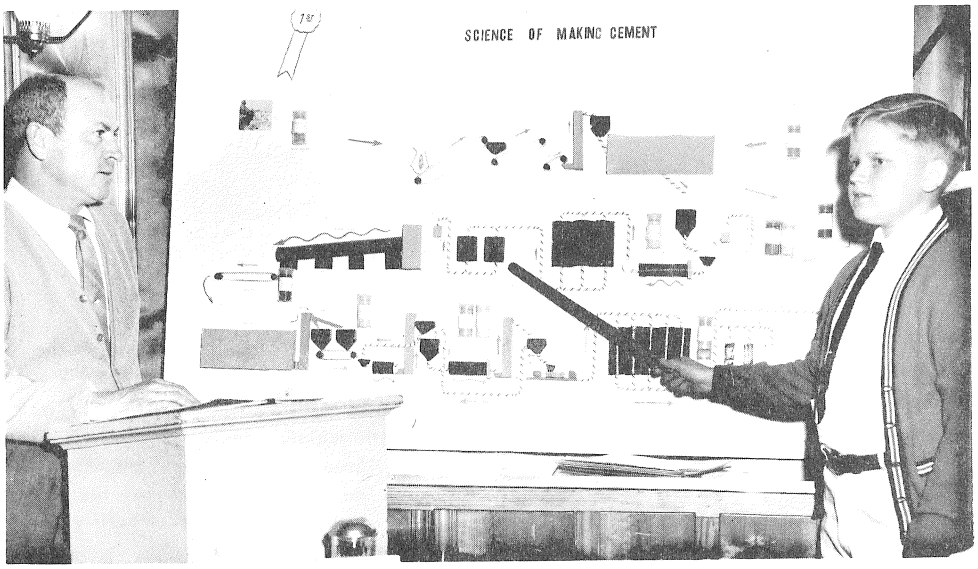
"To Al Moore, Pete Marconi and everybody else that helped make that safety record. The February HIGH MACH has just arrived and it gave me great pleasure to read about the new record for on-the-job injuries. This is one of the most important phases of the work at AEDC, as it improves production, morale and efficiency all at the same time. Shoot for even safer 'sixty-six'."

Span

John "Span" Spanogle
retired 31 May, 1961

With a moment of care – An error you may spare.

Winning Science Project



SEVENTH GRADER Mike Foreman, son of Gene Foreman, MD-SA, demonstrates his winning science project to the Cowan Rotary Club. He won first prize in the Cowan Public School Science Fair with his project the "Science of Making Cement." Looking on is James H. Hawkins, superintendent of the Marquette cement plant in Cowan. Mike's brother Paul won the award last year.

Miss High Mach

MARY DONNA BEAM, secretary in the Plans and Programs division, DCS/Engineering, is a native of Tullahoma and has been employed at the Center for the past three years. She attended MTSU and likes swimming, reading and traveling.

Space Studies (From page 9)

Program. He volunteered for re-assignment to Southeast Asia where for 12 months prior to November 1965, he served as a flight leader advisor to the 516th Fighter Squadron, 41st Tactical Wing of the Vietnamese Air Force.

In addition to 24 U. S. decorations, he received seven citations awarded him by the Vietnamese Air Force for his work in the Southeast Asia battle zone.

Capt. Jones and his wife, the former Miss Mari Herrington of Pleasant Ridge, Mich., have two sons: Brian, 6, and Craig, 5. He will complete requirements for his master's degree at the Space Institute in June 1967. The family resides in Tullahoma, Tenn., at 300 Yeager Street.

Apollo Development (From page 13)

others previously tested and presents a very difficult and delicate testing techniques requirement.

Objectives of the program are to evaluate the ballistic performance and structural integrity of the engine assembly throughout complete mission duty cycles in a high-vacuum, low-thermal environment.

Additional phases include testing of the thrust chamber assembly and nozzle extension at near-space conditions with the engine firing against a flat plate to simulate the flow dynamics of lunar landing similar to previous tests of the LEM ascent engine.

80-Mile Altitudes Simulated

Between the conclusion of the subscale Service Module engine test program and the beginning of the full-scale Service Module test program, extensive testing of the reaction control system motors for both the Service and Command Modules was accomplished. This included, among other work development of test techniques for firing 100-pound-thrust rocket motors at an altitude of nearly 80 miles.

