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CHRONOLOGY

From the Cambridge Field Station
to the
Air Force Geophysics Laboratory
1945 - 1985

ORIGINAL FILE COPY

Air Force Geophysics Laboratory, Hanscom Air Force Base
Bedford, Massachusetts 01731

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This report has been reviewed by the ESD Public Affairs Office (PA)
and is releasable to the National Technical Information Service (NTIS).

This technical report has been reviewed and
is approved for publication.

A. J. Stair, Jr.
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Chief Scientist

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19 ABSTRACT (Continue on reverse if necessary and identify by block number) This CHRONOLOGY covers the entire history (1945-1985) of the Air Force Geophysics Laboratory and its three predecessor organizations. (The latter consist of the Cambridge Field Station, the Air Force Cambridge Research Center, and the Air Force Cambridge Research Laboratories.) The CHRONOLOGY lists major organizational developments and events relating to scientific programs. It also includes illustrations and appendices. The work is intended to provide a historical reference for staff at the Laboratory and at related government agencies.			
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CHRONOLOGY

**From the Cambridge Field Station
to the
Air Force Geophysics Laboratory
1945 - 1985**

**By
Dr Ruth P. Liebowitz, Historian
Information Services Section**

**Air Force Geophysics Laboratory
Hanscom Air Force Base
Bedford, Massachusetts**

Best Available Copy

FOREWORD

With the Laboratory approaching its fortieth anniversary, the author is pleased to present a CHRONOLOGY which lists major events and scientific programs over the entire history of the Air Force Geophysics Laboratory (AFGL) and its predecessor organizations. The document was compiled from the official histories, the Reports on Research at AFGL/AFCKL, and materials in the AFGL History File. It is hoped that the CHRONOLOGY will serve as a useful reference tool and also as an introduction to AFGL's rich history for those not acquainted with it.

This compilation would not have been possible without contributions from many Laboratory staff members, both current and retired, and from the Technical Photography Section. The author gratefully acknowledges their assistance. Special thanks go to Ms Mary Warner for putting the manuscript along with many additions and revisions on the word-processor, and to Dr Alice McGinty for her support of the project.

Suggestions or comments to improve and update entries in the future will be appreciated.



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August 1985

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Original Headquarters of the Cambridge Field Station
224 and 230 Albany St., Cambridge, Massachusetts

CHRONOLOGY

1945

- 13 Aug The Army Air Forces began recruiting scientific personnel at the Massachusetts Institute of Technology's Radiation Laboratory and at Harvard University's Radio Research Laboratory for post-war employment at Army Air Forces laboratories.
- 20 Sep The Air Technical Services Command authorized the establishment of the Cambridge Field Station (CFS) under the jurisdiction of the Watson Laboratories at Red Bank, New Jersey.
- 20 Sep Major John W. Marchetti was appointed Acting Commanding Officer of the new Cambridge Field Station.
- 25 Sep The permanent headquarters of the Cambridge Field Station were set up at 224 Albany St., Cambridge, Massachusetts, close by the Massachusetts Institute of Technology. The Station also acquired the Ipswich Antenna Station and several buildings at the Bedford Army Air Field which had been used by M.I.T.
- 17 Oct A Radar Countermeasures Press Show was held.
- 23 Nov The first meeting of the CFS Steering Committee took place.
- Military projects in progress at M.I.T.'s Radiation Laboratory were divided between the Army and the Navy. The Cambridge Field Station emerged with 15 projects and tons of equipment, which initially were dumped into its warehouse in Lawrence, Massachusetts.

1946

- Jan Work on a prototype airport traffic control system (the AN/CPN-18) begun at the Radiation Laboratory was completed. The unit was then tested at the All-Weather Flying Center at Clinton County Airport, Ohio.
- 8 Mar The technical portion of the Cambridge Field Station was tentatively organized as the Research Division. It initially consisted of four Components Laboratories (Antenna, R. F. Components, Mechanical and

1946, cont'd

Electrical Engineering, and Electronic Components) and six Systems Laboratories (Ground Radar, Navigation, Communications, Relay Systems, Countermeasures, and Special Studies). Each Laboratory was to present a report on its project activities every four months to the Division's Steering Committee.

- 21 Mar The Air Technical Services Command of the Army Air Forces was renamed the Air Materiel Command (AMC).
- 1 Apr The Research Division was established as a staff office under Colonel Francis H. Richardson.
- 19 Jun The Cambridge Field Station was given the formal status of a Class III Installation, reporting to Watson Laboratories, Red Bank, New Jersey.
- 30 Jun As of this date, the Cambridge Field Station had a staffing of 770 personnel (350 technical and 420 non-technical).
- 17 Sep Major Labat T. Fletcher replaced Major John W. Marchetti as Commander of the Cambridge Field Station.
- 19 Nov John W. Marchetti, now a civilian, was named Chief of the Research Division.
- 21 Nov The first successful Air Force firing of a V-2 rocket (V-2, #15) took place at White Sands, New Mexico, under the supervision of Dr. Marcus O'Day, Chief of the Navigation Laboratory.

1947

- 26 Mar The Air Staff for Research and Development at Army Air Forces Headquarters directed that responsibility for research and development in meteorology and related geophysical fields be transferred from the Air Weather Service to the Air Materiel Command. A group of four expert AWS personnel were transferred to AMC to form the nucleus of a staff for its new function.
- Mar The Air Materiel Command established an Atmospheric Laboratory in the Engineering Division of Watson Laboratories in Red Bank, New Jersey.

1947, cont'd

- 14 Apr Colonel Hugh Mitchell succeeded Major Labat T. Fletcher as CFS Commander.
- 5 Jun The first Army Air Forces research balloon launch was conducted at Holloman Air Force Base, New Mexico, by a New York University team working under contract for the Air Materiel Command. It featured a cluster of rubber balloons. The first polyethylene plastic balloons in this project were launched on 3 July 1947.
- Jun The Commonwealth of Massachusetts, the Army Air Forces, and the Army Corps of Engineers agreed to a five-year lease, extending from 1 July 1947 to 30 June 1952, under which their joint use of the Laurence G. Hanscom Field, Bedford, Massachusetts, would continue.
- 18 Sep The Air Force was established as a separate service.
- 1 Dec The Cambridge Field Station was removed from the jurisdiction of Watson Laboratories. It became an exempted installation, designated the 4153d Air Force Base, which reported directly to Air Materiel Command Headquarters.
- Towards the end of the year, the Research Division drew up a five-year plan for advancing electronics research.
- Plans were outlined for Project VOLSCAN (Volumetric Scanning), an experimental air traffic control system, and for Project VOLIR (Volumetric Indicating Radar), an automated scanning radar.

1948

- 25 Feb The Atmospheric Laboratory at Watson Laboratories was redesignated the Geophysical Research Division. Capt Albert C. Trakowski was named Chief of the Division, and a new mission plan was drawn up.
- 15 Mar The Fourth Cliff site near Scituate, Massachusetts, was acquired. It was used as the radar site for Project "Billboard," an experimental long-range, low-frequency radar.
- 22 Mar Two deputy commanders, a Deputy for Research and a Deputy for Administration, were established.

1948, cont'd

- 3 May The Air Materiel Command confirmed official plans to move the Cambridge Field Station to Griffiss Air Force Base, Rome, New York, but uncertainty about the move persisted.
- 14 May The Navigation Laboratory moved into new quarters at the Simmons Building, Watertown Arsenal, Watertown, Massachusetts.
- 14 Jun Lieutenant Colonel Wilfred H. Tetley replaced Colonel Hugh Mitchell as Commander of CFS. Colonel Mitchell was reassigned to head the Advance Party for establishing the Electronic Center at Griffiss Air Force Base.
- 7 Jul An article in the Boston Herald stated that unofficial sources had indicated plans in the office of the Secretary of National Defense were for the Station to stay in Cambridge.
- 7 Jul The Air Materiel Command issued orders for the Geophysical Research Division to move from Watson Laboratories to the Cambridge Field Station. (Because of the projected transfer of the Station to Rome, this was seen as an interim move.) An advance party from the Division arrived in Cambridge at the end of the month.
- 30 Jul Colonel Marcellus Duffy replaced Lieutenant Colonel Wilfred H. Tetley as Commander of CFS.
- 28 Aug Cambridge Field Station was redesignated from the 4153d Air Force Base Unit to the 3160 Electronics Station.
- 1 Oct New Laboratory and supply storage areas were acquired at the Boston Army Base.
- 1 Nov The Geophysics Research Division officially transferred from Watson Laboratories to the Cambridge Field Station.
- 5 Nov The Air Materiel Command announced that the moves of the Watson Laboratories and the Cambridge Field Station to Rome were to be accomplished in an ordered sequence by mid-1950.

1948, cont'd

- 30 Nov The Data Utilization (formerly Visual Design) Laboratory moved to Griffiss Air Force Base.
- 1 Dec A major internal reorganization took place at the Cambridge Field Station. The Research Division became the Base Directorate, Radio Physics Research, with John W. Marchetti as the Director. The Geophysical Research Division became the Base Directorate, Geophysical Research, with Captain Albert C. Trakowski as the Director. Each Directorate had its own Technical Steering Committee. Other administrative offices were realigned in conformity with a uniform organizational structure devised by Air Materiel Command for all exempted installations.
- 27 Dec The Base Directorate, Geophysical Research, occupied newly remodeled space at the Watertown Arsenal.
- An employee at AFCRL invented the light gun which was first used in the VOLSCAN system. The original purpose of the gun was to permit an operator to access a target on a radar display and initiate a track with an analog tracking (ANTRAC) unit. Subsequent applications of the light gun, pencil, or joystick cursors include almost all computer CRT displays.

1949

- 1 Mar The Navigation Laboratory was transferred from Base Directorate, Radio Physics Research, to Base Directorate Geophysical Research, and redesignated the Upper Air Laboratory.
- Mar The Radar Laboratory moved from Cambridge to the Boston Army Base. The CPS printing facilities also moved to the Boston Army Base.
- 26 May Colonel Marcellus Duffy was relieved of the command of CPS and reassigned to the 6107th Air Weather Group, Alaska.
- 1 Jun The move of the Cambridge Field Station to Griffiss Air Force Base at Rome, New York, was "temporarily" (but, in effect, permanently) canceled by Eugene M. Zuckert, Assistant Secretary of the Air Force.



DR. J. H. VAN DER GRAAF



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DR. J. H. VAN DER GRAAF



DR. J. H. VAN DER GRAAF

Base Directorate, Geophysical Research
1950

1949, cont'd

- 2 Jun Colonel Hugh Mitchell assumed the command of the Cambridge Field Station for the second time.
- 1 Jul Cambridge Field Station received Congressional authority to establish a completely equipped printing plant, which became operational at the Boston Army Base in January 1950.
- 5 Jul The Cambridge Field Station (CFS) was redesignated as the Air Force Cambridge Research Laboratories (AFCRL).
- The microwave printed circuit (stripline) was invented at AFCRL. It replaced heavy waveguide and coaxial plumbing for radars with cheap, light, printed circuits.
- GRD developed a technique for objective meteorological forecasting. Through use of standardized observations and a prediction formula, it enabled untrained personnel to create probability forecasts.

1950

- 26 May The first successful experiment launched by AFCRL on an Aerobee rocket took measurements of the solar constant.
- 9 Jul An Air Defense Group was established as a temporary activity at Section level in the Base Directorate, Radio Physics Research, in order to give organizational status to the Air Defense Systems Engineering Committee (the Valley committee).
- 11 Jul The Air Defense Project was officially activated at the Air Force Cambridge Research Laboratories.
- 11 Jul The Secretary of the Air Force announced that the research activities of AFCRL would remain in the Boston area.
- 2 Nov A uniaxial Sunseeker developed under contract by the University of Colorado performed successfully on an Aerobee rocket.
- AFCRL operated its first computer, a Remington Rand with circular card punches.

1951

- 6 Feb The Massachusetts Institute of Technology initiated Project Charles (formerly the Valley Committee and later Project Lincoln).
- 2 Apr The Air Research and Development Command (ARDC) became operational and AFCRL came under its jurisdiction.
- 6 Apr The Upper Air Research Observatory was established as a special off-base activity of the Base Directorate, Geophysical Research. It was located on Sacramento Peak at Sunspot, New Mexico.
- 14 May Air Force Headquarters approved a project proposed by AFCRC to obtain more accurate data on high-altitude winds by using instrumented polyethylene balloons (Project Moby Dick).
- 21 Jun The Air Force requested Congress to authorize \$17.97 million for Bedford Research Center. The Center was planned to include 3 research laboratories under ARDC, a base population of about 80 officers, 15 airmen and 3000 civilian employees.
- 28 Jun The Air Force Cambridge Research Laboratories (AFCRL) became the Air Force Cambridge Research Center (AFCRC). A new administrative staff including a Deputy for Plans and Operations was organized at the Center Headquarters. The Center's Base Directorate, Radio Physics Research, became the Electronics Research Division (ERD), and the Base Directorate, Geophysical Research, became the Geophysics Research Division (GRD). The 6250th Air Base Group was designated to provide logistical and administrative support to AFCRC.
- 28 Jun The Christian Science Monitor began a 7-article feature on the work of the Geophysics Research Division entitled "Probing Earth's Secrets."
- 1 Jul With the retirement of Colonel Hugh Mitchell, Colonel Harvey D. Davidson assumed command of the Air Force Cambridge Research Center.
- 1 Aug The Air Research and Development Command (ARDC) acquired jurisdiction over Laurence G. Hanscom Field from the Air Defense Command, and the Cambridge Research Center became landlord of Hanscom Field as the agent of ARDC.

1951, cont'd

- 20 Aug The 6250th Air Base Group was activated at Hanscom Field.
- 27 Aug The Air Research and Development Command assumed responsibility for the administration of Project Lincoln.
- 28 Aug Major General James F. Phillips replaced Colonel Harvey D. Davidson as AFCRC Commander. On the same date, John W. Marchetti became Technical Deputy to the Commander. The Geophysics Research Division received its first civilian director, Dr Helmut E. Landsberg, and ERD received as its director Dr Edwin G. Schneider.
- 7 Sep ARDC delegated to the Cambridge Research Center the responsibility for administering Project Lincoln and for providing it with the required Air Force support, including that required for systems wide testing. However, the precise role of AFCRC in relation to Project Lincoln, which was contractor operated by M.I.T., underwent various changes and never amounted to full technical management.
- 27 Sep A new Center Master Planning Board was formed to determine AFCRC's laboratory and flight requirements which would entail new construction.
- 22 Oct An Atomic Warfare Division was established at AFCRC for basic and applied research in such fields as radiochemistry and radiobiology.
- AFCRC began a research program which used exploding wires to create high-density, high-temperature plasmas for experimental use.
- 19 Nov The Geophysics Research Division participated in atomic tests in Nevada (Project Buster-Jangle).
- 20 Nov The first SCR-84 Radar for Project Lincoln was installed at Rockport, Massachusetts.
- 17 Dec The 6521st Aircraft Control and Warning (experimental) Squadron was established in support of Project Lincoln.

1952

- Jan A CADAC computer was installed at AFCRC.
- Early in the year the Geophysics Research Division moved from the Watertown Arsenal to new quarters in a former wool warehouse at 415 Summer St., Boston, Massachusetts.
- Early in the year the Air Research and Development Command approved AFCRC's request for a new site at Plum Island, Newburyport, Massachusetts, for the purposes of testing radar equipment and making propagation studies.
- 14- A Project Moby Dick balloon launched from Holloman
18 Feb Air Force Base, New Mexico, flew for 92 hours at 52,000 feet, setting a new record for sustained, constant high-altitude balloon flight.
- 1 Mar The first fully automatic aircraft interception took place. On the basis of data sent from Bedford by slowed-down video (the former Digital Radar Relay), the Whirlwind computer diverted the flight path of a B-26, transmitting orders to its Autopilot over the 8-digit Data Link designed and built by AFCRC.
- 2 Mar The Master Plan for the new location of AFCRC at Bedford, Massachusetts, was approved by the Director of Installations, Headquarters, Air Force.
- 6 Mar The Air Research and Development Command named Rome Air Development Center as the Center responsible for the development of a Tactical Air Control System (TACS) with AFCRC and the Wright Air Development Center as the two supporting Centers. AFCRC then began design and development work on Phase Two of the TACS system. It included an analog tracking computer enhanced with Cartesian coordinates (CARTRAC).
- 31 Mar Arrival of the first AFCRL scientist at Ice Island T-3 to begin a program of Arctic research. The island was named Fletcher's Island in honor of Lt Col Joseph O. Fletcher who as a Major was Deputy for Geophysical Research at CFS in 1948-9.
- Mar The first report was issued in the series Air Force Surveys in Geophysics, which was designed to communicate the results of geophysics research to other government agencies.



Release of a Moby Dick Balloon, using a "covered wagon"
Type of launching platform, 1952.

1952, cont'd

- 1 Apr AFCRC activated the 6520th Test Support Wing to fly test aircraft for Project Lincoln as well as to operate and maintain Laurence G. Hanscom Field.
- 1 Apr Wing "B" of the Bedford Research complex (now Lincoln Laboratory's headquarters) was completed and occupied by Project Lincoln personnel.
- 17 Apr The name "Project Lincoln" for the air defense laboratory was dropped in favor of "Lincoln Laboratory, Massachusetts Institute of Technology."
- 7 May The legal transfer of Hanscom Field from the Commonwealth of Massachusetts to the Air Force became effective.
- 12 Jun The mission of the Center was broadened to include "development and test" activities in its three Divisions and support and testing responsibilities for Project Lincoln.
- 13 Jun By this date the number of personnel in the Laboratories and support units under AFCRC totaled 2,527 (200 officers, 728 airmen, and 1,599 civilians).
- 1 Jul Installation meeting of the newly formed AFCRC branch of the Scientific Research Society of America (RESA). (The AFCRC branch was the first in New England.)
- 16 Jul AFCRC's three Divisions (Electronics, Geophysics and Atomic Warfare) became Directorates.
- 1 Aug-
8 Dec Field testing of the recently completed experimental VOLSCAN air traffic control system began at the All Weather Flying Center, Clinton County Air Force Base, Ohio. The VOLSCAN system contained several new devices developed at AFCRC, including the light gun and an analog tracking computer (ANTRAC).
- Sep Establishment of the Upper Air Observatory at Sacramento Peak, New Mexico, as a branch of the Geophysics Research Directorate.
- 30 Oct Ground was broken for construction of permanent AFCRC laboratory buildings at L. G. Hanscom Field, Bedford, Massachusetts.

1952, cont'd

- 12 Dec AFCRC obtained its first photographic record of solar Lyman Alpha radiation from an Aerobee rocket using a new biaxial pointing control developed under contract by the University of Colorado.
- 29 Dec The last of the radar sites in Project Lincoln's Cape Cod System was activated. This brought the number of sites in the experimental air defense system to twelve.
- In the second half of the year, AFCRC began balloon operations at Vernalis Naval Air Station, California, in addition to those at Holloman Air Force Base, New Mexico.

1953

- 5 Feb The formal lease for the Geophysics Research Directorate to occupy the building at 11 Leon St., Boston, was authorized.
- 3 Mar The move of several GRD laboratories from Summer Street to Leon Street was completed, except for Dr. O'Day's Upper Air Laboratory which moved between 17-20 April.
- 15 Mar A Computer Laboratory was established in the Electronics Research Directorate.
- 18 Mar Major General Raymond C. Maude replaced Major General James F. Phillips as AFCRC Commander.
- Apr The Upper Air Laboratory of the Geophysics Research Directorate was disbanded, with the bulk of its personnel transferred to Atmospheric Physics. Dr Marcus O'Day became Superintendent of the new Advanced Research Laboratory.
- 6 May The Air Force announced its decision to place full reliance on the Lincoln Transition System (based on the Cape Cod System) for air defense.
- 6 May The Air Research and Development Command Headquarters assigned to AFCRC the responsibility for systems engineering of the ground electronic equipment for air defense.

1953, cont'd

- 6 May AFCRC was assigned equipment responsibility for all balloon carrier systems within the Air Force.
- 29 May Project Gopher was assigned to the Geophysics Research Directorate.
- 20 Jul The Research Services Division was established.
- 30 Jul An Air Force helicopter crashed in Nebraska while pre-testing new methods of wind measurements during the Great Plains Turbulence Field Program. Dr. Guenter Loeser of the Atmospheric Analysis Laboratory died in the crash.
- At the end of Fiscal Year 1953, Project VOLIR was phased out. Its hill site at Bedford was leveled as part of the expansion of flight test facilities at Hanscom for Project Lincoln.
- In the fall of 1953, GRD started Project Jet Stream in order to study high-altitude wind currents.
- 16 Dec The Office of the Technical Director was abolished. (Its occupant, John W. Marchetti, then exercised "bumping" rights to resume his old position as ERD Director.) The functions of the office were decentralized to the Directors, their staffs and the Center staff. An AFCRC Steering Committee was established to provide guidance for the Technical Program.

1954

- 15 Jan The Office of Information Services was established consisting of three sections, one of which was the Historical Section.
- 1 Feb The Operational Applications Laboratory was designated at AFCRC from a human factors laboratory at Bolling Air Field, Washington, D.C., concerned with the analysis of systems and human engineering.
- 24 Apr-
26 Sep AFCRC scientists participated in an Arctic research field program to explore the Ellesmere ice shelf.

1954, cont'd

- 26 Apr Dedication ceremonies were held for Buildings A and B of the AFCRC laboratory complex, which were to house the Electronics Research Directorate and the Research Services Division.
- 3 May Resignation of Mr. John W. Marchetti, Director of the Electronics Research Directorate.
- 1 Jul The Atomic Warfare Directorate was disbanded, and its research transferred to the Air Force School of Aviation Medicine and the Air Force Special Weapons Center.
- 6 Aug The AFCRC Community Relations Council was established.
- Aug The final Moby Dick weather balloon flights were launched.
- Aug-Sep Comprehensive tracking studies were made of hurricanes "Carol" and "Edna."

1955

- 21 Jan The Lincoln Project Office was established as a subdivision of ERD. This abolished the latter's so-called "Centralized Air Defense System" project.
- 13 Mar Milton Greenberg, currently detailed as Director of the Geophysics Research Directorate, was officially assigned to the Director's post.
- 19 Apr An official request was submitted to Air Force headquarters for a necessary permanent change of station movement of AFCRC to Bedford.
- 13 Jun The official address of AFCRC headquarters became Laurence G. Hanscom Field, Bedford, Massachusetts, (instead of 224 Albany St., Cambridge).
- Jun The first Guenter Loeser Memorial Lecture was delivered as part of the annual award established in memory of the deceased scientist.
- 1 Jul The 6520th Support Wing (Test) was formally abolished.
- 1 Jul The revised Air Research and Development Manual 80-4 went into effect.

1955, cont'd

12 Oct The first fully successful Aerobee rocket flight from Holloman Air Force Base, New Mexico, employing high-altitude "chemical seeding," in this instance using sodium. The diverse applications of the chemical release technique made it a major tool in AFCRC's explorations of the upper atmosphere.

25 Oct System responsibility for the Tactical Air Control System (System 314L) was shifted from the Rome Air Development Center to AFCRC.

The "Cambridge computer," which was used later for logic network studies, was installed at AFCRC.

The AFCRC-sponsored Sierra Wave Project, which had studied air flow over mountains since 1951, was completed.

1956

Feb First successful aerial launching of a 15-foot diameter balloon, proving the feasibility of exactly positioning a small payload at high altitudes.

12 Mar An Aerobee rocket was launched from Holloman Air Force Base during which nitric oxide gas was released into the high atmosphere during daylight. This GRD project resulted in the formation of what was billed as man's first "artificial ionosphere."

1 May The Upper Air Research Observatory, located at Sunspot, New Mexico, was redesignated the Sacramento Peak Observatory. By this time its coronagraph system for solar research was fully operational, and studies of spicules on the solar limb had begun.

6 Jun AFCRC's new mission statement focused on research and development in electronics, geophysical sciences and human engineering, plus support of Lincoln Laboratory.

16 Jun The Research Services Division was discontinued.

Jul The Lincoln Project Office was withdrawn from the Electronics Research Directorate and established as a separate office.

1956, cont'd

- 22 Jul Major General William M. Morgan replaced Major General Raymond C. Maude as AFCRC Commander.
- 15 Aug A meeting at the Office of Scientific Research (ARDC) was devoted to review of the Research Section of ARDC Manual 80-4. The result was a recommendation that this section be revised in such a manner as to insure that future Research Planning Objectives be in agreement with ARDC long-range planning recommendations.
- AFCRC participated in a nuclear test program (Project Redwing).
- AFCRC conceived and designed its first thermal image furnace for growing crystals (the "clam shell furnace").

