

## INDEX

Note: page references in **bold** denote figures and photographs.

Note: dates glossed for the United Nations Space treaties (Liability Convention, Moon Agreement, Outer Space Treaty, Registration Convention, and Rescue Agreement) are the dates the treaties were opened for signatures.

- 101955 Bennu (asteroid), 1, 133–34, **135**
- 1997 XF11 (asteroid), 248
- 2019 OK (asteroid), 192–93
- 367943 Duende (2012 DA14, asteroid), 251
- 67P/Churyumov–Gerasimenko (comet), 208, **209**
- A-1 (Germany), 258
- A-4 (Germany), 258
- Abe, Shinzo (prime minister, Japan), 310
- ABM Treaty (1972), 261–62, 266, 276
- Additional Protocols to the Geneva Conventions (1977), 355–56
- Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, 244
- Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979); *see* Moon Agreement (1979)
- Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011), 225
- Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (UN, 1995), 163
- Amazon/Kuiper, 49, 59, 63, 68
- Anderson, Eric (CEO, Space Adventures), 20
- Ansari X-Prize, 12
- Antarctic Treaty (1959), 103
- Anti-Ballistic Missile Treaty (ABM Treaty, 1972), 261–62, 266, 276
- anti-satellite weapons; *see also* international humanitarian law (*jus in bello*); *see also* right of self-defence
- ASAT ban, 276–81, 320, 333
- ASAT development, post-2007, 313
- China test (2007), 53, 266, 303, 312–13
- China test (2007), responses, 308–9
- China test (2013), 313
- China test (2014), 313
- counterspace capabilities, 335–43
- cumulative effects of testing, 308–9
- cyber intrusions, 344
- deployment and use verification, 275
- direct-ascent weapons, 267, 275, 283, 324–25, 335
- electronic countermeasures, 335–43
- IADC guidelines, 317–18
- India test (2019), 61, 267–70, **304–22**
- India test (2019), responses, 322
- intergovernmental organizations, decisions, 315–16, 319
- international law, 303, 322, 324–25, 335–37

- Kessler–Cour-Palais syndrome, 263–64
- kinetic weapons, 262–63
- laser tests, 335–43
- Outer Space Treaty (1967), 307
- pellet ring, 368–70
- proximity missions, 343–44
- Russia test (2021), 2–3, 53, 280–81, 303, 324–25
- Russia test (2021), responses, 326–31
- space debris and kinetic weapons, 262–63, 278, 281–82, 310–13, 315
- subsequent practice, 307–9, 313, 315–16, 319, 322, 324–25, 331–32, 337
- UN Charter and self-defense, 345–46
- unilateral declaration, United States, 335
- US test (1985), 265
- US test (2008), 267, 313
- Apophis (asteroid), 195, 251–57
- Arbatov, Alexey, 277
- Arch Mission Foundation (USA), 164–65
- ArianeSpace, 230, 360
- Artemis Accords: China reaction to, 160
- duty to consult, 174
- Global South reaction to, 161
- lunar mining, 130–31
- multilateral law-making, 174
- national appropriation, 159
- political accord, 159
- rationale, 159
- safety zones, 3, 173–76
- safety zones and non-signatory countries, 174
- US military, cis-lunar Space, 294–95
- US–Russia relationship undermined, 160
- Asian Infrastructure Investment Bank, 173
- Aso, Taro (foreign minister, Japan), 310
- Asteroid Terrestrial-Impact Last Alert System (ATLAS), 190–91
- Astra Space, 49
- astronomy; *see also* international law, astronomy
- anthropogenic occultations, 93
- Dark and Quiet Skies, 92
- data loss, 92
- definition of, 101
- ghost streaks, 92
- industry guidelines, informal, 93
- light pollution, 46–47, 47, 117–18, 117–18, 167
- mega-constellation visibility, 94–96
- mega-constellations, altitude limit concerns, 96
- mega-constellations, threats of, 91–92
- natural heritage, 97
- radio astronomy, 92
- satellite brightness, 94–97
- transient interference, 92–93
- Atlas V (USA), 121
- Australia, 159, 311, 328–29
- Space (Launches and Returns) Act (2018), 81, 317
- Austria, 324–25
- Axiom, 17, 45
- Barnes, Richard, 365
- Behnken, Robert (astronaut, NASA), **158**
- Beidou-2 G2 (navigation satellite, China), 314
- Belgium, 147
- Belt and Road Initiative, 173
- Bennu (101955 Bennu, asteroid), 1, 133–34, **135**
- Beresheet* (Israel), 4–5, 164–65
- Bezos, Jeff, 1, 14–16, 38, 136
- Biden, Joe (president, USA), 185, 361
- Bin Cheng, 305
- Birnie, Patricia, 182
- Blinken, Anthony (Secretary of State, USA), 326
- Blue Origin: DRACO program, 34
- FAA registration, 36–37
- lunar lander contract, 16
- New Shepard, 13–14, 16, 33–34, 36–37
- Space tourism, 11, 13–14

- Boothby, Bill, 356
- Borrell, Josep (high representative of the European Union for foreign affairs and security policy), 327–28
- Boyle, Alan, 182
- Brahe, Tycho, 91, 196
- Branson, Sir Richard, 12–13, 15, 38, 44
- Braun, Wernher von, 259
- Breakthrough Listen (SETI project), 297
- Bridenstine, Jim (NASA Administrator), 20, 131, **158**, 162, 172, 269–70, 322–23
- Butow, Steven, 295
- Canada: Artemis Accords signatory, 159
- ASAT test ban proposal, 276–77
- Canadian Space Agency, 317
- Kosmos 954 impact, 63–64, 88
- Near Earth Object Surveillance Satellite (NEOSSat), 250
- Pikialasorsuaq (North Water Polynya), 64
- RadarSat-2, 352
- Remote Sensing Space Systems Regulations (2007), 317
- response to 2007 China ASAT test, 311
- response to 2019 India ASAT test, 324
- terrestrial mining companies, 171
- Canadian Space Agency, 317
- Canary Islands, 191
- Capone, Francesca, 108
- Case Concerning the Gabčíkovo-Nagymaros Project* (1997), 243
- Catalina Sky Survey, 190
- Center for NEO Studies (Jet Propulsion Laboratory, NASA), 198
- Central Bureau for Astronomical Telegrams, 248
- Chang Zheng 3B (China), 119
- Chang'e 4 (lunar lander, China), 291
- Chang'e 5 (lunar lander, China), 131
- Chelyabinsk event, 187–88, 211
- Chicago Convention (1944): aircraft, definition, 35
- duty to rescue, 28, 31, 33–34, 37, 225
- international law, 50
- SpaceShipTwo*, 37
- Chile, 91–92, 191
- China: anti-satellite weapon test (2007), 53, 77, 303
- Asian Infrastructure Investment Bank, 172–73
- Belt and Road Initiative, 172–73
- Chang'e 4 (lunar lander), 291
- Chang'e 5 (lunar lander), 131
- China National Space Administration (CNSA), 56–57, 79, 265, 330–31, 359
- collision avoidance maneuver, 56–57
- Global Times*, 330–31
- Interim Measures on Space Debris Mitigation and Protective Management (2009), 316
- lunar mining, 131, 295
- PPWT (2014), 274–75
- response to 2021 Russia ASAT test, 330–31
- Space-faring state, emergence as, 172–73
- Tiangong Space station, 3, 41, 56–57, 74–75, 172–73, 270, 325
- Working Group on Space Resources, 177–78
- China National Space Administration (CNSA), 57, 79, 265, 330, 359
- CHPS (USA), 291–92, 298
- Chyba, Christopher, 277–78
- Cislunar Highway Patrol Satellite (CHPS, USA), 291–92, 298
- cis-lunar Space: arms control, 298
- blurring of intentions, 294
- Chang'e 4 (lunar lander, China), 291
- Cislunar Highway Patrol Satellite (CHPS, USA), 291, 331–32
- congestion and debris, 297–98
- DARPA, 292, 296, 298
- debris removal, 291–92
- Defense Deep Space Sentinel (D2S2, USA), 291, 298
- definition, 290

