

Table of Contents

List of Figures	vii
Acknowledgments	xi
Preface	xiii
Introduction	1
NCW Myths	5
The Myths	5
Summary	13
The Information Age	15
The Technology	15
Wealth and Power	16
Complexity, Time, and Space	20
Summary	22
Information Age Organizations	25
Value Creation	29
Competitive Awareness	36
Virtual Organizations	38
Cost and Risk Suppression	41
Precision Manufacturing	42

Focused Logistics	44
Precision Retailing	45
The Network Is the Market	48
Lessons and Insights	50
Implications for Military Operations	53
Information Superiority	54
What's Different about the Mission Space and the Battlespace	58
What's Different about Sensors and Actors	65
Challenges and Opportunities for Command and Control	69
Implications for Future Command and Control .	78
The Shift to Network-Centric Operations	82
Network Centric Warfare	87
Definition of Network Centric Warfare	88
Power of NCW	93
Virtual Collaboration	108
Battlespace Entities	115
Roles of Battlespace Entities	123
Battlespace Awareness and Knowledge	133
Sensor Networks	140

Application of Sensor Networks to the Surveillance and Tracking of Objects in Air and Space	141
Application of Sensor Networks to the Surveillance and Tracking of Moving and Mobile Objects on the Surface of the Earth	150
Operational Capabilities of Mission Specific Sensor Networks	152
Command and Control and Execution	157
Speed of Command	163
Rehearsal	167
Engagement with Enhanced Awareness	167
Execution	168
Cooperative Engagement	170
Beyond Line of Sight Engagement	172
Massing of Effects	173
Self-Synchronization	175
Tempo and Responsiveness	180
Implications	184
The Entry Fee	187
Implications for MCPs	193
Concept of Operations	193
Command Approach	194

Organization	194
Infostructure Systems	195
People	196
Coevolution of MCP	197
Making NCW a Reality	199
Lessons Learned	202
Role of Experimentation	209
Assessing the Potential of NCW	215
Measures of Merit	217
The Journey Ahead	223
Security in the Information Age	224
Coalition Environments	226
Jointness	227
Process of Coevolution	227
Investment Strategy	228
Education and Training	229
Bringing It All Together	230
Endnotes	233
Appendix A	245
Moore's Law—2x Every 18 Months	247
Transmission Capacity—2x Every 12 Months	249

Confluence of Trends—Network-Centric Computing	250
Metcalfe’s Law	250
Business Trends—Convergence of Voice and Data	250
Implications of Metcalfe’s Law	251
List of Acronyms	267
Bibliography	271
About the Authors	283

List of Figures

Figure 1. Coevolution and the Shift to Network-Centric Operations	28
Figure 2. Information Flow in the Value-Creation Process	30
Figure 3. Value-Creation Process	31
Figure 4. Metcalfe's Law	33
Figure 5. Superior Information Position	34
Figure 6. The Network-Centric Enterprise	36
Figure 7. Superior Information Position Vis-À-Vis an Adversary	56
Figure 8. Full-Spectrum Dominance Enabled by Information Superiority	57
Figure 9. The Military as a Network-Centric Enterprise	89
Figure 10. Platform-Centric Shooter	95
Figure 11. Platform-Centric Engagement Envelope	97
Figure 12. C2 and Platform-Centric Shooters	98
Figure 13. Platform-Centric Operations vs. Network-Centric Operations	99
Figure 14. Network-Centric Operations	101

Figure 15. NCW Value-Added Combat Power ...	102
Figure 16. Virtual Collaboration—Moving Information, Not People	111
Figure 17. Roles of Battlespace Entities	125
Figure 18. Relationships Between Entities in a Network-Centric Operation	131
Figure 19. Elements of Battlespace Awareness	134
Figure 20. Common Operational Picture at the Brigade Level	136
Figure 21. Variation in Information Content for Operational Pictures	136
Figure 22. Network-Centric Operation of Data Fusion	143
Figure 23. Decreased Time Required to Generate Engagement Quality Awareness	144
Figure 24. Sensor Tasking	145
Figure 25. Formation of a Composite Track Within a CEC Sensor Network	147
Figure 26. Increased Battlespace Awareness Generated by a Sensor Network	149
Figure 27. Payoff of Sensor Fusion	151
Figure 28. Performance Increase of Sensor Network Against Moving Ground Targets	153
Figure 29. Lockout	166

Figure 30. JSEAD Mission Effectiveness	175
Figure 31. Self-Synchronization Interaction	176
Figure 32. Network Centric Warfare—Fleet Battle Experiment	179
Figure 33. Operational Gains of Digitization	181
Figure 34. Variations in the Quality of Service Across the Warfighting Enterprise	188
Figure 35. Role of Experimentation in the Coevolution of MCPs	210
Figure 36. Hierarchy of Measures	219
Figure A-1. Entity Interactions	255
Figure A-2. Attributes of Information Technologies	256
Figure A-3. Traditional Mail	257
Figure A-4. Fax Machines	258
Figure A-5. E-Mail	259
Figure A-6. World Wide Web	260
Figure A-7. Network-Centric Value Creation— On-line Retailing	262
Figure A-8. Network-Centric Value Creation— On-line Trading	263