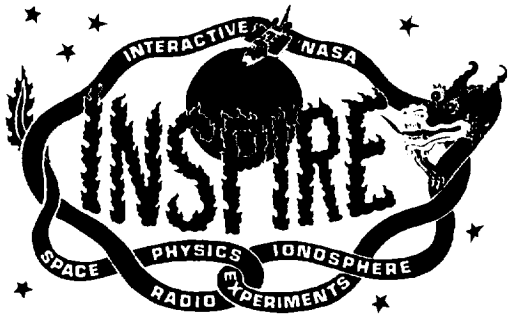


Grant Title:
Investigation of the High Latitude Magnetosphere
and its Response to the Solar Wind

Type of Report:
Performance Report

Name of the Principal Investigator:
William W. L. Taylor

Period Covered by the Report:
April 15, 1995 to April 14, 1996

Name and address of the Grantee's Institution:
The INSPIRE Project, Inc.
518 Sixth St., S. E.
Washington, DC 20003

1.0 Introduction

This grant was proposed to a NASA Headquarters NRA as a Space Physics Educational Outreach (SPEO) supplement. It was selected on April 12, 1994 for a one year period. A one year renewal was granted in April, 1995. An additional one year renewal is expected.

2.0 Background

The INSPIRE Project, Inc. has provided radio receiver kits to over 1500 high school classes over the last seven years to make observations of signals from transmitters in the atmosphere and ionosphere at audio frequencies. Natural radio phenomena in the audio frequency range observable in the atmosphere include:

- Sferics - the impulsive, broadband electromagnetic noise produced by lightning that propagates in the earth-ionosphere waveguide.
- Whistlers - magnetospherically processed sferics that propagate along the earth's magnetic field from hemisphere to hemisphere, becoming dispersed in frequency as they propagate (higher frequencies propagate fastest, thus arriving sooner).

Manmade signals in the audio frequency range are primarily from radionavigation transmitters whose signals propagate in the earth - ionosphere waveguide:

- OMEGA, operated by the US.
- ALPHA, operated by Russia.

INSPIRE is a non-profit scientific, educational corporation whose objective is to bring the excitement of observing natural and manmade radio waves in the audio region to high school students. Underlying this objective is the conviction that science and technology are the underpinnings of our modern society and that only with an understanding of science and technology can people make correct decisions in their lives, public, professional, and private. Stimulating students to learn and understand science and technology is key to them fulfilling their potential in the best interests of our society.

INSPIRE also is an innovative, unique opportunity for students to actively gather data that might be used in a basic research project. INSPIRE began with a test bed project, ACTIVE/HSGS, which involved 100 high schools, with a centerpiece of making observations of 10.5 kHz transmissions from the Soviet ACTIVE satellite. A large number of ground receiving sites was needed, both to enhance the probability of receiving the radio waves from ACTIVE, and to determine the propagation paths to the ground.

The second major project was support to SEPAC (Space Experiments using Particle ACcelerators), a payload on the ATLAS 1 Spacelab mission, flown in March/April 1992. With its electron accelerator SEPAC performed many experiments in the ionosphere, including producing an artificial aurora and the electromagnetic waves produced by pulsing the electron beam. INSPIRE/SEPAC provided more than 1000 ground stations to receive the radio waves, and, at the same time, allowed high school students the opportunity to take data that would be used in a published basic research project.

The third major project is to make observations of the effects of a pulsed electron beam and plasma generator on the MIR Space Station. On request, these instruments are operated over INSPIRE observers. This project began in August, 1995 and will continue with twice yearly operations periods.

An INSPIRE Workshop was held on February 10, 1996 at Gallaudet University in Washington, DC to train teachers in using the INSPIRE project in their classrooms. A second Workshop is planned for 1997 in the DC area.

3.0 Report

The grant was awarded to provide support for INSPIRE. An excellent summary of the activities of INSPIRE is given in Attachment 1, a presentation given to Mr. E. Huckins, Deputy Associate Administrator for Space Science at NASA Headquarters on February 12, 1996. The same presentation was given to six other officials in the Office of Space Science on February 9 and 12, 1996.

