

CALIFORNIA INSTITUTE OF TECHNOLOGY

SIXTY-SEVENTH ANNUAL

COMMENCEMENT
EXERCISES



FRIDAY AFTERNOON AT FOUR-THIRTY O'CLOCK

JUNE NINTH, NINETEEN SIXTY-ONE

ACADEMIC PROCESSION

Chief Marshal: HARVEY EAGLESON, Ph.D.

Assistant Marshals: DONALD S. CLARK, Ph.D.

JAMES C. DAVIES, Ph.D.

RODMAN W. PAUL, Ph.D.

Division I

CANDIDATES FOR THE DEGREE OF BACHELOR OF SCIENCE

CANDIDATES FOR THE DEGREE OF
MASTER OF SCIENCE IN SCIENCE

CANDIDATES FOR THE DEGREE OF
MASTER OF SCIENCE IN ENGINEERING

CANDIDATES FOR THE ENGINEER'S DEGREE

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Division II

THE FACULTY OF THE CALIFORNIA INSTITUTE

THE CHAIRMEN OF DIVISIONS
AND DIRECTORS OF LABORATORIES

THE TRUSTEES OF THE CALIFORNIA INSTITUTE

THE REPRESENTATIVE OF THE UNITED STATES AIR FORCE

THE COMMENCEMENT CHAPLAIN

THE PRESIDENT OF THE CALIFORNIA INSTITUTE

THE COMMENCEMENT SPEAKER

THE HONORARY CHAIRMAN OF THE BOARD OF TRUSTEES

PROGRAM

Presiding: JAMES R. PAGE, LL.D.

Honorary Chairman of the Board of Trustees

MUSIC BY THE CALTECH BAND

PRELUDE AND PROCESSIONAL MARCH

Organist: JAMES H. SHEARER, A.R.C.M., A.R.C.O.

INVOCATION

THE REVEREND JOHN BAKER, B.S., S.T.B.

The Neighborhood Church, Pasadena

COMMENCEMENT ADDRESS

“Birds, Bionics and Beliefs”

JOHN L. BURNS, Sc.D.

President, Radio Corporation of America

PROGRAM—*continued*

CONFERRING OF DEGREES

BY

LEE A. DUBRIDGE, Ph.D., Sc.D.

President of the California Institute of Technology

PRESENTATION OF CANDIDATES FOR DEGREES

For the degree of Bachelor of Science, by

PAUL CONANT EATON, A.M.

Dean of Students

For the degree of Master of Science in Science, by

LEVERETT DAVIS, JR., Ph.D.

Member of the Committee on the Course in Science

For the degree of Master of Science in Engineering, by

DAVID S. WOOD, Ph.D.

Chairman of the Committee on the Course in Engineering

For the Engineer's degree, by

FREDERIC BOHNENBLUST, Ph.D.

Dean of Graduate Studies

For the degree of Doctor in Philosophy, by

DEAN BOHNENBLUST

PROGRAM—*continued*

COMMISSIONING OF AIR FORCE RESERVE OFFICERS

Presentation of Cadets, by

MAJOR FRANCIS R. MACKENZIE, B.S., M.B.A.

Professor of Air Science

*Oath of Office and award of Certificate of Commission as
Second Lieutenant in the Air Force Reserve, by*

BRIGADIER GENERAL WILLIAM G. HIPPS

United States Air Force

CONCLUDING REMARKS

PRESIDENT DUBRIDGE

BENEDICTION

THE REVEREND MR. BAKER

*The audience is requested to remain standing until
the end of the Recessional March*

RECESSIONAL MARCH

Candidates for Degrees

BACHELOR OF SCIENCE IN SCIENCE

- William Robert Bauer**, McCook, Nebraska. *Chemistry*.
Clark Tabor Benson, Portland, Oregon. *Mathematics*.
Roger Woodward Bland, Redding, California. *Physics*.
James David Bowman, Armonk, New York. *Physics*.
Lawrence David Brown, Beverly Hills, California. *Mathematics*.
Shelby Lee Brumelle, Odessa, Texas. *Mathematics*.
Eli Isaac Chernow, North Hollywood, California. *Mathematics*.
Jan Robert Puchlowski Conrad, South Pasadena, California. *Mathematics*.
William Laurence Dowd, Daly City, California. *Chemistry*.
Richard Harold Drew, Junction City, Oregon. *Physics*.
Theodore Henry Elconin, Glendale, California. *Mathematics*.
John L. Emmett, Rochester, Minnesota. *Physics*.
Edward Theodore Evans, Oakland, California. *Chemistry*.
Donald Edward Fahnlne, Sharon, Pennsylvania. *Physics*.
Richard Allyn Foster, Santa Cruz, California. *Mathematics*.
David Friedman, Brooklyn, New York. *Mathematics*.
Ronald Wallace Gatterdam, Orange, California. *Mathematics*.
Alexander Franklin Hermann Goetz, Altadena, California. *Physics*.
Thomas Lain Gordon, Los Angeles, California. *Mathematics*.
Leland Harrison Hartwell, Glendale, California. *Biology*.
Robert Louis Heath, El Segundo, California. *Physics*.
Stephen Herman Hechler, San Leandro, California. *Mathematics*.
Walter Richard Holmquist, Campbell, California. *Chemistry*.
John Raymond Hribar, Geneva, Ohio. *Chemical Engineering*.
Bent Huld, Monrovia, California. *Physics*.
Garret Martin Ihler, Great Falls, Montana. *Chemistry*.
Ernest Geoffrey Janzen, Alhambra, California. *Physics*.
Arnold Richard Jones, Manhattan, Kansas. *Chemistry*.
Jerome Valentine Vincent Kasper, Van Nuys, California. *Chemistry*.
Thomas Edward Keil, Havertown, Pennsylvania. *Physics*.
David Walter Kendle, Salina, Kansas. *Chemical Engineering*.
John James Kennedy, El Monte, California. *Chemical Engineering*.
Hugh Hartman Kieffer, Napa, California. *Geology*.
Stanley Allen Klein, Ontario, California. *Physics*.
David Charles Kubrin, Beverly Hills, California. *Physics*.
James Seward Lindsey, Santa Monica, California. *Physics*.
Peter Ira Lippman, Los Angeles, California. *Physics*.
David Scott Loebbaka, Lima, Ohio. *Physics*.
John E. Lohman, Hillsdale, New Jersey. *Chemistry*.
Robert Everson Long, Mt. Lebanon, Pennsylvania. *Chemistry*.
Don Robert Lortz, Idaho Falls, Idaho. *Physics*.

