TABLE I

PREDICTED TEMPERATURES OF SATELLITE UNDER VARIOUS ORBITAL CONDITIONS

Case	*Nominal*		*Coldest**		*Hottest**		*Books**	*Batteries**	*Oscillator**
	Shell	*Base-plate*	*Shell*	*Base-plate*	*Shell*	*Base-plate*			
Minimum Sun, Magnetic	−30°	+31°	−34°	+23°	−24°	+39°	67° Avg. 66–68~ (±1°F)	62.5° Avg. 59–66~ (±2°F)	80° (±5°)
Minimum Sun, Gravity, Initial Time	−32°	+36°	−36°	+28°	−26°	+44°	67° Avg. 66–68~ (±1°F)	64.5° Avg. 61–68~ (±2°F)	81° (±5°)
Gravity, Transition Sun, Initial-Time	−19°	+45°	−22°	+33°	−13°	+56°	69° Avg. 68.5–69.5~ (±1°F)	68° Avg. 67–69~ (±1°F)	83° (±3°)
Minimum Sun, Gravity, One-Year Degradation	−21°	+48°	−25°	+40°	−15°	+56°	69.5° Avg. 68.5–70.5~ (±1.5°F)	66.5° Avg. 63–70~ (±1°F)	83° (±2°)
Transition Sun, One-Year Degradation	− 3°	+67°	− 6°	+59°	+ 3°	+75°	71.0° Avg. 70.5–71.5~ (±1.0°F)	69.2° Avg. 68–70~ (±1.5°F)	86° (±1°)
Launch, Spin Stabilized	Shell −10° to +30°, Rad. 10°–80°						60–90°	55–85°	70–105°

* The coldest and hottest case conditions account for maximum effects of variations of the solar constant from 429.3 to 459.0 btu/hr-ft², and the maximum effect of a 10° (0 to peak) libration averaged over the orbit. The (± × °F) figures under books, batteries, and oscillator are the predicted results of this effect.

crease reliability of the temperature control system. Good heat transfer paths are provided between components, and failure of one heater will be compensated for by adjacent units.

The so-called "degraded" cases tested (darkening of the white exterior paint due to ultraviolet degradation) correspond to the maximum value of degradation expected in one year. Consequently, the satellite books and batteries will probably be maintained at temperatures in the range of 65° to 75°F for several years. The nearly constant book and battery temperature will also extend the life of the satellite's memory and power system and should provide an overall long life for the satellite.

PUBLICATIONS

The following list is a compilation of recently published technical articles written by APL staff members.

M. H. Friedman, "Shock Tube Measurement of Explosive Sensitivity," *Combustion and Flame,* **10,** No. 2, June 1966, 112-119.

M. H. Friedman, "Approximate Closed Solutions for Detonation Parameters in Condensed Explosives," *AIAA J.,* **4,** No. 7, July 1966, 1182-1187.

S. M. Yionoulis, "Determination of Coefficients Associated with the Geopotential Harmonic of Degree and Order (n,m) = (13, 12)," *J. Geophys. Res.,* **71,** No. 16, Aug. 15, 1966, 4064.

V. G. Sigillito, "Pointwise Bounds for Solutions of the First Initial-Boundary Value Problem for Parabolic Equations." *Soc. Ind. Appl. Math., J. Appl. Math.,* **14,** No. 5, Sept. 1966, 1038-1056.

R. M. Hanes and J. W. Gebhard, "The Computer's Role in Command Decision," *U.S. Naval Inst. Proc.,* Sept. 1966, 60-68.

L. Monchick (APL), R. J. Munn (University of Belfast, Ireland), and E. A. Mason (University of Maryland), "Thermal Diffusion in Polyatomic Gases: A Generalized Stefan-Maxwell Diffusion Equation," *J. Chem. Phys.,* **45,** No. 8, Oct. 15, 1966, 3051-3058.

PUBLICATIONS *(continued)*

H. Shaw, "Discrete Analogs for Continuous Filters," *J. Assoc. Computing Machinery,* **13,** No. 4, Oct. 1966, 600-604.

R. R. Newton, "Dynamics of a Satellite Stabilized by Wires," *J. Spacecraft,* **3,** No. 10, Oct. 1966, 1469-1475.

A. J. Zmuda, J. H. Martin, and F. T. Heuring, "Transverse Magnetic Disturbances at 1100 Kilometers in the Auroral Region," *J. Geophys. Res.,* **71,** No. 21, Nov. 1, 1966, 5033-5045.

J. G. Parker, "Vibrational Relaxation Times of Deuterium and Hydrogen. A Comparison of Theory and Experiment," *J. Chem. Phys.,* **45,** Nov. 15, 1966, 3641-3645.

R. A. Makofski and W. P. Dickens, "Low-Altitude Hypersonic Flow Simulation by Means of a Supersonic Compressor," *J. Spacecraft,* **3,** No. 11, Nov. 1966, 1644-1650.

J. A. Schetz (University of Maryland) and F. S. Billig (APL), "Penetration of Gaseous Jets Injected into a Supersonic Stream," *J. Spacecraft,* **3,** No. 11, Nov. 1966, 1658-1665.

L. W. Ehrlich, "Iterative vs. a Directive Method for Solving Fourth Order Elliptic Difference Equations," *Proc. ACM National Meeting,* 1966, 29-35.

S. N. Foner, "Mass Spectrometry of Free Radicals," *Advances in Atomic and Molecular Physics,* **2,** Academic Press, Inc., New York, 1966, 385-461.

ADDRESSES

The listing below comprises the principal recent addresses made by APL staff members to groups and organizations outside the Laboratory.

