Conversation Pieces

Technically intriguing items from TRW, guaranteed to add luster to your conversation and amaze your friends.

Storm on the Sun In Einsteins's famous equivalence of mass and energy, $E = m C^2$, the C^2 turns out to be a very large number (186,000 mi/sec × 186,000 mi/sec). This means that the destruction of a very small amount of matter yields a very large amount of energy. The immensely destructive forces released by a small hydrogen bomb are dramatic evidence of this fact.

We can begin to appreciate the staggering amount of energy put forth by our sun when we realize that every second the sun converts 5 million tons of mass into energy and radiates it out into space. Light, heat, X-rays—in fact, the entire electromagnetic spectrum—stream forth from this hydrogen-fueled holocaust. In addition, subatomic particles such as protons and electrons are hurled into space carrying with them magnetic fields. This plasma, called the solar wind, blows through the solar system forming a kind of interplanetary weather.

Our own spacecraft earth courses through the solar wind much like a ship plowing through the sea. At its prow, the belts of radiation trapped by earth's magnetic field (the Van Allen belts) are buffeted then flattened by the solar wind and a bow shock wave is formed. Behind, an electromagnetic wake trails out for thousands of earth radii (see Figure 1).

Ordinarily the speed of the solar wind is relatively steady. Sometimes, however, a storm erupts on the sun, and the wind is whipped to hurricane proportions. When this occurs, the earth experiences the assault of a full-blown magnetic storm.

On August 2, 1972, an enormous storm, the largest ever measured in space, suddenly erupted on the sun. Flares leaped hundreds of thousands of miles above the solar surface, and huge discharges of plasma hurtled into space. As the storm slashed out through the solar system, NASA's Pioneer 9 satellite was in orbit between the earth and the sun; Pioneer 10, on its way to Jupiter, was travelling through the asteroid belt. The alignment of the two spacecraft had been anticipated by Pioneer engineers and scientists as an important opportunity to evaluate the normal flow of solar radiation. The giant storm was an unexpected bonus.

Pioneer 9 clocked the gust of solar wind at 2¼ million miles per hour. By the time it struck Pioneer 10, 76 hours later, the wind had slowed to around 1 million miles per hour. Interestingly, its temperature had shot up to nearly 2 million degrees, and the interplanetary magnetic field was 100 times its normal strength. The effects are suggestive of the magnetic "pinch" that scientists seek to control fusion reactions.

After settling down, the sun erupted again on August 7. During this storm NASA's Pioneer 6 satellite counted the greatest number of high energy particles ever seen, over 4,000 times more than normal. In a one hour period, the storm produced energy equal to the U.S. electrical power consumption for 100 million years. As an aside in parting, it warped the earth's magnetic field so severely that power and communication blackouts occurred in Canada, the northern U.S., Sweden and Alaska.

The data collected by these TRW-built satellites during the solar storms of early August are now being evaluated to determine their effect on current theories of the space environment, the earth's atmosphere, and other aspects of space physics. The information is expected to increase our understanding not only of our own star, the sun, but of other stars in the universe as well.

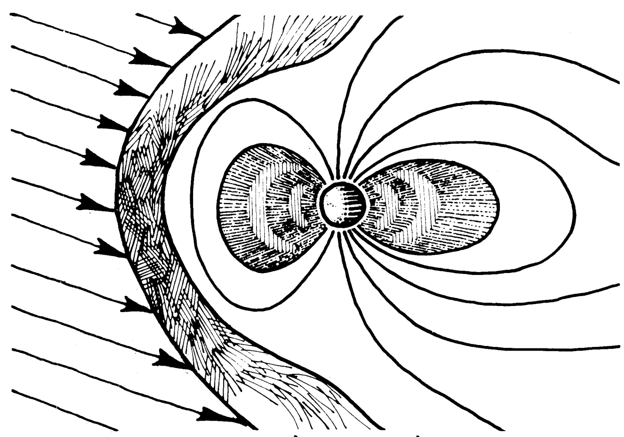

FIGURE 1. THE EARTH IN THE SUN'S ATMOSPHERE

For further information, write on your company letterhead to:

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