12.MILLITARY SPACE PROGRAMS

MILITARY SPACE PROGRAM - USA (FAS space millitary System) - EU (GMES space millitary System) - RUSSIA (POLYUS space milllitary System) SATELITTE NAVIGATION - USA (GPS satellite navigation) - EU (GALILEO satellite navigation) - RUSSIA (GLONASS satellite navigation) The Nautilus is another space-faring craft, a secret military spacecraft which operates by magnetic pulsing. It operates out of the unacknowledged new headquarters of the U.S. Space Command, deep under a mountain in Utah. It makes twice-a-week trips up to the secret military-intelligence space station, which has been in deep space for the past thirty years, and manned by U.S. and USSR (now CIS) military astronauts. In 1988 previous models of spacefaring military vehicles were superseded by the “Nautilus”, a spacecraft with a rounded delta shape built jointly by special projects divisions of Europe's Airbus Industrie and U.S.'s Boeing Corporation. Nautilus has a propulsion system which utilizes magnetic pulsing. Nautilus-type craft make twice-weekly trips up into space and back, to service the secret international space station. The Nautilus is based in Utah. The “Dream Chaser” is a planned manned suborbital and orbital spacecraft being developed by Space-Dev, a wholly owned subsidiary of Sierra Nevada Corporation. It is a spaceplane based on previous NASA & Soviet spaceplane work. 1.Tactical High Energy Laser- THEL The cooperative Tactical High Energy Laser (THEL) Demonstrator ACTD was initiated by a memorandum of agreement between the United States and the Government of Israel on 18 July 1996. The THEL is a high- energy laser weapon system that uses proven laser beam generation technologies, proven beam- pointing technologies, and existing sensors and communication networks to provide a new active defense capability in counterair missions. The THEL can provide an innovative solution not offered by other systems or technologies for the acquisition and close-in engagement problems associated with short- to medium-range threats, thereby significantly enhancing coverage of combat forces and theater-level assets. The THEL low-cost per kill (about $3,000 per kill) will also provide a cost-effective defense against low-cost air threats. It features up to 60 shots without reloading and a P(k) near 1 at ranges of some 5 km. A joint U.S.-Israeli program was initiated to develop a THEL demonstrator using deuterium fluoride chemical laser technologies. THEL uses a Deuterium-Fluoride (DF) laser. NF3 and C2H4 are first reacted in multiple, side-by-side, high-pressure combustion chambers using an oxidizer (NF3) rich mixture that generates free F atoms. After ignition the combustion-generated F atoms, mixed with combustion by- products and a He diluent, flow into the laser cavity. A mixture of He and deuterium is also injected into the laser cavity, and DF is generated in an excited state as deuterium reacts with the free F atoms. The laser cavity is now ready to produce a laser beam. 32 BA 330 Nautilus modul X-37A - Boeing/NASA Sierra Nevada Corporation 2.Alpha High energy laser – AHEL Alpha High energy laser Advanced Mirror Program Satellite - TRW Combination lasers: x-ray laser, infra-red laser, chemical joda laser, laser neutral beams, laser electrons, holographic laser. The beam is formed by a combination of sound and ultrasound waves which causes that a person targeted by this beam hears the sound inside of his head. One of them is the electromagnetic energy. Human Bioelectric Impulses(Signals) Modulation/Monitoring Classified US Department of Defense advanced operative tactical weapon, based on human epithalamus and metathalamus specifically epithalamus biomagnetic resonance and metathalamus biomagnetic resonance. Execution of remote targets (target classification:bioobject) complete by the following steps: 1. Epithalamus/Metathalamus biomagnetic field (resonance) of remote target must be projected to remote computerized device-target systems designed to read and modulate bioelectrical impulses. 2. Biomagnetic potentials projected on epithalamus/metathalamus biomagnetic field (resonance) of remote target in its turn reflect on epithalamus it self and brain cortex .This allows to perform simultaneous no-contact bioelectric monitoring (surveillance) of remote target by reading biomagnetic potentials projected to epithalamus biomagnetic field. 33 Satellite Millitary communication GPS III Satellite Millitäry communication GPS-USA Successful launch campaign and modernization work under way for Global Positioning System With successful launches