Wind Tunnel Test Programs

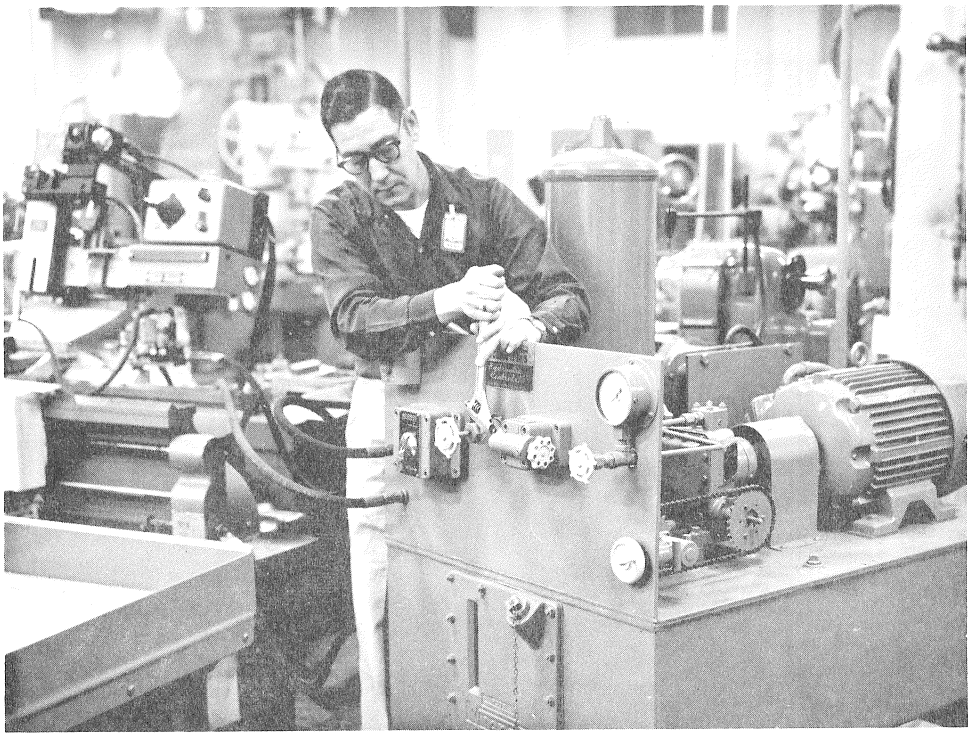
Since the first aerodynamic test was run at Arnold Center in 1960 on a proposed Saturn-Apollo launch configuration, the wind tunnel programs have been expanded to include tests in the 16-foot transonic wind tunnel—an extension of the first base heating tests in the Rocket Test Facility—and to six of

(Continued on page 18)

Clean Up - Fix Up

ANNUAL SPRING DRIVE to beautify the area is on. Let's make a special effort this year to brighten up our area during Clean up – Fix up Week, April 25-30.

Cost Reduction



HOW TO SAVE $4220 ON A $4500 ITEM – Drilling long, small diameter holes requires a high pressure coolant system for the drilling rig. When the PWT shop needed such a system recently, they found one available for $4500. However, after screening surplus hardware in Materials Division it was determined that all the necessary components were on hand. All it took was about $280 in labor to build the unit – a saving of $4220. Shown adjusting a valve on the unit's control panel, is the man who supplied most of that labor; machinist Harry Gibson.