Students whose names appear in boldface type are being graduated with scholastic honor in accordance with a vote of the Faculty.

BACHELOR OF SCIENCE IN SCIENCE

Ivo Lucchitta, Pasadena, California. *Geology*.
Stephen Jay Luner, Los Angeles, California. *Physics*.
Robert Edward Lushene, Eau Gallie, Florida. *Chemical Engineering*.
Hayden Bryant Macurda, Pleasantville, New York. *Physics*.
Peter Conrad Mayer, La Jolla, California. *Physics*.
Lawrence Wayne McCombs, Wasco, California. *Geology*.
Paul Daniel McCormick, San Gabriel, California. *Physics*.
Miles W. McLennan, Dayton, Ohio. *Astronomy*.
Joel Allen Michael, Skokie, Illinois. *Biology*.
Cleve Barry Moler, Salt Lake City, Utah. *Mathematics*.
Nicholas S. Morez, Chicago, Illinois. *Mathematics*.
George Raynor Muenich, III, Camarillo, California. *Physics*.
Robert Dohrmann Nason, San Francisco, California. *Geophysics*.
Richard Stephen Norman, Bethesda, Maryland. *Mathematics*.
James Myron Perry, Reno, Nevada. *Chemistry*.
Robert Franklin Poe, San Jose, California. *Physics*.
Sanford Paul Pollack, Monterey Park, California. *Physics*.
Karl H. Pool, La Habra, California. *Chemistry*.
Paul Walton Purdom, Jr., Philadelphia, Pennsylvania. *Physics*.
Robert James Quigley, Los Angeles, California. *Physics*.
Herbert Rice, Piedmont, California. *Chemical Engineering*.
Rolf Richter, Ithaca, New York. *Chemical Engineering*.
William Charles Ripka, Long Beach, California. *Chemistry*.
Martin Harvey Schultz, Chestnut Hill, Massachusetts. *Mathematics*.
Michael Schwab, Los Angeles, California. *Physics*.
Oliver Seely, Jr., Long Beach, California. *Chemistry*.
Douglas Wilson Shakel, San Francisco, California. *Geology*.
Lawrence Fred Shampine, Ocala, Florida. *Mathematics*.
Laurence J. Sloss, Glencoe, Illinois. *Biology*.
Thomas Buckley Smith, Evanston, Illinois. *Physics*.
Harold Mead Stark, Glendale, California. *Mathematics*.
Douglas Keith Stewart, Burlingame, California. *Biology*.
John Leonard Stromberg, Piedmont, California. *Physics*.
Gary Wendell Stupian, San Gabriel, California. *Physics*.
Henry Archer Thiessen, Dumont, New Jersey. *Physics*.
Richard Scott Thompson, Hobbs, New Mexico. *Physics*.
Gary George Tibbetts, Omaha, Nebraska. *Physics*.
John Andrew Todoroff, Chicago, Illinois. *Physics*.
John Burgess Trenholme, Eugene, Oregon. *Physics*.
Bruce Truman Ulrich, El Cerrito, California. *Physics*.
Peter Richard Vogt, Santa Barbara, California. *Geophysics*.
Wei-yu Francis Wang, Peikang, Formosa. *Chemical Engineering*.
John LeRoy Weaver, San Jose, California. *Mathematics*.
Ortwin Arnold Wersel, Los Angeles, California. *Chemistry*.
John Fergus Wilkinson, Sausalito, California. *Mathematics*.
Clyde Stewart Zaidins, Cincinnati, Ohio. *Physics*.
David William Zimmerman, Waukesha, Wisconsin. *Physics*.