1957

- 12 Jan The Atmospheric Devices Laboratory of the Geophysics Research Directorate moved from 415 Summer St., Boston, to Building F at Laurence G. Hanscom Field.
- 21 May The number of the proposed Capehart housing units at Hanscom Field was dropped to 395 (from an original 670 units). This action resolved the conflict between AFCRC and the Boston National Historic Sites Commission over preservation of Revolutionary sites along the southern perimeter of the Field.
- May The majority of GRD components moved to Building F at Hanscom Field.
- May GRD recommended to the Scientific Advisory Board's Panel of Geophysics and Geography that three types of 1000- to 2000-pound satellites be constructed.
- May AFCRC cut 72 Wage Board and 15 graded spaces.
- Jun GRD forwarded a proposal to the Air Research and Development Command that it become a private corporation and operate under contract to the Air Force, rather than as a part of AFCRC.
- 16 Jul A GRD Aerobee rocket from Holloman Air Force Base equipped with micrometeor detectors flew to a height of 78 miles.

1957, cont'd

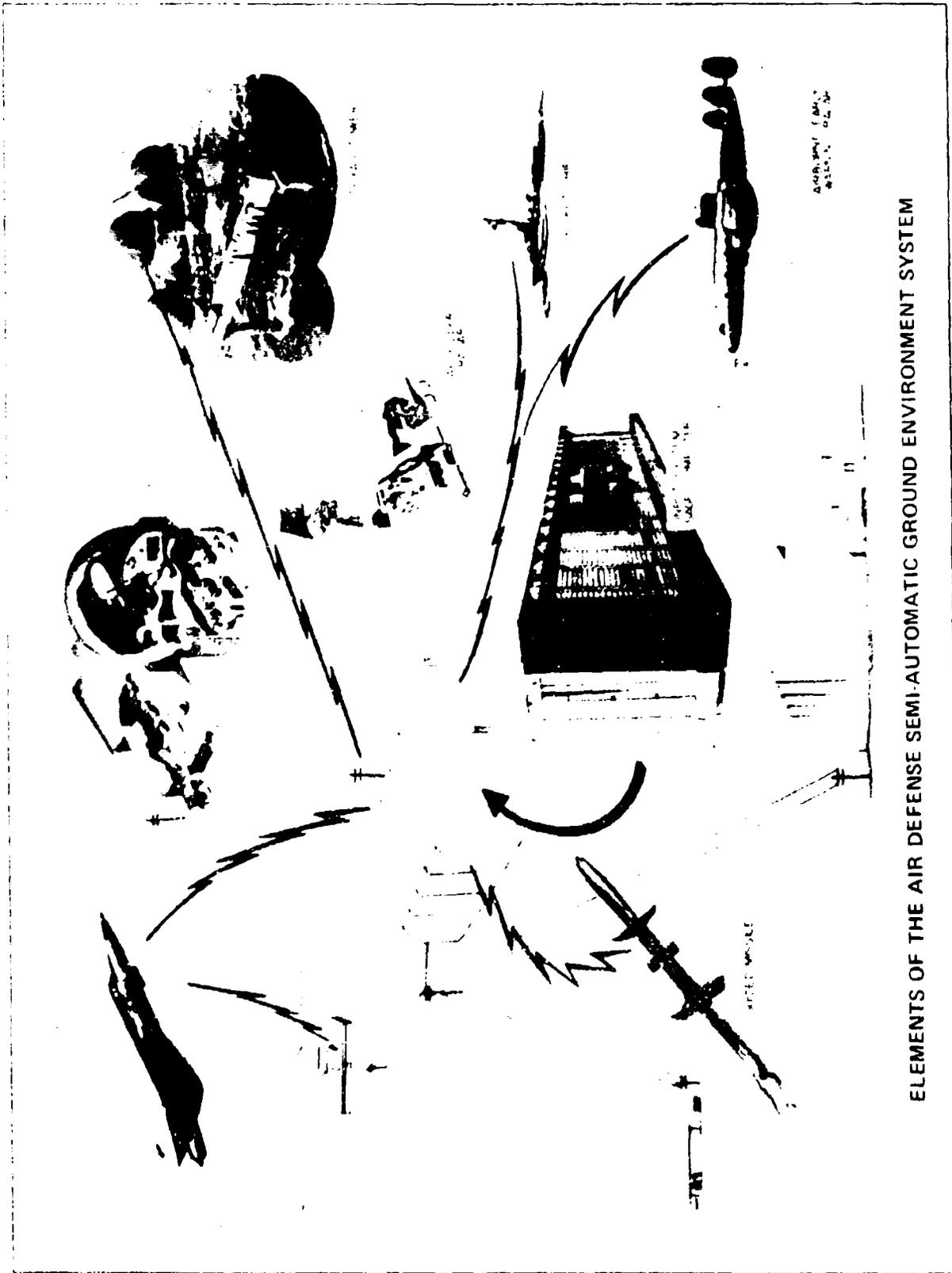
- Jul The International Geophysical Year (IGY), which lasted until December 1958, commenced. AFCRC scientists participated in many of its programs.
- 2 Aug The tri-command Air Defense Systems Management Office (ADSMO) officially began operation from its quarters at Murphy Army Hospital, Waltham, Massachusetts.
- 25 Sep The Photochemistry Laboratory created artificial airglow through the use of sodium released from a balloonborne container at an altitude of 88,000 ft.
- 4 Oct The Russian Sputnik 1 satellite was launched.
- 5 Oct The Geophysics Research Directorate began taping Sputnik radio transmissions.
- 7 Oct Two ERD Laboratories utilized four interferometers together with doppler radar to obtain Sputnik orbital data.
- 16 Oct A GRD Aerobee rocket from Holloman Air Force Base used special explosive charges to blast small artificial meteors out into space.
- 27 Nov AFCRC received Air Force authorization to advertise for bids on Capehart Housing at Hanscom Field.
- 30 Nov Project Harvest Moon (later Project Space Track) became operational at AFCRC. It brought together electronics, geophysics, computer, communications, astronomical, and mathematical experts in a unified program to predict satellite behavior.
- AFCRC participated in Project Plumbob, a nuclear test program.
- The Geophysics Research Directorate published the first edition of the Handbook of Geophysics for Air Force Designers.
- GRD completed the first development model of an Air Force semiautomatic weather system for System 433L.
- The first effort to construct a numerical model for hurricane prediction began at AFCRC.

1957, cont'd

GRD expanded its concept of optimum flight planning for aircraft (pressure pattern flying), which was first tested in 1947.

1958

- 31 Jan The first U.S. satellite, the Army's Explorer 1 (1958-Alpha) was launched. It carried an AFCRC micrometeorite detector of the microphone type.
- 1 Feb The Advanced Research Projects Agency (ARPA) was created within the Department of Defense.
- 3 Feb AFCRC's Technical Library, moved from the Boston Army Base, occupied new quarters in Building A at Bedford.
- 25 Feb GRD's Advanced Research Laboratory was abolished.
- Feb A satellite meteorological research group was established at AFCRC.
- 31 Mar The Air Defense Systems Management Office (ADSMO), now located at Hanscom Field, was redesignated the Air Defense Systems Integration Division (ADSID).
- 1 May Prompted primarily by the challenges and opportunities of the space age, an extensive reorganization of the Electronics Research Directorate took place.
- 11 Jun Official ground-breaking ceremonies for Base Housing were held with General Morgan, AFCRC Commander, presiding.
- 23 Jun On behalf of the Air Research and Development Command, AFCRC accepted the installation of an AN/FSQ-7 computer at McGuire Air Force Base's SAGE Direction Center. This was the first complete FSQ-7 accepted by the Air Force.
- 23 Jul The Geophysics Research Directorate reorganized to meet the space age.
- 15 Aug The first successful AFCRC rocket experiment using a retarding potential analyzer to study solar extreme ultraviolet radiation was flown from Holloman Air Force Base, New Mexico.



ELEMENTS OF THE AIR DEFENSE SEMI-AUTOMATIC GROUND ENVIRONMENT SYSTEM

1958, cont'd

- 27 Aug The first Argus experiment was conducted, in which a small atomic bomb detonated beyond the atmosphere over the South Atlantic created an artificial shell of "trapped" electrons around the earth. AFCRC measured the impact of Project Argus on the atmosphere and on radar and radio communications.
- 1 Oct The National Aeronautics and Space Administration (NASA), created to develop a civilian space program, became a functioning organization.
- Oct The Geophysics Research Directorate's proposal to become a private corporation was informally disapproved by Air Force headquarters. Its Director, Milton Greenberg, together with the Chiefs of GRD's Management Requirements Division, Programs Division, Thermal Radiation Laboratory and Photochemistry Laboratory, resigned from AFCRC. Mr. Greenberg and his associates later founded the Geophysics Corporation of America.
- 1 Nov Colonel Elmer W. Richardson became Acting Commander of AFCRC following the retirement of Major General William M. Morgan.
- Nov AFCRC's Sagamore Hill Radio Observatory at Hamilton, Massachusetts, equipped with an 84-foot radio telescope, was placed in operation.
- Dec AFCRC began a program of airborne gravity measurements.
- By the end of the year, GRD's "Weather Observing and Forecasting System" (System 433L) was being managed by an ARDC Electronic Supporting System Project Office.
- AFCRC established a Geopole Observatory at Thule, Greenland, in order to participate in International Geophysical Year (IGY) studies. The site was used to observe magnetic activity, auroral phenomenon and ionospheric variations.
- A program in microwave acoustics began at AFCRC. Piezoelectric quartz was used to make microwave delay lines.

1959

- 24 Feb Ground-breaking ceremonies were held for the new Base School facility.
- Feb AFCRC's Project Space Track expanded into System 496L. The 496L System Program Office at Hanscom Field developed the SPADAT (Space Detection and Tracking) System for the Air Force.
- Early in the year, Colonel Elmer W. Richardson was given a permanent appointment as Commander of AFCRC.
- Mar The last GRD groups at 415 Summer St., Boston, moved into Building C at Hanscom Field.
- 2- The first Conference on the Exploding Wire Phenomenon
3 Apr was sponsored by AFCRC.
- 12 and A rocket-borne release of cesium created ion clouds
22 May for use as high-frequency radio-wave propagation media. The first photos of shock waves were acquired.
- 27 May The original seven-inch falling sphere was launched on a rocket to measure atmospheric density. It had a range of approximately 35-90 km.
- May The two ERD sections still occupying the original Cambridge Field Station quarters on Albany St., Cambridge, moved out to Building C at Hanscom Field.
- May The remnants of the Operational Applications Laboratory still at Bolling Air Force Base, Washington, D.C., began the move to Building C at Hanscom Field, Massachusetts.
- Jul The rocket (Atlas RUX-2A) nose cone carrying an AFCRC emulsion package for detecting cosmic rays was successfully recovered.
- 25 Sep A staff study on the reorganization of AFCRC Mission Elements was completed. It recommended that, with the exceptions of Systems 496L, 433L, and 431L, all the programs of AFCRC be assigned to the proposed Air Force Research Division of ARDC.
- 2 Nov The Air Materiel Command's Electronic Systems Center (ESC) was activated at Hanscom Field.

1959, cont'd

- 16 Nov ARDC's Air Force Command and Control Development Division (AFCCDD) was activated at Hanscom Field.
- 8 Dec The first launch took place in a series of flights to measure the Atlas missile's exhaust plume. The radiation was measured simultaneously by sensors on the missile and on a throw-off pad.
- Dec The first Symposium on the Plasma Sheath and its Effects was sponsored by AFCRC.
- The Center began a program of biophysical research, which studied the electrical properties of mammalian brains in order to develop new information processing concepts.
- AFCRC sponsored an international conference on silicon carbide.
- Work was completed on the related Tactical Air Control (TACS) and Base Air Defense Ground Environment (BADGE) Systems. They were turned over to the Rome Air Development Center for further development.
- AFCRC acquired a JC-130 aircraft to transport personnel and equipment to the Arctic in support of its Arctic research programs.
- AFCRC began research in techniques for over-the-horizon detection of missiles that was later to become the AF 440L System.

1960

- 15 Jan The Air Force Research Division (AFRD) was established within the Air Research and Development Command (ARDC).
- Jan AFCRC successfully grew artificial diamond crystals in its ultra-high pressure tetrahedral anvil press, which had been in operation at the Center since 1958.
- 22 Mar AFCRC hosted the first Conference on Satellite Geodesy.
- Apr The Boston Globe featured the Electronics Research Directorate and the Geophysics Research Directorate in a series of articles entitled "Science City."

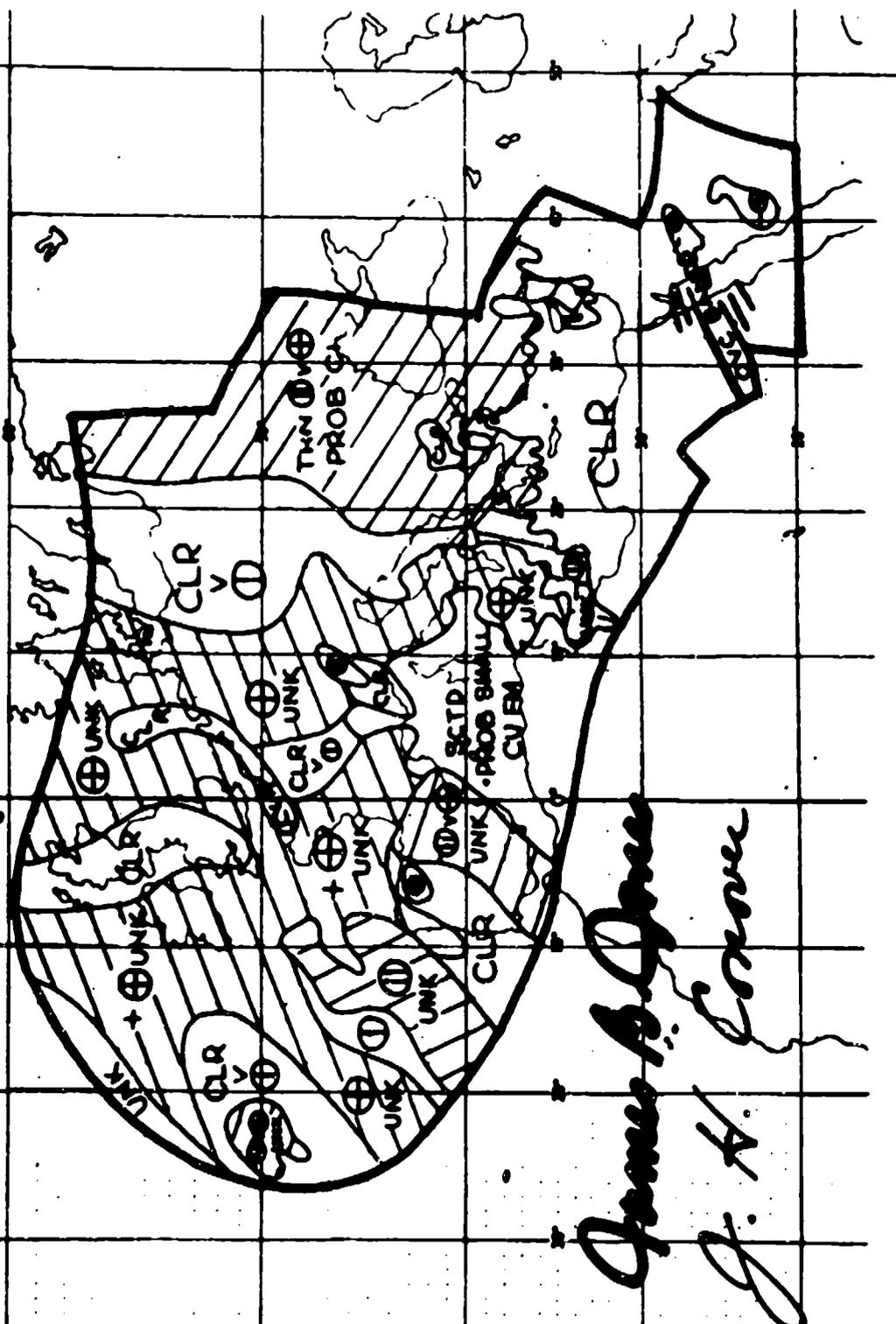
1960, cont'd

- 1 Apr NASA launched its first TIROS satellite, which initiated the transmission of photographs for weather forecasting.
- 1 Apr AFCRC's 6250th Air Base Group at Hanscom was redesignated the 3245th Air Base Wing.
- 1 Apr The Air Force Command and Control Development Division (AFCCDD), newly activated at Hanscom Field, was assigned control over the following units: the Air Force Cambridge Research Center, the Electronic Support System Project Offices, the 3245th Air Base Wing, and the ARDC portion of ADSID. AFCRC's Lincoln Project Office became the Lincoln Laboratory Liaison Office under the Director of Technology, AFCCDD.
- 1-7 Apr Rawinsonde observations made at 1-hour intervals in Bedford during this week provided a unique data base of short-term meteorological variations in the atmosphere as high as 30 km.
- 2 May The Air Force Cambridge Research Center (AFCRC) was dissolved. Its Geophysics and Electronics Directorates (GRD and ERD) were reassigned to the new Air Force Research Division and designated Detachment 2, Headquarters AFRD. For administrative and logistic support, Detachment 2, AFRD, was attached to AFCCDD, in effect becoming a tenant at Hanscom Field.
- 2 May Detachment 4, Headquarters AFCRC at Thule, Greenland, became Detachment 3, Hq AFRD, under operational control of the Geophysics Research Division.
- 2 May Colonel Ernest A. Pinson became the first Commander of Detachment 2, AFRD, succeeding Colonel Elmer W. Richardson, the last Commander of AFCRC.
- Jul Project Firefly got underway. This large-scale program, which operated out of Eglin Air Force Base, Florida, used chemical releases to explore upper atmosphere properties.
- 1 Aug The Air Force Cambridge Research Laboratories (AFCRL) was designated and organized at Hanscom, replacing Detachment 2, Hq AFRD. At this point in time, AFCRL consisted of the Electronics and Geophysics Research Directorates and the Commander's staff. On the same date, Detachment 3, Hq AFRD at Thule, Greenland, became Detachment 1, Hq AFCRL.

FIRST NEPHANALYSIS FROM TIROS I

First Tiros Nephanalysis Distributed for use and evaluation by meteorologists in the United States and Europe. The NEPH was prepared at Ft. Monmouth from Tiros I pictures (Orbit 43 of April 4, 1960) by analysts J. H. Conover of AFCRL and Lt. Col. J. B. Jones, USAF.

Definition of Symbols		+		Dense or heavy	
CLR	Clear Skies	TMN or -	Thin	Thin	
Scld or O	Scattered cloud cover	UNK	Unknown	Unknown	
O	Broken cloud cover	PROB	Probably	Probably	
Ovc or O	Overcast skies	CI	Cirrus cloud form	Cirrus cloud form	
V	Variable	CUM	Cumuliiform clouds	Cumuliiform clouds	



1960, cont'd

- 1 Aug Colonel Ernest A. Pinson assumed command of the new Air Force Cambridge Research Laboratories.
- 26 Aug Construction began on the Arecibo radar-radio telescope planned to have a 1000-foot-wide reflector. The project was funded by the Advanced Research Project Agency and was supervised by AFCRL.
- 25 Sep Brigadier General Benjamin G. Holzman assumed command of the Air Force Cambridge Research Laboratories, replacing Colonel Ernest A. Pinson.
- 1 Oct The Air Force Systems Integration Division (ADSID) was discontinued.
- Nov The first data from cosmic radiation experiments was taken on board the Air Force Discoverer satellites. AFCRL utilized photo emulsion techniques, geiger counters, scintillators, and solid state detectors to measure high energy particles.
- The Operational Applications Laboratory was transferred to the Air Force Command, Control, Development Division and redesignated the Decision Sciences Laboratory.
- The Director of Defense Research and Engineering requested AFCRL to evaluate the over-the-horizon forward-scatter radar technique in a simulated operational environment.

1961

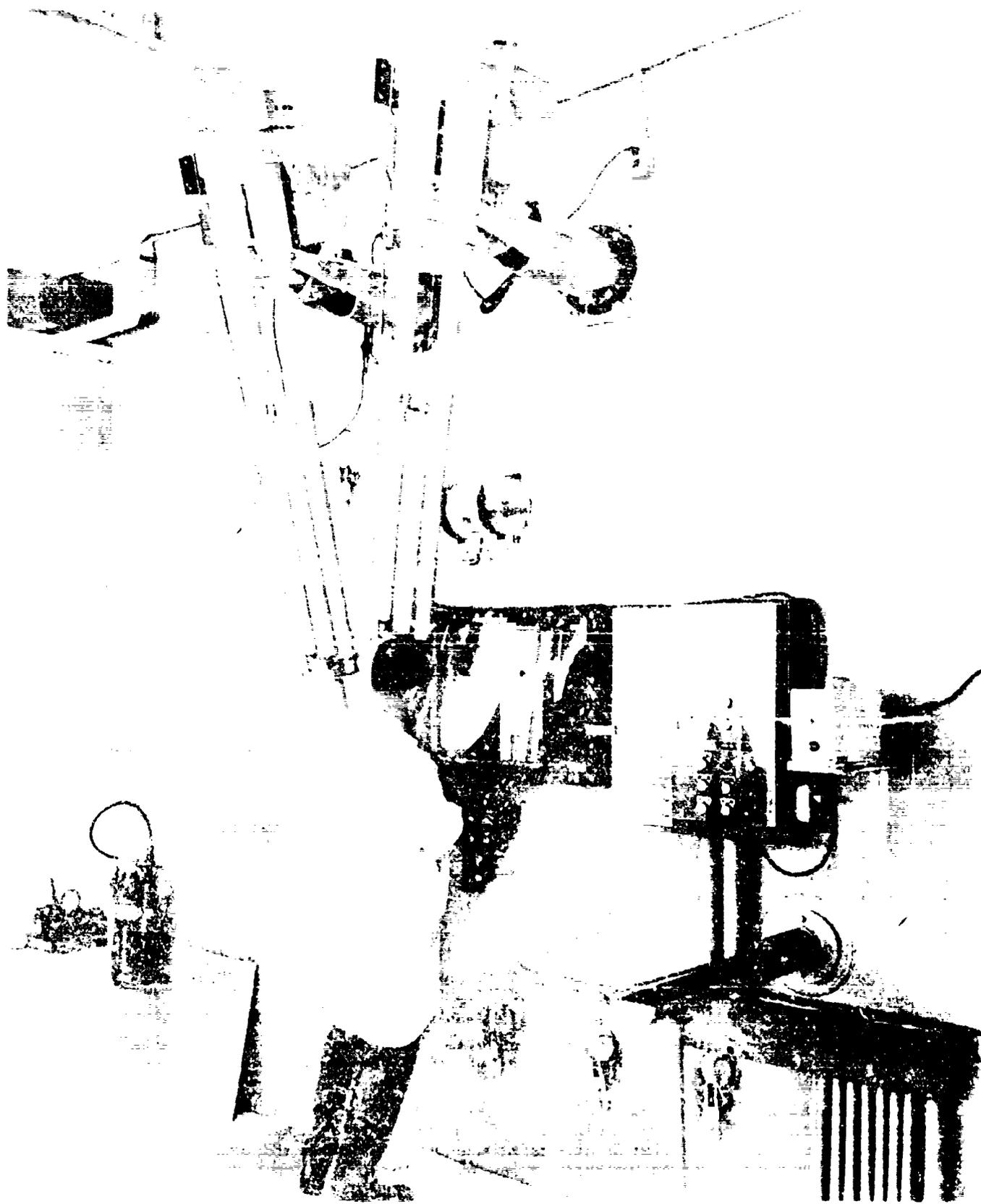
- Jan AFCRL initiated a program of laser research using a ruby laser oscillator.
- 23 Feb AFCRL made the first direct measurements of atmospheric density between 70 and 130 miles altitude. An inflatable sphere equipped with accelerometers to measure aerodynamic drag force was released from a Nike-Cajun sounding rocket.
- Feb-31 May Project Ice Way near Thule, Greenland, demonstrated that processed sea ice provided a feasible base for aircraft operations.

