

KANSAS STATE ENGINEERING NEWSLETTER

IMPACT

Vol. II, No. 1, November 1966

Kansas State University - College of Engineering - Engineering Experiment Station - Division of Engineering and Industrial Extension

SWORDS INTO PLOWSHARES

A current wisecrack pokes fun of a hypothetical Department of Defense committee studying the problem of "Peaceful Uses of the ICBM." But as it turns out, that is no joke.

During the past year the College of Engineering made acquisitions of Air Force facilities which were part of our military missile system. The engineers at Kansas State are now converting the missile siloes and associated equipment into tools for teaching and research. And the savings to the nation and the state must be figured in the millions of dollars. These highly specialized, single purpose facilities have essentially no value in the consumer market except as scrap material, and yet as educational and research tools, their value is an appreciable proportion of their initial cost and their useful life can be extended indefinitely.

Rising from its pod as the top of the shelter rolls back, Atlas, America's first operational intercontinental ballistic missile, has been retired from active combat-alert duty with the U. S. Air Force. Operational with the Strategic Air Command, an 85-foot Atlas missile was once stored horizontally in the missile bay of the site being turned over to Kansas State University today.

The 360,000-lb thrust Atlas was designed to hurl its nuclear payload more than 9000 miles if the U. S. was forced to retaliate against any aggressor missile attack. Although made obsolete by the TITAN II and MINUTEMAN Weapons Systems, ATLAS continues to play an important role today in several pioneer space projects.

Forbes AFB Atlas Site No. 7, located near Wamego, Kansas, is the first excess Atlas installation to be approved for transfer from Air Force inventory. The site, which is virtually intact except for the missile and associated electronic components, will be converted to a unique aerospace laboratory by the College of Engineering.

Part I. Launch Sites to Laboratories

Kansas State University received the keys to three former Atlas missile sites during formal transfer ceremonies in Manhattan on September 30. Accepting the multi-million dollar facilities from the U. S. Air Force, President James A. McCain signed the necessary documents in behalf of the Kansas Board of Regents.

Government, state and local officials involved in the transfer included Col. A. E. Buchanan, vice commander, Forbes Air Force Base, Topeka; Lt. Col. Robert Green, Forbes Air Force Base; Lt. Col. H. H. Houghton, Schilling Air Force Base, Salina; Eldon Sloan, Board of Regents; Robert Ducate, regional office of the Department of Health, Education and Welfare, Kansas City; Robert Arnold, state surplus property section, Topeka; President McCain and faculty members of the College of Engineering.



The first site, located near Wamego includes the horizontal trench which held an Atlas "E" missile, two underground bunkers and a quonset building above ground suitable for laboratory use. To be developed into an Aerospace Laboratory by the College of Engineering, the site was the first transfer of its kind approved by the Air Force. The preliminary approval was announced a year ago in IMPACT.

The other ex-launch pads, one located north of Abilene and the other near Chapman, are cylindrical siloes, designed to launch a later version of the Atlas Intercontinental Ballistic Missile.

"This is a very happy development for Kansas State and the State of Kansas," President James A. McCain said during the transfer ceremonies. "Resources are now available, and we do have exceptionally fine engineering scientists at Kansas State to take full advantage of the new facilities."

Dr. Paul Russell, dean of the College of Engineering, said that the research and educational purposes for which the former ICBM sites can best be used have been carefully planned to meet both the short range and long range educational needs of the College of Engineering

Including unique facilities for research and instruction that could not be duplicated on the campus, the sites will be used to complement engineering studies in gas dynamics, heat transfer, combustion, jet propulsion, high-energy acoustics, cryogenics, vibrations, control systems and environmental testing.

A need for the site developed two years ago when the M. E. Department was awarded a \$12,000 grant from the National Science Foundation to construct a small rocket engine test facility, with matching funds provided by the University. This \$24,000 allocation prompted a search for a suitable site on or near the campus. The rocket engines to be operated would require high-pressure water with considerable amounts of three-phase 440 volt electricity. Telephone communication with the campus was also needed, and the facility has to be protected from extremes in temperatures and moisture, and from the possibility of vandalism when the site might not be in use.

After several possibilities had been eliminated Dr. James Bowyer read a notice stating that the Atlas "E" Squadron with headquarters at Forbes AFB was to be deactivated and that the missile sites would be declared excess. Dr. Bowyer, who is technical director of the MEDAL laboratory and who initiated the NSF proposal, recognized that the Atlas "E" site near Wamego would provide an ideal location. It was sufficiently remote that noise could be tolerated and personnel, fire protection and utilities were available, and much of the auxiliary equipment and other test facilities needed for a modern space laboratory were also included in the missile launch sites.

Bowyer discussed the possibility with Dr. Ralph Nevins, head of Mechanical Engineering and a formal request for the properties and easements associated with the Wamego site was forwarded to the General Services Administration through the Department of Health, Education and Welfare.

The first experiments to be moved to the Wamego site, which will be known officially as the

"Mechanical Engineering Department Aerospace Laboratory," involve an underground rocket static test facility and a \$10,000 shock tube facility.

