

S.A.E. MEETING---NACA LEWIS FLIGHT PROPULSION LABORATORY---NOVEMBER 9, 1953



I. Irving Pinkel

Meeting Subject: "FULL SCALE AIRCRAFT CRASH FIRE RESEARCH"

Speaker: I. IRVING PINKEL, Associate Chief, Physics Division, NACA Lewis Flight Propulsion Laboratory

Speaker's Sponsor: E. J. Manganiello, Assistant Director, NACA Lewis Flight Propulsion Laboratory

Buffet Dinner—6:30 P. M.

Meeting—8:00 P. M.

THE SPEAKER

I. IRVING PINKEL was graduated from the University of Pennsylvania with a BA degree in Physics in 1934, and obtained his Professional Engineer's license in Ohio in 1946. He joined the United States Bureau of Mines, Central Experimental Station, Pittsburgh, Pa., in 1935, for research on production of synthetic fuels by hydrogenation of coal; development of means for the economic production of hydrogen with associated catalysts for promotion of gas reactions; and study of hydrogen purification.

Mr. Pinkel went with NACA at Langley Field, Va., in 1940 and transferred to NACA Lewis Flight Propulsion Laboratory, Cleveland, in 1942. He has worked on a range of problems including non-steady lift forces on vibrating wings, hydraulics of engine lubrication systems for high altitude flight, jet engine combustor performance, supersonic flow, and aircraft operating problems. He was special lecturer for the NACA-Case Institute Graduate School program.

At present he is Associate Chief of the Physics Division, NACA Lewis Flight Propulsion Laboratory, and a member of the NACA Subcommittee on Aircraft Icing Problems and NACA Subcommittee on Aircraft Fire Prevention.

THE PAPER

In an effort to learn how the fire starts that sometimes accompanies an airplane crash, the NACA conducted a full-scale airplane crash-fire study. Thoroughly instrumented cargo-type airplanes were crashed in a simulated take-off accident, and the manner in which the fire started and developed was followed by the instrumentation carried on the airplane and by



E. J. Manganiello

high-speed cameras from stations surrounding the crash area.

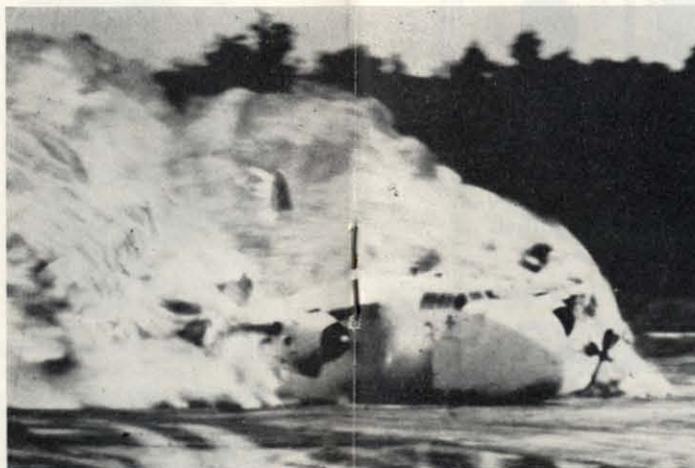
Color motion pictures taken of the airplane crashes are used to show the various ways in which fire may start. The discussion covers the relation between the fire hazard that develops in a crash and the damage sustained by the airplane, the airplane state of motion, and the nature of the terrain on which the crash occurs.

SPEAKER'S SPONSOR

EUGENE J. MANGANIELLO is a native of New York City and was graduated from the College of the City of New York with a BS degree in Engineering in 1934 and an Electrical Engineering degree in 1935.

He joined the staff of the NACA Langley Laboratory in 1936 and transferred to the NACA Lewis Flight Propulsion Laboratory at Cleveland in 1942 as head of the Heat Transfer Section. In 1945 he was appointed Chief of the Thermodynamics Branch and in 1949 became Assistant Chief of Research. In 1952 he was named Assistant Director of the Lewis Laboratory, the position he now holds.

Mr. Manganiello is an Associate Fellow of the Institute of Aeronautical Sciences and an honorary member of Pi Tau Sigma. He has long been active in S.A.E. and is presently Chairman of the Aeronautical Activity.



SPECIAL NOTE

Members and guests of S.A.E. will be admitted at the main gate at 21000 Brookpark Road on the basis of ticket reservation, or identification, and S.A.E. representatives will assist in the checking. Only citizens of the United States can be admitted to this meeting.

S·A·E

*Junior
Journal*

CLEVELAND SECTION

NOVEMBER, 1953



SOCIETY OF
AUTOMOTIVE ENGINEERS

15¢

\$5.50 A YEAR

June 19, 1954

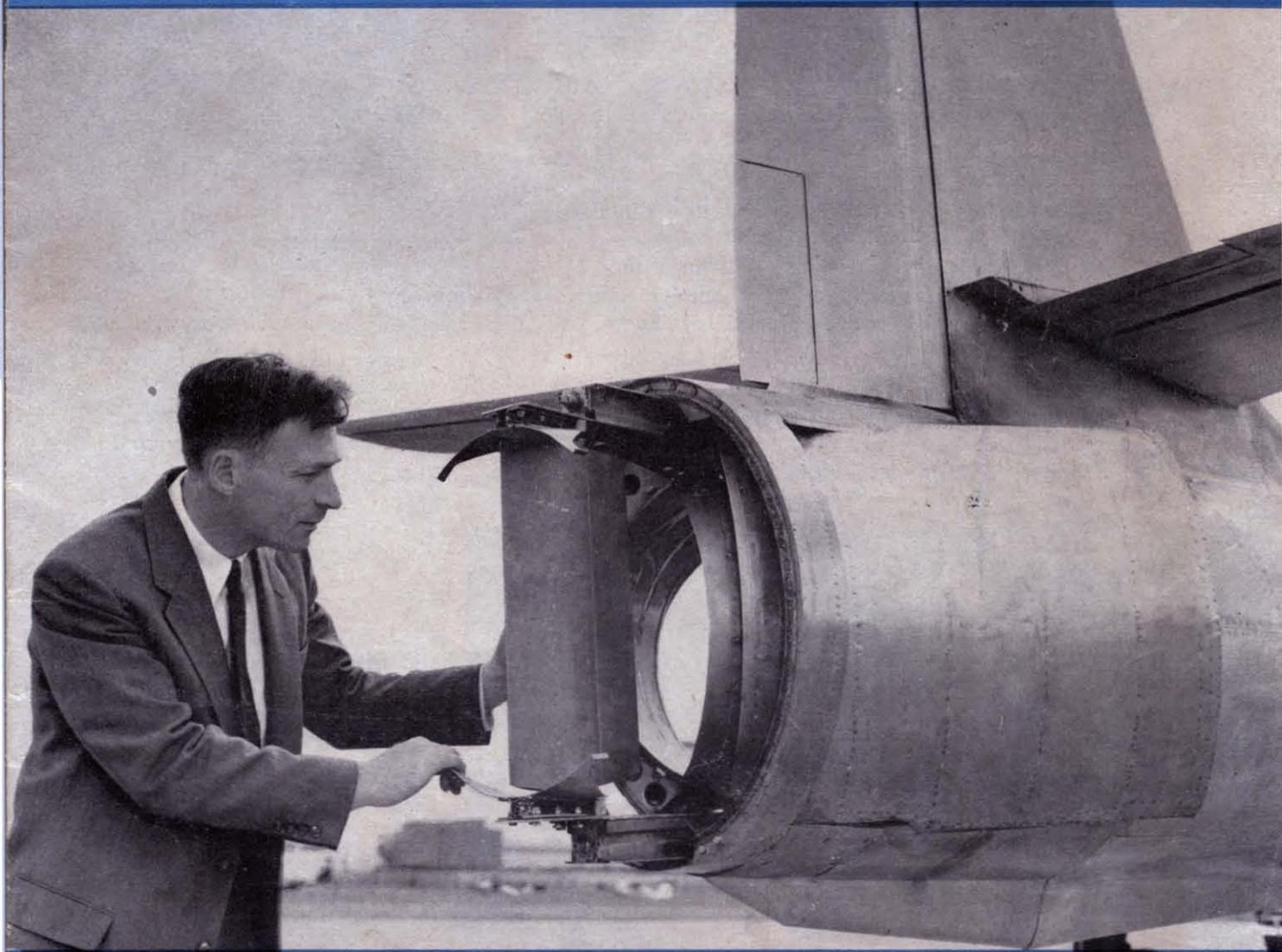
VOL. 65, NO. 25

PAGES 385-400

SCIENCE NEWS LETTER

®

THE WEEKLY SUMMARY OF CURRENT SCIENCE



Turbojet Brake

See Page 387

A SCIENCE SERVICE PUBLICATION

AERONAUTICS

Reverse Thrust Stops High-Speed Turbojets

See Front Cover

► A WAY of stopping high-speed turbojet airplanes during landing has been developed by the National Advisory Committee for Aeronautics. The new device was demonstrated at the Lewis Flight Propulsion Laboratory, Cleveland.

