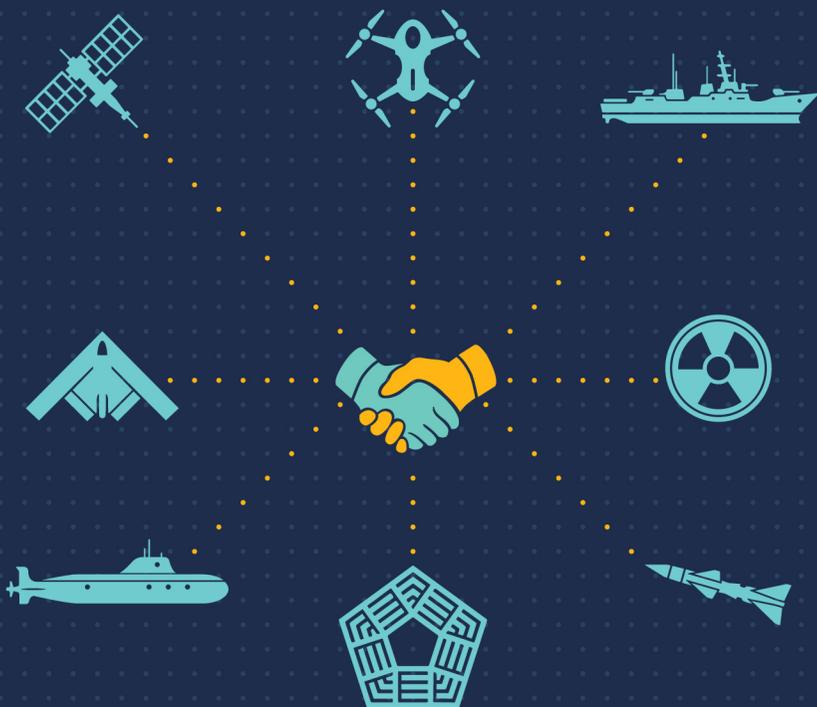


THE ARSENAL OF DEMOCRACY

TECHNOLOGY, INDUSTRY, AND DETERRENCE
IN AN AGE OF HARD CHOICES



EYCK FREYMANN
HARRY HALEM

FOREWORD BY ADMIRAL JAMES O. ELLIS JR., USN (RET.), AND NIALL FERGUSON

INDEX

- A2/AD. *See* anti-access and area denial
- AAI. *See* adversarial AI
- Abe, Shinzo, 263
- ABO. *See* access, basing, and overflight
- Aboukir Bay, 59
- Accelerate the Procurement and Fielding of Innovative Technologies (APFIT), 330n74
- access, basing, and overflight (ABO), 50
- ACE. *See* Agile Combat Employment; Air Combat Evolution
- Acheson, Dean, 51
- Adamsky, Dima, 11
- Advanced Micro Devices, 41
- advanced seabed sensors, 211–12
- adversarial AI (AAI), 176, 190–92
- Aegis Combat System, 40, 78, 267, 365n105
- IAMD with, 126
- SM-6 and, 90
- Aero-Vironment, 70
- Afghanistan War
- logistics in, 98
- MRAP in, 155
- NEO in, 115
- OCO in, 110, 314n76
- AFRL. *See* Air Force Research Laboratory
- Age of Sail, 59
- Agile Combat Employment (ACE), 51, 77, 102
- AI. *See* artificial intelligence
- AIM-54 Phoenix, 306n78
- AIM-174B, 89–90, 306n78
- AIP. *See* air-independent propulsion
- Air Combat Evolution (ACE), 188
- air defenses, 90–92, 267
- and aircraft carriers, 136
- for surface fleet, 132, 136, 141
- in Ukraine, 307n86
- Air Force, US
- Agile Combat Employment of, 52, 77, 102
- air defenses for, 90–92
- budget for, 152, 275
- CCA of, 186–89
- E-8 Joint Surveillance Target Attack Radar System of, 233
- Goldwater-Nichols Act and, 326n28
- HACM of, 85–86
- in INDOCOM, 153
- ITAR and, 170
- JASSM for, 86
- JCIDS and, 150
- US Space Force and, 224
- See also specific topics*
- Air Force Research Laboratory (AFRL), 188
- aircraft carriers, xviii, xx, xxii, 30, 34, 134–37, 276–77
- Charles de Gaulle*-class, 135–36, 321n64
- Ford*-class, 43, 154

- aircraft carriers (*continued*)
 long-range strikes from, 74–75, 79
 in Pacific War, 61–62, 123
 repairs to, 322n67
 in World War I, 123
 in World War II, 74–75
See also supercarriers
- air-independent propulsion (AIP),
 201, 204
- AirLand Battle and Maritime Strategy,
 35, 38, 42
- air-launched ballistic missile
 (ALBM), 253
- Air-launched Rapid Response Weapon
 (ARRW), 83–84
- airpower
 long-range strikes with, 74–78
 naval power and, 25–31, 61
 reserves for, 30
 space power and, 223, 224
 UAS and, 178–80
 in Ukraine, 307n86
 in World War I, 178–79
 in World War II, 35, 147–48,
 179, 324n11
See also PLA Air Force; *specific topics*
- air-to-air refueling, 51, 77, 79
- Albatross I/II, 194t
- ALBM. *See* air-launched ballistic missile
- Aleutian Islands, 45, 50
- All Quiet on the Western Front*, xviii
- All-Domain Attributable Autonomy, 195
- America*-class landing helicopter
 assault, 138
- amphibious ships, 5, 13, 100, 130, 138–40
- Andersen Air Force Base, 45
- anti-access and area denial (A2/AD),
 52–53, 78
 logistics and, 102
 surface fleet and, 132
- antisatellite (ASAT), xxii–xxiii, 129,
 222, 230, 231–33, 244, 300n57,
 351n76, 352n79
 nuclear weapons and, 258
 of PLA, 230, 231
 of Russia, 231, 233
- anti-ship ballistic missile (ASBM), 83,
 119, 124
 light torpedoes and, 209
 of Russia, 135
- anti-ship cruise missile (ASCM), xx–xxi,
 78, 87–88, 119, 124
- antisubmarine warfare (ASW), xxii, 20,
 132, 200
 improvements in, 210–11
 in INDOPACOM, 204–5
 of PLA, 202, 203–4
 for SSBN, 255
 UUVs and, 219
- anti-torpedo defenses, 122
- AOR. *See* areas of responsibility
- APFIT. *See* Accelerate the Procurement
 and Fielding of Innovative
 Technologies
- areas of responsibility (AOR), xviii, 45, 48
- Argus*, HMS, 34
- Arleigh Burke*-class destroyers, 28, 138,
 299n48
- Arms and Influence* (Schelling), 248
- Army, US
 budget for, 152
 Goldwater-Nichols Act and, 326n28
 JCIDS and, 150
 LRHW of, 83
 MDO of, 52–53
 in Pacific War, 99, 100–101
 reserves in, 28
 SM-6 for, 90
 in Taiwan, 275
 UAS for, 197
 UAV of, 291n68
- Army and Navy Defense Systems and
 Acquisition Review Council, 37
- Army Tactical Missile System
 (ATACMS), 86–87
- ARRW. *See* Air-launched Rapid Response
 Weapon
- artificial intelligence (AI), 5, 14, 165, 166,
 273, 274
 AAI, 176, 190–92
 for CCA, 187
 CUAS and, 20
 for quantum sensors, 213
 for radar tracking, 334n20
 for space power, 240–41
 for UAS, 183
- ASAT. *See* antisatellite
- ASBM. *See* anti-ship ballistic missile
- ASCM. *See* anti-ship cruise missile
- Assault Breaker, 37–38, 42

- Astroscale, 239
 ASW. *See* antisubmarine warfare
 ATACMS. *See* Army Tactical Missile System
 ATF. *See* Bureau of Alcohol, Tobacco, Firearms, and Explosives
 Atomic Energy Act, 238
 AUKUS. *See* Australia-UK-US
 Australia
 aircraft carriers and, 135
 defense spending by, 278
 in Five Eyes, 239, 353n97
 HACM of, 85–86
 INDOPACOM and, 48
 ITAR and, 169–70
 pre-positioning in, 111, 117
 SM-6 for, 90
 submarines in, 205
 UAS in, 194t
 XLUUVs of, 215t, 216
 Australia-UK-US (AUKUS)
 HACM and, 85
 ITAR and, 169–71, 332n98
 Pillar I Pathway of, 208
 submarines and, 199–200, 208
 autocannons, 127
 autonomous mines, 216–17
 Avenger torpedo bomber, 123