BACHELOR OF SCIENCE IN ENGINEERING

Guy Joe Andrews, Clovis, New Mexico.
James B. Blackmon, Charlotte, North Carolina.
Ralph Eric Bredehorst, Los Angeles, California.
Ben Graham Burke, Bremerton, Washington.
Ward Calaway, Chicago, Illinois.
Kendall Francis Casey, Jr., Honolulu, Hawaii.
James Quinton Coe, Hanford, California.
DelMar Edwin Curtis, Scotia, California.
Kirk Montell Dawson, Los Angeles, California.
Rodney Devon Dokken, Sacramento, California.
Joel King Donnelly, Santa Monica, California.
Douglas Kenneth Fenwick, Sacramento, California.
Donald Bozell Forrest, Larchmont, New York.
H. Kent Frewing, Vancouver, Washington.
John Michael Haworth, Reseda, California.
Lewis William Hemphill, Eugene, Oregon.
Anthony Itsu Iwata, Los Angeles, California.
Peter Kastan, New York, New York.
Malcolm Lee Kinter, Phoenix, Arizona.
Ronald Allan Kleban, Los Angeles, California.
Curtis Frederick Kuebler, Los Angeles, California.
Sidney Leibovich, Chicago, Illinois.
Milton Scott Lindner, Denver, Colorado.
John Lawrence Long, Cuyahoga Falls, Ohio.
Roy Hiroshi Makino, Honolulu, Hawaii.
Ian Daniel Marks, Los Angeles, California.
Wayne Albert Massey, Glendale, California.
Albert Watts Merrill, La Canada, California.
William Wayne Parker, Salinas, California.
Charles Allen Ray, San Gabriel, California.
Dwain Joe Reed, Woodburn, Oregon.
Neil Ray Richardson, Seattle, Washington.
Robert Maher Ruby, Long Beach, California.
Michael Richard Ruecker, Phoenix, Arizona.
William Keith Shubert, Morenci, Arizona.
Charles Jared Siegel, Lake Forest, Illinois.
Stephen David Slobin, San Marino, California.
John Robert Smith, Los Angeles, California.
John Paul Stenbit, Palo Alto, California.
Kaytaro George Sugahara, New Rochelle, New York.
Samuel Roy Suitt, III, Charlotte, North Carolina.
Byron Fletcher Summers, Jr., El Centro, California.
Thomas Alfred Tisch, Chico, California.
David Price Turner, Berkeley, California.
Christ Orlando Velline, Wayzata, Minnesota.
Gary Orville Wall'a, San Diego, California.
Jerry Doane Woods, Arcadia, California.

MASTER OF SCIENCE IN SCIENCE

Astronomy

- J. Frederick Bartlett. *B.S., Yale University, 1958.*
Subhash Chandra. *B.Sc., 1954, M.Sc., Lucknow University, 1958.*
Lawrence Paul Giver. *B.A., Pomona College, 1960.*
Lewis Lofsky Smith. *A.B., University of California, 1960.*
Howard Martin Stainer. *B.S., Queens College of the City of New York, 1956.*
Laurence Munro Trafton. *B.S., California Institute of Technology, 1960.*

Chemistry

- William George Laidlaw. *B.Sc., University of Western Ontario, 1959.*
Richard Steve Tunder. *B.S., Case Institute of Technology, 1957.*
Frederic Andrew Wallace. *A.B., Harvard University, 1958.*

Chemical Engineering

- Pedro Bolsaitis. *B.S., California Institute of Technology, 1960.*
Ronald Norris Clazie. *B.S., University of California, 1960.*
Kwang-chou Hwang. *B.S., National Taiwan University, 1955.*
Jarold Alan Meyer. *B.S., California Institute of Technology, 1960.*
James Stephen Tyler. *B.S., California Institute of Technology, 1955.*
Kenneth Warren Wood. *B.S., Missouri School of Mines, 1960.*
Joe William Woodward. *B.S., Agricultural and Mechanical College of Texas, 1960.*

Geology

- George Donald Garlick. *B.Sc., University of the Witwatersrand, 1957.*
James Fred Hays. *A.B., Columbia University, 1954.*
Dean Martin Johnson. *B.S., University of Puget Sound, 1959.*
Gerald Douglas Pollock. *B.S., University of Manitoba, 1955.*
George August Sellers. *B.S., Pennsylvania State University, 1959.*
Robert Victor Sharp. *B.S., California Institute of Technology, 1956.*
John Watson. *B.S., 1954, M.S., University of Oklahoma, 1959.*

Geochemistry

- James Louis Aronson. *B.A., Rice Institute, 1959.*
Michael Benton Duke. *B.S., California Institute of Technology, 1957.*

Geophysics

- Shawn Biehler. *B.S.E., Princeton University, 1958.*
Andrew Honore Jazwinski. *B.S., Pennsylvania State University, 1959.*
Maung Sann Maung. *B.Sc., University of Rangoon, 1958.*
Walter Mitronovas. *B.S., Pennsylvania State University, 1959.*

MASTER OF SCIENCE IN SCIENCE

Mathematics

Richard Em Balsam. *B.S., University of Illinois, 1959.*

Physics

Richard Taber Brockmeier. *B.A., Hope College, 1959.*

Joseph Michael Cauley. *B.S., California Institute of Technology, 1960.*

Robert Joseph Hecht. *S.B., Massachusetts Institute of Technology, 1958.*

Thomas Kintzing Hunt. *B.A., Pomona College, 1959.*

Charles Gray Montgomery. *B.A., Yale University, 1959.*

John Marlan Poindexter. *B.S., United States Naval Academy, 1958.*

Warren Lee Simmons. *B.S., Syracuse University, 1959.*

George Warren Simon. *A.B., Grinnell College, 1955.*

Frank Thomas Snively. *B.S., Antioch College, 1959.*

Donald Gary Swanson. *B.S., University of Oregon, 1958; B.Th., Northwest Christian College, 1958.*

Mark Hoy Wagner. *A.B., Miami University, 1958.*

MASTER OF SCIENCE IN ENGINEERING

Aeronautics

Terry Louis Babineaux. *B.S., Louisiana State University, 1959.*

John Carl Casey. *B.S., Purdue University, 1955.*

Ronald F. Draper. *B.S., Carnegie Institute of Technology, 1956.*

Edward Martin Dunaye. *B.S., Tri-State College, 1960.*

Harold Lee Gier. *B.S., California Institute of Technology, 1960.*

Arthur Benjamin Griffin, Jr. *B.S.E., Princeton University, 1960.*

Richard Jenson. *B.S., California Institute of Technology, 1960.*

Douglas Stoddard Johnson. *B.S., United States Military Academy, 1956.*

James Milton Kallis. *B.E.S., Johns Hopkins University, 1960.*

William Edward Kirhofer. *B.S., University of California, 1956.*

Michael Erle Lord. *B.S., University of Oklahoma, 1959.*

Demetrius Philippou. *Diploma, Loughborough College, 1954.*

Stuart Blackton Savage. *B.Eng., McGill University, 1960.*

Erik Jaak Slachmuylders. *Cert., Training Center for Experimental Aerodynamics, 1960.*