It will make possible the use by modern jets of the relatively short runways of today's airports.

A double set of blades are locked inside the tail part. When these are moved into the propelling stream of hot gases, a reversal in thrust occurs. This acts as a brake, giving the same effect as a reversal of airplane propellers that is familiar to airline passengers in their landings. These blades are closed and tucked out of the way when the jet plane is actually in flight.

In the demonstration, a jet plane was actually made to move backwards on a landing strip through the use of this device, which is shown on the cover of this week's SCIENCE NEWS LETTER.

To provide wheel brakes of sufficient size to stop jets in their landing runs would require too much weight.

Aeronautical designers are looking forward to long-range missiles that will travel at the high speeds of 6,600 miles per hour. The temperatures reached at such speeds would be enough to melt any presently known materials. Such aerodynamic heat has been most pronounced when missiles that have climbed outside the earth's atmosphere re-enter it at an extremely high rate. The temperatures thus reached are sufficiently high to vaporize even diamonds.

HIS JOB IS SAFER PLANES

Safety Seat For Planes

Invention of Fairview Man

A Fairview Park man's invention, now being tested on C-46 aircraft at the Ravenna Arsenal, 50 miles south of Cleveland, may make aircraft crashes less deadly than in the past.

The inventor of the new type seat that may make this possible is I. Irving Pinkel of 4671 W. 210 St., chief of Flight Problems Research Division of the Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics. He is undoubtedly the leading man in his field in the nation today.

Inventing a seat of rubber, which inflates, with more "give" to it than existing seats in planes to give pilot, co-pilot and passenger a better chance for survival is but a small part of the work that Pinkel has done and is doing at NACA.

He took this writer on a tour of the non-classified areas at NACA, including a visit to the widely-known "wind tunnel," gave him a look at the inside of a jet engine and a listen to the intake of air flowing through the myriad of tubes that traverse the under-side of the building housing the wind tunnel and the exhausting of that air through tubes on the outside of the building.

Largest Power User

He told us that NACA is the largest single user of Cleveland Electric Illuminating Co. power in Cuyahoga County. In its "wind tunnel" the NACA generates 100,000 horsepower for a four to five hour period, greater than any single industrial user in the county. For NACA Cleveland met the CEI slogan, the "Best Location in the Nation," completely providing the power the laboratory requires.

Pinkel declared:

"That is without a doubt the major reason why NACA located here. The increase in power provided at the Avon Lake plant of CEI was done, I have heard, largely because



I. IRVING PINKEL

of the tremendous use of electric power at the NACA."

As the chief of flight problems research at Lewis, Pinkel has intimate knowledge of the wind tunnel and other aspects of research in aeronautics.

The writer viewed vast panels of instruments which record data learned in the wind tunnel on tape. That information is transcribed rapidly by electronic computers so that Lewis Flight Propulsion Laboratory can make use of it to assist in the development of better, safer commercial and U. S. Air Force planes.

The tour was similar to Albert Einstein describing the Theory of Relativity to a cave man, but it was an eye opener into the broad scope of activity in the field of aircraft research at NACA, the leading center of airplane and missile propulsion in the world. Its supersonic wind tunnels are the largest and best equipped of their kind on the globe.

The wind tunnel is used to subject aircraft to wind conditions they can and do encounter in the atmosphere and find out what reaction the planes have to them, Pinkel told us.

Can It Be Done?

Before research on a flight problem begins, NACA scientists determine whether there is a solution to the problem. If there is not, the time that would have been lost in experimentation is avoided. Finding out if a solution exists to a flight

COAL	FIREPLACE CANNEL PACKAGE — STOKER
	SEASONED SPLIT-LOG
CORDWOOD	
18'—\$16; SLABWOOD \$12	
Kindling 35c per bu.	Any
Cordwood \$1.25 cwt.	Amount
Cannel Coal \$1.25 bu.	At Yard
Package Fuel 5 - \$1; 11 - \$2; 18 - \$3	
Pres-to-Logs, clean pkg. of 6 \$1.69	

WEST LAKE FUEL, LUMBER & SUPPLY CO., ED 1-7550

Foot S. Falmouth Dr. on NKP R.R.
off W. Lake Rd. at 20249, Rear
Drive back and save — ample parking

WE GIVE & REDEEM Eagle Stamps

problem may sound like a tall order, but time and again they do just that—mathematically.

He showed us the paper and pencil work he did before deciding that a safer seat for airplanes could be made than is now in existence.

Yet another invention of Pinkel is a device to make it possible for jet aircraft to brake to a stop. Jets lack propellers, which conventional airplane have to aid them in coming to a stop.

This problem he solved by having jets constructed with side pieces near the rear which can be opened when the plane lands and is preparing to halt. When they open, the air can no longer rush straight through and out the jet exhaust but is diverted by v-shaped pieces of metal to exit through the open slots on each side of the plane's rear. The exiting air acts as a brake on the jet.

A modest man, Pinkel qualifies any credit he may receive for these and other "inventions" by pointing out that many others played a large part in their development, too.

At Home In Plane

Pinkel is right at home in the cabin of one of the U. S. Air Force planes, kept in NACA's hangar for use in the study of upper atmosphere conditions. Filled with instruments to record data needed to make both commercial and Air Force planes safer to fly in, these planes are used to fly under a wide variety of weather conditions.

The NACA flight problems division research chief is not "grounded" in that he does all his work safely behind the doors of his office. He often goes aloft to experience weather conditions along with the crew.

One particularly hazardous feature of winter flying is the formation of liquid super-cooled droplets of moisture in clouds. The droplets are below 32 degrees Fahrenheit in temperature, but are not frozen. However, when a plane flies through such a cloud the droplets freeze on coming in contact with the airplane's metal.

NACA planes, in many instances, carry ice sampling equipment and instruments to measure the important weather factors that produce airplane icing.

Since airplanes are built to specifications precisely calculated for flight, the change in wing shape produced by the ice can make enough difference to cause the

plane to crash, Pinkel declared.

There are many navigational problems confronted by researchers in the field of air flight. And the arrival of faster flying aircraft on the scene has produced difficulties never before existent, Pinkel related.

Clear Vision

There is the visual problem of being able to see clearly through rain-fogged windshields to make a landing with an airplane. Instruments are incapable of landing a plane alone. They help, but when ground contact is to be made there must be clear vision or the plane cannot land, Pinkel declared. Keeping the windshields of today's fast airplanes clear in rain is a complex technical problem under study at the laboratory.

The shape of clouds and the use of radar is helpful to pilots in avoiding "wind gust" areas in the upper atmosphere, according to Pinkel.

The seat devised by Pinkel yields to the pressure of a crash, permitting its occupant to do likewise. This "give" cushions the crash blow and absorbs the deadly shock.