 B-1, 264
 B-2 Stealth Bomber, 154, 264, 328n55, 364n93
 B-17, 76
 B-21 Raider, 78, 186, 264, 276, 328n55, 364n93
 B-24, 147–48
 B-52, 177, 264
 BAE Systems, 195t, 331n84
 balanced force, 152–53
 ballistic missile defense (BMD), 89, 266–68, 365n105
 ballistic missiles
 space power and, 225
 on submarines, 203
 in World War II, 81, 225
 See also specific types
 Bashi Channel, 48, 205
 Basic Logistic Plan, 100
 Bath Iron Works, 145
 Battle of Algeciras, 26
 Battle of Britain, 30
 Battle of Cape Matapan, 75
 Battle of Crete, 75
 Battle of Jutland, 60
 Battle of the Philippine Sea, 27
 Battle of Savo Island, 61–62
 Battle of the Bulge, 27
 Battle of Tsushima, 29
 battlecruisers, 32, 34, 60
 battleships, 122–23
 dreadnought, 31, 32–33, 34
 Iowa-class, 151, 177
 in World War I, 123, 295n11
 in World War II, 151
 Beatty, David, 60
 BeiDou, 221, 229, 230
 Berlin Airlift, 101
 Biden, Joe, 110, 115, 163, 165, 190, 243, 261–62
 SLCM-N and, 266
 Big A (Defense Acquisition Process), 149–50, 156
 Black Sea, 68, 125, 135, 228
Blade Runner, xviii
 Block IB, 90
 Block IV TLAM, 65
 Block V TLAM, 65, 84t, 88
 BMD. *See* ballistic missile defense
 Boeing, 128–29, 145, 148, 154, 162, 324n12
 Bougainville Campaign, 100
 BrahMos missiles, 80
 Brigade Combat Teams, 28
 Brilliant Pebbles, 266–67
 British Pacific Fleet, 101
 British Royal Navy, 122–24
 Brown, Eric, 170
 Brown, Harold, xxii, 36, 38, 39, 41
 Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), 171
 Bureau of Industry and Security, 169
 Burns, William, 4
 Bush, George W., 43
 Buy American Act, 171
 BZK-005, xix, 68, 70

 C2. *See* command-and-control
 C4ISR. *See* computers, intelligence, surveillance, and reconnaissance
 C-130, 115

- camera bombs, 177
- Campbell-Bannerman, Henry, 33
- Canada
 in Five Eyes, 239, 353n97
 Taiwan and, 114
- cannons, 59
- Cape Canaveral, 236
- Cardinal series, 194t
- Cargo Preference Regulations, 108, 117
- Carnegie Endowment for International Peace, 261
- carrier air wings (CVWs), 119, 120
- carrier strike groups (CSGs), 28, 48
- Carter, Jimmy, 24, 36, 38, 163
- CASC Rainbow, 69t
- CCA. *See* collaborative combat aircraft
- CEC. *See* Cooperative Engagement Capability
- center of gravity, 337n54
- CEP. *See* circular error probable
- Cetus, 215t, 216
- CFIUS. *See* Committee on Foreign Investment in the United States
- CH-5, 69t
- “Challenging the U.S. Is a Historic Mistake” (Kagan), xvii
- Charles de Gaulle*-class carriers, 135–36, 321n64
- Chen Yi, 249
- Chicago Council on Global Affairs, xviii, 261
- Chien Hsiang, 194t
- China. *See specific topics*
- China Military Power Report*, by DOD, 10
- China Satellite Network Group, 229
- circular error probable (CEP), 301n7
- Civil Reserve Air Fleet (CRAF), 103
- Clark, George, 33, 80
- Clark Field, 76, 262
- Clausewitz, Carl von, 25, 223, 337n54
- coal power, for naval power, 59
- Cold War, 46t
 counter-scouting in, 63–65
 deterrence in, 57
 DIB in, 144, 151–55
 missile defense systems in, 267
 nuclear weapons in, 266
 scouting in, 57–58
 SM-2 in, 89
 SOSUS in, 211–12
 SSBN in, 202–3
 submarines in, 201, 202, 210, 340n12
 torpedoes in, 217
 collaborative combat aircraft (CCA), 186–89, 276
- Columbia*-class SSBN, 264
- Comet*, HMS, 32
- command-and-control (C2), 53
 for CCA, 188
 in North Korea, 264
 for nuclear weapons, 256, 264
 satellites for, 221
 for space power, 224, 226, 231, 242
 for USVs, 129
- Committee on Foreign Investment in the United States (CFIUS), 171
- Committee on Imperial Defence, 33
- computers, intelligence, surveillance, and reconnaissance (C4ISR), 17, 234, 268, 272
- Congressional Commission on US Strategic Posture, 265
- Conqueror*, HMS, 210
- Constellation*-class frigates, 132–33, 138, 157, 161, 299n48, 328n56
- Cooperative Engagement Capability (CEC), 90
- Corbett, Julian, 223
- cost-plus model, 164
- counter-electronic warfare, 183
- counterintelligence, 21
- counter-scouting, 58, 62–67
 Agile Combat Employment for, 77
 in Cold War, 63–65
 satellites for, 64–65
 stealth for, 63, 65
 surface fleet and, 127
 in World War I, 295n11
- counter-UAS (CUAS), 17, 19–20, 68, 175–76
 in Taiwan, 183, 195
 in Ukraine, 20, 68, 175, 180–82
- Courtney, Joe, 332n98
- CRAF. *See* Civil Reserve Air Fleet
- cruise missiles, 78–79, 81, 301n1
 ASCM, xx–xxi, 78, 87–88, 119, 124
 cost of, 305n66
 HCAM, 85–86
 heavy torpedoes and, 209
 IAMD for, 126

- LRSO, 362n74
 SLCM-N, 261, 265–66
 stealth, 87
 on submarines, 203
 Tomahawk, xxiii, 74, 80, 84t, 87–88, 93
See also hypersonic cruise missiles
- cruisers, xxii, 119
 battlecruisers, 32, 34, 60
Ticonderoga-class, 327n50
- CSGs. *See* carrier strike groups
- CUAS. *See* counter-UAS
- Cuban Missile Crisis, 248
- Currie, Malcolm, 36–37
- CVWs. *See* carrier air wings
- cyber warfare, 351n73
 for counter-scouting, 63
 for CUAS, 180
 MDO for, 53
 quantum cryptography for, 242
 space power and, 225, 228, 231, 232, 268
 against surface fleet, 132
 against USMM, 107
- DARPA. *See* Defense Advanced Research Projects Agency
- Dauntless dive bomber, 123
- DDG(X) program, 322n74
- DDTC. *See* Directorate of Defense Trade Controls
- de Seversky, Alexander P., 223
- decoys
 ACE and, 52
 for counter-scouting, 63
 PJDAMs, 77
 RSC and, 109
 in Ukraine, 2
- DEFCON. *See* Defense Readiness Condition
- Defense Acquisition Process (Big A), 149–50, 156
- Defense Advanced Research Projects Agency (DARPA), 37–40, 188, 238
- Defense and Research and Engineering, 36–37
- Defense Federal Acquisition Regulation Supplement (DFARS), 171
- defense industrial base (DIB), 2, 3, 6, 10, 143–73
 Cold War and, 151–55
 comparisons of, 14
 for deterrence, 54–55
 INDOPACOM and, 161, 171
 outsourcing to allies for, 168–72
 in Pacific War, 145–48
 of PLA, 13
 political will for, 159–60
 procurement system for, 18–19
 productized-sales model for, 164–68
 reforms for, 160–72
 RMA and, 154–55
 submarines and, 20–21, 145, 147, 207
 surface fleet and, 130
 UAS and, 184–86
 Ukraine and, 155–56, 162
 for US Navy, 145–48
 warning signs for, 155–58
 workforce for, 156–58
 in World War II, 145–48
- Defense Innovation Unit (DIU), 165, 237, 238
- Defense Navigation Satellite System Program Office, 37
- defense perimeter, for INDOPACOM, 50–51
- Defense Production Act (DPA), 144, 163–64
- Defense Readiness Condition (DEFCON), 249
- Defense Support Program, of US Space Force, xxiii, 258
- Defense Systems Acquisition Review Council, 36–37
- Defense White Paper, of Japan, 80
- Del Toro, Carlos, 157
- Department of Commerce, US, 109, 117, 169, 170, 183
 NIST of, 242
- Department of Defense, US (DOD), 6
 budget for, 9, 15t, 152–53, 153f, 159, 275
 bureaucratic inertia at, 42
China Military Power Report by, 10
 DIB and, 144
 existing programs of, 14–15
 Federated States of Micronesia and, 118
 hypersonic missiles and, 93
 MARAD and, 108
 missiles and, 88
 nuclear weapons and, 245