1961, cont'd

- 20 Mar The Secretary of the Air Force announced that, effective 1 April, the Air Materiel Command (AMC) would be redesignated as the Air Force Logistics Command (AFLC), and the Air Research and Development Command (ARDC) as the Air Force Systems Command (AFSC); and that ARDC's Air Force Research Division (AFRD) would become the Office of Aerospace Research (OAR), assigned directly to the Air Force Chief of Staff. As regards Hanscom Field, Bedford, Massachusetts, this meant that ARDC's Air Force Command and Control Development Division and AMC's Electronic Systems Center would be combined to form the Electronic Systems Division of AFSC, and that the Air Force Cambridge Research Laboratories, currently assigned to AFRD, would fall under OAR.
- Mar At the request of the Air Force's Space Systems Division, the Laboratory's Sacramento Peak Observatory began making daily five-day predictions of solar activity in order to specify quiet periods for space operations.
- 1 Apr AFRD became the Office of Aerospace Research (OAR) directly under Hq USAF. The Electronic Systems Division (ESD) was activated at Hanscom. In addition to its Headquarters, ESD included the 3245th Air Base Wing at Hanscom and the Rome Air Development Center (RADC) at Griffiss AFB, New York. AFCRL became a tenant of ESD.
- 11 Apr AFCRL sponsored the first International Conference on Ultrapurification of Semi-Conductor Materials.
- 20 Apr AFCRL launched the first artificial meteor from a multi-stage rocket to study the characteristics of meteorites entering the atmosphere. (A second meteor was launched on 6 May 1962.)
- Early in the year the Air Force's Ballistic Systems Division asked AFCRL to measure the relationship of toxic gas diffusion and meteorological conditions during the Titan II launches at Cape Kennedy and at Vandenberg Air Force Base.
- 6 Jun AFCRL deployed a unique "Venus Flytrap" nose cone on an Aerobee-H1 rocket as a particle collector for micrometeorites.

1961, cont'd

- 24 Jul The Air Force Missile Development Center's Balloon Branch at Holloman Air Force Base, New Mexico, was placed under the jurisdiction of AFCRL's new balloon section at Holloman, which had been transferred there from Vernalis, California.
- 23 Aug A rocket-borne, grazing-incidence monochromator measured solar extreme ultraviolet photon flux between 250 and 1300 angstroms.
- Sep AFCRL completed an irradiation facility which consisted of a 7200 Curie cobalt-60 source, a 3 meV Van de Graaf Generator, and a 1.2 meV Dynamitron Electron Accelerator.
- Sep A National Symposium on Winds for Aerospace Vehicle Design was sponsored by AFCRL.
- Sep The Laboratory occupied a new, rented balloon-launching facility at Chico Municipal Airport, Chico, California.
- Summer- Autumn Operation Pea Soup at Arcata, California, continued the Laboratory's series of fog studies, using ground and aircraft experiments to test fog-dispersal techniques.
- 9 Oct Laboratory staff and support elements, which were previously organized within both the Electronics and Geophysics Research Directorates, were consolidated under Headquarters AFCRL.
- 13 Oct Two AFCRL-developed electrostatic analyzers were launched into polar orbit aboard an Air Force satellite. The instruments measured electron and ion densities along the satellite trajectory.
- 24 Oct A polyethelene balloon nearly 12 million cubic feet in volume was launched from from Chico Municipal Airport, California. Flight was terminated 51 hours later over the Atlantic Ocean.
- Nov The Second International Conference on Exploding Wire Phenomena was sponsored by AFCRL.
- A four-year research effort to demonstrate the feasibility of long-range, air-ground VHF ionospheric scatter communications was completed.



The author's laboratory at the University of California, San Diego.

1961, cont'd

15 Dec The newly constructed AFCRL Research Library containing 200,000 technical documents, 95,000 serials, and 75,000 monographs began operations.

Using capacitor discharge techniques, AFCRL generated extremely brilliant light pulses of nanosecond duration. The applications of this type of pulse (later dubbed the Nanolite) included ultra high-speed photography and a high power output for diode lasers.

AFCRL began its support of a network of seismic stations in New England with a central processing station at Weston, Massachusetts.

After several years at the Blue Hill Observatory, the Weather Radar Branch moved to a new location in Sudbury, Massachusetts.

AFCRL became an agent to the Advanced Research Projects Agency for Project Vela Uniform.

1962

Feb AFCRL occupied a new Crystal Physics Laboratory.

1 Mar Detachment 2, Headquarters Office of Aerospace Research, was activated at Fort Churchill, Canada, to administer the Rocket Research Facility there, which was previously under Army management.

Mar The Arcas-Robin rocketsonde system for high-altitude meteorological soundings went into operation.

10 Apr The Second Symposium on the Plasma Sheath was sponsored by AFCRL. The three-day conference dealt with re-entry communications and detection problems.

Early in the year Project CAME BRIDGE was established to study possible operational configurations for over-the-horizon (OTH) detection of missiles.

Spring-Summer Sixty AFCRL scientists participated in high-altitude U.S. nuclear tests in the Pacific, studying the effects of nuclear detonations on radio propagation and on optical systems. Total AFCRL personnel in the field, two-thirds of whom were contractors,

1962, cont'd

numbered 247. Aircraft support consisted of four KC-135's, three for studying thermal and optical emissions, and one for measuring atmospheric and ionospheric effects. Project Fishbowl was the largest logistics operation undertaken by the Laboratory to that date. It also marked the first time that a Michelson interferometer was operated successfully on an aircraft.

- 10 Jun Launch of a 34-foot diameter superpressure balloon from Bermuda, which flew westward at a constant altitude of 66,000 feet. It was destroyed over the Pacific 1200 miles northwest of Honolulu after 30 days' flight, having broken all existing records for sustained balloon flight.
- 18 Jun The second in a series of rocket-borne x-ray experiments took place. While measuring x-ray flux from the moon, AFCRL unexpectedly detected galactic sources of x-rays, a discovery verified in subsequent probes.
- 11 Aug AFCRL, NASA, and the Swedish Space Committee made a joint probe of noctilucent clouds using a rocket-borne particle collector.
- 22 Aug The first Marcus O'Day Award, established in memory of the Laboratory scientist who died 16 November 1961, was presented at AFCRL.
- Summer A special speech data processor together with a vocoder system was placed in operation at AFCRL to study digital voice communications.
- Summer AFCRL ended the balloon support it provided to Phases I and II of the Defense Atomic Support Agency's Project BANSHEE (Balloon and Nike Scaled High Explosions Experiments).
- Sep AFCRL participated in a meeting of the International Gravity Commission in Paris and pressed for a worldwide gravity standardization program.
- 26 Oct The STARAD (Starfish Radiation) satellite, its payload designed by AFCRL, was launched to measure the enhanced radiation in the magnetic field resulting from the Starfish nuclear detonation of 9 July 1962.

1962, cont'd

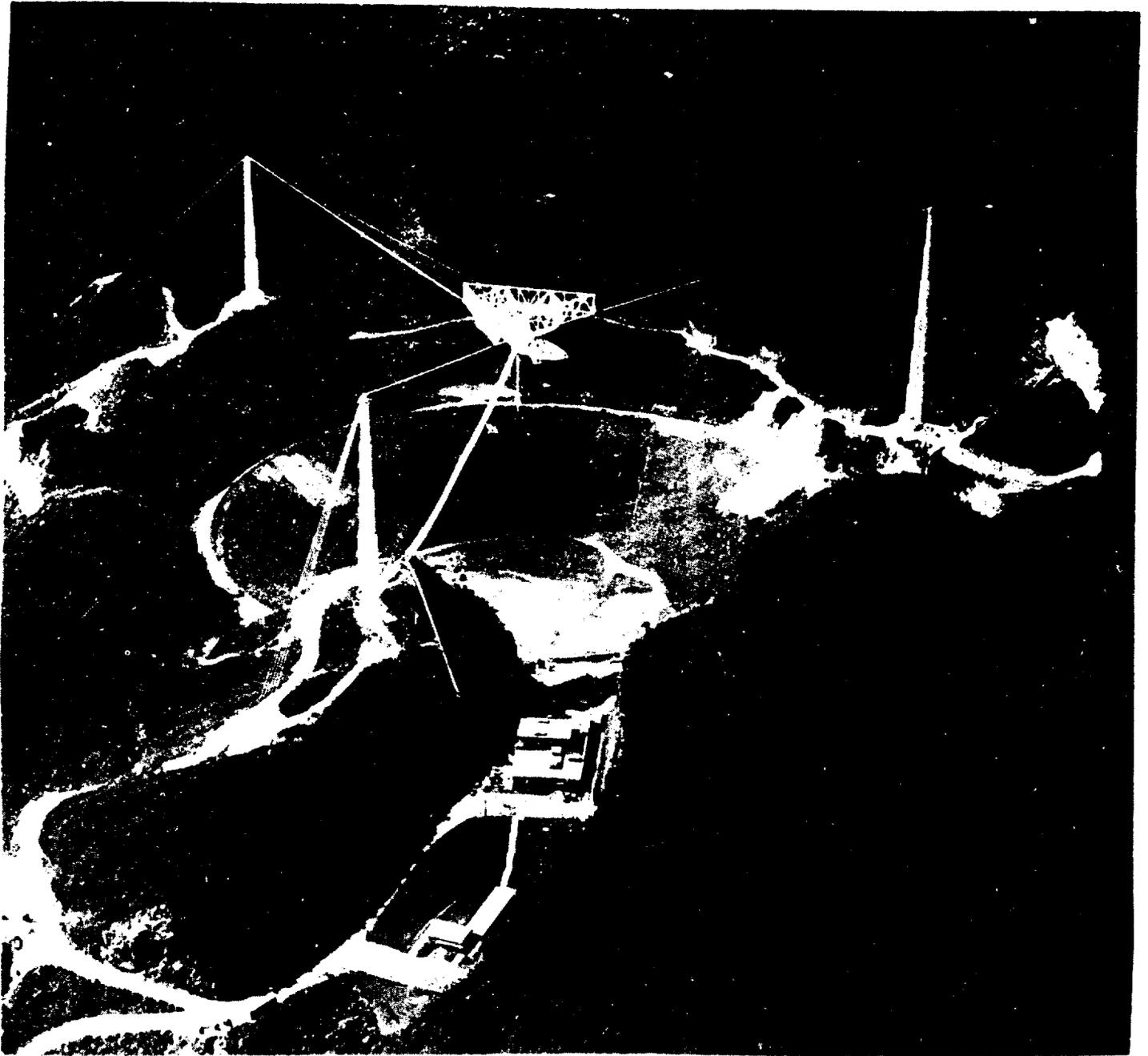
- 31 Oct The first successful geodetic satellite (Project ANNA 1B) was launched. AFCRL was responsible for its flashing strobe light feature, the establishment of a world-wide optical triangulation network, and the analysis of the optical data.
- 20 Nov The National Federation of Federal Employees granted a charter for Laboratory staff members to form Professional Local No. 1384, Bedford, Massachusetts.
- 13-14 Dec A two-man balloon gondola tested the feasibility of manned balloon-astronomical laboratories (Project Stargazer).
- Dec Publication of the Revised U.S. Standard Atmosphere, to which AFCRL scientists made extensive contributions.
- Late in the year a new lunar environment chamber was put into operation at AFCRL.
- AFCRL's Arctic Ocean site on the T-3 Ice Island (Fletcher's Island), occupied since 1952, was transferred to the Navy.
- An Experimental Dynamic Processor, the DX-1 System, which provided a mechanism for extracting minimal sets of invariant attributes from raw sensor data, was put into operation at AFCRL.
- A C-130A aircraft assigned to the Laboratory was specially instrumented by the University of California's Visibility Laboratory for the AFCRL program in atmospheric visibility.
- The Storm Radar Data Processor (STRADAP) tested successfully for use in displaying wind intensities within tornadoes at various altitudes.
- One of AFCRL's C-130 aircraft began surveys of dry lake beds (playas) at locations such as Centrum Lake, in order to assess their potential use as landing sites for Air Force operations.
- Late in the year, the new 150-foot radio telescope at the Sagamore Hill Radio Observatory was put into use.

1963

- Jan AFCRL inaugurated an Ozone Network, which used balloon and aircraft-borne ozonometers to measure vertical ozone distribution over the North American continent.
- Jan AFCRL placed in operation a shock tube for measuring the absolute spectral line intensities (f-values or transition probabilities) of the elements forming the sun and stars.
- Mar The flight-testing of AFCRL's "Supercooled Cloud Dissipator," AN/AMQ20, was completed. It created holes in clouds by seeding the cloud layer with dry-ice pellets.
- 15 Apr There was a full-scale internal reorganization at AFCRL, eliminating the Geophysics and Electronics Research Directorates (GRD and ERD) and consolidating their fourteen laboratory elements into nine major laboratories.
- 27 Apr A 1.0 mil polyethylene, zero-pressure, balloon carried a 4500 pound payload to an altitude of 92,000 feet.
- May AFCRL participated with the Weather Bureau in a six-week National Severe Storms Program. The Laboratory's U-2 aircraft, specially instrumented for meteorological research, photographed the formation of storm systems from above.
- Spring A new Plasma Physics facility was occupied.
- 1 Jul AFCRL announced the establishment of a worldwide network of 19 riometer (relative ionospheric opacity meter) sites. It was to play a large role in monitoring solar disturbances during the International Years of the Quiet Sun (IQSY).
- 1 Jul The P-11 subsatellite, designed and instrumented by AFCRL, was launched from an Air Force satellite into an elliptical polar orbit to measure trapped energetic particles near the polar region (Project HITCHHIKER).
- 30 Jul An AFCRL instrumentation package on a Blue Scout Jr rocket reached an apogee of 7,000 miles to measure cosmic noise and impedance of the ionosphere.

1963, cont'd

- Jul AFCRL started rocket probes of the aurora and high-latitude ionosphere at the Fort Churchill Range in Canada.
- 8 Aug The Nuclear Test Ban Treaty was signed between the U.S. and the U.S.S.R., becoming effective on 10 October 1963. It prohibited nuclear tests in the atmosphere and restricted the tonnage permissible for underground nuclear tests.
- Aug A series of experiments were conducted near Dallas, Texas, to measure low-level jet streams, continuing AFCRL's program begun early in 1961.
- Summer A prototype model of the semi-automatic weather station, AN/FMQ-5 (XD-4), was delivered to the Electronics Systems Division. This completed the Laboratory's intensive support work for ESD's System 433L (Weather Observing and Forecasting System).
- 25-27 Sep The first Symposium on Scientific Ballooning was conducted by AFCRL in Boston, Mass.
- Sep The Sacramento Peak Observatory undertook a continuous, long-range patrol of sunspot activity, to extend over at least one eleven-year solar cycle.
- 1 Oct The final launch of Project Firefly took place from Eglin Air Force Base, Florida. In this extensive series of rocket flights begun in the summer of 1960, chemical releases were utilized to study various properties of the atmosphere. Dense electron clouds formed by chemical releases created an artificial ionosphere for the transmission of VHF radio signals. Chemical trails also served as tracers for measuring winds, temperatures, and densities.
- 31 Oct An AFCRL rocket-borne quadrupole mass spectrometer made the first measurements of the ion and neutral composition of the D-region, which opened the way to a new understanding of this layer of the atmosphere.
- 31 Nov The Arecibo radar-radio telescope was dedicated in Arecibo, Puerto Rico. Its special feed mechanism permitting the radar to scan over a 40-degree cone evolved from research conducted at the Air Force Cambridge Research Center in the early 1950's. (The telescope was placed in operation early in 1964 by Cornell University.)



The Arecibo Ionospheric Observatory, Puerto Rico, as originally built. The feed mechanism for radar pointing and scanning is suspended between three towers over the 1000 ft-wide, wire mesh reflector.

1963, cont'd

- Dec Using the 84-foot dish at the Sagamore Hill Observatory, AFCRL radio astronomers contributed to the discovery that hydroxyl radical is a constituent of interstellar gas.
- Dec An Automatic Picture Transmission (APT) camera system developed by an AFCRL contractor went into operation on the TIROS VIII satellite. By automatically rectifying and digitizing satellite cloud pictures, the system greatly speeded up their processing.
- A C-130A aircraft was instrumented for AFCRL's cloud physics research.
- During the year an experimental model of a multiplate antenna was constructed at the AFCRL Strawberry Hill test site in Concord, Massachusetts. (It was dismantled in December 1964.)
- 1964
- Jan AFCRL placed its newly developed laser spectrograph in operation.
- Jan A Space Forecasting Branch was established at AFCRL to develop techniques for predicting changes in the near-space environment.
- 10-12 Mar The third Conference on the Exploding Wire Phenomenon was sponsored by AFCRL.
- Mar Two new lunar environment chambers were placed in operation at AFCRL.
- Apr Solar wind simulation experiments performed with a plasma accelerator started at AFCRL.
- 17 May The rocket-borne chemical release program (Project Firefly) was continued under the designation "Redlamp." AFCRL launched more rockets under this program than under any other single program.
- Spring An AFCRL-sponsored study by the University of California's Visibility Laboratory, which developed techniques to automate the determination of visibility thresholds, was completed.

1964, cont'd

- Jun An experimental radar was installed at AFCRL to monitor meteor trails as an index of upper atmosphere winds and densities. (The radar was transferred to the University of New Hampshire in May 1967.)
- 1 Jul The 3245th Air Base Wing at Hanscom became the 3245th Air Base Group.
- Jul AFCRL published the first issue of the "Geophysics and Space Data Bulletin."
- Aug-Sep AFCRL used its new ocean-bottom seismometer to locate hypocenters for seismic events originating near island arcs such as the Aleutian Islands. The field program was conducted jointly with the Air Force Technical Applications Center and the U.S. Coast and Geodetic Survey.
- 4 Sep NASA launched the first Orbiting Geophysical Observatory (OGO-A) with two AFCRL plasma probes to measure electrons and ions in the 0 to 1 keV energy range.
- Summer Warm cloud and fog studies (Project Cat Feet) started at Otis Air Force Base, Cape Cod, Massachusetts.
- 26 Oct Appointment of Dr John N. Howard, Senior Scientist in the Optical Physics Laboratory, as the first Chief Scientist at AFCRL.
- 27 Oct Colonel Leo A. Kiley replaced the retiring Brigadier General Benjamin G. Holzman as AFCRL Commander.
- Oct-Nov As part of the International Years of the Quiet Sun (IQSY) Program, AFCRL conducted a series of rocket-borne ionospheric experiments from Eglin Air Force Base, Florida.
- 18 Nov The second Orbiting Radio Beacon Ionospheric Satellite (ORBIS II) experiment confirmed the hypothesis that a radio signal sometimes becomes trapped between two layers of electrons in the ionosphere.
- 27 Nov The first successful test of the Niro (two-stage, Nike and Iroquois) sounding rocket was held.
- A new IBM 7044-1460 general purpose digital computer was installed at AFCRL, replacing previous computer services obtained under contract.

1964, cont'd

AFCRL scientists observed infrared airglow by producing and measuring hydroxyl ion emissions in a laboratory experiment.

AFCRL published a theoretical study on the reliability of large polyfunctional logic networks.

The successful research on over-the-horizon (OTH) detection led to the transition of the work to ESD for system development of OTH forward and backscatter systems.

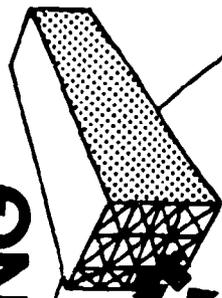
The USAF Gravity Reference Network was completed.

1965

- 21 Jan AFCRL completed the world's first successful aiming of a pulsed laser beam to a reflective satellite (LARGOS, S-66) and then captured the beam's reflection on a photographic plate, marking the debut of satellite laser geodesy.
- Jan A series of balloon flights began which measured moisture concentration in the stratosphere, in order to evaluate the design and performance of satellite infrared detectors.
- 15 Mar-
30 Apr Project Stormy Spring studied the anatomy of individual cyclonic systems over southern New England. This was one of the most intensive mesoscale observing programs undertaken to that point.
- Mar Rocket launches were made from an aircraft carrier (U.S.N.S. Croatan) off the coast of Peru to measure the equatorial electrojet. A new telemetry antenna with a nearly omni-directional radiation pattern was successfully tested during the program.
- Apr A 21 meV linear accelerator was placed in operation at AFCRL to study irradiation damage of electronic components.
- 21 May A balloon using a new reinforced material for its envelope, a laminate of woven Dacron fiber and mylar film, had its first launch.

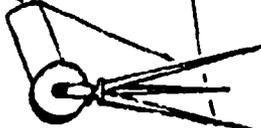
LARGOS

LASER ACTIVATED REFLECTING
GEODETIC OPTICAL SATELLITE



MIRRORS ON
SATELLITE

PC-1000
CAMERA



PHOTOSENSOR

LASER SYSTEM

1965, cont'd

- 28 May This date marked the first launch in a year-long, tethered-balloon program. AFCRL provided NASA with extensive support in testing the soft-landing capabilities of the Surveyor lunar vehicle.
- Spring A new speech synthesizer was incorporated in an experimental multimode vocoder to create an improved voice communications device.
- Spring New equipment was installed for the Data Collection and Decommuration Facility to process data from AFCRL sensors rapidly for space forecasting.
- 12 Aug A balloon-borne telescope was launched to study the composition of the lunar surface (Project Skytop).
- 21 Aug The Gemini 5, which carried AFCRL radiometric instruments to measure earth and sky backgrounds, was launched. (Similar instruments were carried by Gemini 7, launched on 4 December 1965.)
- Summer A new 6.6 meter ultraviolet vacuum spectrograph was installed at AFCRL for studies of the molecular structure of atmospheric gases.
- Summer Continuous total electron content (TEC) measurements of the ionosphere were made using VHF radio signals from the Early Bird satellite.
- 5 Oct This date marked the first successful launch in the Air Force's Orbiting Vehicle series of low-cost satellites. The program was managed by AFCRL's headquarters, the Office of Aerospace Research.
- 18 Oct Colonel Robert F. Long replaced Colonel Leo A. Kiley as AFCRL Commander.
- 16-17 Nov Rocket-borne, cryogenically-pumped, mass spectrometers uncovered a heavy region of metallic ions, the result of a meteor shower, in the atmosphere between 82 and 100 km (the D and lower E regions).
- AFCRL assumed responsibility for the operation of a new field site at NASA's Wallops Island facility. The radars were used for observations of atmospheric conditions associated with clear air turbulence.

1965, cont'd

AFCRL published the Handbook of Geophysics and Space Environments.

The leased Haven Acres site, five square miles of wheat fields near Liberal, Kansas, was established to perform computer-controlled studies in micrometeorology.

A numerical model was developed for hurricane prediction.

AFCRL issued a descriptive catalogue of dry lake beds in the U.S. as potential sites for Air Force operations.

AFCRL worked towards the completion of an improved, completely automatic Verneuil furnace for growing artificial crystals, particularly rubies, through a flame fusion process.

1966

- Jan Daily observations of solar radio emissions were initiated at the Sagamore Hill Observatory, Hamilton, Massachusetts, with the assistance of Air Weather Service personnel.
- 30 Mar The OVI-5 satellite launched on this date measured radiation across the spectrum from the ultraviolet to the far infrared (0.2-30 microns).
- 30 Mar A ceremony was held at the AFCRL Research Library to mark the acquisition of the Rayleigh Archive. The papers included the fourth Lord Rayleigh's airglow observations and the original of the third Lord Rayleigh's Nobel Prize-winning paper on Argon.
- Spring AFCRL established a West Coast Office to effect a closer coordination of its programs with those of the Air Force's Space Systems Division and Ballistic Systems Division.
- 18 Jul First flight of a balloon measuring 26 million cubic feet in volume, which was designed by AFCRL for NASA's Project Voyager. It provided a full-scale evaluation of the parachute system to be used in the soft landing of the Voyager instrumentation on Mars. (A second flight took place on 30 August 1966.)

1966, cont'd

- Summer AFCRL's C-130 meteorological aircraft participated in a multi-agency program for hailstorm modification (Project Hailswath) sponsored by the National Science Foundation.
- 28 Oct The OV3-2, one of two satellites totally designed, fabricated, integrated, and tested by AFCRL personnel was launched. Its primary mission was to measure irregularities in the distribution of electrons and ions in the upper atmosphere, particularly the auroral zone.
- 11 Nov NASA's Gemini 12 Spacecraft was launched. When its fuel cells malfunctioned during flight, AFCRL's experimental altitude control system on board was pressed into operational service because its power requirement was much less than that of the main control system. AFCRL's system (two pairs of positive ion sensors) aligned Gemini 12 in the proper position for retrofire.
- 11 Dec The Air Force satellite, OV1-9, was launched. AFCRL instruments on board the satellite measured for the first time polar electric fields associated with geomagnetic activity.
- Dec An IBM 7094-11 was installed at the Laboratory and coupled for operation with the existing IBM 7044.
- Late in the year the first data was obtained from a new double mass spectrometer which permitted laboratory studies of selected ion species over a range of interaction energies.
- Winter AFCRL conducted tests of its technique for dissipating cold fog by dry ice seeding at seven Air Force bases.
- A simple ground-fire detection system was developed and tested for use in Vietnam. It used filtering techniques developed in AFCRL's speech analysis program.
- Programs were initiated to develop improved infrared and radar devices in response to Vietnam requirements.

