

#### References:

1. University of Bolton [Электронный ресурс] - URL: [http://www.ami.ac.uk/courses/topics/0156\\_intm/](http://www.ami.ac.uk/courses/topics/0156_intm/) дата обращения (1.03.2015).
2. The National Academies Press [Электронный ресурс] - URL: [http://www.nap.edu/openbook.php?record\\_id=5701](http://www.nap.edu/openbook.php?record_id=5701) дата обращения (1.03.2015).
3. The Naked Scientists [Электронный ресурс] - URL: <http://thenakedscientists.com/HTML/articles/article/in-search-of-advanced-intermetallics/> дата обращения (1.03.2015).
4. Популярная механика [Электронный ресурс] - URL: <http://www.popmech.ru/science/55084-innovatsionnyu-splav-ne-ustupayushchiy-titanu-deshevle-ego-na-poryadok/> дата обращения (1.03.2015).

### **First Artificial Earth satellite**

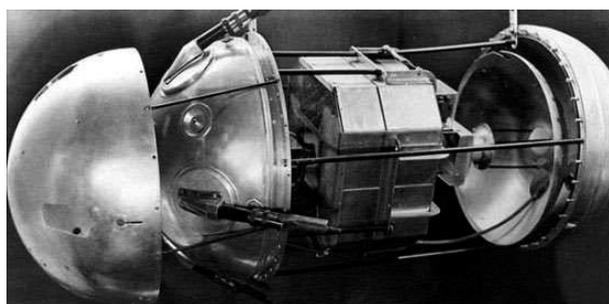
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History changed on October 4, 1957, when the Soviet Union successfully launched first artificial satellite, called 'Sputnik-1'. It was 58 cm diameter and 83 kg weight metal sphere that transmitted simple radio signal [1].

#### **Designing and construction of sputnik:**

Designing of SS-1 (simple satellite) was began in November, 1956 and in September, 1957 state testing was finished. Design was performed by NII-4 of State Defense Department. Sputnik was designed as very simple device with 2 transmitters for trajectory measurements. Range of transmitters was chosen such way that radio fans could receive its signal. Inside sphere were placed power supply, radio transmitter, thermal relay, sensors of temperature and pressure, onboard control system, cable network [2].

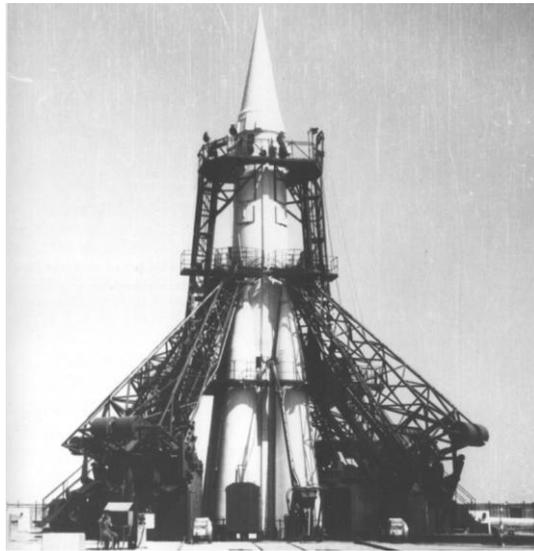


Picture 1 - Internal device of satellite

#### **Designing and construction of rocket**

The R-7 was 34 m long, 3.02 m in diameter and weighed 280 tons. It had two stages, powered by rocket engines using liquid oxygen (LOX) and kerosene and capable of delivering its payload up to 8,800 km with an accuracy (СЕР) of around 5 km. The initial launch was boosted by four liquid rocket boosters making up the first stage, with a central sustainer engine powering through both the first and the second stage. Design work began in 1953 at OKB-1 in Kaliningrad with the requirement for a two-stage missile of 170 tons with a range of 8,000 km carrying a 3,000 kg payload. Following first ground tests in late 1953 the initial design was heavily reworked and the final design was not approved until May 1954 when more than 100 design proposals were reviewed. In 1954 draft project was completed. First launch was May 14, 1957. Fire broke out right away

