Exo-Mars
Метео

Scientific objectives

- a study of the vertical structure of the atmosphere;
- the study of spatial and temporal (from daily to annual scale) of the characteristics and variations of the General circulation of the atmosphere;
- a study of climatological cycles of CO2, H2O and dust (local and global dust storms, the processes of outgassing and sublimation of CO2, H2O, the influence of aerosols on the heat balance);
- the study of interaction processes between surface and atmosphere (exchange of momentum and mass boundary layer, heat flux) from diurnal to annual scales;
- the study of the phenomenon of mesoscale or regional level and related processes (infrasound and gravity waves);

Scientific team

- **PI - Alexander Lipatov**
- Who PI each instrument???
- **Team:**

Russia	Finland	Espanish	Franch	Ather
Vjacheslav Linkin	Ari-Matti Harri	LuisVazquez	Jean-Pierre Pommereau	Francesca Ferri
Alexey Economov	Walter Schmidt	Ignacio Arruego Rodríguez		
Daniil Rodionov	Maria Genzer	Francisco Cortes Martinez		
Oleg Korablev	Harri Haukka	Juanjo Jimenez		
Andrey Ljash	……	Maite Alvarez		
Andrey Borisov		……		
Dobrolensky				
…..				

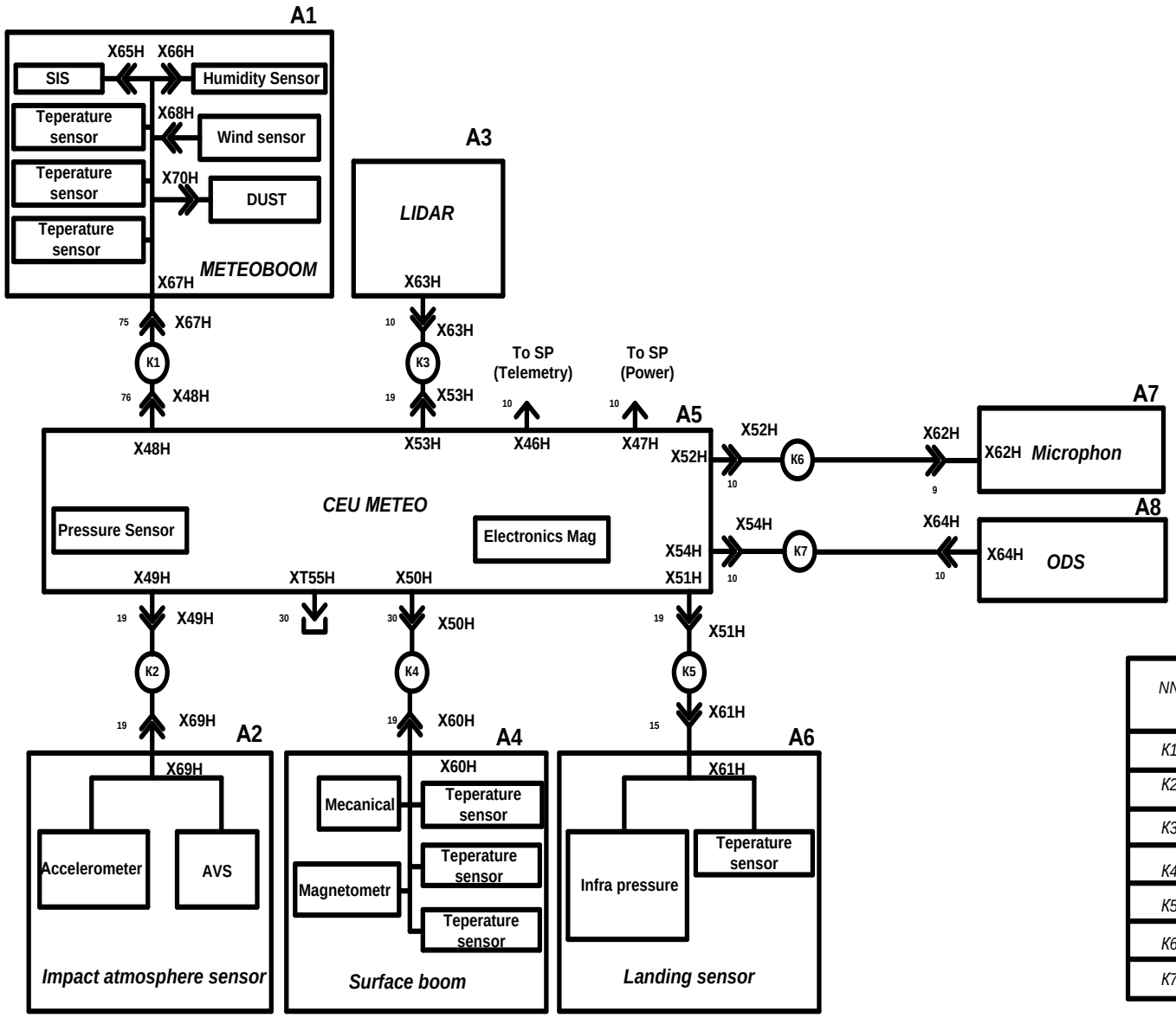
- **Cooperation:**
- IKI, OKB IKI, TSNIIMASH, NPO «Typhoon» и ect.
- FMI, INTA, UCM, CNRS и ect.

General specifications

Mass:	**3,4 kg**
***Power consumption*:**	
-average	**3 W**
-maximum	**20 W**
I*nformative:*	**150 - 500 kb\day**
Operating temperature range:	
-for sensors outside	**–125 to +60°C**
-for sensors under thermal insulation	**– 40 to +50°C**

The number of control commands is determined by each device

Structural scheme



NN	Name	Numbre	number of circuits
K1	Cable K1	1	MC16-13 0,12; 75 wires
K2	Cable K2	1	MC16-13 0,12; 19 wires
K3	Cable K3	1	MC16-13 0,12; 10 wires
K4	Cable K4	1	MC16-13 0,12; 30 wires
K5	Cable K5	1	MC16-13 0,12; 15 wires
K6	Cable K6	1	MC16-13 0,12; 9 wires
K7	Cable K7	1	MC16-13 0,12; 10 wires

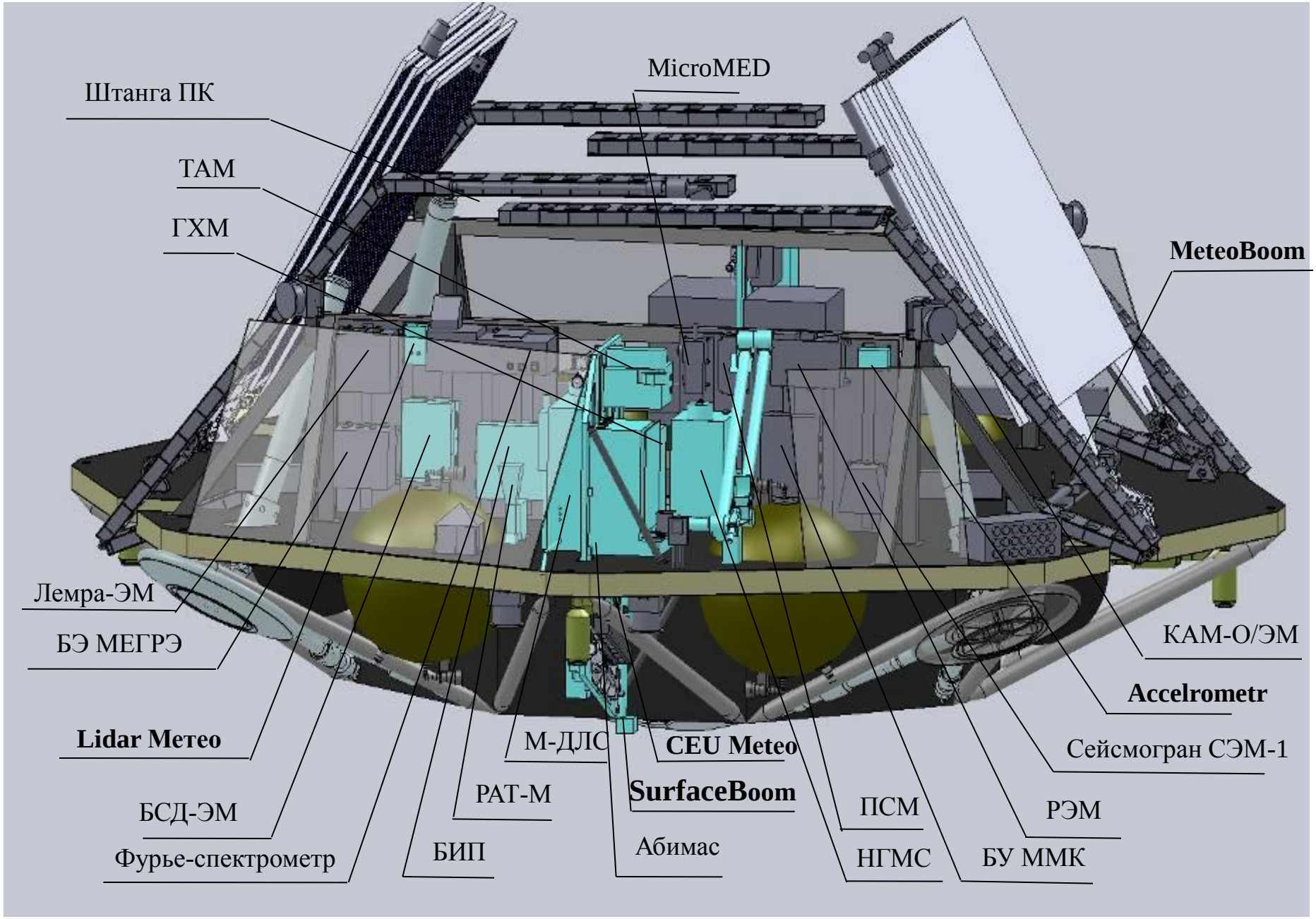
The composition of meteorological instruments

METEO	Mass (kg)	Dimensions (мм)	The installation location
Sensors are employed during the landing: Accelerometer and angular velocity sensor.	0,4	82×52×66	Under thermal insulation
Weather boom: temperature (3PCs.), humidity (1 PCs.), wind sensor, solar radiation, dust sensor.	1,3	1200×124×90	Outside
Boom of surface: temperature sensors (3 pieces), the magnetometer, deployment mechanism.	0,56	560×60x62	Outside
Sensor of lower atmosphere: the temperature sensor, pressure sensor	0.08	85x52x42	Under thermal insulation and outside
Lidar	0.4	105x80x50	Under thermal insulation
The control unit meteorological instruments	0,8	160×140×60	Under thermal insulation
Sensor of acoustic waves	0,06	50x50x39	Under thermal insulation
Optical depth sensor	0,12	43x28x30	Under thermal insulation
Total	3,72		