One of the greatest hopes of success in the employment of the flexible, inflated rubber seat developed for passenger and transport planes is the ability of the human body to withstand the series of blows to which it is subjected in a crash, Pinkel said.

Col. John Stapp of the U. S. Air Force dramatically proved this fact by with-standing 80 G's (G stands for gravity pull) in Air Force experiments. Eighty G's is equal to 16,000 pounds. Pinkel supervised innumerable "swing tests" of the flexible seat at NACA which submitted dummies to 20 G's or 4,000 pounds of pull and more, before the seats were taken for crash testing on the C-46 air craft.

Aircraft Crash Fires

One of the most extensive research projects Pinkel has supervised is the theme of a 52-page paper he has written with G. Merritt Preston and Gerard J. Pesman, also of NACA.

Titled "Mechanism of Start and Development of Aircraft Crash Fires," the report relates details and facts learned from full scale aircraft crashes, devised to give

Pinkel says even today he cannot help being amazed as he was then when he observed coal being put into a convertor and coming out as gasoline.

He and his wife, Anne, are the parents of two children, Dan, 11,

large fuel spillage and a high incidence of fire, made to investigate the mechanism of the start and development of crash fires.

The study showed the characteristics of the sources of the fire, the manner in which the combustibles spread, the mechanism of the union of combustibles and ignition sources and the pertinent factors governing the development of a crash fire.

Results of this work, done at Ravenna, O., Arsenal property taught researchers many valuable facts about aircraft crash fires.

Among them were that:

REDUCTION IN aircraft crash-fire hazard can be realized by any design measure that increases the forward and spanwise distance and elevation of the engine in relation to fuel storage. This will reduce likelihood of contact between fuel in mist form with the many ignition sources at the nacelle (covering over the engine).

DEVICES OR design features acting to intercept spilled fuel flowing within the channels provided by airplane structure are helpful in reducing fire hazard.

PROVISION FOR drainage of intercepted fuel to spillage points in open air away from nacelles would improve effectiveness of the interception of fuel.

LOCATION OF landing lights

away from chordwise positions in front of fuel storage is indicated.

EMPLOYING PAINTS that have a reduced tendency to accumulate electrostatic charge by friction with dust and fuel on parts likely to be detached in a crash and trail the airplane is indicated.

DEENERGIZING OF all electrical systems not needed for landing should be accomplished by the pilot in approaching for a crash landing.

FUEL FLOW to engines should be cut off just before touchdown to allow the engine to purge itself with air before crash impact.

Irving Pinkel is never more enthusiastic about his work than when he has problems like crash fire factors to study.

With a background of 20 year experience in the government scientific service, Pinkel began government work in the Bureau of Mines. That was in the era when he began to worry about our gasoline resources and learned that coal could be converted to gasoline. The short age later proved not as great a had been thought.

IRVING PINKEL WINS NACA'S HIGHEST AWARD

I. Irving Pinkel, Chief of Fluid Systems Division at Lewis Laboratory, has received the NACA's highest award, the Distinguished Service Medal. His scientific research on causes of fire and impact hazards in aircraft crashes led to successful demonstrations of fire prevention and equipment and principles of seat design which enhance passenger safety.

The honor was presented by Dr. James H. Doolittle, NACA Chairman, at a regular meeting of the Committee in Washington.

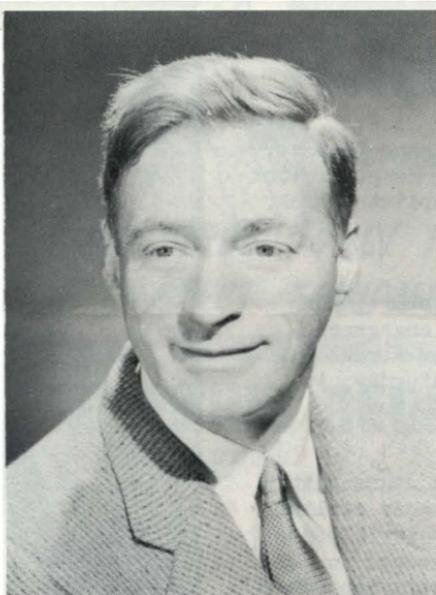
The citation read: "The scientific investigations of I. Irving Pinkel identified the sources of fire ensuing after aircraft crashes. He demonstrated practical equipment to prevent such fires. Through crash research he determined the time history of the forces developed in airplane crashes and demonstrated the use of the data in the design of passenger seats to alleviate crash impact hazards. These scientific contributions enhance the safety of air transportation."

Pinkel entered on duty at the Langley Laboratory on August 13, 1940 as a junior physicist and transferred to Lewis in October, 1942, to work on the hydraulics problems of aircraft engine lubricating systems operating at high altitudes.

During Pinkel's experimental work in crash fire research, which began in 1949, a number of surplus aircraft were crashed under carefully controlled conditions. The runway, barrier, and impact area were designed to provide maximum crash severity and fire hazard. Extensive instrumentation and photographic coverage of the crashes obtained the previously lacking data on the origin and spread of fire.

Initial crashes were conducted to determine potential ignition sources during the crash. Several following experimental crashes of severity which had previously produced fires were made with this equipment. No fires ensued.

(Continued on page 3)



I. Irving Pinkel, Chief of Fluid Systems Division at Lewis Laboratory, has received the NACA's Distinguished Service Award.

When Pinkel demonstrated that crash fires could be prevented, he turned his attention to the hazard of crash impact. This required a determination of how people are injured during aircraft crashes, and by what means these injuries could be prevented.

An additional series of airplanes was crashed under conditions simulating maximum possible impact without crushing the aircraft's cabin or cockpit. This series of crashes produced data on forces and stresses exerted during crash impact on aircraft structures and occupants. A flexible seat which greatly reduces the impact hazard to occupants was conceived and designed on the basis of this data.

He and his associates received the Laura Taber Barbour Award "for the development of a system for suppressing crash fires" in 1956. In 1953, they were presented the Flight Safety Foundation Award "for contributions to the safe utilization of aircraft."

Pinkel was born in Gloversville, New York on April 22, 1913. He graduated with honors from the University of Pennsylvania in 1934. As an undergraduate, he was elected to Phi Beta Kappa, Sigma Xi, honorary scientific society, and Pi Mu Epsilon, honorary mathematics fraternity.

He resides at Fairview Park, Ohio, with his wife, Ann, and their two children, Daniel and Robert.



National Advisory Committee for Aeronautics
Lewis Flight Propulsion Laboratory
Cleveland 11, Ohio

Washington, D.C., June 20, 1957. Dr. James H. Doolittle, NACA Chairman, presents the NACA's highest award, the Distinguished Service Medal, to I. Irving Pinkel. Pinkel, an aeronautical research scientist at the Lewis Flight Propulsion Laboratory, Cleveland, was cited for his scientific research on causes of fire and impact hazards in aircraft crashes which led to successful demonstrations of fire prevention equipment and to principles of seat design that enhance passenger safety.

PROMOTION

Space Fair Orbits As Sponsor Is Struck

By George Wilt

Even a strike closing Cleveland's daily newspapers couldn't ground the *Cleveland Plain Dealer's* Space Science Fair.

In spite of the fact that the suspension came right smack in the middle of the big community-service event co-sponsored by the Plain Dealer and the National Aeronautics and Space Administration, the fair continued to pack them in.

In fact, the 10-day exposition drew 375,738 curious students and adult visitors, breaking all previous city attendance records at Cleveland's Public Hall.

The comprehensive exhibits of spacecraft and rockets, the largest ever assembled by NASA for public examination, were presented in Cleveland without any admission charge. The 30,000 square feet of exhibit area in the main arena was twice as large as the Seattle World's Fair area occupied by NASA.

The joint effort by NASA's Lewis Research Center, located in Cleveland, and the Plain Dealer, was aimed at introducing the space program to the public; to give a progress report on the space science program; and bolster pride in the nation's space effort. The stimulation of student interest in science in general, and in participation in the space program in particular, was a major academic objective of the Space Fair.

