

CHEMICAL HERITAGE FOUNDATION

WILLIAM G. McMILLAN

Transcript of an Interview
Conducted by

James J. Bohning

in

Los Angeles, California

on

25 March 1992

(With Subsequent Corrections and Additions)

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WILLIAM G. McMILLAN

1919 Born in Montebello, California, on 19 October

Education

1941 B.A., chemistry, University of California, Los Angeles
1943 M.S., chemistry, Columbia University
1945 Ph.D., chemical physics, Columbia University
1946-1947 Guggenheim Fellow, University of Chicago, Institute for
Nuclear Studies

Professional Experience

1941-1944 Teaching Assistant, Columbia University
1944-1946 Research Assistant, Manhattan Project

University of California, Los Angeles [UCLA]
1947-1951 Assistant Professor, Department of Chemistry
1951-1958 Associate Professor, Department of Chemistry
1959-1965 Chairman, Department of Chemistry
1959-1990 Professor, Department of Chemistry
1990-present Professor Emeritus

1949 Visiting Professor, Columbia University
1951-1952 Carothers Visiting Lecturer, Harvard University
1954-1971 Senior Physicist, The RAND Corporation
1966-1968 Science Advisor to Commander, U.S. Military Assistance Command,
Vietnam
1971-present President, McMillan Science Associates, Inc.

Honors

1938 Lena De Groff Scholarship, UCLA
1938 Pi Mu Epsilon (mathematics)
1939 Paramount Pictures Scholarship, UCLA
1940 Phi Lambda Upsilon, (chemistry), UCLA
1940 Phi Beta Kappa, UCLA

1942	Sigma Xi, Columbia University
1957-1961	Alfred P. Sloan Fellow
1968	Distinguished Civilian Service Award, U.S. Department of the Army
1969	Distinguished Public Service Award, U.S. Department of Defense
1969	Knight of the National Order of Vietnam
1970	Exceptional Civilian Service Award, U.S. Department of the Air Force
1984	Exceptional Civilian Service Award, U.S. Department of the Air Force

ABSTRACT

William McMillan begins this interview with a discussion of his parents and youth in Montebello, California. The youngest of seven siblings, McMillan expressed an interest in science at an early age. He attended Montebello High School, where he was greatly influenced by his chemistry teacher, Leon Broock. After graduation, McMillan entered UCLA, receiving his B.A. in chemistry in 1941. In 1941 he attended Columbia University and there earned his M.S. in chemistry in 1943, and his Ph.D. in chemical physics in 1945. While working towards his Ph.D. degree, McMillan was employed in the Special Alloys and Materials Project, a forerunner to the Manhattan Project. While a post-doc at the University of Chicago, McMillan worked under Edward Teller. In 1947, McMillan joined the faculty of UCLA as an assistant professor of chemistry, and remains there today as Professor Emeritus. He became chairman of UCLA's chemistry department in 1959, and worked to implement more student programs and offices at the university. During his tenure at UCLA, McMillan also worked for RAND Corporation as a consultant to the U.S. military. He helped form the Group on Weapons Effects, which later became the SAGE Advisory that reported on weapons tests. McMillan also worked with the Armed Forces in Vietnam, developing concepts for artillery and military reconnaissance. After contracting hepatitis in Vietnam, McMillan researched the disease and developed a blood chemistry analysis. Some of his personal research projects have included: global warming and ozone depletion issues; atmospheric studies of Venus; and Neutrinos work. In 1971, McMillan developed his own consulting company, McMillan Science Associates. He concludes the interview with thoughts on the future of the military and defense budget, and an expository analysis of the structure of electrons.