- international law, 295–96
- Lagrange points, 290, 297
- radio astronomy, 296
- Space situational awareness, 290–91, 298
- Space-based monitoring, 290
- Clapp, Jennifer, 365
- ClearSpace-1* (European Space Agency), 314
- CNSA, 57, 79, 265, 330, 359
- Commercial Space Launch Competitiveness Act (USA, 2015), 151–54, 157–58
- Committee on Space Research (COSPAR), 165
- Committee on the Peaceful Uses of Outer Space (COPUOS): Action Team 14 (hazardous NEO investigation), 211
- creation of, 6
- Declaration of Legal Principles, 78–104
- Guidelines for the Long-Term Sustainability of Outer Space Activities (2018, 2019), 83, 121
- IAWN and SMPAG recommendations, 211–34
- legal subcommittee, 32–33, 177, 179, 276, 323–24
- long-term sustainability of Space activities (LST, 2019), 320
- membership, 78–81, 315, 340
- property rights, 137–38
- ROSCOSMOS, 281
- soft law, 78–79
- Space Debris Mitigation Guidelines (2007, 2010), 78–81, 121, 315, 317, 329
- Space mining, 138–39, 147–49
- Comprehensive Test Ban Treaty (1996), 226, 232–33
- Conference on Disarmament, 274–75, 277, 301, 334
- Connor, Larry, 17
- Convention against Torture (1984), 79, 282, 332
- Convention on Cluster Munitions (2008), 184
- Convention on International Civil Aviation (1944); *see* Chicago Convention (1944)
- Convention on Registration of Objects Launched into Outer Space (1974), 37
- Convention on the Continental Shelf (1958), 170, 230
- Convention on the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction (1992), 301
- Convention on the International Liability for Damage Caused by Space Objects (1972); *see* Liability Convention (1972)
- Convention on the International Regulations for Preventing Collisions at Sea (1972), 70–71
- Convention on the Law of the Sea (1982); *see* UNCLOS (1982)
- Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-personnel Mines and on Their Destruction (1997), 129, 184, 301–2
- COPUOS; *see* Committee on the Peaceful Uses of Outer Space (COPUOS)
- Corfu Channel Case*, 220–21
- COSPAS-1 (satellite), 364
- Cour-Palais, Burton, 263, 306
- Crew Dragon (SpaceX): astronaut transport to ISS, 16
- duty to rescue, 28
- environmental impacts, 39–40
- passenger/crew distinction, 17–18
- rescue capability, 38–39
- Space debris, 39–40
- Space tourism, 19–20
- spacesuits, 15
- Cruise, Tom, 20
- Cruz, Ted (senator, USA), 151
- customary international law: chemical weapons, 300–1
- deep seabed mining, 176
- duty to rescue, 43
- environmental protection, 106–8

- customary international law: chemical weapons (cont.)  
 hard law, 78  
 international law, source of, 220  
*jus cogens* rules, 282  
 kinetic ASAT weapons testing, 282  
 multilateral negotiations, 183  
 persistent objectors, 340  
 precautionary principle, 181–82  
 proportionality, 357  
 right of self-defence, 237, 240, 345–46  
 silence as acquiescence, 340  
 soft law, relationship to, 78–79  
 Space mining, 138, 148–49  
 state practice, 112, 150, 170, 172, 302, 316, 322, 325, 338–39, 341–42  
 state responsibility, 99, 240–41  
 subsequent practice, 153–54, 156, 159, 168–69, 175, 185, 331–32  
 treaty interpretation, 28, 30, 138–39  
 Vienna Convention (1969), 24
- D2S2 (USA), 292, 298  
 D'Amato, Anthony, 282, 332  
 DARPA (USA), 292–94, 296, 298  
 DART (NASA), 167, 200–1  
 Deep Impact (comet probe, NASA), 208  
 Defence Research and Development Organisation (India), 321  
 Defense Advanced Research Projects Agency (DARPA, USA), 292–94, 296, 298  
 Defense Deep Space Sentinel (D2S2, USA), 292, 298  
 Delta IV (USA), 126  
 De Man, Philip, 153–54  
 Demonstration Rocket for Agile Cislunar Operations (DRACO, DARPA), 294  
 Desautels, Eric, 343  
 Dimorphos (asteroid), 167, 200–1  
 Disasters Charter, 172  
 Double Asteroid Redirection Test (DART, NASA), 167, 200–1  
 Downer, Alexander (Foreign Minister, Australia), 311  
 Draft Articles on State Responsibility (2001), 240–46  
 duty to rescue; *see also* under Rescue Agreement (1968); *see also* under Liability Convention (1972); *see also* under Outer Space Treaty (1967)  
 Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011), 225  
 Chicago Convention (1944), 28, 31, 33–34, 37, 223–24  
 commercial spacecraft, 28  
 Cospas-Sarsat, 365  
 non-governmental passengers, 31  
 planetary defence, 222–23  
 regional and bilateral treaties, 224  
 SAR Convention (1979), 28, 34, 37, 223–25  
 SOLAS Convention (1914), 28, 31, 33–34, 37, 223–24  
 UN Charter, 43  
 UNCLOS (1982), 28, 34, 37  
 universal applicability, 37
- Edgeworth–Kuiper Belt (Kuiper Belt), 207–8  
 environmental impacts: aluminium  
 from satellite demise, 64  
 aluminium from solid fuel rockets, 67  
 anthropogenic atmospheric injection modeling, 66–67  
 black carbon, 38, 41, 67  
 commercial travel, volume, 38  
 deorbiting space objects, 63–64  
 mesospheric cloud formation, 33–41, 66–67  
 ozone layer depletion, 67  
 satellite demise, 64  
 Space debris, 41  
 ESA; *see* European Space Agency (ESA)  
 European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), 364