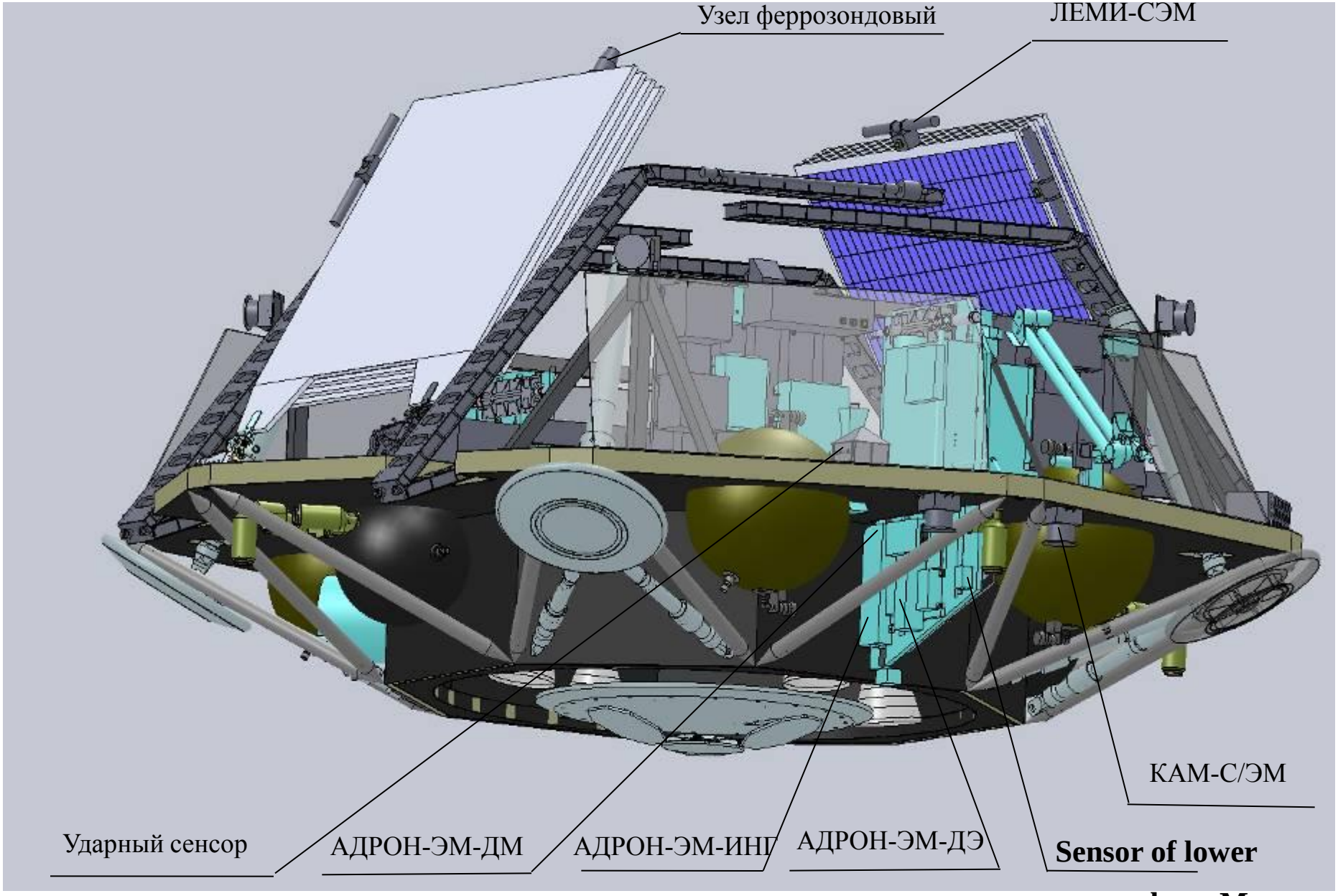
Comparative analysis of the developed sensors

Mission	Sensor	Power W	Mass kg	Accuracy	Sensitivity
Viking	Temperature Pressure The wind speed Acceleration	4	2,5	±1,5 ºK 0,1mbar ±15% -	0,1 ºK 0,07mbar 0,3 m\s -
Pathfinder	Temperature Pressure The wind speed Acceleration	6	3,5	±1,0 ºK 1,0 mbar ±10% -	0,01 ºK 0,25 mbar 0,1 m\s 20 μm/s^2
Mars-96	Temperature Pressure The wind speed Acceleration Humidity	1,3	0,9	±0,5 ºK 0,1 mbar ±10% - 5%	0,01 ºK 0,02 mbar 0,3 m\s 20 μm/s^2
Mars-Polar-98	Давление	4	1,0	0,1 mbar	0,05mbar
Exo-Mars	Temperature Pressure The wind speed Acceleration Humidity	3	0,7	0,2 ºK 0,1 mbar ±5% - 5%	0,003 ºK 0,05 mbar 0,1 m\s 5·10^{-6} m/s^2

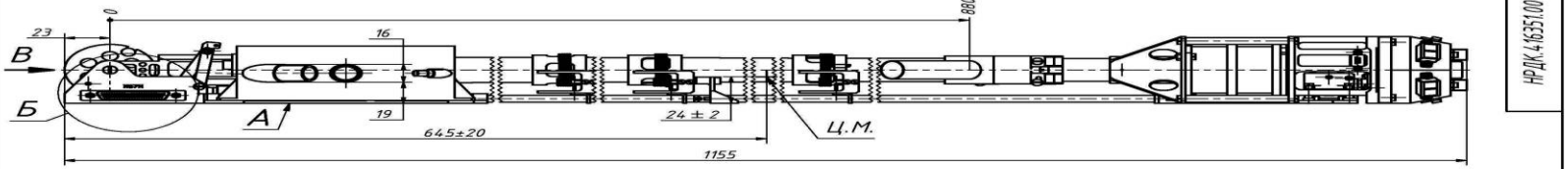
The location of the devices

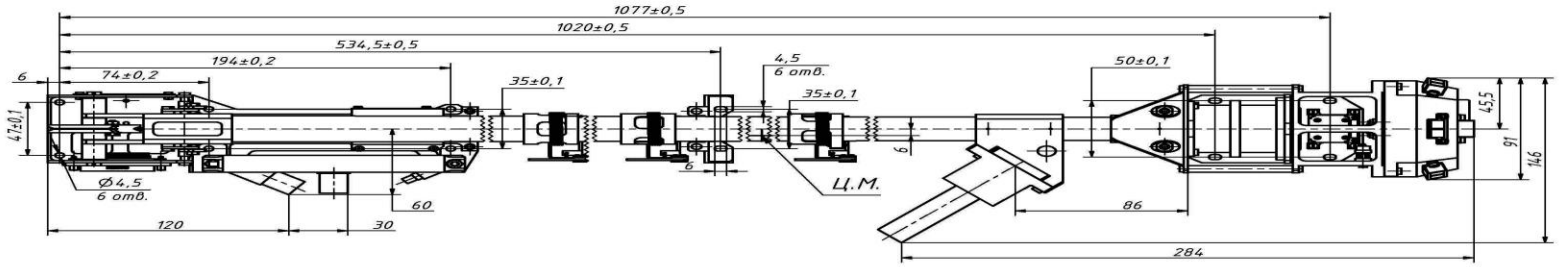


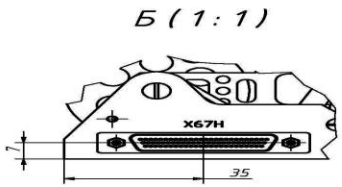
The location of the devices

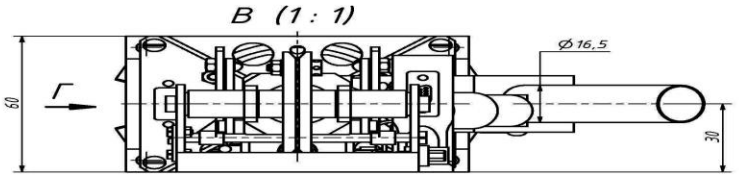


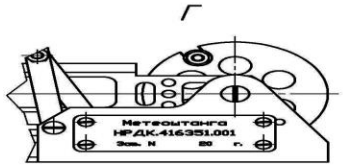
Meteoboom



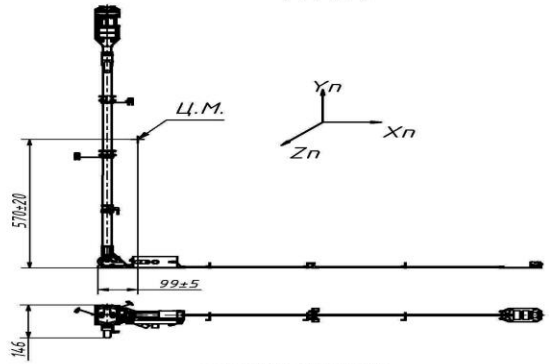








Метеоштанга в раскрытом положении
(1 : 10)



1 Прибор устанавливается на верхней части конструкции ПсМ КА без теплоизоляции через теплопроводящую прокладку.
2 При работе с прибором должны выполняться требования ОСТ 92-1615-2013.
3 Направление перегрузок – произвольное.
4 А – посадочная поверхность прибора. Материал посадочных поверхностей – сплав АМг6, покрытие Хим. Окс. э. ГОСТ 9.306-85.
5 Металлизация корпуса прибора с объектом осуществляется по ГОСТ 19005-81, через винт крепления.
6 Моменты инерции прибора относительно центра масс, кг·м ²: Jxo=0,021; Jyo=0,012; Jzo=0,023.
7 Допустимый диапазон температуры конструкции ПсМ КА в зоне посадочных мест прибора на этапе перелета от минус 90 до плюс 50 °С.
8 После посадки на поверхность Марса тепловой режим прибора обеспечивает его разработчик.
9 Соединитель X67H – вилка MWDM 2L-7SS-6K7-18B.
10 Соединитель в состоянии поставки закрыт заглушкой красного цвета.
11 Корпуса соединителей металлизированы с корпусом прибора по ГОСТ 19005-81.
12 Потребление прибора P раб.max = 5 Вт.
13 Материал внешней поверхности кабелей плетенка ПОМС-М ТУ 4833-001-97263433-2008.
14 Площадь основания прибора 11000 мм ².
15 Масса прибора указана с точностью ±0,017 кг.
16 Положение Ц.М., масса прибора уточняются после изготовления технологического образца.
17 Режим работы – мониторинг.
18 Материал корпуса штанги – стеклопластик, покрытие – эмаль ЭКОМ-1 (ТУ 2313-397-56897835-2006).