Some 50,000 students from 15 northeastern Ohio counties were guided through the exposition. 11,000 advanced students attended the special Science Institute for a one-hour orientation in space exploration, and an hour-long specialized lecture and two-hour excursion through the sprawling exhibit. The balance of the students attending in school-sanctioned groups took in the exhibits only.

Spacecraft Exhibited

Some of the show stoppers included a full-scale, detailed mock-up of Apollo, the spacecraft designed to carry a three-man crew on lunar missions; two Mercury orbital capsules actually used in manned space flight; models of the Explorer, Vanguard and Discoverer satellites, the X-15 rocket plane; full-size two-man Gemini cap-

sule; the seven-story high Scout rocket; and Ranger, Surveyor and Prospector spacecrafts designed for investigating the lunar surface.

A Space Commemorative Dinner, kicking off the exposition attracted 1,000 northern Ohio opinion makers, including Anthony J. Celebrezze, former Cleveland mayor and now Secretary of Health, Education and Welfare. A taped and filmed statement from President Kennedy was presented at the Dinner.

The Plain Dealer announced its plans to co-sponsor the Space Science Fair in June. One month before the show opened, they put its editorial support of the coming event into high gear. Under the direction of Philip W. Porter, managing editor, two stories a day were published about various aspects of the show, and details of space hardware.

NASA Coordination

NASA was responsible for the coordination, transportation and installation of all exhibits, and furnished about 150 personnel to man the show. The Plain Dealer bore the rental costs of the Public Auditorium and coordinated the entire promotion program for the successful public service.

A barometer of the appeal of the undertaking is the fact that over 100 Ohio newspapers carried a total of 473 articles about the Space Science Fair. The event was also extensively covered by local and national radio and television media.

It's a shame that the Plain Dealer can't tell its readers how successful their promotion turned out until the strike is over.

YOUNG IDEAS — The *Boston Globe* used a five-column filler ad to tell its readers about its youth projects. Covered in picture and caption technique were State Drama Festivals, Massachusetts Art Awards, State Science Fair, Baseball and Basketball Clinics, and High School Editors' Press Conferences.

PHILLY SAMPLES — The *Philadelphia Inquirer* was quick

to capitalize on the comments of New Yorkers who were reading their paper during the shutdown of New York's dailies, as reported in E&P. Promotion manager Len Bach picked quotes from the E&P story, and used them on a sample folder, wrapped around copies for distribution in New York ad shops. Sample copies of the *Inquirer* (including full color rop ads and editorial art) were wrapped in a blue cover stock folder. A Fred Phillips cartoon on the cover showed glum newspaperless commuters, and one happy *Inquirer* reader. The quotes appeared in balloons in the cartoon, and in type on the back of the folder.

GROCERIES — Scripps-Howard Newspapers has reissued its annual Study of Grocery Product Distribution in 13 Scripps-Howard Markets. The 84-page booklet tabulates the distribution of products found in corporate chain grocery stores in each market. The report shows distribution for 75 classifications of merchandise. Of the 6,236 brands listed in the study, almost half of them had distribution in only one of the 13 markets. Copies are available from Hal Reisz, advertising promotion and research director, Scripps - Howard Newspapers, 230 Park Avenue, New York 17, N. Y.

TRAVEL SHOW — The *Boston Herald-Traveler* sponsored a five day "Vacation Vistas" Travel Show at the Commonwealth Armory, under the direction of promotion manager James Nolan. Playing to packed houses throughout the show, it was consistently promoted with news and feature stories, in-paper ads and photographs. In addition to booth exhibits, the show featured Tahitian dancers, folk dance groups, Turkish troubadours, ski and golf demonstrations, entertainment and films. The *Herald and Traveler* published special Travel Show sections.

MERCHANDISING — Booth Michigan Newspapers have produced an interesting promotion to get the maximum benefit from advertisements they are running in newspapers in New York, Chicago, Detroit, San Francisco and Los Angeles. Glossy proofs of the newspaper ads are enclosed in the pocket of a folder in which is reproduced the illustrations of the newspaper ads. Heading is: "The boy on the bike . . . the lady with buying on her mind . . . and the man's favorite person . . . have interesting things to tell you . . . HERE!"



FEATURES IN READER INTEREST

NATIONAL COLUMNS

- MARQUIS CHILDS
- DORIS FLEESON
- MARY McGRORY
- HENRY J. TAYLOR
- WILLIAM S. WHITE

COMMENTARY COLUMNS

- AL CAPP
- INEZ ROBB
- ROBERT C. RUARK
- RICHARD STARNES

SPECIALTY COLUMNS

- BY GEORGE Humorous Advice
- WILLIAM A. DOYLE Daily Investor
- MOLLY MAYFIELD Personal Problems
- DR. ERNEST G. OSBORNE Child Training
- STELLA Daily Horoscope
- AMY VANDERBILT Modern Manners
- JOE WILLIAMS Sports

VARIETY FEATURES

- LONDON EXPRESS SERVICE
- SAMUEL LUBELL "THE PEOPLE SPEAK"
- MUTUAL FUNDS - INVESTMENT COMPANIES
- SPOTLITE SERIES
- CROSSWORDS, DAILY & SUNDAY

COMIC STRIPS

- ABBIE AN' SLATS D/S
- BLAST BLAIR D
- DAVY JONES D
- FERD'NAND D/S
- GORDO D/S
- LI'L ABNER D/S
- NANCY D/S
- PEANUTS D/S
- TARZAN D/S
- TWIN EARTHS D
- FRITZI RITZ S
- CAPTAIN AND THE KIDS S

PANELS

- ALL STARS D
- EDITORIAL CARTOONS D
- EMMY LOU D/S
- GINGER D
- HEALTH CAPSULES D
- STEE SEES W OR S
- STRANGE AS IT SEEMS D/S
- THE GOOD OLD DAYS W
- THE GOOD OLD DAYS - ANTIQUES FAIR S
- TICKER TOONS D

UNITED FEATURE SYNDICATE, INC., 220 East 42nd St., New York 17, N.Y.

Methodical Tour of Space Fair Is Best

The Space Science Fair is "a real smorgasbord," with something for everyone, its executive chairman says.

Getting the most out of the fair involves methodical touring, I. Irving Pinkel said yesterday. He is chief of the fluid system components division of the Lewis Research Center here.

Lewis Research Center is operated by the National Aeronautics and Space Administration, which is sponsoring the fair with The Plain Dealer.

PINKEL SUGGESTED that visitors first walk through the center of the main arena at Public Hall to get the



I. Irving Pinkel

general impression of the show.

At the end of the arena is a display with models showing the proposed first flight to the moon.

Then the visitor can branch off to give more study to

areas that particularly interest him, Pinkel said.

EXHIBITS are divided into three main groups:

- Astronomy—Where are we going?
- Space vehicles—How do we get there?
- Man's space flight—How do we live when we arrive?

In each case displays around the edge of the arena are related to vehicles or other large exhibits opposite them in the center of the hall.

AT EACH DISPLAY, a sign reading "Start Here" shows the spot where the visitor should begin in order to get a connected idea of the entire theme.

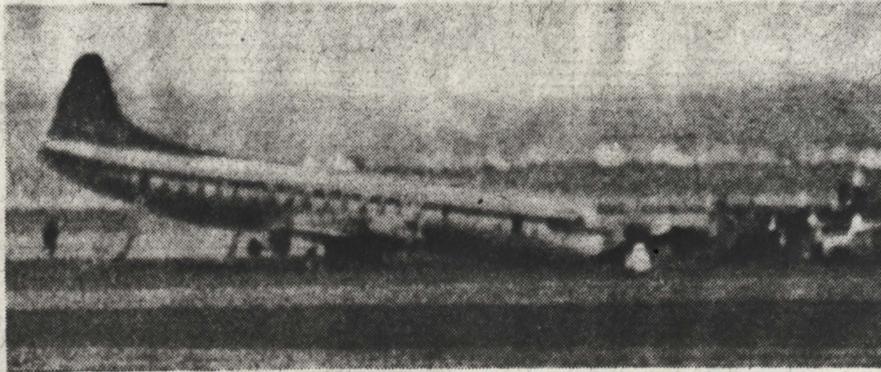
Pinkel urged that the fair-goer take time to read descriptions of exhibits and listen to NASA science lecturers.