1966, cont'd

AFCRL's contractor RCA announced a new semiconductor, thin-film transistor technique using N and P type MOS transistors in complementary symmetry arrangement.

AFCRL placed in operation at Concord, Massachusetts, a new lunar observatory with a 24-inch telescope. (This was closed after the Mauna Kea observatory opened in 1968.)

The Space Forecasting Workshop was established to coordinate the activities of AFCRL, Air Weather Service and other agencies in this area.

The U.S. Standard Atmosphere Supplements, 1966 was published as a companion to the U.S. Standard Atmosphere, 1962. AFCRL scientists were major contributors to this volume.

AFCRL's U-2 aircraft used for high-altitude meteorological observations since the late 1950's was withdrawn for another mission.

AFCRL discontinued its biophysical research program because of loss of key personnel.

1967

- 23 Jan AFCRL's Environmental Consultation Service was created. It established an affiliation with AFCRL for Air Weather Service personnel serving as staff meteorologists at Air Force installations.
- 17 Mar A second balloon-borne telescope obtained the first clear mid-infrared spectrum from the moon, an emission band at 7 microns.
- Mar NASA launched its third Orbiting Solar Observatory (OSO-III) satellite. It carried an AFCRL grazing-incidence monochromator to observe time variations of solar extreme ultraviolet radiation.
- 28 Apr The Air Force launched the OV5-1 satellite instrumented by AFCRL, which was designed to monitor solar radiation. Its highly elliptical orbit had a 111,000 km apogee and a perigee of about 8000 km.



The "Royal Order of Aerobee Rocketeers," AFCKL Members,
March 1969.

1967, cont'd

- Apr AFCRL hosted a meeting of the Working Group for World Standard and First Order World Gravity Network.
- 23 May AFCRL collected comprehensive data on a white-light solar flare which was followed by auroras as far south as Georgia and by a major magnetic storm.
- May The reinstrumentation of one of AFCRL's KC-135's as a fully-equipped flying infrared laboratory was completed.
- Spring AFCRL's network for detecting sferics (lightning discharges), in operation since 1961, was dismantled.
- 27 Jul The Air Force satellite OVI-86 was launched. It carried an AFCRL interferometer with a thermoelectrically cooled detector to permit more sensitive infrared measurements.
- 17-18 Oct AFCRL sponsored a Tethered Balloon Workshop.
- Oct The Fourth Conference on the Exploding Wire Phenomenon was sponsored by AFCRL.
- 6 Nov Dedication of the Cerro Tololo Inter-American Observatory in Chile. The construction of its 60-inch telescope for stellar astronomy was sponsored jointly by AFCRL and the National Science Foundation.
- Dec An AFCRL-invented, coded-pulsed, ruby laser made the first successful, optical ranging measurements to a reflective satellite during the daytime.
- Late in the year, AFCRL's NKC-135 aircraft for ionospheric studies photographed for the first time a pulsating brightening of the polar sky, the auroral E layer.
- At AFCRL's Molecular Physics Facility in Bedford, Massachusetts, a large molecular beam generator was installed. It used a supersonic nozzle technique to study chemical reactions.

1967, cont'd

AFCRL demonstrated a high-performance, injection-locked magnetron, a possible new power source for radars.

AFCRL developed a medial axis transform for shape recognition, part of the program for improving computerized processing of photographic data.

A report was published entitled "Syntactic Analysis," which summarized AFCRL's studies of the linguistic requirements for programming a computer directly in English. These problems were worked on a UNIVAC M-460 computer using the LISP programming language.

AFCRL's 6.75 MHz planar array antenna began testing at Sudbury, Massachusetts.

The Air Weather Service decided to establish a new network of solar observatories to provide data for space forecasting.

AFCRL was given technical responsibility for the Department of Defense's Military Standard 210, "Climatic Extremes for Military Equipment."

1968

4 Mar

Several changes in Laboratory structure became effective. The Sacramento Peak Observatory was removed from the Space Physics Laboratory to become a separate entity. Elements were drawn from the Space Physics and Upper Atmosphere Physics Laboratories to create a new Ionospheric Physics Laboratory. The reduced Upper Atmosphere Physics Laboratory was renamed the Aeronomy Laboratory.

17-
19 Jun

AFCRL grew the largest yet (though imperfect) cylindrical boule of silicon carbide as part of its research into semiconductors.

1 Jul

Colonel Dale J. Flinders replaced Colonel Robert F. Long as AFCRL Commander.

1968, cont'd

- 11 Jul The SPADES and Cannonball I satellites (respectively OV1-15 and OV1-16) were simultaneously launched into orbits with perigees of 120 km. The Cannonball I was specially designed to maximize weight for volume (600 pounds of instrumentation in a 20-inch diameter sphere) to accomplish density measurements at the lowest possible altitudes.
- 8 Aug The Injun V satellite was launched into an elliptical polar orbit. It carried AFCRL plasma probes to examine the electric structure in near-earth space.
- Aug Rocket-borne experiments were launched from Brazil to measure the latitude variation in meteor flux. The program used new techniques to overcome background contamination.
- Sep-
Oct The first C-130 expedition went to Thailand to measure atmospheric transmission properties during the monsoon season. (A second expedition beginning 14 February 1969 observed transmission during the dry season.)
- 15 Nov An AFCRL rocket launched from Brazil obtained the first sharp profile of equatorial dayglow.
- The Haskell Gravity-Seismic Observatory located near the AFCRL Research Library was placed in operation.
- AFCRL sponsored the Second International Conference on Silicon Carbide.
- A new lunar observatory with a 24-inch telescope, whose construction was funded by AFCRL, came into operation atop Mauna Kea in Hawaii. It was operated jointly by AFCRL and the University of Hawaii.
- A compilation of a complete set of atmospheric absorption line parameters was begun at AFCRL.
- The Meteorology Laboratory developed the Plan Shear Indicator, a new technique for detecting and displaying severe turbulence in storms.

1969

- 4 Apr A new monochromator with channel electron multipliers was launched from a rocket for observations of solar extreme ultraviolet radiation.
- 23 May The Air Force satellite OV5-6 was launched into a 10,000 by 60,000 nautical mile orbit to measure x-rays and particulate radiation from the sun. (OV5-6 was still transmitting data early in 1976, when it was decided to switch over to better-quality data available from the SOLRAD II satellites launched on 15 March 1976.)
- Jul-
Nov A program at Fort Churchill, Canada, studied polar cap absorption (PCA) events causing communications blackouts in the region. This was AFCL's largest field expedition since the last atmospheric nuclear tests in 1962. More than 40 AFCL scientists and the KC-135 Ionospheric aircraft participated in the program, observing a giant solar proton burst on 2 November 1969. (The event was also monitored by the recently launched OV5-6 satellite.) The results obtained from this program formed the basis of current D region models.
- 13 Aug A rocket launch of AFCL's newly developed negative ion mass spectrometer obtained the first clear-cut measurements of D region negative ions. (A second flight took place on 11 October 1969.)
- 2 Sep AFCL's lunar laser facility near Tucson, Arizona, received its first return signals from the retro-reflector array placed on the moon by Apollo 11 astronauts on 20 July 1969.
- 15 Oct AFCL's new tower vacuum telescope for solar observing at the Sacramento Peak Observatory was dedicated.
- Nov Detachment 5 at Patrick Air Force Base, Florida, was transferred from the jurisdiction of Headquarters, Office of Aerospace Research, to AFCL.
- The Mansfield Amendment (Section 203) was passed into law. It required that research sponsored by the Department of Defense demonstrate its relevance to military operations and systems.
- A set of eight absolute gravity determinations was accomplished with AFCL's new laser-interferometric apparatus. This semiportable system had a total weight of 2500 pounds.



The Solar Vacuum Tower Telescope, Sacramento Peak Observatory, New Mexico.

1969, cont'd

In the latter part of the year, AFCRL curtailed its program in stellar astronomy and discontinued its use of the Cerro Tololo Observatory in Chile.

AFCRL's short backfire antenna, first demonstrated in 1962, was adopted by the Air Force Systems Command as the basic ground terminal antenna for the Tactical Satellite Communications System.

The Meteorology Laboratory, in conjunction with the Army, performed an extensive series of fog-clearing tests at Lewisburg, West Virginia. They demonstrated that the downwash action of large helicopters could clear areas up to 1500 feet, provided the warm fog was less than 400 feet deep. (This technique was used later for rescue operations in Southeast Asia.)

Using the gel growth method, the Solid State Sciences Laboratory grew cuprous chloride crystals of large size and perfection, a promising material for laser light modulation.

AFCRL made the first applications of the Fourier Fast Transform Technique to Michelson interferometric spectroscopy. This reduced computer time by two orders of magnitude.

Laboratory scientists first established the existence of negative ions of carbon dioxide and nitrous oxide.

The initial version of the Short Arc Geodetic Adjustment Computer Program was developed for use in satellite altimetry.

The new National Environmental Policy Act required the Air Force to provide environmental impact statements for its operations.

1970

12 Jan-
21 Feb

AFCRL participated in an intensive multi-agency field program (Project Haven Hop) centered at NASA's facility on Wallops Island, Virginia, to improve detection and forecasting of clear air turbulence.

1970, cont'd

- Mar A solar eclipse, a solar flare and a polar cap absorption event all occurred within a few days. Fifty AFCRL scientists in Thule and other posts around the globe, together with the KC-135 infrared aircraft, measured the effects of these phenomena on the atmosphere and on communications.
- Mar AFCRL published the Microwave Acoustics Handbook, including information on new AFCRL surface wave devices it had developed.
- Mar AFCRL sponsored the Aspen Conference on Fourier Spectroscopy, the first international conference devoted exclusively to this new field.
- Early in the year AFCRL acquired a high-intensity flash x-ray machine which was used to study radiation damage to electronic devices and materials.
- 1 May The Chief of Staff, USAF, directed AFSC to proceed with the development of an experimental Over-the-Horizon Backscatter (OTH-B) Radar System.
- 30 Jun As of this date, the AFCRL balloon group held all the records with respect to maximum balloon size (34 million cubic feet), maximum altitude reached (161,000 feet) and maximum payload carried aloft (seven tons).
- 30 Jun In response to the Mansfield Amendment and funding cuts, AFCRL's lunar and planetary research and research in meteor physics were discontinued at the end of Fiscal Year 1970. The use of the Mauna Kea lunar observatory reverted largely to the University of Hawaii.
- 1 Jul AFCRL's headquarters, the Office of Aerospace Research, was deactivated. All Air Force research and development was unified under the Air Force Systems Command, and AFCRL started to report to AFSC's Director of Laboratories.
- Summer The initial version of the Space Forecasting System, a joint AFCRL-Air Weather Service endeavor, went into operation. Solar optical and radar observatories in Iran, Puerto Rico, Hawaii, and the Philippines were linked to the Air Force Global Weather Central's computers at Offutt Air Force Base, Nebraska.

1970, cont'd

- Summer The Deputy for Research Services was established, combining the offices of logistics and administration.
- Summer AFCRL closed its Haven Acres site for measurements of small-scale meteorological phenomena at a field site near Liberal, Kansas. (A new site was opened at Donaldson, Minnesota, in 1971.)
- 8 Oct The Federal Labor Relations Authority certified that Professional Local 1384 of the National Federation of Federal Employees had been voted the exclusive bargaining agent for AFCRL employees. (The Local was expanded to include RADC employees at Hanscom in 1977.)
- Oct A new balloon-borne gas laser measured the size distribution of aerosols at high altitudes.
- 20 Nov The ALADDIN I (Atmospheric Layering and Density Distribution of Ions and Neutrals) experiment was carried out. This joint AFCRL, NASA/Goddard, and Army rocket program utilized releases of trimethyl aluminum as a tracer chemical. (ALADDIN II took place on 12 April 1972.)
- Nov AFCRL occupied its newly completed Computation Center, a \$2 million structure linking the Laboratory's four wings. The Command Section, the Technical Plans and Operations Division, and the Office of Research Services also moved into the Center building.
- Dec A CDC 6600 computer replaced the existing dual IBM 7094-11 and IBM 7044 system. (A second CDC 6600 was added in July 1972.)
- A chemical decoy system to protect aircraft from heat-seeking missiles was flight-tested at Eglin Air Force Base, Florida.
- Using the Czochralski technique, the Solid State Sciences Laboratory grew superior single crystals of rare-earth cobalt alloys in its thermal imaging furnace.
- The report, Earth Sciences Applied to Military Use of Terrain was published. It discussed the techniques developed by AFCRL during the 1960's for conducting airborne geological surveys; namely, multi-spectral photography and thermal infrared imaging procedures.

1970, cont'd

AFCRL terminated studies on the properties of solids as derived from their absorption and emission spectra.

AFCRL devised a 22-level atmospheric model to describe the interaction and transport of ozone in the atmosphere.

The Loki-Dart rocket sounding system for measuring upper air winds and temperatures, which was developed by AFCRL, was put into operational use in the Meteorological Rocket Network and at test ranges. It replaced the larger and more expensive Arcas-Robin system developed earlier at AFCRL.

AFCRL expanded its Direct Readout Infrared System for improved interpretation of satellite-views cloud images. The system was applied to forecasting weather for Southeast Asia.

1971

- 31 Jan AFCRL's Optical/Infrared Flying Laboratory made radiometric and spectral measurements of the plume of the Apollo 14 booster during launch. (On 26 July 1971 similar measurements were made for Apollo 15.)
- 1-
2 Mar The first Air Weather Service/AFCRL Forum was held at AWS Headquarters, Scott Air Force Base, Illinois. Its purpose was to coordinate the Laboratory's research and development programs in meteorology with the Air Weather's operational requirements.
- 3 Apr The HI-STAR rocket probe series to map the infrared celestial background was begun.
- May In a cooperative program with the Brazilian Air Force, AFCRL's new high-resolution ionosounder was used to measure the ionospheric reflectivity associated with a horizontal geomagnetic field.
- May Corpuscular photographic material carried by a balloon recorded the presence of relativistic nuclei heavier than iron at a 37 km altitude.

1971, cont'd

- May The first simultaneous measurements of incoming particle fluxes were made by the ISIS-II satellite, AFCRL's KC-135 ionospheric aircraft, and a Defense Meteorological Satellite Program satellite.
- Spring AFCRL's later model C-130 aircraft was withdrawn. This brought to a close the programs conducted through the 1960's in airborne gravimetry and in airborne remote sensing of soil terrain.
- 1 Jun Colonel William K. Moran, Jr., replaced Colonel Dale J. Flinders as AFCRL Commander.
- 13 Jun John P. Cahill, Thomas L. Walter, Anthony J. Theriault and David Penney, all of the Radiation Effects Branch, died in an aircraft accident. It occurred while they were on duty monitoring a French nuclear explosion in the Pacific. (On 27 June 1972 they were posthumously given Meritorious Civilian Service Awards.)
- 7 Aug The OVI-21 satellite carrying AFCRL's new velocity mass spectrometer for measuring neutral composition at satellite altitudes was launched.
- 7 Aug The Air Force launched two satellites, Cannon Ball II and Musket Ball, for whose instrumentation and integration AFCRL had total responsibility.
- Aug The International Gravity Standardization Net to which AFCRL had made extensive contributions was published.
- Sep AFCRL conducted experiments in Florida in the modification of warm cumulus clouds, using micro-encapsulated urea as the seeding agent.
- Oct AFCRL's new Ionospheric Observatory at Goose Bay, Labrador, became operational. The site was chosen for its auroral activity and magnetic latitude.
- 31 Dec AFCRL's Microwave Research Facility on Haystack Hill in Tyngsboro, Massachusetts, was transferred to the Massachusetts Institute of Technology.

1971, cont'd

Dec Test flights were completed for the airborne Synthetic Aperture Dual Frequency Radar (SADFRAD) system, which was developed under Project Shedlight starting in 1966. The tests demonstrated the ability of the radar to locate stationary military ordnance in a foliage background

The Meteorology Laboratory began measurements of the erosion of reentry vehicles' nose cones due to rain and ice crystals. Initial tests in this program conducted in support of the Space and Missile Systems Organization were performed at Wallops Island, Virginia.

An initial version of the optical/infrared (OPTIR) computer code was developed. It was designed to estimate the effects of nuclear detonations on optical/infrared detection systems.

1972

Feb AFCRL's Mesonet, a mesoscale, weather-observing network centered around Hanscom Air Force Base, began operations. Its goal was to improve short-term (0 to 4 hours) forecasting for airfield weather.

Feb-Mar Project Haven Hop II was conducted in northwestern Texas.

6 Mar The first launch of the ICECAP (Infrared Chemistry Experiments for Coordinated Auroral Programs) program took place at Poker Flat Research Range, Alaska. This extensive rocket program was sponsored by the Defense Nuclear Agency.

26 Mar The Anti-Ballistic Missile Treaty between the U.S. and the U.S.S.R. became effective as part of the SALT I agreement.

1 May A rocket and ground field program at Churchill Research Range, Canada, measured field-aligned currents during an intense magnetospheric substorm.

19-
23 Jun The Super-Loki rocket and its miniature transponder payload for meteorological observations were successfully flight-tested. This less expensive system with a higher altitude capability replaced the currently standard Loki-Dart system.

1972, cont'd

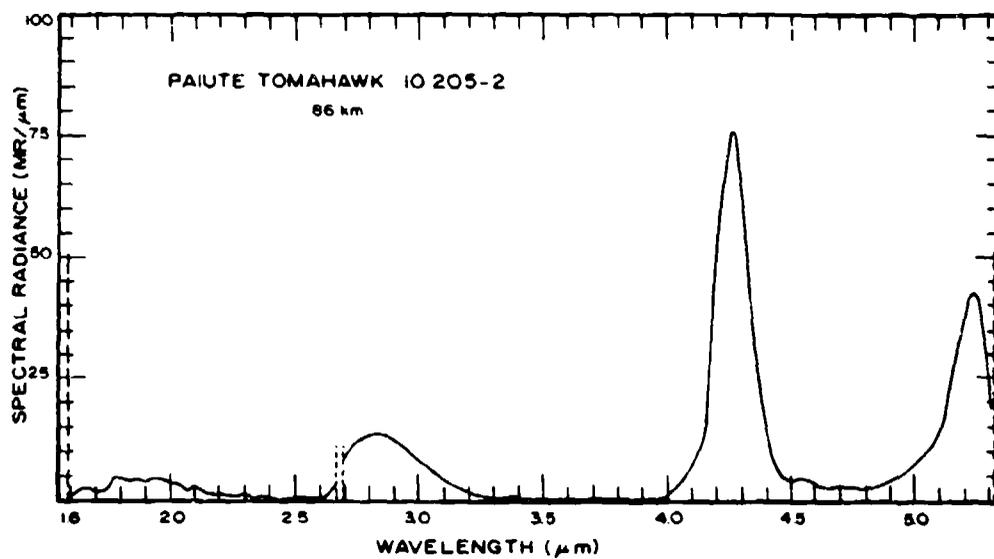
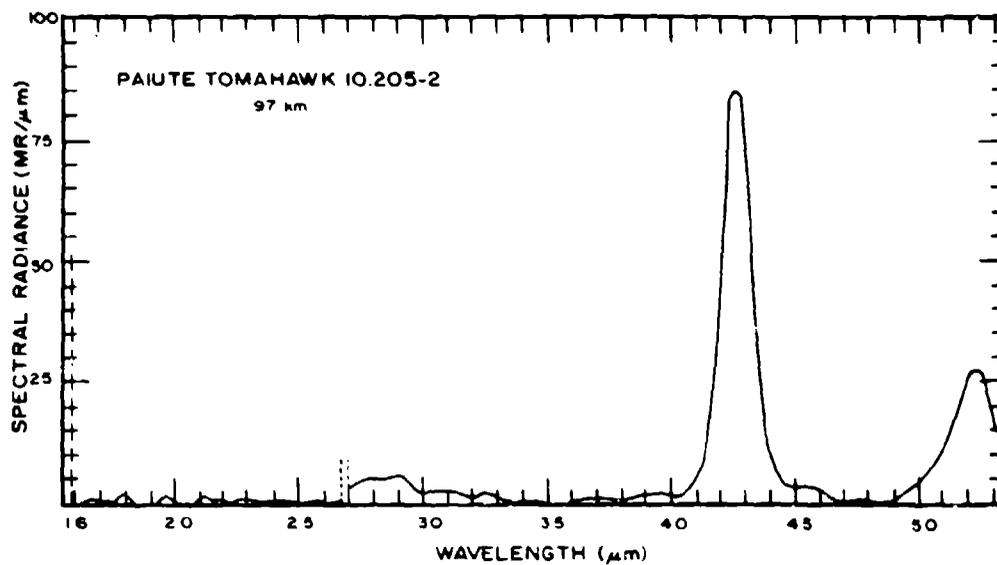
- 30 Jun AFCRL's lunar laser observatory in the Catalina mountains near Tucson, Arizona, closed. The equipment was transferred to NAT MAP, Australia's national mapping agency.
- 30 Jun The Data Sciences Laboratory was abolished in response to a large reduction in manpower authorizations. The Laboratory had been created from other units in the 1963 reorganization. Its research on speech patterns dated back to the late 1940's.
- 11 Jul AFCRL began a series of four balloon drops in support of parachute decelerator tests for NASA's Viking Lander.
- Jul At the request of the Space and Missile Systems Organization, AFCRL tested four types of neutron-hardened bipolar transistors in its linear accelerator to determine their response to high dose radiation.
- Jul The Energy Research and Development Administration transferred responsibility for the balloon operations of Project Ashcan from the Air Weather Service to AFCRL's Aerospace Instrumentation Laboratory. (Project Ashcan, which collected samples of high altitude atmospheric nuclear debris, was begun in 1956 by the Atomic Energy Commission.)
- 16 Sep A prototype powered balloon, designed to achieve a high-altitude hovering capability, was test flown at Holloman Air Force, New Mexico.
- 2 Oct The Air Force satellite, S72-1, carrying AFCRL's proton and alpha isotope detector, was launched.
- 11 Oct The final rocket probe for Project Chaser was conducted for the Space and Missile Systems Organization. It used a new technique for rocket tracking of missile trajectories in order to measure their plumes.
- 16 Oct The Satellite Meteorology Branch received the first pictures from the NOAA-2 satellite. The combination of infrared and visual images transmitted permitted significant advances in satellite assessment of cloud cover.

1972, cont'd

- 27 Oct AFCRL launched a 47.8 million cubic foot, single-cell balloon to a record altitude of 170,000 feet from its facility at Chico, California. The thin polyethylene balloon envelope was protected by a self-opening reefing sleeve.
- Oct The Flying Ionospheric Laboratory completed a series of flights to specify the HF propagation characteristics of the ionosphere in real-time in support of Cobra Mist.
- 30 Oct- AFCRL sponsored the Second Conference on High Power
1 Nov Infrared Laser Window Materials, which was held in Hyannis, Massachusetts.
- 29 Dec AFCRL published the LOWTRAN 2 computer code. It provided a flexible, efficient capability for modeling atmospheric propagation for a range of systems applications, which led to its wide use throughout the Department of Defense.
- The Air Weather Service decided to develop a second-generation solar optical observation system and to upgrade solar radio instrumentation at various sites.

1973

- 26 Jan The first edition of the AFCRL Atmospheric Absorption Line Parameters Compilation was published. Known also as the HITRAN (High Spectral Resolution Atmospheric Transmission) data base, the compilation has specific applicability to laser-type systems.
- Jan A field test at Travis Air Force Base, California, established the potential of the LIDAR (Light Detection and Radar) technique for measuring slant-path visual range for aircraft landing operations.
- Mar The first successful test observations of stellar images were made with AFCRL's Automatic Astronomic Positioning System.
- Apr A Laboratory-designed system for measuring wind and temperature variations was accepted by the Air Force Flight Test Center for use on the 15,000 foot runway at Edwards Air Force Base, California.



Sample spectral scans from the spectrometer aboard a Paiute-Tomahawk rocket launched from Poker Flat, Alaska, on 24 March 1973. AFCRL's 1973 ICECAP Program made the first-time-ever measurements of auroral infrared excitations.

