

# CONTENTS

	Page
FOREWORD .....	iii
PREFACE.....	v
ACKNOWLEDGMENTS .....	vii
 <b>CHAPTER ONE:</b>	
<b>THE NATIONAL BUREAU OF STANDARDS AT MID-CENTURY.....</b>	<b>1</b>
A NERVOUS NATION.....	1
THE STATE OF SCIENCE.....	6
A UNIQUE INSTITUTION .....	14
THE NATURE AND CHARACTER OF THE BUREAU .....	19
THE TECHNICAL WORK.....	34
Length and Light: Natural Standards v. Artifacts.....	37
Applied Mathematics and Computers .....	40
The Isotope Effect in Superconductivity .....	44
The Charters of Freedom .....	47
Standards and Fundamental Constants .....	54
The Bureau and X Rays: High Energies Come to the Bureau .....	56
LIFE AT THE BUREAU .....	62
 <b>CHAPTER TWO:</b>	
<b>TESTING CAN BE TROUBLESOME .....</b>	<b>71</b>
POLICIES ON COMMODITY TESTING AND PUBLICATIONS.....	72
THE AQUELLA INCIDENT.....	74
THE BATTERY ADDITIVE INCIDENT.....	79
BATTERIES AND BATTERY ADDITIVES.....	80
A SHORT TECHNICAL NOTE .....	84
THE INCIDENT BEGINS .....	87
THE INCIDENT DEVELOPS .....	89
THE NATIONAL BETTER BUSINESS BUREAU .....	92
THE MILITARY TESTS .....	93
THE BUREAU TESTS AD-X2 AND THE PACE QUICKENS .....	94
THE BUREAU GOES PUBLIC ON AD-X2.....	95
RITCHIE GOES POLITICAL .....	101
THE POST OFFICE ENTERS THE FRAY, AND THE FEDERAL TRADE COMMISSION TAKES ANOTHER LOOK .....	102
THE SENATE SELECT COMMITTEE ON SMALL BUSINESS GETS INVOLVED.....	104

	Page
<b>CHAPTER TWO: (Continued)</b>	
FINALLY A PUBLIC TEST . . . . .	105
MIT CONDUCTS TESTS WITH SEEMINGLY STARTLING RESULTS . . . . .	107
THE POST OFFICE DEPARTMENT TAKES ACTION . . . . .	110
THE BEGINNING OF THE RESOLUTION . . . . .	111
ASTIN IS FIRED AND WEEKS LEARNS THE WAYS OF WASHINGTON . . . . .	114
THE VISITING COMMITTEE . . . . .	119
THE SENATE HEARINGS . . . . .	121
THE INCIDENT WINDS DOWN . . . . .	127
THE POST OFFICE DEPARTMENT AND THE FEDERAL TRADE COMMISSION . . . . .	128
THE BUREAU . . . . .	129
THE COMMITTEES REPORT . . . . .	130
CONCLUSIONS . . . . .	133

**CHAPTER THREE:**

<b>DIVESTITURE AND REAFFIRMATION, 1950-1957 . . . . .</b>	<b>137</b>
A PLACID NATION . . . . .	137
SCIENCE GROWS EXPLOSIVELY . . . . .	143
DIVESTITURE AND REAFFIRMATION . . . . .	148
A NEW ORGANIC ACT . . . . .	149
LOYALTY, SECURITY, AND THE RESIGNATION OF A DIRECTOR . . . . .	154
ALLEN VARLEY ASTIN . . . . .	171
FULLFILLING A REPORT . . . . .	173
THE ACQUISITION OF THE BOULDER SITE, AND A NEW PROGRAM IN CRYOGENIC ENGINEERING. . . . .	182
POSTDOCS COME TO THE BUREAU . . . . .	188
AN INSTRUMENTATION PROGRAM . . . . .	191
THE TECHNICAL WORK . . . . .	193
ELECTRICITY; OPTICS AND METROLOGY . . . . .	193
Project Tinkertoy . . . . .	200
HEAT AND POWER . . . . .	203
The Parity Experiment . . . . .	207
ATOMIC AND RADIATION PHYSICS . . . . .	213
CHEMISTRY . . . . .	218
MECHANICS . . . . .	226

	Page
<b>CHAPTER THREE: (Continued)</b>	
MATERIALS RESEARCH . . . . .	231
Organic and Fibrous Materials . . . . .	232
Metallurgy . . . . .	238
Ship Failures . . . . .	240
Mineral Products . . . . .	246
BUILDING TECHNOLOGY . . . . .	253
APPLIED MATHEMATICS AND COMPUTERS . . . . .	261
CENTRAL RADIO PROPAGATION LABORATORY . . . . .	269
The Speed of Light . . . . .	278
TESTING . . . . .	282
SUMMARY . . . . .	285
 <b>CHAPTER FOUR:</b>	
<b>REORIENTATION AND RECONSTITUTION, 1958-1964 . . . . .</b>	<b>287</b>
THE BEGINNING OF A TIME OF TURMOIL . . . . .	287
Foreign Affairs . . . . .	288
National Affairs . . . . .	291
THE GLORY DAYS . . . . .	294
THE BUREAU . . . . .	297
Budget Matters . . . . .	298
An Evaluation and a Status Report . . . . .	304
An Organization Changes . . . . .	312
JILA, The Joint Institute for Laboratory Astrophysics . . . . .	322
The National Standard Reference Data System . . . . .	329
Civilian Industrial Technology—The Bureau Gets a Small, Short Program . . . . .	333
A Bold Proposal Leads to a Major Reorganization . . . . .	338
THE TECHNICAL WORK . . . . .	345
STANDARDS MATTERS . . . . .	345
Length . . . . .	345
Temperatures High and Low . . . . .	353
High Pressures . . . . .	355
Large Forces . . . . .	362
Time and Frequency . . . . .	367
<i>Frequency Standards</i> . . . . .	368
<i>The Definition of the Second</i> . . . . .	372
<i>Frequency and Time Dissemination</i> . . . . .	374