Two small 160-pound thrust rocket engines will be installed in the missile bay and flame tunnel where the basic principles of rocket propulsion, chemical composition of rocket exhaust plumes and radiation heat transfer can be demonstrated and investigated experimentally. The heavy concrete construction of the missile bay and flame tunnel will be used as protective revetments and noise suppressors.

A Shock Tube, also located at the site, will be used to study high-temperature gas dynamics, high-temperature high-speed heat transfer, and problems of hypersonic re-entry into a planetary atmosphere. Located in the missile bay adjacent to the rocket engine test facility, the shock tube will make extensive use of the site's already installed dehumidifier as an air dryer, as well as the high pressure gas supply systems to charge the shock tube driver and sections.

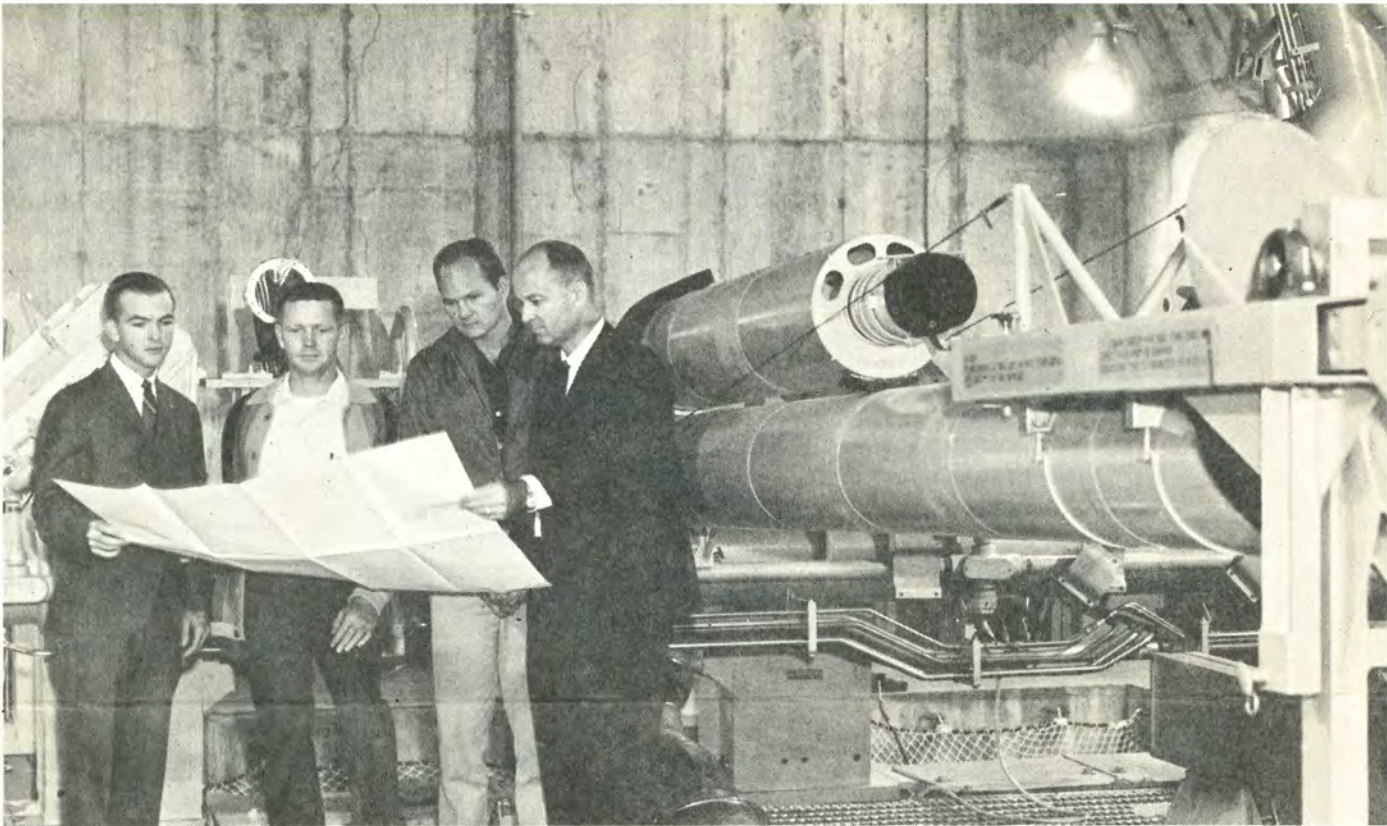
"We are more enthusiastic each time we visit the site," was Dr. Nevins' comment. "The possibilities for developing the facility and fully utilizing the space and equipment are tremendous. It will provide us laboratory facilities in which to conduct research in areas we haven't had an opportunity to investigate before."

One of the most favorable aspects of this acquisition is the fact that systems and equipment left in the launch facility will be utilized for engineering instruction and research programs in the future. It is gratifying to realize that this very sophisticated and expensive equipment can be put to such use, in place of being dismantled and abandoned.