Warren David Smith. *B.S., Louisiana State University, 1960.*

Furman Yates Sorrell, Jr. *B.S., North Carolina State College of Agriculture and Engineering, 1960.*

William K. Tabata. *B.S., Purdue University, 1958.*

James Alfred Wooster. *B.S., California Institute of Technology, 1960.*

Victor Lu Hsung Yen. *B.S., University of Redlands, 1960.*

Civil Engineering

Arlen William Bell. *B.S., California Institute of Technology, 1956.*

Charles William Carry. *B.S., Loyola University of Los Angeles, 1960.*

Shin-kien Chow. *B.S.A., National Taiwan University, 1957.*

MASTER OF SCIENCE IN ENGINEERING

- Donald Paul Dubois. *B.S., State College of Washington, 1957.*
Melvin E. Holland. *B.S., California Institute of Technology, 1960.*
Paul Hamilton King. *B.S., California Institute of Technology, 1957.*
Robert Ching-Yee Koh. *B.S., California Institute of Technology, 1960.*
Lakshman Saran Srivastava. *B.Sc., 1955; M. Tech., Indian Institute of Technology, 1957.*
Raymond Myles Thompson. *B.E., Auckland University, 1956; B.Sc., Wellington University College, 1960.*
John Zoltek, Jr. *B.C.E., City College of New York, 1960.*

Electrical Engineering

- Charles A. Allen. *B.S., University of Pittsburgh, 1956.*
Constantine S. Ananiades. *B.A., Dartmouth College, 1960.*
George Wood Beeler, Jr. *B.S.E., Princeton University, 1960.*
David Jordan Blakemore. *B.S., California Institute of Technology, 1960.*
David William Butterfield. *B.S., California Institute of Technology, 1960.*
Peter Osgoode Clark. *B.Eng., McGill University, 1960.*
Joseph Delma Cointment, III. *B.S., California Institute of Technology, 1960.*
George Allen Davison, Jr. *B.S., California Institute of Technology, 1960.*
Alan Jerome DeVilbiss. *B.S., Louisiana Polytechnic Institute, 1960.*
Richard B. Fradella. *B.S., University of California, 1957.*
Allan Burton Friedland. *B.E.E., City College of New York, 1960.*
Samuel Ginsburg. *B.S., California Institute of Technology, 1960.*
Jean-Dominique Heyl. *Dipl. d'Ing., École Centrale de Paris, 1960.*
Peter A. Johanson. *B.S., California Institute of Technology, 1960.*
Vassilios Kerdemelidis. *B.E., University of New Zealand, 1957.*
Richard Marshall Kimball. *B.S., University of New Hampshire, 1960.*
Roland Kitten. *Ing. Dipl., École Polytechnique, 1957.*
Pierre Jean Kridelka. *Ing. Physicien, University of Liege, 1959.*
Ronald Charles Kunzelman. *B.S., California Institute of Technology, 1960.*
Allan Laderman. *B.S., California Institute of Technology, 1960.*
Donald Ross Lampe. *B.E.S., Johns Hopkins University, 1960.*
Delano Rubin Lawin. *B.S., Montana State College, 1960.*
Kelvin Shun-Hung Lee. *B.S., California Institute of Technology, 1960.*
George Wladimir Lewicki. *S.B., Massachusetts Institute of Technology, 1960.*
Richard Franklin Lutomirski. *B.E.E., Brooklyn Polytechnic Institute, 1960.*
Norman Ewen Maclean, Jr. *B.S., California Institute of Technology, 1960.*
Michael Martin Mann. *B.S., California Institute of Technology, 1960.*
John D. Mihalov. *B.S., California Institute of Technology, 1959.*
James Kent Neeland. *B.S., California Institute of Technology, 1960.*
Kevin Frederick O'Brien. *B.E., National University of Ireland, 1959.*
Michael Holmes O'Malley. *B.S., California Institute of Technology, 1960.*
Alan S. Pine. *B.S., University of California, 1960.*
Herman Lee Renger. *B.S., California Institute of Technology, 1960.*
Daniel Ross. *B.S., California Institute of Technology, 1960.*
Heinz Walter Rüegg. *Dipl. Ing., E.T.H. of Swiss Federal Institute of Technology, 1959.*
Steven Emanuel Schwarz. *B.S., California Institute of Technology, 1959.*
Paul Bundesen Skov. *B.S., California Institute of Technology, 1960.*

MASTER OF SCIENCE IN ENGINEERING

Electrical Engineering—continued

- John Russell Sopko. *B.S., Pennsylvania State University, 1959.*
John Frederick South. *B.S., California Institute of Technology, 1960.*
Walter Albert Specht, Jr. *B.S., California Institute of Technology, 1957.*
Edgar Georg Stromer. *Dipl. Ing., E.T.H. of Swiss Federal Institute of Technology, 1959.*
Keith Alan Taylor. *B.S., California Institute of Technology, 1960.*
Lawrence Randolph Weill. *B.S., California Institute of Technology, 1960.*
Paul Richard Widess. *B.S., California Institute of Technology, 1960.*
Gerald Gordon Wilhelmy. *B.S., California Institute of Technology, 1960.*
Robert Charles Yost. *B.S., Purdue University, 1958.*

