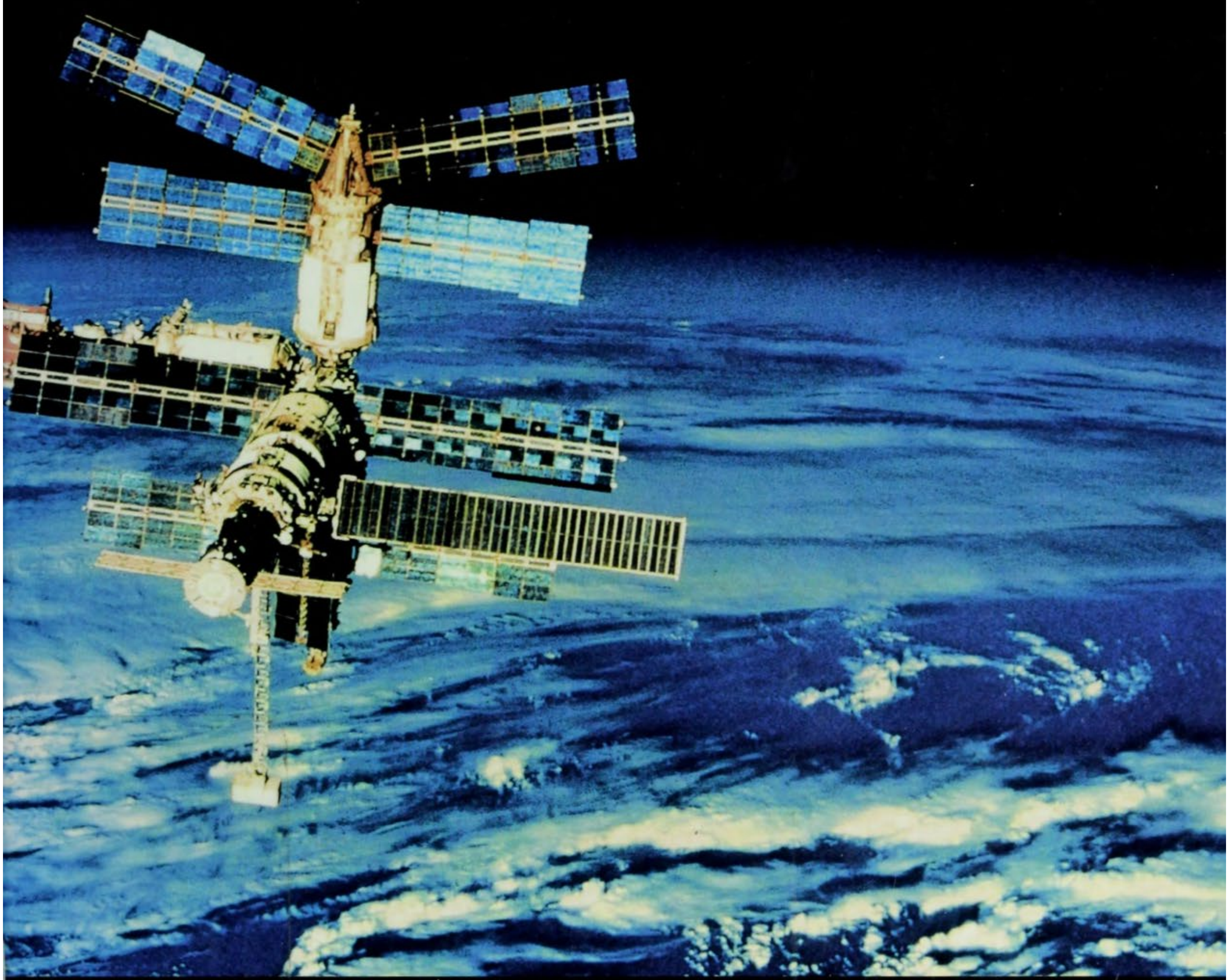
THE DICTIONARY OF SPACE TECHNOLOGY

SECOND EDITION



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weight of any element is approximately equal to the total number of protons and neutrons in its nucleus.

atomize To divide a liquid into extremely minute particles, either by impact with a jet of steam or compressed air or by passage through some mechanical device.

attached payload 1. With respect to the space shuttle, any payload that is launched in the orbiter, remains structurally and functionally attached throughout the flight, and is landed in the orbiter. 2. With respect to a space station, a payload located on the base truss outside the pressurized modules.

See also: PAYLOAD.

attached shock wave An oblique or conical shock wave that appears to be in contact with the leading edge of an airfoil or the nose of a body in a supersonic flow field. Also called an *attached shock.*

attack assessment An evaluation of information to determine the potential or actual nature and objectives of an attack for the purposes of providing information for timely decisions.

attenuation The decrease in intensity of a signal, beam, or wave upon passage through a transmitting medium. Attenuation is due to the action of the transmitting medium itself and occurs as a result of absorption of energy and of scattering out of the path of a detector but does not include the reduction due to geometric spreading (i.e., the inverse square of the distance effect). The attenuation process can be described by the equation:

$$I = I_0 e^{-\alpha x}$$

where I is the flux (photons or particles per unit area) at a specified distance (x) into the attenuating medium, I_0 is the initial flux, and α is the attenuation coefficient (with units of inverse length) and e is a special mathematical function, the irrational number 2.71828 . . . The expression e^x is called the exponential function.

attitude In general, the position of a body as determined by the inclination of the axes to some frame of reference. In aerospace, the position or orientation of a vehicle (e.g., a spacecraft, shuttle orbiter, airplane) either in motion or at rest, as determined by the relationship between its axes and a reference line or plane (e.g., the horizon) or a fixed system of reference axes. Attitude often is expressed in terms of *pitch, roll,* and *yaw.*

attitude and articulation control subsystem (AACS) A spacecraft's *attitude,* or orientation in space, must be stabilized and controlled for a variety of reasons, including: to accurately point the spacecraft's high-gain antenna to Earth, to precisely point onboard science experiments for accurate data collection and subsequent interpretation and analysis, to support spacecraft thermal control by carefully managing the heating and cooling effects of sunlight and shadow, and to support the precise execution of propulsive maneuvers so that the spacecraft achieves the correct trajectory and final destination on its mission.

Stabilization can be achieved by spinning the spacecraft, as was done on the *Pioneer 10* and *11* missions to the outer solar system and on the Galileo mission to Jupiter. In this approach, the gyroscopic action of the rotating spacecraft mass is the stabilizing mechanism. Propulsion-subsystem thrusters are fired to make any desired changes in the spacecraft's spin-stabilized attitude.

The spacecraft also can be designed for active three-axis stabilization, as was done on the *Voyager 1* and *2* spacecraft, which explored the outer solar system and beyond. In this method of stabilization, small propulsion subsystem thrusters gently nudge the spacecraft back and forth within a deadband of allowed attitude error. Another method of achieving active three-axis stabilization is to use electrically powered reaction wheels, which are also called *momentum wheels.* These massive wheels are mounted in three orthogonal axes onboard the spacecraft. To rotate the spacecraft in one direction, the proper wheel in the opposite direction is spun. To rotate the vehicle back, the wheel is slowed down. Excessive momentum, which builds up in the system due to internal friction and external forces, occasionally must be removed from the system; this usually is accomplished with propulsive maneuvers.

Either general approach to spacecraft stabilization has basic advantages and disadvantages. Spin-stabilized vehicles provide a continuous "sweeping motion," which is generally desirable for fields and particle instruments, but these types of spacecraft then may require complicated systems to