Located 2 miles northwest of Wamego and only 15 miles from the K-State campus, the site has its own electric power, water and sanitation facilities, hydraulic and pneumatic control systems, air conditioning systems, storage and transfer systems for various gases and liquids, combustible fuel vapor and gaseous oxygen detection systems, and safety showers and eye wash laboratories. Some 22 acres are involved in the basic facility, plus easements for safety and noise abatement.

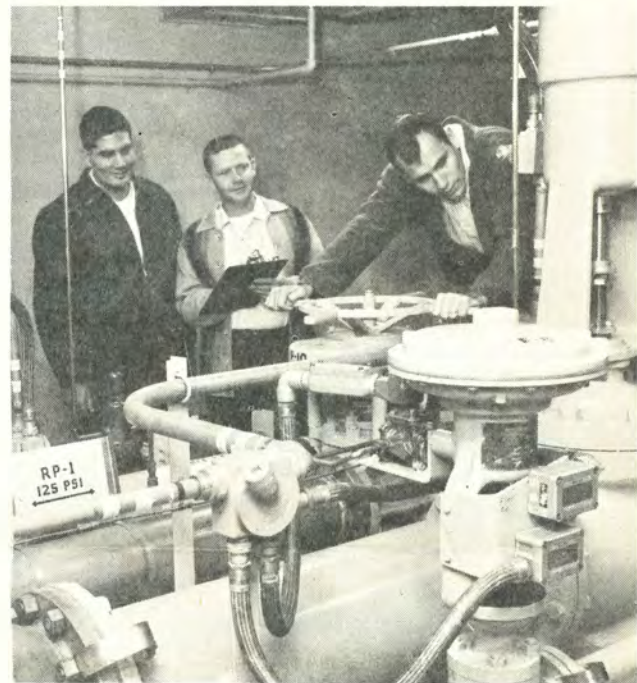
During this first year of operations, Dr. Nevins does not anticipate establishing any permanent office or group of resident graduate students on location. Most of the experimental analysis and analytical work will be accomplished on campus. However, the site will be used by students and professors in various experiments during assembly of apparatus, during the actual tests, and in the course of recording necessary test results and data. He stated that it would require several years before the site can be completely developed.

The Mechanical Engineering Department's Aerospace Laboratory at Wamego is actually the second such field test station to be operated by the College of Engineering. In 1961 the Department of Nuclear Engineering acquired land and facilities five miles west of the campus, to develop its extensive Radiation Shielding Test Facility.

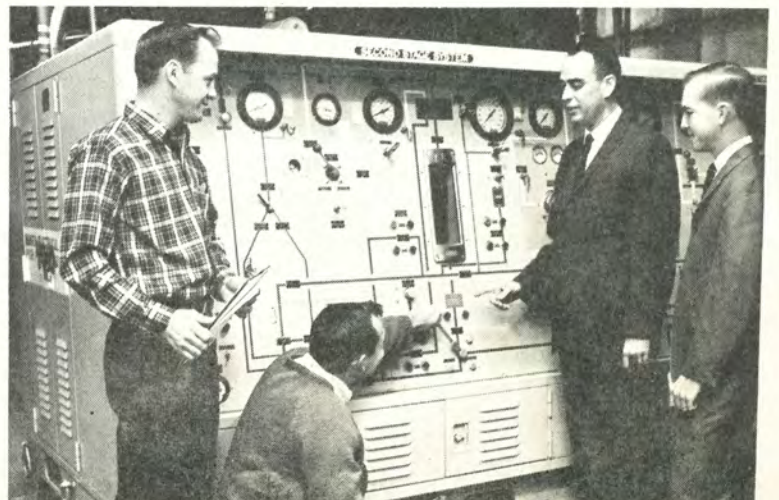


In preparation for installing a small rocket engine static test facility near the missile erection gear, Dr. James M. Bowyer, Technical Director of the Laboratory (far right) and his aerospace engineering students examine a blueprint of the missile launch bay.

