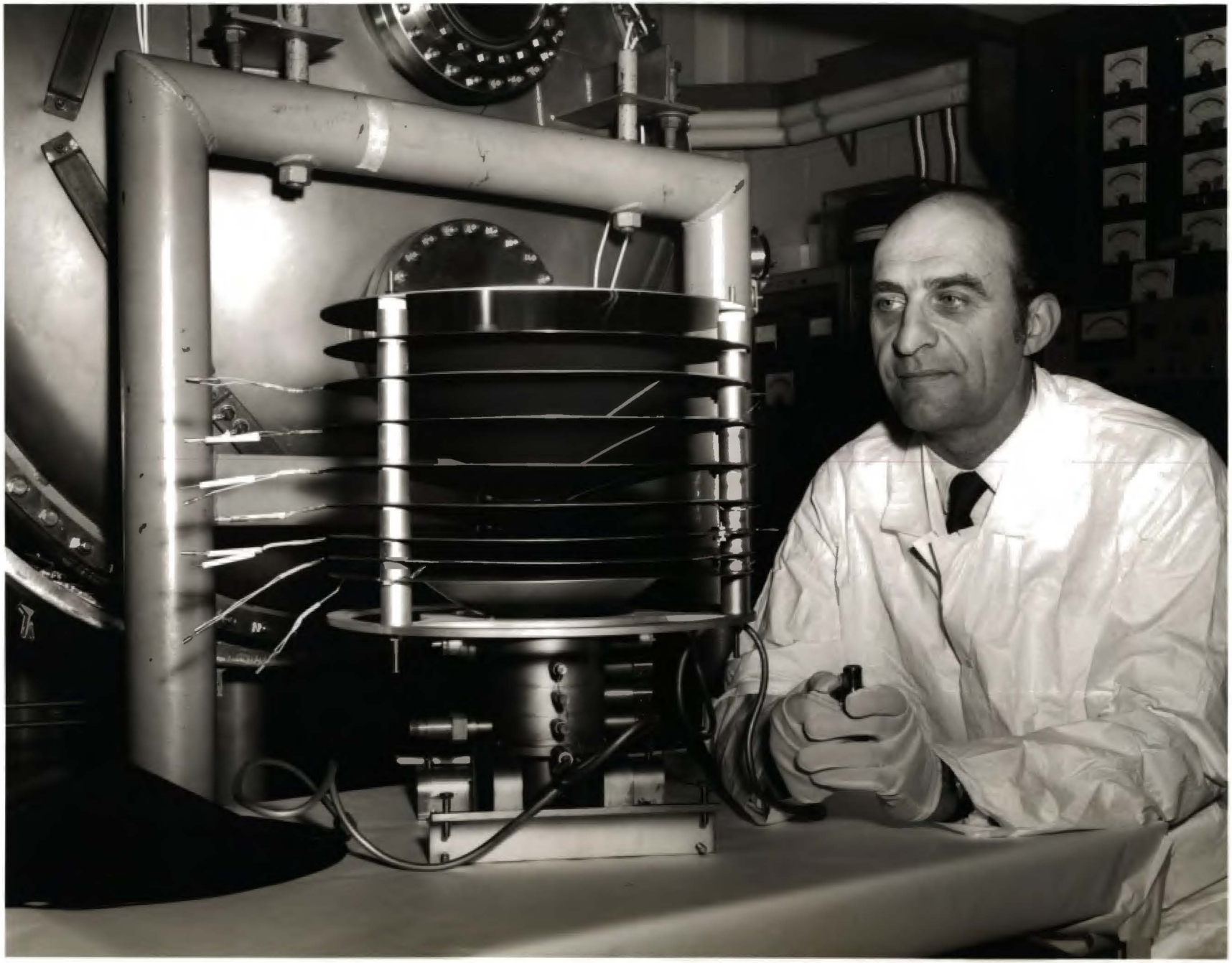

Public Information Office
NASA Lewis Research Center
Cleveland, Ohio 44135
433-4000, ext. 415