- European Space Agency (ESA):  
 collision avoidance maneuver, 57  
 COPUOS observer status, 325  
 DART test, 237  
 debris clearance, 314–15  
 European Cooperation for Space  
 Standardization, 82, 318–19  
 IADC member, 79  
 ISO, 82, 318  
 response to 2019 India ASAT test,  
 324  
*Rosetta/Philae (probe/lander)*, 208,  
**209**  
 termination of co-operation with  
 Russia, 360  
 European Union, 310, 320, 327–28; *see*  
*also* European Space Agency (ESA)  
 Exxon Valdez, 83, 128
- FAA, 14, 36–37  
 Falcon 9 (SpaceX), 20, 38, 41, 67, 114  
 FCC: categorical exclusion, claim of,  
 110  
 collision risk underestimation, 61  
 de facto regulator of LEO, 170–71  
 orbital shell assignment, 69  
 SpaceX, 60  
 Starlink, 48–49, 63, 108, 110  
*Viasat, Inc. v. Federal*  
*Communications Commission*,  
 111–12  
 Federal Aviation Administration  
 (FAA), 14, 36–37  
 Federal Communications Commission  
 (FCC); *see* FCC  
 Fédération Aéronautique  
 Internationale, 13  
 Finland, 324  
 flag-of-convenience states:  
 Luxembourg, 4  
 maritime law, 171  
 Rwanda, 172  
 Space mining, 138–39, 168,  
 171–72  
 suppression of, 98  
 Forden, Geoffrey, 278–80  
 France, 148, 324, 327  
 Funk, Wally, 16, 32  
 G77 states, 138  
 Galileo (EU GPS system), 74  
 General Atomics, 294  
 Geneva Conventions (1949), 355  
 GEO (geosynchronous orbit), 52, 58,  
 70, 111–12  
 Geosynchronous Satellite Launch  
 Vehicle, 62–63  
 Germany, 258–59, 276, 323–24, 329  
 Glassmeier, Karl-Heinz, 66–67  
 global positioning system (GPS); *see*  
 GPS  
 Global South, **124**, 125–26, 129, 161,  
 171, 176  
*Global Times*, 330–31  
 GPS, 48, 265, 352, 367  
 Gray, Christine, 350  
 Green, James, 189, 228–29, 237  
 Guidelines for the Long-term  
 Sustainability of Outer Space  
 Activities (COPUOS, 2018, 2019),  
 83, 121  
 Guiding Principles Applicable to  
 Unilateral Declarations (UN,  
 International Law Commission,  
 2006), 336  
 Guo Wang/StarNet, 49, 59, 185
- Hagle, Sharon and Mark, 2  
 Hague Conventions, The (1907), 355  
 Hague International Space Resources  
 Governance Working Group, The,  
 157  
 Harris, Kamala (vice president, USA),  
 335, 337  
*Hayabusa-1* probe (Japan), 132  
*Hayabusa-2* probe (Japan), 133, 166  
 Hirano, Yozo (filmmaker), 20  
 Hitchens, Theresa, 334  
 Hobe, Stephan, 35  
 Huang Zhicheng, 331  
 Hurley, Douglas (astronaut, NASA),  
**158**  
 Hyten, General John E., 267
- IADC: ASAT tests, 277, 307–18  
 creation of, 265  
 deorbiting guidelines, 74, 84–85

- IADC: ASAT tests (cont.)  
 kinetic ASAT ban, 279  
 law-making, 279  
 mega-constellations, 50  
 ODMSP influence, 317  
 Space debris mitigation guidelines,  
 307–18
- India, 61–63, 118–19, 304–22, **304–22**
- Indonesia, 119–20, 137–38, 178–79
- Instituto de Astrofísica de Canarias  
 (Canary Islands), 191
- Inter-Agency Space Debris  
 Coordination Committee (IADC);  
*see* IADC
- International Agreement to Prevent  
 Unregulated High Seas Fisheries  
 in the Central Arctic Ocean  
 (2018), 163, 181
- International Asteroid Warning  
 Network (IAWN), 211–34
- International Astronautical Congress, 159
- International Astronomical Union, 93,  
 103–4, 186, 219, 248
- International Civil Aviation  
 Organization (ICAO), 70
- International Code of Conduct for  
 Outer Space Activities (EU), 320
- International Committee of the Red  
 Cross, 358
- International Convention for the  
 Prevention of Pollution from  
 Ships (MARPOL Convention,  
 1992, 2001, 2003), 128
- International Convention for the Safety  
 of Life at Sea (1914); *see* SOLAS  
 Convention (1914)
- International Convention on Maritime  
 Search and Rescue (1979); *see* SAR  
 Convention (1979)
- International Cospas-Sarsat  
 Programme, 172, 363–65
- International Court of Justice: *Advisory  
 Opinion on the Legality of the  
 Threat or Use of Nuclear Weapons*  
 (1996), 244  
*Case Concerning the Gabčíkovo-  
 Nagymaros Project* (1997), 243  
*Corfu Channel Case* (1949), 220–21  
 environmental protection, 107  
 information sharing, 220–21  
 judicial decisions, 112  
*Nicaragua Case* (1986), 338, 346–47,  
 349–50  
*North Sea Continental Shelf Cases*  
 (1969), 230, 338  
*Nuclear Test Cases* (1974), 279,  
 335–36  
*Oil Platforms Case*, 347
- International Covenant on Civil and  
 Political Rights (1976), 79
- international humanitarian law (*jus in  
 bello*): Additional Protocols to the  
 Geneva Conventions (1977),  
 355–57  
 ASAT weapons, 355, 358  
 distinction, 355–56  
 Geneva Conventions (1949), 355  
 military necessity, 355–56  
 proportionality, 357  
 proportionality and ASAT use,  
 357–58  
 proportionality, example of,  
 357–58
- international law, astronomy: Antarctic  
 Treaty (1959), 103  
 compliance, 112–13  
 customary international law, 106  
 Declaration of Legal Principles  
 (COPOUS), 78–104  
 due regard, context, 104–5  
 due regard, duty of, 98, 104–6,  
 108–9  
 due regard, ordinary meaning, 104–5  
 environmental impact assessments,  
 98, 107–9  
 exploration and use, 98–100, 102  
 exploration and use, context, 101–2  
 exploration and use, ordinary  
 meaning, 99–100
- International Court of Justice, 106–7  
 mega-constellations, 77–78  
 negotiation required, 108–9  
 precautionary principle (Rio  
 Declaration (1992)), 98  
 Rio Declaration (1992), 106–7  
 Stockholm Declaration (1972), 106