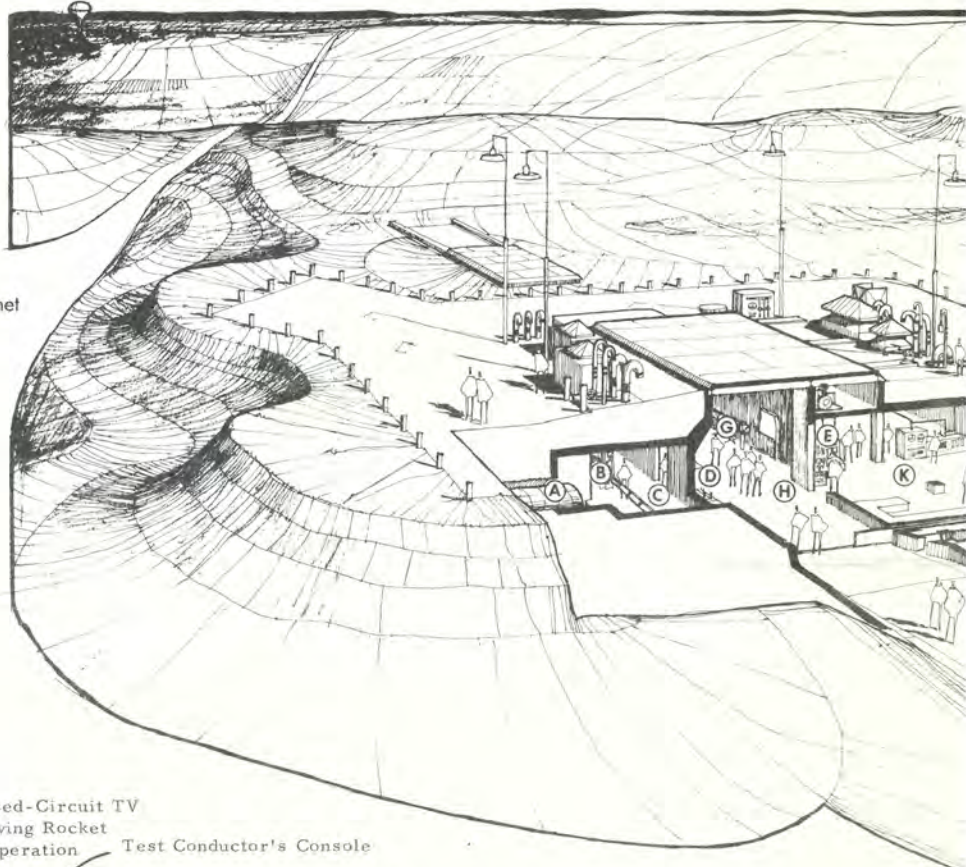
Studying the transfer system formerly used to supply RP-1 (a kerosene like fuel) to the Atlas "E" missile in pre-launch operations, an inquisitive mechanical engineering student mans a valve as fellow investigators observe results.



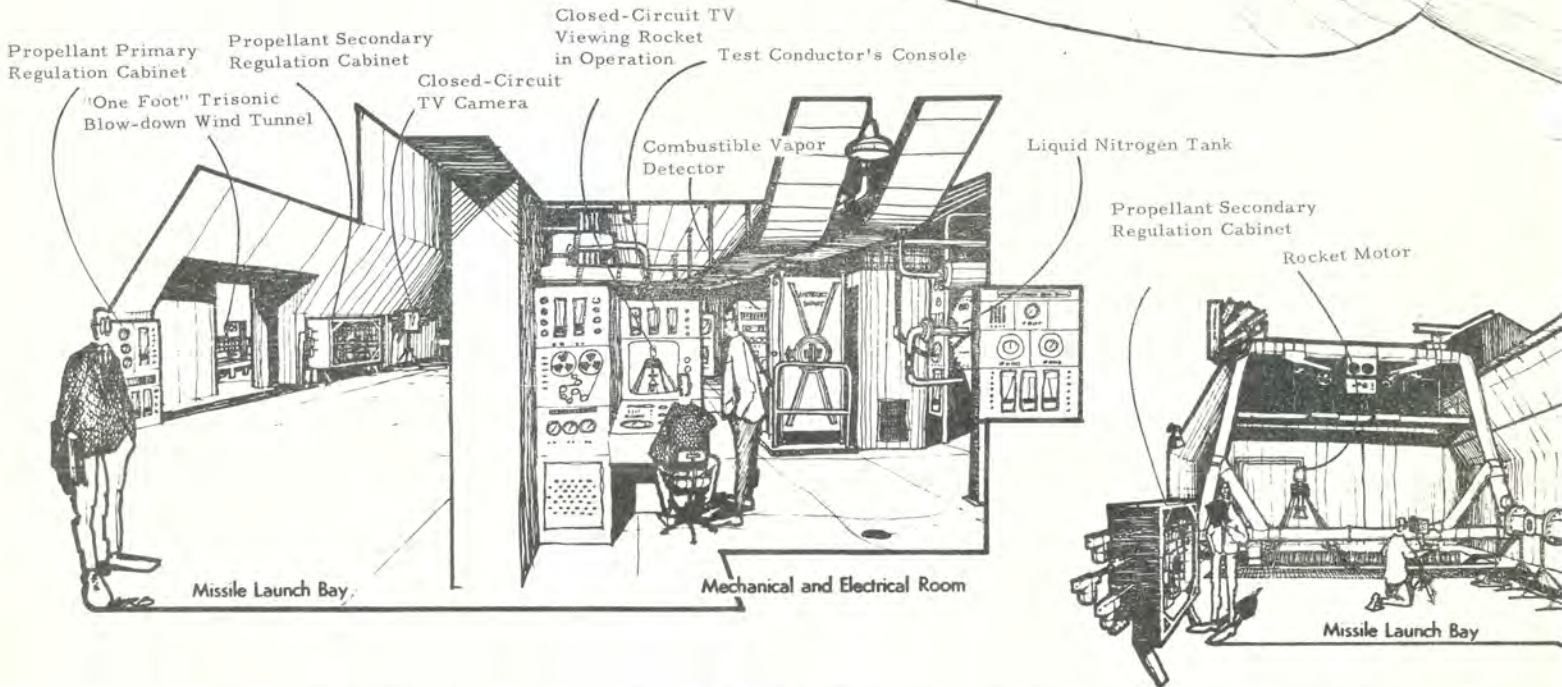
Pointing out a possible way the second stage console could be modified for use in an automatic controls experiment to instruct students in mechanical engineering is Dr. Ralph G. Nevins (third from left), head of the department of mechanical engineering. The console was formerly used to check the second stage of the Atlas "E" series missile during pre-launch operations.