Co-Op Dance

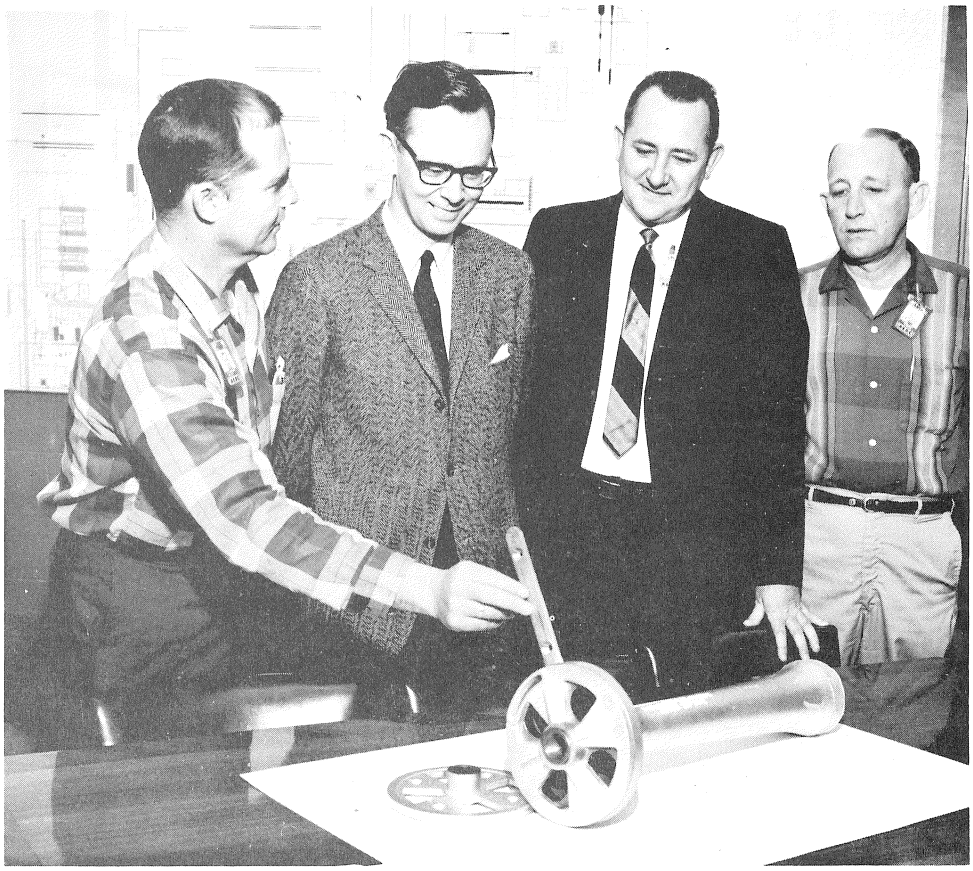
SPRING QUARTERLY dance of the Center's young Co-ops is held at the Officers' Club.

It's Springtime

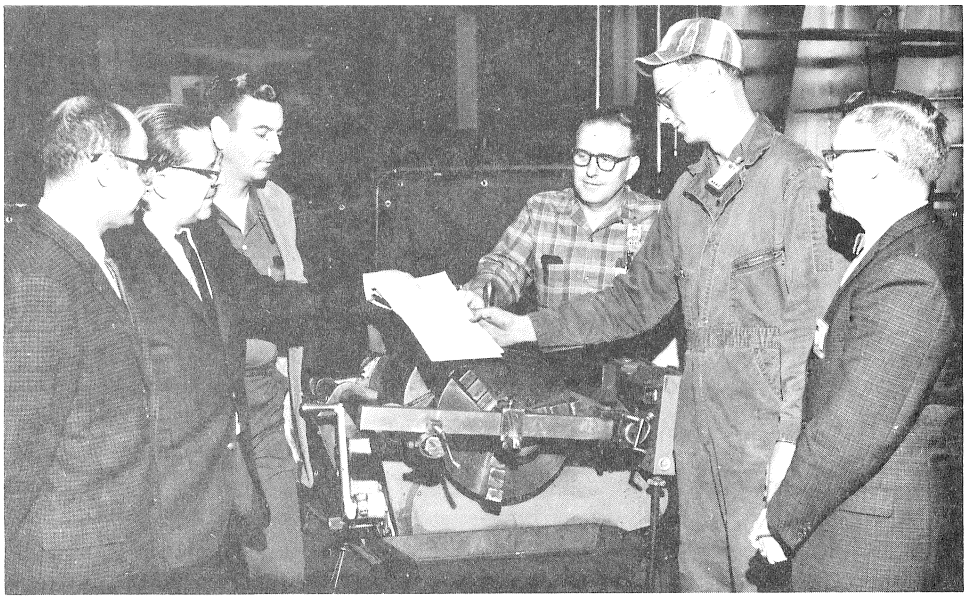
MOWING EQUIPMENT gets an early seasonal start on the area's 1400 acres of grass.

RAISING DUST on the front lawn is ok on a sunny Saturday if the new turf needs to be limed. Carl Billingsley, RTF, is enjoying it all too.