"A person could easily spend several days at the fair," he said, citing exhibits in science, engineering, biology, electronics and other subjects.

A leaflet given out at the main entrance includes a map locating the various displays.

There are no conducted tours of the entire fair. Pinkel said such tours would be impossible because of the huge number of visitors and the arrangement of the exhibits.

Plane Skids In on Nose Here, 84 on Board Safe



Northwest Airlines Electra plane after it skidded to a halt off the edge of runway at Cleveland Hopkins Airport when its nose landing gear collapsed on landing.

Plain Dealer Photo (Dudley Brumbach)



Gear Collapses, Airliner Halted Atilt on Grass

An airliner with 77 passengers and a crew of 7 narrowly averted a major crackup at Cleveland Hopkins Airport last night when the nose landing gear collapsed seconds after landing and the plane skidded along the runway for a quarter of a mile.

None of the passengers aboard the ship—a Northwest Airlines turboprop Electra arriving from Washington—was injured. But all were shaken up inside their seat belts.

The plane came to a stop at the edge of the runway, with its nose in the mud and the tail slanted up at about a 15-degree angle.

QUICK ACTION by the pilot prevented a tragedy, passengers said.

The plane came down on the southwest-to-northeast jet runway, the airport operations supervisor, Joseph C. Planisek, reported.

The time was 6:56 p.m.

Seconds later, the nose landing gear collapsed. Passengers reported a thunderous noise.

The plane tipped forward after sliding along the runway on its nose. Sparks flew.

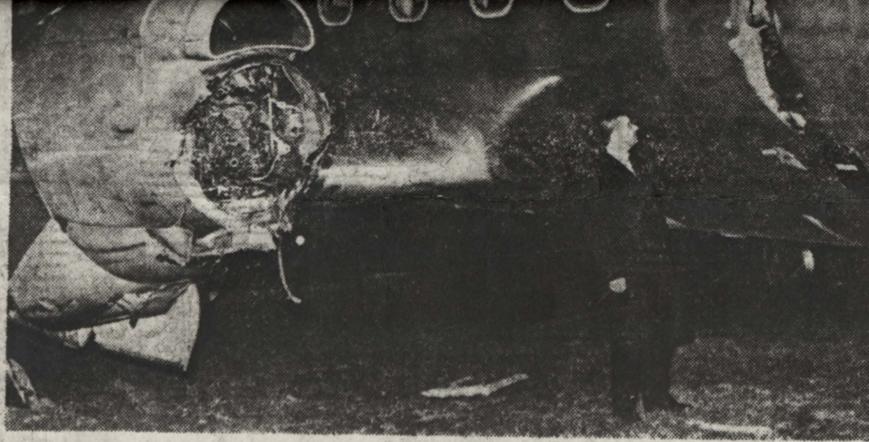
PROPELLERS on the in-board engines and parts of their housing were torn off.

The propeller on the right side slashed into the fuselage



Capt. Elman Lemley

Hero Pilot



Propeller on inboard right engine of Northwest Airlines plane tore off and slashed into section of fuselage. Joseph A. Ryan, Cleveland sales representative for Northwest, is shown near the eight-foot gash.

Plain Dealer Photo (Karl J. Rauschkolb)



Capt. Elman Lemley

Hero Pilot Just Acted by the Book

By FRED MOLLENKOPF

When you talk to pilot Elman Lemley, you know you would like to have him in charge if the airliner you are riding in encounters trouble.

Lemley, 43-year-old native of Core, near Morgantown, W. Va., safely halted the skidding Northwest Airlines plane at Cleveland Hopkins Airport last night and won the praise of its 77 passengers, its crew and airport operations personnel.

In his 28 years of flying, Lemley had never so much as blown a tire on an aircraft.

IN A SOFT, southern drawl the self-effacing former Air Force pilot tried to recount how he felt when he first realized the nose landing gear had collapsed on the Electra turboprop plane.

"It's hard to recall. You know your nose is going down and you know you're helpless. You automatically do all the things you know you must do in an emergency and then hope you don't catch fire and burn up your passengers," Lemley said.

"I THINK WE prevented serious fire by cutting in our

The plane came down on the southwest-to-northeast jet runway, the airport operations supervisor, Joseph C. Planisek, reported.

The time was 6:56 p.m.

Seconds later, the nose landing gear collapsed. Passengers reported a thunderous noise.

The plane tipped forward after sliding along the runway on its nose. Sparks flew.

PROPELLERS on the inboard engines and parts of their housing were torn off.

The propeller on the right side slashed into the fuselage of the plane in the area of the cloakroom. It made an eight-foot gash in the plane's body.

The other propeller fell to the runway.

The pilot, Elman Lemley, 43, of Minneapolis, performed automatic procedures when he knew the landing gear had collapsed.

Aided by co-pilot Paul Carrell, 31, of Minneapolis, Lemley quickly shut off fuel to the engines. They noticed fire in both engines as the props ripped off. They cut in automatic fire extinguishers.

An airlines spokesman said the plane came to a halt in a grassy strip about 100 feet off the runway.

Planisek flashed the emergency signal at the field. This alerted fire companies which sped to the scene.

THE EMERGENCY signal also closed down the field to all aircraft for 21 minutes.

The Northwest flight began in Washington and made a stop at Pittsburgh before arriving here. It was scheduled to go on to Detroit, Milwaukee and Minneapolis-St. Paul.

About a third of the passengers aboard slid down an emergency escape chute in the tail of the plane, Birkett L. Williams, a passenger, told The Plain Dealer.

Others were able to leave by the passenger door.

Continued on Page 7, Col. 6

Safety Ace on Airliner Unruffled

By MICHAEL D. ROBERTS

The calmest of 77 passengers abroad the disabled Northwest Airlines turboprop Electra had to be I. Irving Pinkel.

A physicist for the National Aeronautics and Space Administration, Pinkel spent a great deal of time about a decade ago on a government research project . . . crashing old airplanes.

Pinkel, nationally known air safety expert, leaned nonchalantly against the Northwest luggage counter in Cleveland-Hopkins Airport and said:

"OH, YES, I'VE seen a lot of planes crash. This is the first one I've been in, though."

Pinkel was seated in the midsection of the plane. He said the nose gear collapsed about 10 seconds after touchdown and the plane veered sharply to the right.

Continued on Page 7, Col. 2

WOMAN IS ALONG

Nazi on Run Slips Into Switzerland

HANNOVER, Germany (AP)—Escapee Hans Walter Zech-Nenntwich, a convicted war criminal, crossed to Switzerland yesterday with a pretty woman companion.

He had been helped by a prison guard who once was a Nazi and had outside help in arranging the flight to Switzerland by plane, authorities reported. Swiss police are hunting for him.

The Justice Ministry of Lower Saxony said Hans Zeeman, a former Nazi labor service leader turned prison guard, admitted letting Zech-Nenntwich out of prison in Brunswick Wednesday night because of "old friendship" and the promise of a good job.

POLICE ARRESTED Zeeman and also a man who drove the escaped prisoner to the airport for his flight from Germany.

Zech-Nenntwich, 47, was sentenced Monday to four years for his part in the massacre of 5,200 Jews in Pinsk in Nazi-occupied Poland.

French territory. The couple went by taxi to Basel railway station and took a train headed for central Switzerland, police said.

The pilot of the four-seater plane, a German, took off again almost immediately. German authorities said the plane is owned by a German textile industrialist. He was not named.