- UN Framework Convention on  
Climate Change (1992), 106–7
- West Ford Experiment (1961–63),  
78–104, 238–39
- international law, satellite collisions:  
causation, 77, 89–90  
disaster response, 83, 90–91  
enforcement, 87–88  
fault, determination of, 84  
hard law, 78–79  
IADC guidelines, 74, 79  
indirect damage (knock-on  
collisions), 85–87  
ISO standard, 81  
liability, 87  
liability and national courts, 89  
national implementation of  
COPUOS guidelines, 81  
negligence, determination of, 77  
soft law, 78  
Space Debris Mitigation Guidelines  
(COPUOS, 2007), 78–82  
state recovery of compensation,  
87–88  
sustainability guidelines, 83  
tort law, 89
- International Law Commission (ILC,  
United Nations), 154–55, 240–43,  
245, 336
- International Maritime Organization,  
83, 128
- International Organization for  
Standardization (ISO), 82, 318
- International Space Station (ISS); *see*  
ISS
- International Telecommunication  
Union (ITU); *see* ITU
- Iridium, 8, 48, 51, 53, 92
- Iridium 33 (satellite), 8
- Isaacman, Jared, 19–20
- ISO, 82, 318
- ispace (Japan), 153, 162, 172
- Israel, 4–5, 164–65, 255
- Israel, Brian, 151–52, 156
- ISS: civilian control, 238  
collision risks, 74–75, 264, 266,  
269–70, 281, 322–23, 325–26, 328  
feature film production, 2, 20
- Space debris, 3, 41
- Space tourism, 2, 11
- Italian Space Agency, 237
- Italy, 159, 237
- Itokawa (asteroid), 132
- ITU: communication satellites, orbital  
assignments, 70  
Constitution and Convention, 71  
LEO regulatory role, 70  
mega-constellations, 49  
mega-constellations, milestone-  
based regulatory approach, 71–72  
milestone-based regulatory  
approach, problems, 72–73, 75–76  
Radio Regulations, 71–72  
radio spectrum allocation, 71, 172  
Radiocommunication Bureau, 71–72  
Rules of Procedure, 71–72
- Ivanov, Sergei (deputy prime minister,  
Russia), 311
- Ivory Coast, 118
- Jakhu, Ram, 144–45
- Japan: Artemis Accords signatory, 159  
*Hayabusa-1* probe, 132–33  
*Hayabusa-2* probe, 132–33, 166  
ispace, 153, 162, 172  
Japanese Space Agency, 132–33  
response to 2007 China ASAT test,  
310  
response to 2021 Russia ASAT test,  
329  
Space mining, 152
- Japanese Space Agency, 132–33
- Jet Propulsion Laboratory (NASA), 198
- Johndroe, Gordon (NSC  
spokesperson), 309–10
- Johnson, Christopher, 296
- Kamo'oalewa (asteroid), 133–34
- Kármán Line, 13, 153, 259
- Kepler Communications, 49, 62, 75
- Kepler, Johannes, 91, 196, 207
- Kessler, Donald, 263, 306
- Kessler–Cour-Palais Syndrome, 54,  
263–65, 272, 281, 302, 306
- Kongsberg Satellite Services (KSAT,  
Norway), 352–53, 366

- Koplow, David, 353  
 Korolev, Sergei Pavlovich, 145  
 Kosmos 1408 (Russia), 2, 270, 282, 325, 328, 330  
 Kosmos 2251 (Russia), 8, 54  
 Kosmos 954 (Russia), 63–64, 88  
 K–T extinction event, 186, 257
- Lagrange points, 64, **290**, 297  
 Laliberté, Guy, 44  
*Law of Treaties, The* (McNair, 1986), 106  
 LEO; *see also* mega-constellations  
   automated collision avoidance, 8  
   debris-generating events, 8  
   GEO transfer orbits, 41, 58, 111–12  
   inter-operator communications, 55, 57–58  
   Kessler–Cour-Palais Syndrome, 54–55  
   orbital congestion, 7–8, 54–55, **55**, 58, 75  
   satellites prior to 2019, 48  
   satellite–satellite collision, 8, 53  
   situational awareness, 55, 90  
 LeoLabs, 90  
 Liability Convention (1972): absolute liability, 34–35  
   damage on return, 36  
   enforcement, 88–89  
   fault, 84  
   indirect damage (knock-on collisions), 86–87  
   planetary defence, 247  
   rocket bodies, 121  
   space object, 36  
   state liability, 87  
   suborbital flights, 36–37  
 Liemer, Ross, 277–78  
 Liman, Doug, 20  
 Limited Test Ban Treaty (1963), 226, 229–30, 239, 261, 298, 302  
 Liu Jianchao (Foreign Ministry, China), 312  
 Liu Jing, 330  
 Lockheed Martin, 294  
 Long March (China), 63, 118  
 low Earth orbit (LEO); *see* LEO  
 Lunar Gateway (NASA), 166  
 Lunar Outpost, 162  
 Luxembourg: Artemis Accords signatory, 159  
   flag-of-convenience state, 4  
   GEO communication companies, 152  
   ispace Europe, 162  
   Space mining, 152, 162, 172
- McDowell, Jonathan, 13, 119  
 McNair, Lord, 106  
   *The Law of Treaties* (1986), 106  
 Maezawa, Yusaku, 20–21  
 Marsden, Brian, 248–49  
 Marvel Space Communications, 49, 73–74  
 Masten Space Systems, 162  
 mega-constellations; *see also*  
   international law, satellite collisions; *see also* ITU; *see also* international law, astronomy; *see also* OneWeb, *see also* Starlink  
 Amazon/Kuiper, 49, 59–60  
 Astra Space, 49  
 automated collision avoidance, 59–60  
 collision risks, 58–60, 74–75  
 congestion/collision mitigation, 62  
 consumer electronic product model, 49, 58  
 deorbiting satellites, 58–60  
 deorbiting satellites, safety, 63  
 differential access, 51  
 environmental effects of rocket launches, 68–69  
 environmental effects of satellite demise, 64  
 fragmentation events, 60–61  
 governance, 49, 70  
 Guo Wang/StarNet, 49, 59–60  
 ITU regulatory approach, 72  
 Kepler Communications, 49  
 market change, 51  
 Marvel Space Communications, 49, 73–74  
 meteoroid collisions, 60–61  
 military use, 50–51