C-71-1544

SUPER EFFICIENT TUBE -- A half-size version of this high efficiency, high power tube developed by scientists at the National Aeronautics and Space Administration's Lewis Research Center will be tested in space on a Communications Technology Satellite. A joint U. S. -Canadian project, the satellite is scheduled for launch in 1974 to advance technology for broadcast distribution from space to remote areas such as villages in northern Canada and Alaska. The Lewis tube will amplify radio and television signals for transmission to Earth at high power levels in the Super High Frequency band. Dr. Henry Kosmahl is shown here with the depressed collector tube that he and his co-horts have worked on for the past three years. The collector, resembling concave plates, retrieves the excess energy passing through the tube and cycles it back to the power supply. This process saves substantial amounts of energy, giving the tube a working efficiency of more than 50%. Lewis will develop a flight-qualified depressed collector tube and power conditioning system to operate it for the communications satellite.

#

News

NASA LEWIS RESEARCH center

21000 BROOKPARK ROAD CLEVELAND, OHIO 44135
PUBLIC INFORMATION OFFICE
PHONE - (AREA CODE 216) 433-4000 EXT. 415

FOR RELEASE: MAY 6, 1971

Release 71-19

Charles E. Kelsey
(res: 234-3034)

CLEVELAND, Ohio, May 6 -- A highly advanced type of tube for amplifying radio and television signals is being developed by the National Aeronautics and Space Administration's Lewis Research Center for Canada's experimental communications satellite.

The Lewis tube, more efficient and powerful than any in space today, will operate at 12 GigaHertz in the Super High Frequency (SHF) band. "The lower frequency band is very crowded today," says Elmer Davison, manager of the project for Lewis. "The high power tube will help make the upper part of the frequency spectrum available for microwave transmission."

The satellite that will use the tube is the Communications Technology Satellite, a cooperative U.S. - Canadian project. Scheduled to be flown in 1974, it will test new technology and techniques for broadcast distribution from space, particularly to isolated regions such as small villages in the north of Canada and to Alaska. The experimental satellite will transmit television

- more -

and audio signals to small ground receiving antennas in the SHF band as well as relay narrow band signals in the UHF banda

Lewis also will design and build a power conditiong system for the communa ication satellite under the international agreement. Power conditioning is required to convert the electrical power from the solar arrays to both AC and DC current at proper voltages for operating the broadcast equipment. A Canadian power conditioning system will be used for two ion engines for station keeping and for other electrical systems on the spacecraft.

The satellite project provides Lewis with an opportunity to flight test its high power tube under development since 1967, for the first time; its successful operation represents an advance in the state-of-the-art in broada cast distribution technology.

Called a depressed collector tube, its high power and high efficiency are important attributes for communications satellites, according to Dr. Henry Kosmahl, Head of the Tube Development Section at Lewis. The tube's power output of up to 200 watts means the beam transmitted from the satellite to earth will be well defined, permitting better reception. The tube also will operate at more than 50% efficiency, which sharply contrasts with tubes in use today that have efficiencies of only 10 to 20%.

Dr. Kosmahl explains, "the efficiency of the tube is particularly important in space where energy is so expensive." It costs about $1 million for a solar array to furnish one kilowatt of electric power, Dr. Kosmahl says. A

more efficient tube saves weight in a spacecraft because less power conversion equipment and thermal control surfaces (for radiating heat) are required.

What gives the new tube its superefficiency? Typically more than half of the energy streaming through an ordinary traveling wave tube is lost as heat, due to the basic inefficiency of the tube. However, the Lewis tube has a collector attached at the end of it to retrieve the excess energy and return it to the power supply for re-use. This device actually is a series of electrodes, resembling concave plates, that recover electrons of varying velocities. The collector not only sorts out the electrons by velocity, but also slows them down and prevents them from streaming back into the tube.

In addition to carrying the high power tube, the Communications Technology Satellite probably will carry a medium-power (20 watt) and low power (1 watts) tube. These tubes also will be employed for SHF signal amplification, and will also serve as back-ups should the high-power tube fail. The medium and low power tubes can only transmit to large ground receiving antennas.