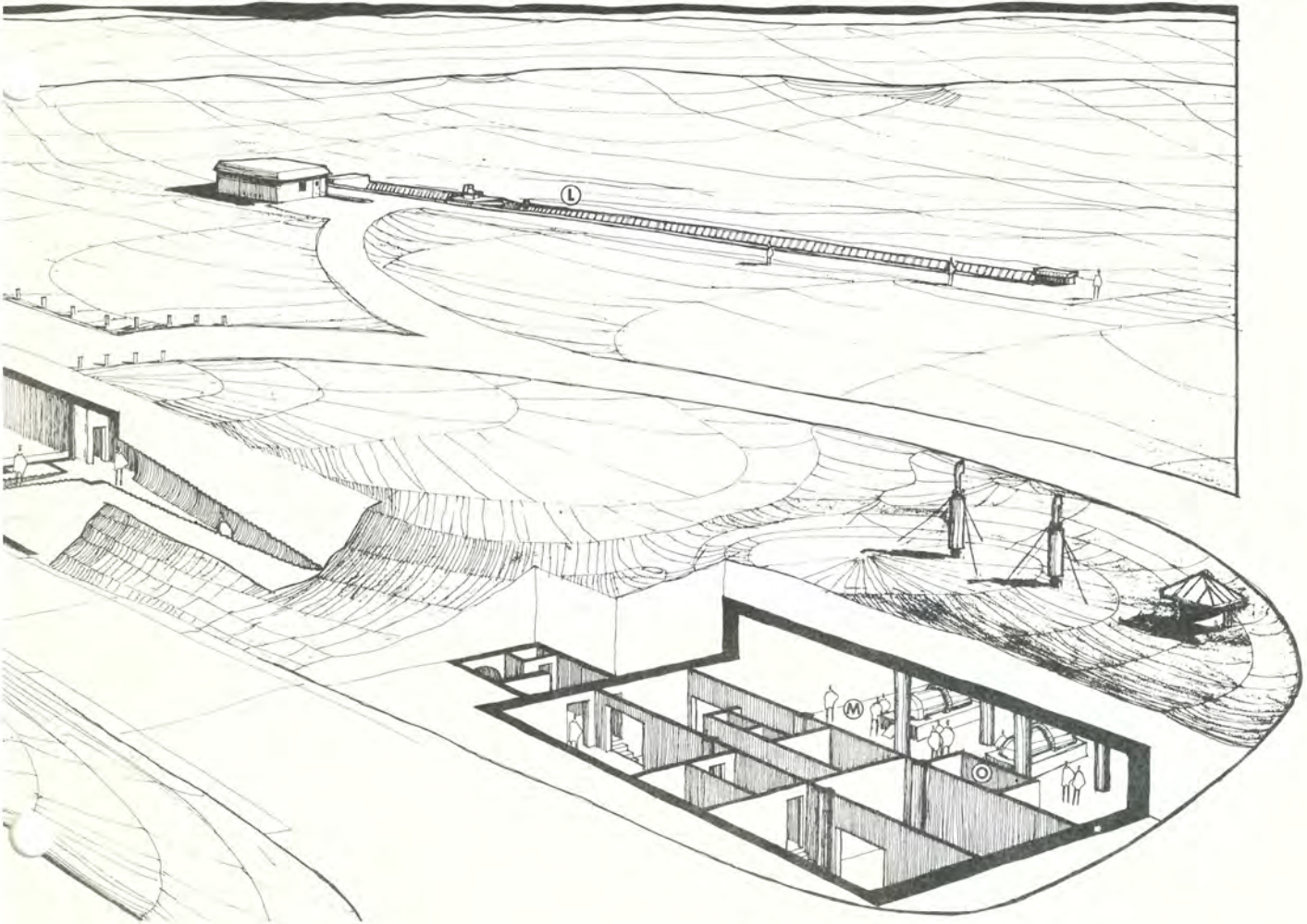
- A Environmental Test Chamber
- B Trisonic Blow-down Wind Tunnel
- C Liquid Oxygen Loading Room
- D Undergraduate Rocket Test Facility
- E Propellant Primary Regulation Cabinet
- F Test Conductor's Console
- G Shock Tube Facility
- H Missile Launch Bay
- I Mechanical and Electrical Room
- J Acceleration-Deceleration Facility
- K Utility Room
- L Acoustical Test Laboratory



