

David M. Harland

---

# Exploring the Moon

**The Apollo Expeditions**



Springer

Published in association with  
Praxis Publishing  
Chichester, UK



## Table of contents

List of illustrations.....	xi
List of tables .....	xvii
Foreword .....	xix
Author's preface.....	xxi
Acknowledgements .....	xxvii
List of acronyms .....	xxix
1 <b>The robots</b> .....	1
The importance of being first .....	1
Ranger .....	3
Lunar Orbiter.....	7
Surveyor.....	12
Missions accomplished .....	17
Selecting a landing site .....	18
2 <b>Magnificent desolation</b> .....	21
Eagle's descent .....	21
Moonwalk!.....	23
Moonrocks.....	28
Sense of perspective.....	31
3 <b>'Pin-point' target</b> .....	33
Relaxing the pace .....	33
Need for precision .....	34
Landing by the Snowman.....	35
Scientific station .....	37
Geological traverse .....	40
Hurry up, and wait .....	47
Second 'rock fest' .....	48

viii **Table of contents**

<b>4</b>	<b>From the Moon – Knowledge.....</b>	51
	Satisfying the geologists.....	51
	Cuts .....	54
	Unlucky thirteen .....	54
	Deep sounding .....	56
	Apollo grounded .....	56
	Revised plans .....	57
	Once more Moon-bound .....	57
	Chores .....	58
	Cone Ridge .....	60
	Fra Mauro rocks.....	72
	Big picture .....	75
	Exploration imperative .....	76
<b>5</b>	<b>The wonder of the unknown at Hadley–Apennine .....</b>	79
	‘Advanced’ mission .....	79
	Skimming the mountains.....	80
	Site survey.....	83
	A good night’s sleep .....	87
	Venturing out.....	89
	Wheels .....	90
	Across the plain .....	99
	On the rille.....	102
	Elbow .....	104
	St George.....	107
	Heading home.....	113
	Frustrations .....	115
	The long drive.....	115
	Working on the slope.....	119
	Spur’s treasure .....	129
	Tantalising Dune.....	136
	Journey’s end .....	139
	The saga of the drill .....	140
	Racing west.....	150
	On the rim .....	154
	Final act.....	162
	No longer unknown .....	163
	Apennine Front.....	164
	Rille and plain .....	167
	Appenine Bench .....	171
	North Complex .....	173
	Seismic network .....	174
	Lunar ‘heat engine’ .....	175

## Table of contents ix

<b>6</b>	<b>Surprise at Descartes–Cayley .....</b>	179
	Quest .....	179
	Perfect place.....	180
	Better late than never .....	183
	Plan in tatters.....	185
	Beautiful rocks .....	185
	Deploying the ALSEP .....	187
	Flag and Spook.....	191
	Plum .....	193
	Buster .....	198
	Heading south.....	204
	Stone Mountain .....	208
	Lower slope.....	212
	Sampling South Ray .....	216
	To North Ray .....	224
	Biggest boulder .....	228
	Shadow Rock.....	234
	Back to the drawing board .....	237
	New seismic insight .....	243
<b>7</b>	<b>The beautiful valley of Taurus–Littrow .....</b>	245
	Dilemma .....	245
	Geologist-astronaut .....	246
	Multiplicity of objectives .....	247
	Routine landing .....	250
	First impressions .....	252
	All in all, a good start .....	252
	Dash south.....	259
	Somewhere near Steno’s Crater .....	260
	Back home .....	263
	Breaking records .....	265
	Longest run.....	266
	Light mantle.....	269
	Sampling the talus.....	270
	Back down the scarp .....	276
	Trials and tribulations .....	278
	‘Holy Grail?’ .....	280
	Camelot’s boulders .....	285
	The geology of Tracy’s Rock.....	288
	Another piece of the puzzle .....	295
	Sculptured Hills.....	296
	Mysterious Van Serg .....	299
	Hidden valley .....	305
	So much for the fumerole.....	306

x Table of contents

The Tycho link? .....	308
Christmas finale .....	309
<b>8 Luna revival.....</b>	<b>311</b>
Samplers .....	311
Lunokhods.....	312
Missed opportunities .....	313
<b>9 Apollo in context .....</b>	<b>315</b>
Ground truth .....	315
Remote sensing .....	323
Synergy .....	325
Lost 'I-missions .....	329
For a few dollars more.....	329
NASA's assessment .....	330
Starting over .....	332
<b>10 The Prospectors.....</b>	<b>335</b>
Galileo .....	335
Clementine .....	337
Albedo map .....	339
Basins .....	339
Gravity survey.....	340
Mineralogy.....	342
Volatiles .....	344
Lunar Prospector .....	345
Water! .....	349
What next? .....	349
<b>Appendix .....</b>	<b>353</b>
<b>Apollo lunar samples.....</b>	<b>361</b>
<b>Glossary .....</b>	<b>365</b>
<b>Chronological bibliography .....</b>	<b>379</b>
<b>Apollo lunar explorers.....</b>	<b>393</b>
<b>Afterword .....</b>	<b>395</b>
<b>Index .....</b>	<b>399</b>