S.1. Current and Future Carrier Force Structures ................ xvi
S.2. Build Intervals for Sustaining a 12-Ship Fleet ................ xviii
S.3. End-of-Fuel Dates for Current Carriers in Relation to Nominal Ship-Construction Schedule ................ xix
S.4. Effect of CVN 77 Start Date and Build Period on Total Shipyard Costs ........................................ xx
S.5. The CVN 77 Labor Demand and the Total Shipyard Workforce Profile. ...................................... xxi
S.6. Labor-Demand Requirements for Construction of CVN 77 for Different Start Dates and Build Periods, in Relation to Other Work at NNS .................................... xxi
S.7. Annual Costs for Scheduled Availabilities and Ship’s Enlisted Company, Nimitz Class .................. xxv
S.8. Initiatives to Reduce Maintenance and Crew Costs ........ xxv
2.2. Current and Future Carrier Force Structures ............ 16
2.3. Carrier Response in Relation to Number of Carriers in Fleet .... 18
2.4. Breakdown of a Nimitz-Class Carrier’s Life Cycle .......... 18
2.5. Carriers Completed Each Year, by Shipyard ............... 21
3.1. Relationship Among Fleet Size, Ship Retirement Age, and Build Rate ............................................. 24
3.2. Service Lives of Carriers Commissioned Since 1955 .......... 26
3.3. Build Intervals for Sustaining a 12-Ship Fleet .......... 28
3.4. End-of-Fuel Dates for Current Carriers in Relation to Nominal Ship-Construction Schedules ........................................... 29
3.5. Time Required to Increase Fleet Size ........................................ 32
4.1. CVN 77 Labor-Demand Profile .......................................................... 39
4.2. Total NNS Labor Demand, by Skill Group, Assuming CVN 77 Starts in 2002 ................................................................. 39
4.3. Total NNS Labor Demand, by Project, Assuming CVN 77 Starts in 2002 ................................................................. 40
4.4. Total Demand for Welders at NNS, Assuming CVN 77 Starts in 2002 ................................................................. 41
4.5. Need for Excess Supply of Welders, Assuming CVN 77 Starts in 2002 ................................................................. 43
4.6. Total NNS Employment Profile, Assuming CVN 77 Starts in 2002 ................................................................. 43
4.7. Effect of CVN 77 Start Date on Construction Costs ......................... 45
4.8. Anticipated Labor Level at Newport News over the Period of Concern ................................................................. 45
4.9. Labor Demand of Commercial Projects in Relation to That Required to Build CVN 77 ................................................................. 47
4.10. Build Periods and Construction Costs .............................................. 47
4.11. Build Periods for Recent Carriers .................................................... 48
4.12. Labor-Demand Requirements for Construction of CVN 77 for Different Start Dates and Build Periods, in Relation to Other Work at NNS ................................................................. 50
4.13. Effect of CVN 77 Start Date and Build Period on Construction Costs, Assuming CVX Starts in 2006 ......................... 51
4.14. Effect of CVX on Extra Cost or Savings Associated with Varying CVN 77 Start Date and Build Period .......................... 52
4.15. Response of Figure 4.7 Results to Changes in the Schedule of Another Project (CVN 70 RCOH) ................................................................. 54
5.1. Shrinkage of Workforce to Match Volume Reduction, BWX Technology, Nuclear Equipment Division ................................................................. 60
5.2. Age of Hourly Workforce, BWX Technology, Nuclear Equipment Division, as of November 14, 1996 ................................................................. 61
5.3. Seniority of Hourly Workforce, BWX Technology, Nuclear Equipment Division, as of November 14, 1996 .................. 62
5.4. Schedule for CVX (Nuclear) Heavy-Equipment Components (FY06 CVX 78 Shipyard Start) ............................. 64
5.5. BWX Technology’s Recommended Schedule for Heavy-Equipment Components and Current Schedule (FY06 CVX 78 Shipyard Start) ............................. 64
5.6. Shipyard Need Dates and Manufacturing Spans for Heavy-Equipment Components, Based on CVN 76 and Nimitz-Class Experience ........................................ 65
6.1. Total Dollar Value of Contractor-Furnished Equipment in Relation to Number of Suppliers .............................. 68
6.2. Recent Ship-Construction Times (Award to Delivery) ........ 70
6.3. Recent Ship-Construction Times (Keel to Delivery) ........ 71
6.4. Vendor Cost Increment Attributable to Production Gap ....... 73
7.1. Anticipated Costs of Scheduled CVN 77 Availabilities, by Year .... 86
7.2. Net Present Value of CVN 77 Scheduled-Availability and Enlisted-Crew Costs, for Different Discount Rates .............. 87
7.3. Anticipated Costs of Nimitz-Class Scheduled Availabilities, by Year ....................................................... 88
7.4. Net Present Value of Nimitz-Class Scheduled-Availability Costs, for Different Breadths of Application .................. 89
7.5. Anticipated Costs of the Enlisted Crew for the Nimitz Class, by Year ............................................................ 90
7.6. Net Present Value of Nimitz-Class Enlisted-Crew Costs, for Different Breadths of Application .......................... 91
D.1. Effect of CVN 77 Start Date and Build Period on Total Shipyard Costs ................................................. 113
D.2. Effect of CVN 77 Start Date and Build Period on Shipyard Labor Costs ...................................................... 114
D.3. Effect of CVN 77 Start Date and Build Period on Shipyard Fixed-Overhead Costs ........................................ 114
D.4. Effect of CVN 77 Start Date and Build Period on Shipyard Costs for Contractor-Furnished Equipment .................. 115
E.1. Labor-Demand Profiles for Various Projects in Newport News Shipyard .................................. 118
G.1. DCN Industrial Activities in France ........................................... 139
G.2. Brest Ship Construction and Overhauls .................................. 141
G.3. French Naval Nuclear-Propulsion Organization ..................... 144
G.4. French Nuclear Reactors Safety Control Organization .......... 144
J.1. Annual Direct Unit Costs for Each Nimitz-Class Ship, by Hull Number by Age ................................ 158
J.3. Annual Direct Depot Maintenance Costs for Each Nimitz-Class Ship, by Hull Number by Age .......... 159
J.4. Annual Indirect O&S Costs for Each Nimitz-Class Ship, by Hull Number by Age .............................. 160
J.5. Annual O&S Costs for CVN 68, by Cost Category by Age ........ 160
J.6. Annual O&S Costs for CVN 69, by Cost Category by Age ........ 161
J.7. Annual O&S Costs for CVN 70, by Cost Category by Age .......... 161
J.8. Annual O&S Costs for CVN 71, by Cost Category by Age .......... 162
J.9. Annual O&S Costs for CVN 72, by Cost Category by Age .......... 162
J.10. Annual O&S Costs for CVN 73, by Cost Category by Age ....... 163
J.11. Annual Scheduled Ship Overhaul Costs, by Hull Number by Age ......................................................... 163
J.12. Annual Non-Scheduled Ship Repair Costs, by Hull Number by Age ......................................................... 164
J.13. Annual Fleet Modernization Costs, by Hull Number by Age .... 164
J.14. Annual Other Depot Costs, by Hull Number by Age ............... 165
J.15. Annual Depot Maintenance Costs for CVN 68, by Age .......... 165
J.16. Annual Depot Maintenance Costs for CVN 69, by Age .......... 166
J.17. Annual Depot Maintenance Costs for CVN 70, by Age .......... 166
J.19. Annual Depot Maintenance Costs for CVN 72, by Age .......... 167
J.20. Annual Depot Maintenance Costs for CVN 73, by Age .......... 168