Engineering Science

- Donald Harvey Lamb. *B.A., Pomona College, 1959.*
Henry Luming. *B.S., Purdue University, 1958.*
Jean-Pierre Quent. *Dipl. d'Ing., École Supérieure d'Électricité, 1959; Dipl. d'Ing., Genie Atomique, Université de Grenoble, 1960.*

Mechanical Engineering

- George S. Argyropoulos. *M.&E.E. Dipl., National Technical University of Athens, 1960.*
Martin Rafael Berkman. *B.A., 1959; B.S., Rice Institute, 1960.*
Narain Mulchand Bhatia. *B.M.E., Poona University, 1960.*
Thomas Eugene Bowman. *B.S., California Institute of Technology, 1960.*
Robert Glenn Chamberlain. *B.S., California Institute of Technology, 1960.*
Donald Leslie Cronin. *B.S., Rutgers University, 1957.*
Earl Leonard Dowty. *B.S., Oklahoma State University, 1960.*
Joseph Carl Free. *B.E.S., Brigham Young University, 1958.*
John Alexander Garba. *B.S., University of Illinois, 1958.*
Philip Mwangi Githinji. *B.S., Purdue University, 1960.*
Herman Guenther Hartung. *B.S., California Institute of Technology, 1960.*
Edward Gerald Hauptmann. *B.Sc., University of Alberta, 1960.*
John Michael Kallfelz. *B.S., United States Military Academy, 1956.*
Etienne Macke. *Dipl. d'Ing., École Supérieure d'Électricité, 1959; Dipl. d'Ing., Genie Atomique, Université de Grenoble, 1960.*
David Bennat Morse. *B.S., Michigan State University, 1957.*
Sharat Chandra Rastogi. *B.Sc., Banaras Hindu University, 1960.*
William Curson Rochelle. *B.S., University of Texas, 1960.*
Louis Camille Roesch. *Dipl. d'Ing. Civil des Mines, École Nationale Supérieure des Mines de Paris, 1960.*
K. Dietrich Schwarz. *Dipl., Technische Hochschule Munchen, 1960.*
Glenn Edwin Schweitzer. *B.S., United States Military Academy, 1953.*
Stanton Allen Shipley. *B.S., Oregon State College, 1960.*
Michael Elmer Slater. *B.S., University of California, 1959.*
Frank William Spaid. *B.S., Oregon State College, 1959.*
Andre Jacques Tesniere. *Dipl. d'Ing., École Supérieure d'Électricité, 1959; Dipl. d'Ing., Genie Atomique, Université de Grenoble, 1960.*
Suryanarayana Rao Varanasi. *B.E., Andhra University, 1960.*
Martin Wolff. *B.S., California Institute of Technology, 1960.*

ENGINEER'S DEGREE

Aeronautical Engineer

- John Alan Copper. *B.A.E., University of Minnesota, 1957;*
M.S.A.E., 1959.
- Delbert Harold Jacobs, Lt., U.S.A.F. *B.S., United States Military Academy, 1955;*
M.S., California Institute of Technology, 1960.
- Louis Kingsland, Jr., Lt., U.S.A.F. *B.S., United States Air Force Academy, 1959;*
M.S., California Institute of Technology, 1960.
- James Orville Rice, Lt., U.S.N. *B.S., University of California, 1952;*
B.S.Ae.E., U.S. Naval Postgraduate School, 1960.
- Timothy Lay Sullivan. *B.Ae.E., University of Detroit, 1959;*
M.S., California Institute of Technology, 1960.
- Howard Wong. *B.S., University of California, 1955;*
M.S., 1956.

Civil Engineer

- Jean Maurice Meuris. *C.E., University of Brussels, 1957;*
M.S., California Institute of Technology, 1960.
- Robert Hugh Taylor, Jr. *B.A., Swarthmore College, 1949;*
B.S., University of Colorado, 1957;
M.S., California Institute of Technology, 1958.

Mechanical Engineer

- Charles Albert Bodeen, Lt., U.S.A.F. *B.S., California Institute of Technology, 1956;*
M.S., 1959.
- Harvey N. Kreisberg. *B.M.E., Rensselaer Polytechnic Institute, 1958;*
M.M.E., 1959.
- Theodore Edmund Lang. *B.S., California Institute of Technology, 1957;*
M.S., 1958.
- Michael Edmond James O'Kelly. *B.E., National University of Ireland (Cork), 1958;*
M.S., California Institute of Technology, 1960.