INSPIRE

SPACE PHYSICS EDUCATIONAL OUTREACH

INSPIRE

PRESENTATION TO:

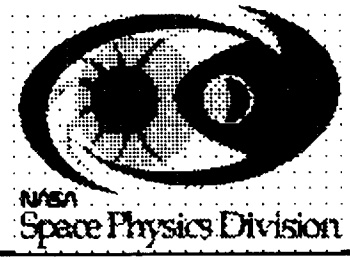
EARLE HUCKINS

OFFICE OF SPACE SCIENCE

NASA HEADQUARTERS

FEBRUARY 9, 1996

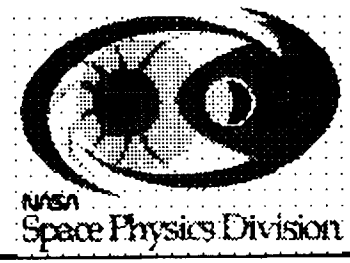
Presented by:
William W. L. Taylor
President, INSPIRE
Nichols Research Corporation
Arlington, Virginia
703-527-2410
taylor@nssda.gsfc.nasa.gov



INSPIRE

Outline

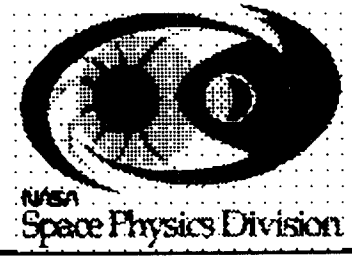
- Background
- Objectives
- History
- Recent Accomplishments
- Future Plans



INSPIRE

What is INSPIRE?

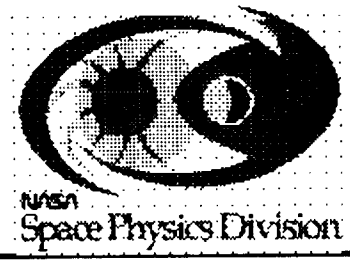
- An educational/scientific project to stimulate interest in science and technology in K-12 students
- An Space Physics Educational Opportunity Grant recipient
- A nonprofit corporation



INSPIRE

What are INSPIRE's objectives?

- To provide access to radio receivers to K-12 students so they can observe natural and manmade VLF radio waves that have been processed by the ionosphere and magnetosphere
- To learn more about the ionosphere and magnetosphere
- To give students experience in building electronics, planning experiments, and taking and analyzing data
- To give teachers a real world application to anchor their science teaching
- To show students examples of waves, electromagnetic waves, plasma physics, ionospheric physics, magnetospheric physics, electronics, mechanicial and electronic construction, and data processing



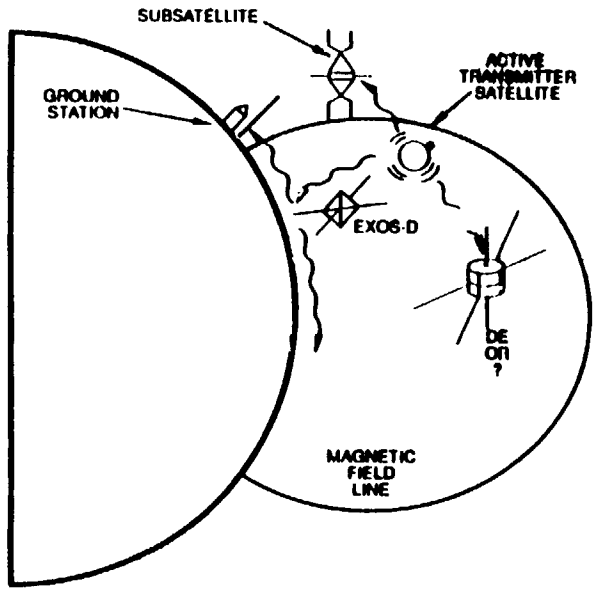
INSPIRE

History of INSPIRE

- ACTIVE, a US/USSR project to study the propagation of VLF waves from the ionosphere to the ground, was the first opportunity
- TRW gave a grant to help provide receivers and study materials to 100 schools to observe ACTIVE from the ground
- Letters sent to 10,000 largest high schools in US inviting their participation
- More than 1000 schools participated in observations of audio frequency pulsed electron beams from SEPAC on ATLAS 1

ACTIVE

SUMMARY



- TWO SATELLITE IONOSPHERIC MISSION TO PROBE AND PERTURB PLASMA
- 500 KM BY 2500 KM BY 82.5° ORBIT
- POWERFUL TRANSMITTER AT 9.6 KHZ
  - 5 KW AMPLIFIER
  - 20 M LOOP ANTENNA
- RECEIVERS
  - ON TRANSMITTER SATELLITE
  - ON RECEIVER SUBSATELLITE
  - ON THE GROUND