СОГЛАСОВАНО:

От ИКИ РАН _____ Б.С.Новиков

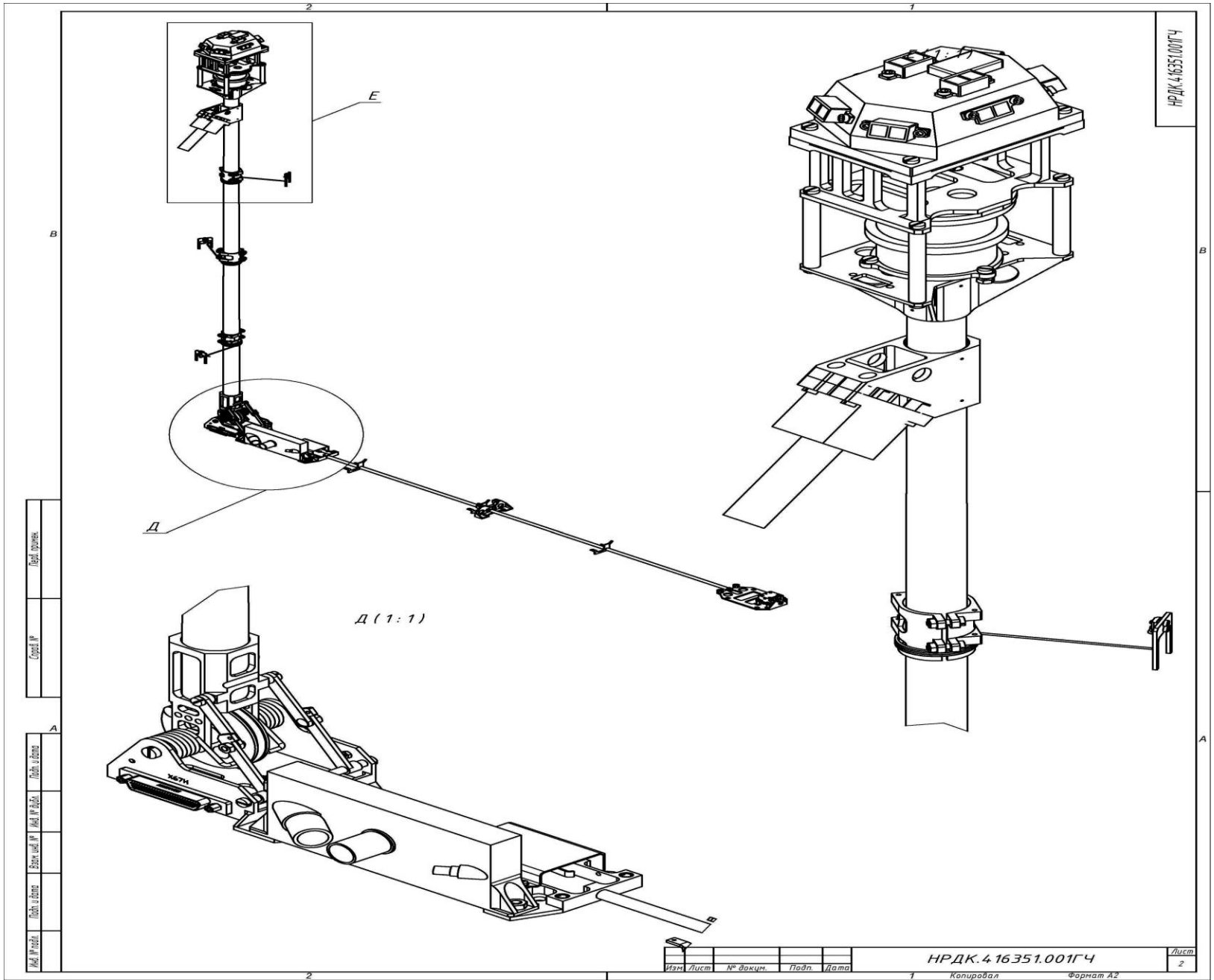
От НПОЛ _____ С.Н.Алексашкин

Изм.	Лист	№ докум.	Подп.	Дата	НРДК.416351.001ГЧ			
Разраб.		Хлюстова			Метеоштанга	Лит.	Масса	Масштаб
Пров.		Макаров					1,2	1:2
Т. контр.					Габаритный чертеж	Лист 1	Листов 2	
Нач.отд.						ИКИ РАН		
Н. контр.		Аверьянова						
Утв.		Липатов						

Копировал Формат А2

Перв. примен. НРДК.416351.001 | Справ. № | Подп. и дата | Инв. № подл. | Взам. инв. № | Инв. № дубл. | Подп. и дата

Meteoboom


НРДК.416351.001ГЧ
Е
Д
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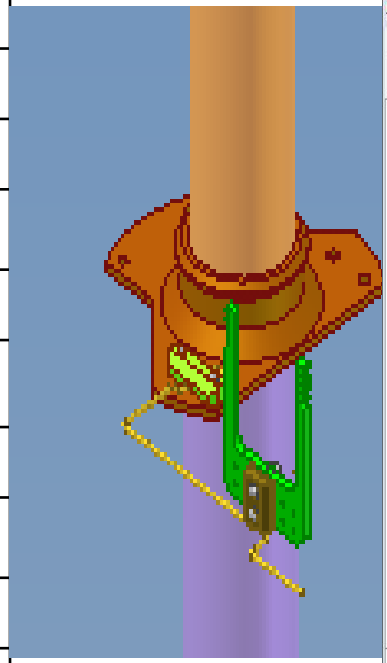
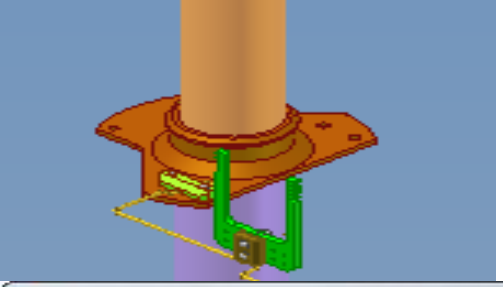
Изм. Лист № докум. Подп. Дата
НРДК.416351.001ГЧ
Лист 2
Копировал
Формат А2

Temperature sensors

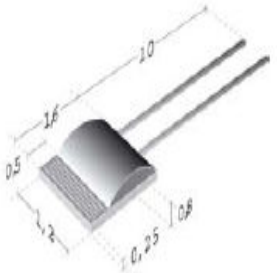
Location	Number	Mass g	Dimensions mm
The sensor Assembly boom	3	5	100x30x5
The sensor Assembly of soil	3	5	100x2x2
The sensor Assembly on the descent	2	5	50x2x2

The parameter	Value
Measurement range, °C	-196...600
Sensitivity, °C	$3 \cdot 10^{-3}$
Operating frequency, Hz	0– 10
Nonlinearity, %	не хуже 10^{-2}
The number of sensors	8
Update frequency information Hz	10
Power Consumption, W	0,05
Temperature range °C	-190 до +70
Weight, g	5,0





Temperature sensors



TS-2012 Module v1.0

File Tools Help

Waveform

51.12
51.115
51.11
51.105
51.1
51.095
51.09
51.085
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Meter

System time	401.649
Temperature ADC	+28.08956
Platinum TS1	-0.18675
Thermocouple E1	-0.09072
Platinum TS2	+51.10455
Thermocouple E2	+51.10163
Mean	+51.1047931
RMS Noise	0.0029977

Temp / Volts

Mode

Channel: TS2 & TC2

Num Samples: 100

Average: 2

Auto Scale

Auto Offset

Range: 0.01

Move

Control / Status

TE Power On

TS Power On

Busy

Power TE

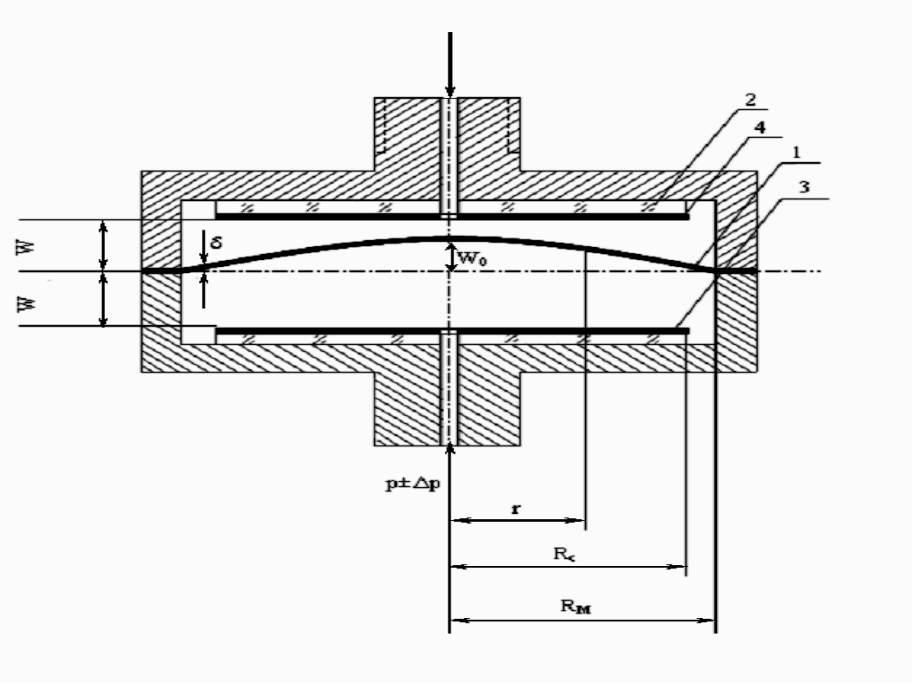
Power TS

Stop

Probe | Config | Test

Pressure sensors

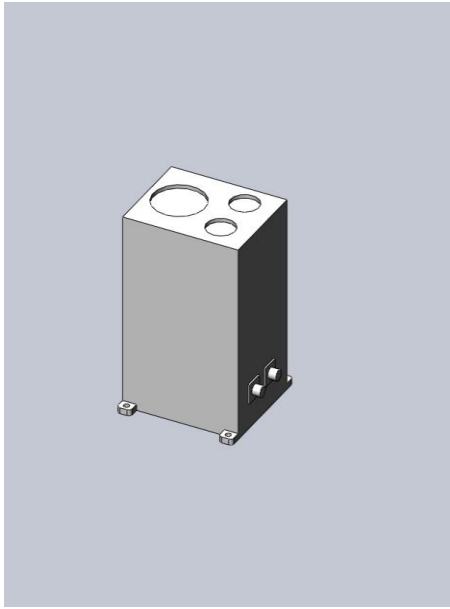
The name of the parameter	Значение
Measuring range, mbar	0-10
Sensitivity, mbar	10^{-4}
Operating frequency, Hz	5
Nonlinearity, %	не хуже 0,1
The update rate, Hz	2
Communication interface	RS422
Dimensions, mm	Ø60x35
Power Consumption, W	0,2
Temperature range,°C	-55 до +50
Weight, g	165