DOCTOR OF PHILOSOPHY

- Henry Ivan Abrash (Chemistry and Mathematics). *B.A., Harvard College, 1956.*
Thesis: I. Steric and Electrostatic Repulsions in the Inhibition of alpha-Chymotrypsin Catalyzed Hydrolyses by Indole Derivatives.
II. Steric Requirements for Substrates of alpha-Chymotrypsin.
- Daniel Kwoh-i Ai (Aeronautics). *B.S., Swarthmore College, 1953;*
M.S., University of Wisconsin, 1954.
Thesis: I. Cylindrical Couette Flow in a Rarefied Gas According to Grad's Equation.
II. Small Perturbations in the Unsteady Flow of a Rarefied Gas Based on Grad's Thirteen Moment Approximation.
- Norman Edward Albert (Chemistry and Physics). *B.S., Polytechnic Institute of Brooklyn, 1954.*
Thesis: Infrared Absorption Associated with Strong Hydrogen Bonds.
- Harold Russell Almond, Jr. (Chemistry and Biology). *B.S., California Institute of Technology, 1956.*
Thesis: I. The Consequences of Systematic Error in Enzyme Kinetics.
II. L-Tyrosyl-L-Tyrosine Derivatives for the Detection of Transpeptidation in alpha-Chymotrypsin-Catalyzed Hydrolyses.
III. The Interaction of alpha-Methyl-alpha-Acylamino Acids with alpha-Chymotrypsin.
IV. The Apparent Ionization Constants of a Series of Phenylalanine Derivatives.
- Hugh Riddell Anderson, Lt., U.S.A.F. (Physics). *B.A. State University of Iowa, 1954.*
Thesis: Primary Cosmic Radiation in 1958 and Variations.
- Richard Michael Aron (Electrical Engineering and Physics). *B.S.E., Princeton University, 1956; M.S., California Institute of Technology, 1957.*
Thesis: Bandwidth Limitations and Synthesis Procedures for Negative Resistance and Variable Reactance Amplifiers.
- Russell Keith Bardin (Physics and Mathematics). *B.S., California Institute of Technology, 1953.*
Thesis: A Measurement of the $t_{1/2}$ -Value of the Beta Decay of ^{14}O .
- Ari Ben-Menahem (Geophysics). *M.Sc., The Hebrew University (Israel), 1954.*
Thesis: Radiation of Seismic Surface-Waves from Finite Moving Sources.
- Stuart Brooke Berger (Chemistry and Physics). *B.A., Alfred University, 1956.*
Thesis: I. Rates of Paramagnetic Pulse Reactions by Nuclear Magnetic Resonance.
II. The Electron Paramagnetic Resonance Spectrum of Gas Phase $^{14}\text{N}^{16}\text{O}_2$ and Its Pressure Dependence.
- Harris Bernstein (Genetics). *B.S., Purdue University, 1956.*
Thesis: I. Imadazole Compounds Accumulated by Purine Mutants of *Neurospora crassa*.
II. Complementation Studies with Isoleucine-Valine Mutants of *Neurospora crassa*.
- Olaf Alexander Boedtker (Mechanical Engineering and Physics). *Dipl. Eng., Zurich Institute of Technology, 1944; M.S., California Institute of Technology, 1958.*
Thesis: Delay Time in the Alpha to Gamma Transformation of Iron.

DOCTOR OF PHILOSOPHY

- James Harrison Boyden (Physics). *B.S., Carnegie Institute of Technology, 1954; M.S., 1955.*
Thesis: Photoproduction of Positive Pions from Hydrogen at Small Angles at Energies 700 to 1025 Mev.
- Gordon Lawrence Cann (Aeronautics and Physics). *B.S., University of Toronto, 1949; M.S., California Institute of Technology, 1956.*
Thesis: Energy Transfer Processes in a Partially Ionized Gas.
- Marvin Chester (Physics and Mathematics). *B.S., The City College of New York, 1952.*
Thesis: Some Experimental and Theoretical Observations on a Configurational EMF.
- William Stephen Childress (Aeronautics and Mathematics). *B.S.E., Princeton University, 1956; M.S.E., 1958.*
Thesis: Asymptotic Expansion of Navier-Stokes Solutions in Three Dimensions for Large Distances.
- Walter H. Christiansen (Aeronautics and Physics). *B.S., Carnegie Institute of Technology, 1956; M.S., California Institute of Technology, 1957.*
Thesis: Development and Calibration of a Cold Wire Probe for Use in Shock Tubes.
- Daniel Joseph Collins (Engineering Science and Physics). *B.A., Lehigh University, 1954; M.S., California Institute of Technology, 1955.*
Thesis: Microhydrodynamics: A Study of Hydrodynamic Interactions of Macromolecules in Solution by Means of Precision Viscometry.
- Peter Linton Crawley (Mathematics). *B.S., California Institute of Technology, 1957; M.S., 1958.*
Thesis: A Decomposition Theory for Lattices without Chain Conditions.
- John Kalman Dienes (Mechanical Engineering). *B.A., Pomona College, 1957; M.S., California Institute of Technology, 1958.*
Thesis: Some Applications of the Theory of Continuous Markoff Processes to Random Oscillation Problems.
- Duane Floyd Dipprey (Mechanical Engineering and Physics). *B.S., University of Minnesota, 1951; M.S., 1953.*
Thesis: An Experimental Investigation of Heat and Momentum Transfer in Smooth and Rough Tubes at Various Prandtl Numbers.
- James Robert Dodd (Geobiology). *A.B., Indiana University, 1956; A.M., 1957.*
Thesis: Paleocological Implications of the Mineralogy, Structure, and Strontium and Magnesium Contents of Shells of the West Coast of the Genus *Mytilus*.
- Norman Dombey (Physics and Mathematics). *B.A., Magdalen College, Oxford, 1959.*
Thesis: Weak Pion Production and Related Processes.
- Ian Morley Duck (Physics). *B.Sc., Queen's University, 1955; M.Sc., University of British Columbia, 1956.*
Thesis: Muon Capture in the Shell Model.