Two ARO Employes Win Big Awards:



AIR-FUEL VALVE CONVERSION SUGGESTION – Kelly M. Johnson, vKF plant operations supervisor, shows how he modified one of the 96 mixing valves in a huge air heater, permitting it to be converted from burning natural gas to propane in a half-hour's time. Previously, the job required 24 hours. Shown with Mr. Johnson are J. Lukasiewicz, facility chief; Paul Conrad, manager of plant operations and Tom Mullican, maintenance section supervisor.



EARNS $920 AWARD FOR SUGGESTING AUTOMATIC PIPE BEVELER – Apprentice pipefitter Joe D. Little receives a check and commendation for his suggestion for an automatic pipe beveling device now in operation at the Center. Making the presentation is George Pope, ESF chief. Others (from left) are branch manager A.M. Ramunno; pipefitters' union representative on the Company's Joint Apprenticeship Committee, M.R. Hale; ESF pipe shop supervisor F.D. McClure and ARO's Training Branch Manager Joe A. Williams.

$1,000 Award To VKF's Kelly Johnson

An inexpensive device which permits a huge gas heater to be quickly converted from burning natural gas to propane has earned a $1,000 award for Kelly M. Johnson, plant operations supervisor for the von Karman Gas Dynamics Facility.

Basically, the device suggested by Kelly is a new type air-fuel mixing valve for each of the heater's 96 gas orifices. The size orifice required for one type gas can be changed to that required for the second by merely removing a flat brass bar from a slot in each valve; reversing it and reinserting it.

Conversion Equipment

Standard conversion equipment is commerically available, but it costs about $50,000. The modification proposed by Johnson cost only $2,000, including the design, fabrication and installation which was done at the von Karman Gas Dynamics Facility.

Need for the conversion has arisen several times during the past two winters when the gas-fired air heater, which can heat up to 1500 c.f.m. to a temperature of 900°F., encountered a shortage of natural gas with which it is normally supplied. A supply of propane gas is kept on hand, but the job of converting the heater required that two wind tunnels engaged in high-priority tests be shut down for 24 hours. The conversion, before Johnson's idea was put into effect, required 100 man-hours of labor. The conversion can now be made in 30 minutes by two men.

Automatic Pipe Beveler Joe D. Little Earns $920

Joe D. Little, a 22-year-old apprentice pipefitter from Decherd, Tennessee, has received a $920 award for suggesting a fast, simple, automatic method for beveling cut pipe prior to welding.

Essentially, his idea was to attach an adjustable beveling tool to a pipe-cutting or threading machine. It can be used on any such machine having the power to turn the pipe – and it does a better and more uniform job than was possible heretofore when it was standard practice throughout industry to use a disc grinder and file to bevel the pipe after it was cut.

(Continued on page 19)

Apollo Development

(From page 15)

the wind tunnels in the von Karman Gas Dynamics Facility. A wealth of data has been provided the sponsor and the users which have contributed immeasurably to the design of the launch and upper stage configurations, as well as to the Command/Service Module, Command Module and emergency abort configurations.

The overall test program was designed by NASA and the users to obtain data on aerodynamic heating, stability during re-entry, effects of center of gravity offset and heat ablation, interaction between separating components during escape operations, aerodynamic loads throughout the flight regime and to help solve related problems that arise during development.

Generally, objectives of the wind tunnel work in the von Karman Facility have been to determine:

1) Static and dynamic stability of the launch escape system.

2) Static and dynamic stability of the Command Module during re-entry.

3) Static stability of the complete launch configuration.

4) Static stability of the launch escape system with the escape motor operating.

5) Steady-state pressure distribution on the launch escape, spacecraft and re-entry vehicles.

6) Heat transfer distribution on the launch, escape, spacecraft and re-entry configurations.

Critically Important Information

These aerodynamic tests have provided information that has been critically important in solving literally hundreds of problems and tasks associated with Apollo development. Many voluminous techincal reports and a mass of precise test data have resulted from these tests. However, the tests are extremely complicated and it is virtually impossible to provide a valid "brief summary" and describe the significance of the results.

Future issues of HIGH MACH will contain short articles on some of these Apollo wind tunnel tests. However, a general appreciation of the significance of this wind tunnel testing may be gained from considering one specific problem as an example. It involved stability of the launch escape vehicle during abort.