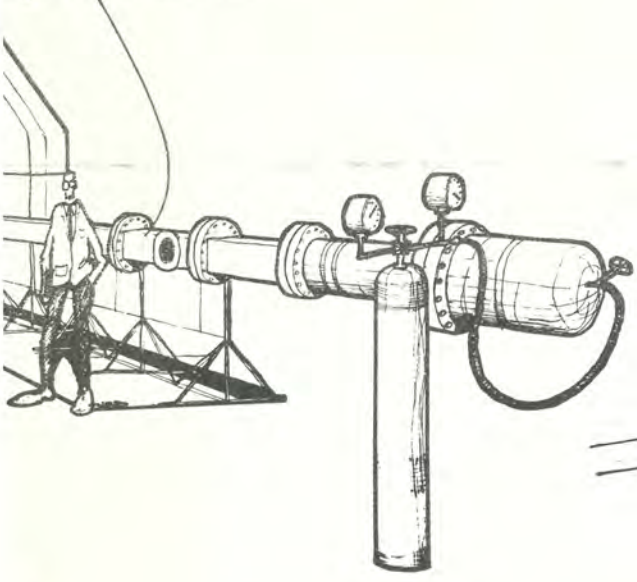
Undergraduate Rocket Test Facility



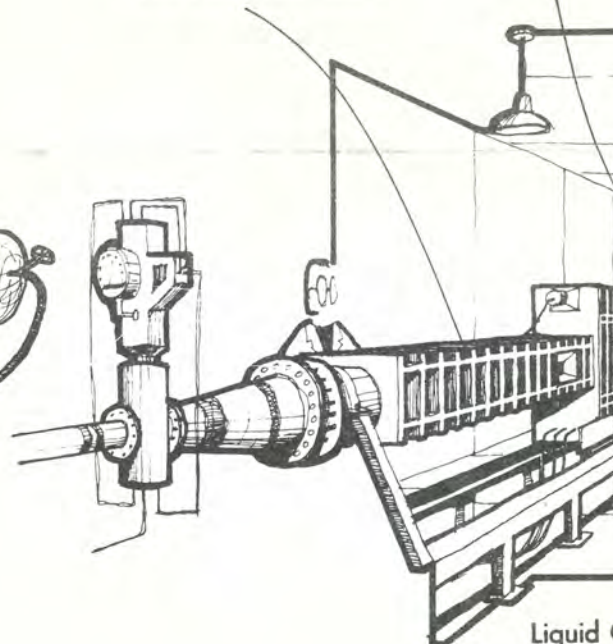
MECHANICAL ENGINEERING DEPARTMENT AEROSPACE LABORATORY
 Kansas State University



High-Pressure Shock Tube

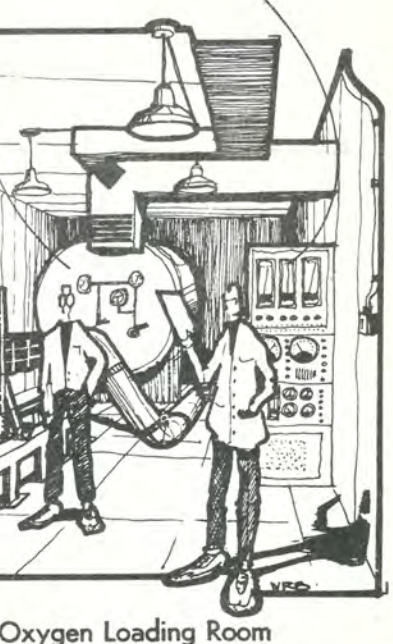


"One Foot" Trisonic Blow-down Wind Tunnel Test Section



Cryogenic Facility

Gaseous Oxygen Detector



Liquid Oxygen Loading Room

Part II.

Warlike Digital Computer Is Domesticated

A giant \$1,800,000 Missile Guidance Computer is another acquisition to the College of Engineering which is being "retrained" for use in civilian life.

To be developed into a modern "hybrid" computing system by the department of electrical engineering, the 21,000 pound system, declared surplus by the U. S. Air Force, was obtained from Lowry Air Force Base, Denver, Colorado.

"The computer was originally designed and manufactured for use in the Titan missile system," Dr. W. W. Koepsel, electrical engineering department head explains. "Since the site was deactivated by the Air Force, this computer, along with others, was available for educational use. "As a semi-general purpose digital computer, this system will be used as a teaching tool and also in our much needed hybrid computing system, which we hope to develop in the near future."

The digital computer is being modified and tied into a new analog computer currently being purchased by the College of Engineering, along with associated interface equipment. Mating both systems together will utilize the best features of each computer to solve problems of a complex nature.

Some functions are more difficult for an analog to solve alone. Because of its greater memory capacity, complex decision problems will be transferred to the digital system so that data can be analyzed and results determined more quickly and at less cost than now possible.

This will especially benefit research being conducted in the Engineering Experiment Station

on optimization techniques. Such studies are presently directed toward improving Kansas transportation systems, water supply distribution systems, industrial and domestic waste collection and treatment systems, as well as improving communication systems.