Police said the pilot reported that Zech-Nenntwich was traveling under an alias, and tried to bribe him into flying on to Italy.

Zeeman told interrogating officials that all through the trial Zech-Nenntwich was convinced he would be freed be-

Birkett Williams Praises Air Crew

Birkett L. Williams, former Cleveland safety director and prominent auto dealer, who was aboard the Northwest Airlines plane, praised the crew for expert handling of the emergency.



Birkett L. Williams
Plain Dealer Photo

Williams told The Plain Dealer:

"I WAS SITTING in the tail of the plane. We had just touched down on the runway when there was a loud crash. "We were still moving forward at landing speed. The nose of the plane tipped forward. We were sliding along on the nose.

"Everybody aboard knew the front landing gear had collapsed.

"I WAS WATCHING the motors. Sparks were flying as we slid along the concrete runway.

"Then the propeller on a motor on the right side tore off. It landed on the runway.

"I saw a burst of flame from the exhaust of the other engine on the right side. It stopped almost immediately.

"This leads me to think the



Paul Carrell
Copilot of damaged plane

pilot cut out the gasoline supply. This was clever of him, and probably prevented fire."

Williams added that the plane slid along the runway until it ran off into the mud along the edge, where it came to a stop.

"BY THIS TIME the steward and stewardess were among the passengers saying, "Don't panic. There's no fire. There's no hurry."

Williams said two crew members opened the emergency canvas escape chute in the tail of the plane. The two crew members were the first to leave. Passengers followed.

"I slid down it too," said Williams. "I wanted to see what it was like."

Williams said about a third of the passengers left this way. The others were able to leave by the passenger door.

Firemen were standing by to help, Williams said.

He said none of the passengers appeared to be hurt.

"EVERYBODY LEFT the plane and were talking about how lucky they had been," said Williams.

The Clevelander had been in Washington on a one-day business trip.



Stewardesses aboard craft were, from left, Miss Deanna Cunningham, 21, of Richfield, Minn., and Miss Ruth Lietha, 22, of Alexandria, Va.
Plain Dealer Photo (Karl J. Rauschkotb)

Acted Automatically, Hero Pilot Declares

★ From First Page

automatic extinguishers on No. 3 and No. 2 engines right away. We had fire in them—we realized that as soon as we saw the heavy sparking. We followed our emergency procedures (cutting fuel supply, power switches, etc.) and tried to get the plane stopped as best we could."

Lemley remembered that it had been a good touchdown and that it was a good landing roll ("not because I made it.") This was backed up by control tower personnel and plane passengers who were used to flying a lot.

"When we knew our landing

gear was gone, we knew the worst might happen—that we had to do the best we could, I guess. We knew it but I don't think we thought about it because there wasn't time," said Lemley.

Lemley has flown for Northwest for 20 years. His Air Force flying (he was a combat veteran) included B-17 bombers.

He and his wife and two sons, Travis, 20 and Roger, 17, have lived in Minneapolis 19 years. Roger is in the Navy.

Lemley heaped praise on his stewardess for keeping the passengers calm.

Safety Expert Calmest Passenger

★ From First Page

"A propeller blade on the right inboard side snapped off and ripped into the fuselage toward the front," he said. "I expected that to happen."

FORTUNATELY, nobody was near the cloakroom, where the propeller fragment entered the plane.

"A woman across the aisle from me was eating," Pinkel said. "She forgot to buckle her seat belt. Her tray flew

into the air and she started to slide down the aisle.

"I was expecting the second (outside) right-side propeller to break and the woman was sliding toward the spot where I expected the blade to enter the plane.

"SO I REACHED OUT and grabbed her by the shoulder and held her.

"I was surprised. The second prop didn't break."

Pinkel spoke in a soft, casual voice. His wife, who met him on his return from a busi-

ness trip to Washington, laughed at how unconcerned her husband was.

There was no panic aboard, Pinkel said.

"It happened too fast."

HE COMMENDED the crew for quick action but took advantage of the crash to do a little safety preaching.

Passengers should always have their seat belts fastened on landing, said Pinkel. It is the same rule he insisted upon just one month ago, in a Plain Dealer series on plane crashes.



I. Irving Pinkel

Airliner Skids In on Nose Here



From First Page

A Northwest spokesman at the airport said passengers were driven from the field to the airlines terminal by limousines.

DOCTORS WERE summoned to examine passengers for possible injuries.

The Northwest plane remained on the field most of the night while federal officials checked for the cause of the accident.

Officials of the Federal

Aviation Agency hurried to the scene to begin their investigation.

Among passengers were 28 members of the League of Women voters from Minneapolis, who were returning from a Washington convention.

Flight engineer of the plane was Robert Weigel; steward, Robert Reardon, St. Paul; stewardesses, Miss Deanna Cunningham, 21 Richfield, Minn., Ruth Lietha, 22, of Alexandria, Va., and Nancy Fredrickson, 22, of Arlington, Va.

Research at Lewis Accents Noise Reduction, Reliability

By JOHN FISHER

(First in a series reviewing research work under way at the Fluid Systems Components division, Lewis Research Center, National Aeronautics & Space Administration.)

CLEVELAND — Noise abatement and safety through reliability are getting more attention in work on components for air breathing engines and V/STOL engines at Lewis Research Center, here.

Increased emphasis has been placed on safety and noise abatement because Congress has singled them out. A bill in a House Committee calls for a substantial reduction in noise abatement as a principal objective of the Federal Aviation Authority.

"There is no sense in developing engine components that ignore the noise and safety problems," said I.I. Pinkel, chief, Fluid Systems & Components division.

Mr. Pinkel's division works on components for the Air Breathing Engine division at Lewis.

The other principal task of the division is to develop reliable components and machinery for space power systems designed for 10,000 hours much longer space flights than now planned.

Noise abatement and safety are not limited to factors in design of components at Lewis. It has these noise and safety programs under way:

- A long-term study by a group headed by Newell D. Sanders, chief, Chemicals & Energy Conversion division, aimed at reducing noise of jet aircraft.

- A study by the Fluid Systems Components division of a method of preventing turbine wheels from breaking free and damaging controls or puncturing cabin walls. This work is being done in conjunction with the Naval Aircraft Engine Laboratory, Philadelphia Navy Yard.

In addition to these projects, Mr. Pinkel is working as a personnel consultant to the Army in developing thickened fuels and fuel in emulsion form to lessen danger of engine fires.

This work is under the direction of F.P. McCourt, chief, Safety & Survivability division, U.S. Army Aviation Material Laboratories, Fort Eustiss, Va.

Thickened fuel contains additives to make it jell. It thus is less likely to catch fire; it burns slower and it is easier to extinguish. The fuel also would be much less vulnerable to ignition from gunfire," Mr. Pinkel said.

One of the fuel preparations under study contains 3 per cent water. In jell form, however, the fuel is hard to pump into an engine.

Lewis Research Center, under the direction of Mr. Pinkel, developed a program some years ago aimed at eliminating fires as a result of airplane crashes. But the program never was implemented because of the additional weight it would create in planes and because a multi-million dollar research program would have been required to carry it out.

"Our work on space power system is concentrated on design of machinery and compressors, pumps and turbines that drive the machinery. Work on components in this area is trailing off,"

The division is working on bearings and bearing seal designs that will allow unattended

operation for 10,000 hours at 1,400 to 1,500 degrees F.

Dual Fuel Role

"We prefer to have the bearing lubricated by the fuel itself," Mr. Pinkel said. "One problem we have to solve in lubrication of bearings is that the component the turbine drives is closely coupled. Heat from the turbine causes distortion to gas bearings which operate at tolerances of 0.0005 between pads and the journal."

Design work in this area is aimed at minimizing thermal distortion and increasing ability of the bearing to withstand heat.

"We are also trying to work out a practical preloading of gas bearings. The trick is to have strong forces working on the bearing on all sides but working in balance," Mr. Pinkel said.