- new services, 51  
 NewSpace, 53, 54  
 OneWeb, 49, 59–60  
 orbital shell assignment, 70  
 radio astronomy, interference with, 91–93  
 satellites, brightness mitigation, 47, 91–92  
 satellites, light pollution, 46–47, 47  
 Space debris, 51  
 SpaceX, collision assessments, 60  
 user base, 50  
*Viasat, Inc. v. Federal Communications Commission*, 111–12  
 mesopause, 12  
 mesosphere, 12, 66  
 Microsat-R (ASAT target, India), 267, 268  
 Minor Planet Center (International Astronomical Union), 219  
 Montreal Protocol on Substances that Deplete the Ozone Layer (1987), 127  
 Moon Agreement (1979), 144–45, 149–50, 158, 180  
 Musk, Elon, 16, 41, 52, 66, 246, 367  
 Nair, Madhavan (Indian Space Research Organization), 310–11  
 NASA; *see also* Artemis Accords  
   Catalina Sky Survey, 190  
   cometary impact scenario, 210  
   Commercial Crew Program, 20  
   Deep Impact, 208  
   Double Asteroid Redirection Test (DART), 167, 200–1, 211–37  
   IADC membership, 79  
   Jet Propulsion Laboratory, 198  
   Lunar Gateway, 166  
   lunar lander contract, 16  
   lunar regolith purchase, 131–32, 161–62, 172  
   Near-Earth Object Surveillance Mission (NEOSM), 192  
   NEOWISE, 191–92  
   Orbital Debris Mitigation Standard Practices (ODMSP, 2001), 81, 120–21, 317  
   OSIRIS-REx probe, 133, 136  
   Pan-STARRS Project, 190  
   SpaceX, collision avoidance coordination, 57–58  
   US ASAT test (1985), objections to, 265  
   Wolf Amendment (2011), 359  
 National Aeronautics and Space Administration (NASA); *see* NASA  
 National Environmental Policy Act (USA), 110–11  
 National Transportation Safety Board (USA), 128  
 NATO, 326–27, 343, 366  
 Near Earth Object Surveillance Satellite (NEOSSat, Canada), 250  
 Near-Earth Object Surveillance Mission (NEOSM, NASA), 192  
 NED: advantages of use, 203  
   challenges to use, 203  
   claim of necessity, 226  
   Comprehensive Test Ban Treaty (1996), 226, 232–33  
   deflection method, 202  
   Limited Test Ban Treaty (1963), 226, 229–30, 239  
   NEO rendezvous, 202  
*North Sea Continental Shelf Cases*, 230  
   Oberth effect, 203  
   Outer Space Treaty (1967), 226  
   Space-based nuclear weapons tests, 230  
   Space-based testing moratorium, 231–32  
   UN Security Council authorisation, 226  
 Nelson, Bill (NASA Administrator), 326  
 NEOWISE (comet), 191–92  
 NEOWISE (NASA satellite), 191–92  
 Netherlands, 324  
 New Shepard (Blue Origin), 14, 16, 33, 37  
 NewSpace, 53, 54, 152, 255  
*Nicaragua Case*, 338, 346–47, 349–50  
 NOM4D, 293, 293–94, 296, 298

- North Atlantic Council (NATO), 327
- North Sea Continental Shelf Cases, 230, 338
- Norway, 9, 352–53, 366
- Novel Orbital and Moon  
 Manufacturing, Materials and Mass-Efficient Design (NOM4D, DARPA), 293–94, **293**, 296, 298
- nuclear explosive device (NED); *see* NED
- Nuclear Test Cases*, 279, 335–36
- Obama, Barack (president, USA), 151
- Oberth effect, 203
- Office for Outer Space Affairs, 93
- Oil Platforms Case*, 347
- OneWeb: collision avoidance, 60  
 collision risks, 75  
 environmental impact statements, 99  
 Geosynchronous Satellite Launch Vehicle, use of, 62–63  
 Greg Wyler (CEO), 74–75  
 mega-constellation, 49, 59  
 Soyuz rocket, use of, 62–63  
 Ukrainian war, 360
- Oort Cloud, 207
- Operation Burnt Frost, 64
- Orbital Debris Mitigation Standard Practices (ODMSP, USA, 2001), 81, 120–21, 317
- OSIRIS-REx* probe (NASA), 1, 133, **135**
- OST; *see* Outer Space Treaty (1967)
- Outer Space Institute, 157
- Outer Space Treaty (1967): collision avoidance, 56–57  
 duty of due regard, 105, 141–42  
 duty to consult, 142, 163, 306  
 duty to rescue, 21  
 duty to rescue, celestial bodies, 42  
 duty to rescue, commercial spacecraft, 28  
 duty to rescue, non-governmental passengers, 33  
 exploration and use, 101–2, 146, 305–6  
 geographic scope of rescue, 23  
 information sharing, 219–20  
 liability, Space tourism, 34  
 mega-constellations, 50  
 NEDs, 227–29  
 non-state actors, 246  
 object and purpose, 102, 106, 143  
 orbital shells, *de facto* use, 69–70  
 origins, 279–80  
 principles, 154–56  
 property rights, 137, 141–43, 146, 148–49  
 Space mining, 1, 138–41  
 Space security, 261, 279–98  
 subsequent practice, 153  
 unilateral action against NEO, 238
- Pan-STARRS Project, 190
- Parly, Florence (defence minister, France), 327
- PDV Mk-II (India), 283
- pellet ring, 368–70
- Pence, Karen, **158**
- Pence, Mike (vice president, USA), **158**
- Peresild, Yulia, 20
- PL-19 Nudol (Russia), 281, 283, 325
- Planet Labs, 48
- planetary defence; *see also* NED; *see also* Space Mission Planning Advisory Group (SMPAG)  
 airbursts, 187  
 anthropogenic environmental degradation, 192  
 asteroid deflection, 196  
 Asteroid Terrestrial-Impact Last Alert System (ATLAS), 190–91  
 B-plane, 196, **198**, 201–2  
 Catalina Sky Survey, 190  
 Chelyabinsk event, 187, 211  
 circumstances precluding wrongfulness, 241  
 circumstances precluding wrongfulness, consent, 241–42  
 circumstances precluding wrongfulness, distress, 242–43  
 circumstances precluding wrongfulness, necessity, 243–46  
 collective Space agency action, 234  
 cometary impact scenario, NASA, 209–10  
 comets, 206–7