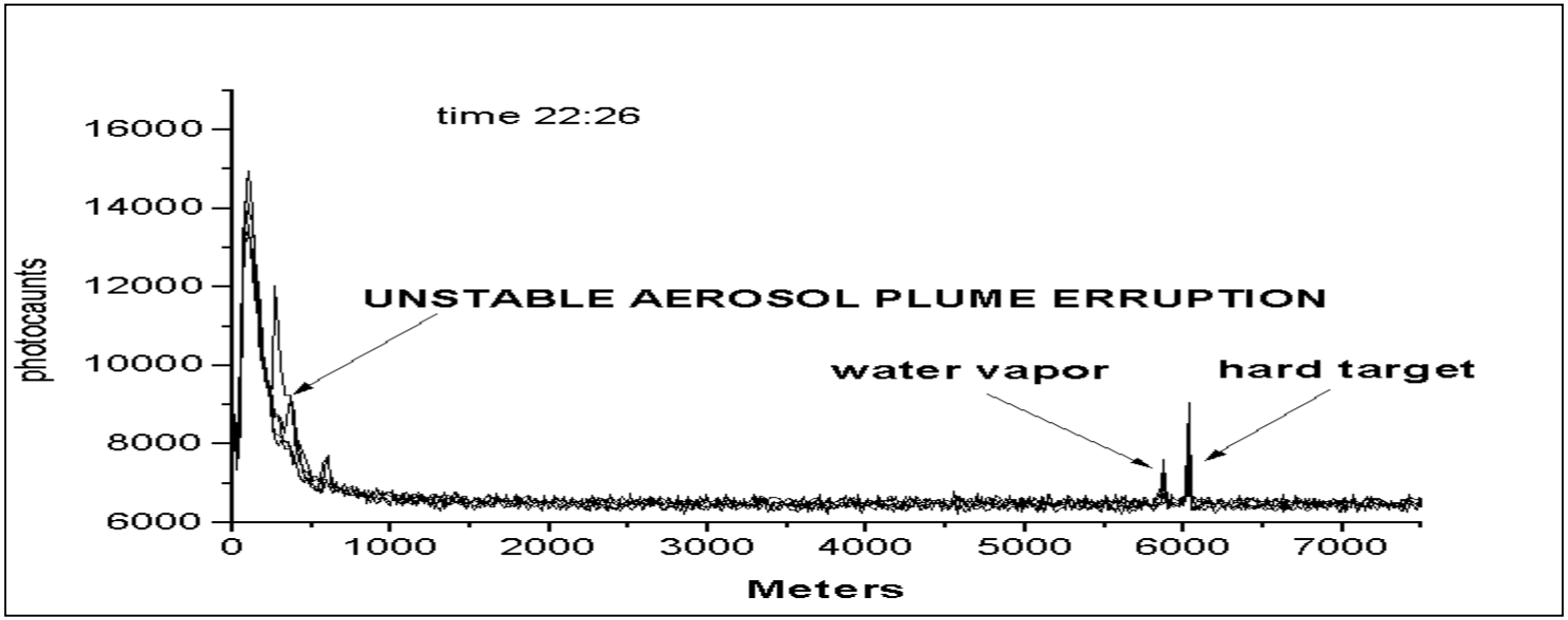


The sensing element of the pressure sensor: 1 – membrane; 2 – insulator; a 3.4 – electrodes; RM is the radius of the periphery of the membrane; Rc is the radius of the electrode; r– radius of the membrane; ∆ p– pressure difference acting on the membrane; W, the initial over-Zor between the electrode and the membrane; W0 is the deflection at the center of the membrane.

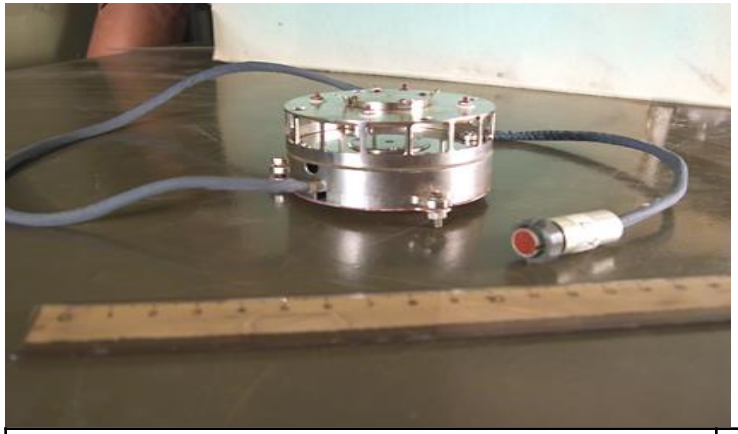
Lidar

	The maximum range of registration (m) in terms of the atmospheric dust concentration (transparency)		
Sun zenith angle	**Minimum**	**Average**	**Maximum**
Night<90 degree	**6600**	**11500**	**14000**
80 degree	**898**	**1260**	**1560**
65 degree	**840**	**1090**	**1260**
50 degree	**810**	**1010**	**1160**
20 degree		**740**	

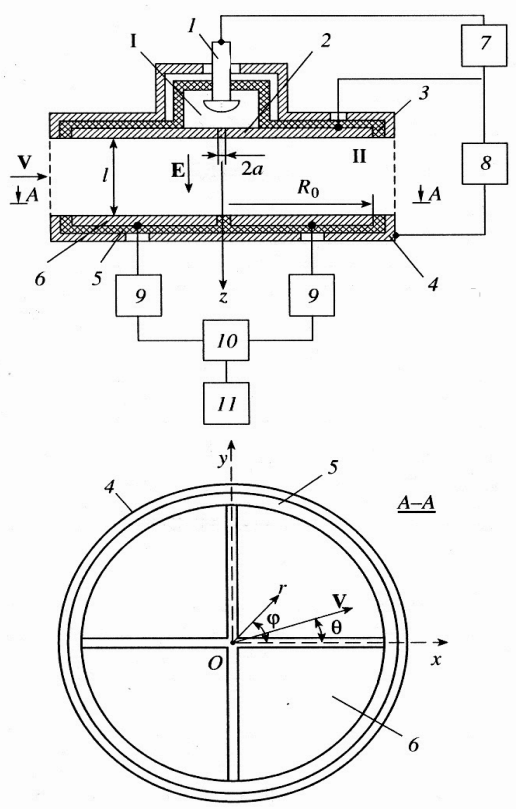




The wind speed sensor



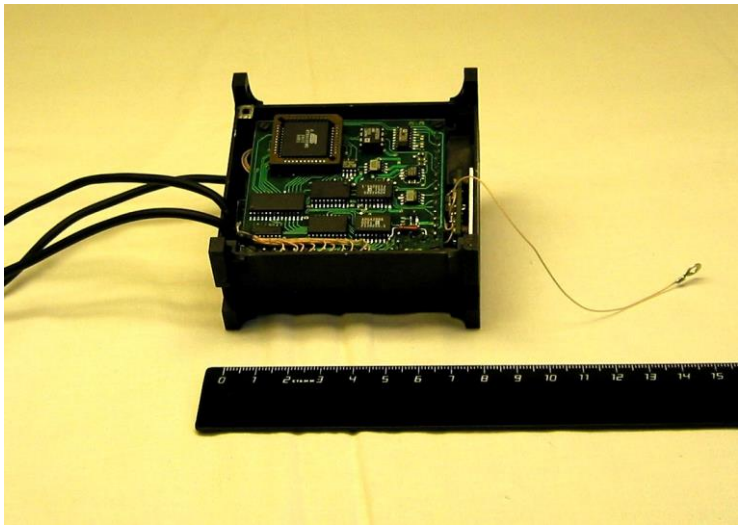
The name of the parameter	The value
Measurement range, m/s	±50
Sensitivity, m/s	0,1
Operating frequency, Hz	20
Nonlinearity, %	<= 5
Number of axes	2
The update rate, Hz	10
Communication interface	RS422
Dimensions, mm	Ø55x50
Power Consumption, W	0,1
Temperature range,°C	-95 to +50
Weight, g	85



Gas discharge anemometer.