DOCTOR OF PHILOSOPHY

- Victor A. Erma (Physics). *B.S., University of Texas, 1953; M.A., 1955.*
Thesis: An Extension of the Statistical Model of the Atom.
- Viktor Evtuhov (Electrical Engineering and Physics). *B.S., University of California at Los Angeles, 1956; M.S., California Institute of Technology, 1957.*
Thesis: Theory of the Valence Band Energy Level Structure of Ge and Si in an External Magnetic Field.
- Grover Louis Farrar (Chemistry). *B.S., Randolph-Macon College, 1956.*
Thesis: I. *cis*- and *trans*-1,2-Diaminocyclohexanes.
I. A Study of the Tertiary Amine Precursors of Pyrlylene.
- Victor Gilinsky (Physics). *B.E.Ph., Cornell University, 1956.*
Thesis: Decay of Bound Muons.
- Concetto Richard Giuliano (Chemistry and Physics). *B.S., University of Southern California, 1957.*
Thesis: I. Carbon-thirteen Interactions in the Electron Resonance of Oriented Organic Radicals.
II. Rate of Electron Transfer between Vanadium (V) and Vanadium (IV) by Nuclear Magnetic Resonance.
- Meredith Grant Gross, Jr. (Geology). *A.B., Princeton University, 1954;*
M.S., California Institute of Technology, 1959.
Thesis: Carbonate Sedimentation and Diagenesis of Pleistocene Limestones in the Bermuda Islands.
- Boyd Archer Hardesty (Biochemistry and Chemistry). *B.S., State College of Washington, 1953; M.S., 1956.*
Thesis: The Biochemistry of Cytochrome *c* in Relation to Maternally Inherited Phenotypes of *Neurospora*.
- Daniel Everett Harris (Astronomy and Physics). *B.A., Haverford College, 1956;*
M.S., California Institute of Technology, 1957.
Thesis: The Continuous Spectra of Radio Sources with Particular Reference to Non-Thermal Galactic Sources.
- John Holding Healy (Geophysics and Physics). *S.B., Massachusetts Institute of Technology, 1951; M.S., California Institute of Technology, 1957.*
Thesis: Geophysical Studies of the Basin Structures along the Eastern Front of the Sierra Nevada.
- John Eugene Hearst (Chemistry and Physics). *B.E., Yale University, 1957.*
Thesis: Ultracentrifuge Studies on Deoxyribonucleic Acid and Tobacco Mosaic Virus.
- Elgin Alexander Hill III (Chemistry). *B.S., Allegheny College, 1957.*
Thesis: Stabilization of Carbonium Ions in the Vicinity of Metalloocene Nuclei.
- Albert Hybl (Chemistry and Mathematics). *B.A., Coe College, 1954.*
Thesis: I. The Crystal Structures of Mono- and the Two Dimethylureas.
II. The Determination and Use of Crystallographic Parameters.
- Wilfred Dean Iwan (Mechanical Engineering, Electrical Engineering, and Physics). *B.S., California Institute of Technology, 1957; M.S., 1958.*
Thesis: The Dynamic Response of Bilinear Hysteretic Systems.

DOCTOR OF PHILOSOPHY

- Earl Donald Jacobs (Physics). *B.S., California Institute of Technology, 1953; M.S., 1954.*
Thesis: A Cloud Chamber Investigation of Interactions at Energies Greater than 50 Bev.
- Orval Elmer Jones (Mechanical Engineering and Physics). *B.S., Colorado State University, 1956; M.S., California Institute of Technology, 1957.*
Thesis: Theoretical and Experimental Studies on the Propagation of Longitudinal Elastic Strain Pulses in Wide Rectangular Bars.
- Richard Theodore Jones (Chemistry). *B.S., University of Oregon, 1953; M.S., M.D., 1956.*
Thesis: Chromatographic and Chemical Studies of Some Abnormal Human Hemoglobins and of Some Minor Hemoglobin Components.
- Jirair Kevork Kevorkian (Aeronautics and Mathematics). *B.A.E., Georgia Institute of Technology, 1955; M.A.E., 1956.*
Thesis: The Uniformly Valid Asymptotic Approximations to the Solutions of Certain Non-Linear Ordinary Differential Equations.
- Edgar Francis Kiefer (Chemistry). *B.S., Stanford University, 1957.*
Thesis: Synthesis and Solvolytic Reactivity of Unsaturated Cyclobutyl Bromides.
- Malcolm Harvey Lock (Aeronautics and Mathematics). *Higher Natl. Cert., Hatfield Technical College (England), 1954.*
Thesis: A Study of Two-dimensional Panel Flutter.
- Dennis Vernon Long (Civil Engineering). *B.S., California Institute of Technology, 1949; M.S., 1955.*
Thesis: Mechanics of Consolidation with Reference to Experimentally Sedimented Clays.
- Yen-Mow Lynn (Aeronautics and Physics). *B.S., National Taiwan University, 1956; M.S., California Institute of Technology, 1957.*
Thesis: Isentropic Plane Waves in Magneto hydrodynamics.
- John Owen Maloy (Physics and Mathematics). *B.S., University of Arizona, 1954.*
Thesis: Polarization of Recoil Protons from the Photoproduction of Neutral Pions in Hydrogen at 585 and 660 Mev.
- Jean-François Marin (Mechanical Engineering and Physics). *Ing. Civ., École Nationale Supérieure des Mines (Paris), 1957; M.S., California Institute of Technology, 1958.*
Thesis: Transitions in Chromium.
- William Brewster Mather, Jr. (Chemistry). *A.B., Princeton University, 1957.*
Thesis: Coulometric-Acidometric Titrations and Related Studies in Acetic Acid-Acetic Anhydride Solutions.
- Dennis Robert McCalla (Biochemistry and Genetics). *B.Sc., University of Alberta, 1957; M.Sc., University of Saskatchewan, 1958.*
Thesis: I. Chemical Study of Necrotic Corn Mutants.
II. The Metabolism of a Kinin.
III. The Chemical Nature of an Insect Gall Growth Factor.
- Howard Carl Merchant (Mechanical Engineering). *B.S., University of Washington, 1956; S.M., Massachusetts Institute of Technology, 1957.*
Thesis: Mode Superposition Methods Applied to Linear Mechanical Systems Under Earthquake Type Excitation.

