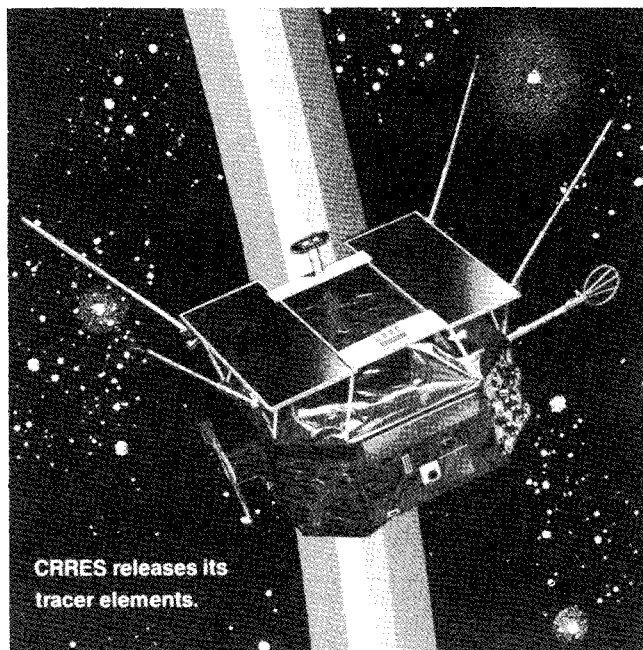


Combined Release and Radiation Effects Satellite

THE Combined Release and Radiation Effects Satellite (CRRES), launched from the Cape Canaveral on July 25, 1990 on an Atlas-Centaur booster, is the first major science mission to the outer Van Allen belt since NASA's Small Scientific Satellite (S³) was flown two decades ago. Since then, the emphasis has been on the geosynchronous region and the planets. The radiation models for this region are primarily extrapolations from low altitude and geosynchronous altitude measurements. In 1976, Dr. George Paulikas of The Aerospace Corporation suggested to the US Air Force Space Test Program (STP) office that a scientific satellite be put into the geosynchronous transfer orbit (GTO) to make measurements of the particle environment there. Dosimeters and microelectronic chips were also to be included in the payload, so as to get an intercomparison between the particle environment, the dose from the environment, and the susceptibility of microelectronics to that environment. The USAF was receptive to the suggestion and directed the Air Force Geophysics Laboratory to implement the mission, which became RADSAT. Initial efforts were frustrated by the high cost (relative to the STP science budget) of a booster for this high-energy orbit. By 1982, NASA was looking for assistance in funding a satellite to provide operation control for releasing large quantities of chemicals for ionospheric investigations. Since NASA had the Shuttle available as a booster, the NASA Chemical Release mission and the RADSAT mission were merged onto a single spacecraft, with the Air Force funding the satellite and NASA funding the launch. Thus CRRES was born. CRRES would be launched into a low-altitude, medium inclination orbit by Shuttle. During a 45-day period, the chemical canisters would be released over observing sites. RADSAT would be inert during this time. After release of most of the chemicals, a solid booster would place the vehicle into the GTO and the RADSAT part of the mission would begin.

At that time, the STP office also had an ionospheric science mission which was awaiting a launch opportunity. The Low Altitude Satellite Study of Ionospheric Irregularities mission, (LASSII), had been initiated in the mid-1970s by Dr. Edward Szuszczewicz at Naval Research Laboratory. LASSII required a low-altitude, medium inclination orbit, similar to the Chemical Release mission. Since the Shuttle has a very large lift capability, STP added LASSII to CRRES to make use of its telemetry and command facilities during the period the RADSAT instruments were inert. The launch was scheduled for June 1986 on Challenger. With the Challenger failure in January 1986, CRRES was de-manifested from the Shuttle schedule and a new booster was sought. An Atlas-Centaur combination was selected, although it did not have sufficient lift capability for the original CRRES mission. Half of the chemical payload was transferred to expendable rockets. The rest of the payload was launched into a low inclination orbit, which was a compromise by all of the missions. The RADSAT mission wanted an equatorial orbit, LASSII wanted a middle inclination low altitude circular orbit, and the Chemical Release mission wanted a low inclination low altitude orbit. How does this compromise affect the individual missions? RADSAT doesn't get measurements near the equator much of the time, but still can accomplish its full mission. On the plus side, a quantity of chemical was dedicated to high altitude releases for investigations into basic plasma processes in the geomagnetosphere. The Chemical Release team has a much harder time getting release opportunities because of the longer orbit period, but the higher perigee velocity of the GTO, compared to the originally-planned low altitude circular orbit, provided a better platform from which to perform the critical velocity experiments. The LASSII mission suffered the greatest com-



promise. The short duration at ionospheric altitudes cuts drastically into their observation time. The time is further reduced by the requirement of the GTO mission to also obtain data at ionospheric altitudes. Additionally, the high velocity at perigee coupled with the lower data rate available via the GTO tape recorder, makes the measurement of small scale irregularities quite difficult. The up-side of the LASSII situation is that the experimenters are getting immeasurably better ionospheric data on CRRES than they would have gotten had LASSII been still on the ground looking for a launch vehicle.

Because of the high interest shown in the CRRES data by the international science and engineering communities, it was felt that papers describing the missions and the instruments should be published as a group in an archival journal with wide availability. Thus the *Journal of Spacecraft and Rockets* was approached with the project. The Editor-in-Chief, Dr. Lewis, agreed. The following papers are the result.

The initial papers provide overviews of the CRRES spacecraft and of the several missions. Individual papers follow with descriptions of instrumentation, their operation, and samples of on-orbit data. The papers are intended to be thorough enough to provide non-involved investigators with sufficient information to determine whether a particular data set from CRRES is useful in their research. The data, which cover the period from July 25, 1990, to the failure of the satellite on October 9, 1991, are available from the National Space Science Data Center, Goddard, Maryland. Potential users of the data are cautioned to contact the Principal Investigators before proceeding to use raw data. The purpose of this cautionary statement is not to dissuade them from using what might be considered "proprietary" data—it isn't proprietary. Rather, prudence dictates that use of unpublished data always be coordinated with its source. Raw data which may be perfectly adequate for one purpose may lead an uninformed investigator into an inaccurate or even totally incorrect conclusion if used for another purpose. All of the CRRES investigators are readily accessible via electronic mail.

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Special Section Editor