of replenishment satellites, a new contract to modernize existing spacecraft and an architecture study for the next-generation satellite system, Space Systems is keeping pace with the Air Force's timetable to modernize and improve its GPS constellation. The sixth straight successful GPS IIR satellite was launched in January and is operational. The IIR satellites have increased the GPS constellation's accuracy and are consistently within the top 10 performers in the constellation. Fourteen more IIR spacecraft have been delivered by Space Systems to the U.S. Air Force Space and Missile Systems Center for future launches including another planned this year. The Global Positioning System allows any user equipped with a GPS receiver to determine velocity and worldwide position within a few meters. Although originally designed as a guidance and navigational tool for the military, GPS has proven beneficial in the commercial and civil markets for transportation, surveying and rescue operations. In late 2000, Space Systems was awarded a contract to modernize up to 12 of the 14 GPS satellites currently in storage. The satellites will be modified to incorporate two new military signals and a second civil signal, thus providing military and civilian users of the navigation system with expanded capabilities much sooner than previously envisioned. This modification represents the first significant upgrade to the navigation signal since the inception of GPS. Also in late 2000, Space Systems was awarded one of two industry contracts for a 12- month System Architecture and Requirements Definition stud for the next-generation Global Positioning System, GPS III. 34 GLONASS Navigation - RUSSIA GLONASS-K satellite GLONASS-K is a substantial improvement of the previous generation: it is the first unpressurised GLONASS satellite with a much reduced mass (750 kg versus 1,450 kg of GLONASS-M). It has an operational lifetime of 10 years, compared to the 7-year lifetime of the second generation GLONASS-M. It will transmit more navigation signals to improve the system's accuracy, including new CDMA signals in the L3 and L5 bands which will use modulation similar to modernized GPS, Galileo and Compass. The new satellite's advanced equipment—made solely from Russian components—will allow the doubling of GLONASS' accuracy.As with the previous satellites, these are 3-axis stabilized, nadir pointing with dual solar arrays.The first GLONASS-K satellite was successfully launched on 26 February 2011 Ground control The ground control segment of GLONASS is entirely located within former Soviet Union territory. The Ground Control Center and Time Standards is located in Moscow and the telemetry and tracking stations are in Saint Petersburg, Ternopol, Eniseisk, and Komsomolsk- na-Amure. Receivers Septentrio, Topcon, JAVAD, Magellan Navigation, Novatel, Leica Geosystems and Trimble Inc produce GNSS receivers making use of GLONASS. NPO Progress describes a receiver called "GALS-A1" which combines GPS and GLONASS reception. SkyWave Mobile Communications manufactures an Inmarsat-based satellite communications terminal that uses both GLONASS and GPS. 35 SPACE STATION - COLUMBUS (EU) Columbus laboratory The Columbus laboratory is ESA's biggest single contribution to the International Space Station. The 4.5-metre diameter cylindrical module is equipped with flexible research facilities that offer extensive science capabilities. During its 10-year projected lifespan, Earth-based researchers, together with the ISS crew, will be able to conduct thousands of experiments in life sciences, materials science, fluid physics and a whole host of other disciplines, all in the weightlessness of orbit. To keep costs low and reliability high, Columbus shares its basic structure and life-support systems with the Italian space agency's (ASI) Multi-Purpose Logistics Modules (MPLM). But whereas the MPLM is aptly described as a 'space moving van' - albeit a very sophisticated moving van - the 75 cubic metres of space inside Columbus contains an entire suite of science laboratories. Payload racks The Columbus laboratory has room for ten International Standard Payload Racks (ISPRs), eight situated in the sidewalls, and two in the ceiling area. Each rack is the size of a telephone booth and able to host its own autonomous and independent laboratory, complete with power and cooling systems, and video and data links back to researchers on Earth. ESA has developed a range of payload racks, all tailored to squeeze the maximum amount of research from the minimum of space and to offer European scientists across a wide range of disciplines full access to a weightless environment that cannot possibly be duplicated on Earth. 36 Columbus was outfitted with five internal payload racks at launch • Biolab - supports experiments on micro-organisms, cells and tissue cultures, and even small plants and small insects. • The European Physiology Modules

Facility (EPM) - a set of experiments that will be used to investigate the effects of long-duration spaceflight on the human body. Experiment results will also contibute to an increased understanding of age-related bone loss, balance disorders and other ailments back on Earth. • The Fluid Science Laboratory (FSL) - will accommodate experiments in the strange behaviour of weightless liquids. These too, could bring far-reaching benefits on Earth: better ways to clean up oil spills, for example, and even improved manufacture of optical lenses. • The European Drawer Rack (EDR) - is a modular and flexible experiment carrier system for a large variety of scientific disciplines, providing basic accommodation and resources for experiment modules housed within standardised drawers and lockers. • The European Transport Carrier (ETC) - accommodates items for transport and stowage. In orbit ETC will serve as a workbench and stowage facility. Columbus Control Centre, Oberpfaffenhofen, Germany. Under the call sign 'Munich', the Columbus Control Centre will, from 2007, be responsible for systems on board the orbiting Columbus laboratory and for European science activities on board the ISS.The centre is already building operational expertise during ESA's Astrolab Mission. 