R. M. Hanes and J. W. Gebhard, "A Review of APL's Studies in Tactical Decision Making," *Symposium, Raytheon Missile Systems Division,* Raytheon Company, Bedford, Mass., Oct. 27, 1966.

I. Katz, "Probing the Clear Atmosphere by Radar," *Electronics Division Seminar,* Naval Research Laboratory, Washington, D.C., Nov. 30, 1966.

G. R. Valenzuela, "Depolarization of E. M. Waves by Slightly Rough Surfaces," *URSI Meeting,* Palo Alto, Calif., Dec. 5-7, 1966.

F. S. Billig, "Supersonic Combustion," *Technical Specialists Meeting of Niagara Frontier Section of AIAA,* Cornell Aeronautical Laboratory, Buffalo, N.Y., Dec. 7, 1966.

T. A. Potemra, A. J. Zmuda, C. R. Haave, and B. W. Shaw, "VLF Phase Perturbations Caused by the Solar Proton Event of 5 February 1965," *International Scientific Radio Union,* Palo Alto, Calif., Dec. 7-9, 1966.

A. C. Schultheis, "The Navy Navigational Satellite System and User Equipment," *U.S. Naval Reserve Company 5-2,* Washington, D.C., Dec. 8, 1966.

T. G. Konrad, "Radar Returns from Clear Air Structures," *Mid-Atlantic Soaring Association,* Bethesda, Md., Dec. 9, 1966.

T. A. Stansell, "The Navy Navigational Satellite System," *Lions Club,* Silver Spring, Md., Dec. 28, 1966.

PATENTS

Listed below are U. S. Government patents recently issued to Laboratory staff members for inventions produced in support of APL objectives.

G. L. Dugger, J. L. Keirsey, and R. W. McCloy—*External Expansion Ramjet Engine,* Patent No. 3,280,565.

S. D. Bruck and R. R. Rector—*Micrometer Controlled Leak-Proof Syringe,* Patent No. 3,281,023.

T. Wyatt—*Satellite Heating by Atomic Energy,* Patent No. 3,285,534.

L. Wilson, W. E. Hull, J. D. Steinberg, and R. E. Fischell—*Sublimation Timing Switch,* Patent No. 3,286,064.

A. F. Hogrefe—*Satellite Commutator Having Reed Relay Matrix,* Patent No. 3,286,234.

C. J. Swet—*Method and Apparatus for Supporting Life in Outer Space,* Patent No. 3,286,954.

W. L. Vann—*Power Modulator for Transmitter Beam Scan,* Patent No. 3,290,599.

T. G. Calhoon—*Electronic Storage for ATRAN,* Patent No. 3,290,674.

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Nov. 11—"Molecularly Flat Surfaces," by F. P. Bowden, Cambridge University.

Nov. 18—"The Creative Life Pattern in Scientists and Artists," by Anne Roe, Harvard University.

Dec. 16 — "Electro-Optical Data Processing," by L. J. Cutrona, University of Michigan and Conductron Corporation.

WITH THE AUTHORS

A. J. Zmuda, author of "The Auroral Oval," is an earlier contributor to the pages of the *Digest,* having authored "Solar-Terrestrial Disturbances and Solar Protons in July 1961" in the January-February 1962 issue and having co-authored "VLF Phase Perturbations Associated with High-Altitude Nuclear Bursts" in November-December 1962. A native of Shenandoah, Pennsylvania, Dr. Zmuda received a B.S. degree in mathematics from St. Francis College in 1942 and his Ph.D. in physics from Catholic University in 1951. Dr. Zmuda, a member of the Electronic Physics Group in the Research Center, joined APL in 1951 and is a specialist in geomagnetism, ionospheric physics, and space physics. His work has also included analysis and basic studies on magnetic guidance, optical and infrared trackers, and inertial systems, as well as studies in missile guidance. He is a panel member of the World Magnetic Survey of the National Academy of Sciences and has been a consultant to the Geophysics Panel of the Scientific Advisory Board of the U.S. Air Force. Dr. Zmuda is chairman of a group in the International Union of Geodesy and Geophysics which is presently working on a recommendation for an International Geomagnetic Reference Field. Dr. Zmuda is a Fellow of the Washington Academy of Sciences and the American Physical Society, and a member of the American Geophysical Union, and the Philosophical Society of Washington.

D. W. Rabenhorst, author of "A Simplified Passive Spacecraft Separation System," was born in Washington, D.C. and attended Catholic University where he received a B.Ae.E. degree in aeronautical engineering in 1942. A specialist in missile composite design coordination with emphasis on aeronautical and mechanical engineering aspects, Mr. Rabenhorst joined APL in 1945. He has participated in various supersonic and hypersonic wind tunnel studies at the Laboratory and was active in the composite design of the Terrier/Tartar missiles, and in the design coordination of the Polaris missile. As Supervisor of the Special Projects Office, Mr. Rabenhorst is responsible for coordinating several launch facilities and operations, as well as launch vehicle coordination, preliminary spacecraft design, spacecraft contractor liaison, and spacecraft data sheet coordination for the Space Development Department.

S. E. Willis, Jr., author of "Thermal Design of Current Navigational Satellites," is a native of Charlotte, North Carolina. He received a B.S. degree in engineering science from The Johns Hopkins University in 1959. Prior to joining APL in 1963, Mr. Willis was employed by the Bethlehem Steel Corporation where he was a project engineer for equipment installation at new plant facilities. Before his present assignment to the Payload Systems Group of the Space Development Department, he was engaged in testing and analyzing the Typhon Radar cooling systems.

A specialist in thermal design, Mr. Willis is responsible for the thermal design and analysis of several navigational satellites, including GEOS B. Mr. Willis has also written or updated many of the existing computer programs used in refining the thermal analysis of orbiting satellites.