In the abort operation, the launch escape tower and motor are jettisoned to allow deployment of the recovery chutes.

After many aerodynamic fixes were attempted, two retractable canards were installed on the nose section of the launch escape motor. It was found that deployment of the canards achieves the desired trim attitude at Mach numbers between 1.5 and 5.

This information might someday mean the difference between success and failure in the recovery of the three astronauts if they have to abort during a launch.

Major Modification; Major Test

The biggest Apollo test yet is currently underway at AEDC. Preparations are proceeding at top priority to ready test cell J-4 for tests of the Saturn S-IVB stage engine, complete with tankage and associated controls, at simulated altitude conditions of more than 100,000 feet. The test firings are scheduled later this year.

S-IVB is the second stage of Saturn IB which will be used in the sub-orbital Apollo flights and the third stage of the Saturn 5 Apollo flight.

The retro-rockets for S-IVB were tested in J-4 late last year. Four of these 5,000-pound-thrust engines are fired to insure proper separation of the S-IVB stage from the Service Command and Lunar Excursion Modules which continue to the moon.

A substantial amount of testing related to the Apollo project remains to be done at AEDC. How well we do the work will be a vital factor of how—and when—this country will be successful in placing man on the moon.

Secretaries Appreciation Day

INDISPENSABLE CONTRIBUTION of today's secretaries was given proper tribute recently by the office of DCS/Civil Engineering when the distaff assistants were honored with a luncheon at the Officers' Club. The Civil Engineering secretaries, the office chiefs and the luncheon planning committee members are: Reba Rhodes, secretary, TRIPLTEE Program Office; Shirley Weatherington, secretary, Industrial Engr. Analysis Div.; Mary Donna Beam, secretary, Plans and Programs Div.; Col. O.A. Israelsen, DCS/Civil Engr.; Estelle French, secretary, DCS/Civil Engr.; Lillian Ashley, secretary, Engr. Div., and Marguerite Gallagher, clerk-typist, Industrial Engr. Analysis Div. Standing are G.G. Ather, chief, Industrial Engineering Analysis Div.; S.F. Krogstad, mechanical engineer, Plans and Programs Div.; C.H. Smith, chief, Plans and Programs Div.; Capt. Paul Landry, project officer, Engineering Div.; Lt. Col. Gordon Gray, chief, TRIPLTEE Program Office; C.E. Ellis, chief, Engineering Division, and E.V. Kohl, adm. asst., Industrial Engr. Analysis Div.

Pines To Pulpwood

CUTTING PINES – In the oldest of the Center's more than 6,000 acres of pine tree stands, scenes like this are being repeated several hundred times daily. Workmen recently began selective cutting, thinning of the pines as part of the Center's long-range Forest Management program which provides for sustained yield of pulpwood over a 60-year period. Initial cutting is in a 190-acre, 14-year-old stand near the hunter checking station on the AEDC access highway. With an additional 300 acres soon to be marked for cutting, about 2,000 cords of pine pulpwood are expected to be produced this year.

PULPWOOD PRODUCER Glen Parson of Tracy City, Tenn., discusses loading operations at a rail site with Lt. Col. H.L. Wilson, Chief, Materiel Management Division, Directorate of Contract Management, and Col. J.T. Hill, AF Administrative Contracting Officer at the Center. Parson, an independent producer, is directing the cutting and loading for Hiwassee Land Co., which purchased the pulpwood for shipment to the giant Bowaters paper mill at Calhoun, Tenn.

Awards (From page 17)

Substantial Savings

Substantial savings in time are possible using the new technique, depending upon the size and thickness of the pipe being beveled. For example, a four-inch-diameter stainless steel extra heavy pipe previously required 40 minutes of labor to bevel before welding. Now the same job can be done in 10 minutes. Four-inch-diameter standard pipe which used to require 15 to 20 minutes of finishing can now be done in 45 seconds.

Joe D. is in his third year of training in the ARO Apprenticeship Program. In this Program, his rating is based in equal part on his classroom instruction and his practical work. When he perfected his idea for beveling pipe, he put it to use on his job without calling attention to it.