"Although researchers have been working on these optimization programs for several years to advance specific industrial process and engineering systems in Kansas, we have now reached a limit in advancing this type of research because of the lack of an adequate hybrid computing system to serve analytical requirements," Dr. Paul Russell, Dean of the College of Engineering, said.

The new computer, which occupies 700 square feet of floor space in the department of electrical engineering, will give far greater versatility to solving the complex type of problems currently being studied in engineering research. To be used for student instruction and graduate research programs in the department of electrical engineering, the new system also will be made available to other research organizations throughout the state.

Seventeen of these systems were declared surplus by the air Force with the dismantling of missile sites throughout the country. Two systems were allocated to the state of Kansas. Through the Kansas Surplus Property Section, one unit was assigned to Kansas State University and one was given to Kansas University for use in their engineering research and teaching program.

"In the next five years we can anticipate a tremendous increase in requirements to reduce data by computers," says Dr. Koepsel. "We hope the new system, when completely developed, will meet these present requirements and give us computer capabilities far into the future."



DISTINGUISHED SCIENTIST TO N. E. FACULTY

Dr. Hermann J. Donnert, a research scientist of international renown, has joined the staff of the Department of Nuclear Engineering. Dr. Donnert will act as faculty advisor for graduate students engaged in thesis research and will continue his own research activities.

Donnert, a native of Austria, received his formal academic education at the University of Innsbruck, in mathematics and physics. On December 15, 1951 the University of Innsbruck conferred upon him the degree of Doctor of Philosophy *summa cum Laude*.

He worked on postdoctoral research and later held academic appointments at the University of Cologne and University of Freiburg. His immigration to the United States in 1957 was sponsored by the U. S. Government under Operation Paperclip (Defense Scientist Immigration Program). Since then he has been employed as a research physicist at the U. S. Army Nuclear Defense Laboratory, Edgewood Arsenal, serving as Chief Scientist for that organization since 1962. He also held positions at the University of Maryland as Assistant Professor of Mathematics and Assistant Professor of Physics.

AG ENGINEERS GET SOIL DYNAMICS EXPERT

Dr. Stanley J. Clark has been appointed to the faculty of the Department of Agricultural Engineering as an assistant professor. Clark, a native of McPherson, Kansas, has taught in the agricultural engineering departments at Colorado State and Purdue. He received his B.S. and M.S. degrees from Kansas State and earned his Ph.D. at Purdue University. He has conducted extensive research on the use of LP gas for insect control, design of an onion harvester, potato storage and mechanical damage studies and farm tractor traction. An Air Force pilot, Clark served for three years as an installation engineer and squadron commander in the Air Force.

CHEM ENGINEERS HAVE VISITING PROFESSOR

Dr. E. Stanley Lee, a visiting professor in Chemical Engineering this year, has been associated with the Phillips Petroleum Company as a chemical engineer for the past six years.

He will teach in the areas of design and optimization and collaborate in writing a textbook in the field with Professors L. T. Fan and L. E. Erickson. Lee received his undergraduate degree in chemical engineering from the Ordinance Engineering College in China, his M.S. degree from North Carolina State College and his Ph.D. from Princeton University. A specialist in optimization techniques, he has published numerous technical articles in professional engineering journals.

THREE NEW ASSISTANT PROFESSORS IN E. E.

Three new assistant professors were appointed to the faculty in the Department of Electrical Engineering this Fall.

Dr. Gary L. Johnson, a native of Osage City, Kansas, received his B.S. and M.S. degrees from Kansas State and did advanced work at the Uni-

versity of Washington and Oklahoma State University, he received his Ph.D. from Oklahoma State. As an undergraduate he was awarded a General Motors Scholarship and later received a National Science Foundation Fellowship for graduate study. He has worked for the Boeing Company at Wichita and Seattle and has published several papers on electromagnetic theory.

Dr. Dale T. Young received his B.S. and M.S. degrees from the University of Oklahoma and was a fulltime staff member at O. U. for 3 years. He worked for Bell Telephone Laboratories and did graduate work at the Polytechnic Institute of Brooklyn. He received his Ph. D. from Oklahoma in 1966. He is the author of numerous technical papers on electromagnetic theory and microwave devices.

Dr. Donald H. Lenhart, formerly of Wichita earned his B.S. degree with honors from K-State in 1966. He received his M.S. and Ph.D. degrees from Syracuse University. He was a research and teaching associate at the University of New Mexico for five years, was an associate research engineer with the Dikewood Corporation for two years and served as 1st Lieutenant in the Air Force. Recipient of numerous special awards as a student, he is the author of a number of publications in the field of electromagnetic wave theory and space research.

NUCLEAR APPOINT ASSISTANT PROFESSOR

Dr. John Robinson was appointed as Assistant Professor in Nuclear Engineering this fall. He received his B.S. in mechanical engineering and his M.S. and Ph.D. degrees in nuclear engineering at the University of Michigan. During his eight years at Michigan he served as Research Assistant, Assistant Research Engineer, Research Associate, and Lecturer in the Department of Nuclear Engineering and Postdoctoral Research Fellow at the Institute of Science and Technology. He has co-authored numerous publications in the field of cavitation.

