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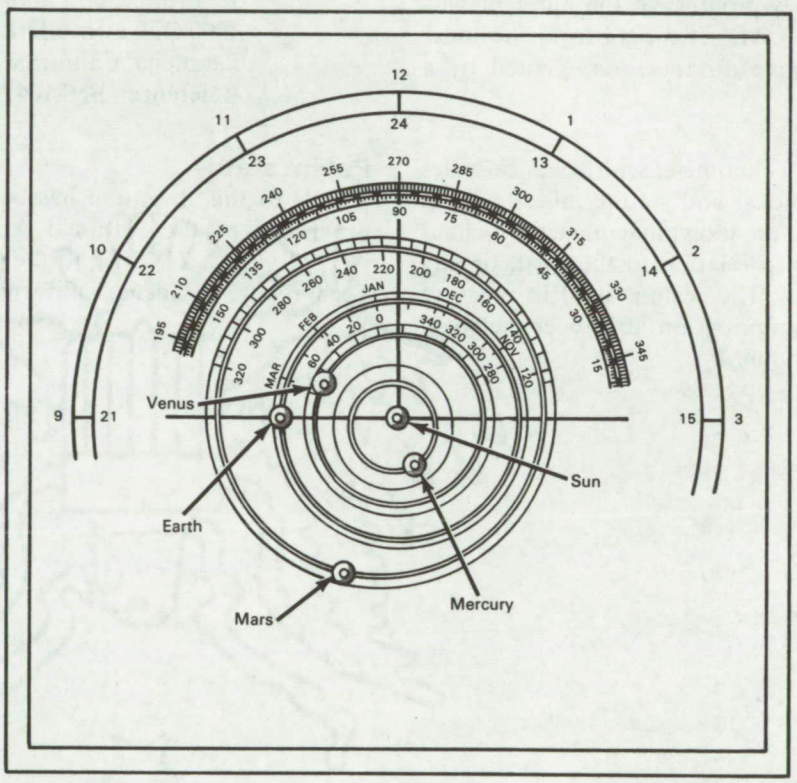
NASA TECH BRIEF

Analog Solar System Model Relates Celestial Bodies Spatially



The problem:

To design a portable analog model of the solar system to demonstrate the true and apparent day-to-day motions of the Sun and its orbiting planets. The model should include the means to plot the paths of man-made satellites and space probes.

The solution:

A portable planetarium that indicates the relative time and space angular locations of the Sun and planets. Distance measuring scales, angular direction indicators, and typical probe trajectories are included.

How it's done:

A flat box has a small sphere located at its center to represent the Sun. Successively larger annular plates around the Sun sphere represent Mercury, Venus, Earth, and Mars respectively. These plates are properly oriented about the ecliptic pole and offset centrally to represent the actual aphelion and perihelion of

(continued overleaf)

each body's orbit as it relates to the Sun. The inclination and declination in relation to the celestial equator is readily represented by tilting the plates in predetermined positions relative to one another. Grooves in the plates are adapted to receive sliding blocks that hold small spheres to represent the four planets. Each of the annular plates has the days marked on its periphery, starting at the perihelion at 20-day intervals around the orbital plane through the aphelion and on to the perihelion again. The plate representing Earth's orbit has the months as well as the days marked about its periphery. A square plate that conforms to the normal plane of the bottom of the box is centrally mounted around the assembled annular plates in a position to represent the Sun's movement as viewed from Earth. A companion model demonstrates the yearly progress of the outer planets through the year 2000 AD. It differs from the inner planets model in relative distances represented by a factor of ×20.

Notes:

1. A goniometer and a clinometer with distance scales (in millions of nautical and statute miles) can be used to determine an individual planet's inclination or declination in relation to the earth or any of the other planets. The scale is used to measure the relative communication distances between any planet and the Sun.
2. A support on the rear of the box can tilt the model forward 23.5° to simulate the inclination of Earth's equator to its orbit plane. In addition, daily time periods and instrument coordinates for line-of-sight observation or tracking of probes or planets are indicated directly on a 24-hour clock dial.
3. To demonstrate the path of a space probe, calculations are made for a certain firing date and an overlay is prepared on clear acetate. By placing the overlay on the model, the positions of the probe in time can be quickly observed in relation to the Sun, Earth and other planets from launch through planned orbit.
4. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B66-10413

Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457 (f)], to the California Institute of Technology, Pasadena, California.

Source: Herbert R. Baerg
(JPL-195)