Foundations of the UNH Space Science Center

1951-1961

This poster shows activities in the Space Science Center from its very early days until the year 2000. Not all events are included here, the focus is on showing the people involved and the range of projects. These projects include satellite, rocket, balloon and ground-based experiments as well as theory.

- ***All news clippings are from The New Hampshire archives***
- ***Most photos are from archives of the UNH Library, some were provided by individuals.***
- ***Photos/illustrations of spacecraft are provided by NASA***

1951: Prof John Lockwood received an Air Force contract for $20,000 for the study of neutron intensities on the summit of Mt. Washington. The goal of that project was to correlate neutron intensities with meteorological conditions. This work continues to this day.
(TNH, Nov. 1, 1951 and Feb 5, 1953).



Physics Dept. Gets $20,000 Fed. Grant

The University of New Hampshire has announced the signing of a research contract in excess of $20,000 for the study of neutron intensities on the summit of Mt. Washington. The contract will be sponsored by the Air Force Research Laboratory of Cambridge, Mass.

Dr. Albert F. Dagnon, coordinator of research, describes the project as "the correlation of neutron intensities with meteorological conditions." Data obtained from the observatory, at 6,288 feet elevation, an elevation of 4,250 feet, will be compared with that obtained at sea level around Durham. Information from the weather station in Portland, Me., which is also participating in the study of the atmosphere through the use of balloons and special equipment will also be available.

The work will be carried out using counters imbedded in paraffin. The neutron component of cosmic rays will be compared with the regular weather data in attempts to more accurately predict weather.

The project will be under the direction of Dr. John A. Lockwood, assistant Professor of Physics at the University of New Hampshire, and Mr. Frank R. Wood, an instructor in the same department.

1958: Prof Robert Houston completed his PhD in ionospheric physics at Pennsylvania State University and immediately took a faculty position at UNH in the fall of 1958. He received an Air Force contract ($115k) to track satellites, including Sputnik III. The motivation for this study was to use these signals to characterize ionospheric properties.
(TNH, May 7, 1959)

Robert E. Houston, Asst. Professor Of Physics, Tracks Satellite Orbits

A young, well-spoken professor in the Physics Department is carrying on research in ionospheric storms in the University's laboratory.

Robert E. Houston, Asst. Prof. of Physics and head of the Physics Department, has been tracking satellites since late 1958, with a trailer-full of electronic equipment. The equipment includes several special receivers, a dozen oscilloscopes, and four recorders of various types.

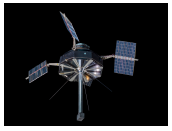
To Observe IGY Satellite

By the time Mr. Houston set his equipment up in the trailer, the physical satellite, Explorer, which would be used, he had begun making observations of Sputnik III. Sputnik III is still tracking it, Later, some American satellites came, but they became inactive very quickly, Mr. Houston explained. Then the Air Force Research Center of Cambridge signed a new for observing the IGY satellite which is to be launched in early 1959. The satellite vehicle was to be launched by Vanguard rocket and a few days ahead of time. Mr. Houston has received information from Washington and the satellite is now being constructed.

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1959-1961: Prof Laurence Cahill, who had recently received his PhD under James Van Allen at the University of Iowa, moved to UNH in 1959. Among the many research efforts that Prof Cahill was involved with in those early days, the provision of a magnetometer for NASA's Explorer 12 mission, launched in 1961, was the most impactful. The outcome of that mission? The discovery of the magnetopause, the boundary in space between Earth's magnetic field and the magnetic field of the solar wind. This first observation of the solar wind magnetic field remains one of the most important in the field of space science.





Fun Fact

On May 5, 1961, Alan Shepard, from Derry, NH, became the first American to fly in space. What is not well known is that just over 3 months later (on August 16, 1961), NASA launched the Explorer 12 satellite that carried a small suite of instruments including the FIRST UNH instrument to fly in space. This was a 3-axis fluxgate magnetometer, provided by Prof Laurence Cahill. The outcome of that mission? The first measurements of the solar wind magnetic field!

The fully instrumented back-up for the Explorer 12 spacecraft is now with the National Air and Space Museum at the Steven F. Udvar-Hazy Center in Chantilly, VA.

1962-1967

1962: Following the launch of Explorer 12, a series of 3 satellites were launched from April-July, 1962. Each of these missions included a neutron detector designed and built by James Trainor, a graduate student of Prof Lockwood. The purpose of this work was to measure Earth's neutron albedo, the flux of neutrons escaping Earth, in order to evaluate the possible connection between neutron fluxes and the Van Allen radiation belts.

Dr Trainor then joined NASA in 1964, where he worked for 30 years. During his time there, he became the Associate Director and Chief Scientist of NASA's Goddard Space Flight Center.





1964: These were the early days of NASA's rocket program, which included UNH from the very beginning. The photos above show Prof Cahill and his graduate student, Nelson Maynard, supporting a 1964 launch from India with the objective of characterizing Earth's equatorial electrojet. These were Nike-Apache rockets and the sole instrument was a UNH magnetometer.

1965: While projects in these early years were focused on satellite and rocket missions, a theory effort also emerged with the arrival of Prof Richard Kaufmann. Prof Kaufmann's contributions typically involved the analysis of spacecraft data and the development of theory to explain the data.

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Evidence for Rapid Motion of the Outer Boundary of the Magnetosphere

ANDREW KONRADI
Goddard Space Flight Center, Greenbelt, Maryland
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University of New Hampshire, Durham

In 1966, perhaps one of the most significant events for Space Science at UNH was the establishment of the Space Science Center. With total external funding levels of approximately $800,000 per year, support was also sought for a new building on campus to be built using a NASA facility grant. The grant apparently did not materialize, but the Space Science Center was formed nonetheless, with Prof Cahill being the Director.