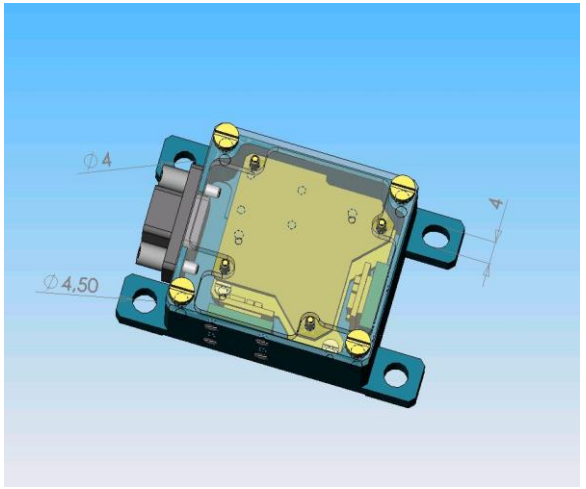
Accelerometer

The name of the parameter	The value
The range of measurements, m/S2	190 dB $5 \cdot 10^{-6}$– 200 (190 dB)
Sensitivity m/S2	$5 \cdot 10^{-6}$
Operating frequency, Hz	0,1– 10
Nonlinearity, %	<= 3
Number of axes	3
The update rate, Hz	10
Communication interface	RS422
Dimensions, mm	70x40x40
Power Consumption, W	1,0
Temperature range,°C	-55 to +70
Weight, g	200



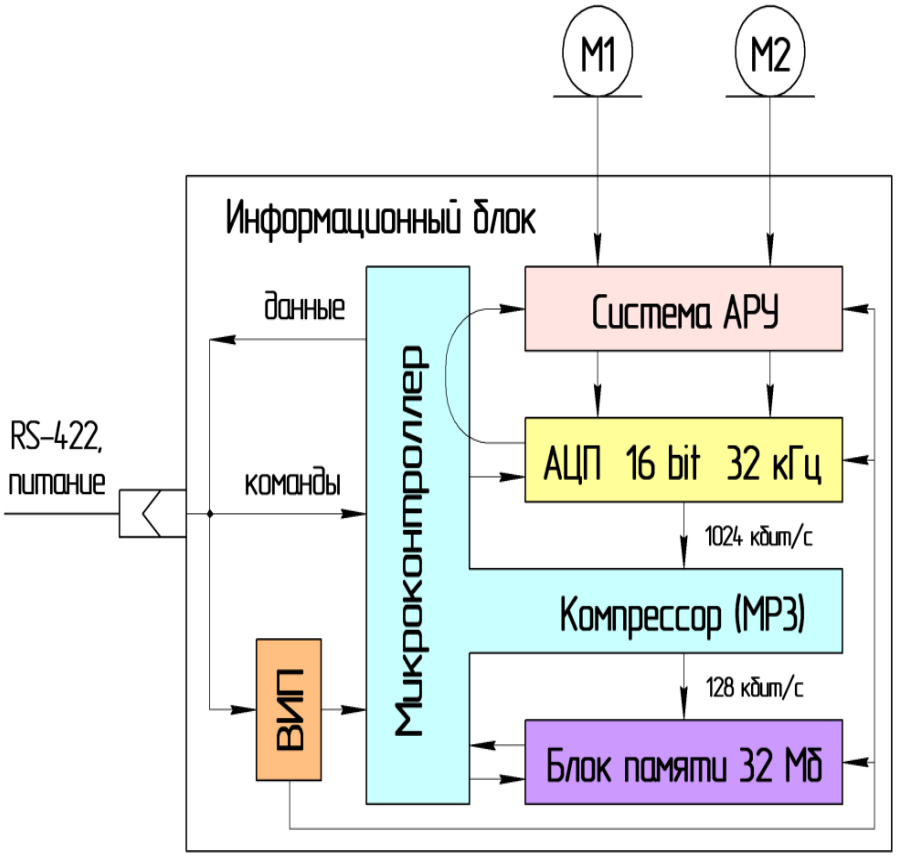
The angular velocity sensor

The name of the parameter	The value
Range, deg / sec	±60
Sensitivity, deg / sec	0,01
Number of axes	3
The update rate, Hz	> 10
Dimensions, mm	55*35*20
Voltage	5-14 В
Communication interface	RS422, 485
The transmission speed, kbit	128
Power Consumption, W	0,5
Temperature range ,°C	-55 to +50
Weight, g	20

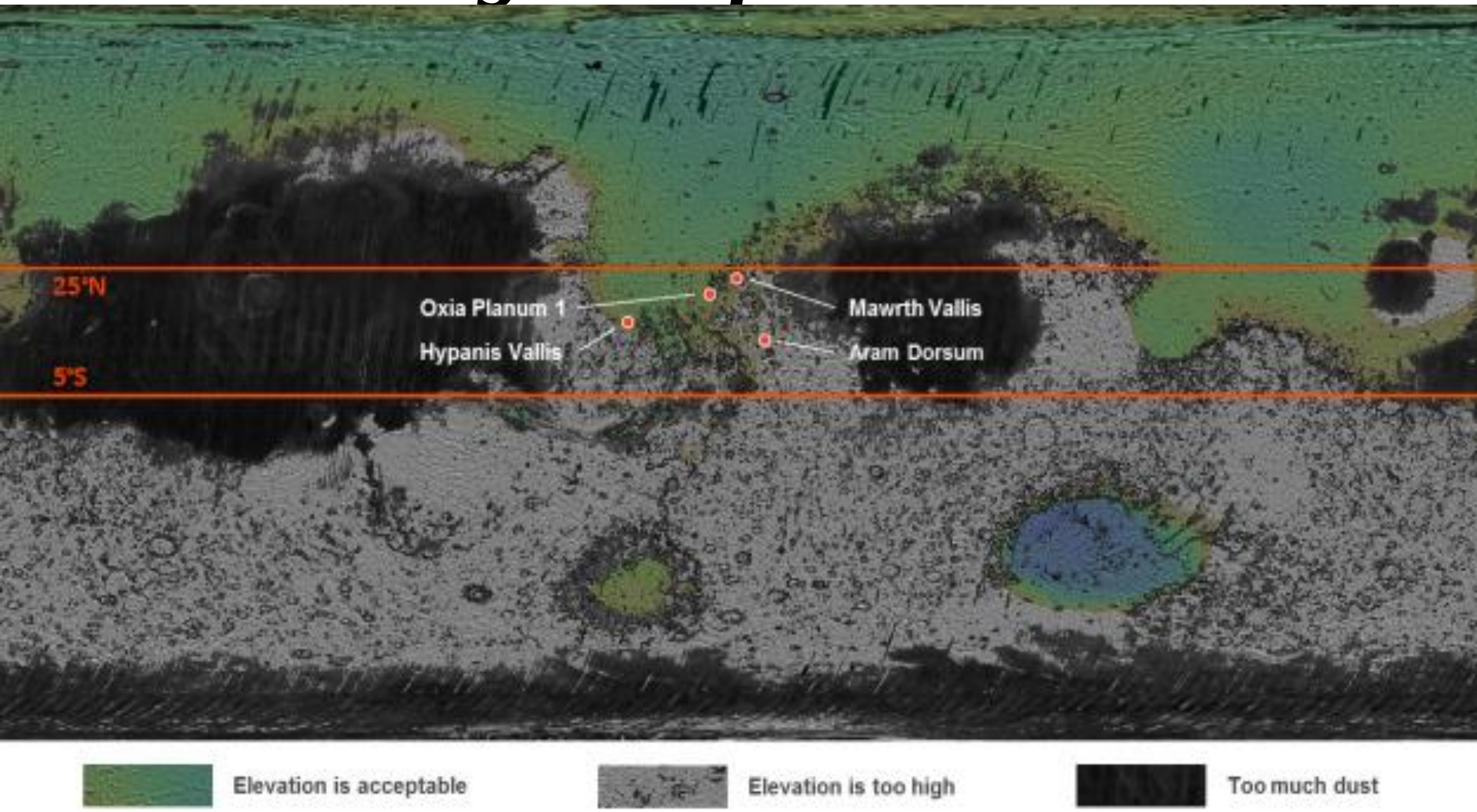


Sensor of acoustic waves

The name of the parameter	The value
Frequency range, Hz	20 – 15000
The number	2
Dimensions, mm	50 x 50 x 15
Temperature range, °C	-50 to +50
Consumption, W (when recording) (sleep mode)	<= 0,2 <= 0,02
Weight, g	60



landing sites for Exo-Mars



The Oxia Planum site (18.20°N, 335.45°E)
The candidate landing site at Mawrth Vallis region (approximately 22°N, 342°E)
The candidate landing site at Aram Dorsum (7.9°N, 348.8°E)