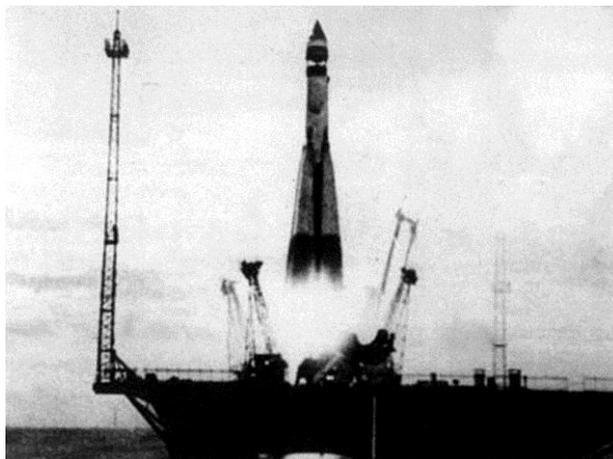
from takeoff in booster engine. After 98 seconds this unit broke away and command to switch engines was given. The next attempt has been occurred June 11, an electrical short caused the missile to start rolling uncontrollably and disintegrate 33 seconds after takeoff. The first successful long flight, of 6,000 km was made on 21 August 1957 [3].



Picture 2 - R-7 rocket on the downrange before launch. August 1957

#### **Launch and subsequent flight:**

October 4, 1957, at 22:28:34 (Moscow time) R-7 rocket with satellite was launched from cosmodrome Baikonur. After 295 seconds ПС-1 was delivered on elliptical orbit 947 km apogee altitude and 288 km perigee altitude. After 314 seconds satellite was separated from central unit and transmitted first signal. Sputnik was flying during 92 days and made 1440 turns around the Earth. Its transmitters worked 2 weeks after launch. Because of friction with upper atmosphere, sputnik slowed, entered Earth's atmosphere and burned down due to air friction [4].



Picture 3 - Launch of R-7 rocket with PS-1 satellite onboard

#### **Value of the flight**

During the flight following scientific observations were carried:

- checking calculations and basic technical solutions adopted to launch;
- ionosphere research passing radio waves emitted by transmitters of the satellite;

- Experimental determination of the density of the upper atmosphere by inhibition of the satellite;
- research of the conditions of work equipment.

Also sputnik had big political meaning. Its flight was vied by all the world. Transmitted signal could be received by every radio fan in any point of the Earth. "Radio" magazine has published detailed recommendations for reception of signals from space. Soviet Union demonstrated possession of advanced technologies and dealt a blow to the prestige of USA.

October 4, 1957 – the first Soviet artificial earth satellite (AES) opened the space age, and up to the present time many hundreds of artificial bodies have been orbited. Now days over 32,000 man-made objects have orbited Earth at some point or other.

Each flying laboratory has made its contribution to the study of the world surrounding us and has made it possible to learn something new about the Earth and the space surrounding it.

#### References:

1. Sputnik and The Dawn of the Space Age. Steve Garber [Электронный ресурс] – URL: <http://history.nasa.gov/sputnik/>
2. Memories of Boris Sokolov. Boris Sokolov. [Электронный ресурс] – URL: <http://gagarin.energia.ru/en/55th-anniversary-of-the-launch-of-the-first-artificial-earth-satellite-sputnik.html>.
3. R-7. Encyclopedia Astronautica. [Электронный ресурс] – URL: <http://www.astronautix.com/lvs/r7.htm>.
4. Sputnik 1. Dr. David R. Williams. [Электронный ресурс] – URL: <http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=1957-001B>.

### **Lyapunov and Structural Instability in Simulation Problems of Amorphous Metals**

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**Abstract.** Some results of computer simulation of atomic structure of amorphous metals (Al, Cu, Ni), received from melts by force of ultra-fast cooling are cited and analyzed from the position of dynamic systems theory. It is determined that the atomic structure of such amorphous metals is unpredictable and irreproducible. A homologous equation for a structural instability research is received. Found aluminum amorphous state with a low degree of short range order.

#### **1. Introduction**

It is known that the amorphous condition of a solid is genetically linked to the nanocrystals. The most common method of obtaining nanocrystalline structures is controlled by annealing the amorphous condition.

For this and other reasons, recently considerable attention has been paid to the amorphous metal and alloys [2, 3]. The article analyzes the atomic structure of nickel, copper and aluminum by molecular dynamics

It is determined that Lyapunov and structural instability significantly influence the formation of different atomic structure.

We deal with the modelling of the amorphous metals by means of superfast cooling of the liquid melt. We use method of molecular dynamics. The settlement block contains from 13500 to 108000 atoms.

The numerical calculations show the possibility of reception various nuclear structures, depending on the entry conditions and the speed of cooling.