INTERNATIONAL SCIENTIFIC TEAM

USSR

- IKI, PROJECT LEADERSHIP, TRANSMITTER SATELLITE

CZECHOSLOVAKIA

- GEOPHYSICAL INSTITUTE, SUBSATELLITE

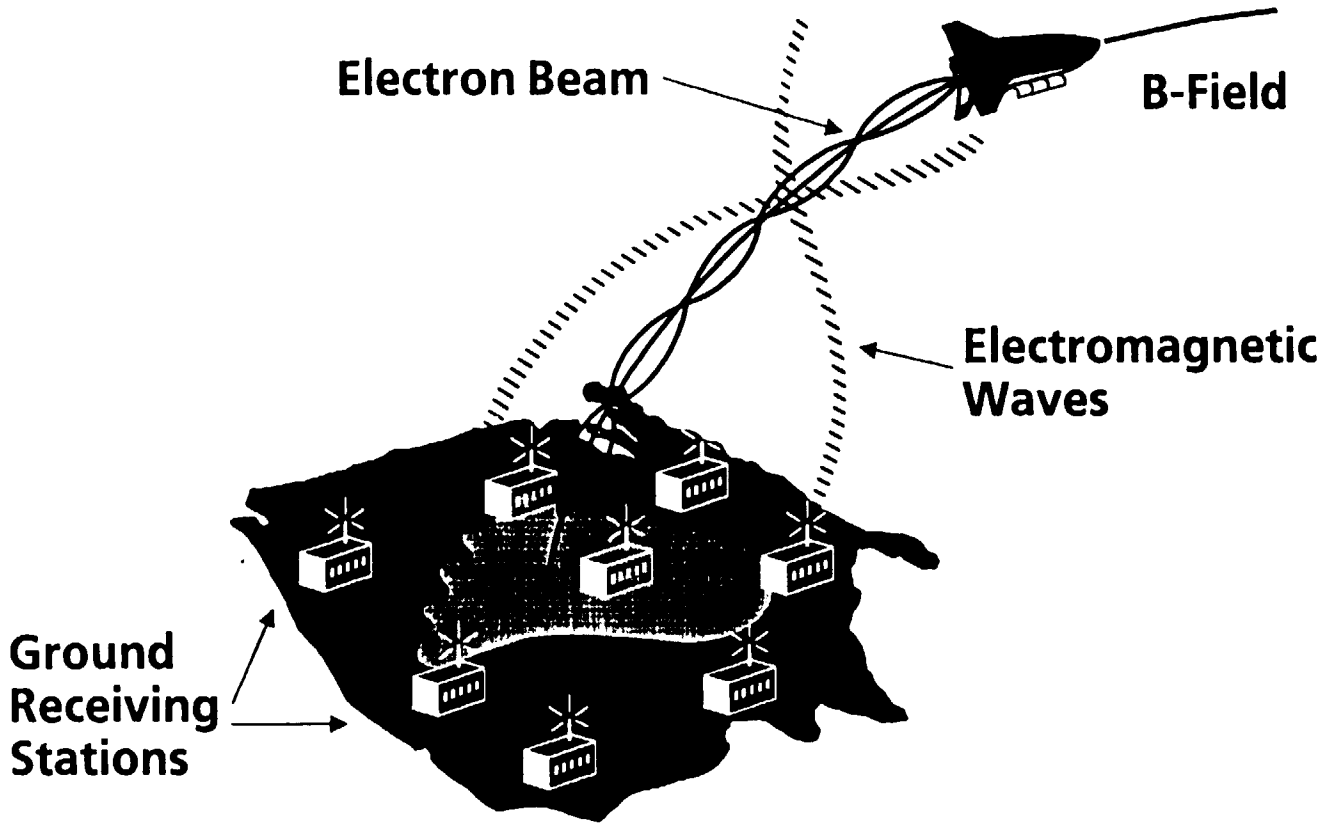
OTHERS

- POLAND
- HUNGARY
- GDR
- BULGARIA
- CUBA
- USA
- JAPAN
- FINLAND
- BRAZIL
- CANADA
- ENGLAND

SCIENTIFIC OBJECTIVES

- ANTENNA PROPERTIES
- NEAR ZONE (FIELD) STUDIES
- WAVE PROPAGATION
- WAVE PARTICLE INTERACTIONS
- NONLINEAR EFFECTS
- CRITICAL IONIZATION VELOCITY
- ION BEAM-PLASMA INTERACTIONS