Approximately 20 years later, federal funding was received for the construction of a new research and engineering building, now known as Morse Hall.

1967: High-altitude balloons have been used for space research since the 1950s. UNH's entry into the balloon world began with a test launch from the UNH football field in 1967. A main objective of this launch was preparation for the actual mission, a launch in Palestine, TX.

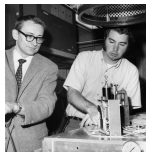
Instrument Box Still Unrecovered

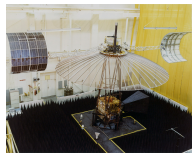
Physics Department Balloon Is Released; Measures Cosmic Rays in Journey To N. J.

By John Christie

1971-1984

1971: Prof Roger Arnoldy and engineer Philip Isaacson working on a plasma instrument for the ATS-6 satellite. Although the first use of "satellite TV" was to broadcast the 1964 Olympics from Tokyo, NASA realized the value that geosynchronous satellites could provide for the USA and began the effort to carry this out. ATS-6 was the result, which was 3D stabilized to support communications. It also hosted more than 20 plasma instruments to support studies of the space environment.





1972: Prof William Weber who, with Prof Edmond Roelof, provided an instrument for the Pioneer 10 spacecraft to measure the energy and electric charge of cosmic rays, seeking to understand the dynamics of stellar evolution. The satellite eventually passed by Jupiter, where "The particles in the magnetosphere are more energetic and there are more of them than we expected" (E. Roelof, TNH, 1974)





1972: Profs Cahill and Arnoldy traveled to Antarctica to install induction coil magnetometers at the newly established Siple Station. This project used VLF waves transmitted from Siple Station to Roberval, Quebec to explore and characterize Earth's Plasmasphere. The effort included several institutions in support of a wide range of measurements to do this. This work eventually led to the installation of induction coil magnetometers at the South Pole and other stations. This work is ongoing, with the array now being expanded to cover interhemispheric observations.





1980: While experimental efforts dominated the work in the Space Science Center in the early years, theory efforts that sought to solve the mysteries resulting from these observations surged with financial support from NASA. Professors Isenberg, Fisk, Lee, Smith and Hollweg formed a "Solar Terrestrial Theory" group to study "Physics of the Solar Atmosphere and the Solar Wind". The program provided by NASA included steady funding of theory teams that led to numerous advancements in solar-terrestrial theory.

1984: The Solar Maximum Mission (SolarMax) was launched in 1984 to investigate Solar phenomena, specifically solar flares. UNH was selected in 1976 and was awarded $1.8M to provide a Gamma-ray Spectrometer to observe solar gamma-rays.

The photo shows the UNH science team of Professors Ed Chupp, Robert Houston and David Forrest posing with the completed instrument.



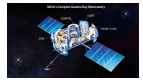
1984-2000



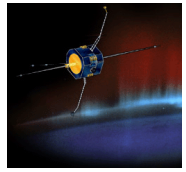
1984: Graduate student Mark McConnell (left) and research scientist Dave Forrest (right) during pre-flight calibration of a balloon payload at the National Scientific Balloon Facility in Palestine, TX.

The Directional Gamma-ray Telescope (DGT) was designed to image gamma-rays (0.2-10 MeV) using a coded mask technique. It successfully measured the gamma-ray spectrum of both the Crab pulsar and the black hole Cygnus X-1 during a 40-hour flight.

1991: The Compton Gamma Ray Observatory (CGRO) mission was part of NASA's Great Observatories series, along with the Hubble Space Telescope and other missions. The CGRO objectives were to measure gamma rays from space, providing insights into high-energy phenomena like gamma-ray bursts, black holes, and other cosmic events.



At UNH, Profs Lockwood and Weber led the team that provided the Imaging Compton Telescope (COMPTEL). This instrument completed an all sky map of 26 Al, which is expelled from large dying stars and has a half-life of one million years. By imaging the galaxy at these wavelengths, the current locations and numbers of these dying stars and those being formed.



1996: The Fast Auroral SnapshoT Explorer was NASA's first mission dedicated to studies of auroral physics. Carrying a suite of particle and fields instruments into a polar orbit, FAST used novel high-speed sampling schemes to acquire important details of the various types of aurora.

Led by Professors Eberhard Moebius and Lynn Kistler, UNH provided the Time-of-flight Energy Angle Mass Spectrograph (TEAMS) instrument for measuring aspects of the major ion species. The discoveries that emerged from this effort include numerous papers on ion outflow, a key component of the study of planetary atmospheric escape.

1997: As NASA research highlighted the importance of making measurements of the solar wind, it became increasingly clear that an upstream "outpost" was needed. This resulted in a satellite being positioned at the L1 Lagrange point (about 870,000 miles upstream). From this location, solar wind parameters are measured roughly 45 minutes before their impact on Earth, e.g., enough time to provide an early warning of the arrival of magnetic storms.

The satellite, the Advanced Composition Explorer (ACE), carries 9 plasma instruments, including UNH's Solar Energetic Particle Ionic Charge Analyzer (SEPICA), which measures energetic particles erupting from solar flares. This work was, again, led by Profs Moebius and Kistler.



While this poster shows some of the major activities in Space Science from its very early days until the year 2000, numerous other efforts were ongoing throughout that time, including:

- **— the launches of 55 sounding rocket missions**
- **— the launches of 19 balloon missions**
- **— numerous theoretical results in the worlds best journals**
- **— continuous ground-based observations from Mt Washington to the South Pole**