Detailing Soviet Gamma-Ray 'Garbage'

Gamma-rays and positrons emitted by unshielded nuclear reactors aboard more than 30 Soviet satellites have interfered with several space research projects during the 1980s, a problem long kept hidden by U.S. officials. Now, using recently declassified data, four teams of scientists have released details of the negative effects and have even described some benefits.

Astronomers first noticed the interference while observing gamma-rays from solar flares and other cosmic sources using the Solar Maximum Mission satellite. Researchers noticed the strange signals soon after Solar Max's launch in 1980 and deduced from their periodicity that they probably came from human-made satellites. The Department of Defense kept the information classified until last summer.

Three of the four reports in the April 28 SCIENCE come from scientists working with Solar Max. The other describes observations from a balloon-borne gamma-ray telescope built by researchers at the University of California, Riverside. Most astronomers say the satellites are irksome or even damaging to their projects, but one team is taking advantage of reactor-generated particles to study Earth's magnetosphere.

Only about 3 percent of the gamma-rays reaching Solar Max come directly from the Soviet reactors. Most come from positively charged electrons, known as positrons, emitted when gamma-rays spontaneously generate a positron-electron pair. The positrons spiral along Earth's magnetic field lines for a few minutes. When positrons meet electrons, both particles annihilate, leaving behind two gamma-rays, each with exactly 511 kilo-electron-volts of energy. Because positrons encounter electrons in all ordinary matter, they produce gamma-rays when hitting the Solar Max gamma-ray detector, registering a generally unwanted signal.

According to one Solar Max astronomer, Edward L. Chupp of the University of New Hampshire in Durham, the Soviet reactors operate for only a few months and then switch off. In 1987, the amount of interference from Soviet reactors shot up by more than a factor of 25. Chupp says the increase came because the Soviets launched two new satellites into orbits far higher than usual. The emitted positrons last much longer at higher altitudes. Scientists can distinguish the satellite-generated signals from those from the sun and elsewhere in space, says Chupp, so these satellites haven't confused any earlier data. Still, he says, sorting the satellite interference from natural signals creates an annoying burden. "It is the equivalent of light pollution for people using ground-based telescopes," he says.

But David J. Forrest of the University of New Hampshire contends the extraneous positrons and gamma-rays can devastate other astronomers' projects. The hardest-hit victim was probably the Japanese Ginga satellite, he says, explaining that Ginga's detectors work like a voice-activated tape – they switch on only when they encounter gamma-rays to record. The radiation interference filled Ginga's tape with "garbage" and prevented further observations. Forrest and other scientists worry that the U.S. Gamma-Ray Observatory, scheduled for launch next year, may suffer a similar fate. Concerns about that project may have persuaded the Defense Department to lift its veil of secrecy. If scientists aren't warned about all the interference, Forrest says, "equipment on this craft may be useless."

Things might get worse if the United States launches a reactor contemplated for the Strategic Defense Initiative with 25 times the radiation of the Soviet satellites, says Steven Aftergood of the Los Angeles-based Committee to Bridge the Gap.

But one scientist's interference can be another scientist's tracer. Edward W. Hones and Paul R. Higbie of Los Alamos (N.M.) National Laboratory have used the satellites' positrons to study the structure of the magnetosphere. Hones says in 1964 he proposed adding positrons to the atmosphere as tracers, following the particles' motion to test models of Earth's magnetic field. The Soviets inadvertently granted his wish.

Hones and Higbie are now analyzing the data from Solar Max's detector. Hones says that if world governments don't soon ban orbiting reactors – a move proposed last year by a group of U.S. and Soviet scientists – he would like to launch detectors designed especially to detect their positron trails. *– F. Flam*

Heart-rhythm drugs found risky for many

Noting that two drugs under evaluation increased patients' chances of sudden cardiac death, federal officials this week halted a major portion of a large, multicenter clinical trial designed to evaluate the long-term effectiveness of drugs that suppress abnormal heart rhythms. Early results of the National Institutes of Health-sponsored study have prompted the FDA to narrow its recommendations for use of the two drugs, both of which have been on the market for more than two years.

Study patients taking encainide (marketed as Enkaid by Bristol Laboratories in Evansville, Ind.) and flecainide (marketed as Tambocor by 3M Riker in St. Paul, Minn.) showed a two- to three-fold greater risk of cardiac arrest or death compared with patients taking placebo after an average treatment period of 10 months. A third drug in the trial, moricizine, so far shows no significant adverse or beneficial trends in comparison with placebo and will continue under investigation. Moricizine has yet to gain FDA approval and is not available for general use.

Begun in June 1987 and designed to run until 1992, the Cardiac Arrhythmia Suppression Trial sought to compare each of the three drugs to placebo in a total of 4,400 patients who had a heart attack and developed arrhythmias within two years before enrollment in the study. Earlier tests had confirmed that both of the FDA-approved drugs suppress cardiac arrhythmias. But this trial was the first to examine death rates in patients taking the drugs.

Early review of the data by an independent safety monitoring board revealed that 56 of 730 patients given encainide or flecainide had died from some cause or suffered a heart attack, compared with 22 of 730 patients given placebo. Specifically, 33 taking one of the two drugs experienced sudden cardiac death or a nonfatal heart attack, compared with 9 in the placebo group.

Company representatives estimate that about 200,000 U.S. patients with various degrees of cardiac arrhythmias currently take one of the two drugs withdrawn from the study. NIH and FDA officials emphasize that these patients should not stop taking the drugs without consulting a physician. In a "Dear Doctor" letter the FDA is distributing nationwide, health professionals will be informed that the two drugs are to be reserved almost entirely for "immediately life-threatening arrhythmias" and only rarely used for less threatening arrhythmias.

Other FDA-approved anti-arrhythmics exist but are more toxic than encainide and flecainide and have not been tested for their effects on mortality. Both of the two newer drugs act on heart-muscle cell membranes, slowing electrical conduction in the heart and normalizing extremely rapid or otherwise untimely contractions that can lead to cardiac arrest.

More than 1 million people in the United States show some symptoms of cardiac arrhythmia. *– R. Weiss*