1973, cont'd

- 10 May AFCRL flew a 5 million cubic foot balloon with a 2500 pound payload from Chico, California. A high-altitude parachute and a new balloon destruct anti-fouling system performed successfully.
- 14 May The Skylab I spacecraft was launched. It permitted space physicists their first view of solar processes unencumbered by the earth's atmosphere.
- May Three balloon flights were conducted at Holloman Air Force Base, New Mexico. A newly developed counter measured particle concentration and size distribution of aerosols between 12 and 26 km altitudes.
- May Using its new acoustic surface wave technology, the Microwave Physics Laboratory completed initial development of a compact microwave frequency synthesizer.
- May The Air Force Systems Command directed AFCRL to be the focal point for all vacuum ultraviolet investigations in surveillance technology.
- Summer Tests of nose cone erosion for the Space and Missile Systems Organization's ABRES (Advanced Ballistic Reentry Systems) Program began at the Kwajalein Missile Range in the Western Pacific Ocean.
- Summer The operational capability of the Vacuum Tower Telescope at the Sacramento Peak Observatory was substantially increased by two newly added devices, a Diode Array and a Universal Birefringent Filter.
- Summer Joint AFCRL/English experiments conducted at Donaldson, Minnesota, studied the turbulent transport of momentum and heat throughout the atmospheric boundary layer.
- 1 Sep Air Force flying activities at the Laurence G. Hanscom Field were officially terminated.
- Nov A balloon-borne telescope with a 50-inch aperture measured infrared emission from the planets Venus and Jupiter.
- Nov-Dec AFCRL participated in the initial phase of Project GEST (Gaseous Explosive Simulation Tests) as balloon technical adviser to the Air Force Weapons Laboratory.

1973, cont'd

- 6 Dec The fifth and last probe in the Trailblazer II rocket series was flown. The program acquired data and developed a technique to suppress the flow of electrons which disrupts communications from vehicles reentering the atmosphere.
- 16 Dec NASA's Atmospheric Explorer (AE-C) satellite was launched into a low perigee elliptical orbit. It carried AFCRL's Miniature Electrostatic Accelerometer for density measurements and an extreme ultraviolet spectrophotometer.
- Dec AFCRL concluded successful field tests of its tethered balloon, the Hugo II Wind Data System.
- Dec The Department of Defense accepted Military Standard 210B, "Climatic Extremes for Military Equipment." AFCRL coordinated tri-service work on the revision of the standard.
- The Sagamore Hill Observatory completed engineering work on a prototype station for the Air Weather Service's planned Radio Solar Telescope Network.
- AFCRL developed a cloud-free, light-of-sight model to assist the deployment of weapons systems using optical, infrared, and laser sensors.
- During the 1973 ICECAP Program, AFCRL used a rocket-borne, helium-cooled spectrometer with a circular variable filter to make the first-time-ever observations of auroral infrared excitations.

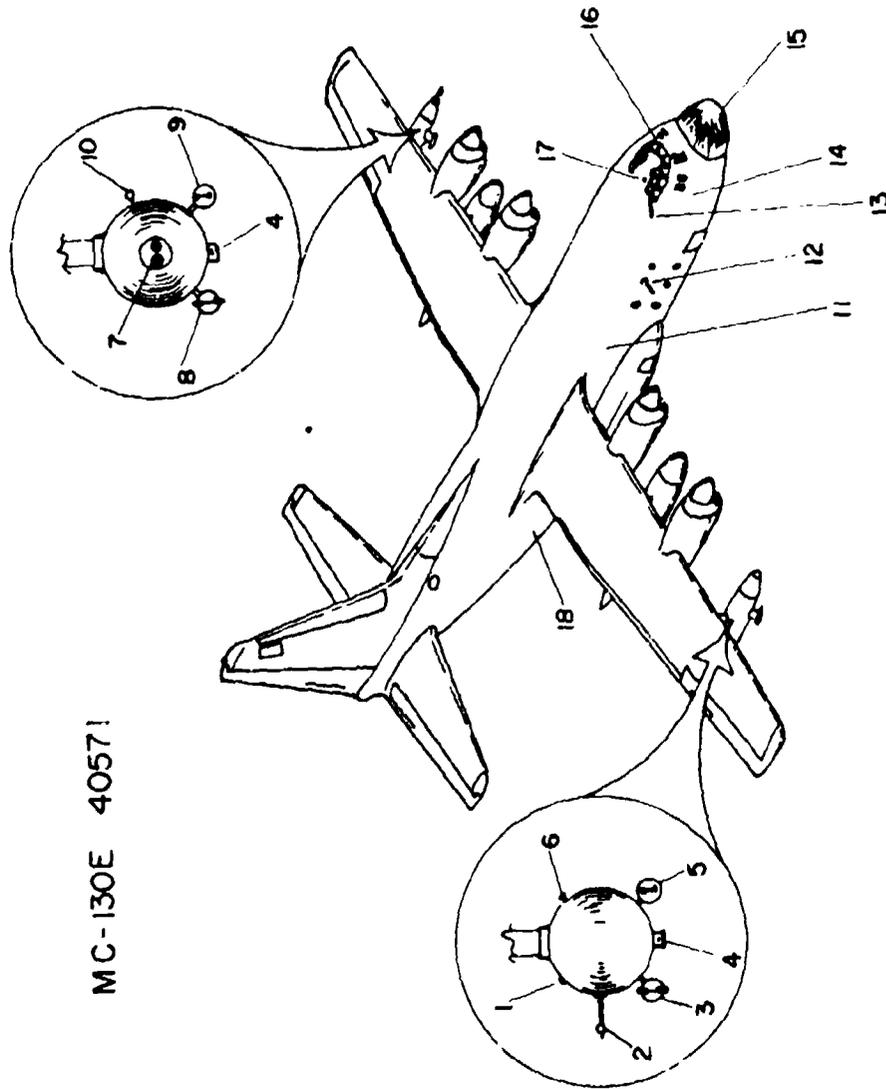
1974

- 1 Jan Colonel Bernard S. Morgan, Jr., replaced Colonel William K. Moran, Jr., as AFCRL Commander.
- 1 Jan The AFCRL branch of the Scientific Research Society of American (RESA) joined Sigma Xi, becoming one of its chapters.
- 3 Jan The Optical Physics Division published a report on atmospheric transmittance for carbon dioxide, hydrogen fluoride and deuterium fluoride laser systems.

1974, cont'd

- 26-
29 Jan A coordinated experiment between the KC-135 ionospheric aircraft and the Thule, Greenland, ground station confirmed that geomagnetic effects are not uniform over the polar cap region.
- Early in the year an MC-130E aircraft was added for use by the Meteorology Laboratory in the ABRES nose cone erosion test program.
- 22 Jun The Laurence G. Hanscom Field was redesignated Laurence G. Hanscom Air Force Base.
- 29-
30 Jun The Atmospheric Layering and Density Distributions of Ions and Neutrals (Aladdin III) multi-agency program sponsored by AFCRL was conducted at Wallops Island, Virginia. It was the largest coordinated scientific program to date on the upper atmosphere, with 50 rockets launched in a twenty-four hour period.
- 30 Jun Further reductions in civilian manpower authorizations amounted to a cut of more than fourteen percent in civilian staffing since 1970. As a result of these cuts, the Energy Conversion, Plasma Physics, Solar Plasma Dynamics, and Space Forecasting Branches of the Space Physics Laboratory were terminated. The Vertical Sounding Techniques Branch of the Meteorology Laboratory was also abolished.
- 1 Jul This date marked the official start of the Stratospheric Environment Project. Its goal was to provide data needed by the Air Force in order to write environmental impact statements for the operations of the B-1 and F-15 aircraft.
- Jul Tethered balloon flights at Holloman Air Force Base, New Mexico, demonstrated the feasibility of using a small tethered balloon supporting a special antenna to serve as an emergency replacement for disabled Loran-D antenna towers. Subsequently, ESD's Tactical LORAN System Program Office requested AFCRL to develop a prototype system.
- Aug The Chapman Report prepared by the Air Force Laboratory Utilization Study Group was published. It emphasized the need to ensure the transfer of technology from the laboratories to the product divisions.

MC-130E 40571



KEY

1. DEW POINT HYGROMETER PROBE
2. PMS 1-D AXIAL SCATTER PROBE (2-30 μ)
3. PMS 1-D PRECIP. PROBE (300-4500 μ)
4. HYDROMETEOR FOIL SAMPLER
5. PMS 1-D CLOUD PROBE (20-300 μ)
6. TOTAL AIR TEMPERATURE PROBE
7. EWER PROBE
8. PMS 2-D PRECIP. PROBE (200-6400 μ)
9. PMS 2-D CLOUD PROBE (25-800 μ)
10. JW CLOUD WATER PROBE
11. PDP-8/E COMPUTER & LINE PRINTER
12. FORMVAR HYDROMETEOR PROBE
13. VISUAL HYDROMETEOR PROBE
14. I.N.S. & DOPPLER RADAR
15. AN/APQ-122 K₉ & 5CM WEATHER RADAR
16. 16mm NOSE CAMERA
17. PROBE LIGHT
18. TELEMETRY

CLOUD PHYSICS AIRCRAFT
USED FOR THE ABRES PROGRAM

1974, cont'd

- Sep Three rocket probes from the Woomera Range in Australia extended the measurements of the infrared sky background (the HI-STAR Program) to the Southern Hemisphere.
- 17 Oct The initial launch in the EXCEDE Program (dubbed PRECEDE) demonstrated that a rocket-borne electron accelerator provided a viable tool for achieving controlled ionization of the upper atmosphere.
- Autumn The Sacramento Peak Observatory completed the pre-production model of an optical observing system for the Air Weather Service's planned Solar Optical Observing Network (SOON).
- 22 Nov The Air Force announced Realignment and Reduction Actions. As part of these Actions, the Air Force directed that the geophysics research then being conducted at the Cambridge Research Laboratories be transferred to Kirtland Air Force Base, New Mexico. The space left open by this move was to be filled by the transfer to Hanscom of the major activities of the Rome Air Development Center, which would concentrate Command, Control, Communications, and Intelligence activities at Hanscom Air Force Base. It was also announced that civilian staffing at AFCRL could be reduced by 200 positions.
- 29 Nov The newly formed SAVE (Scientists Allied to Veto Extinction) Committee at AFCRL sent a memorandum to the Air Force presenting cost estimates of the proposed move to Kirtland Air Force Base.
- The Secretary of the Air Force stated that no Reduction in Force would take place at AFCRL in the Fiscal Year 1975.
- The Solid State Sciences Laboratory developed a charge-coupled imaging device for use with the Schottky Barrier infrared sensing array.
- AFCRL performed design optimization experiments on its proposed Thermal Fog Dispersal System for airport runways at Irvine, California.

1974, cont'd

The Microwave Physics Laboratory began the development of three new airborne radars with the capability of detecting moving targets in a foliage background.

AFCRL instrumented a Minuteman test silo at Hill Air Force Base, Utah, with motion sensors, including a new Automated Azimuth Measuring System. During the year it measured earth-induced silo and missile motions which affect the accuracy of guidance systems.

The Optical Physics Division's LABCEDE (Laboratory Cold Electron Deposition Experiment) chamber became operational.

AFCRL reported the development of a new technique for studying time-varying spectral features using Fourier Spectroscopy.

1975

- 24 Jan Program Action Directive (AFSC75-6) set out a plan for implementing the 22 November 1974 decisions regarding AFCRL and RADC.
- Early in the year, AFCRL installed a new borehole tiltmeter in cased holes 120 m deep at Bedford, Massachusetts, to acquire more reliable data on crustal motions.
- 19-26 Apr The Ad Hoc Committee on Relocation of the Air Force's geophysics research laboratories to Kirtland Air Force Base, New Mexico, made its report.
- 24 Apr The Have Car Implementation Plan 75-6 for the move of AFCRL's geophysics section to Kirtland Air Force Base, New Mexico, was issued.
- Apr Project AEOLUS (Auroral Electrojet Oscillations and Layering of the Underlying Species) was conducted at the Churchill Range in Canada. Three series of rockets were launched to investigate the production of high-latitude ionospheric disturbances which affect UHF radar systems such as Cobra Dane.
- Jun The first rocket-borne, high power dye laser to measure aerosols in the atmosphere was launched.

1975, cont'd

- Jun A series of balloon flights were started to measure stratospheric composition using a cryogenic whole air sampler.
- 31 Jul The Secretary of the Air Force, John L. McLucas, decided not to relocate the geophysics portion of AFCRL to Kirtland Air Force Base, New Mexico.
- 11 Nov AFCRL launched its first balloon flight using liquid helium as a gas source. The test was conducted at Holloman Air Force Base as part of AFCRL's development of an Air-Launched Balloon System (ALBS).
- 19 Nov The NASA Atmospheric Explorer (AE-E) satellite was launched. It carried an AFCRL-designed spectrometer composed of 24 individual collimating grating monochrometers. The experiment was operated by a flexible CMOS-logic system using an on-board memory of command sequences sent for each orbit from the ground.
- AFCRL began the Multispectral Measurements Program (a follow-on to Project Chaser) and the Balloon Altitude Mosaic Measurements Program, both in support of Space Division.
- Late in the year the Air Force launched the research satellite S3-2 carrying a number of AFCRL instruments, including a mass spectrometer and a new piezoelectric accelerometer.
- A duplicate of the Man-computer Interactive Data Access System (McIDAS) developed at the University of Wisconsin was delivered to AFCRL to process satellite meteorological data.

1976

- 1 Jan Detachment 1 (Deputy for Electronic Technology), Rome Air Development Center, was designated and activated at Hanscom Air Force Base from a portion of the Air Force Cambridge Research Laboratories. The units transferred to RADC consisted of the Microwave Physics Division, the Solid State Sciences Division, the Laser Physics Branch of the Optical Physics Division, and the Electromagnetic Environment and Ionospheric Radio Physics of the Ionospheric Physics Division.

1976, cont'd

- 15 Jan The Air Force Cambridge Research Laboratories minus the sections transferred to the Rome Air Development Center was redesignated the Air Force Geophysics Laboratory (AFGL).
- 15 Mar In a cooperative program between the Navy and the Air Force, the SOLRAD 11A and 11B satellites were launched. They carried AFGL instrumentation to monitor solar particle fluxes.
- 1 Apr The final rocket probe in the ICECAP (Infrared Chemistry Experiments for Coordinated Auroral Programs) series was conducted at Poker Flat Research Range, Alaska. It carried a High Resolution Interferometer-Spectrometer (HIRIS), the first rocket-launched, cryogenically-cooled interferometer, which permitted substantial improvements in spectral measurements.
- 4 May The high-altitude, high mass density, Laser Geodetic Satellite (LAGEOS) was launched.
- 13 May A new paraform parachute recovery system planned for use with Aries rockets in the Multispectral Measurements Program was successfully drop-tested.
- 30 Jun A 200-position reduction in civilian personnel became effective at AFGL. The following actions were taken to implement the reduction. The Sacramento Peak Solar Observatory was abolished as a separate division, the facilities given to the National Science Foundation, and the employees paid by the Air Force reduced from 45 to 7. The Boundary Layer and Aerosol Interactions Branches of the Meteorology Division, the Spectroscopic Studies Branch of the Optical Physics Division, the Wave Propagation Branch of the Terrestrial Sciences Division, and the Polar Atmospheric Processes Branch of the Space Physics Division were abolished. The Chemical Physics Branch of the Aeronomy Division was reduced from 15 to 5 people and made a part of the Composition Branch. The rest of the reductions were taken by small cut-backs in other areas and in Research Services.

1976, cont'd

Additional organizational consolidations were announced at this time. The Ionospheric Physics Division was abolished. The Ionospheric Dynamics and Trans-Ionospheric Propagation Branches were incorporated into the Space Physics Division. The Spectroscopic Studies Branch of the Aeronomy Laboratory was merged into the Ultraviolet Radiation Branch. Detachment 3 of the Aerospace Instrumentation Division at Chico Municipal Airport, California, was abolished, and its military personnel were transferred. The Energetic Particles Branch of the Space Physics Division was merged into the Geomagnetism Branch. Lastly, AFGL's Laboratories were redesignated as Divisions.

- Jun AFGL closed its Geopole Observatory at Thule, Greenland, in operation since 1958. This terminated the program of upper atmospheric research on the central polar cap.
- Jun AFGL hosted the Fourth Sounding Rocket Technology Conference sponsored by the AIAA (American Institute for Aeronautics and Astronautics).
- 3 Aug Preliminary data for earth limb and zodiacal radiances were obtained from a rocket probe at White Sands Missile Range, New Mexico, as part of AFGL's ongoing infrared backgrounds measurement programs, conducted for Space Division.
- Aug AFGL tested a new, flush-mounted UHF telemetry and C-Band beacon antenna, developed for the Ute/Palute-Tomahawk rockets, at the Kwajalein Missile Range.
- Oct A rocket-borne, telescope-spectrograph measured coronal temperatures via the Lyman-alpha line during the solar eclipse.

Two Laboratory-developed systems were completed for use on the future SCATHA (Spacecraft Charging at High Altitudes) satellite. The Satellite Electron Beam System and the Satellite Positive Ion Beam System were planned to test different techniques for controlling vehicle potential.

The U.S. Standard Atmosphere, 1976 was published. It included AFCRL's revisions for the 50-90 km altitude range.

1976, cont'd

The initial East-to-West network of AFCRL's Magnetometer Network began archiving data. The five stations spaced across the northern U.S. at about 55 degrees N corrected geomagnetic latitude were instrumented with fluxgate and searchcoil magnetometers to monitor magnetic activity from the ground.

In the winter of 1976-77 AFGL began the Optical Atmospheric Quantities in Europe (OPAQUE) field measurements program.

AFGL's Weather Radar Facility developed a new Doppler processing scheme, the pulse-pair technique, for speedy calculation of the velocity structure within storm systems.

In the winter of 1976-77, AFGL's Man-computer Interactive Data Access System (McIDAS) acquired the capability to receive direct transmissions from the Geostationary Operational Environment Satellite (GOES) series.

The first version of the catalog entitled The AFGL Four Color Infrared Sky Survey was published.

An upgraded facility to calibrate ultraviolet instruments for rocket, satellite and other uses became operational at AFGL. It offered a single-direction light source, eliminating the need to rotate spectrometers being tested.

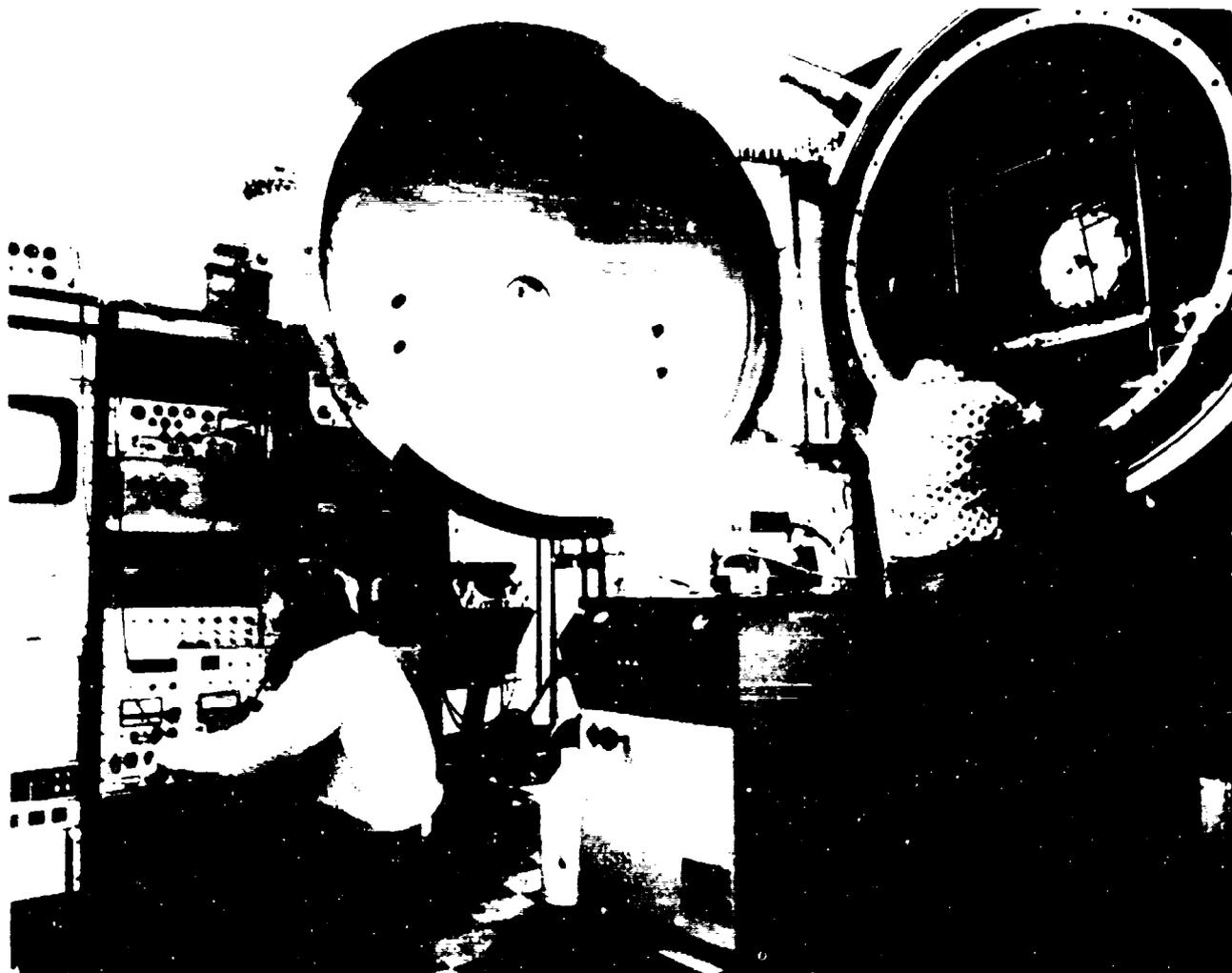
The Optical Physics Division's new laboratory facility called COCHISE (Cold Chemi-excited Infrared Simulation Experiments) became operational.

AFGL initiated the Background Measurements Program in support of the Space Defense Program. Rocket probes were planned to measure celestial, zodiacal, and earthlimb infrared backgrounds.

1977

18 Jan

Laurence G. Hanscom Air Force Base was redesignated Hanscom Air Force Base.



The COCHISE facility shortly after it became operational, showing the reaction vessel inside the cryogenically-pumped vacuum chamber and the computer control and data acquisition system.

1977, cont'd

- Jan A prototype MAWS (Modular Automated Weather System) was installed for a two-year demonstration test at Scott Air Force Base, Illinois. The MAWS system provided weather sensing technology needed for the development of the Automated Weather Distribution System.
- Mar This date marked the close of six consecutive winter seasons of testing at Wallops Island, Virginia, in support of the Advanced Ballistic Reentry System (ABRES) Program. AFGL provided specialized weather inputs for the test trajectories.
- 20 May AFGL provided NASA with balloon support for a drop-test of the Pioneer probe vehicle designed to explore the atmosphere and surface of Venus.
- Jun The first satellite in the Defense Mapping Agency's Satellite Positioning Program was launched. This series carried a new single proof mass triaxial accelerometer developed by AFGL for density and gravity studies.
- 28 Sep The Spectral Infrared Rocket Experiment (SPIRE) was conducted from Poker Flat Range, Alaska. Using a cooled spectrometer, it obtained the first infrared day-night profile of earthlimb radiance.
- Oct The Cloud Physics Branch began a systematic study of the microphysics of large-scale cloud systems using its specially instrumented MC-130E aircraft.
- 11 Nov AFGL launched its the first payload in its Multispectral Measurements Program (MSMP), a follow-on to Project Chaser. The Target Engine Measurements (TEM-1) experiment utilized a new rocket payload which divided into two parts during flight. A sensor module traced and recorded the radiating exhaust plumes from a small rocket motor. For the MSMP program, AFGL initiated its use of the Aries rocket, the first guided sounding rocket.
- Late in the year, AFGL's Magnetometer Network reached its full complement of seven stations.
- AFGL conducted a special study at Vandenberg Air Force Base to establish expected motion levels at the SLC-6 complex planned for Space Shuttle launches.

1977, cont'd

AFGL completed an effort to investigate the Boundary Layer Model in use at the Air Force Global Weather Central's computer for possible improvements in its forecasts.

1978

- 16 Mar DoD issued a Plan for Atmospheric Transmission Research and Development. The Air Force delegated to AFGL the responsibility for updating transmission and data codes (LOWTRAN and HITRAN) now in standard use throughout DoD. AFGL was also directed to hold an annual review conference.
- Mar The Air Force launched the S3-4 satellite, carrying AFGL's Vacuum Ultraviolet Sensor. Its performance demonstrated the potential for vacuum ultraviolet sensors to detect auroral excitation regions by day as well as night.
- 16-18 May The first DoD Annual Review Conference on Atmospheric Transmission Models was held at AFGL.
- May The Geodesy and Gravity Branch made its first field measurements with the second-generation absolute gravity measuring system. The new version of the laser-interferometer apparatus required less time for observation and reduced the weight of the system from 2500 to 800 pounds.
- 20-21 Jun AFGL made its first deployment of the tethered balloon antenna system designed for the LORAN Program Office. The test demonstrated the effectiveness of Kevlar cables developed by the Aerospace Instrumentation Division.
- 27 Jun The Navy launched its SEASAT-1 satellite. Although the satellite failed after several months, one global set of improved altimetric data for gravity studies was acquired.
- 21-23 Aug The Tenth AFGL Scientific Balloon Symposium was held at Portsmouth, New Hampshire.