INTERVIEWER

James J. Bohning is currently Visiting Research Scientist at Lehigh University. He has served as Professor of Chemistry Emeritus at Wilkes University, where he was a faculty member from 1959 to 1990. He served there as chemistry department chair from 1970 to 1986 and environmental science department chair from 1987 to 1990. He was chair of the American Chemical Society's Division of the History of Chemistry in 1986, received the Division's outstanding paper award in 1989, and presented more than twenty-five papers before the Division at national meetings of the Society. He has written for the American Chemical Society News Service, and he has been on the advisory committee of the Society's National Historic Chemical Landmarks committee since its inception in 1992. He developed the oral history program of the Chemical Heritage Foundation beginning in 1985, and was the Foundation's Director of Oral History from 1990 to 1995.

TABLE OF CONTENTS

- 1 Early Years
Parents. Growing up in Montebello, California. Siblings. Attending high school. Influence of Leon Broock. John D. Roberts. Attending UCLA. UCLA chemistry department.
- 7 Graduate School
Going to Columbia University. Teaching assistantship with Jacob Beaver. Joseph E. Mayer. Meeting Edward Teller. Course with Harold Urey. Special Alloys and Materials Project. UF₆ process. Obtaining Ph.D.
- 18 Post Graduate School Activities
Manhattan Project. Army Scientific Advisory Board. Returning to UCLA as assistant professor. Working for RAND Corporation. David Griggs. Nancy McMillan.
- 26 Military Involvement
Ionizing radiation effect. Group on Weapons Effects. Atmospheric tests. Fragamcord Antipersonnel Mine. Military Issues in Vietnam. Conceptual development of SAM-defense suppression weapon. General Westmoreland. Creating new, unmined landing zones. Acoustic Locator System. Munitions development. Weekly Intelligence Estimate Update. Student response to Vietnam War.
- 42 Research Projects
Teaching the Defense Science Seminar. Chlorofluorocarbons. Atmosphere of Venus. Thunderstorms. Neutrinos. Astrophysics. Forming McMillan Associates.
- 54 Career
Molecular orbital theory. Teaching for a year at Harvard. Saul Winstein. Becoming chairman of chemistry department at UCLA. Growth of graduate program. Creating a better atmosphere for students. Interest in explosions. Contracting hepatitis. Coordinate treatment of electrolytes. Research on tunnel detection.
- 67 Final Thoughts
Ph.D. students. Future of military. Defense budget issues. Chemysteries. Electron structure. Importance of research.
- 83 Notes
- 87 Index

NOTES

1. Robertson, G. Ross, *Laboratory Practice of Organic Chemistry* (New York: The Macmillan Company, 1937, 1947, and 1954); later revised (4th Edition 1962) in collaboration with T. L. Jacobs.
2. W. G. McMillan, J. D. Roberts and C. D. Coryell, "The Thermodynamic Constants of the Dithionite (Hydrosulfite) Ion," *Journal of the American Chemical Society* 64 (1942): 398-399.
3. T. L. Jacobs, J. D. Roberts and W. G. McMillan, "The Dielectric Constants and Dipole Moments of Acetylene Ethers," *Journal of the American Chemical Society* 66 (1944): 656.
4. W. G. McMillan, "The Halcyon Years: 1936-1941," in John D. Roberts, *Thirty Years of Teaching and Research*, (New York: W. A. Benjamin, 1970).
5. W. G. McMillan, "Thirty Times Around the Sun," a Tribute to Professor Joseph E. Mayer on his Retirement, (2 June 1972).
6. W. G. McMillan with D. Appleman and K. N. Trueblood, *In Memoriam: "James Blain Ramsey, 1892-1965,"* University of California, June 1967.
7. Edouard Goursat, *A Course in Mathematical Analysis*, Volume 1, translated by E. R. Hedrick (Boston: Ginn & Co., 1904).
8. Bruno H. Zimm, interviewed by James J. Bohning at Anaheim, California, 9 September 1986 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript #0055).
9. W. G. McMillan and J. E. Mayer, "The Statistical Thermodynamics of Multicomponent Systems," *Journal of Chemical Physics* 13, (1945): 276-305.
10. W. G. McMillan and E. Teller, "On the Production of Mesotrons by Nuclear Bombardment," *The Physical Review* 72 (1947): 1-6; "The Assumptions of the B.E.T. Theory," *Journal of Physical and Colloid Chemistry* 55 (1951): 17-20; "The Role of Surface Tension in Multilayer Gas Adsorption," *Journal of Chemical Physics* 19, (1951): 25-32.
11. Professional Dossier, W. G. McMillan, updated October 1975. See Chemical Heritage Foundation Oral History research file #104.
12. W. G. McMillan, "The Nuclear Stability Curve," *The Physical Review* 92 (1953): 210.