- Department of Defense (*continued*)
 pre-positioning and, 109
 procurement system of, 12, 19, 25, 53,
 148–51, 162, 275–76
 quantum communications and, 243
 RMA and, 24, 35–44
 SBIR and STTR and, 330n74
 semiconductors and, 40–41
 space power and, 234
 Strategic Capabilities Office of, 128
 surface fleet and, 127, 134
 UAS and, 70, 195–96, 334n17
 workforce and, 277
 zero trust at, 330n72
*See also specific topics; specific topics
 and organizations*
- Department of State, US, 115, 169, 170,
 332n98
- destroyers, xxii, 119, 122
Constellation-class frigates and,
 132–33
- deterrence, xxiii, 3–7, 24
 aircraft carriers for, 135
 allies in, 278
 in Cold War, 57
 counter-scouting for, 63
 current state of, 13–14
 DIB for, 54–55, 144, 158
 INDOPACOM and, 53–54
 logistics and, 17–18, 101
 long-range strikes and, 74, 77
 by NATO, 36
 nuclear weapons and, 226, 246, 251,
 265, 268, 357n18
 RMA and, 44
 space power and, 222, 232–35
 submarines for, 202
 World War II and, 22
- DEWs. *See* directed energy weapons
- DF. *See* Dong Feng
- DF-11, xix, 78
- DF-15, xix, 78
- DF-17, 82–83
- DF-21D, xix, 124
- DF-26, xix, 102, 124, 256, 257
- DF-27, 83
- DFARS. *See* Defense Federal Acquisition
 Regulation Supplement
- dial-a-yeild weapons, 266, 365n100
- DIB. *See* defense industrial base
- Diego Garcia, 50, 256, 309n14
- direct-ascent weapons, 234, 351n76
- directed energy weapons (DEWs),
 126–27, 133, 138, 293n100, 323n74
 for CUAS, 176, 180
- Directorate of Defense Trade Controls
 (DDTC), 169, 171
- Distributed Maritime Operations
 (DMO), 51, 102, 119, 125–26
 aircraft carriers and, 136–37
 logistics and, 129–30
 USVs and UUVs and, 128–29
- DIU. *See* Defense Innovation Unit
- DJI, 176, 182, 185, 186
- DMO. *See* Distributed Maritime
 Operations
- DOD. *See* Department of Defense
- Dong Feng (DF) ballistic missiles, xix–xx,
 78
- Douhet, Giulio, 223
- DPA. *See* Defense Production Act
- Dreadnought*, HMS, 32, 33, 34, 122–23
- dreadnought battleships, 31, 32–33, 34
- drones, xviii, xxi
 DEWs for, 126–27
 SAR for, 337n59
 in Ukraine, 1, 2, 227–28
See also unmanned
- Dynamic Space Operations, 240
- E-2D Hawkeyes, 90
- E-8 Joint Surveillance Target Attack
 Radar System, 233
- EABO. *See* Expeditionary Advanced Base
 Operations
- EAR. *See* Export Administration
 Regulations
- early warning systems, for nuclear
 weapons, 258
- Eccles, Henry E., 95
- edge computing, 176, 187, 190, 192, 333n2
- EDI. *See* European Deterrence Initiative
- Eisenhower, Dwight, 163, 247, 249
- Elbit Hermes 900, 194t
- Electric Boat, 145, 207–8
- electromagnetic spectrum
 management, 222
- electronic warfare (EW), 2, 58
 aircraft carriers and, 135
 CCA and, 186, 187

- for counter-scouting, 63
- CUAS and, 20, 176
- DEWs and, 127
- MDO for, 53
- of Russia, 129
- space power and, 225
- surface fleet and, 141
- swarms and, 190
- UAS and, 178, 179–80, 183
- EMPs. *See* nuclear electromagnetic pulses
- EPFs. *See* Expeditionary Fast Transports
- ESA. *See* European Space Agency
- ESB. *See* Expeditionary Sea Base
- Euromissiles, 260
- European Deterrence Initiative (EDI), 110
- European Space Agency (ESA), 352n81
- EW. *See* electronic warfare
- Excluded Technologies List, 169
- Ex-Im Bank, 108
- Expeditionary Advanced Base
 - Operations (EABO), 102–3
- Expeditionary Fast Transports (EPFs), 111
- Expeditionary Sea Base (ESB), 111, 140
- Export Administration Regulations (EAR), 171
- extra-large UUVs (XLUUVs), 214–16, 215t, 219

- F-14 Tomcat, 306n78
- F-15C, 76
- F-16, 76–77
- F-35, 43, 90, 129, 154, 276
- Falklands War, 210
- FAS. *See* Federation of American Scientists
- Federal Aviation Administration, 334n17
- Federated States of Micronesia, 118
- Federation of American Scientists (FAS), 254
- FIC. *See* First Island Chain
- Fincantieri Marinette Marine (FMM), 157–58, 208
- First Island Chain (FIC), 5, 45, 47f, 49f, 50–51, 54
 - amphibious assault ships in, 140
 - counter-scouting in, 65
 - Force Design 2030 for, 52
 - ISR for, 71
 - logistics for, 103
 - long-range strikes from, 74
 - submarines in, 202, 205
 - surface fleet in, 132
- First Opium War, 46t
- First Sino-Japanese War, 46t
- first-person view (FPV), 2, 177, 180, 184, 333n4
- Fisher, Jacky, 33, 34
- Five Eyes, 239, 353n97
- Five Powers Clause, 112
- Fleet Air Arm, 35
- floating dry docks, 100, 101
- FMM. *See* Fincantieri Marinette Marine
- FOB. *See* fractional orbital bombardment
- Force Design 2030, 52
- Ford, Gerald, 37
- Ford*-class aircraft carriers, 43, 154
- Formidable*, HMS, 75
- Forward Afloat Base, 140
- 14th Five-Year Plan, 229
- FPV. *See* first-person view
- fractional orbital bombardment (FOB), xx, 83
- France
 - aircraft carriers of, 135–36, 321n64
 - nuclear weapons of, 255
 - Very Lightweight Torpedo program in, 218
- frequency hopping, 190
- frequency jamming, 63, 128, 180, 184
 - for ASAT, 231, 232
 - CCA and, 187
 - GPS for, 232
 - of satellites, 222
- Freyman, Eyck, xvii–xix, xx, xxi, xxiii, 8
- frigates, xxii
 - Constellation*-class, 132–33, 138, 157, 161, 299n48, 328n56
- Fritz-X, 333n5
- Furious*, HMS, 34
- Future Imagery Architecture satellite constellation, 43

- Galileo, 221
- GARC. *See* Global Autonomous Reconnaissance Craft
- GBI. *See* Ground-Based Interceptor
- General Atomics Aeronautical Systems, 188

- General Dynamics, 145, 148, 154,
163, 324n12
submarines by, 207–8
- George, David Lloyd, 33
- Geosynchronous/High Earth Orbit
satellites, 231
- Gerald Ford*, USS, 136, 328n55
- Geran 2, 318n23
- Germany
Rheinmetall of, 326n37
See also World War I; World War II
- Ghost Fleet*, xviii
- Ghost Fleet Overlord, 128
- Ghost Shark, 215, 216
- GIUK. *See* Greenland-Iceland-UK
- Global Autonomous Reconnaissance
Craft (GARC), 128
- global positioning system (GPS),
39, 67
for frequency jamming, 232
nuclear deterrence and, 226
for PNT, 221
for space power, 221, 226, 228, 230
swarms and, 190
- Global War on Terror, 62, 110, 155
satellites for, 226
UAS in, 178
- GLONASS, 221, 228, 230
- La Glorie*, 32
- Goldwater-Nichols Act of 1986, 152, 153,
154, 326n28
- Gorbachev, Mikhail, 65, 260, 267
- Gorshkov, Sergey, 149
- GPS. *See* global positioning system
- GPU. *See* graphics processing unit
- Grand Fleet, 60–61
- graphics processing unit (GPU), 190
- gravimeters, 213
- Great Depression, 146
- Greenland-Iceland-UK (GIUK) gap, 64
aircraft carriers and, 135
- Grotius, Hugo, 223
- Ground-Based Interceptor (GBI), 267,
365n105
- Guadalcanal Campaign, 99–100
- Guam, 45, 48–49
IRBM and, 256
long-range strikes from, 77
missile defense systems in, 314n78,
316n102
remote sensing in, 241
submarines in, 205
- Gulf War, 114
MSC in, 105
RRF in, 309n14
satellites in, 226
UAS in, 177
- H-6N, 253
- HACM. *See* Hypersonic Attack Cruise
Missile
- HALE. *See* high altitude, long-endurance
- Halem, Harry, xvii–xix, xx, xxi, xxiii, 8
- Halibut*, USS, 202
- HALO. *See* Hypersonic Air-Launched
Offensive
- hardening
ACE and, 52
of INDOPACOM, 18
in logistics, 109–12
UAS and, 67, 70
- Harpoon, 74, 84t, 88, 93
- Haystack, 58, 63–64
- Hayward, Thomas, 40
- HCMs. *See* hypersonic cruise missiles
- heavy torpedoes, 209
- Heihachirō, Tōgō, 60
- Hellscape, xxi, 70, 196
- Henderson Field, 62
- HGVs. *See* hypersonic glide vehicles
- Hicks, Kathleen, 70
- high-altitude, long-endurance (HALE)
UAS, xix, 68–69, 70
- High Mobility Artillery Rocket System
(HIMARS), 86–87, 305n62
- HMAS Stirling, 205
- homing torpedoes, 343n46
- Horowitz, Michael, 11
- Houthi, 98
- Hsiung Feng IIE cruise missile, 79
- Hughes, Wayne P., 223
- Huntington Ingalls Industries, 145, 148,
154, 324n12
Orca by, 128–29, 214, 215t
submarines by, 208
supercarriers by, 322
- HVGP. *See* Hyper Velocity Guided
Projectile
- HVX. *See* Hypersonic Air Vehicle
Experimental