The gas bearings must operate for 10,000 hours in space.

Design for Long Life

A major part of the division's work on components for SST engines and V/STOL engines is

designing to avoid fatigue failure in components for compressors, fans and turbines.

"One plus-factor in work on the SST engine is that as the engines get bigger, components get bigger, allowing design features not possible in the past," Mr. Pinkel said.

An example: the use of aerodynamic principles such as the slotted wing concept in air cooled turbine blades, thus preventing separation of air over the trailing edge of the blade surface.

Lewis researchers are seeking to utilize turbine blade cooling air to drive successive stages of the turbines in the SST engine.

"The objective in this research is to reduce the amount of machinery needed in the turbine by making each section do more work, Mr. Pinkel said.

Cooling 2-Stage

He said that he would like to cool only one rather than two stages of the SST turbine but plans call for cooling two stages.



I. I. PINKEL, chief, Fluid Systems & Components division, Lewis Research Center, Cleveland, National Aeronautics & Space Administration.



Some of the new Fellows and Honorary Fellows meet before banquet. Foreground: I. Irving Pinkel of NASA Lewis. First row: H. Norman Abramson of Southwest Research Institute; Richard H. Battin of MIT; Walter M. Hartung of the Academy of Aeronautics; Wernher von Braun of NASA, an Honorary Fellow. Second row: Daniel Bershader of Stanford Univ.; John V. Breakwell of Stanford Univ.; George B. Litchford, consultant; H. W. Withington of Boeing; Kermit E. Van Every of General Dynamics; John W. Barter of Douglas. Back row: Joseph Gleason Gavin Jr. of Grumman; Neil Armstrong of NASA; Ralph B. Lightfoot of Sikorsky; F. A. Cleveland of Lockheed; Stanley G. Hooker of Rolls-Royce, Honorary Fellow; and Maj. Gen. Lee V. Gossick, USAF.



Some of the new Fellows and Honorary Fellows meet before banquet. Foreground: I. Irving Pinkel of NASA Lewis. First row: H. Norman Abramson of Southwest Research Institute; Richard H. Battin of MIT; Walter M. Hartung of the Academy of Aeronautics; Wernher von Braun of NASA, an Honorary Fellow. Second row: Daniel Bershader of Stanford Univ.; John V. Breakwell of Stanford Univ.; George B. Litchford, consultant; H. W. Withington of Boeing; Kermit E. Van Every of General Dynamics; John W. Barter of Douglas. Back row: Joseph Gleason Gavin Jr. of Grumman; Neil Armstrong of NASA; Ralph B. Lightfoot of Sikorsky; F. A. Cleveland of Lockheed; Stanley G. Hooker of Rolls-Royce, Honorary Fellow; and Maj. Gen. Lee V. Gossick, USAF.

high proportion of its 607 members.

Tennessee took the Outstanding Section Award for those with 500 or fewer members. Although also engaging in a broad range of activities, the Section has done particularly well with its education program and helping local governments. Chairman Charles R. Bartlett appeared to take the banner home.

The spotlight then turned on an outstandingly active member, as President Smelt presented the Distinguished Service Award to Dana Moran of Battelle Memorial Institute. His Section Chairmanship in 1968-69 and work on many committees earned him the award for "exemplary and continuous service since 1949 to the Los Angeles Section and to the national organization."

For its Aerospace Fair toured by nearly 860,000 visitors, the Sacramento Section won the Section Special Event Award. The display ran as part of the 1969 California State Fair in Sacramento. Ward Sanders of Aerojet-General, Section Chairman at the time of the event and originator of the idea, accepted the award for the Section.

Student-paper winners this year were selected at a National Student Conference held in Houston at the same time as the Annual Meeting, and received their awards at the banquet. Neal L. Funston of the Air Force Institute of Technology



Astronauts Schweikert, above at left, and Armstrong, center, talk shop with bemedalled Soviet Cosmonaut Major General Andrian G. Nikolayev and his interpreter, far right. At right, award-winning flight-controller Glynn Lunney receives earnest advice from space doctor Hubertus Strughold.





Award winners gather before banquet. First row, from left: Christopher C. Kraft Jr., Louis W. Hill Transportation Award; Maxime A. Faget, Spacecraft Design Award; William F. Chana for the San Diego Section, Outstanding Section with over 500 members; Glynn S. Lunney, Lawrence Sperry Award. Second row: Neal L. Funston, co-winner of graduate student paper award; Wernher von Braun, Honorary Fellow; Charles R. Bartlett for the Tennessee Section, Outstanding Section with 500 or fewer members; Ward Sanders for the Sacramento Section, Special Event Award. Rear row: Erik Mollo-Christensen, Von Karman Lecturer; Gary S. Settles, undergraduate student paper winner; Stanley G. Hooker, Honorary Fellow; Dana Moran, Distinguished Service Award; Dr. Walton L. Jones, John Jeffries Award.



Secretary of Transportation John Volpe trades stories with Stanley Hooker, left, and Wernher von Braun, center, at the reception. At left, **Erik Mollo-Christensen** delivers his Von Karman Lecture.

CalTech; T. Claude Ryan of Ryan Aeronautical Co.; Kermit E. Van Every of General Dynamics Corp.; and H. W. Withington of The Boeing Co.

Resuming the ceremonies after dinner, President Smelt introduced the three new Honorary Fellows. Grover Loenig, now 76, could not make the trip from his home in Key Biscayne, Florida. A pioneer aircraft inventor, he worked with the Wrights and won the 1921 Collier Trophy. Wernher von Braun, now NASA Deputy Associate Administrator for Planning, led development of the Saturn rocket while director of Marshall Space Flight Center. Stanley G. Hooker of Rolls-Royce equalled his performance at the January Aerospace Sciences Meeting by bringing down the house with one of his funny stories. As Technical Director of the Bristol Engine Div., he was cited for his role in the design and development of the Pegasus engine, which powers the Harrier VTOL attack aircraft.

The awards program began with the Outstanding Section Award for Sections with over 500 members, which went to San Diego; and Section Chairman William F. Chana, the man most responsible for the Section's outstanding performance, accepted the banner. For its size, San Diego has carried out an exceptionally wide range of activities and done them well, while involving a

Aeronautics & Astronautics

A PUBLICATION OF THE AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

DECEMBER 1970

Toward City-Center Air Service



MR I M695-3517 CL
NASA L IRVING PINKEL
AEROSP SAFETY RESH CTR
21000 BROOKPARK RD
CLEVELAND OH INST
44135 CB2A



I. E. Pinkel

Perceptions On Safety

Irving Pinkel, former director of the Aerospace Safety Research and Data Institute at NASA Lewis Research Center, treated Heat Transfer Luncheon attendees to a well-illustrated description of how unusual technical problems and changing attitudes on public safety responsibility is of important concern to today's mechanical engineer.

In a humorous vein, Pinkel expressed some surprise at his invitation to speak but then he said he "came to

realize that the new morality in safety, as reinforced by the laws and the courts, has quickened your interest." Engineers will find that some very capable people have recently moved into the field and have established a respectable and difficult discipline. They have reacted to the challenge of the new industrial, military research systems which are so complex that probability for error and accidents is high. In addition, the consequences of these accidents are so great that they cannot be ignored.

Pinkel presented his concepts of safety engineering from the technical, social, economic, psychological, legal, and moral viewpoints. He noted that a high technical quality had been generally achieved in safety but its application has been spotty.

He described some weaknesses in the application of safety he had observed. He suggested that "if you are in the position of extrapolating from a small data base to a large conclusion—you had better test your conclusion." He went on to show how a so-called aircraft safety fuel which refused to burn in a small volume glass exploded when tested in quantity in a real air-

plane crash.

Again he showed how NASA had tested mixing of oxygen and hydrogen in small quantities with no explosions. Yet with the mixing of large quantities an explosion producing a nuclear-like mushroom cloud resulted. In another case he showed how resonant heating of aluminum in oxygen systems had caused NASA grief.