- dark asteroids, 192  
 decision-making matrix, 234  
 Deep Impact (NASA), 208  
 defence capability, development of, 250  
 direction of approach, 191–92  
 Double Asteroid Redirection Test (DART, NASA), 200–1, 211  
 duty to rescue, international law, 223–26  
 Earth impactors, **186**, 186  
 Edgeworth–Kuiper Belt (Kuiper Belt), 206–8  
 fault-based liability, 249  
 gravity tractors, 205–6  
 impact timescales, 187–88  
 information sharing, 211  
 information sharing, international law, 219–20  
 Instituto de Astrofísica de Canarias (Canary Islands), 191  
 International Asteroid Warning Network (IAWN), 211–12  
 international cooperation, 211  
 keyholes, 251–53, **253**, 256  
 kinetic impactors, 199–202  
 K–T extinction event, 186, 257  
 liability, 247  
 liability and false alarms, 247–49  
 mass drivers, 204–5  
 minimum orbital intersection distance (MOID), 192, **194–96**  
 mission-ready assets, 250–51  
 multilateral assistance, 221–22  
 Near-Earth Object Surveillance Mission (NEOSM, NASA), 192  
 NEO identification, 190  
 NEOWISE (NASA), 191  
 NGO liability, 249  
 non-state actors and state responsibility, 246, 255  
 Oort Cloud, 206–7  
 Pan-STARRS Project, 190  
 precautionary defence, mission restriction, 251–53  
 precautionary defence, NEO deflection, 255  
 precautionary principle, 254, 257  
 pre-emptive self-defence, 239–40  
 risk assessment, 188, 194–96, 233–34  
 Rosetta/Philae (probe/lander), 208, **209–10**  
 safe harbours, 256  
 Shoemaker–Levy 9 (comet), 209–10  
 Space Mission Planning Advisory Group (SMPAG), 211, 213  
 Space-based sensors, 191, 250  
 state responsibility, 221  
 tabletop exercise (2017), NED use, 217, 244–45  
 tabletop exercise (2019), deflection mission, 215–17, **217**  
 tabletop exercise (2021), impact emergency, 214–15  
 Tunguska event, 188  
 UN Security Council, 235–36  
 unilateral action, 211  
 unilateral action and military involvement, 237–38  
 unilateral action, international law, 237–38  
 Vera C. Rubin Observatory (Large Synoptic Survey Telescope, Chile), 191  
 waiver of liability (UN Security Council), 236  
 Yarkovsky effect, 195  
 PPWT (2014), 274–75  
 precautionary principle (Rio Declaration [1992]):  
   environmental degradation, 107  
   environmental impact assessments, 98–99, 107–8  
   planetary defence, 250–51, 254, 257  
   Space mining, 168, 181–83  
 Privateer, 90  
 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (1925), 300  
 Putin, Vladimir (president, Russia), 281, 360  
  
 R-7 (Russia), 259  
 RadarSat-2 (Canada), 352

- radio astronomy, 92–93, 297
- Raju, Nivedita, 331
- Reagan, Ronald (president, USA), 264, 365
- Reddy, G. Satheesh, 321
- Redstone (USA), 259
- Registration Convention (1974), 37
- Remote Sensing Space Systems Regulations (Canada, 2007), 317
- Rescue Agreement (1968): alighted, interpretation of, 22  
cost reimbursement, 37  
duty to rescue, 21–22, 31, 34, 37  
duty to rescue, celestial bodies, 42  
duty to rescue, commercial spacecraft, 30–31  
duty to rescue, non-governmental passengers, 32–33  
duty to rescue, *travaux préparatoires*, 32–33  
geographic scope of rescue, 22  
*travaux préparatoires*, 28
- right of self-defence: ASAT use on civilian satellite, 348  
ASAT use on dual-use satellite, 348  
ASAT use on military satellite, 347–48  
gravity threshold, 346–47, 349, 354  
necessity and proportionality, 350–51  
necessity and proportionality, debris creation, 354–55  
necessity and proportionality, dual-use satellites, 352–54, 368  
necessity and proportionality, military satellites, 351–52  
Space debris, 354  
UN Charter and ASAT weapons, 345–46
- Rio Declaration (1992), 106–7, 181
- rocket bodies: casualty risk assessment, 120, **122–23**  
casualty risk assessment, future risk, 122–23, **124**  
controlled re-entry, 114  
controlled re-entry, switch to, 124  
environmental risks, 62, 68–69  
generic term, 114  
Global South, 121, **124**, 124  
Guidelines for the Long-Term Sustainability of Outer Space Activities (2018), 120–21  
Liability Convention (1972), 121  
liability risk, 121  
light pollution, 117–18, **117–18**  
low-risk, high-consequence events, 120–21  
negotiation before disaster, 128–29  
on-orbit abandonment, 114, 120  
Orbital Debris Mitigation Standard Practices (ODMSP, USA), 120–21  
re-entry safety risks, 62  
Space debris, 53–54, 114, **116**  
Space Debris Mitigation Guidelines (2010), 120–21  
SpaceX, best practices, 62  
tragedy of the commons, prevention of, 127–29  
uncontrolled re-entry, 62, 114, 120  
uncontrolled re-entry, casualty expectations, 122–23  
uncontrolled re-entry, surface impacts, 118–20, **119**
- Rogers, A.P.V., 357–58
- Rogozin, Dmitry (ROSCOSMOS director general), 20, 137, 160, 179, 362–63
- ROSCOSMOS: IADC membership, 79, 265  
property rights, 137–38, 160  
Russia (2021) ASAT test, 281  
Space debris, 281, 311–12  
Space tourism, 17, 20–21  
Ukrainian war, 362–63
- Rosetta/Philae* (probe/lander, ESA), 208, **209**
- Rubio, Marco (senator, USA), 151
- Russia; *see also* ISS; *see also* Soyuz (Russia); *see also* ROSCOSMOS  
anti-satellite weapon test (2021), 2–3, 53, 270–71, 281–82, 303  
ASAT tests (1968–1982), 262  
bilateral Russia/US ASAT test ban proposal, 277  
Chelyabinsk event, 187–88, 211