INSPIRE CONCEPT



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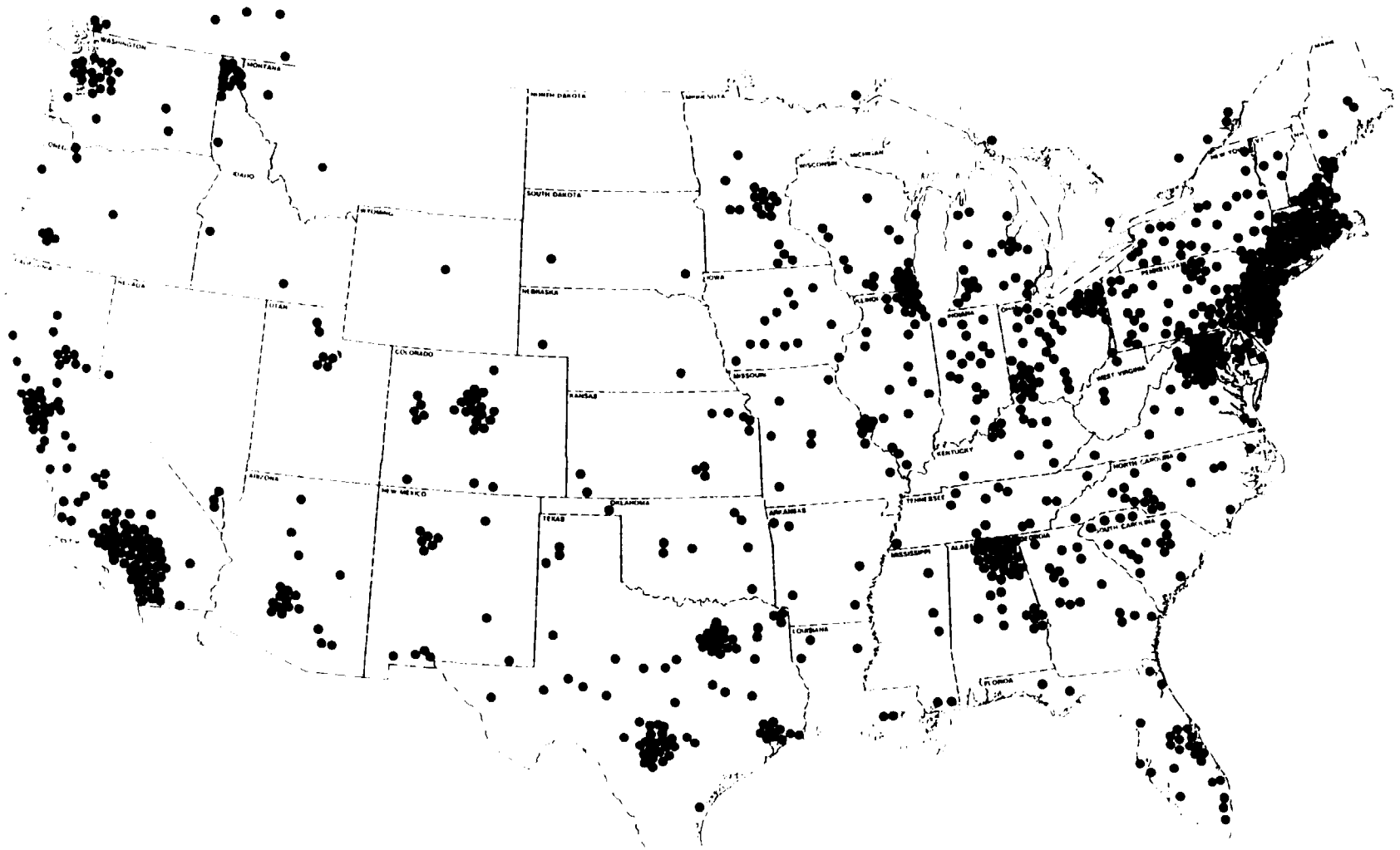
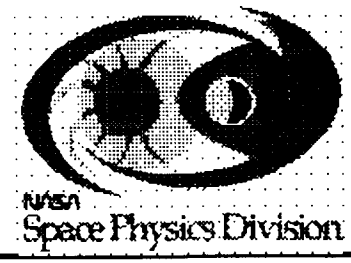
1000 OBSERVING SITES FOR INSPIRE