Landing sites of all the Lendery

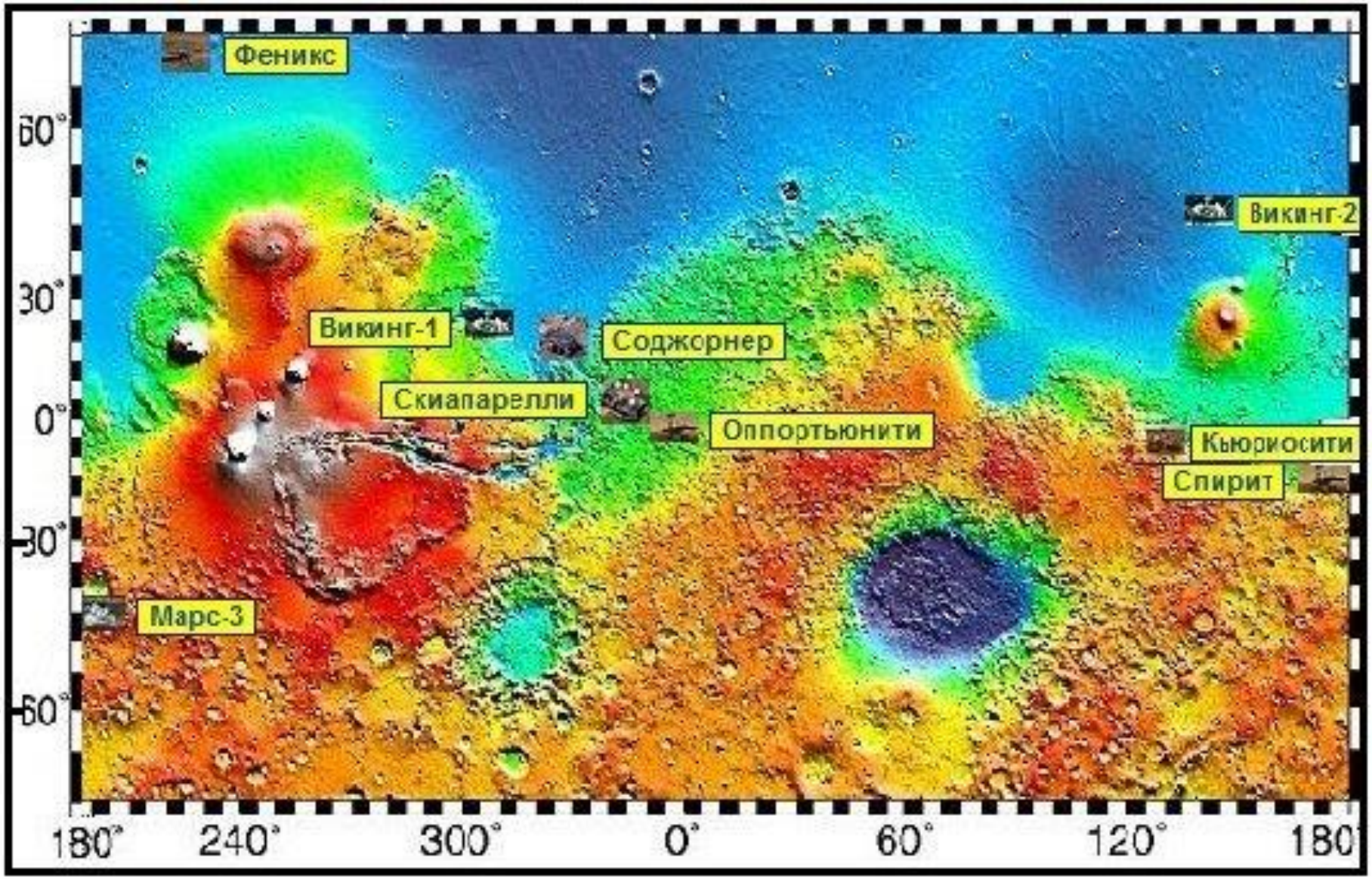
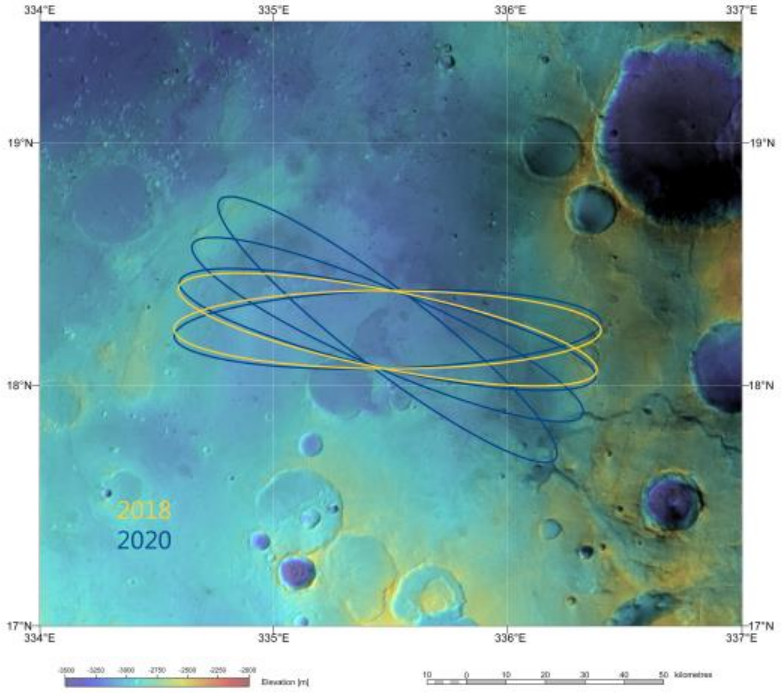
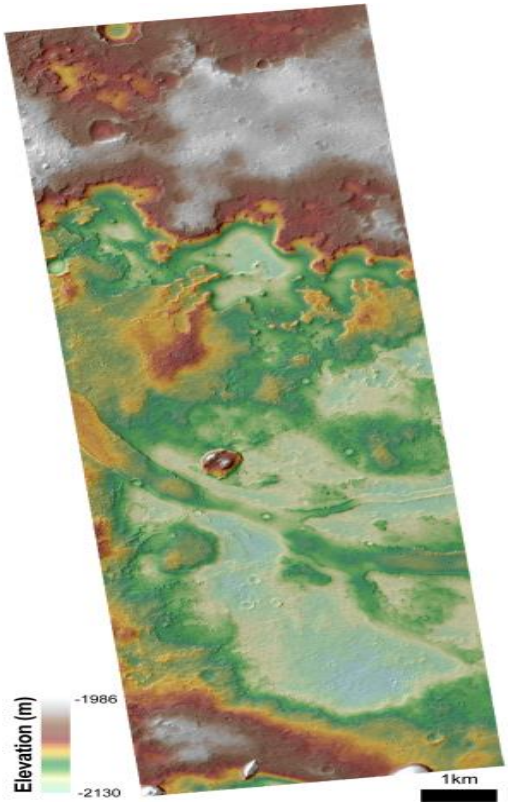


Рис. 5

Landing sites





Oxia Planum

(Oxia Planum is one of four candidate landing sites being studied for the ExoMars 2018 mission. The other sites are Aram Dorsum and Mawrth Vallis.)

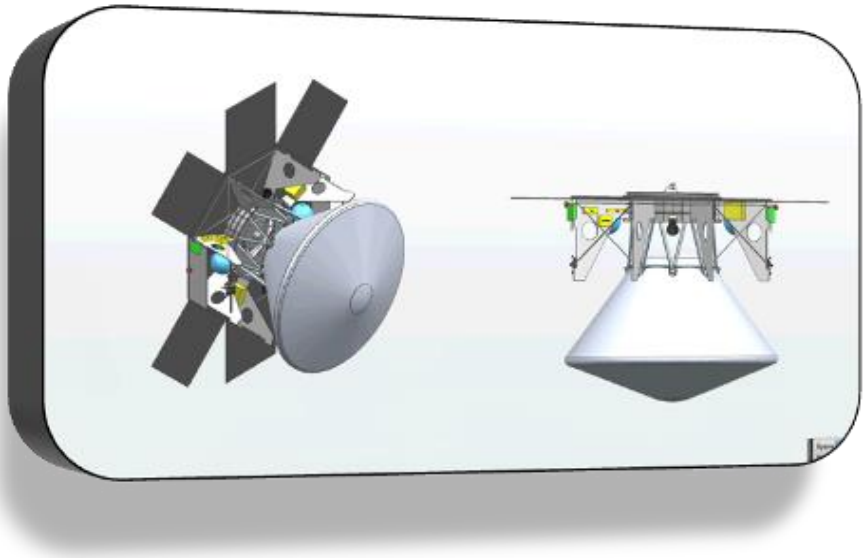
The Oxia Planum site (18.20°N, 335.45°E) lies a few hundred kilometres to the south west of Mawrth Vallis, to the east of the Chryse Planitia lowlands. The region is characterised by ancient highland cratered terrains that become increasingly eroded towards the highland-lowland boundary

Requirements to the sequence diagram

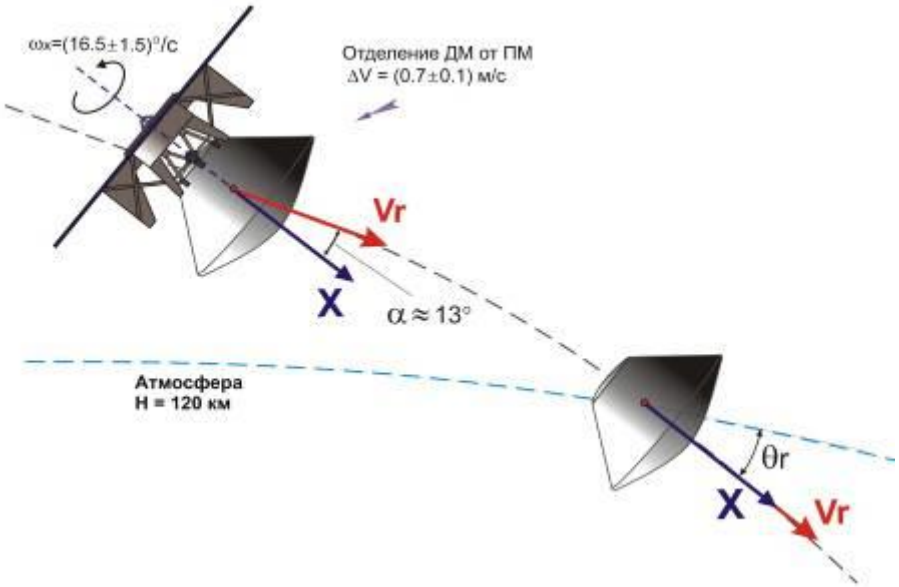
- The Meteorological work is carried out in automatic mode after power-on.
- The beginning of work going on for 20,000 km before flying to Mars, during descent and after landing to end the mission.
- The operation of devices in meteo is produced by internal sequence diagram of the clock and continuously.
- The Meteorological work is carried out cyclically with a duty cycle and duration in accordance with the limit restrictions on the consumption and information.
- Time on and off each instrument meteorological is determined in the same inner sequence diagram depending on the time of day.
- Information is stored in the processing unit and control and is Packed into data packets.
- The reset information is available on request from the system.
- Allowed off met with a message about the shutdown or no , but with the confirmation of shutdown.

RUSSIAN-EUROPEAN PROJECT “EXOMARS"

Separation of DM from CM



- Time of separation - ~30 min before the entry into the Mars atmosphere
- H_{entry} = 120 km above the areoid surface
- DM stabilization – by spinning-up
- $\Delta V_{sep.}$ = 0.6 m/s ÷ 0,8 m/s