37 SPACE STATION - NAUTILUS-X (NASA) NAUTILUS-X stands for Non-Atmospheric Universal Transport Intended for Lengthy United States eXploration This tubular spacecraft could serve as a reusable vehicle for lunar and deep-space missions, holding a crew of six and enough supplies for a two- year expedition. Dubbed Nautilus-X, for “Non-Atmospheric Universal Transport Intended for Lengthy United States eXploration,” this craft could be built in orbit and ready for space missions by 2020, according to a briefing by NASA’s Future In Space Operations group. Nautilus is a multi-mission space exploration vehicle, so it could incorporate mission-specific propulsion units, according to Edward Henderson of NASA Johnson Space Center. Theoretically, you could swap out engines and fuel depending on where you wanted to go. Such an all-purpose system would be simpler than building heavy-lift rockets for specific missions to the moon or Mars. Henderson described the system at a briefing on NASA’s Technology Applications Assessment Team, which is studying (relatively) inexpensive, quick-turnaround technologies for space exploration. Check out the PowerPoint slides here. HobbySpace has a nice roundup of the meeting, which also included a DARPA-funded geosynchronous satellite servicing project, in- situ water recovery on the Moon, a project that would demonstrate space- based solar power beams, a solar electric propulsion vehicle, and propellant depots floating in geosynchronous orbit. 38 MILITARY SPACE PROGRAM - GMES/EU Sentinel-2 Sentinel-2 will provide systematic global acquisitions of high-resolution multispectral imagery for Europe's Global Monitoring for Environment and Security (GMES) programme. GMES (Global Monitoring for Environment and Security) is the response to the need by Europe for geo-spatial information services. It provides autonomous and independent access to information for policy-makers, particularly in relation to environment and security. The success of GMES will be achieved largely through a well-engineered Space Component for the provision of Earth-observation data to feed into a range of services for monitoring the environment and supporting civil security activities. With the benefit of more three decades of experience in implementing satellite missions to observe Earth from space, ESA is well-placed to develop and manage this core component of GMES. The GMES Space Component comprises two types of satellite missions, ESA's five families of dedicated Sentinels and missions from other space agencies, called Contributing Missions. A unified ground segment, through which the data are streamed and made freely available for GMES services, completes the Space Component. The Sentinels will be launched from 2013. These missions carry a range of technologies, such as radar and multi- spectral imaging instruments for land, ocean and atmospheric monitoring: • Sentinel-1 will provide all-weather, day and night radar imagery for land and ocean services, • Sentinel-2 will provide high-resolution optical imagery for land services, • Sentinel-3 will provide high-accuracy optical, radar and altimetry data for marine and land services, • Sentinel-4 and Sentinel-5 will provide data for atmospheric composition monitoring from geostationary orbit and polar orbit, respectively. 39 MILITARY SPACE PROGRAM - POLYUS(RUSSIA) The Polyus military testbed was put together on a crash basis as an answer to America's Star Wars program. It was built around a surplus TKS manned spacecraft and was meant to test prototype ASAT and Star Wars defense systems. It failed to reach orbit, but it had succeeded, it would have been the core module of a new Mir-2 space station. Its mere

presence could have decisively changed the shape of the Cold War in its final months. Polyus Starwars system launched in 1987: The Polyus testbed contained means of defence against both ASAT weapons and beam weapons, though according to Kornilov's article these were only meant to conduct approach and docking tests. A cannon was mounted on Polyus to defend against ASAT weapons. An optical sighting system for the defensive cannon was included in addition to a sighting radar. By this means hostile ASAT weapons could be tracked without generating traceable signals. Experiments to check the efficiency of barium clouds in diffusing particle beams were also to have been conducted with Polyus. A Polyus mock-up was delivered by the Krunichev Factory to Baikonur Cosmodrome in July, 1986, for tests of the Polyus/Energia interface. The spacecraft was about 37 meters in length, 4.1 meters in diameter and weighed about 80 metric tons. A question exists whether a mock-up of the Polyus test bed was constructed and if it still exists. There have been several schemes advanced by the Salyut Design Bureau and the Krunichev Factory for the commercial adaptation of Polyus and these may be intended to make use of this mock-up. Polyus's failure to achieve working orbit was caused by a faulty inertial guidance sensor. An article entitled “Unknown Polyus” by Yuri Kornilov, Chief Designer of the Salyut Design Bureau, has appeared in the journal “Earth and the Universe”, and it provides details about the construction and testing of the first payload for the Energia rocket, the “Polyus” spacecraft. While Kornilov invites the reader to “read between the lines” and points out previous Soviet mis-statements about the Polyus, he is under a security ban which would lead to a 10 years in prison if he reveals (Soviet) “state” secrets. His article continues to claim that weapons systems tests were peaceful experiments. 