13. B. B. Fisher and W. G. McMillan, "Two-dimensional Transitions in Adsorbed Monolayers," *Journal of the American Chemical Society* 79 (1957): 2969; I: *Journal of Chemical Physics* 28 (1958), 549; II: *Ibid*, 555; III: *Ibid*, 562.
14. A. L. Latter, R. L. Latter and W. G. McMillan, "A Reevaluation of the Equation of State of Lithium Hydride (U)," (1 January 1958). RAND Defense Research Report, RM-2087-AEC (SRD).
15. A. L. Latter and W. G. McMillan, "Arguments in Support to the Proposed Atmospheric Nuclear Effects Tests (U)," (December 1961). RAND document, RM-2962-PR (SRD).
16. D. T. Griggs and W. G. McMillan, "Proposal for the Declaration of the Geophysical World Intervals in the Fishbowl Test Series," (4 April 1962). Report of Subcommittee of the Ad Hoc Group on Weapons Effects (SRD).
17. A. L. Latter and W. G. McMillan, "Aurora from the Teak Shot," (17 June 1959). RAND Research Report, R-348 (U).
18. Reports of the Ad Hoc Committee on Radiation Effects (Air Force, Navy and Office of the Director of Defense Research & Engineering, July 1963 through April 1966), W. G. McMillan, Chairman.
19. Reports of the Ad Hoc Group on Weapons Effects (Office of the Director, Defense Research and Engineering, 1961 through October 1964); renamed the Scientific Advisory Group on Effects (Office of the Director, Defense Atomic Support Agency November 1964 to May 1966), W. G. McMillan, Chairman. For complete list of reports, see McMillan professional dossier (ref. #11).
20. R. T. Schimmel and S. J. Lowell, "Concept for a Linear Anti-Personnel Mine (FRAGMACORD) (U)," Ammunition Engineering Directorate, Picatinny Arsenal, (July 1966). RAND Research Report 3375.
21. "The Defense Science Seminar, Third Session," August 1966. Brochure in Chemical Heritage Foundation Oral History research file #104.
22. Anthony Smith, *Jambo* (New York: E. F. Dutton & Co., 1963); paperback edition (New York: Signet Books, 1964).
23. W. G. McMillan, "Delilah—A Proposed SAM-Suppression Weapon (U)," (April 1971). Rand Research Report WN-7390-PR (C).
24. U. S. G. Sharp, *Strategy for Defeat: Vietnam in Retrospect* (Navato, CA: Presidio Press, 1986).