- Cospas–Sarsat rescue programme, 364
- General Requirements on Space Systems for the Mitigation of Human-Produced Near-Earth Space Pollution (2008), 317
- knock-on collision, 77
- Kosmos 954 impact, 63–64, 88
- Luna-16 probe, 145
- NED testing, 231
- Outer Space Treaty, *travaux préparatoires*, 148
- Pikialasorsuaq (North Water Polynya), 64
- PPWT (2014), 274–75
- response to 2007 China ASAT test, 311
- response to 2019 India ASAT test, 323
- Salyut-7 Space station, 118
- satellite–debris collision, 266
- satellite–satellite collision, 8, 53
- Space mining, 131, 145
- Tunguska event, 188–89
- Ukrainian war, 6, 334, 343–44, 359–60
- West Ford Experiment, reaction to, 103
- Working Group on Space Resources, 179
- Russia–China International Lunar Research Station, 359
- Russian Space Agency (ROSCOSMOS); *see* ROSCOSMOS
- Rwanda, 49, 73–74, 172
- Ryugu (asteroid), 133–34, 166
- Salyut-7 Space station, 118
- SAR Convention (1979), 29, 34, 37, 224–25
- Saraswat, Vijay Kumar, 321
- SC-19 (China), 283
- Scaled Composites, 12
- Schmitt, Michael, 358
- Schulz, Leonard, 66–67
- Sea Launch project, 64
- Shanahan, Patrick (Defense Secretary, USA), 323
- Shijian-21* (spacecraft, China), 314
- Shipenko, Klim, 20
- Shoemaker–Levy 9 (comet), 209–10
- SiriusXM, 48
- SM-3 missile (US), 267, 276, 283
- SOLAS Convention (1914): duty to rescue, 28, 31, 33–34, 37, 223–24, 365
- international law, 50
- South Korea, 330
- Soviet Union; *see* Russia
- Soyuz (Russia): ISS resupply and crew rotation, 361
- Space tourism, 11, 17, 20–21, 44
- Ukrainian war, 360, 362–63
- uncontrolled re-entry, 62–63
- Space; *see also* Space tourism; *see also* environmental impacts; *see also* LEO; *see also* GEO (Geosynchronous Orbit); *see also* rocket bodies; *see also* astronomy; *see also* Space mining; *see also* planetary defence; *see also* Space security; *see also* IADC; *see also* ISS; *see also* Committee on the Peaceful Uses of Outer Space (COPUOS); *see also* Space debris; *see also* anti-satellite weapons
- definition of boundary, 12–13
- determining astronaut title, 13–14
- freedom of exploration and use, 305
- governance, 6, 9, 49–50, 70–71, 184, 359
- governance breakdown, 359
- grand challenges, 7
- LEO denial of safe access, 368–70
- ownership, 5–6
- rules of the road, 70–71
- satellite companies, national registration, 71
- satellite–satellite collision, 8, 53–54
- spacefaring states, 339–40
- sustainable development, 9
- traffic management, 58
- Ukrainian war, 366–68
- Space (Launches and Returns) Act (Australia, 2018), 81, 317
- Space Adventures, 11, 17, 20

- Space debris; *see also* Kessler–Cour-Palais Syndrome
- active debris removal, 54, 344
  - anti-satellite weapons tests, 3, 53, 60–61, 265–69, **268**, 271–73, 278, 281–82, 322
  - cis-lunar Space, 297–98
  - debris-generating events, 8, 60–61
  - gas drag clearance, 53
  - graveyard orbits, 314, 318
  - mega-constellations, 52
  - meteoroid collisions, 60–61
  - missile defence systems and debris generation, **273**, 283–85, 287–90
  - national implementation of UN guidelines, 316–17
  - on-orbit infrastructure, 52, **53**, 75–76
  - rocket bodies, 53
  - tracked debris, 52
  - tragedy of the commons, 7
  - untrackable debris, 8, 60
- Space Debris Mitigation Guidelines (COPUOS, 2007, 2010), 78–82, 121
- Space Force (USA), 4, 171–72, 366–67
- Space mining; *see also* Space mining, US approach
- accidents, 1
  - asteroid mining, 133–36
  - asteroid trajectory change, 167
  - asteroids, scientific interest, 134–35
  - China–Russia joint mission (Kamo’oalewa asteroid), 134–35
  - debris streams, 165–66
  - deep seabed mining as example, 176
  - duty to consult, 142
  - exploration and use, 146
  - flag-of-convenience states, 172
  - freedoms and restrictions, 180
  - invasive-species protection, 164–65
  - light pollution, 167
  - low-risk, high-consequence events, 167
  - lunar mining, 130–36
  - lunar orbits, 165–66
  - lunar regolith purchase, NASA, 131, 161–62, 172
  - military resource use, 180
  - mining, duty of due regard, 141–42, 181
  - mining, duty to consult, 162–63
  - mining, non-state actors, 141
  - mining, ordinary meaning, 140–41
  - Moon Agreement (1979), 144–45, 148–49
  - multilateral agreement required, 162–63, 173, 179–80, 183
  - national policy, 152–53, 156
  - opposition, 1, 156
  - planetary defence, 205
  - precautionary principle, 181
  - property rights, 137, 141–43, 146, 148–49, 184–85
  - risks, 136
  - scientific knowledge, potential loss, 164
  - Space-based fuel production, 130, 136
  - subsequent agreement, 144–45
  - subsequent practice, 131–32, 138, 145–46, 150–51, 153–54, 156, 162, 168–69, 172, 184–85
  - travaux préparatoires*, 147
  - treaty negotiations, 156–57
  - Working Group on Space Resources, 177–79, 183
- Space mining, US approach: China as counter-balance, 172
- Commercial Space Launch Competitiveness Act (2015), 151–54, 156–57
- de facto regulatory regime, 170–71
- global commons, rejection of, 157–58
- NewSpace, 152
- obligations *erga omnes*, 154–56
- power imbalance, 153–54
- property rights, 151
- regulatory flight, 171–72
- Space companies as non-state actors, 168, 180
- Space companies, US concentration, 168
- Space Mission Planning Advisory Group (SMPAG): Ad-Hoc Working Group on Legal Issues, 211
- creation of, 211
- DART mission, 211

- non-state actors, 255
- planetary defence, 213, 234
- potential sidelining in emergency, 235
- Space agency cooperation, 211, 254
- Space security; *see also* cis-lunar Space
  - ABM Treaty (1972), 261, 265, 276
  - ASAT ban, 277–81
  - ASAT limitation proposals, 276
  - ASAT weapons, kinetic, 262–63, 267, 270, 273–74
  - bilateral Russia–US ASAT test ban proposal, 277
  - China ASAT test (2007), 265
  - FTG-15 (US interception test), 273, 273, 287
  - IADC, 265
  - increased collision risk, 270, 271–72, 272–73
  - India ASAT test (2019), 267
  - Kessler–Cour-Palais Syndrome, 263–64
  - Limited Test Ban Treaty (1963), 261
  - military Space activity, historical, 258–59
  - missile defence systems, 283
  - missile defence systems and debris generation, 273, 283–85, 287–90
  - missile defence systems, permitted use, 288–89
  - Outer Space Treaty (1967), 261
  - PPWT (2014), 273–74
  - Russia ASAT test (2021), 270, 280–81
  - space debris and kinetic weapons, 262–63, 265, 267, 268, 271–73, 278, 281–82
  - spacecraft approach speeds, 279
  - Starfish Prime, 260–61
  - Strategic Arms Limitation Talks Agreement (SALT 1, 1972), 261
  - Strategic Defense Initiative (SDI), 264
  - UN General Assembly resolutions, 276
  - US ASAT test (1985), 265
  - US ASAT test (2008), 267
  - US unilateral ASAT test ban, 279, 283
  - US-Soviet Orbital Debris Working Group, 265
- Space Systems - Space Debris Mitigation Requirements (ISO, 2010), 82, 318
- Space tourism; *see also* duty to rescue
  - environmental impacts, 2, 11, 38–39
  - extinction tourism, 44–45
  - international law, 11
  - liability, 34–38
  - liability regime, determination of, 34–36
  - orbital tourism, 16–21
  - safety, 14–15
  - Space debris, 11
  - suborbital tourism, 12–16, 16–21
  - types, 2, 11
- SpaceIL (Israel), 164–65, 255
- SpaceShipOne* (Virgin Galactic), 12
- SpaceShipTwo* (Virgin Galactic):
  - altitude limit, 12, 14
  - carrying capacity, 12
  - Chicago Convention, 36–37
  - environmental impacts, 38–39, 67
  - FAA registration, 36–37
  - launch, 12
  - liability regimes, 35
- SpaceX; *see also* Starlink; *see also* Crew Dragon (SpaceX); *see also* Falcon 9 (SpaceX)
  - astronaut transport to ISS, 16, 29
  - collision assessments, 60
  - control of orbits, 4
  - Falcon 9, 20, 38, 41, 114
  - lunar lander contract, 16
  - movement of operations, 4
  - NASA contracts, 4, 171–72
  - NASA, collision avoidance coordination, 57–58
  - orbital tourism, 16–17, 19–20
  - rocket body best practices, 62
  - Space Force contracts, 4, 171–72
  - Space tourism, 11
  - Starship, 20–21, 41, 67–68, 255, 257
  - Tesla automobile launch, 165
- SS *Titanic*, 33, 223, 365
- Starfish Prime (US NED test), 232