Work Technique Noticed

One day – two or three weeks later – J.R. Pennington, General Foreman of the Pipe Section, noticed the smoothness of the pipe beveled by Joe D. and upon investigation found that the young apprentice had come up with a technique that had escaped everyone else in the business.

Mr. Pennington said he had been trying to figure it out for about 25 years. He feels sure that the new technique will be welcomed by shop personnel everywhere where the commonplace task of beveling pipe for welding is performed. Already one of the major welding company's southeastern U.S. representatives has started telling his clients about it.

Suggestion Submitted

Facility Chief George Pope shared Mr. Pennington's excitement and they suggested that Joe D. submit the idea to the Suggestion Program Committee. Mr. Pope said, "Of all the suggestions I've seen submitted which affect Engineering Support Facility shop operations, I believe this is the most significant from the cost savings standpoint as well as the quality standpoint."

Joe D. graduated from Franklin County High, Winchester, in 1961 and helped his father, B.W. Little, build houses until he was employed by ARO in January 1963. He is scheduled to "top-out" of the Apprenticeship Program and earn his journeyman rating in January 1967.

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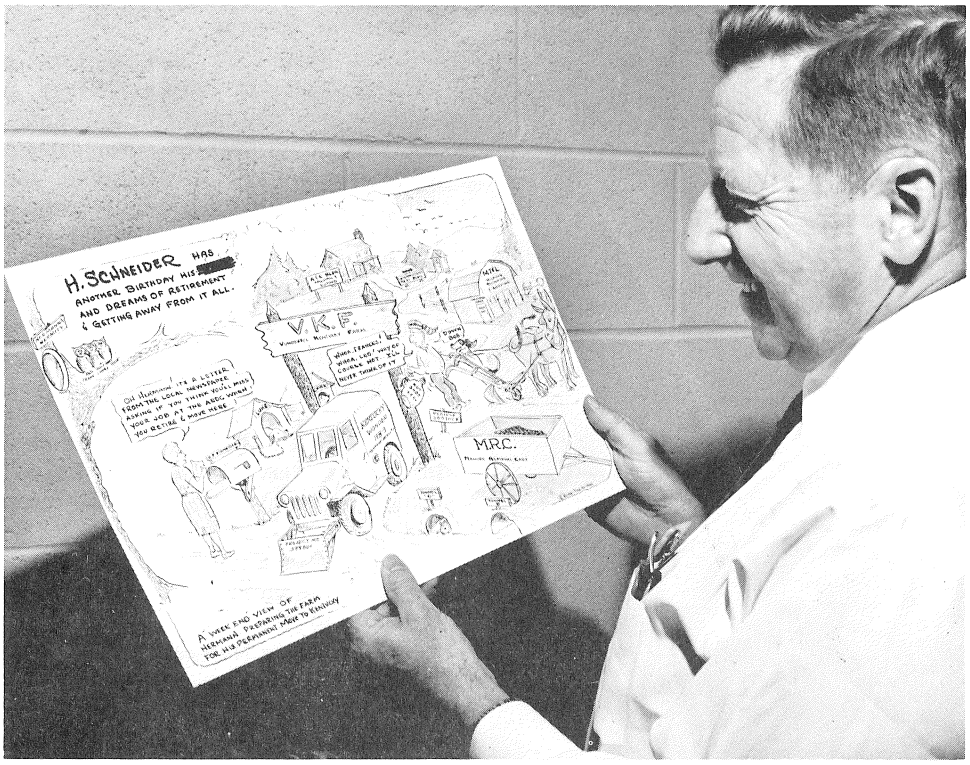
Retirement Visions



DREAMING OF THAT DAY occupies the attention of Hermann Schneider, manager of vKF's Testing Operations branch, as he looks over a drawing of his "Old Kentucky Home" portrayed in fun by Bob Bear, former vKF employe. On the right he is enjoying it all with L.S. Burch, Shop and Installation section supervisor.

Golf Council

SPRING SESSION. Members of the Center Golf Council are shown busy laying the plans for the upcoming season. In session at the club are Lt. Col. Ross B. Young, Air Force representative and council chairman; Herschel McDonald, ARO representative; Capt. W.C. Scott, AF; Hubert Smith, professional at the course; Sgt. Sam Kornegay, AF, and Jay Graham, ARO representative.

AF - AEDC
Arnold AFS Tenn