40 On March 23, 1983, United States President Ronald Reagan set forth his vision of “Star Wars”, a shield intended to defend the United States against nuclear attack from any place on Earth. The leader of the Soviet Union, Yuri Andropov, immediately accused the United States of seeking to militarily dominate the Soviet Union, and it appears he also authorised the design of counter-measures, including Polyus. Andropov sought to bring about a treaty banning military weapons from space until he fell ill in June, 1983. The Soviet space program ran on a five year cycle and Kornilov complains that the Polyus spacecraft had less than the customary five years for development. It was decided that the Polyus would be the payload for the first launch of the Energia heavy lifter, then scheduled for the fall of 1986. Kornilov gives no reason for the rushed development. Kornilov then goes on to declare that because of this rush Polyus was created by combining components from several current projects. The interface between Polyus and the Energia booster was adapted from the Buran Space Shuttle. The central module was adapted from a module for the Mir 2 Space Station. The replaceable and returnable space station to house cosmonauts was adapted from the upgrade of the existing TKS Transport Supply Spacecraft (Kosmos 929, 1267, 1443, 1668). Since the interface of the replaceable space station with the Proton launch vehicle was adapted to interface it with the central module, the rocket engines for orbital insertion had to be placed in the nose of the vehicle. This placement had catastrophic consequences for the Polyus spacecraft. After Andropov's death in February, 1984 his successor Konstantin Chernenko continued to press for a treaty banning the militarisation of space. None the less, apparently following the successful test by the US Army of an anti-ballistic missile on June 12, 1984, and the rejection of a Soviet diplomatic initiative on July 1, construction of the Polyus began at the Krunichev Factory. Design and construction of the platform was given the highest priority, and was under the personal supervision of Armaments Minister O D Baklanov (who later organised the coup against Michael Gorbachev) and Vice Minister O N Shishkin. These two met weekly with project leaders and issued immediate orders for the production of any needed components. Chernenko's successor Michael Gorbachev denounced the militarisation of space on his first diplomatic trips abroad in December, 1984. Following Chernenko's death on March 12, 1985, and his becoming leader, Gorbachev proposed a freeze on the development of space weapons. 41 NAVAL - SPACE COMMAND Mission Headquartered at Dahlgren, Va., Naval Space Command began operations …. Oct. 1, 1983. Naval Space Command uses the medium of space and its potential to provide essential information and capabilities to shore and afloat naval forces by a variety of means: • Operating surveillance, navigation, communication, environmental, and information systems; • Advocating naval warfighting requirements in the joint

arena; • Advising, supporting, and assisting the naval services through training, and by developing space plans, programs, policies, concepts, and doctrine. Overview Naval Space Command's headquarters staff and operational element numbers approximately 350 Navy military and civilian personnel. Their component commands include the Naval Satellite Operations Center and the Fleet Surveillance Support Command. Naval Space Command, a component of USSPACECOM, operates assigned space systems to provide surveillance and warning, and provides spacecraft telemetry and on-orbit engineering support. In addition, Naval Space Command serves as the Alternate Space Control Center [AASC] for USSPACECOM's primary centers located at Cheyenne Mountain AS. ASCC missions include operational direction of the entire global space surveillance network (SSN) for commander in chief, USSPACECOM (USCINCSPACE). The ASCC also detects, tracks, identifies, and catalogs all man-made objects in space and provides position information on these objects to about 1,000 customers. In addition, ASCC is charged with monitoring the space environment and informing owners and operators of U.S. and allied space systems of potential threats to their assets by continuous liaison with the systems' operations centers. The heartbeat of Naval Space Command revolves around providing space support to day-to-day operations of the Fleet and Fleet Marine Forces worldwide, whether for routine deployments, exercises, or actions in response to a crisis situation. This space support to terrestrial and naval forces can be categorized across a broad spectrum of activities that encompass communications, surveillance and indication, and warning, intelligence, navigation, and remote sensing. 