

*Launch Options for the Future: A Buyer's  
Guide*

July 1988

NTIS order #PB89-114268



### Recommended Citation:

U.S. Congress, Office of Technology Assessment, *Launch Options for the Future: Buyer's Guide*, OTA-ISC-383 (Washington, DC: U.S. Government Printing Office, July 1988).

Library of Congress Catalog Card Number 88-600540

For sale by the Superintendent of Documents  
U.S. Government Printing Office, Washington, DC 20402-9325  
(order form can be found in the back of this report)

## Foreword

Adequate, reliable space transportation is the key to this Nation's future in space. Over the next several years, Congress must make critical decisions regarding the direction and funding of U.S. space transportation systems. These decisions include improving existing launch systems, designing and procuring new launch systems, and developing advanced technologies. America's constrained budgetary environment and the lack of a national consensus about the future of the U.S. space program make Congress's role in this process more difficult and important than ever.

In order to decide which paths to take in space transportation, Congress must first decide what it wants to do in space and what it can afford. A space transportation system designed to meet current needs would be woefully inadequate to support a piloted mission to the planet Mars or to deploy ballistic missile defenses. Accordingly, this special report, which is part of a broader assessment of space transportation requested by the House Committee on Science, Space, and Technology, and the Senate Committee on Commerce, Science, and Transportation, takes the form of a "buyer's guide" to space transportation. It describes the range of launch systems that exist now or could be available before 2010 and explores the costs of meeting different demand levels for launching humans and spacecraft to orbit. It also discusses the importance of developing advanced technologies for space transportation.

In undertaking this special report, OTA sought the contributions of a wide spectrum of knowledgeable and interested individuals and organizations. Some provided information, others reviewed drafts of the report. OTA gratefully acknowledges their contributions of time and intellectual effort. As with all OTA reports, the content of this special report is the sole responsibility of the Office of Technology Assessment and does not necessarily represent the views of our advisors or reviewers.

  
JOHN H. GIBBONS  
*Director*

## Advisory Panel on Launch Options for the Future: A Buyer's Guide

M. Granger Morgan, *Chair*  
Head, Department of Engineering and Public Policy  
Carnegie-Mellon University

I.M. Bernstein  
Provost and Academic Vice President  
Illinois Institute of Technology

Anthony J. Macina  
Program Manager  
IBM Federal Systems Division

Michael A. Berta  
Assistant Division Manager  
Space and Communications Group  
Hughes Aircraft Company

George B. Merrick  
Vice President  
North American Space Operations  
Rockwell International Corporation

Richard E. Brackeen  
President  
Martin Marietta Commercial Titan, Inc.

Alan Parker  
Senior Vice President  
Technical Applications, Inc.

Edward T. Gerry  
President  
W. J. Schafer Associates, Inc.

Gerard Piel  
Chairman Emeritus  
Scientific American

Jerry Grey  
Director, Science and Technology Policy  
American Institute of Aeronautics and  
Astronautics

Bryce Poe, II  
General, USAF (retired)  
Consultant

William H. Heiser  
Consultant

Ben R. Rich  
Vice President and General Manager  
Lockheed Corporation

Otto W. Hoernig, Jr.  
Vice President  
Contel/American Satellite Corporation

Sally K. Ride  
Professor, Center for International  
Security and Arms Control  
Stanford University

Donald B. Jacobs  
Vice President, Space Systems Division  
Boeing Aerospace Company

Tom Rogers  
President  
The Sophron Foundation

John Logsdon  
Director, Graduate Program in Science,  
Technology and Public Policy  
George Washington University

Richard G. Smith  
Senior Vice President  
JLC Aerospace Corporation

Hugh F. Loweth  
Consultant

William Zersen  
Project Manager  
Space Flight Systems  
United Technologies Corporation

OTA appreciates the valuable assistance and thoughtful critiques provided by the advisory panel members. The views expressed in this OTA report, however, are the sole responsibility of the Office of Technology Assessment. Participation on the advisory panel does not imply endorsement of the report.

# **OTA Project Staff on Launch Options for the Future: A Buyer's Guide**

Lionel S. Johns, *Assistant Director, OTA  
Energy, Materials, and International Security Division*

*Peter Sharfman, International Security and Commerce Program Manager*

**Richard DalBello**, *Project Director*

Eric O. Basques

Michael B. Callahan

Stephen W. Korthals-Altes

Gordon Law

Ray A. Williamson

## **Administrative Staff**

Jannie Home Cecile Parker Jackie Robinson

## Acknowledgments

The following organizations generously provided OTA with information and suggestions:

Aerojet Corporation	NASA Marshall Space Flight Center
Aerospace Corporation	National Security Council
Boeing Aerospace Company	Pratt and Whitney
General Dynamics	Rockwell International Corporation
Hughes Aircraft Company	Strategic Defense Initiative Organization
Lockheed Space Operations Company	United Technologies
Martin Marietta	U.S. Air Force Arnold Engineering Development Center
McDonnell Douglas	U.S. Air Force Astronautics Laboratory
NASA Headquarters	U.S. Air Force Cape Canaveral Air Force Station
NASA Johnson Space Center	U.S. Air Force Directorate of Space Systems
NASA Kennedy Space Center	U.S. Air Force Space Division
NASA Langley Research Center	

This report has also benefited from the advice of many space transportation experts from the government and the private sector. OTA especially would like to thank the following individuals for their assistance and support. The views expressed in this report, however, are the sole responsibility of the Office of Technology Assessment.

Ivan Bekey  
NASA

John Jordan  
Boeing Aerospace Company

Darrell Branscome  
NASA

Lawrence Lewis  
Rockwell International, Inc.

Vincent Caluori  
Boeing Aerospace Company

David Moore  
Congressional Budget Office

Lt. Col. Roger Colgrove  
U.S. Air Force

Dale Myers  
NASA

Col. Robert Dickman  
U.S. Air Force

Maj. Gen. Thomas Moorman, Jr.  
U.S. Air Force

Cort Durocher  
Hughes Aircraft Company

Robert Rosen  
NASA

John Gaines  
General Dynamics

William Strobl  
General Dynamics

Daniel Gregory  
Boeing Aerospace Company

Col. John Wormington  
U.S. Air Force