- Starlink: aluminium from satellite demise, 64  
 automated collision avoidance, 59–60  
 brightness mitigation, 91–92  
 Chinese collision avoidance maneuver, 56–57  
 collision risks, 74–75  
 deorbiting satellites, 58  
 deployment, 48–49  
 environmental impact assessments, 98–99, 107–8  
 ESA collision avoidance maneuver, 55–57  
 FCC licence, 110  
 orbital congestion, 59–60  
 Ukrainian war, 367
- Starship, 20–21, 41, 67–68, 255, 257
- Statute of the International Court of Justice, 112
- Stockholm Declaration (1972), 107
- Stoltenberg, Jens (NATO Secretary-General), 326–27
- Strategic Arms Limitation Talks Agreement (SALT 1, 1972), 261
- Strategic Defense Initiative (SDI), 264, 365
- stratosphere, 66, 68
- Suffredini, Michael, 17
- Sundahl, Mark, 30–31
- Swift Tuttle (comet), 248
- tardigrades (water bears), 4–5, 164–65
- Telstar 1 (communications satellite), 231, 260
- thermosphere, 12
- Thompson, General David (Vice-Chief of Space Operations, US Space Force), 366–67
- Tiangong Space station, 3, 41, 56–57, 74–75, 173, 270, 325
- Titanic, 33, 223, 365
- Tito, Dennis, 11, 17
- tragedy of the commons, 7, 50, 70, 78, 90–91, 127–29, 184
- Transparency and Confidence-Building Measures in Outer Space Activities (UN, 2012), 319–20
- Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects (PPWT [2014]), 274–75
- Truman Proclamation (1945), 170
- Trump, Donald (President, USA), 157–58, 158, 161, 258
- Tunguska event, 188–89
- Ukrainian war, 6, 334, 343–44, 359–60
- UN Charter, 227, 236–37, 274–75, 295, 345–46
- UN Framework Convention on Climate Change (1992), 107–8
- UN General Assembly resolutions: Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (1962 [XVIII]), 78–104, 143, 280
- No First Placement of Weapons in Outer Space, 276
- Prevention of an Arms Race in Outer Space (PAROS), 276
- resolution 110 (II), 143
- resolution 1721 (XVI), 303–5
- resolution 1884 (XVIII), 143
- resolution 1962 (XVIII), 303–5
- resolution 68/75, 211
- resolution 76/231, 333–34
- UN Space treaties; *see* Outer Space Treaty (1967); *see* Liability Convention (1972); *see* Moon Agreement (1979); *see* Rescue Agreement (1968); *see* Registration Convention (1974)
- UNCLOS (1982), 29, 34, 37, 173, 176, 224
- United Arab Emirates (UAE), 159
- United Kingdom, 74, 99, 108, 159, 311, 328–29
- United States; *see also* NASA; *see also* ISS; *see also* Blue Origin; *see also* SpaceX; *see also* FCC; *see also* Virgin Galactic
- Cislunar Highway Patrol Satellite (CHPS, USA), 291–92, 298

- Counter Communications System (CCS), 343
- DARPA, 292–94, 296, 298
- Defense Deep Space Sentinel (D2S2, USA), 291–92, 298
- Demonstration Rocket for Agile Cislunar Operations' (DRACO, DARPA), 294
- FAA, 14, 36–37
- military Space activity, 258
- NewSpace, 152, 255
- response to 2007 China ASAT test, 309–10
- response to 2019 India ASAT test, 322
- response to 2021 Russia ASAT test, 326
- Space Force, 4, 171–72, 366–67
- Space security advocacy, 264–65
- unilateral declaration on ASAT tests, 279, 283, 335–37
- United States Air Force Research Laboratory, 291–92
- United States Space Command (USSPACECOM), 60, 90, 258, 270, 322
- Wolf Amendment (2011), 359
- United States Air Force Research Laboratory, 291–92
- United States Space Command (USSPACECOM), 60, 90, 258, 270, 322
- Universal Declaration of Human Rights (1948), 79
- USA 193 (US reconnaissance satellite), 267, 269
- V-2 (Germany), 258–59
- V-2 (US), 259
- Van Allen radiation belts, 231, 260–61
- Vance, Cyrus (Secretary of State, USA), 151
- Vande Hei, Mark (astronaut), 361, 363
- Vera C. Rubin Observatory (Large Synoptic Survey Telescope, Chile), 191
- Viasat, 110–11, 344, 366–67
- Viasat, Inc. v. Federal Communications Commission*, 110–11
- Vienna Convention (1969): astronomy, 98, 100–2
- Outer Space Treaty (1967), 142–43
- Rescue Agreement (1968), 24–25, 31–32
- Space mining, 138–39, 141, 146, 152
- subsequent agreement/practice, 144
- subsequent practice, 153, 307–8
- travaux préparatoires*, 25
- Vienna Convention for the Protection of the Ozone Layer (1985), 127
- Vienna Convention on the Law of Treaties (1969); *see* Vienna Convention (1969)
- Virgin Galactic: altitude flight limits, 34
- environmental impacts, 40
- landing site, 34
- safety, 15
- Space tourism, 11
- SpaceShipTwo*, 12–14, 35, 37–40, 67
- Vulcan Centaur (USA), 63, 68
- West Ford Experiment (USA, 1961–63), 103–4, 238–39, 370
- West, Jessica, 294
- WhiteKnightTwo* (Virgin Galactic), 39–40
- Wood, Steven, 25, 27–28, 33
- Working Group on Space Resources, 139, 177–79, 183
- Wyler, Greg, 74
- Yarkovsky Effect, 195
- Yun Zhao, 316
- Zhao Lijian, 330