1978, cont'd

At the request of the Weapons Laboratory's TRESTLE Program Office, AFGL installed a MAWS (Modular Automated Weather System) for wind warning at the TRESTLE site in New Mexico.

Oct The first data-gathering flight was conducted in the Balloon Altitude Mosaic Measurements (BAMM) Program. Infrared sensors recorded the backgrounds for new downward-looking mosaic staring surveillance sensors.

The Optical Physics Division issued the first edition of FASCODE (Fast Atmospheric Signature Code), a line-by-line computational package utilizing the HITRAN data base.

AFGL began work as consultant to the Ballistic Missile Organization, conducting seismic studies for the MX Program.

Three AFSC Laboratories (Armament, Geophysics, and Avionics) began a program to develop a Tactical Decision Aid for infrared electro-optical weapons systems.

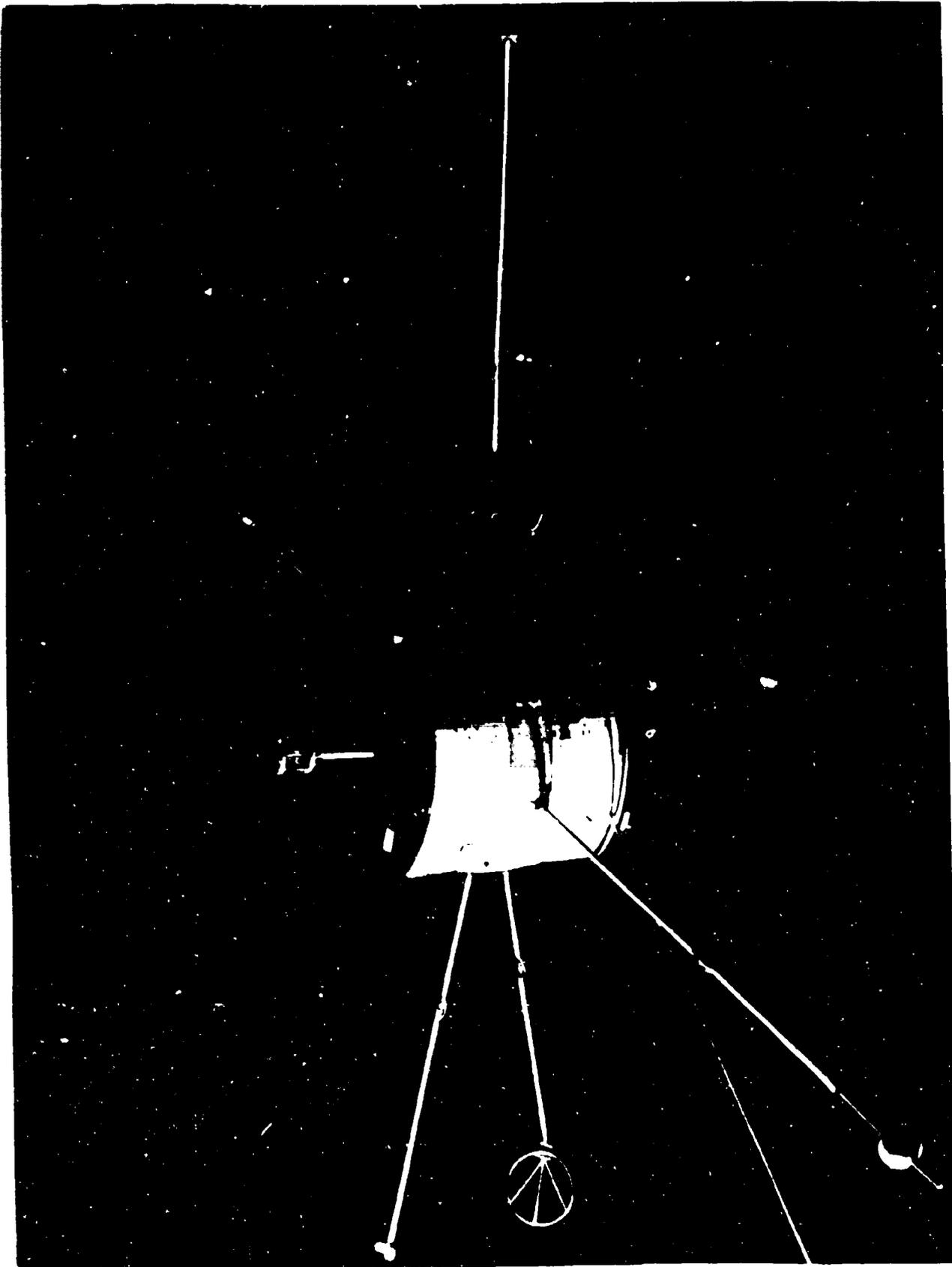
1979

1 Jan The SCATHA (Spacecraft Charging at High Altitudes) satellite, designated S78-1, was launched into an equatorial, near-geosynchronous orbit. It carried AFGL experiments for measuring electric fields and particle fluxes and for controlling spacecraft charging using active techniques.

Jan AFGL resumed tests started for the Air Force Flight Test Center in 1975 to verify icing and precipitation conditions anticipated during aircraft refueling.

26 Feb AFGL observed chemical reactions in the D and E regions of the ionosphere during a solar eclipse as part of the Eclipse 79 Program. This large international effort conducted at Red Lake, Ontario, Canada, seized the last opportunity to study a total solar eclipse in the Northern Hemisphere during this century.

6- AFGL held its first Workshop on Geomagnetism.
7 Apr



An artist's conception of the SCATHA satellite in orbit, showing its electric and magnetic field sensors extended.

1979, cont'd

- 19 Jun In a high-altitude balloon flight from Eielson Air Force Base, Alaska, AFGL tested CR-39 plastic track detector as a potential improved material for recording the passage of cosmic-ray iron nuclei.
- 17 and 23 Jul AFGL launched rocket-borne ion mass spectrometers from the Kwajalein Atoll in the Pacific. The probes were part of the Defense Nuclear Agency's "Plumex" Program to study the causes of equatorial scintillations.
- 31 Jul Colonel James E. Baker replaced Colonel Bernard S. Morgan, Jr., as Commander of AFGL.
- 12 Oct Third data-gathering flight for the Balloon Altitude Mosaic Measurements Program took place. This last of the BAMB-1 series was flown from Keesler, Mississippi. (The second one in May 1979 flew from Holloman Air Force Base, New Mexico.)
- 12 Oct-12 Nov AFGL conducted a series of five tests for NASA at the Dugway Proving Ground, Utah, in order to determine the extent of carbon fiber burns from a simulated aircraft crash. A pair of interconnected, widely separated tethered balloons raised and lowered a net of Kevlar cable to collect the effluents.
- 19 Oct The Excede Spectral Experiment was launched from Poker Flat, Alaska. An electron accelerator simulated an artificial aurora in order to make a controlled study of radioactive processes. The 5850 pound payload was the heaviest known on a sounding rocket.
- Dec An AFGL field campaign near Ascension Island revealed an extremely irregular ionospheric structure and intense scintillations not previously known. (The Laboratory's equatorial scintillation campaigns began in October 1976.)
- At the request of the Army's Ballistic Missile Division, AFGL prepared the Kwajalein Reference Atmospheres, 1979.
- The Weather Radar Branch participated in the 1979 joint Doppler Operational Project. The good performance of Doppler technology in detecting tornadoes decided its selection for the Next Generation Weather Radar (NEXRAD) system, which is being developed jointly by the Departments of Commerce, Defense and Transportation.

1979, cont'd

AFGL's newly developed Geokinetic Data Acquisition Stand-Alone System was used for the first time for seismic field studies in Nevada.

AFGL and the National Oceanic and Atmospheric Administration co-sponsored a Solar-Terrestrial Predictions Workshop to study the propagation of solar protons from flare sites to the earth.

In the winter of 1979-80, AFGL completed environmental testing of the Rosemont Ice Detector as part of a program to develop a climatology of ice accretion for Air Force systems.

1980

- 14 Feb NASA launched the Solar Maximum Mission (SMM) satellite. AFGL's Solar Research Branch participated in the satellite experiments, which were part of an international program for the solar maximum year.
- 21 May AFGL launched its one-thousandth sounding rocket from the White Sands Missile Range, New Mexico. The Aries rocket carried the second Target Engine Measurements (TEM-2) payload in the Multispectral Measurements Program.
- May The Air Force Systems Command and NASA signed the "Agreement for NASA/OAST-USAF/AFSC Space Interdependency on Spacecraft Interactions." AFGL's part in this eight-year program included studying and modeling large space systems/environment interactions, and issuing engineering and test standards for systems design.
- Jun Colonel Baker, AFGL Commander, decided that the 1965 edition of the Handbook of Geophysics should be updated.
- 18 Aug The rocket-borne, zodiacal infrared probe (ZIP) experiment was launched from White Sands, New Mexico. This was the first probe in the Background Measurements Program. (A second ZIP probe took place on 31 July 1981.)

1980, cont'd

- 18 Sep The last of five rocket probes between 1976 and 1980 was flown from White Sands in order to measure solar ultraviolet radiation during the rising phase of the solar cycle.
- 11 Nov AFGL participated in the International Energy Budget
1 Dec Campaign conducted in Norway and Sweden. This large-scale ground and rocket program studied heating input and dissipation in the high-latitude upper atmosphere during three levels of geomagnetic activity.
- 4- AFGL participated in the Defense Nuclear Agency's
12 Dec Project PLACES (Position Location and Communication Effects Simulations).
- 17 Dec The first test of AFGL's MITES (Miniature Interferometric Terminal for Earth Surveying) system, developed under contract with M.I.T., was conducted near Haystack Observatory in Westford, Massachusetts.
- The first experiments were performed using AFGL's new Selected Ion Flow Tube. Designed and fabricated at the Laboratory, this SIFT apparatus was the first to run on negative as well as positive ions.
- The Engineering designs were completed for a ground-based LIDAR (Light Detection and Ranging) system. The two-color neodymium-Yag laser was programmed to discriminate between Rayleigh and Mie scattering.
- The Applied Crustal Physics Branch installed a bi-axial tiltmeter at the University of California's Pinon Flat Geophysical Observatory.
- The Solar Research Branch achieved significantly higher accuracies in its daily forecasts of solar flares by upgrading its Multivariate Discriminant Analysis (MVDA) technique and its flare data base.
- AFGL provided the Air Force Weapons Laboratory with a series of reports on particle distribution in cirrus clouds in support of AFWL's laser-beam weapons program.
- AFGL's Meteorology Division launched a new research program in atmospheric dynamics to create an improved global numerical weather prediction model.

GLOBAL POSITIONING SYSTEM MITES

GPS SATELLITES

ANTENNA RECEIVER

1980, cont'd

The Geodesy and Gravity Branch completed analysis of the more than 3000 range measurements made during the 1970's between McDonald Observatory in Texas and four of the retroreflectors placed on the moon by Apollo and Soviet space missions.

AFGL concluded its extensive weather and density measurement campaigns conducted at the Kwajalein Missile Range during the 1970's. The campaigns supported the ABRES (Advanced Ballistic Reentry System) Program.

1981

- 26-
27 Jan AFGL held an International Workshop on the Earth's Radiation Belts.
- 28 Feb AFGL's Airborne Ionospheric Observatory completed 27 flights in support of the Over-the-Horizon Backscatter (OTH-B) Experimental Radar System.
- Feb AFGL's Weather Systems Program, the first advanced development program fully managed by the Laboratory, was officially started.
- 6 Mar A cover story in the journal Science featured the new turbulence transport parameter (in the vertical direction) developed at AFGL as part of the stratospheric environment program.
- 6-
7 Mar The Auroral E Program was conducted at Poker Flat Research, Alaska. A battery of rocket, ground, aircraft and radar instrumentation measured the diffuse aurora in the E-layer of the ionosphere.
- 20 Mar Dr John N. Howard, the Laboratory's first Chief Scientist who was appointed in 1964, retired.
- 1 Apr The Meteorology Division's MC-130E aircraft was transferred to another mission.
- 22-
23 Apr The first Tri-Service meeting to discuss revision and expansion of MIL-STD-210B "Climatic Extremes for Military Equipment" was held at AFGL.

1981, cont'd

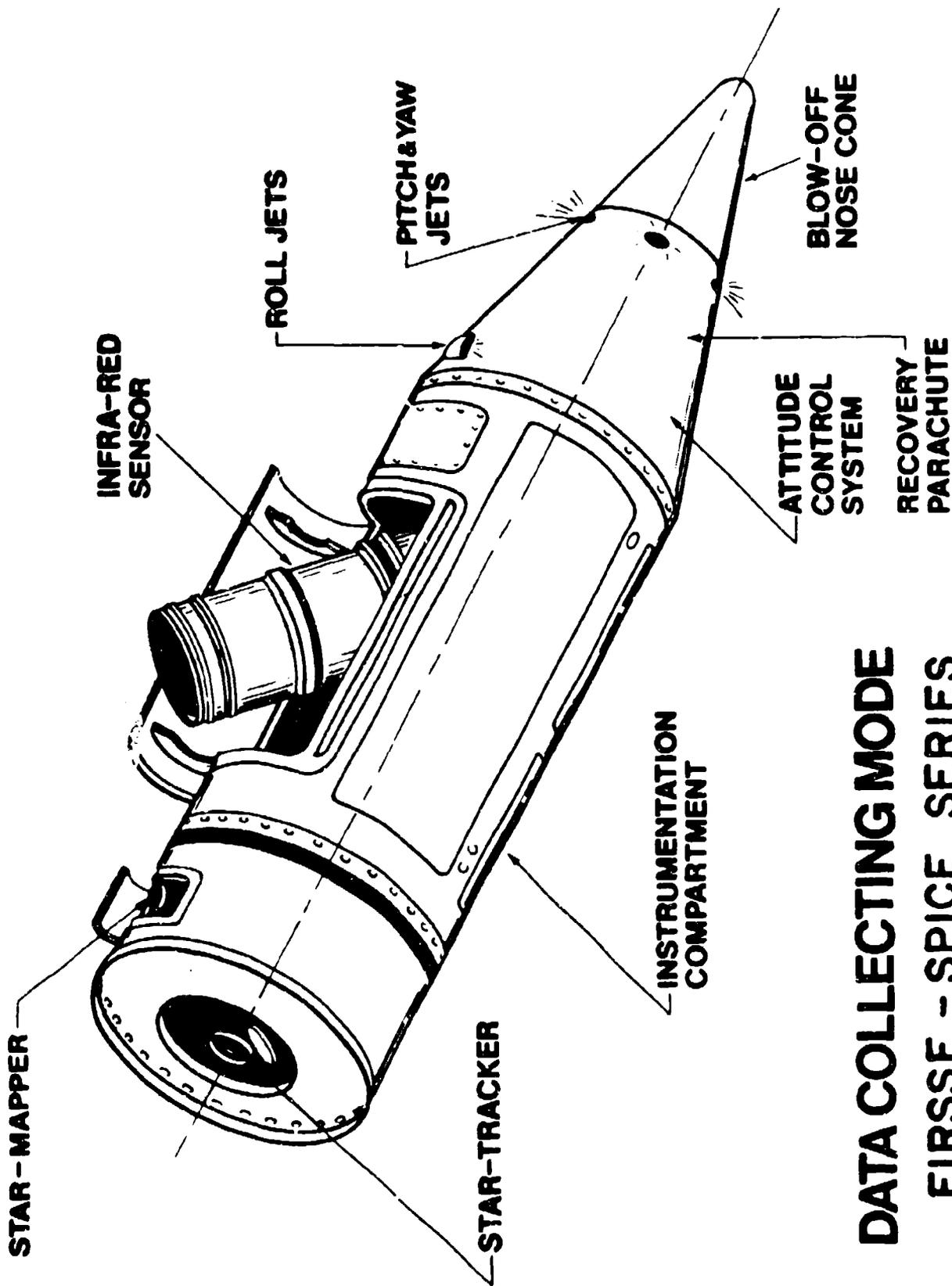
- 10 Jun The NASA Atmospheric Explorer (AE-E) satellite terminated operations after transmitting 5 1/2 years worth of solar ultraviolet data during the rising half of the solar cycle.
- 13 Jun Col James E. Baker, AFGL Commander, departed to become Commander at the Air Force Office of Scientific Research. Col Gerald P. D'Arcy, AFGL Vice Commander, became Acting Commander of the Laboratory.
- Jun-Aug AFGL participated in a cooperative field program at the Millstone Hill Radar Facility, Westford, Massachusetts, to systematically compare techniques for measuring optical turbulence.
- 27 Jul-7 Aug AFSC's Inspector General conducted a Management Effectiveness Inspection of AFGL.
- Jul The Space Physics Division installed a jumbo space simulation vacuum chamber, to be used for studying charging and discharging processes and preparing space vehicle payloads.
- 10 Aug AFGL demonstrated its newly developed Weapons Support System (WSS) at the Defense Mapping Agency Aerospace Center.
- 1 Sep Col John Friel took up his station as AFGL Commander.
- 1 Sep AFGL flight-tested an Air Launched Balloon System (ALBS) prototype.
- 18 Sep AFGL was notified that it had won AFSC's Laboratory Outstanding Technical Achievement Award for January-March 1981.
- Sep AFGL was notified that it had won the Air Force Outstanding Unit Award for the years 1978-80.
- 2 Oct The program for Multiple Protective Shelter Basing Mode for the MX Missile was canceled by President Reagan.
- 5 Oct-30 Nov The Meteorology Division conducted tests on the Electronics Systems Division's Digital European Backbone (DEB) Line-of-Site Links.

1981, cont'd

- 7 Oct AFGL was designated as lead laboratory to manage the Moving Base Gravity Gradiometer Program funded by the Defense Mapping Agency.
- 16 Nov AFGL completed the preparation of instruments to measure contamination and electrical distortions of the Space Shuttle environment.
- 2-4 Dec AFGL held its Second Geomagnetism Workshop.
- Dec-Feb The SNOW 1-A tests conducted by the Cold Regions Research and Engineering Laboratory (CRREL), U.S. Army, at Camp Ethan Allen in Jericho, Vermont, used AFGL's instruments for atmospheric transmission and snow characterization.

1982

- 4 Jan The Optical Physics Division completed the preparation of the Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS 1) experiment.
- 11 Jan Dr A. T. Stair, Jr., Chief of the Radiation Effects Branch, was named as AFGL's second Chief Scientist.
- 14-15 Jan AFGL Airborne Ionospheric Observatory supported Mr Walter Cronkite's CBS "Universe" team, which filmed a TV program on the aurora and defense research.
- 23 Jan The Far Infrared Sky Survey Experiment (FIRSSE) payload was launched from White Sands Missile Range, New Mexico. This Background Measurements Program (BMP) probe measured the celestial background at far infrared wavelengths.
- 19 Mar AFGL's 84-foot dish antenna at Sagamore Hill Solar Radio Observatory, Hamilton, Massachusetts, which had been erected in 1958, was demolished.
- 30 Apr The first data-gathering flight in the BMM-II Balloon Program was launched from Chico, California.
- 21 May The first flight of Balloon-Borne Ion Mass Spectrometer (BBIMS) was launched from Holloman AFB, New Mexico, to study the ion chemistry of the stratosphere.



DATA COLLECTING MODE FIRSE - SPICE SERIES

1982, cont'd

- 28 May The third Target Engine Measurements (TEM-3) payload was launched from White Sands Missile Range, New Mexico.
- 1 Jun The plans for a new Air Force Geophysics Scholar Program to begin in 1982-83 were finalized.
- 21 Jun The Air Force announced the creation of a new Space Command. AFGL, together with the Air Force Weapons Laboratory and the Air Force Rocket Propulsion Laboratory, was assigned to a new Space Technology Center at Kirtland AFB, New Mexico, under the Air Force Space Division.
- 17 Jul AFGL drop-tested a simulated Galileo probe for NASA at White Sands Missile Range, New Mexico.
- 8-13 Sep Rocket launches were conducted for the Brazil Ionospheric Modification Experiments (BIME) Program were conducted in Natal, Brazil. This joint AFGL/Brazilian program tested a method for artificially creating ionospheric irregularities in equatorial regions.
- 14 Sep The second Survey Program Infrared Celestial Experiments (SPICE-2) payload in the BMP Program was launched from White Sands Missile Range, New Mexico.
- 14-15 Sep AFGL sponsored a Workshop on Natural Charging of Large Space Structures in Near Earth Polar Orbits.
- 23 Sep The Implementation Plan for the new Air Force Space Technology Center was issued.
- Sep It was announced that the fourth and final site for the Radio Solar Telescope Network, would be located at San Vito, Italy.
- 1 Oct As of this date AFGL was assigned to Space Technology Center.
- 22 Oct AFGL delivered the SCATHA Environmental Atlas to Space Division.
- Nov During the launch of Space Shuttle STS-5, AFGL measured the seismo-acoustic environment of the launch pad at Kennedy Space Center.

1982, cont'd

Dec The Air Force launched the Defense Meteorological Satellite Program's F6 Satellite, carrying the new AFGL SSJ/4 sensor (upward-looking, electrostatic analyzers) and its SSIE (Special Sensor Ions and Electron) sensor.

1983

Jan-Mar Tethered Aerostat Cold Weather Tests were conducted at Camp Ethan Allen, Vermont, in support of the Arctic Distant Early Warning (Dew Line) Defense System.

31 Jan A Memorandum of Agreement was signed between AFGL and the Brazilian Air Force's Centro Tecnico Aeroespacial (CTA) for a joint five-year sounding rocket program.

28 Feb AFGL awarded the system development contract for the Gravity Gradiometer Survey System (GGSS) to Bell Aerospace Textron, Inc.

15 Mar The termination of the High Performance Target Engine Measurements (HPTEM) Program was announced.

18 Mar The Earth Limb Infrared Atmospheric Structure (ELIAS) payload was launched from Poker Flat Research Range, Alaska, and made the first simultaneous two-color measurements of auroral spatial structure in an earth limb mode.

23 Mar President Reagan announced a new Strategic Defense Initiative (the "Star Wars" speech).

1 Apr AFGL terminated its balloon-launching facilities at Chico Municipal Airport, California, leased since 1961.

6 Apr The President's Commission on Strategic Forces (the Scowcroft Commission) issued its report.

12 Apr AFGL launched the Field-Widened Interferometer (FWI) payload from Poker Flat Research Range, Alaska. The instrument obtained the first high-resolution measurements of minor infrared emitters as a function of altitude during a low-level aurora.

19 Apr A rocket-borne ultraviolet experiment was launched from White Sands Missile Range, New Mexico. This was the last planned flight by AFGL of the Aerobee, a sounding rocket first launched in 1946.

1983, cont'd

- 27-
28 Apr The CIRRES 1A Critical Design Review was held at Utah State University, Logan, Utah.
- 10 May The Air Force Space Test Program approved a Space Flight Plan for AFGL's Space Radiation (SPACERAD) Program on board the CRRES (Combined Release/Radiation Effects) satellite.
- 19-
20 May Tri-Service Aerosol and LIDAR (Light Detection and Ranging) Workshops were held at AFGL in conjunction with the Annual Transmission Models Conference.
- 1 Jun The Information Resources Management Division (RM) was established at AFGL.
- 16 Jun The Optical Physics Division published The Revised AFGL Infrared Sky Survey Catalog.
- 27 Jun The HILAT (high-latitude) satellite, a project of Space Division's Space Test Program and the Defense Nuclear Agency was launched. AFGL experiments on board included an ultraviolet sensor (the Auroral Ionospheric Mapper), an SSJ/3 sensor, and a plasma measurements package.
- 2 Jul AFGL's West Coast Office was converted into a West Coast Office for the Air Force Space Technology Center.
- 6-
7 Jul AFGL supplied Air Force representatives to AIAA (American Institute for Aeronautics and Astronautics) panel meetings reviewing the second version of the Military Space Systems Technology Model (MSSTM) for Space Division.
- 25 Jul AFGL provided NASA with a balloon launch for the second and successful drop-test of Project Galileo at Roswell, New Mexico.
- 22 Aug The reorganization of AFGL's Scientific Divisions was announced. The Aeronomy Division (LK) was abolished, and two new divisions, the Ionospheric Physics Division (LI) and the Infrared Technology Division (LS), were created.
- 25 Aug AFGL/RADC's National Federation of Federal Employees Local 1384 signed a renegotiated Memorandum of Agreement for three years with the Commander, 3245th Airbase Group, Hanscom AFB.