42 Surveillance: A constant and vigilant surveillance of potentially hostile military threats is critical in preserving the operational effectiveness of our armed forces around the world. Naval Space Command manages two distinct surveillance efforts in support of Fleet and Fleet Marine Forces: tracking satellites in orbit and monitoring over-the-horizon threats from sea and air forces. First, Naval Space Command operates a surveillance network of nine field stations located across the southern U.S. Three transmitter sites in the network are located at Jordan Lake, Ala., Lake Kickapoo, Texas, and Gila River, Ariz. Six receiver sites are located at Tattnall, Ga., Hawkinsville, Ga., Silver Lake, Miss., Red River, Ark., Elephant Butte, N.M., and San Diego, Calif. These surveillance stations produce a “fence” of electromagnetic energy that can detect objects out to an effective range of 15,000 nautical miles. Over one million satellite detections, or observations, are collected by this surveillance network each month. Data gathered is transmitted to a computer center at Naval Space Command headquarters in Dahlgren, where it is used to constantly update a data base of spacecraft orbital elements. This information is reported to Fleet and Fleet Marine Forces to alert them when particular satellites of interest are overhead. The command also maintains a catalog of all earth-orbiting satellites and supports USSPACECOM as part of the nation's worldwide Space Surveillance Network… Intelligence: Naval Space Command provides space intelligence support to deployed naval forces through an initiative dubbed “Chambered Round.” The Chambered Round product is a message that provides deployed naval forces with tactical assessments of hostile space capabilities and specific reactions to their operations. This knowledge assists Fleet and Fleet Marine Force tactical units in reducing their vulnerability to space reconnaissance efforts… TRW - Direct Energy Weapon “Naval-Surface Warfare Center” - Virginia MARYLAND COMPUTERS 43 Maryland’s aerospace and defense industry includes 12 major military installations, 16 of America’s top 25 aerospace companies and 70 of the top 100 defense contractors. The state is a thriving location for space exploration, satellite technology and research, design and manufacturing of UAVs and robotics. The industry includes Department of Defense related activities such as biodefense, cyber security, avionics, informatics and ordnance and weapons testing. In 2009, Maryland’s 2,600 aerospace and defense businesses were awarded $3.5 billion in federal contracts and generated $21.2 billion in Gross Domestic Product. RESEARCH Maryland has more than 50 federal research agencies and ranks second nationally in research and development investments by the federal government, with $12.5 billion in annual funding. ADVANCING SPACE EXPLORATION Research and development in Maryland based organizations revolutionize aerospace and space exploration offering mankind an up-close look at mysteries of our planet with help from the Hubble Space Telescope, the MESSENGER satellite and the James Webb Space Telescope. • JHU Applied Physics Lab • U.S. Army Research Laboratory • Naval

Air Warfare Center Aircraft Division • Naval Air Systems Command • NASA Goddard Space Flight Center • Mid-Atlantic Regional Spaceport MARYLAND MILITARY INSTALLATIONS • Aberdeen Proving Ground • Adelphi Laboratory Center • Army Corps of Engineers, Baltimore District • Carderock Division, Naval Surface Warfare Center • Coast Guard Yard, Curtis Bay • Fort Detrick • Fort George G. Meade • Joint Base Andrews Naval Air Facility Washington • National Naval Medical Center at Bethesda • Naval Air Station Patuxent River • Naval Support Facility Indian Head • United States Naval Academy 44 TOP MARYLAND DEFENSE IT CONTRACTORS • Boeing • IBM • Booz Allen Hamilton • L-3 Communications • CACI International • Lockheed Martin • CSC • MITRE • General Dynamics • Northrop Grumman • Honeywell International • SAIC EDUCATION Maryland has world-renowned colleges and universities with outstanding computer science and engineering programs. Nationally ranked STEM and competitive research programs include the University System of Maryland, which attracts more than $1 billion annually in external research and development support and Johns Hopkins University, the nation’s leading University in volume of research. • University of Maryland College Park is ranked among the top ten universities in graduate and undergraduate aerospace engineering and produces the largest number of STEM graduates in the state. • University of Maryland Baltimore County has the second highest percentage of graduates in STEM fields of any university in the state and is home to the Center for Information Security and Assurance. • University of Maryland University College is one of the world’s largest public universities. Specialized training programs include Homeland Security and Information Assurance, Information Technology, Project Management and Software Engineering. • United States Naval Academy ranks second in the nation among top public liberal arts colleges, fifth in undergraduate engineering (among schools without PhD programs); its programs in aerospace and electronics/ communications engineering rank in top ten. • Anne Arundel Community College the first 2-year college to develop a cybersecurity curriculum, the Information Systems Security program offers an AA degree, certificate and courses to students for entry-level positions in cybersecurity.

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