Pinkel warned against following the go-go attitudes of those willing to take risks in order to get the job done. The cost of mistakes is going up by orders-of-magnitude because of the new moral attitudes and awards of the courts.

Presided over by Division Chairman Lloyd H. Back, the post-luncheon program featured the presentation of two 1973 Heat Transfer Division Memorial Awards. One went to Donald Edwards, professor of engineering at the University of California, Los Angeles, for his contributions in surface and gaseous radiation. The second was awarded to Dr. Long Sun Tong, Sr., consultant at the Westinghouse Electric Corp. Nuclear Center, for outstanding contributions in nuclear heat transfer design and development.



from the desk of...

BRUCE LUNDIN

Our -
My boy mailed this
to me from Austin.

Thought you'd like to
see yourself in print.

Best regards (and visit
often)

Bruce

TC Nominations Open

Nominations for membership on the 1981 TCs open May 1, 1980 and close August 15, 1980. Nomination packages will be available May 1 and may be obtained from Josephine Sosa, Coordinator, Technical Activities, AIAA, 1290 Avenue of the Americas, New York, N.Y. 10019, (212)581-4300, ext. 240. A complete TC-roster appeared in the April issue, page B-39.

Pinkel Takes Safety Award

At the Reliability and Maintainability Symposium in San Francisco consultant Irving Pinkel received the 1980 AIAA Systems Effectiveness and Safety Award for "his pioneering contributions to aerospace safety and system effectiveness, and for service in

promoting research and development both through management of key R&D programs and industry-wide stimulation of related activities."

During his years at NASA-Lewis Pinkel carried out crash studies, probed the lightning hazard and the fire hazard to aircraft and spacecraft and helped in the investigation of the Apollo fire and the subsequent redesign.



Irving Pinkel, at right, retired from NASA, received the 1980 AIAA Systems Effectiveness and Safety Award from **Thomas Gagnier** of Martin Marietta, chairman of the SES Technical Committee.

October 8, 1982

News Notes

Aerospace detective to address AIAA

Well-known accident investigator I. Irving Pinkel will speak at the October 21 meeting of the Northern Ohio Section of the American Institute of Aeronautics and Astronautics (AIAA). In his presentation, "The Engineer Scientist Turns Detective to Investigate Accidents. What Does He Do?" Mr. Pinkel will present the logic used to reconstruct the essential features of an accident from the evidence. He will review some well-known airplane and spacecraft accidents with motion pictures and detailed photos.

Pinkel was on the original staff of the Lewis Research Center, having begun his Government scientific service in 1935. In his 32-year career with NACA and NASA, he served as chief of several research divisions. Following his participation in the investigation of the 1967 Apollo fire, he established the NASA Safety Research and Data Institute.

Pinkel is the recipient of the NACA Distinguished Service Medal and the Distinguished Researcher Award from the Experimental Aircraft Association. He also is an AIAA Fellow.

The meeting, to be held in the NASA Lewis DEB Cafeteria, will begin at 5:30 p.m. with an attitude adjustment hour, followed by dinner at 6:30 p.m. and the program at 7:30 p.m. Cost of the dinner is \$7.00 for AIAA members and family, \$6 for student members and \$8 for non-members. For dinner reservations, call Karen Beyer at PAX 8275 or PBX 6995 by October 18. The program is free to all.



Dr. Silverstein

Abe Silverstein, a native of Terre Haute, Ind., began his scientific career with the National Advisory Committee for Aeronautics in 1929 at Langley Research Center after graduating from Rose Polytechnic Institute

In 1943 he transferred to Lewis in Cleveland and was chief of the wind tunnel and flight division. After WW II Dr. Silverstein was responsible for the conception, design and construction of the first supersonic propulsion wind tunnels.)

In 1958 he was transferred to NACA headquarters in Washington to plan the organization and programs of the

National Aeronautics and Space Administration, successor to NACA. He became director of NASA's office of space flight programs in late 1958. Development programs under his direction included manned and unmanned space flight systems.

Dr. Silverstein returned to Cleveland in November, 1961, to take the helm of the Lewis Research Center as director.)

In 1962 he received the National Civil Service League's Career Service Award in Washington, D. C., for his 32 years of leadership in aircraft and space technology.

I. IRVING PINKEL

Irving Pinkel entered government scientific service in 1935 to work on the conversion of coal to liquid hydrocarbons. In 1940 he transferred to the NACA Langley laboratory to study non-steady aerodynamics and wing flutter. He was a member of the nucleus staff of the NACA Lewis Research Center when it was commissioned in 1942. In his 30 year career at Lewis he served as the Chief of several research divisions. Following his participation in the investigation of the Apollo fire in 1967 he established the NASA Safety Research and Data Institute which he directed until his retirement from NASA in 1972. Since then he has had an active consulting practice.

He is the recipient of the NACA Distinguished Service Medal, several awards for contributions to flight safety and in August of 1982 he received the NASA Distinguished Researcher Award from the Experimental Aircraft Association.

Mr. Pinkel is a Fellow of the AIAA.

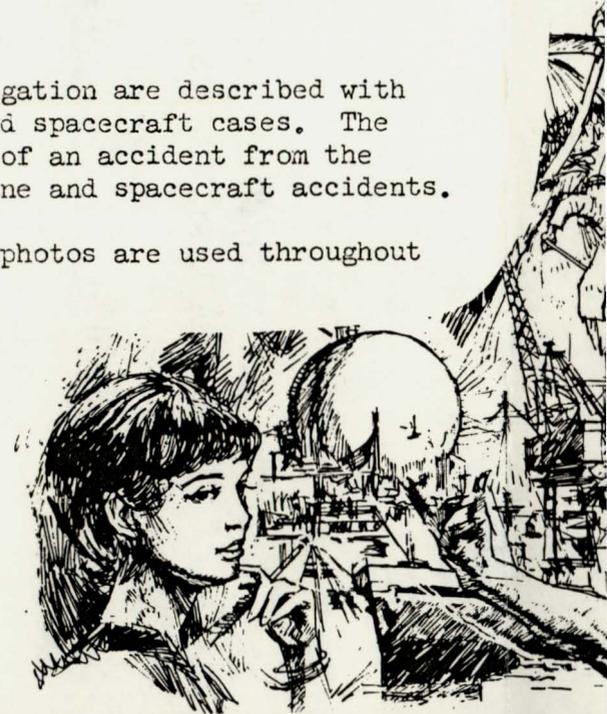
ABSTRACT

Issues covered in an accident investigation are described with illustrations drawn from a variety of airplane and spacecraft cases. The logic used to reconstruct the essential features of an accident from the evidence is reviewed using some well-known airplane and spacecraft accidents.

Motion pictures and detailed accident photos are used throughout the talk.

Cleveland Ohio - September 3, 1982

Dr. Abe Silverstein, Honorary Fellow of the AIAA, was enshrined into the Western Reserve Aviation Hall Of Fame as one of the Aviation greats known around the world, who brought fame to northern Ohio.



NORTHERN AIAA NEWS

"THE ENGINEER/SCIENTIST TURNS DETECTIVE TO INVESTIGATE ACCIDENTS. WHAT DOES HE DO?"

by

I. IRVING PINKEL, CONSULTING ENGINEER

Date: Thursday October 21, 1982

Location: NASA Lewis Research Center
DEB Cafeteria

Time: 5:30PM Attitude Adjustment
6:30PM Dinner
7:30Pm Meeting

Cost: Dinner: \$7.00 Members
8.00 Non-Members
6.00 Students

Meeting: No Cost

"THE ENGINEER/SCIENTIST TURNS DETECTIVE TO INVESTIGATE ACCIDENTS. WHAT DOES HE DO?"

by

I. IRVING PINKEL, CONSULTING ENGINEER

Date: Thursday October 21, 1982

Location: NASA Lewis Research Center



Reservations: Call Karen Beyer @ 433-400 X6995