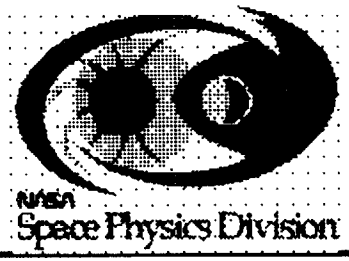




INSPIRE

Recent Accomplishments

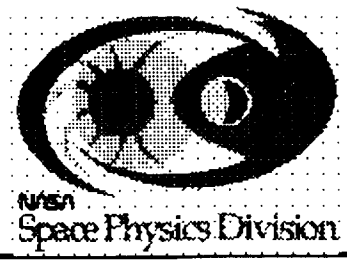
- Received augmentation to SPEO grant
- INSPIRE student observing teams made observationsduring MIR passes over US and Italy
- Fourth year of publishing the INSPIRE Journal
- INSPIRE World Wide Web has new Webmaster, Mike Callaham. URL is http://www.gsfc.nasa.gov/education/inspire/inspire_home.html
- INSPIRE is prominent in IMAGE proposal for MIDEX



INSPIRE

Recent Accomplishments (Continued)

- Spring and fall school observing campaigns
- Solstice and equinox baseline national observing campaigns begun
- Stock of INSPIRE receiver kits purchased to offer to schools
- Letters sent to 3000 more high schools, offering participation in INSPIRE
- INSPIRE became a member of the District of Columbia Space Grant Consortium



INSPIRE

Future Plans

- Workshop at Gallaudet University, February 10, 1996
- Spring and fall campaigns
- Vernal equinox, summer solstice, autumnal equinox and winter solstice campaign
- MIR observations to continue withtwice yearly campaigns
- INSPIRE to be proposed as a part of MAXWELL, a joint US/Russia mission to L1 of the Radio Plasma Imager
- 10,000 letters to high school phyiscs teachers planned for August, 1996

INSPIRE Workshop

Sponsors?	NASA, INSPIRE, DCSGC, Howard U., and Gallaudet U.
When?	February 10, 1996, 9:00 am to 8:00 pm
Where?	Gallaudet University
Cost?	No cost to participants First 15 schools will receive a free INSPIRE receiver kit First 50 participants will receive meal ticket for B, L, & D at Gallaudet cafeteria Coffee Breaks provided
Objective?	Teach the teachers about INSPIRE so they can use in as a teaching tool
Who's Invited?	Physics teachers from all High Schools in DC, public and private Physics teachers from selected High Schools in MD and VA, public and private Physics professors from the Universities in DC Interested youth organizations in the DC area NASA sponsors of DCSGC and INSPIRE Anyone who's interested
Just Teachers?	Each teacher or adult leader may bring up to two students

IMAGE - A MIDEX Proposal

POETRY

Public Outreach

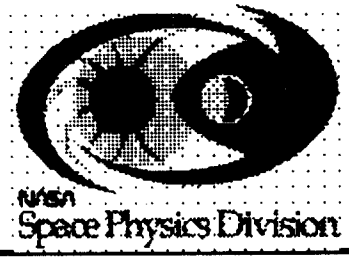
- Connections
  - Cooperative project - NASA, Rice U., Houston Museum of Natural Science
  - Uses WWW, planetarium shows, and museum kiosks
  - Will provide IMAGE images of the magnetosphere, simulations and background

Education, Teaching

- Curriculum development
  - Begins during the summer of 1996
  - Elementary, middle and high school curricula will be developed around the theme of IMAGE science
- Computer aided learning modules
  - Dramatize physics principles in space environment
  - Demonstrate geophysical phenomena
- International Space University
  - IMAGE image archive
  - Curricula and design projects

Reaching Youth

- Regularly scheduled Internet video conferencing
  - Short description of the state of the magnetosphere
  - Question and answer period
- INSPIRE
  - RPI will broadcast at perigee at frequencies above 3 kHz
  - Observations will be made by INSPIRE groups around the world.



INSPIRE

Leverage

- $5k SPEO grant in 1994
- $20k SPEO grant s in 1995
- Matching $5k Hughes/STX grants in 1994, 1995
- Chaffey High School, Ontario, CA
  - $10k grant for data analysis equipment from Toyota, 1994
  - NSI connection from NASA in June, 1995
- Support for February , 1996 Workshop from DCSGC, Howard University, Gallaudet University
- Grant from Washington Space Business Roundtable expected