25. Reed Irvine, "Global Warming—Or Media Hot Air?" *Accuracy in Media*, XXI-5 (March 1992).
26. Peter Beckmann, "Greenhoax: Where Do Scientists Stand?" *Access to Energy*, V19, #8 (April 1992).
27. A. L. Latter, R. E. LeLevier, E. A. Martinelli, and W. G. McMillan, "A Method of Concealing Underground Explosions," *Journal of Geophysical Research* 66 (1961) 943-946; A. L. Latter, E. A. Martinelli, J. Mathews, and W. G. McMillan, "The Effect of Plasticity on Decoupling of Underground Explosions," *Journal of Geophysical Research* 66, (1961): 2929-2936.
28. W. G. McMillan and R. E. LeLevier, "The Autogenesis of Smog," Invited paper presented at the Symposium on Air Pollution, American Chemical Society Western Regional Meeting, Los Angeles, 19 November 1965.
29. W. G. McMillan and N. C. McMillan, "Some Considerations in the TPQ-37 Competition," (30 May 1975), McMillan Science Associates TR-10-HF (U).
30. W. G. McMillan, "Determination of Rate-Constant Ratio in Competitive Consecutive Second Order Reactions," *Journal of the American Chemical Society* 79, (1957): 4838-9.
31. John D. Roberts, *The right place at the right time / John D. Roberts* (Washington, DC: American Chemical Society, 1990).
32. C. F. Wilcox, Jr., S. Winstein and W. G. McMillan, "Neighboring Carbon and Hydrogen. XXXIV. Interaction of Nonconjugated Chromophores," *Journal of the American Chemical Society* 82 (1960): 5450-4.
33. C. P. Nash and W. G. McMillan, "On the Mechanism of Exploding Wires," *Physical Fluids* 4 (1961): 911-7.
34. K. B. Eisenthal and W. G. McMillan, "Collective-Coordinate Treatment of Electrolytes," *Journal of Chemical Physics* 42, (1965): 3766-3771.
35. E. R. Hardwick, F. M. Ingels and W. G. McMillan, "Acoustic Weapons Location, Semi-Annual Technical Report," (4 September 1974). McMillan Science Associates TR-8-DARPA (C).
36. P. C. F. Pau, J. O. Berg and W. G. McMillan, "Applications of Stokes' Law to Ions in Aqueous Solution," *Journal of Physical Chemistry* 94 (1990): 2671-2679.
37. G. Marc and W. G. McMillan, "The Virial Theorem," *Advances in Chemical Physics* 58 (1985): 209-361.

38. L. M. Hively, V. R. R. Uppuluri and W. G. McMillan, "Fibonacci-Type Relations among Solutions to the Pell Equation," *Tennessee Academy of Science*, October 1992, 65-69.
39. J. J. Gilvarry and W. G. McMillan, "Thermodynamic Properties of Mixtures on the Statistical Model," *The Physical Review* 105 (1957): 579-580.
40. W. G. McMillan, "Approximate Compressibilities of Elements on the Statistical Model," *The Physical Review* 111, (1958): 479.
41. W. G. McMillan and A. L. Latter, "On the Compressibilities of Simple Metals," *Journal of Chemical Physics* 29, (1958): 15-17.
42. K. B. Eisenthal and W. G. McMillan, "Comment on the Collective-Coordinate Treatment of Electrolytes," *Journal of Chemical Physics* 44, (1966): 2542.
43. D. K. Haskell, A. C. Kolb and W. G. McMillan, "Electrostatic Capacitive Energy," in *Encyclopedia of Applied Physics*, Vol. 6, ed. G. Lockwood, (New York: VCH Publishers, 1993: 155-176).
44. Weekly "Chemysterics" appearing in "This Week in Chemistry & Biochemistry at UCLA." See McMillan CHF OH file #0104.

INDEX

A

A Shau Valley, Vietnam, 38
Aberdeen Proving Ground, 15
Abrams, General Creighton, 32, 36
Accuracy in Media, 44
Acoustic Locator System (LASL), 33, 35-36
Adams, --, 8
Advanced Research Project Agency (ARPA), 30, 36, 45
 Defense Advanced Research Projects Agency (DARPA), 73
Agnew, Harold, 33, 35-36
Alvarez, Luis W., 21
American Chemical Society (ACS), 6, 10, 22, 55, 68
Atlas, 70

B

Baldeschwieler, John D., 29
Beaver, Jacob J., 9, 13
Beckmann, Peter, 44-45
Benjamin, William A., 4, 10-11
Berkeley cyclotron, 21
BET theory, 21, 24
Blacet, Francis E., 4, 10, 56
Bohm, David J., 62
Bosons, 63
Brocken Peak, Harz Mountains, Germany, 46
Broock, Leon T., 2-3
Brown, Harold, 26-27, 29-30
Bunker, Ellsworth, 73