- Hycore cruise missile, 86
 hydrophones, 203, 212
 Hyper Velocity Guided Projectile (HVGP), 86
 Hypersonic Air Vehicle Experimental (HVX), 86
 Hypersonic Air-Launched Offensive (HALO), 83, 137
 Hypersonic Attack Cruise Missile (HACM), 85–86
 hypersonic cruise missiles (HCMs), 82, 85t, 86
 cost of, 305n66
 IAMD for, 126
 hypersonic glide vehicles (HGVs), xx, 82–83, 85t
 IAMD for, 126
 hypersonic missiles, xx, 81–83, 93, 303n38
 air defenses for, 91
- IAMD. *See* integrated air and missile defense
 ICBM. *See* intercontinental ballistic missile
 improvised explosive devices (IUDs), 155
 India
 BrahMos missiles from, 80
 nuclear weapons of, 255–56
 UAS in, 194t
 Very Lightweight Torpedo program in, 218
 Indonesia, 114
 Indo-Pacific Command (INDOPACOM), xviii
 adaptation in, 45–53, 46t, 47f, 49f
 ASW in, 204–5
 defense perimeter for, 50–51
 deterrence and, 53–54
 DIB and, 161, 171
 hardening of, 18
 JCIDS for, 153–54
 logistics for, 18, 95–118
 nuclear weapons and, 249
 scouting in, 57–71
 SSBN in, 205, 206
 submarines in, 202–6
 UAS in, 175, 184, 192–96
 See also specific topics
- INF. *See* Intermediate-Range Nuclear Forces
Inflexible, HMS, 32
 in-space servicing, assembly, and manufacturing (ISAM), 239–40
 In-Space Upgrade Satellite System (LINUSS), 239
 integrated air and missile defense (IAMD), 126
 intelligence, surveillance, and reconnaissance (ISR), 58, 65
 for FIC, 71
 for PLA, 229
 SAR for, 337n59
 satellites for, xix, xxii–xxiii, 221, 229
 intercontinental ballistic missile (ICBM), xx, 81, 256, 359n26
 BMD against, 267
 with HGVs, 83
 for nuclear weapons, 245–46
 intermediate-range ballistic missile (IRBM), 256, 257
 Intermediate-Range Nuclear Forces (INF) Treaty, 260, 261
 International Traffic in Arms Regulations (ITAR), 19, 21, 169–72, 276, 332n98
 space power and, 235, 238, 244
 Internet of Things (IoT), 333n2
Iowa-class battleships, 151
 UAS for, 177
 Iran, 3, 9, 91
 BMD against, 267
 drones of, 2
 loitering munitions of, 318n23
 nuclear weapons of, 255, 360n49
 Iraq War, 87
 logistics in, 97–98
 MRAP in, 155
 OCO in, 110, 314n76
 See also Gulf War
 IRBM. *See* intermediate-range ballistic missile
 ironclads, 32
 ISAM. *See* in-space servicing, assembly, and manufacturing
 ISR. *See* intelligence, surveillance, and reconnaissance
 Israel, 91
 pre-positioning in, 109
 UAS in, 177, 196

- ITAR. *See* International Traffic in Arms Regulations
- IUDs. *See* improvised explosive devices
- jamming. *See* frequency jamming
- Japan, 10
- aircraft carriers and, 135
 - Astroscale of, 239
 - defense spending by, 278
 - HVGP and HCMs of, 86
 - INDOPACOM and, 48
 - ITAR and, 170
 - logistics and, 118
 - Marine Littoral Regiments, 66
 - missiles of, 80, 89
 - nuclear sharing with, 257, 263, 269
 - nuclear weapons and, 22, 247, 260, 262, 361n57
 - pre-positioning in, 111
 - Russia and, 29, 60
 - satellites of, 235, 352n81
 - shipyards of, 117
 - SM-6 for, 90
 - Taiwan and, 4–5, 114
 - See also* Pacific War
- JASSM-ER. *See* Joint Air-to-Surface Standoff Missiles—extended range
- JASSMs. *See* Joint Air-to-Surface Standoff Missiles
- JAXA, 352n81
- JCIDS. *See* Joint Capabilities Integration and Development System
- JDAM. *See* Joint Direct Attack Munition
- Jellicoe, John, 60
- JETSON. *See* Joint Emergent Technology Supplying On-Orbit Nuclear Power
- Jeune École* (Young School), 122
- Jin*-class submarines, 359n26
- JL-3, 253, 359n26
- Joint Air-to-Surface Standoff Missiles (JASSMs), xx, 65, 74, 84t, 86–88, 93
- Joint Air-to-Surface Standoff Missiles—extended range (JASSM-ER), 86
- Joint Capabilities Integration and Development System (JCIDS), 149–50, 153–54, 171
- Joint Declaration of the Denuclearization of the Korean Peninsula, 263
- Joint Direct Attack Munition (JDAM), 77
- Joint Emergent Technology Supplying On-Orbit Nuclear Power (JETSON), 238
- Joint Missile Defense System (MDS), 314n78, 316n102
- Joint Purchasing Board, 100
- Jointness Czar, 160–61
- Jomini, Antoine-Henri, 223
- Jones Act, 106, 312n64
- Kadena Air Base, 51
- Kagan, Robert, xvii–xviii, xx
- KAI, 194t
- Kármán Line, 225
- KDA. *See* Kongsberg Defence and Aerospace
- Kennan, George, 50–51
- Kennedy, John, 262, 356n10
- kinetic weapons
- for CUAS, 180
 - of Russia, 222
 - space power and, 224–25, 231, 232
- King, Ernest, 100
- Kinzhal, 303n38
- Kongsberg Defence and Aerospace (KDA), 88
- Korean War, 97, 151–52, 163
- Lai Ching-te, 114
- Landing Craft Air Cushion (LCAC), 139, 141
- landing helicopter assault (LHA), 138–39
- landing helicopter deck (LHD), 138–39
- landing platform docks (LPDs), 139
- launch technology, for space power, 236–37
- LCAC. *See* Landing Craft Air Cushion
- LCS. *See* Littoral Combat Ship
- leading edge semiconductors, 176
- Lehman, John, 151
- LEO. *See* low-earth orbit
- Leyte Gulf, 27
- LHA. *See* landing helicopter assault
- LHD. *See* landing helicopter deck
- Liberty supply ships, 100
- Light Amphibious Warship, 139
- light torpedoes, 209, 217–18
- with autonomous mines, 216
- LINUSS. *See* In-Space Upgrade Satellite System

- Littoral Combat Ship (LCS), 138, 139, 161, 299n48
 cost of, 328n56
- Lockheed Martin, 39–40, 41, 145, 148, 154
 ITAR and, 170
 JASSMs and LRASMs of, 86–88
 LINUSS of, 239
 LRHW of, 83
 torpedoes by, 209
 workforce for, 158
- logistics, 104f
 aircraft for, 103
 of deterrence, 17–18
 deterrence and, 17–18, 101
 hardening in, 109–12
 for INDOPACOM, 95–118
 for naval power, 31
 in Pacific War, 98–101
 pre-positioning for, 109–12, 117
 for surface fleet, 129–30
 for Taiwan, 97
 tankers for, 103
 in World War II, 100, 101, 107, 311n38, 324n11
- loitering munitions, 216, 318n23
 IAMD for, 126
 in Taiwan, 13
 in Ukraine, 88–89
- Long-Range Anti-Ship Missiles (LRASMs), xx, 65, 74, 84t, 86–88, 93
 for aircraft carriers, 137
- Long-Range Hypersonic Weapon (LRHW), 83–84
- Long-Range Stand-Off (LRSO), 261, 266, 362n74
- long-range strikes, 73–93
 from aircraft carriers, 74–75
 with airpower, 74–78
 with missiles, 78–92
 in Pacific War, 76
 from submarines, 74, 80
 from UAS, 79
 from US Navy, 80–81
 in World War II, 74–75
- Los Angeles*-class submarines, 203, 218, 340n12
- low-earth orbit (LEO) satellites, 21, 68
 for ASAT, 231–32
 C4ISR for, 234
 for CUAS, 195
 ISAM for, 239–40
 mesh networks of, 222
 nuclear weapons and, 227
 for Starlink, 227–28
 for submarines, 219
- LPDs. *See* landing platform docks
- LRASMs. *See* Long-Range Anti-Ship Missiles
- LRHW. *See* Long-Range Hypersonic Weapon
- LRSO. *See* Long-Range Stand-Off
- LSM. *See* Medium Landing Ship
- Ma Xingrui, 229–30
- MacArthur, Douglas, 4–5, 50–51, 99, 101
- MAD. *See* mutually assured destruction
- Made in China 2025, 229
- magic weapon, 38
- magnetometers, 212–13
- Mahan, Thayer, 223
- MALE. *See* medium-altitude, long-endurance
- Malta, 75
- maneuverable reentry vehicles (MaRVs), 81
- MARAD. *See* Maritime Administration
- Marine Corps, US
 EABO of, 102–3
 Force Design 2030 of, 52
 Goldwater-Nichols Act and, 326n28
 HIMARS for, 86–87
 in INDOPACOM, 153
 JCIDS and, 150
 LSM and LSC of, 139
 NSM for, 88
 pre-positioning for, 111
 UAS for, 197
- Marine Littoral Regiments, 66
- Maritime Administration (MARAD), 105–6
 Cargo Preference Regulations of, 108, 117
 VISA of, 108
- Maritime Pre-positioning Force, 111
- Maritime Security Program (MSP), 106, 108, 309n14
- Mars, 230, 238
- Marshall, Andrew, xxii, 36
- Marshall, George, 100