1983, cont'd

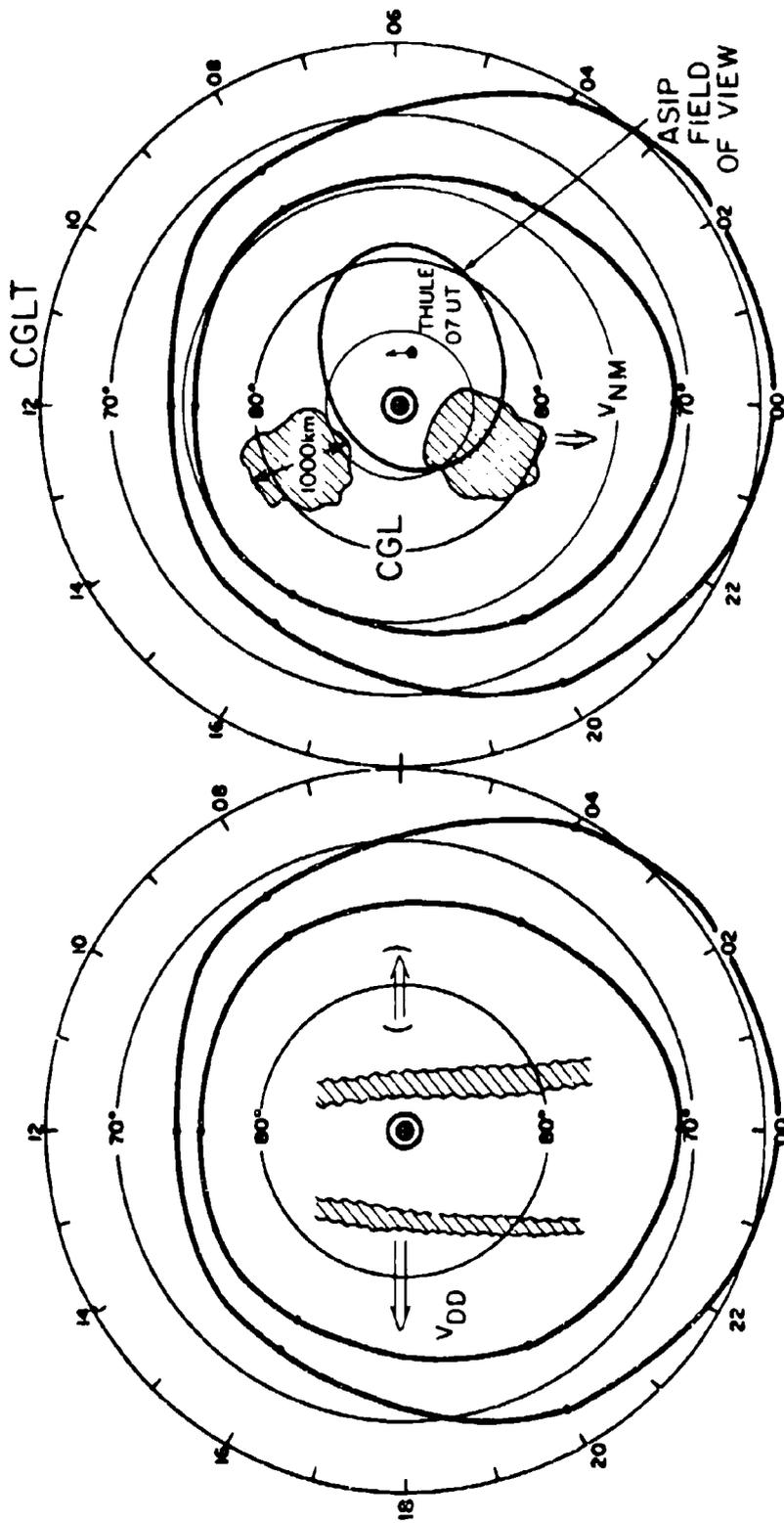
- Aug The Laboratory received a Cyber 170-750 mainframe computer to replace its two CDC 660's in operation since the early 1970's.
- 16 Sep Col John Friel, AFGL Commander, was appointed to be Assistant Deputy Chief of Staff for Plans and Operations at Hq AFSC, effective 15 October 1983. Col Gerald P. D'Arcy, AFGL Vice Commander, was appointed to succeed Colonel Friel as Laboratory Commander.
- 28 Sep The contract for the development of a Flight Model Discharge System (FMDS) for the Space Shuttle was awarded to Hughes Research Laboratories.
- 6 Oct AFGL's new LIDAR (Light Detection and Ranging) facility located on the roof of Wing F became operational.
- 11 Oct AFGL successfully flew its first balloon-borne, high-altitude gravimetry experiment (dubbed DUCKY 1A) from Holloman Air Force Base, New Mexico.
- 15 Oct Colonel John Friel departed to assume his new position at Systems Command Headquarters. Colonel Gerald P. D'Arcy, Vice Commander of AFGL since 1979, assumed command of the Laboratory.
- 18-
20 Oct AFGL and the Office of the Undersecretary of Defense for Research and Engineering sponsored the Tri-Services Infrared Backgrounds Symposium, which was held at the Mitre Corporation, Burlington, Massachusetts.
- 18-
20 Oct AFGL sponsored a Polar Cap Workshop held at the Laboratory.
- 24 Oct The Earth Sciences Division took seismic measurements during the Defense Nuclear Agency's Direct Course Program at Kirtland Air Force Base, New Mexico.
- 25 Oct The Earth Limb Clutter (ELC) rocket-borne experiment was successfully launched from White Sands Missile Range, New Mexico. This concluded a series of probes starting in 1980 for the Background Measurements Program.

1983, cont'd

- 31 Oct
9 Nov Three AFGL/Brazilian Air Force ionospheric modification experiments were conducted at NASA's Wallops Island Facility in Virginia.
- 15-
16 Nov The Critical Design Review for the Gravity Gradiometer Survey System (GCSS) was held at Bell Aerospace Textron, Buffalo, New York.
- 28 Nov Two former Laboratory employees pleaded guilty to charges of conspiracy to steal and receiving stolen government property.
- Dec The Defense Meteorological Program's F7 satellite carrying AFGL's Special Sensor Ions and Electrons (SSIE) sensor, a fluxgate magnetometer, dosimeter, and electrostatic analyzers was launched.
- 31 Dec AFGL's ground-based Magnetometer Network, established in the mid-1970's, ended its data-collecting operations.
- The Laboratory delivered to the Air Weather Service an Operational Tactical Decision Aid (OTDA) for infrared weapons systems. Work began on tactical decision aids for visible and laser weapons.
- The Ionospheric Physics Division characterized two major types of ionospheric irregularities in the polar cap region.
- AFGL successfully tested an automatic active discharge system in a vacuum chamber. A flight model of the system was planned for the BERT-1 (Beam Emission Rocket Test) payload to be flown in FY-85.

1984

- Jan AFGL participated in the Middle Atmosphere Program-Winter in Northern Europe (MAP-WINE), a rocket field program conducted in Norway.
- 17 Jan The Space Radiation Environment and Radiobiological Effects Workshop, sponsored by the Space Physics Division, was held at AFGL.
- Jan A new Fourier Transform Mass Spectrometer was installed at AFGL.



TYPE 2 PATCHES
ANTI-SUNWARD DRIFT

TYPE 1 SUNALIGNED ARCS
DAWN-DUSK DRIFT (PREDOMINANT)

POLAR CAP F REGION STRUCTURES

1984, cont'd

- Feb AFGL participated in performance tests of the Electronic Systems Division's new TRC-170 digital tropo-scatter radio system over the English Channel.
- 1-
19 Mar AFGL conducted the first phase of its vibro-acoustic sounding study of the SLC-6 launch area at Vandenberg Air Force Base, California.
- 2 Mar Colonel Gerald P. D'Arcy, AFGL Commander, was appointed to be Commander of the Air Force Office of Scientific Research. Colonel John Friel, the previous Laboratory Commander, was appointed to be Commander of the Air Force Space Technology Center at Kirtland Air Force Base, New Mexico.
- 28 Mar AFGL's pilot Local Area Network became fully operational.
- 30 Mar Colonel Joseph D. Morgan, III, Deputy for Development Plans, Electronics Systems Division, was selected to assume command of AFGL.
- May AFGL's MITES System completed successful tests on the Eifel Geodetic Network, West Germany.
- 1 Jun The second and last flight in the second series of Balloon Altitude Mosaic Measurements (BAMM II-A) was launched from Corpus Christi, Texas.
- 15 Jun AFGL's Conference Room #2 was renamed the "Rocco S. Narcisi Conference Room," in honor of the recently deceased scientist who served as Chief of the Composition Branch from 1965-1984.
- 15 Jun A Change of Command Ceremony was held at AFGL with Colonel John Friel, Commander of the Air Force Space Technology Center, presiding. Colonel Joseph D. Morgan, III, took up his station as AFGL Commander.
- Jun AFGL presented an advanced model for cloud-cover simulations, the Sawtooth Wave Model. It developed out of an earlier AFCRL model for aerial coverage (Gringorten-B).
- 1 Jul The Boston Area NEXRAD (Next Generation Weather Radar) Demonstration was successfully completed.

1984, cont'd

- 5 Jul The Stratospheric Cryogenic Interferometer Balloon Experiment (SCRIBE) launched from Holloman AFB, New Mexico, measured infrared emissions of minor atmospheric constituents.
- 16-20 Jul The Critical Design Review for the Combined Release/Radiation Effects Satellite (CRRES) was held at Ball Aerospace Systems Division, Boulder, Colorado.
- 7-8 Aug A Sensor Design Concept Review for the Large Aperture Infrared Telescope System (LAIRTS) Program was held at AFGL.
- 23 Aug The first Airborne Balloon Laser (ABLE) system flew from White Sands Missile Range, New Mexico.
- Aug By the end of the month the main sensor for the SPIRIT-1 (Spectral/Spatial Infrared Radiometer Interferometer, Telescoped) Program successfully completed cryogenic testing.
- Summer The Air Force satellite S85-1 was launched. It carried the last in a series of AFGL's satellite electrostatic triaxial accelerometers.
- 1 Sep AFGL selected experiments for the Interactions Measurements Payload for Shuttle (IMPS) system.
- 14 Sep The Army Corps of Engineers signed a \$2.23 million contract with M. G. Allen Construction Company, Warwick, Rhode Island, to construct a Payload Verification and Integration Facility at AFGL.
- 17-22 Sep AFGL coordinated a multi-agency program for global observations of short-term variability in ionospheric transmission characteristics.
- 20 Sep The Information Resources Management Division began staff training sessions to implement the automation of Laboratory data bases.
- 20 Sep The Laboratory received the initial funding from Air Force Systems Command in a five-year program to repair and replace roofing at AFGL.
- Sep AFGL conducted continuous, month-long turbulence and imaging measurements at the White Sands Missile Range in support of the Air Force Weapons Laboratory's High Energy Laser Program.

1984, cont'd

- Sep The final floor plans for a comprehensive reallocation of space at AFGL Headquarters were approved, and work started on alterations in Wing C.
- 1 Oct Colonel Morgan, AFGL Commander, directed the formation of a Balloon Study Committee to assess AFGL's balloon capabilities and support requirements.
- 5 Oct The Space Shuttle Challenger (STS 41-G) carrying AFGL's auroral photography experiment was launched from the Kennedy Space Center, Florida.
- 22 Oct A ground-breaking ceremony was held for AFGL's Payload Verification and Testing Facility.
- Oct The main campaign for Project MERIT (Measurement of Earth Rotation and Intercomparison of Techniques) concluded. AFGL's Geodesy and Gravity Branch was a major participant in this international campaign which began in September 1983.
- Oct AFGL completed a high-resolution, global spectral model tailored to moisture and cloud prediction studies. By demonstrating the value of representing moisture in the form of relative rather than specific humidity, the model contributed to improving Air Force operational forecasting.
- 6 Nov AFGL's Tethered Aerostat Antenna Program (TAAP) system participated with great success in a worldwide Defense Communication Agency Technical Test.
- 15 Nov Colonel Morgan established within AFGL an independent Tiger Team to assess the status of the CIRRIS 1A Program.
- Nov The Satellite Meteorology Branch completed installation of the central hardware for its planned McINNES (Man-computer Interactive Network System) facility.
- Nov The Infrared Technology Division dedicated its conference room to four staff members killed in the June 1971 aircraft accident.
- 4 Dec Colonel Morgan directed the formation of the CIRRIS 1A Program Office.
- 31 Dec The hardware design of the SPACERAD Microelectronics Package for the CRRES satellite was completed.



AFGL Headquarters in mid-1985.
In the foreground, the frame of the new Payload
Verification and Integration Facility.

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- Appendix A: Commanders of the Air Force Geophysics Laboratory and Its Predecessor Organizations
- Appendix B: Designations, Headquarters, and Commands, 1945-1985
- Appendix C: Internal Organization of the Laboratory in 1952, 1970, and 1984
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COMMANDERS OF THE AIR FORCE GEOPHYSICS LABORATORY
AND
ITS PREDECESSOR ORGANIZATIONS

Air Force Geophysics Laboratory

18 Jul 1985 - present - Col J. R. Johnson
 15 June 1984 - 18 July 1985 - Col Joseph D. Morgan III
 7 October 1983 - 15 June 1984 - Col Gerald P. D'Arcy
 1 September 1981 - 7 October 1983 - Col John Friel
 13 June 1981 - 1 September 1981 - Col Gerald P. D'Arcy (Acting)
 31 July 1979 - 13 June 1981 - Col James E. Baker
 1 January 1974 - 31 July 1979 - Col Bernard S. Morgan, Jr.

Air Force Cambridge Research Laboratories

1 June 1971 - 1 January 1974 - Col William K. Moran, Jr.
 1 July 1968 - 1 June 1971 - Col Dale J. Flinders
 18 October 1965 - 1 July 1968 - Col Robert F. Long
 27 October 1964 - 18 October 1965 - Col Leo A. Kiley
 25 September 1960 - 27 October 1964 - Brig Gen Benjamin G. Holzman
 1 August 1960 - 24 September 1960 - Col Ernest A. Pinson

Detachment 2, Headquarters Air Force Research Division

2 May 1960 - 1 August 1960 - Col Ernest A. Pinson

Air Force Cambridge Research Center

1 November 1958 - 2 May 1960 - Col Elmer W. Richardson
 22 July 1956 - 1 November 1958 - Maj Gen William M. Morgan
 18 March 1953 - 22 July 1956 - Maj Gen Raymond C. Maude
 28 August 1951 - 18 March 1953 - Maj Gen James F. Phillips
 1 July 1951 - 28 August 1951 - Col Harvey D. Davidson

Air Force Cambridge Research Laboratories

5 July 1949 - 1 July 1951 - Col Hugh Mitchell

Cambridge Field Station

26 May 1949 - 5 July 1949 - Col Hugh Mitchell

30 July 1948 - 26 May 1949 - Col Marcellus Duffy

14 June 1948 - 30 July 1948 - Lt Col Wilfred H. Tetley

14 April 1947 - 14 June 1948 - Col Hugh Mitchell

17 September 1946 - 14 April 1947 - Maj Labat T. Fletcher

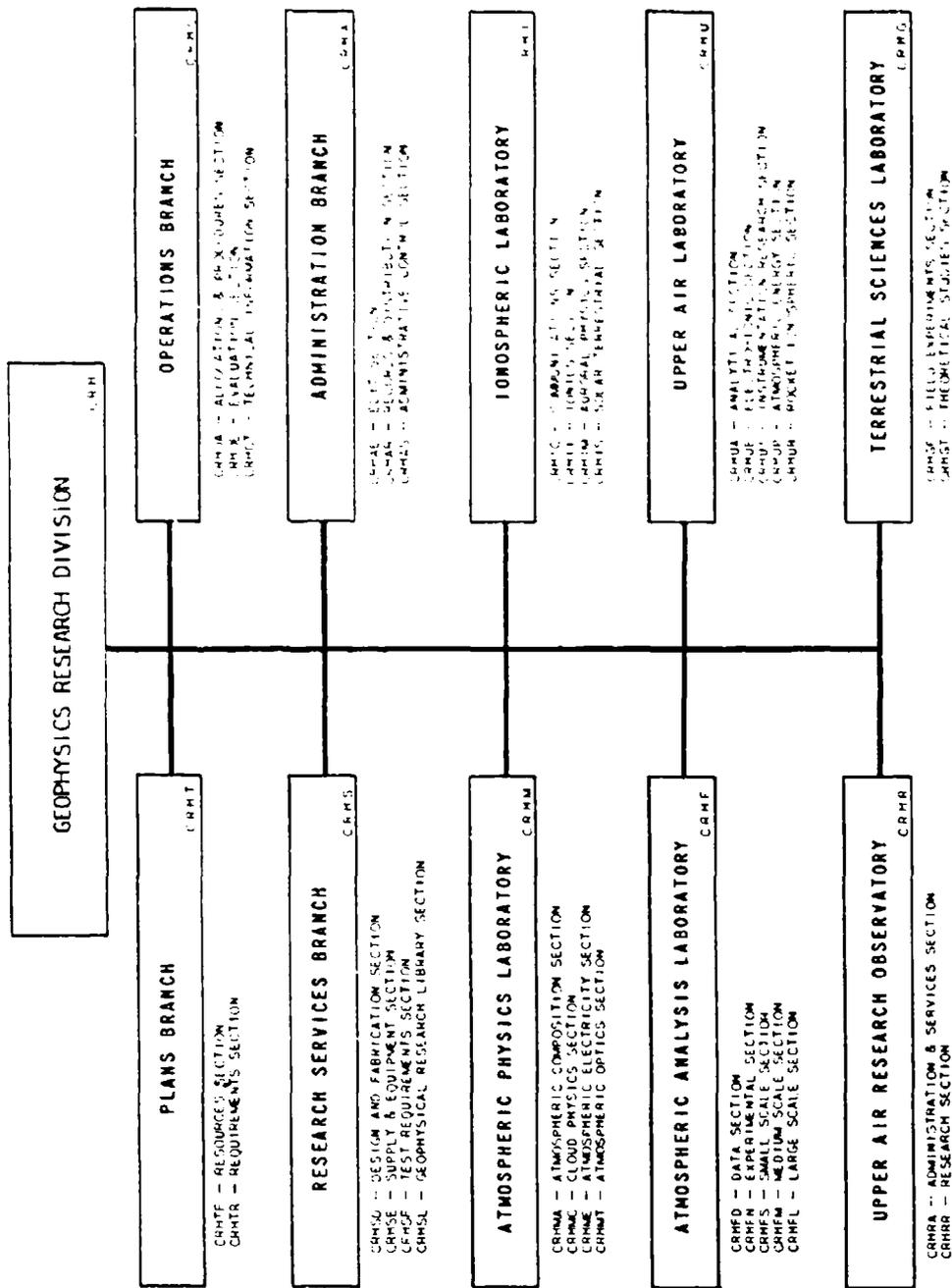
20 September 1945 - 17 September 1946 - Maj John W. Marchetti

<u>Designation</u>	<u>Dates</u>	<u>Headquarters</u>	<u>Command</u>
Cambridge Field Station (CFS)	20 September 1945- 5 July 1949	Watson Laboratories, Red Bank, N.J. 20 September 1945- 1 December 1947	Air Technical Service Command (in 1946 re- named the Air Materiel Command), 20 September 1945-2 April 1951
Air Force Cambridge Research Laboratories (AFCRL)	5 July 1949- 28 June 1951		
Air Force Cambridge Research Center (AFCRC)	28 June 1951- 2 May 1960		Air Research and Develop- ment Command (ARDC) 2 April 1951-1 April 1961
Detachment 2, Headquarters, Air Force Research Division (AFRD)	2 May 1960- 1 August 1960	Air Force Research Division	
Air Force Cambridge Research Laboratories (AFCRL)	1 August 1960- 15 January 1976**		Office of Aerospace Research (OAR)* 1 April 1961- 1 July 1970
Air Force Geophysics Laboratory (AFGL)	15 January 1976- present	Director of Labora- tories, 1 July 1970- 1 October 1982	Air Force Systems Command (AFSC) 1 July 1970-present
		Space Technology Center 1 October 1982-present	

*The Office of Aerospace Research had command status and reported directly to Headquarters USAF.

**Two Divisions of AFCRL were transferred to the jurisdiction of the Rome Air Development Center (RADC) on 1 January 1976.

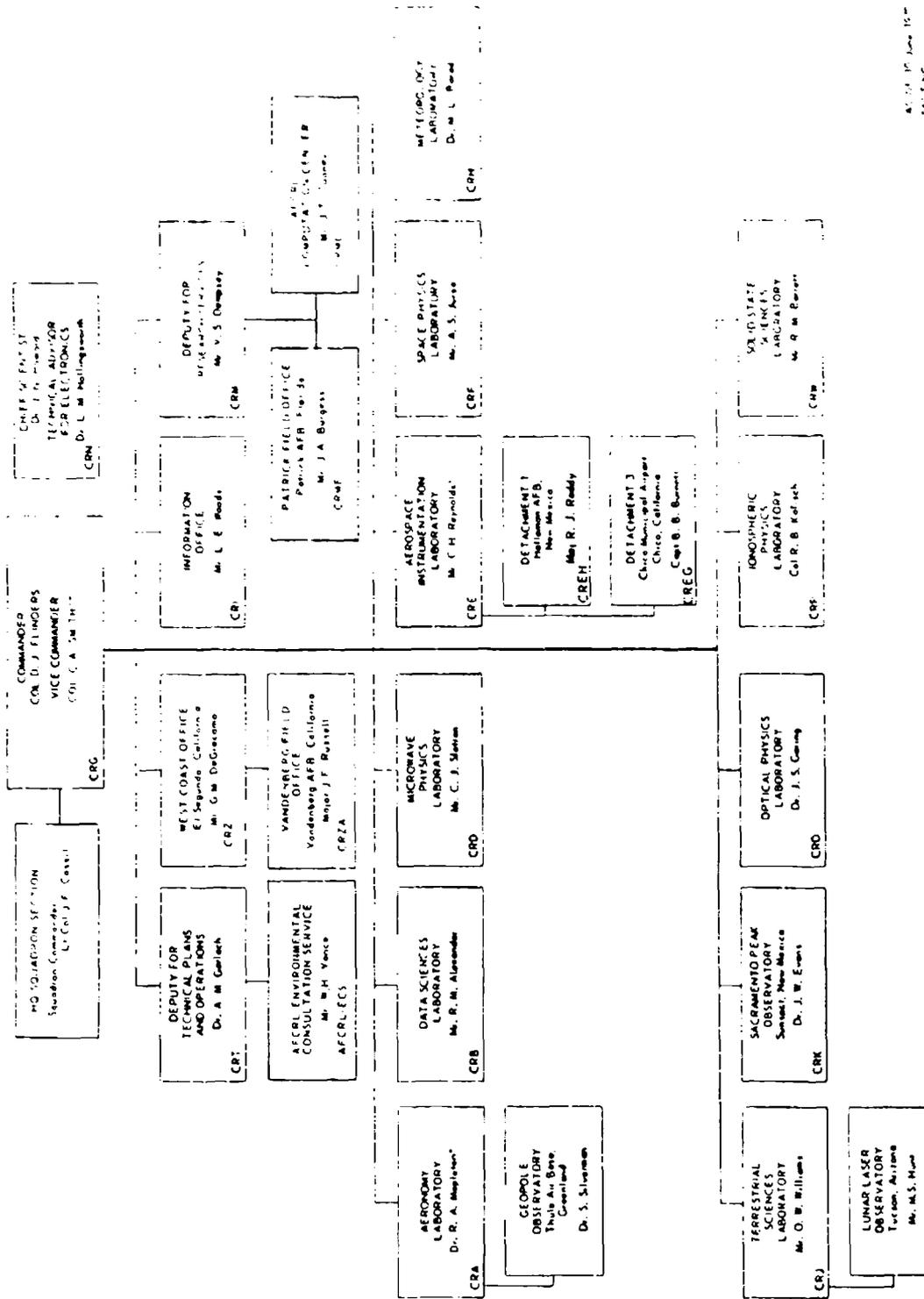
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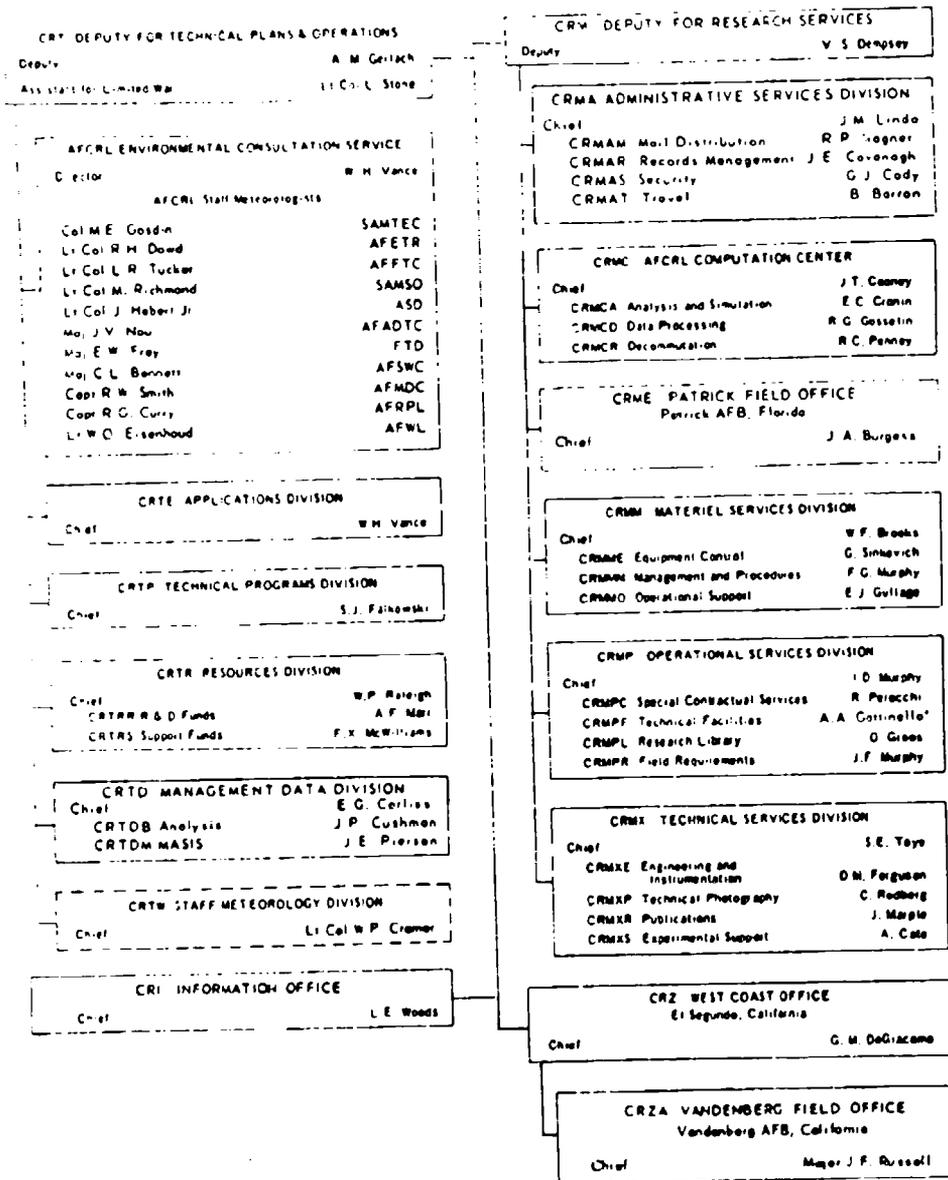
Air Force Cambridge Research Laboratories