C

C-124 aircraft, 37
California Institute of Technology (CalTech), 3, 5, 29, 55-56
California, University of, Berkeley, 25
California, University of, Davis, 58
California, University of, Los Angeles (UCLA), 3-6, 8-12, 16, 22-24, 26, 29,
 35, 42, 48, 56, 58, 74
 Campus Development Program, 56
 chemistry department, 4-5, 71
 Defense Science Seminar, 29, 43, 61
 Institute of Geophysics, 74
 Office of Graduate Advising, 58
 Office of Undergraduate Advising, 58
Capacitors, 71

Carter, President James Earl, 26
Cesar, Colonel Ed, 37
Cesaro, Richard, 30
Chemysteries, 71
Cheyenne Mountain, Colorado, 29
Chicago, Illinois, 21-22, 25, 68, 80
Chicago, University of, 22
Chlorofluorocarbon (CFC), 43-44
Cold War, 27
Collbaum, Frank, 24
Colorado, University of, 45
Columbia University, 5, 7-9, 11-16, 19, 22, 43, 62
 Havemeyer Hall, 13
 Pupin Hall, 19
 Schermerhorn Hall, 19
Combat Operations Center (COC), 41
Committee on Radiation Effects, 27
Compton wavelength, 75
Con Thien, Vietnam, 33
Coryell, Charles D., 5-7
Cram, Donald J., 55
Crist, Ray H., 19
Crowell, William R., 4

D

Davidson, Phil, 41
Davis, Ray, 50
Death Valley, California, 48
Debye theory of conductivity, 60, 62
Defense Atomic Support Agency, 28
Defense Science Board, 69
Delsasso, Leo P., 35
Delta, 70
Dennin, William, 33
Depression, The, 3
DePuy, Bill, 40
Dewar, Michael J. S., 55
Diophantine, 65
Donnelly, Major General Sam, 27
Doty, Paul, 12, 15
Douglas Aircraft, 24

E

Eglin Air Force Base, 73
 Divisional Advisory Group, 72
Einstein coefficients, 64
Eisenthal, Ken B., 62
Encyclopedia of Applied Physics, 71
Erlenmeyer flask, 35

F

Fermi, Enrico, 12, 25, 63, 80
Fermions, 63
Fibonacci numbers, 65
Fibonacci Journal, 65
Fisher, Billy B., 24
Flood, --, 48
Foster, John S., 29-30, 36
Fourier analysis, 12, 21, 62
Fourvectors, 81
Fragmacord, 28, 30
Fragmacord Antipersonnel Mine, 28
Fresno, California, 1
Fuchs, Klaus, 15
Fuel air explosions, 74

G

Gabriel, General Charles A., 69
Gallium detector, 50
Geissman, Theodore A., 5
Glory Effect, 46
 Brocken Bow, 46
Goudsmid, --, 76
Goursat, Edouard, 12
GR-8, 35
Greenwood Grammar School, 2
Griggs, David T., 24, 74
Group on Weapons Effects, 27
Gulf War, 69
Guyler, Noel, 73

H

Haig, General Alexander M., 36
Hamburger, Gabriele, 6
Hammett, Louis P., 7-9, 56
Hardwick, E. Russell, 57
Harris, Doug, 64

Hartley oscillator, 8
Harvard University, 55
Hawthorne, Frederick M., 29
Helmholtz resonator, 35, 81
Hepatitis, 61
Hively, L. M., 65
Ho Chi Minh City, Vietnam, 30
Ho Chi Minh Trail, Laos, 40
Homing anti-radiation missiles (HARM), 31
Hughes Co., 54

I

Internal energy, 59
Irvine, Reed, 44
Isomorphs, 81

J

Jacobs, Thomas L., 5, 7-8
Jambo, 30
Jellium, 62
Johnson, President Lyndon Baines, 42
Johns Hopkins University, The, 11
Johnson Island, 28
Joncich, --, 58
Journal of Chemical Physics, 11, 14