- MaRVs. *See* maneuverable reentry vehicles
- Matrix*, xviii
- Mattis, James, 12
- Maxar Technologies, 228, 234
- McNamara, Robert, 148, 149–50
- MDO. *See* Multi-Domain Operations
- MDS. *See* Joint Missile Defense System
- Medium Earth Orbit (MEO) satellites, 231
- Medium Landing Ship (LSM), 139–40
- medium-altitude, long-endurance (MALE)
- UAS, xix, 68–69, 69t, 70, 79, 178, 196
 - UAV, 299n52
- medium-range ballistic missile (MRBM), xx, 78
- with HGVs, 82–83
- MEO. *See* Medium Earth Orbit
- Merchant Marine. *See* US Merchant Marine
- mesh networks, of LEO satellites, 222
- MEV. *See* Mission Extension Vehicle
- MGM-140, 86
- Michener, James, xxi–xxii
- Micrus, 242
- Middle East, 1, 4, 159
- UAS in, 20, 175, 178, 182
- Mid-Range Capability, in the Philippines, 80
- Midway, 30, 61
- Mikawa, Gunichi, 61–62
- Military Sealift Command (MSC), xx, 96, 103–5, 116, 126
- EPFs of, 111
 - MARAD and, 105–6
 - pre-positioning by, 111
- Millett, Allan, 10
- Milley, Mark, 160–61
- Mine-Resistant Ambush Protected (MRAP) program, 155
- Minuteman III, 264
- MIRV. *See* multiple independent reentry vehicle
- missile defense systems, 81
- for aircraft carriers, 136–37
 - BMD, 89, 266–68, 365n105
 - in Cold War, 267
 - in Guam, 314n78, 316n102
 - surface fleet and, 141
- Missile Technology Control Regime (MTCR), 169
- missiles
- air defenses for, 90–92
 - amphibious ships and, 139
 - CEP for, 301n7
 - for CUAS, 180
 - DEWs for, 126–27
 - of Japan, 80, 89
 - long-range strikes with, 78–92
 - naval power and, 79
 - NDAA for, 162
 - in the Philippines, 80
 - as surface fleet replacement, 120
 - types of, 81–83
 - in US arsenal, 83–90, 84t–85t
 - See also specific types*
- Mission Extension Vehicle (MEV), 239
- Missouri*, USS, 177
- Mitchell, Billy, 223
- Miyako Strait, 48, 205
- Mk41, 322n73
- Mk-48, 209
- Mk-60, 216
- Montreux Convention, 135
- Morse code, 179
- MQ-1 Predator, 178
- MQ-4C Triton, 69t, 299n51
- MQ-9A Reaper, 68–69, 69t, 178, 299nn51–52, 300n53
- MQ-9B, 194t
- MQ-25 Stingray, 137
- MQ-28 Ghost Bat, 194t
- MQM 105 Aquila, 291n68
- MRAP. *See* Mine-Resistant Ambush Protected
- MRBM. *See* medium-range ballistic missile
- MSC. *See* Military Sealift Command
- MSP. *See* Maritime Security Program
- MTCR. *See* Missile Technology Control Regime
- Multi-Domain Operations (MDO), 52–53
- multiple independent reentry vehicle (MIRV), 255
- Murray, Russell, 39
- Murray, Williamson, 10
- Musk, Elon, 228
- mutually assured destruction (MAD), 247, 248, 356n6

- Napoleonic Wars, 26
- NASAMs, 92
- National Chung-Shan Institute of Science and Technology (NCSIST), 90, 194t
- National Defense Authorization Act (NDAA), 162
- National Defense Reserve Fleet (NDRF), 105
- National Institute of Standards and Technology (NIST), 242
- National Security Council, 33
- National Security Memorandum on Promoting United States Leadership in Quantum Computing While Mitigating Risks to Vulnerable Cryptographic Systems (NSM-10), 243
- National Semiconductor, Fairchild, 41
- National Technology and Industrial Base (NTIB), 171
- NATO. *See* North Atlantic Treaty Organization
- Naval Construction Battalions (Seabees), 100
- Naval Information Warfare Center (NIWC), 241
- naval power, xxii, 23–55
 - airpower and, 25–31, 61
 - coal power for, 59
 - logistics for, 31
 - missiles and, 79
 - oil power for, 59
 - repairs for, xxii, 28–29
 - scouting for, 57–71
 - space power and, 223, 224
 - steam power for, 31–32, 59
 - in World War I, 32, 34
 - in World War II, 26, 27, 29*See also* PLA Navy; *specific topics*
- Naval Strike Missile (NSM), 74, 84t, 88
- Navstar, 39
- Navy, US, 18, 20–21
 - budget for, 152, 275
 - counter-scouting by, 63–64
 - DDG(X) program of, 322n74
 - DIB for, 145–48
 - DMO of, 52, 102, 119, 125–26, 128–30, 136–37
 - GARC of, 128
 - Goldwater-Nichols Act and, 326n28
 - in INDOPACOM, 153
 - ITAR and, 170
 - logistics for, 100–101
 - long-range strikes from, 80–81
 - LRASM, 86–87
 - LRHW of, 83
 - MSC of, xx, 96, 103–5, 108, 111, 116, 126
 - NATO and, 23
 - in Pacific War, 98–101
 - radar evasion for, 39–40
 - shipyards for, 133
 - SM-6 in, 89–90
 - SOSUS of, 211–12
 - Soviet Union and, 23
 - surface fleet of, 119–41, 131f
 - UAS of, 128
 - VLS of, 322n73, 323n74
 - in World War II, 30*See also specific topics*
- NC3. *See* nuclear command, control, and communications
- NCSIST. *See* National Chung-Shan Institute of Science and Technology
- NDAA. *See* National Defense Authorization Act
- NDRF. *See* National Defense Reserve Fleet
- Nelson, Horatio, 59
- NEO. *See* noncombatant evacuation operation
- New Zealand, in Five Eyes, 239, 353n97
- NFU. *See* No First Use
- Nimitz*-class supercarriers, 151
- NIST. *See* National Institute of Standards and Technology
- NIWC. *See* Naval Information Warfare Center
- Nixon, Richard, 163
- No First Use (NFU), 256–57
- noncombatant evacuation operation (NEO), 114–16
- North Atlantic Treaty Organization (NATO), 2–3
 - air defenses for, 91, 92
 - aircraft carriers and, 135
 - deterrence by, 36
 - Navy and, 23
 - Nuclear Planning Group of, 262
 - nuclear sharing with, 262, 269

- North Atlantic Treaty Organization
(continued)
 nuclear weapons and, 246–47, 259–60
 Soviet Union and, 37–38, 259–60
 Ukraine and, 156, 250
 War Reserve Stocks in, 109
See also Cold War
- North Korea, 3, 9–10
 BMD against, 267
 C2 in, 264
 MIRV of, 255
 nuclear weapons of, 255, 256, 260, 264, 360n49
 Russia and, 3
 satellites of, 21
 South Korea and, 261–62
- Northrop Grumman, 145, 148, 154
 air defense system of, 92
 B-21 Raider by, 78, 186, 328n55, 364n93
 MEV by, 239
 Minuteman III by, 264
 NIWC and, 241
 torpedoes by, 209
 UUVs by, 344n57
- NSM. *See* Naval Strike Missile
- NSM-10. *See* National Security Memorandum on Promoting United States Leadership in Quantum Computing While Mitigating Risks to Vulnerable Cryptographic Systems
- NTIB. *See* National Technology and Industrial Base
- NTP. *See* nuclear thermal propulsion
- nuclear command, control, and communications (NC3), 265
- nuclear electromagnetic pulses (EMPs), 231
- Nuclear Planning Group, 262
- nuclear sharing, 247–48
 with Japan, 257, 263, 269
 with NATO, 262, 269
 with South Korea, 257, 263, 269
- nuclear thermal propulsion (NTP), 238–39
- nuclear weapons, xviii, xxii, 21–22, 245–69
 ASAT and, 258
 on ballistic missiles, 81
 C2 for, 256, 264
 in Cold War, 64, 266
 coordinated use of, 360n49
 deterrence and, 226, 246, 251, 265, 268, 357n18
 early warning systems for, 258
 effects on alliances and, 258–64
 escalation dynamics for, 256–58
 of France, 255
 ICBM for, 245–46
 of India, 255–56
 INDOPACOM and, 249
 of Iran, 255, 360n49
 in Japan, 22, 247, 262, 361n57
 modernization of US arsenal, 264–66
 of NATO, 246–47, 259–60
 of North Korea, 255, 256, 260, 264
 of Pakistan, 256
 in the Philippines, 262
 of PLA, 249, 251–56, 253f
 of Russia, 256, 260, 261, 266, 365n103
 on satellites, 225, 227
 South Korea and, 261–62
 of Soviet Union, 36, 247–48
 of UK, 255
 in Ukraine, 250, 268
- Nuclear-Armed Sea-Launched Cruise Missile (SLCM-N), 261, 265–66
- nuclear-powered ballistic missile submarine (SSBN), 199, 359n26, 365n101
 in Cold War, 202–3
 in INDOPACOM, 205, 206
Ohio-class, 262, 264
 of PLA, 251–53, 255
- Nunn, Sam, xxii
- Obama, Barack, 43, 165
- Ocean Venture, 64
- OCO. *See* Overseas Contingency Operations
- Office of Net Assessment (ONA), 36
- Office of the Secretary of Defense (OSD), 127, 150, 152, 155, 156, 171–72
- Offshore Petroleum Distribution System, 111
- Ohio*-class SSBN, 262, 264
- oil power, for naval power, 59
- Okinawa, 48, 50–51
 ACE in, 51
 long-range strikes from, 76–78
 missiles and, 89