During its two year life time, the satellite will relay television, audio and data signals from a stationary point some 22,300 miles above the earth, providing an extensive series of communications experiments of benefit to Canada and the U. S.

# # #

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Lewis Research Center
21000 Brookpark Rd.
Cleveland, Ohio 44135

FOR RELEASE:

Phone (area code 216)
433-4000, ext. 415

IMMEDIATE

Release 73-51

Charles Mitchell
(res: 243-6228)

AWARDS FOR RESEARCH

CLEVELAND, Ohio -- Fourteen scientists and engineers at NASA's Lewis Research Center were presented monetary awards and certificates for their research in various fields which has been publicized to encourage commercial use.

NASA Tech Briefs, concise announcements describing innovative or novel phases of NASA's work, are published to acquaint the public with the new technology.

Chief of Lewis' Technology Utilization Office, Paul E. Foster, states that Tech Briefs, as they are published, are sent to some 15,000 persons

- more -

October 17, 1973

and organizations representing a cross section of institutions throughout the country.

In presenting the awards Foster told the recipients, "NASA appreciates your efforts in bringing these innovations to the Technology Utilization program and thereby to the attention of people throughout the country."

Persons who received awards for Tech Briefs were:

NAME	RESIDENCE	TITLE OF TECH BRIEF
Dennis P. Townsend	Westlake	"Lubricant Selection for Gear Designers"
David C. Byers	North Olmsted	"Improved High Voltage Insulator Use in Vacuum"
John P. Barranger	Fairview Park	"High Temperature Permeameter for Measuring Magnetic Properties"
Warren Philipp Stanley J. Marsik	North Olmsted Fairview Park	"Radiation Induced Nickel Deposits"
Ralph D. Thomas George A. Mazaris	Cleveland 44144 Brookpark	"Thermocouple Tape"
Roland Breitwieser	Fairview Park	"Tungsten-Reinforced Tantalum"
Henry G. Kosmahl	Olmsted Falls	"Technique for Refocusing, Decompressing, and Conditioning Spent Electron Beams"

NAME	RESIDENCE	TITLE OF TECH BRIEF
Robert L. Bowman Ernest W. Spisz	Berea North Olmsted	"Improved Transmittance Measurements with a Magnesium Oxide Coated Integrating Sphere"
Edward A. Maslowski	Seven Hills	"Automatic Method of Measuring Silicon-Controlled-Rectifier Holding Current"
James E. Dudenhoefer Mario N. Miraldi	Huron Lorain	"Water Tight Low-Cost Electrical Connector"

# #

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Lewis Research Center
21000 Brookpark Rd.
Cleveland, Ohio 44135

FOR RELEASE:

Phone (area code 216)
433-4000, ext. 415

TUESDAY
October 29, 1974

Release 74-66

Charles Mitchell
(res: 243-6228)

NASA honors work of six

CLEVELAND, Ohio -- Six employees of NASA's Lewis Research Center were presented the agency's highest awards by NASA Administrator Dr. James C. Fletcher in ceremonies in Washington, D. C. today (October 29).

Dr. Henry G. Kosmahl, Head of the Power Amplifier Section and a resident of Olmsted Falls, was presented the NASA Medal for Exceptional Scientific Achievementa

Four Lewis employees were awarded NASA's Medal for Exceptional Service. They are G. Mervin Ault, Director of Space Technology and Materials and a resident of Olmsted Falls; Mrs. Anne T. Barber, Secretary to the Lewis Director and a resident of Bay Village; and James F. Connors

- more -

Director of Technical Services and resident of North Olmsted; and Daniel J. Shramo, Director of Space Flight Programs and resident of Cleveland 44121.

Dr. Julian M. Earls, Chief, Environmental Health Office was presented the NASA Medal for Equal Employment Opportunity. He lives in Maple Heights.

A scientist working on high power amplifiers for communication satellites, Dr. Kosmahl was cited "for his exceptional contributions to the field of microwave power transmission in space." He perfected a device called a depressed collector tube which can transmit microwave signals from space very efficiently. Greater efficiency will reduce the weight and cost of communication satellites. Its first use will be on a satellite in 1975 for the direct TV broadcasts of educational, medical, and other information to Canada, Alaska, and Hawaii. The tube also has military applications.

