Digital Apollo:

Human and Machine in Spaceflight

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Preface and Acknowledgments

On June 14, 1966, a robotic spacecraft had just landed on the moon and begun transmitting images to NASA. Project Gemini was drawing to a close, Apollo hardware was beginning to emerge from factories, and Apollo software was experiencing a crisis. And on that day I was born.

I do not remember the first lunar landing of Apollo 11 or the drama of Apollo 13, but I do remember watching the later launches and landings on television. In that sense, I am among the first of a generation—those for whom lunar landings have always been a fait accompli—for whom the twentieth century’s greatest technological spectacle was an accomplishment rather than a dream. Nevertheless, as a boy I was fascinated by images of Apollo. When my father brought home a book, *Apollo: Expeditions to the Moon*, filled with wonderful, complicated imagery, I pored through it hundreds of times. The book shaped my lifelong fascination with machinery and my later choice to become an engineer.

This book arises out of a later scholarly trajectory. It is the third in an unplanned trilogy, a series of books I have been writing since I chose to become a historian in 1991. For fifteen years, beginning with a study of the USS *Monitor* in the American Civil War, I have written about the relationship of humans and machines, the experiences of new technologies and their effects on human identity. My second book, *Between Human and Machine: Feedback, Control, and Computing before Cybernetics*, explored the history of human interfaces, control systems, and digital computing. That book included an episode during World War II when Charles Stark Draper (and his young associate Robert Seamans) collaborated on a gun sight project with James Webb, then a lawyer for the Sperry Gyroscope Company. These three men would play central roles in the Apollo program. As I completed that book I found more and more continuities between the earlier history and the lunar landings. A project funded by the Sloan Foundation and the Dibner Foundation on the History of Recent Technology on the World Wide Web provided early support for collecting documents and interviews (that website is available at http://digitalapollo.mit.edu). A senior research fellowship from the Dibner Institute supported early writing.
A number of colleagues, friends, and students have been patient interlocutors and
have read manuscripts in various states: Alexander Brown, Stephen Cass, Paul Ceruzzi,
Don Eyles, Slava Gerovitch, Jeff Hoffman, Thomas P. Hughes, Chihyung Jeon, Rich
Katz, Alex Kosmala, Roger Launius, John Logsdon, Fred Martin, Larry McGlynn, Dava
Newman, Jim Nevins, Chuck Oman, Wayne Ottinger, Philip Scranton, Sherry Turkle,
John Tylko, and Rosalind Williams. Paul Fjeld made incisive readings and a variety of
documents from the Grumman Archives available from his personal collection; John
Knoll generously created the cover image with historical help from Fjeld. Eldon Hall
also generously shared documents and photographs, as did Hugh Blair Smith and Jim
Nevins. Victor McElheny, as always, proved an engaging friend and also provided ac-
tess to his collection of documents from his reporting on Apollo for the Boston Globe.
Sarah Fowler assisted the research for the final stages of the manuscript with energy
and humor. Thanks to Jack Garman for granting permission to produce the image
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Test Pilots for providing access to their back issues of journals and newsletters (some
of them dug out of a closet). A number of Apollo participants generously gave their
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Blair-Smith, Ed Blondin, Herb Briss, Ed Copps, Ed Duggan, Cline Frasier, Joe Gavin,
John Green, Eldon Hall, Margaret Hamilton, David Hanley, David Hoag, Alex Kosmala,
Dan Lickly, Fred Martin, Jim Miller, John Miller, Jack Poundstone, Herb Thaler, and
Bard Turner.

While writing this book I created a course at MIT, “Engineering Apollo: The Moon
Project as a Complex System,” as an exploration of the project from numerous angles,
from management techniques to software, from presidential policy to press coverage.
I’ve been fortunate to teach in collaboration with Professor Larry Young from whom I
have learned a great deal. We brought a wonderful mix of guests to class to create a
unique educational experience for graduate students in engineering, management,
and history: Buzz Aldrin, Dick Battin, Hugh Blair-Smith, Charlie Duke, Don Eyles, Joe
Gavin, Eldon Hall, Sy Liebergot, John Logsdon, Victor McElheny, Ed Mitchell, Bob
Parker, and Bob Seamans. A particularly interesting moment was attending a lunch
with Chris Kraft, Bob Seamans, Aaron Cohen, and Jeff Hoffman. Each, through their
generosity, memory, and insight, has contributed to my own thinking on Apollo.

I have also been fortunate to serve on the NASA Historical Advisory Committee and
to work with the NASA historians, archivists, and librarians without whom books like
this would not be possible. These include Nadine Andreassen, Steve Dick, Steve Garber,
Christian Gelzer, Mike Gorn, Roger Launius, Peter Merlin, Jane Odom, Curtis Peebles,
Jennifer Ross-Nazal, Rebecca Wright, and the numerous interviewers who have col-
lected NASA history since the 1960s. The NASA History Office preserves and publishes
a history that, in addition to being central to spaceflight, exemplifies the evolution of
a large technological system. Open and well documented, NASA’s systems are more ac-
cessible to scholars than military or corporate ones, and hence provide crucial material for understanding the human evolution of technology.

Only the second time I met my wife’s family, they accompanied me to the Cradle of Aviation Museum in Long Island and enjoyed a detailed tour of a lunar module. Their genuine interest and excitement made a warm welcome into the Getnick family that I will always remember.

Pamela, whom I met and married while writing this book, sang me through it. I dedicate the book to her, for laughing with me through every day and into our future.