- ONA. *See* Office of Net Assessment
 Operation Iraqi Freedom. *See* Iraq War
 Operation Prosperity Guardian, 98
 Operation Shoestring, 100
 Orca, 128–29, 214, 215t
 Orlan-10, 1
 OSD. *See* Office of the Secretary of
 Defense
 Outer Space Treaty (OST), 225, 233
 Overseas Contingency Operations
 (OCO), 110, 314n76
- P-8, 68
 P-40, 76
 Pacific Deterrence Initiative (PDI), 54,
 110, 117
 budget for, 314n78, 316n102
 Pacific War
 aircraft carriers in, 61–62, 123
 DIB in, 145–48
 INDOPACOM in, 46t, 50–51
 logistics in, 98–101
 long-range strike in, 76
 Pearl Harbor attack and, 29, 98–99
 scouting in, 61–62
 Taiwan in, 76
See also specific topics
- Pakistan, 256
 Palantir, 165
 Palau, 45, 118
 Paparo, Samuel, 14, 196
 Parkinson, Brad, 37
 Patriot air defense systems, 91, 92, 267
 Paxton, Michael, 157
 PDI. *See* Pacific Deterrence Initiative
 Pearl Harbor, 48, 61
 attack on, 29, 98–99
 DIB after, 146
 submarines at, 205
- Pelosi, Nancy, 113
 People's Liberation Army (PLA), xix, 2
 AIM-174B and, 89–90
 ASAT of, 230, 231
 ASW of, 202, 203–4
 DIB of, 13
 hypersonic missiles of, 83
 ISR for, 229
 long-range strikes and, 77–78
 nuclear weapons of, 249, 251–56, 253f
 People's War of, 358n21
 pre-positioning and, 109
 satellites of, 221–22
 scouting of, 16–17
 space power and, 228–30
 SSBN of, 251–53, 255
 submarines of, 201, 204–5, 218
 Taiwan and, 4, 5–6, 13, 44, 53, 66–67,
 79–80, 113, 195
 UAS of, 70
- People's War, 358n21
 Perry, William J., xxii, 36, 39–40
 Pershing II, 260
 the Philippine Sea, xx, 79, 95, 308n4
 nuclear weapons and, 260
 RSC in, 65
 submarines in, 202, 204
 in World War II, 27
- the Philippines, 3, 98–100
 INDOPACOM and, 48–50
 missiles in, 80, 89
 nuclear weapons in, 262
 in Pacific War, 76
 pre-positioning in, 110–11
 submarines in, 205
 Taiwan and, 4–5, 114
 UAS in, 194t
- Pillar I Pathway, of AUKUS, 208
 PJDAMs. *See* Powered JDAMs
 PLA. *See* People's Liberation Army
 PLA Air Force (PLAAF), 51, 79
 air defenses for, 90–92
 missiles of, 89
- PLA Navy (PLAN), xxii, 20–21, 31, 51, 79
 missiles of, 89
 submarines and, 203
 surface fleet of, 131–32, 131f
 Taiwan and, 113–14
- PLA Rocket Force (PLARF), xix–xx, 78,
 89, 251
- PLAAF. *See* PLA Air Force
 PLAN. *See* PLA Navy
 Planning, Programming, Budget, and
 Execution (PPBE), 150, 171
- PLARF. *See* PLA Rocket Force
 Plumb, John, 227
- PNT. *See* positioning, navigation,
 and timing
- Pollpeter, Kevin, 230
- positioning, navigation, and timing
 (PNT), xxiii, 221, 226

- Powered JDAMs (PJDAMs), 77
- PPBE. *See* Planning, Programming, Budget, and Execution
- pre-positioning, 117
 for logistics, 109–12, 129–30
 for SIC, 129–30
 for surface fleet, 129–30
- Price, Ned, 115
- productized-sales model, for DIB, 164–68
- Project 221, 229
- Project 621B, 37
- Project Maven, 165
- Proliferated Low Earth Orbit Satellite-Based Services, 234
- Proliferated Warfighter Space Architecture, 237
- Puget Sound Naval Shipyard and Intermediate Maintenance Facility, 205
- Putin, Vladimir, 240, 268
- QKD. *See* quantum key distribution
- Quadrennial Defense Review, 43
- quantum communications, 223, 242–43, 355n120
- quantum computing, 242–43, 273
 for quantum sensors, 213
- quantum cryptography, for space power, 241–43
- quantum key distribution (QKD), 242
- quantum sensors, 212–13
- Queen Elizabeth*-class carriers, 135, 321n64
- radar tracking, 180–81, 334n20, 335n21
- radio frequency (RF), for radar tracking, 180, 334n20, 335n21
- railguns, 127, 133
- Rapid Defense Experimentation Reserve (RDER), 330n74
- Raytheon (RTX), 83–84, 90, 145, 154, 163
 torpedoes by, 209
- R&D. *See* research and development
- RDER. *See* Rapid Defense Experimentation Reserve
- Ready Reserve Force (RRF), 96, 105–6, 108, 117
 in Gulf War, 309n14
- Reagan, Ronald, 24, 150–51, 159, 260
 Strategic Defense Initiative of, 225, 266–67
- Reciprocal Defense Procurement, 171
- reconnaissance-strike complex (RSC), 65–68, 78
 logistics and, 103
 scouting and, 299n48
 US Navy and, 119–20
- remote sensing
 for space power, 240–41
 in Ukraine, 240
- Replicator, xxi, 70, 195–96
- research and development (R&D), 166
 by DOD, 41
 for Strategic Defense Initiative, 267
- reserves, 25, 27–28
 for airpower, 30
 for logistics, 103, 105–6
- revolution in military affairs (RMA), 16, 24, 35–44
 DIB and, 154–55
- RF. *See* radio frequency
- Rheinmetall, 326n37
- Rich, Ben, 39
- Richards, Frederick, 33
- RMA. *See* revolution in military affairs
- Roosevelt, Franklin Delano, vii, 7, 98, 146–47, 279–80
- Roscosmos, 233
- RQ-4 Global Hawk, 68, 69t, 299n51, 300n54
- RQ-20B Puma, 70
- RQ-101, 194t
- RRF. *See* Ready Reserve Force
- RSC. *See* reconnaissance-strike complex
- RTX. *See* Raytheon
- Rumsfeld, Donald, 43
- Russia, 9
 aircraft carriers and, 135
 ASAT of, 231, 233
 ASBM of, 135
 EW of, 129
 hypersonic missiles of, 82, 303n38
 Japan and, 29, 60
 kinetic weapons of, 222
 loitering munitions of, 318n23
 MIRV of, 255
 North Korea and, 3
 nuclear weapons of, 256, 260, 261, 266, 360n49, 365n103
 satellites of, 21
 space power of, 230, 233

- submarines of, 204
 - UAS in, 184
 - XLUVs of, 215t
 - See also* Soviet Union; Ukraine
- Russo-Japanese War, 46t
- SALT I, 259
- SALT II, 259
- SAR. *See* synthetic aperture radar
- Sarma, 215t
- satellites, 21
 - for C2, xxiii, 221
 - for communication, xxii
 - for counter-scouting, 64–65, 67
 - dazzling of, 67, 231, 298n39
 - direct-ascent weapons against, 234, 351n76
 - frequency jamming of, 222
 - for Global War on Terror, 226
 - in Gulf War, 226
 - for ISR, xix, xxii–xxiii, 221, 229
 - of Japan, 235, 352n81
 - nuclear weapons on, 225, 227
 - of PLA, 221–22
 - PNT of, xxiii, 221, 226
 - SAR for, 337n59
 - for scouting, 58, 62, 68
 - SM-6 and, 90
 - for Ukraine, 227–28, 237
 - See also* antisatellite; *specific types*
- Savo Island, 29
- SBIR. *See* Small Business Innovation Research
- ScanEagle, 194t
- Scheer, Reinhard, 60
- Schelling, Thomas, 246, 248
- Schmidt, Helmut, 259
- scouting, xix, 16–17
 - CCA and, 186
 - in Cold War, 57–58
 - in INDOPACOM, 57–71
 - RSC and, 299n48
 - satellites for, 68
 - UAS for, 58, 67–71, 69t
 - USVs and, 112
 - in World War I, 295n11
 - See also* counter-scouting
- sea lines of communication (SLOCs), 102
- Sea Shadow, 40
- Seabees (Naval Construction Battalions), 100
- Seawolf*-class submarines, 203, 340n12
- Second Island Chain (SIC), 45, 47f, 50, 54
 - pre-positioning for, 129–30
- Second Offset, 36, 38, 39
- Second Opium War, 46t
- Second Sino-Japanese War, 46t
- second-strike capacity, 21
- Sembawang Naval Installation, 205
- semiconductors
 - DOD and, 40–41
 - leading edge, 176
 - for swarms, 190
 - from Taiwan, 5
- Senkaku Islands, 135
- Sentinel, 264
- Shahed, 91, 181t, 318n23
- Shijian-21, 239
- Shipbuilders Council of America, 157
- Ship-to-Shore Connector (SSC), 139
- shipyards/shipbuilding
 - capacity, 133
 - FMM, 157–58, 208
 - in Japan, 117
 - Puget Sound Naval Shipyard and Intermediate Maintenance Facility, 205
 - for submarines, 207–8, 219
 - for US Navy, 133
 - workforce for, 157–58
 - in World War II, 100, 279
- short-range ballistic missiles, 78
- SIC. *See* Second Island Chain
- Singapore, 205
- 600-Ship Navy, 151
- Sky Bow, 92
- Skydio, xxi, 182
- SLAM-ER. *See* Standoff Land Attack Missile-Expanded Response
- SLBMs. *See* submarine-launched ballistic missiles
- SLCM-N. *See* Nuclear-Armed Sea-Launched Cruise Missile
- SLOCs. *See* sea lines of communication
- SM-2. *See* Standard Missile-2
- SM-6. *See* Standard Missile-6
- Small Business Innovation Research (SBIR), 330n74

