

This is a section of [doi:10.7551/mitpress/8844.001.0001](https://doi.org/10.7551/mitpress/8844.001.0001)

Rational Accidents

Reckoning with Catastrophic Technologies

By: John Downer

Citation:

Rational Accidents: Reckoning with Catastrophic Technologies

By: John Downer

DOI: 10.7551/mitpress/8844.001.0001

ISBN (electronic): 9780262377010

Publisher: The MIT Press

Published: 2024

The open access edition of this book was made possible by generous funding and support from MIT Press Direct to Open



The MIT Press

RATIONAL ACCIDENTS

Inside Technology

Wiebe Bijker and Rebecca Slayton, series editors

A list of books in the series appears at the back of the book.

RATIONAL ACCIDENTS

RECKONING WITH CATASTROPHIC TECHNOLOGIES

JOHN DOWNER

The MIT Press
Cambridge, Massachusetts
London, England

© 2023 Massachusetts Institute of Technology

This work is subject to a Creative Commons CC-BY-NC-ND license.
Subject to such license, all rights are reserved.



The MIT Press would like to thank the anonymous peer reviewers who provided comments on drafts of this book. The generous work of academic experts is essential for establishing the authority and quality of our publications. We acknowledge with gratitude the contributions of these otherwise uncredited readers.

This book was set in Stone Sans and Stone Serif by Westchester Publishing Services.

Library of Congress Cataloging-in-Publication Data

Names: Downer, John (John R.), author.

Title: Rational accidents : reckoning with catastrophic technologies / John Downer.

Description: Cambridge, Massachusetts : The MIT Press, [2023] | Series: Inside technology | Includes bibliographical references and index.

Identifiers: LCCN 2023002845 (print) | LCCN 2023002846 (ebook) | ISBN 9780262546997 (paperback) | ISBN 9780262377027 (epub) |

ISBN 9780262377010 (pdf)

Subjects: LCSH: Reliability (Engineering) | Aircraft accidents—Prevention. | Risk assessment. | Industrial accidents—Prevention.

Classification: LCC TA169 .D69 2023 (print) | LCC TA169 (ebook) | DDC 620/.00452—dc23/eng/20230202

LC record available at <https://lcn.loc.gov/2023002845>

LC ebook record available at <https://lcn.loc.gov/2023002846>

Dedicated to Dick, Babs, Greenie, and the Loris.
My family.

CONTENTS

ACKNOWLEDGMENTS ix

INTRODUCTION: PURPOSE, SCOPE, AND STRUCTURE xv

I THE AVIATION PARADOX 1

1 CATASTROPHIC TECHNOLOGIES: THE RISE OF RELIABILITY AS A
VARIABLE OF CONSEQUENCE 3

2 FINITISM AND FAILURE: ON THE LOGICAL IMPLAUSIBILITY OF
ULTRAHIGH RELIABILITY 17

3 THE AVIATION PARADOX: ON THE IMPOSSIBLE RELIABILITY OF
JETLINERS 29

II CONFRONTING ULTRAHIGH RELIABILITY 39

4 ORGANIZING AVIATION SAFETY: RELIABILITY REQUIREMENTS AND
LOGICS 41

5 WHEN THE CHICK HITS THE FAN: TESTING AND THE PROBLEM OF
RELEVANCE 53

6 THE SUM OF ALL PARTS: MODELING RELIABILITY WITH
REDUNDANCY 71

7 RATIONAL ACCIDENTS: ON FINITISM'S CATASTROPHIC
IMPLICATIONS 89

III MASTERING ULTRAHIGH RELIABILITY 109

- 8 PARADOX RESOLVED: TRANSCENDING THE LIMITS OF TESTS AND MODELS 111
- 9 DESIGN STABILITY REVISITED: CONTEXT, CAVEATS, COMPOSITES, AND CONCORDE 131
- 10 SAFETY COSTS: THE STRUCTURAL FOUNDATIONS OF ULTRARELIABLE DESIGN 151
- 11 INCENTIVES IN ACTION: ON DEFICIENT 737s AND NEGLECTED SURVIVABILITY 173

IV RECKONING WITH CATASTROPHIC TECHNOLOGIES 191

- 12 BURDENS OF PROOF: THE HIDDEN COSTS OF POSITIVISM 193
- 13 THE MYTH OF MASTERY: ON THE UNDERAPPRECIATED LIMITS OF TECHNOLOGICAL AMBITION 211
- 14 FUKUSHIMA REVISITED: REAPING THE WHIRLWINDS OF CERTAINTY 223

NOTES 235

REFERENCES 255

INDEX 293

© 2023 Massachusetts Institute of Technology

This work is subject to a Creative Commons CC-BY-NC-ND license.
Subject to such license, all rights are reserved.



The MIT Press would like to thank the anonymous peer reviewers who provided comments on drafts of this book. The generous work of academic experts is essential for establishing the authority and quality of our publications. We acknowledge with gratitude the contributions of these otherwise uncredited readers.

This book was set in Stone Sans and Stone Serif by Westchester Publishing Services.

Library of Congress Cataloging-in-Publication Data

Names: Downer, John (John R.), author.

Title: Rational accidents : reckoning with catastrophic technologies / John Downer.

Description: Cambridge, Massachusetts : The MIT Press, [2023] | Series: Inside technology | Includes bibliographical references and index.

Identifiers: LCCN 2023002845 (print) | LCCN 2023002846 (ebook) | ISBN 9780262546997 (paperback) | ISBN 9780262377027 (epub) |

ISBN 9780262377010 (pdf)

Subjects: LCSH: Reliability (Engineering) | Aircraft accidents—Prevention. | Risk assessment. | Industrial accidents—Prevention.

Classification: LCC TA169 .D69 2023 (print) | LCC TA169 (ebook) | DDC 620/.00452—dc23/eng/20230202

LC record available at <https://lcn.loc.gov/2023002845>

LC ebook record available at <https://lcn.loc.gov/2023002846>