DESIGN AND SANITARY SPECIALISTS TO C. E.

Two new assistant professors, Dr. Peter Cooper and Dr. Richard Dague, have been appointed in the Department of Civil Engineering.

Cooper, a native of Manchester, Conn., received his B.S., M.S., and Ph.D. degrees from Lehigh University and has been associated with Lehigh for the past seven years, where he taught engineering undergraduate courses and supervised graduate thesis work. He was also employed by the Electric Boat Division of General Dynamics and has written several papers related to the design and testing of welded plate girders.

Dague, completed his Ph.D. in environmental health engineering at the University of Kansas and received his B. S. in civil engineering and his M.S. in sanitary engineering from Iowa State University. He has served on active duty with the U. S. Navy Seabees and has been associated with construction and consulting firms as a design engineer. He has been in private practice specializing in water supply and waste treatment, drainage and flood control and road and street design.

Newsworthy Notes

NEW GRANTS FOR RESEARCH

Grants and contracts awarded through the Engineering Experiment Station so far this year amount to just under \$500,000. These grants cover a wide range of investigations and programs and provide assistance in both undergraduate and graduate instruction as well as research.

NSF GRANT TO CHEMICAL ENGINEERING

Dr. Benjamin G. Kyle, professor of chemical engineering, will study the behavior of liquid solutions under a new two year grant from the National Science Foundation. The project is entitled "Thermodynamics of Partially Miscible Systems" and is a continuation of an earlier project. According to Kyle, one of the major problems facing chemical engineers in industry is the lack of information on exactly how solutions behave during the vaporization process. By understanding this behavior significant improvements could result in the design of chemical processing equipment such as distillation columns. The more efficient design requires a more exact method for predicting the state of equilibrium existing between the vapor and the liquid phase. At present, the data for design must be obtained in the laboratory at considerable expense.

ESTABLISH OCD SERVICE CENTER

The Department of Defense, Office of Civil Defense, has established a Professional Development Service Center in the Department of Nuclear Engineering. Under a \$54,000 contract the Center will conduct seminars, lectures and workshops on fallout shelter analysis, design, and construction techniques for architects, engineers and for state and local government officials. In addition, guidance and assistance will be offered to architectural and engineering firms. Heading up the program as Director and Lecturer will be Jerry Rathbun, who received his BS and MS degrees in nuclear engineering at Kansas State. For the past three years he worked as research engineer at the Allison Division, GMC, in Indianapolis.

DESALINATION RESEARCH CONTINUES

Two members of the Chemical Engineering faculty at Kansas State have been awarded a contract to develop a revolutionary device called a "flow-work exchanger" which is to be used to reduce costs of purifying sea water. Prof. Cheng-yen Cheng and Dr. L. T. Fan will direct the research under a new grant (the third in the desalination field) from the Office of Saline Water. The \$40,000 contract will finance development of pilot equipment which uses a displacement vessel to form a closed loop within a processing system. This is expected to eliminate the need for turbines and other pumps usually required to pressurize the fluids and thereby substantially reduce energy requirements in any of the desalination plants which operate at very high inlet pressures.

TILLMAN TO HEAD INDUSTRIAL ENGINEERING

Dr. Frank A. Tillman was appointed head of the Department of Industrial Engineering on July 1. He replaces Dr. George Schrader who is now director of state technical services in Nebraska. Tillman joined the K-State faculty in 1965 and has taught graduate courses in operations research, reliability and engineering economics.

NEW RESEARCH SUMMARY

The annual report of the Engineering Experiment Station, entitled "Research Activities-1966," is in press and is expected within a month. The report gives a brief description of the purpose and results of each of the 85 research projects which were active in the College of Engineering in 1966. To receive a copy write to IMPACT, College of Engineering, and request the report by name. It will be mailed free of charge.

NEW HEAD OF INDUSTRIAL EXTENSION

The new director of the Kansas industrial extension and state technical services program is Prof. Kenneth Razak, former dean of engineering at Wichita State University. He will administer the industrial extension activities of all state colleges and universities and will be responsible for the operation of the State Technical Services Program, with headquarters in Seaton Hall. He is a native Kansan with two engineering degrees from the University of Kansas. He was a member of the KU engineering faculty from 1939 to 1943 and of the WU faculty from 1943 to 1964. For the past two years he has been a consulting engineer in Wichita. Among his first responsibilities was the establishment of an information service to tell industries of the activities at the state schools which are of interest to industry and business in Kansas.

Mr. Dean Kenny will be editor of the KANSAS INDUSTRIAL EXTENSION JOURNAL. The paper, which will be published monthly beginning in January, will inform Kansas industry and business of the latest advances in science and technology, advise on the methods of using this information and will tell how the colleges and universities of the state can be used more effectively in the growth of both large and small industries. To be placed on this mailing list contact: Professor Kenneth Razak, Kansas Industrial Extension Service, Kansas State University, Manhattan, Kansas 66502.

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