- Small Business Technology transfer (STTR), 330n74
- small unmanned aerial system (SUAS), 184–86
- Solomon Islands, 123
- Somervell, Brehon, 100
- sonar arrays, 203–4, 212, 340n5
- sonar systems, of submarines, 343n46
- sonobuoys, 203, 204, 340n5
- Sound Surveillance System (SOSUS), 211–12
- South China Sea, 4, 6, 45, 135
 - nuclear weapons and, 257
 - submarines in, 202
- South Korea, 9–10, 117, 326n37
 - aircraft carriers and, 135
 - defense spending by, 278
 - Hycore cruise missile of, 86
 - INDOPACOM and, 48
 - missiles and, 89
 - North Korea and, 261–62
 - nuclear sharing with, 257, 263, 269
 - nuclear weapons and, 22, 260, 261–62
 - Taiwan and, 114
 - UAS in, 194t
- Soviet Union (USSR)
 - Berlin Airlift and, 101
 - NATO and, 37–38, 259–60
 - Navy and, 23
 - nuclear weapons of, 36, 247–48
 - procurement system of, 149
 - RMA and, 37–39
 - Sputnik of, 225, 226
 - See also* Cold War
- Space Development Agency, 237
- Space Force, US, 224, 227
 - Defense Support Program of, xxiii, 258
 - JCIDS and, 150
 - launch technology for, 237
- space power, 221–44
 - airpower and, 223, 224
 - ballistic missiles and, 225
 - C2 for, 224, 226, 231, 242
 - cyber warfare and, 225, 228, 231, 232, 268
 - deterrence and, 222, 232–35
 - emerging technologies for, 235–43
 - EW and, 225
 - GPS for, 221, 226, 228, 230
 - hybrid space architectures for, 237
 - ISAM for, 239–40
 - kinetic weapons and, 224–25, 231, 232
 - launch technology for, 236–37
 - naval power and, 223, 224
 - NTP for, 238–39
 - PLA and, 228–30
 - quantum communication for, 241–43
 - quantum cryptography for, 241–43
 - remote sensing for, 240–41
 - of Russia, 230, 233
 - space debris and, 225, 231, 232
 - See also* satellites
- Space-Earth Integrated Information Network Mega Project, 229, 230
- SpaceX, 195, 227–28, 236
- Special Security Arrangements (SSAs), 171
- Sphinx*, 32
- spoofing, 176, 184, 190–92
- Sputnik, 225, 226
- SS-20, 259, 260
- SSAs. *See* Special Security Arrangements
- SSBN. *See* nuclear-powered ballistic missile submarine
- SSC. *See* Ship-to-Shore Connector
- Standard Missile-2 (SM-2), 84t, 89
- Standard Missile-6 (SM-6), 80, 85t, 89–90
- Standoff Land Attack Missile-Expanded Response (SLAM-ER), 84t, 88
- Star Wars (Strategic Defense Initiative), 225, 266–67
- Starlink, 227–28, 231
- stealth
 - for counter-scouting, 65
 - cruise missiles, 87
 - for quantum sensors, 213
 - for submarines, 201
 - for UAS, 177
- stealth aircraft, 39–40
 - B-2 Stealth Bomber, 154, 264, 328n55, 364n93
 - for counter-scouting, 65, 67
- steam power, for naval power, 31–32, 59
- Storm Shadow/SCALP-EG, 87
- Strait of Malacca, 48
- Strategic Arms Reduction Treaty, 248
- strategic bombardment, 180, 181t, 334n18
- Strategic Capabilities Office, 128
- Strategic Defense Initiative (Star Wars), 225, 266–67

- strategic deterrence system (*zhanlüe weishe tixi*), 254
- Strix, 194t
- STTR. *See* Small Business Technology transfer
- SUAS. *See* small unmanned aerial system
- Subic Bay, 80, 205, 262
- submarine-launched ballistic missiles (SLBMs), 252, 253
- submarines, xviii, 119, 199–219
 - AIP for, 201, 204
 - AUKUS and, 199–200, 208
 - in Australia, 205
 - B-21 and, 364n93
 - ballistic missiles on, 203
 - in Battle of the Philippine Sea, 27
 - in Cold War, 201, 202, 210, 340n12
 - for counter-scouting, 65
 - cruise missiles on, 203
 - for deterrence, 202
 - DIB and, 20–21, 145, 147, 207
 - emerging technologies for, 210–18, 215t
 - in FIC, 202, 205
 - in Guam, 205
 - in INDOPACOM, 202–6
 - LEO satellites for, 219
 - long-range strikes from, 74, 80
 - maintenance cycles for, 204, 206–7
 - NDAA for, 162
 - at Pearl Harbor, 205
 - in the Philippine Sea, 202, 204
 - in the Philippines, 205
 - of PLA, 201, 204–5, 218
 - PLAN and, 203
 - readiness crisis for, 20, 199, 206–10
 - of Russia, 204
 - service life of, 342n33
 - shipbuilding workforce for, 157
 - shipyards for, 207–8
 - in Singapore, 205
 - sonar systems of, 343n46
 - in South China Sea, 202
 - of Soviet Union, 64
 - stealth for, 201
 - in Taiwan, 202, 205
 - tracking of, 201, 203–4
 - of UK, 210
 - unique value of, 200–202
 - Virginia*-class, 199, 203, 219, 328n55, 340n12, 342n33
- in World War II, 200–201, 210, 311n38
- See also* antisubmarine warfare; nuclear-powered ballistic missile submarine; torpedoes; unmanned underwater vehicles
- Suez Canal, 135
- Sunda Strait, 48
- supercarriers, 134, 322
 - Nimitz*-class, 151
- super-cavitating torpedoes, 217
- surface fleet
 - divestment in, 137–40
 - evolving threat to, 124–28
 - history of, 121–24
 - logistics for, 129–30
 - sizing of, 130–34
 - Taiwan and, 120
 - of US Navy, 119–41, 131f*See also specific types of ships*
- surface warfare (SUW), 132, 211
- Surveillance Towed Array Sensor System (SURTASS), 212
- SUW. *See* surface warfare
- swarms, 20, 79, 176, 189–90, 196
- synthetic aperture radar (SAR), 167, 240–41, 337n59
- Taiwan, xviii, xxi, 42
 - A2/AD for, 78
 - air defenses for, 92
 - amphibious ships and, 139
 - attempted invasion of, 12–13
 - autonomous mines in, 216–17
 - blockade of, 13, 17, 80, 112–16, 118
 - choke points at, 48, 216
 - crisis scenarios for, 4
 - CUAS for, 183, 195
 - in defense perimeter, 51
 - HIMARS in, 87
 - Japan and, 4–5
 - JASSMs and LRASMs and, xx
 - logistics for, 97
 - long-range strikes and, 76–80
 - missiles and, 89
 - NCSIST in, 90
 - NEO for, 114–16
 - in Pacific War, 76
 - the Philippines and, 4–5
 - PLA and, 4, 5–6, 13, 44, 53, 66–67, 79–80, 113, 195