L. G. HANSCOM FIELD, BEDFORD, MASS



AS OF 15 June 1964
 PACTING
 11 Oct 1964

CRG
 COMMANDER
 COL D J FLINDERS
 VICE COMMANDER
 COL C A SMITH**



AS OF 30 June 1970
 * ACTING
 ** EOD July 1970

CRG

COMMANDER
COL D. J. FLINDERS
VICE COMMANDER
COL C. A. SMITH**

CRA AERONOMY LABORATORY	
Director	R. A. Mapleton
Senior Scientist - Solar Ultraviolet	H. Hinteregger
Senior Scientist - Spectroscopy	Y. Tanaka
Senior Scientist - Design Climatology	N. Sissanwala
CRAA Polar Atmospheric Processes	S. Silverman
Geopole Observatory, Thule Air Base, Greenland	S. Silverman
CRAB Atmospheric Structure	K. S. W. Champion
CRAC Chemical Physics	N. W. Rosenberg
CRAS Spectroscopic Studies	R. A. Mapleton
CRAU Solar Ultraviolet	H. Hinteregger
CRAW Design Climatology	N. Sissanwala
CRAZ Composition	R. S. Narcisi

CRB DATA SCIENCES LABORATORY	
Director	R. M. Alexander
Senior Scientist - Computer Sciences	H. Zschint
CRBA Applied Mathematics	R. M. Urbano
CRBD Logic Technology	M. E. Brooking
CRBG Image Processing	J. C. Mott-Smith
CRBI Multisensor Signal Processing	C. M. Walter
CRBS Digital Speech Processing	C. P. Smith
CRBV Speech Research	W. Wathen-Dunn

CRD MICROWAVE PHYSICS LABORATORY	
Director	C. J. Sletten
CRDG Radiation & Reflection	P. Blacksmith
Ipswich Test Facility Ipswich, Mass.	W. Mavroides
CRDM Plasma Electromagnetics	W. Rotman
CRDP Microwave Acoustics	P. H. Carr
CRDT Millimeter Wave	E. Altshuler
Prospect Hill Millimeter Wave Observatory Waltham, Mass.	K. N. Wulfsberg
CRDW Waves & Circuits	R. G. Newburgh

CRE AEROSPACE INSTRUMENTATION LABORATORY	
Director	C. H. Reynolds*
Senior Engineer	T. W. Kelly*
Senior Engineer - Meteorological Equipment	A. S. Catten
CREA Balloon Flight Requirements Analysis	T. J. Danaher
CREB Balloon Research	J. C. Payne*
CREC Balloon Instrumentation	R. J. Cowie
CREE Experimental Balloon Activities	F. X. Donerty
CREH Balloon Research & Development Test (Detachment 1)	Maj R. J. Reddy
CREG Balloon Flight Test (Detachment 3)	Capt B. B. Burnett
CREI Research Probe Instrumentation	M. B. Patterson*
CREJ Research Probe Flight	P. Gustafson
CREK Meteorological Observing Techniques	W. H. Paulsen
CREL Vertical Sounding Techniques	R. Leviton
CREM Direct Sensing Techniques	J. F. Morrissey

CRF SPACE PHYSICS LABORATORY	
Director	A. S. Jursa
Senior Scientist - Astrophysics	H. K. Sen
CRFA Plasma Physics	M. A. Levine
CRFC Energetic Particles	L. Kitz
CRFE Energy Conversion	N. Yannoni
CRFG Geomagnetism	J. McClay
CRFL Spectroscopic Studies	J. W. Salisbury
CRFM Meteor Physics	R. A. Sarrajnes
CRFS Solar Plasma Dynamics	F. W. Ward
CRFW Space Forecasting	R. A. Skrivanek*

CRM METEOROLOGY LABORATORY	
Director	M. L. Brad
Senior Scientist - Heat Transfer	C. N. Touart
CRMA Weather Radar	K. R. Hardy
Weather Radar Facility Maynard, Mass.	K. R. Hardy
CRMB Boundary Layer	D. A. Haugen
CRMC Convective Cloud Physics	R. M. Cunningham
CRMD Dynamics	L. Berkofsky*
CRME Aerosol Interaction	S. J. Birstein
CRMF Satellite Meteorology	T. J. Keegan
CRMS Stratiform Cloud Physics	B. A. Silverman
CRMU Upper Atmosphere	W. S. Hering

CRJ TERRESTRIAL SCIENCES LABORATORY	
Director	O. W. Williams
Senior Scientist - Gravity	B. Seabe
CRJA Geodesy and Gravity	O. W. Williams*
Lunar Laser Observatory Tucson, Arizona	M. S. Hunt
CRJT Geotechnics	R. S. Williams
CRJW Wave Propagation	K. C. Thomson

CRK SACRAMENTO PEAK OBSERVATORY Sunspot, New Mexico	
Director	J. W. Evans
Senior Scientist - Solar Physics	R. B. Dunn
CRKI Instrumentation	R. B. Dunn
CRKO Observational Operations	J. M. Beckers
CRKR Research	J. W. Evans
CRKS Services	R. B. Hunter

CRO OPTICAL PHYSICS LABORATORY	
Director	J. S. Garing
CRDA Atmospheric Optics	R. W. Fenn
CRDI Infrared Physics	R. G. Walker
CRDL Laser Physics	C. M. Suckley
CRDO Radiometry	T. P. Condon
Radiometry Facility Bedford, Mass.	T. P. Condon
CROR Radiation Effects	H. P. Gouvin
Molecular Physics Facility Bedford, Mass.	A. T. Starr

CRP IONOSPHERIC PHYSICS LABORATORY	
Director	Col R. B. Kalisch
Senior Scientist - EM Propagation	P. Newman
Senior Scientist - Ionospheric Physics	W. Pfister
Senior Scientist - Radio Astronomy	J. Aarons
CRPA Radio Astronomy	J. Aarons
Sagamore Hill Radio Observatory Hamilton, Mass.	J. Aarons
CRPC Boundary Interactions	G. J. Gassmann
CRPE Electromagnetic Environment	E. A. Lewis
CRPG Electrical Processes	R. C. Sagalyn
CRPJ Ionospheric Perturbations	J. C. Ulwick
CRPR Ionospheric Radio Physics	K. Toman

CRW SOLID STATE SCIENCES LABORATORY	
Director	R. M. Barrett
Senior Scientist - Lattice Dynamics	J. N. Plendl
CRWB Purification and Growth	C. S. Sahagian
CRWD Properties and Phenomena	A. Mahan
CRWF Semiconductor Physics	C. E. Ryan
CRWG Device Physics	R. P. Doan
CRWH Radiation Effects	C. D. Turner

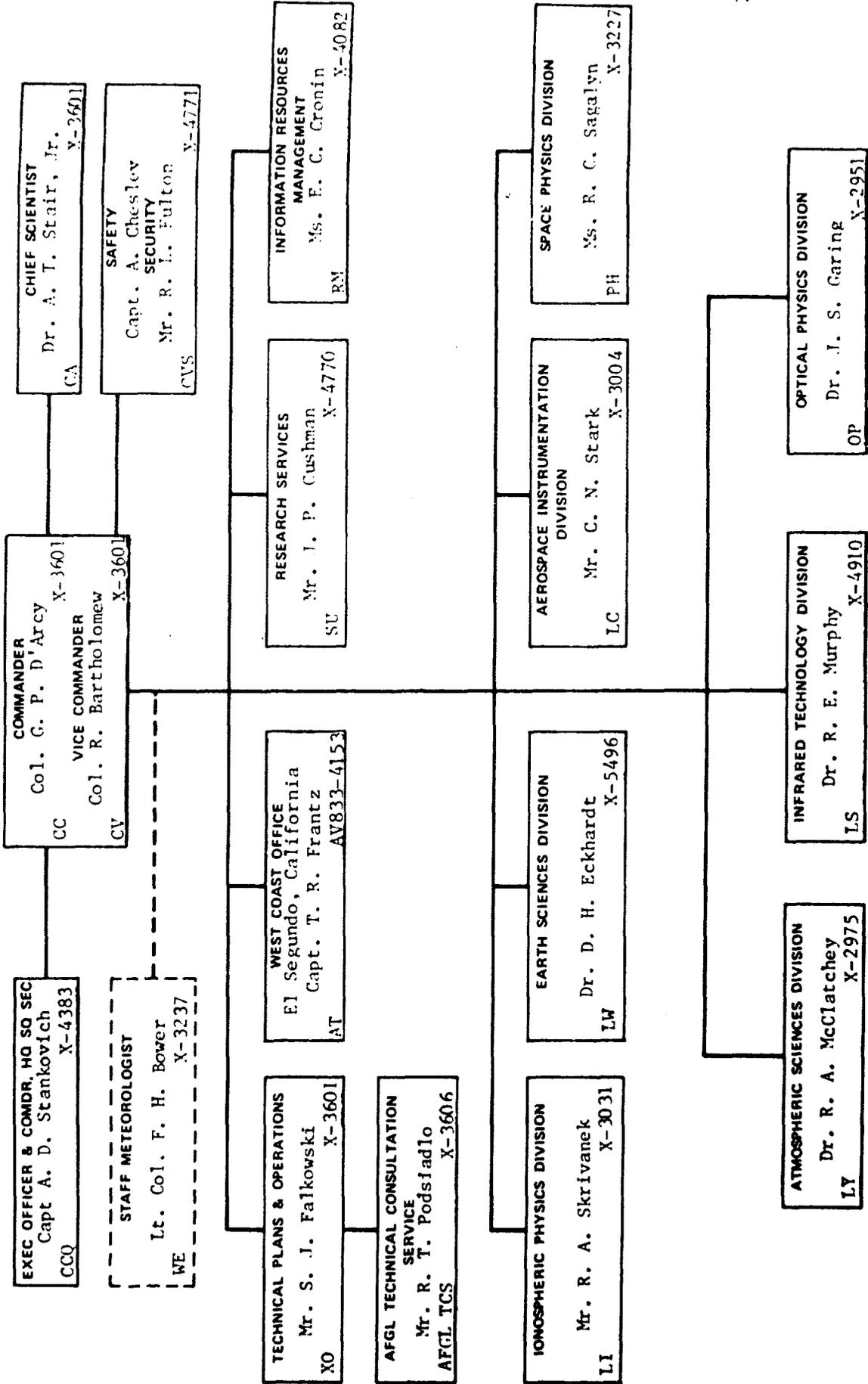
AS OF 30 June 1970

* ACTING

** EOD July 1970

Air Force Geophysics Laboratory

HANSCOM AIR FORCE BASE, BEDFORD, MASS.



Appendix C

As of 1 March 1984
• Acting

AUTOVON: 478-XXXX
Commercial — Area Code (617) 961-XXXX

CC	COMMANDER
	COL G. P. D'ARCY
CV	VICE COMMANDER
	COL R. BARTHOLOMEW

LI	IONOSPHERIC PHYSICS DIVISION
Director	R. A. Skrivanek
Senior Scientist-Aerospace Radiation	H. E. Hinteregger
LID Ionospheric Disturbance & Modification	R. S. Narcisi
LIS Ionospheric Effects	H. C. Carlson
LIU UV Surveillance & Remote Sensing	L. J. Heroux

LW	EARTH SCIENCES DIVISION
Director	D. H. Eckhardt
LWG Geodesy & Gravity	T. P. Rooney
LWH Solid Earth Geophysics	H. A. Ossing

LC	AEROSPACE INSTRUMENTATION DIVISION
Director	C. N. Stark
LCA Balloon Design & Flight Analysis	A. O. Korn
LCC Balloon Instrumentation	R. J. Cowie
LCR Sounding Rocket	E. F. McKenna
LCM Mechanical Engineering	A. B. Brozchi
LCD Balloon R&D Test (Holloman AFB NM)	Maj. J. K. Lyon

PH	SPACE PHYSICS DIVISION
Director	R. C. Sagalyn
Senior Scientist Astro Physicist	G. W. Simon
PHS Solar Research (OL-AC. Sunspot NM)	Capt. S. L. Keil
PHK Spacecraft Interactions	C. P. Pike, Jr.
PHG Space Plasmas & Fields	W. J. Burke
PHP Space Particle Environment	E. G. Mullen*

LY	ATMOSPHERIC SCIENCES DIVISION
Director	R. A. McClatchey
Senior Scientist-Rad Transf.	J. I. F. King
LYC Cloud Physics	A. A. Barnes, Jr.
LYR Ground-Based Remote Sensing	K. M. Glover
LYT Tropospheric Structure	D. D. Grantham
LYP Atmospheric Prediction	D. A. Chisholm
LYS Satellite Meteorology	K. R. Hardy
LYD Global Density	K. S. Champion

OP	OPTICAL PHYSICS DIVISION
Director	J. S. Garing
OPA Atmospheric Optics	R. W. Fenn
OPI Infrared Physics	B. D. Schuring

LS	INFRARED TECHNOLOGY DIVISION
Director	R. E. Murphy
LSI Infrared Dynamics	R. Armstrong*
LSA Airborne Measurements	B. Sandford*
LSP Atmospheric Backgrounds	R. E. Murphy*

AS OF 1 MARCH 1984
* ACTING

WAR DEPARTMENT
HEADQUARTERS ARMY AIR FORCES
Washington, D. C.

AFDRE-2A

26 March 1947

SUBJECT: Meteorological Research and Development Responsibilities
in the Air Forces

TO: Commanding General
Air Materiel Command
Wright Field, Dayton, Ohio

Attention: Chief of Administration - TSTEX

1. Responsibilities for research and development in meteorology and related geophysical fields as assigned to the Army Air Forces and referred to in AR 95-150, dated 19 May 1945, and delegated to the Air Weather Service by AAF Regulation 20-58, dated 1 July 1945, are hereby redelegated to your Command. Appropriate charges to existing AAF regulations pertaining to these responsibilities will be issued at a later date.

2. Army Air Forces and War Department requirements for atmospheric research and development go far beyond the problems of forecasting weather in the troposphere and for the purposes of this directive are defined to encompass, among other elements, the following theoretical researches:

a. Theoretical Researches: Researches relating to atmospheric radiation, ozone measurements, meteorological aspects of terrestrial magnetism, ionospheric weather relationships, radar-weather propagation relationships, atmospheric acoustics, atmospheric electricity, diffusion, turbulence, meteorological optics, atmospheric composition, meteorological application of electronic computers, meteorological aspects of biological problems, meteorological ballistics, all phases of statistical and mathematical forecasting, seismic weather problems, theoretical aspects of optimum-flight techniques, theoretical aspects of artificial control of weather, meteorological problems relating to hydrodynamics, thermodynamics and hydrostatics, verification of forecast methods and forecaster abilities, theoretical aspects and development of special diagrams, computers, wind scales, and other devices leading to increased efficiency and accuracy of special meteorological work.

b. Applied Researches: Researches relating to weather analysis and forecasting, station and observational techniques, soil trafficability, long-range forecasting, upper air and constant pressure analysis techniques, weather accident analysis, display and presentation of weather charts and data, the practical application of flight techniques; practical applications

Ltr to CG, AMC, Wright Field, Dayton, Ohio, Sub: Meteorological Research and Development Responsibilities in the Air Forces.

of the artificial control of weather; forecasting, measurement and analysis relating to micro- and hydro-meteorology; climatological aids to forecasting; use of radiation measurements and ozone observations in forecasting; observational aspects of meteorological acoustics, optics, and high-atmosphere parameters; and specialized arctic and tropic techniques.

3. The Air Weather Service of Air Transport Command will be responsible for providing observational and forecast information, advice, and intelligence for all War Department agencies as outlined in AR-95-150. In addition, the Air Weather Service will be responsible for the submission of requirements for research and development of techniques and equipment in the meteorological and allied geophysical fields, as outlined in Par 2, which will permit the Air Weather Service to perform its mission.

4. In order to assist in the performance of the functions herewith assigned, a total of twenty (20) civilian position vacancies will be transferred to your Command from the Commanding General, Air Transport Command on or before 30 April 1947. In addition, sixty-one (61) military personnel allotments will be similarly transferred and your manning tables increased accordingly. Two (2) civilians and two (2) military incumbents of the Air Weather Service competent in performing subject functions will be transferred to your Command on or about 30 April 1947 as a nucleus for establishing an activity to perform subject responsibilities. Subsequently, as they become available, ten (10) additional Air Weather Service military personnel will be similarly transferred upon completion of present temporary duty field assignments. At a later date, additional Air Weather Service military personnel will be made available for training to meet qualifications for laboratory assignments and transfer to your Command.

5. All Air Transport Command functions, facilities, records, reference material and contracts, relating to subject responsibilities, will also be transferred to your Command for carrying out these responsibilities. Funds under Budget Project 630 in the approximate amount of \$300,000 have been allocated to your Command for research and development projects in this field.

6. Appropriate rotation procedures for military personnel will be set up between the Air Weather Service and your Command to provide for career development opportunity in these technical and specialized fields of endeavor.

7. Close cooperation and active liaison will be maintained between the Headquarters, Air Weather Service and your command in carrying out the intent of this directive.

Brig Gen A R Crawford/CRB/mew/74153
Written 24 March 1947

Ltr to CG, AMC, Wright Field, Dayton, Ohio: Sub: Meteorological Research
and Development Responsibilities in the Air Forces.

8. It is desired that immediate and aggressive action be taken to implement this directive. Information and comments are requested regarding the manner in which your Command will discharge these responsibilities with the personnel made available by this section or already assigned to Air Materiel Command projects which meet the definition of Paragraph 2 above and with the funds now in your Command.

BY COMMAND OF GENERAL SPAATZ:

/s/ Curtis E. LeMay
CURTIS E. LeMAY,
Major General, USA
Deputy Chief of the
Air Staff for Research
and Development.

(Copy: RPL, 10 July 1984)

Guenter Loeser Memorial AwardAwarded for an Outstanding Research Contribution

- 1955 - Dr Jean I. F. King
1956 - Dr Robert G. Breene, Jr.
1957 - Dr David Atlas
1958 - Mrs Rita C. Sagalyn
1959 - Dr Norman A. Haskell
1960 - Dr Hans Hinteregger
1961 - Dr Yoshio Tanaka
1962 - Dr Kenneth S. W. Champion
Dr Robert A. Mapleton
1963 - Mr Herman Yagoda
1964 - Dr Jules Aarons
1965 - Dr Allan C. Shell
1966 - Dr Hari K. Sen
1967 - Dr John W. Evans
1968 - Dr Robert E. Huffman
1969 - Dr John W. Salisbury
1970 - Dr Rocco S. Narcisi
1971 - Dr Norman W. Rosenberg
1972 - Dr Leon J. Heroux
1973 - Dr Paul H. Carr
1974 - Dr A. T. Stair, Jr.
1975 - Mr Edward A. Burke
1976 - Dr Robert A. McClatchey
1977 - Dr William Swider
1978 - Dr George Vanasse
1979 - Dr Ralph Shapiro
1980 - Dr Donald H. Eckhardt
1981 - Dr Randall E. Murphy
1982 - Dr Edmond Murad
1983 - Dr George W. Simon
1984 - Dr John R. Jasperse
1985 - Mr Don F. Smart
Ms Margaret Ann Shea

Marcus O'Day Memorial AwardAwarded for the Best Scientific Paper Published in the Preceding
Calendar Year

1962 - Dr Johannes N. Plendl	1977 - Dr Frank P. Billingsley
1963 - Dr Hermann Poverlein	1978 - Dr John R. Jasperse
1964 - Dr David Atlas	1979 - Dr John P. Kennealy Dr Francis P. DelGreco
1965 - Dr Frederick W. Ward, Jr.	1980 - Mr Robert R. O'Neil Mr E. Ray Huppi Dr Edward T. P. Lee
1966 - Dr Rocco S. Narcisi Mr Alan D. Bailey	1981 - Dr. Robert E. Huffman Dr Duane Paulsen Mr Francis LeBlanc Mr Joseph Larrabee
1967 - Dr C. Martin Stickley	1982 - Dr Donald H. Eckhardt
1968 - Mr Wayne S. Hering Dr Paul H. Carr 2nd Lt Andrew Slobodnik	1983 - Dr William J. Burke Dr David A. Hardy Dr M. Susan Gussenhoven
1969 - Dr Vera S. Pless Mr J. Leon Poirier	1984 - Mr Edward W. Cliver Dr Steven Kahler Mr P. S. McIntosh Dr Daniel H. Katayama Ms Judith A. Welsh
1970 - Mr James C. Sethares	1985 - Dr Edward J. Weber Mr Jurgen Buchau Mr James G. Moore Dr James R. Sharber Mr Robert C. Livingston Dr J. David Winningham Dr Bodo Reinisch
1971 - Dr John F. McClay	
1972 - Dr Robert J. Mailloux	
1973 - Dr Frederic E. Volz	
1974 - Mr Peter D. Gianino Dr Bernard Bendow	
1975 - Dr Ronald L. Fante	
1976 - Dr Randall E. Murphy Mr Floyd H. Cook Dr Hajime Sakai	

Commander's AwardAwarded for Outstanding Service or a Significant Contribution to the Organization

1971 - Mr James D. Murphy
1972 - Mr Edward F. McKenna
1973 - Mr John P. Cushman
1974 - Mr Thomas Danaher
1975 - Mr Joseph Hess
Mr Robert W. Gowell
1976 - Mr Clifford Rodberg
1977 - Mr James F. Murphy
Lt Col Paul H. Crandall
1978 - Mr Donald McLeod
1979 - Mr William K. Vickery
Mr Henry Novak
1980 - Mr Tangredo Maltacea
1981 - Mr Robert E. McInerney
1982 - Mr Charles D. Howard
1983 - Ms Frances T. Stewart
1984 - Mr Richard A. Jones
1985 - Mr Patrick J. Windward

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