Ault was recognized for his "exceptional contributions in carrying out the difficult transition from space nuclear power programs to terrestrial energy technology at NASA's Lewis Research Center."

Mrs. Barber was cited "for continued and dedicated contributions to the effective operation of the Office of the Director of Lewis Research Center. As secretary to the Director since 1961, the skill, grace, and wisdom she has brought to her daily tasks have been of inestimable value

and support to senior management."

Connors received a medal "in recognition of continued exceptional performance as manager of all blue collar work carried out at NASAás Lewis Research Center, and especially as leader of services such as experimental test rigs, provided in direct support of the Center's research and development activities.

NASA recognized Shramo with its Service Medal "for significant management and technical contributions to the design and development of the Atlas/Centaur D/1A vehicle, culminating in the successful launching of the Mariner-Venus Mercury, Intelsat IV, and Pioneer-Jupiter missions.á'

Dr. Earls' "outstanding leadership in the formation of a Cleveland Chapter of the National Technical Association and the development of programs which have provided inspiration for minority youths and furthered their interest in scientific and technical fields," brought him NASAás Medal for Equal Employment Opportunity.

#

NASA News

National Aeronautics and
Space Administration

Lewis Research Center
21000 Brookpark Road, Cleveland, Ohio 44135
AC 216 / 433-4000 / Ext. 415

For Release:

80-30

IMMEDIATE

Charles Mitchell
216/243-6228

HIGHEST-EVER CASH AWARD GIVEN NASA LEWIS INVENTOR

CLEVELAND, OH -- Dr. Henry G. Kosmahl, a satellite communications specialist at NASA Lewis Research Center here, has received the highest monetary award ever given by Lewis for an invention.

He is the recipient of a check for $15,000 for taking the lead role in development of what is considered the world's most powerful and efficient amplifier for audio and video signals from space.

Dr. Kosmahl's invention is known as a depressed collector tube. As part of a traveling wave tube in space, it provides the tube with 10 to 50 times the transmitting power of a conventional traveling wave tube such as used in commercial satellite communications today.

The depressed collector tube operates by retrieving energetic electrons which would otherwise give up their energy and returning them to the power source for reuse in transmitting signals from space. An analogy might be droplets of water in a fountain being captured on their way up while they still have energy or force. If you allow the droplets to reach the peak of their upward thrust, at that point all their energy will have been spent.

-more-

(distributed July 11, 1980)

Capabilities of, and prospects for, the Kosmahl tube were demonstrated and proved on the Communications Technology Satellite. The latter, for three years, operated on an experimental basis as the world's most powerful communications satellite, transmitting public service broadcasts over remote areas of the U.S. using low-cost earth terminals. Lewis managed these telecasts.

Currently, the U.S. Department of Defense is using the Kosmahl tube as part of its electronic warfare arsenal. The tube is also expected to be used on future commercial communications satellites and in UHF-TV transmitters throughout the U.S. to reduce electric power consumption. In the latter case, a power savings of approximately one billion kilowatthours per year is expected.

German-born, Dr. Kosmahl holds ten U.S. patents, six foreign patents and has three patents pending. In 1974 NASA awarded him its highest science medal for developing the depressed collector tube. He is a Fellow of the Institute of Electrical and Electronic Engineers, and is listed in Who's Who in Science and Technology as well as in American Men of Science.

The NASA Lewis scientist has delivered lectures at Stanford University, Cornell University, Case Western Reserve University and Massachusetts Institute of Technology. He is also the author of 40 published articles and co-author of two books.

Dr. Kosmahl lives with his wife, Gisela, in Olmsted Falls. They are parents of two daughters and a son.

###

(NOTE: Black and white photo of Dr. Kosmahl with invention available on request.)