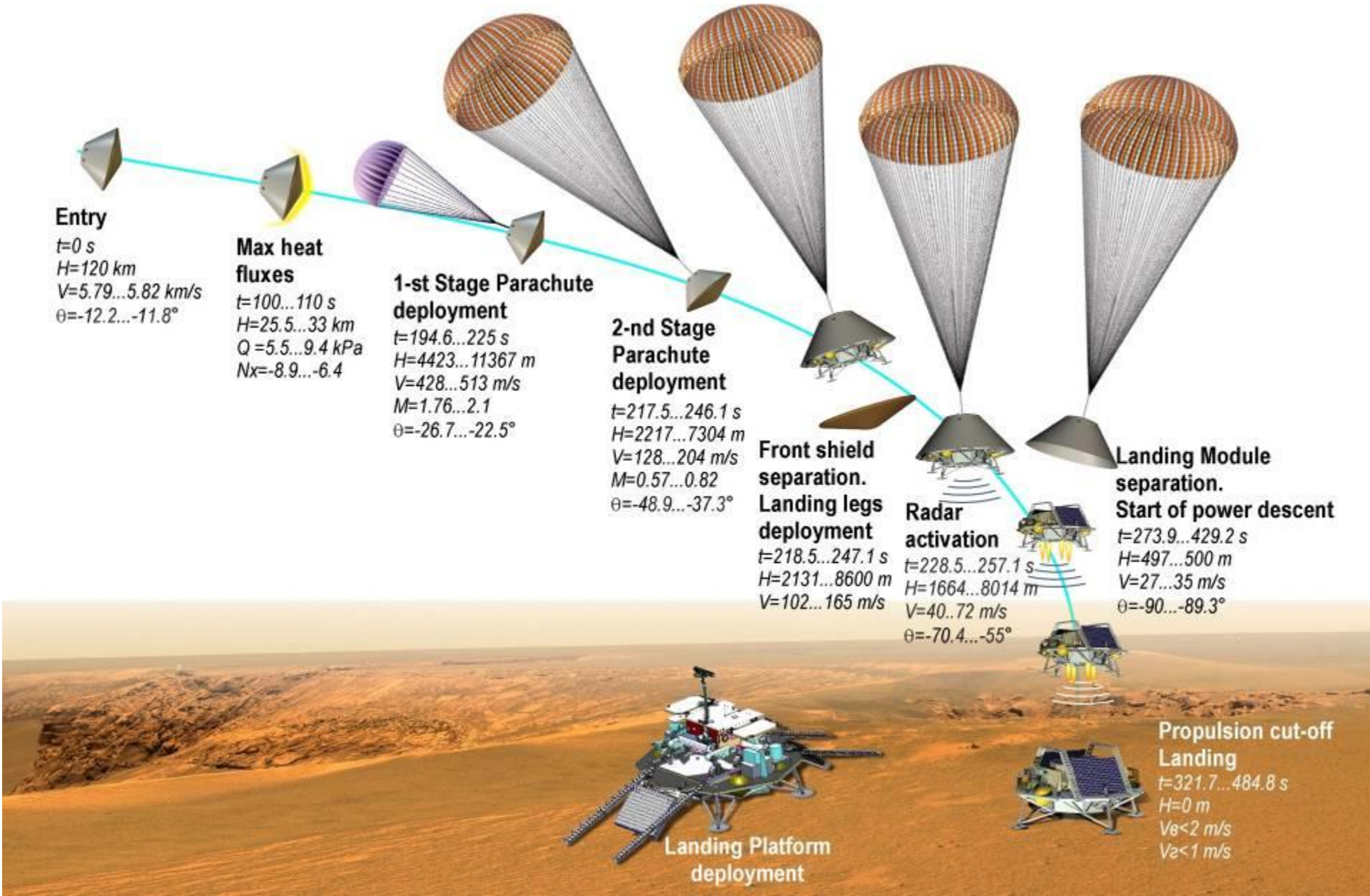


Parameters of Entry into the Atmosphere

Landing Site	Altitude above MOLA Level, km	Entry Velocity (m/s)	MIN Trajectory Angle, deg	MAX Trajectory Angle, deg
Beagle-2	-3.75	5791.935	-13.5591	-11.3933
Elysium Planitia	-2.66	5786.307	-13.0812	-10.8930
Mawrth Vallis	-2.90	5816.888	-13.8541	-11.7675

RUSSIAN-EUROPEAN PROJECT “EXOMARS"

Profile of Descent in the Mars Atmosphere



Sequence diagram of the descent

Nam	min	max	Operation
	Tseparate		Separation of SM and DM, undermining EJP1x4
	Tseparate + 1min		The inclusion of the radar in mode of warming up
	Tseparate + 3 min		The inclusion of metalocomplex
Tatm	Tseparate +30 min		Entry into the atmosphere of Mars
T_1	Tatm+183 s	Tatm+208 s	Input 1st cascade parachute system, table 2
T_1 + 2 s	Tatm+185 s	Tatm+210 s	Ejection of the container lids PS
T_1 + 17 s	Tatm+200 s	Tatm+217 s	Input 2nd cascade parachute system
T_2	Tatm+210 s	Tatm+227 s	Shooting aerodynamic screen
T_2 + 3 s	Tatm+213 s	Tatm+230 s	Disclosure of the supports, the opening of the valve APK (evacuation etc)
T_2 + 5 s	Tatm+215 s	Tatm+232 s	The work of DMT (damping of angular velocity); the closure of the valve APK, open valves EK2, and the valve unit EBL (filling thoroughfares TD fuel)
T_2 + 10 s	Tatm+220 s	Tatm+237 s	The inclusion of radar in the measurement mode
T_3	Tatm+224 s	Tatm+241 s	The opening of the valve APK – start and warm TD, closing EK2
T_3 + 3 s (Tseparate)	Tatm+227 s	Tatm+244 s	The office of PS and the rear cover, cutting of the RF cable MNA rear cover, pause in the management of DMT
	Tseparate+ 1 s		Management of DMT, PRT BU, TDU
h=~250м	–20 s	–9 s	Intensive braking
	–8 s	–2,5 s	Descent with a constant vertical speed
Ttouch	0		Touch the surface of Mars, dt deactivation (closing of the valve unit EBL and APK), disabling BU PRT; opening ЭК1, EK2, Epkr (beginning purge)
T_0 + 5 s	+5 s		Closing IPCPR, ЭК1, EK2 (end of venting)

Vertical structure of atmosphere

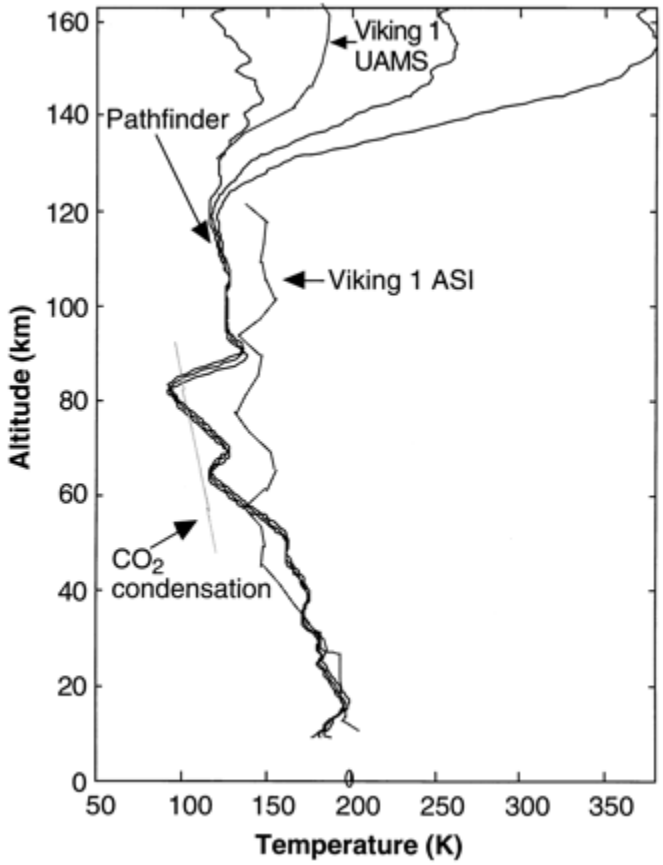


Fig.1. The density profile of the atmosphere according to the ASI/MET. The solid line is obtained by measuring the acceleration of the capsule, the measurement uncertainty within ±2s. The error in the aerodynamic coefficients is not considered because it is not expected that she will be able to significantly change the range of errors. Further work with the data of the accelerometer and the barometer has allowed us to extend the profile to the surface, where the calculated density of 1.76 × 10-2 kg/m3 (the ellipse on the X-axis). For comparison, the results of a similar experiment (ASI) and the data of the mass spectrometer upper atmosphere (UAMS) at the Viking 1 [2,3].

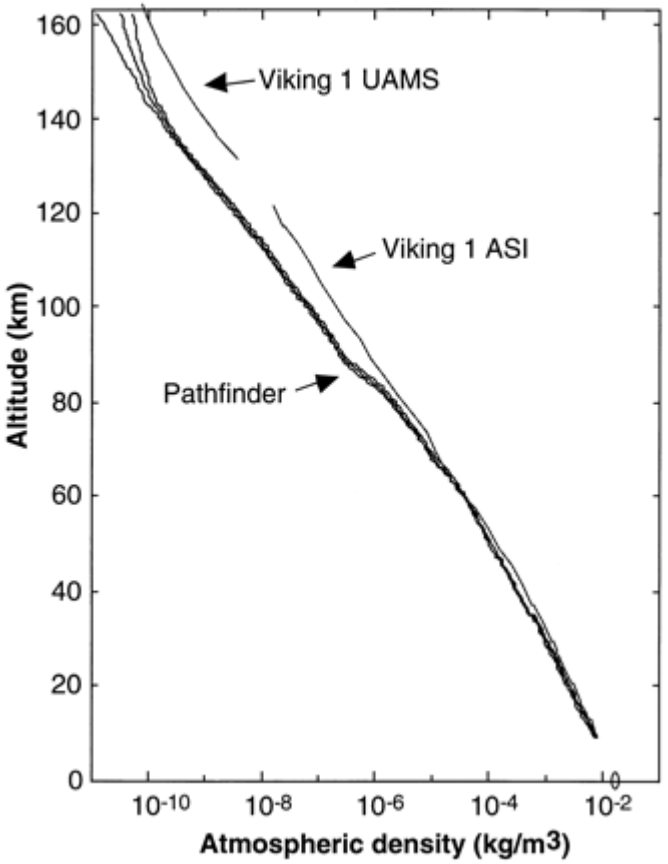


Fig.2. The temperature profile of the atmosphere obtained from the density profile (solid lines). To obtain the pressure was integrated with respect to the equation of hydrostatics, and the temperature was calculated from the pressure and density in the approximation of an ideal gas. The uncertainty in the values of the parameters of the upper atmosphere (density, molecular weight) leads to a substantial discrepancy between possible profiles at the heights of large 120-125 km the atmosphere is well mixed and has an average molecular weight of 43.49. For comparison, temperature profiles from Viking 1 (ASI+UAMS) and the condensation temperature of CO2 .

The temporal pressure profile

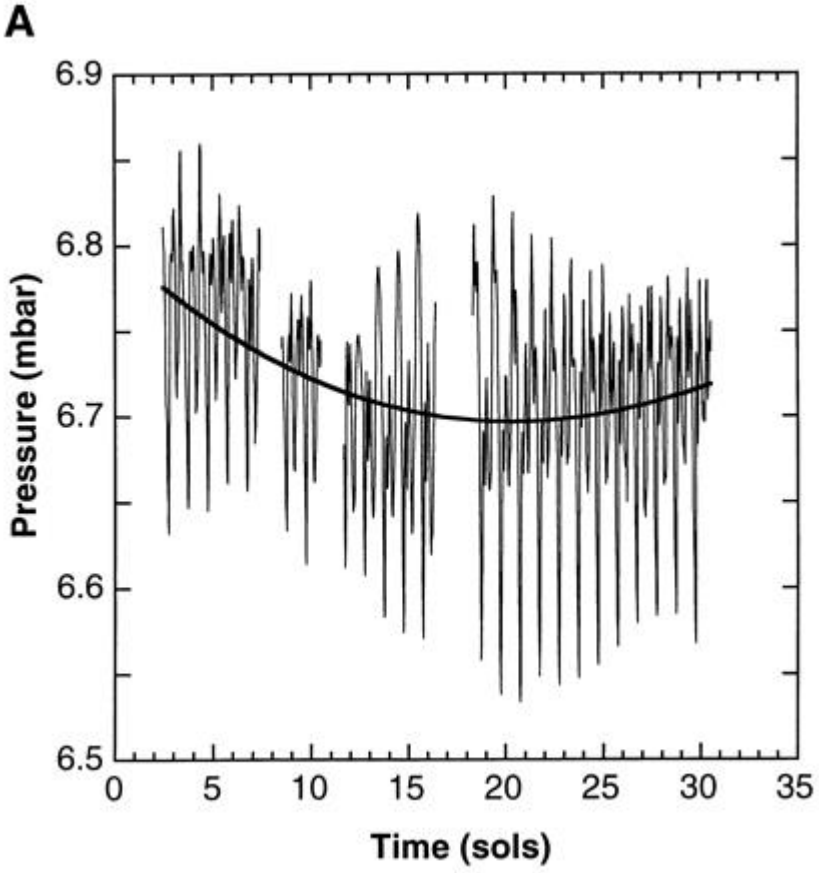


Fig.3A. Time-averaged pressure for the first 30 sols. Averaging basically 3-minute sessions 51 sessions per day. The resulting points were connected by straight lines, except for from 12 to 15 Sol, where the lack of data for 8 hours enterprisesales splines.Large gaps in 1,8,11, and 17 Saul caused reboots and connection issues. The long-term trend (solid curve) is represented by fitting a polynomial of 3rd order.