DOCTOR OF PHILOSOPHY

- Alan Theodore Moffet (Physics and Astronomy). *B.A., Wesleyan University, 1957.*
Thesis: Interferometric Measurement of Brightness Distributions in Discrete Radio Sources.
- Lawrence Kernan Montgomery (Chemistry). *B.S., Colorado State University, 1957.*
Thesis: Substitution Reactions Occurring via the Elimination-Addition Mechanism.
I. The Reactions of 1-Chlorocyclopentene and 1-Bromocyclobutene with Phenyllithium.
II. The Coupling Reaction of Phenyllithium and Cyclopropyl Chloride and the Action of Strong Bases on 1-Bromoadamantane.
- Roddam Narashima (Aeronautics and Physics) *B.E., University of Mysore, 1953;*
D.I.I.Sc. (Ae), Indian Institute of Science, 1955.
Thesis: Some Flow Problems in Rarefied Gas Dynamics.
- Thomas Wyatt Noonan (Physics and Mathematics). *B.S., California Institute of Technology, 1955.*
Thesis: The Structure of the Coma Cluster of Galaxies.
- Martin Emery Nordberg, Jr. (Physics). *B.S., University of Rochester, 1957;*
M.S., California Institute of Technology, 1959.
Thesis: Comparison of the beta-alpha Angular Correlations in the Beta Decays of Li^8 and B^8 .
- John Eric Nordlander (Chemistry). *B.A., Cornell University, 1956.*
Thesis: Studies of Grignard Reagent Rearrangements by Means of Nuclear Magnetic Resonance Spectroscopy.
I. The Structure of Allylic Grignard Reagents.
II. The Interconversion of Cyclopropylcarbinyl and Allylcarbinyl Grignard Reagents.
- Jack Castle Overley (Physics). *S.B., Massachusetts Institute of Technology, 1954.*
Thesis: A Study of the Elastic Scattering of Protons by B^{10} .
- Manuel Panar (Chemistry). *B.S. (Hons), University of Alberta, 1957.*
Thesis: The Elimination-Addition Mechanism of Nucleophilic Aromatic Substitution.
- Robert Alden Phinney (Geophysics). *S.B., Massachusetts Institute of Technology, 1959;*
S.M., 1959.
Thesis: I. Propagation of Leaking Modes in a Plane Seismic Waveguide.
II. Propagation of Leaking Interface Waves.
- Elliot Neil Pinson (Electrical Engineering and Physics). *B.S.E., Princeton University, 1956;*
S.M., Massachusetts Institute of Technology, 1957.
Thesis: An Adaptive Control Technique for Systems with Lightly Damped Resonances.
- John David Rogers (Physics). *B.S., California Institute of Technology, 1956; M.S., 1958.*
Thesis: Determination of the g-Factor for Several Short-Lived Nuclear States.
- Ronald Efrom Rolfe (Chemistry). *B.S., Stanford University School of Medicine, 1953;*
M.D., 1956.
Thesis: I. The Relative Homogeneity of Microbial DNA.
II. The Molecular Arrangement of the Conserved Subunits of the DNA of *E. coli*.

DOCTOR OF PHILOSOPHY

- Ann Roller (Virology and Biochemistry). *B.A., Sarah Lawrence College, 1952;*
M.S., Georgetown University, 1957.
Thesis: Studies on the Replication and Transfer to Progeny of the DNA of the Bacteriophage T4.
- Howard Calvin Rumsey, Jr. (Mathematics). *B.S., California Institute of Technology, 1957;*
M.S., 1958.
Thesis: Sets of Visible Points.
- David Allison Russell (Aeronautics and Physics). *B.Eng., University of Southern California, 1956; M.S., California Institute of Technology, 1957.*
Thesis: Studies of the Effects of Cross Sectional Area Change and Boundary Layer Growth on the Motion of a Shock Wave.
- David Israel Schuster (Chemistry and Physics). *B.A., Columbia College, 1956.*
Thesis: Synthesis and Free Radical Decarbonylation of Some Small-Ring Aldehydes.
- Stewart Wilson Smith (Geophysics and Mathematics). *S.B., Massachusetts Institute of Technology, 1954; M.S., California Institute of Technology, 1958.*
Thesis: An Investigation of the Earth's Free Oscillations.
- Ronald Oran Stearman (Aeronautics and Mathematics). *B.S., Oklahoma State University, 1955; M.S., California Institute of Technology, 1956.*
Thesis: Stability of a Membrane in a Subsonic Flow and a Grid of Panels in a Supersonic Flow.
- Charles Myron Steinberg (Virology and Physics). *B.A., Vanderbilt University, 1954.*
Thesis: I. Some Theoretical Problems Arising in the Genetics of Bacteriophage.
II. A Critical Test of a Current Theory of Genetic Recombination in Bacteriophage.
- Martin Vogel (Chemistry). *B.S., California Institute of Technology, 1955.*
Thesis: Stereochemical Study of Cyclopropylcarbonyl Derivatives in Carbonium-ion Reactions.
- Ivan Jeanne Mayfield Weiler (Psychobiology and Immunology). *B.A., Pomona College, 1955.*
Thesis: Restoration of Visual Acuity after Optic Nerve Section and Regeneration in *Astronotus ocellatus* Agassiz.
- Ronald Howard Willens (Engineering Science and Physics). *B.S., California Institute of Technology, 1953; M.S., 1954.*
Thesis: I. A Vacuum X-Ray Diffractometer for High Temperature Studies.
II. An Investigation of the Allotropic Transformation of Titanium.
- John Coe Wilson (Geology and Geobiology). *B.S., California Institute of Technology, 1953; M.A., University of Kansas, 1955.*
Thesis: Geology of the Alta Stock, Utah.
- Kenneth Geddes Wilson (Physics). *A.B., Harvard College, 1956.*
Thesis: An Investigation of the Low Equation and the Chew-Mandelstam Equations.

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