- Taiwan (*continued*)
 PLAN and, 113–14
 RSC and, 65–67
 semiconductors from, 5
 submarines in, 202, 205
 surface fleet and, 120
 UAS for, 183, 194t
 US Army in, 275
 USMM and, 112–13
- Taiwan Strait, xx, 77, 124, 135
 nuclear weapons and, 249, 257
- Tanker Security Program (TSP), 106
- Teng Yun, 194t
- Terminal High Altitude Area Defense (THAAD), 267, 365n105
- terrain, 25–27
- THAAD. *See* Terminal High Altitude Area Defense
- Thailand
 INDOPACOM and, 48
 Taiwan and, 114
- The Bridges at Toko-Ri* (Michener), xxi–xxii
- Three Communiqués, 80
- Ticonderoga*-class cruisers, 327n50
- TLAM. *See* Tomahawk Land Attack Missile
- Tomahawk cruise missiles, xxiii, 74, 84t, 87–88, 93
 in the Philippines, 80
- Tomahawk Land Attack Missile (TLAM), 66
- torpedo boat destroyers, 122, 124
- torpedoes, 122, 124, 204
 advancements in, 217–18
 in Cold War, 217
 heavy, 209
 homing, 343n46
 industrial base for, 208–9
 light, 209, 216, 217–18
 miniaturization of, 217–18
- Trafalgar, 59
- Transformation, 43
- Transformational Satellite Communications System, 43
- Trenchard, Hugh, 223
- Truman, Harry, 163
- Trump, Donald, 163, 227
- TSP. *See* Tanker Security Program 2034, xviii
- Two-Ocean Navy Act of 1940, 146, 279
- Type 094 Jin-class SSBNs, 252–53
- Type 095 submarine, 204
- Type 096 submarines, 204
- Typhon transporter-erector-launcher system, 80
 for SM-6, 90
- U-2 spy plane, 226
- U-864, 210
- UAS. *See* unmanned aerial systems
- UAV. *See* unmanned aerial vehicle
- UK. *See* United Kingdom
- Ukraine
 air defenses in, 91, 92, 307n86
 airpower in, 307n86
 CUAS in, 20, 68, 175, 180–82
 DIB and, 155–56, 162
 drones in, 1, 2, 227–28
 EDI and, 110
 HIMARS in, 86, 305n62
 missiles in, 88–89
 NATO and, 2–3, 156, 250
 NEO in, 115
 nuclear weapons in, 250, 268
 remote sensing in, 240
 SAR in, 167, 241
 satellites for, 227–28, 237
 stealth cruise missiles in, 87
 SUAS in, 185–86
 terrain in, 26
 UAS in, 19, 67–68, 175, 180–84, 181t, 189–90
 USVs in, 125
 UUVs in, 216
- Unified Pacific Fleet Project for Tactical Improvement and Data Extraction (UPTIDE), 58, 63–64, 294n1
- United Defense, 331n84
- United Kingdom (UK, Britain)
 aircraft carriers of, 135–36, 321n64
 BAE Systems of, 331n84
 balanced force of, 152–53
 British Royal Navy of, 122–24
 defense spending by, 278
 in Five Eyes, 239, 353n97
 Grand Fleet of, 60–61
 HVX of, 86
 ITAR and, 169–70
 nuclear weapons of, 255
 in Pacific War, 101

- stealth cruise missiles of, 87
- submarines of, 210
- Taiwan and, 114
- torpedo boat destroyers of, 122, 124
- Very Lightweight Torpedo program
 - in, 218
 - in World War I, 295n11
 - XLUUVs of, 215t, 216
 - See also* Australia-UK-US; World War I; World War II
- United States. *See specific topics*
- unmanned aerial systems (UAS), xix, 16,
 - 19–20, 119, 175–97
 - AAI for, 176, 190–92
 - air defenses for, 91
 - airpower and, 178–80
 - in Australia, 194t
 - batteries for, 182–83, 185
 - CCA, 186–89
 - DIB and, 184–86
 - DOD and, 70, 195–96, 334n17
 - economies of scale in production of, 184–86
 - edge computing for, 176
 - in Global War on Terror, 178
 - in Gulf War, 177
 - HALE, xix, 68–69, 70
 - in Hellscape, 196
 - in India, 194t
 - in INDOPACOM, 175, 184, 192–96
 - in Israel, 177, 196
 - long-range strikes from, 79
 - MALE, xix, 68–69, 69t, 70, 79, 178, 196
 - NDAA for, 162
 - origins of, 177–80
 - in the Philippines, 194t
 - for radar tracking, 334n20, 335n21
 - in Russia, 184
 - for scouting, 58, 67–71, 69t
 - in South Korea, 194t
 - spoofing for, 184, 190–92
 - swarms for, 189–90
 - for Taiwan, 183, 194t
 - in Ukraine, 19, 67–68, 175, 180–84, 181t, 189–90
 - for US Army, 197
 - for US Marine Corps, 197
 - of US Navy, 128
 - in Vietnam War, 177
 - in World War II, 177
 - WPT for, 190, 338n60
- unmanned aerial vehicle (UAV), 69f, 119,
 - 169, 291n68, 299n52
- unmanned surface vehicles (USVs), 18,
 - 112, 119, 125, 128–29, 130, 176–77, 196, 215t, 216, 275, 276
- unmanned undersea vehicles (UUVs).
 - See* unmanned underwater vehicles
- unmanned underwater vehicles (UUVs),
 - 128–29, 130, 176–77, 215t, 216, 275, 276
 - ASW and, 219
 - in Hellscape, 196
 - ITAR and, 169
 - by Northrop Grumman, 344n57
 - in Ukraine, 216
 - XLUUVs, 214–16, 215t, 219
- UPTIDE. *See* Unified Pacific Fleet Project for Tactical Improvement and Data Extraction
- US Coast Guard (USCG), 105
- US Merchant Marine (USMM), xx,
 - 96, 103–9
 - MARAD and, 105–6, 108
 - MSP and, 106
 - segments of, 312n64
 - Taiwan and, 112–13
 - TSP and, 106
 - workforce for, 108–9
 - in World War II, 116
- US Munitions Import List (USMIL), 171
- USCG. *See* US Coast Guard
- USMIL. *See* US Munitions Import List
- USMM. *See* US Merchant Marine
- USSR. *See* Soviet Union
- USVs. *See* unmanned surface vehicles
- UUVs. *See* unmanned underwater vehicles
- V-2, 225
- Vandenberg Space Force Base, 236
- venture capital (VC), 164–68
- Venturer*, HMS, 210
- Vertical Launching System (VLS),
 - 28, 117, 125–26, 133, 137, 322n73, 323n74
- Very High Speed Integrated Circuits (VHSIC), 41
- Very Lightweight Torpedo program, 218

- VHSIC. *See* Very High Speed Integrated Circuits
- Viasat, 228
- Victory supply ships, 100
- Vietnam, 114
- Vietnam War, 36
 - logistics in, 97
 - PLA in, 251
 - UAS in, 177
- Villeneuve, Pierre-Charles de, 59
- Vinson, Carl, 146–47, 150–51
- Virginia Payload Module (VPM), 219, 342n33
- Virginia*-class submarine, 199, 203, 219, 328n55, 340n12, 342n33
- VLS. *See* Vertical Launching System
- Voluntary Intermodal Sealift Agreement (VISA), 108
- VPM. *See* Virginia Payload Module
- V-weapons, 81, 225
- War of 1812, 97
- War on Terror. *See* Global War on Terror
- War Plan Orange, 98
- War Production Board, 147–48
- War Reserve Stocks, 109
- Warden, John A., 223
- Washington and London Naval Treaties, 146
- Wasp*-class landing helicopter deck, 138
- Watkins-Johnson, 41
- Weather Gauge, 59
- Weinberger, Caspar, 151
- Wicker, Roger, 147
- Wing Loong, 68, 69t
- Wing Loong II, 69, 299n52
- wireless power transfer (WPT), 190, 338n60
- workforce
 - for DIB, 156–58
 - DOD and, 277
 - for shipbuilding, 157–58
- World War I, 1, 23
 - aircraft carriers in, 123
 - airpower in, 178–79
 - battleships in, 123, 295n11
 - logistics in, 97
 - naval power in, 32, 34
 - scouting in, 60–61, 295n11*See also specific topics*
- World War II, vii, xvii–xviii, 23
 - aircraft carriers in, 74–75
 - airpower in, 30, 35, 147–48, 179, 324n11
 - ballistic missiles in, 81, 225
 - battleships in, 151
 - deterrence and, 22
 - DIB in, 145–48
 - logistics in, 97, 100, 101, 107, 311n38, 324n11
 - long-range strike in, 74–75
 - navy in, 26, 29
 - the Philippine Sea in, 27
 - reserves in, 27
 - shipbuilding in, 279
 - submarines in, 200–201, 210, 311n38
 - terrain in, 26
 - UAS in, 177
 - US Navy in, 30
 - USMM in, 116*See also Pacific War; specific topics*
- WorldView, 234
- WPT. *See* wireless power transfer
- Wylie, J. C., 25, 223
- WZ-7 Soaring Dragon, 70, 300n54
- Xi Jinping, 2, 4, 5, 44, 268
 - nuclear weapons and, 252–53, 254, 255
 - space power and, 229–30
- XLUVs. *See* extra-large UUVs
- XQ-67A, 188
- YJ-18, xx–xxi
- YJ-21, 83
- Yokosuka Naval Base, 48, 205
- Yom Kippur War, 249
- Yoon Suk-yeol, 261, 262
- Young School (*Jeune École*), 122
- Yuan Jiajun, 230
- Yun Feng cruise missile, 79
- zero trust, 330n72
- Zhang Junshe, 112–14
- zhanlüe weishe tixi* (strategic deterrence system), 254