K

K-25 diffusion plant, 20-21
Keats, Jim, 36
Kennedy, President John Fitzgerald, 26
KFAC 1300, 9
Khe Sanh, Vietnam, 33, 37, 40
Kimball, George E., 8
Kinetic energy, 50, 59
Kissinger, Henry A., 36
Ky, General --, 73

L

Lamb, Willis, 12
Lamb-Rutherford shift, 12
Lanchester, Frederick William, 74
Lanthanide contraction, 63
Latter, Albert L., 26
Latter, Richard, 26
Lawrence Livermore National Laboratory, 25-26, 29-30

Legendre functions, 80
 LeMay, General Curtis E., 27
 Leonard, Robert, 35
 Lesage, George-Louis, Jr., 17-18
 Gravitational Theory, 17
 Leyden University, 76
 Libby, Willard F., 13-14, 19-20, 57
 Limited War Lab, 36
 Lithium hydride, 25
 Lodge, Henry C., 73
 Logicon, 53
 Long Binh, Vietnam, 37
 Lorentz, --, 76-78
 Lorentz Transformation, 81
 Los Alamos, New Mexico, 16, 21, 25, 36
 Scientific Laboratory, 33
 Los Angeles, California, 1-2, 51
 Louisiana Salt Dome, 49
 Cowboy Experiments, 49

M

Madelung Rule, 70
 Manhattan Project, 13-14, 18-19, 24
 Marroletti, Bill, 37
 Massachusetts Institute of Technology (MIT), 55
 Maxwell Equation, 81
 Maxwell, Major General Bill, 73
 May Company, 1
 Mayer, Joseph E., 8-12, 14-15, 17
 Mayer, Maria Goeppert, 11
 McCullough, James D., 6, 11
 McMillan Science Associates (MSA), 38, 52
 McMillan, William G.
 father, 1-2
 mother, 1
 siblings, 1-3
 wife (Nancy), 20, 25, 80
 McNamara Barrier, 33, 40
 McNamara, Secretary of Defense, Robert S., 73
 Mercene numbers, 65
 Mercuric oxide, 47
 Mesotrons, 21
 Mills, Billy J., 38
 Minuteman I, 70
 Minuteman II, 26, 70

Minuteman III, 70
Momyer, General Spike, 34, 40
Montebello High School, 2
Montebello, California, 1-2
 Planning Commission, 2
 School Board, 2
 Unified School District, 2
 Water Board, 2
Morgan, William Conger, 4-5
Mount Pinatubo, 43
Murphy, Franklin, 43

N

Nakhom Phenom (NKP), 40
Nash, Charles P., 19, 58-59
National Aeronautic and Space Administration (NASA), 47-48, 74
National Science Foundation (NSF), 58
Neutrinos, 50-52, 76
New Mexico, University of, 48
New York City, New York, 13, 15, 21-22
Newtons, 18
Nixon, President Richard Milhous, 36
North Vietnamese Army (NVA), 34
Noyes, Arthur Amos, 4

O

Oak Ridge National Laboratory, 65
Office of Science and Technology Policy (OSTP), 29
Operation Combat Trap, 33, 38
Operation Neutralize, 34
Operation Niagara, 40
Ozone, 43-44

P

Palmer, Bruce, 37
Patriot missile, 54
Pauli, Wolfgang, 80
Pell equation, 65
Pennsylvania, University of, 60
Physics of Fluids, 60
Picatinny Arsenal, 29
Pines, David, 62
Planck radiation, 64
Polaris, 27
Pollard, Jim, 47

Polytechnic High School, 3
Poynting vector, 78
Proceedings of the Tennessee Academy, 66