NASA News

National Aeronautics and
Space Administration

Lewis Research Center
21000 Brookpark Road, Cleveland, Ohio 44135
AC 216 / 433-4000 / Ext. 415

For Release:

82-9

IMMEDIATE

Paul T. Bohn
(res: 216/333-9454)

NASA DEVICE COULD SIGNIFICANTLY

REDUCE POWER NEEDS OF UHF TV STATIONS

CLEVELAND, OH -- A compact radio wave amplifier invented by Dr. Henry G. Kosmahl of NASA's Lewis Research Center here may benefit UHF television stations by reducing their electrical power requirements significantly.

This power has potential advantages especially for the nation's non-commercial public television stations since the majority of them transmit on the UHF television band.

The device is a multi-stage depressed collector and was originally invented by Kosmahl to improve communications satellite efficiencies. The device is used to increase the intensity of the radio signals transmitted by communications satellites without increasing their electric power consumption--a real benefit for solar-cell-operated spacecraft. The device can also be used for terrestrial microwave or ultra high frequency (UHF) television transmissions.

A typical, large, 200,000-watt UHF television station in a medium to large metropolitan area requires about $300,000 worth of electricity per year to stay on the air.

-more-

(Distributed February 11, 1982)

Smaller stations servicing smaller markets require less power. By 1985, with expected fuel surcharge and inflation increases, the electric bill for all the nation's UHF broadcasters could reach $100 million.

The application of the multi-stage depressed collector to transmitter amplifier tubes now installed at UHF stations could reduce their electric consumption by as much as one-third to one-half. This could amount to a savings of some $45 million beginning in 1985. Installation and equipment charges for this device are expected to pay for themselves in one year.

UHF television stations presently use devices called klystrons to generate and amplify the ultra high frequency current, which is the broadcast signal. Klystrons are vacuum electronic tubes which operate at efficiencies of only about 10 to 15 percent. By modifying the klystrons to include the multi-stage depressed collector, efficiencies of up to 30 percent are achievable. These higher efficiencies reduce power consumption levels correspondingly.

Kosmahl estimates the cost of converting the multi-stage depressed collector to work with UHF transmitter klystrons would be about a million dollars and would involve a development program lasting about three years. Following that effort, individual UHF stations could purchase klystrons with the efficiency-improving device directly from industry sources.

Kosmahl invented the device in 1969 and was awarded a U.S. patent in 1972. An experimental model of the electron beam device, fabricated by Litton Industries, was launched aboard the Communications Technology Satellite in 1976 for a three-and-one-half-year-long test managed by Lewis Research Center. During that period, it produced the most powerful radio signals ever transmitted from space and beamed broadcasts to smaller, low-cost antennas sited in remote areas of the United States, including Alaska, and Canada.

-more-

Communications satellites use microwave frequency amplifiers that generate radio waves for transmission to Earth antennas. These amplifiers are, however, weak performers and are able to convert only about 20 percent of available electricity into radio waves. The remaining 80 percent of the electricity--produced by solar cells--becomes waste heat within the satellite and must be dissipated by a cooling device.

Kosmahl's device, however, recaptures this waste energy, uses it to strengthen the microwave signal and reduces on-board heat. Because of this heat reduction, the size of the cooling device needed for dissipating onboard heat is smaller and less complicated.

The device consists of a series of concave electrodes that recover electrons of varying velocities just before they have spent their energy. The collector not only sorts out electrons by velocity but also slows them and prevents them from streaming back into the tube (similar to the manner by which a series of plates catches water droplets coming from a fountain. When the droplets reach an apex, the role of the collector is to catch the droplets before they fall and lose their energy).

The device can, after some modification, be applied to any microwave power transmitting device to improve its efficiency. At present at least five manufacturers are building devices like this for installation in military equipment. In Japan and Great Britain, similar devices, based on U.S. technology. are already widely used with UHF television transmitters.

An electron physicist, Kosmahl came to the United States from his native Germany in 1956 and has been associated with the Lewis Center for nearly 20 years. He holds 10 U.S. patents, six foreign patents and has three patents pending. In 1980, he received NASA's highest monetary award, $15,000, for his work in developing the Multi-Stage Depressed Collector.

###