**CHAPTER FOUR: (Continued)**

Calibrations . . . . .	377
Standard Samples Become Standard Reference Materials . . . . .	379
The End of Product Testing . . . . .	380
Commodity Standards and a Reversal of Position . . . . .	381
Weights and Measures . . . . .	382
The International Yard and Pound; SI . . . . .	385
A TOUR OF THE DIVISIONS . . . . .	387
Optics and Metrology . . . . .	387
Mechanics . . . . .	389
The Electricity Division Stimulates Polymer Science . . . . .	390
Radio Standards . . . . .	395
Heat . . . . .	398
<i>A Program on Free Radicals</i> . . . . .	399
Atomic and Molecular Physics . . . . .	402
<i>A New Light Source</i> . . . . .	405
<i>Molecular Spectroscopy</i> . . . . .	410
Radiation Physics . . . . .	411
<i>Two New Radiation Sources</i> . . . . .	413
Chemistry . . . . .	419
Materials . . . . .	421
Applied Mathematics . . . . .	430
Data Processing . . . . .	433
Instrumentation . . . . .	436
Central Radio Propagation Laboratory . . . . .	438
<i>The International Geophysical Year</i> . . . . .	439
Cryogenics . . . . .	445
Building Research . . . . .	449

**CHAPTER FIVE:**

<b>TECHNOLOGICAL TRIUMPH: SOCIAL TURMOIL, 1964-1969 . . . . .</b>	<b>453</b>
THE VIETNAM AGONY . . . . .	453
A SPATE OF LEGISLATION . . . . .	456
TECHNOLOGICAL TRIUMPH AND DRAMA . . . . .	460
THE RISE OF RELEVANCE . . . . .	460

## CHAPTER FIVE: (Continued)

TOWARD A NEW LEADERSHIP . . . . .	465
BUDGET, PERSONNEL AND MANAGEMENT MATTERS . . . . .	466
THE PLANNING-PROGRAMMING-BUDGETING SYSTEM . . . . .	472
THE GAITHERSBURG RELOCATION. . . . .	474
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION. . . . .	492
A NUMBER OF NEW RESPONSIBILITIES . . . . .	493
Automobile Safety . . . . .	494
Automatic Data Processing (ADP) . . . . .	500
Fire Research and Safety . . . . .	504
SYSTEMS ANALYSIS AND THE TECHNICAL ANALYSIS DIVISION . . . . .	507
THE NATIONAL MEASUREMENT SYSTEM. . . . .	510
THE CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION. . . . .	513
INVENTION AND INNOVATION . . . . .	515
A DIRECTOR RETIRES . . . . .	518
STANDARDS MATTERS . . . . .	521
LASERS AND NEW VISTAS IN METROLOGY . . . . .	522
Time Dissemination . . . . .	529
Mass and Measurement Assurance Programs . . . . .	533
The Josephson Effect and Maintenance of the Volt. . . . .	537
Temperature . . . . .	541
Radio Standards . . . . .	542
Toward a New Era in Radiometry. . . . .	544
Standard Reference Materials (SRMs) . . . . .	550
Standard Reference Data . . . . .	553
Weights and Measures for the States . . . . .	555
Federal Information Processing Standards . . . . .	558
THE GENERAL RESEARCH. . . . .	560
Superconducting Semiconductors . . . . .	560
Electron Scattering From Nuclei . . . . .	563
Making the Draft Lottery Impartial. . . . .	565
Research at the Reactor . . . . .	567
Critical Phenomena. . . . .	569
Fracture Mechanics Comes to the Bureau. . . . .	573
The Investigation of the Point Pleasant Bridge Collapse. . . . .	576

	<b>Page</b>
<b>CHAPTER FIVE: (Continued)</b>	
Atomic Weights and Isotopic Abundances .....	580
A Program on Crystal Growth.....	582
Silicon Resistivity.....	586
Evaluation Nuclear Radiation Detectors .....	588
Building Research and the Performance Concept.....	590
Disaster Investigation.....	592
Experiments in Fire and Smoke.....	595
SUMMARY .....	598
 <b>APPENDICES</b>	
A. Tables .....	601
B. Acronyms Dictionary .....	603
C. Legislation Relating to the Organization, Functions, and Activities of the National Bureau of Standards .....	607
D. The National Bureau of Standards in the Federal Administration..	659
E. Appropriations and Expenditures Charts .....	661
F. Members of the Visiting Committee of the Secretary of Commerce to NBS and NIST .....	665
G. NBS Authorized Personnel Chart .....	669
H. NBS/NIST Publications .....	671
I. Organizational Levels of the National Bureau of Standards .....	689
J. Site Information and Maps: Gaithersburg and Boulder.....	777
 <b>BIBLIOGRAPHIC NOTE AND REFERENCES.....</b>	 783
 <b>INDEX .....</b>	 787