R

Rabi, Isidor I., 12
Ramsey, James Blaine, 6, 8, 11, 57
RAND Corporation, 24-27, 30, 49, 53, 74
 physics department, 26, 30, 53
Regan, President Ronald Wilson, 69
Roberts, John D., 3-10, 55, 57
Robertson, G. Ross, 5
Rowland, F. Sherwood, 44

S

Saigon, Vietnam. *See* Ho Chi Minh City
SAM-defense suppression weapon (DELILAH), 31-32
Santa Barbara, California, 73
Schriever, General Bernard A., 26
Schurr, George M., 2-3
Scientific Advisory Group on Effects (SAGE), 28
SCUD missiles, 54
Serum glutamic-oxaloacetic transaminase (SGOT) blood analysis, 61
Sharp, Admiral U.S. Grant, 42, 73
Shockley, William B., 26
Shriever, General Benny, 73
Slichter, Louis B., 74
Smith, Admiral Levering, 27
South China Sea, 33
Special Alloys and Materials Project, 13
Stanford University, 57
Star formation, 50
Stewart, Captain John, 40-41
Stockmayer, Walter H., 13
Stokes' Law, 64-65
Stone, Hosmer, 48
Strategy for Defeat, 42
Sullivan, Leonard, 36
Supersonic Transport Program, 73
Surface-to-air missile (SAM), 31-32

T

Tabor, Brigadier General Bob, 37
Taylor, General Maxwell D., 73
Tchepone, Laos, 33
Teller, Edward, 11-13, 19, 21-22, 25, 49, 59, 75, 80
Tesla coil, 3
Tet, Vietnam, 41
Thieu, General --, 73
Thomas-Fermi Potential, 63
Thomas-Fermi-Dirac model, 66
Tietz, --, 63
Tokyo, Japan, 37
Tolman, General --, 38
Tompkins, General Tommy, 37
TPQ-37 (FIREFINDER), 54
Trimethylamine, 15

U

U.S. Air Force, 26-27, 32-34, 38, 61, 69-70, 75
 C-130 aircraft, 33
 Cambridge Research Center, 61
 MACSA, 36-38
 Military Assistance Command, Vietnam (MACV), 38
 Scientific Advisory Board, 72
 Seventh Air Force, 33-34, 40
 Systems Command, 26
 U.S. Air Force, Europe (USAFE), 69
 Weapons Advisory Group, 72
U.S. Army, 20, 32-37, 40, 61
 Crane helicopter, 33
 Research Laboratory, 61
 Science Advisory Board, 20
 U.S. Army, Republic of Vietnam (USARV), 36-37, 40
U.S. Department of Defense (DOD), 69
U.S. Marines, 13, 33-34, 37
 I-Corps, 37-38, 40
U.S. Navy, 27, 73
 Brown Water Navy, 73
UF₆, 14, 24
Uhlenbeck, --, 76
Union Carbide Corporation (UCAR), 19
Uppuluri, V. R. R., 65
Uranium isotopes, 13
Urey, Harold C., 11, 13, 19, 21

V

Van Allen belts, 46
Van de Graaff, Robert J., machine, 49
Vela satellite, 45
Venus, 46-47
Vertical circulation, 51-52
Viet Cong (VC), 30, 63
Vietnam War, 38-39, 45, 69, 73
Virial Theorem, 65-66
VT fuze, 28

W

Walt, Lew, 73
Washington, D. C., 36, 73
Webb, Harold W., 12
Weekly Intelligence Estimate Update (WIEU), 39-40
West Point Military Academy, 42
Westmoreland, General William C., 11, 29-30, 32, 34, 38-41, 73
Weyburn, William, 12
Winstein, Bruce, 68
Winstein, Saul, 7, 56, 68
Wisconsin, University of, 9
Workman, Everly J., 48
World War I, 2
World War II, 8, 24, 28, 34-35
 Pearl Harbor Attack, 13

Y

Young, William G., 5, 7-9, 22, 56

Z

Zimm, Bruno H., 12, 15
Zuckert, Eugene M., 27