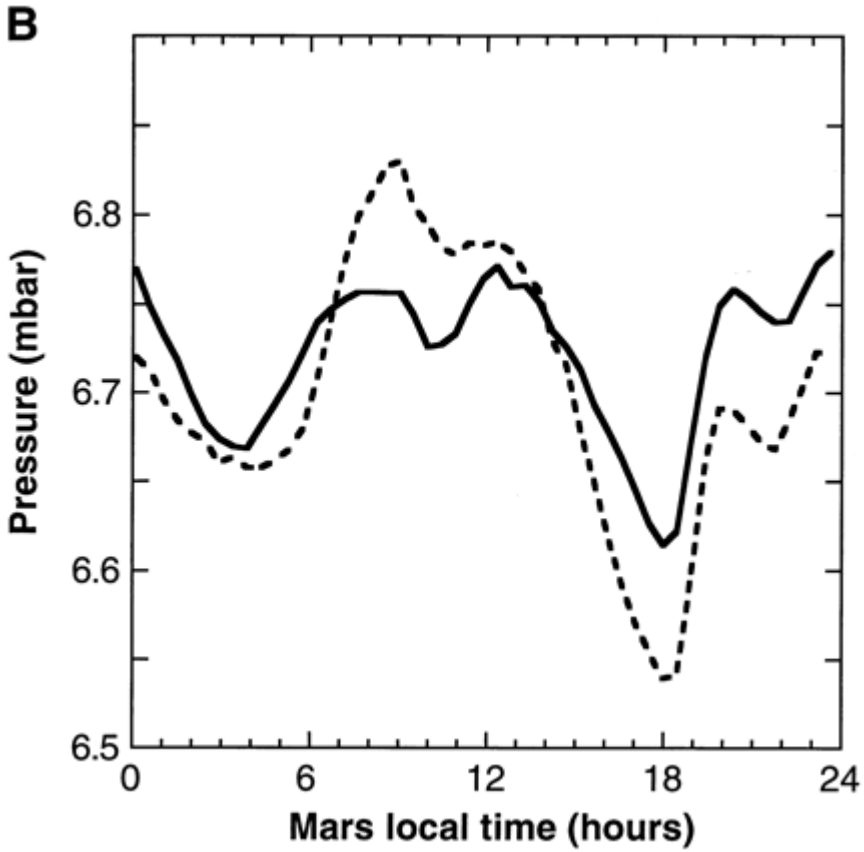


Fig.3B. Diurnal pressure cycles for the Sola 9 (solid line) and 19 (dashed) show the SYNOPTIC changes and you to more clearly see features of the pressure variations.

The temporal temperature profile

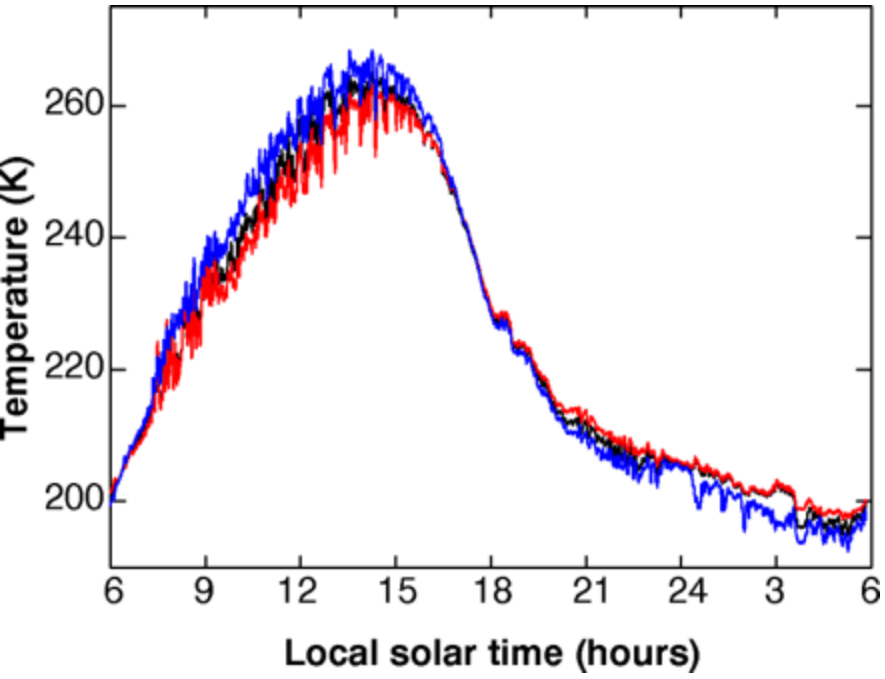


Fig.4. Daily variations of atmospheric temperature, measured by thermocouples at the top (red), middle (black) and bottom (blue) mast 06.00 LST of the 25th Sola 0600 LST 26th Sola.Thermocouples located at 100, 50 and 25 cm above the plane of the solar panels. The measurements were performed every 4 s, but the chart data is averaged over the interval of 2 minutes to reduce fluctuations.

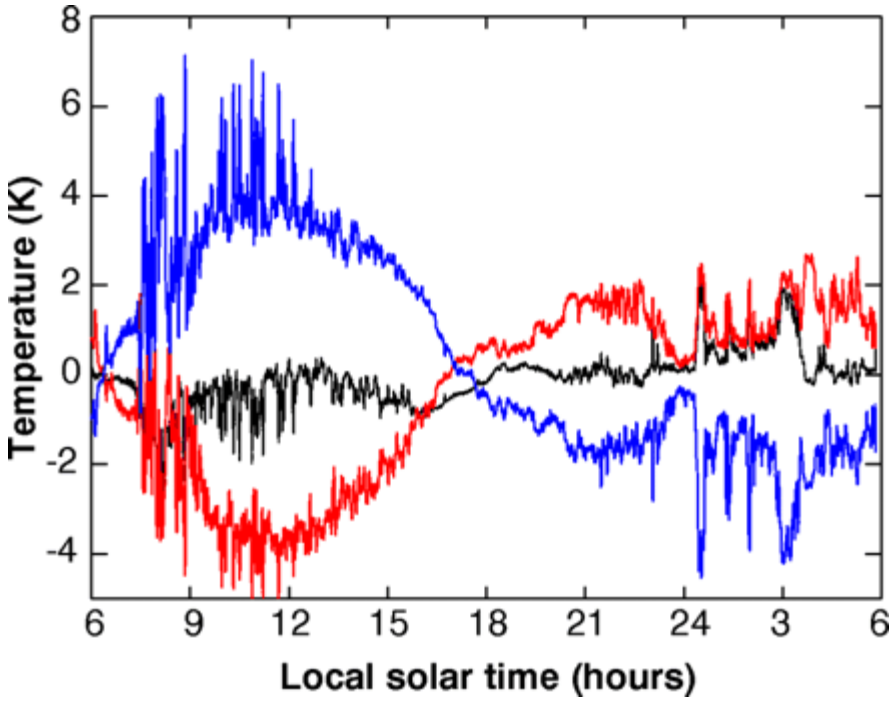


Fig.5. The Data Of Fig.4, constructed as deviations from the mean of all three thermocouples. The rest is similar.

The temporal wind profile

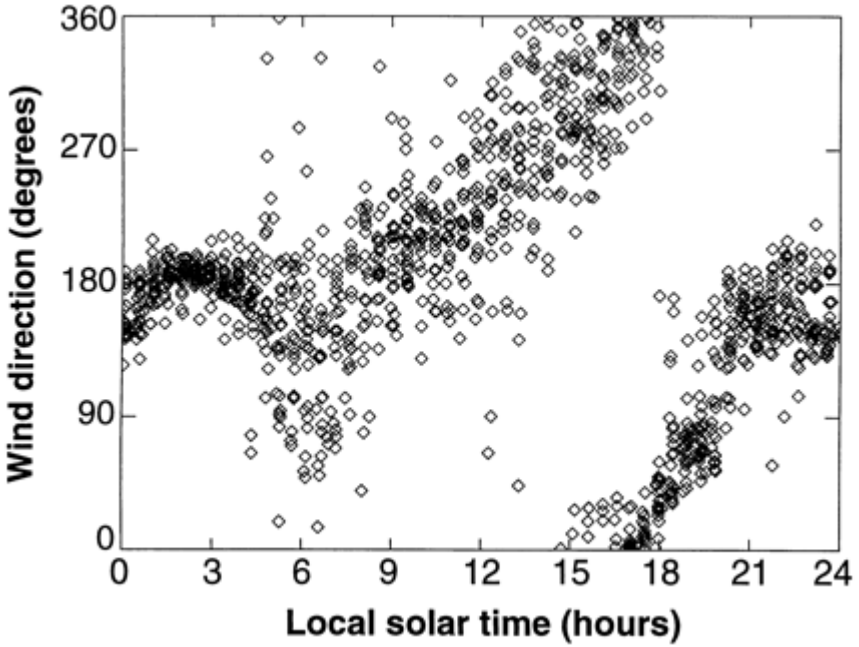


Fig.6. Time-averaged wind direction for the first 30 sols as a function of local solar time. Each point represents the average for 3 minutes. Marking directions: 0° and 360° (North), 90° (East), 180° (South) and 270° (West).

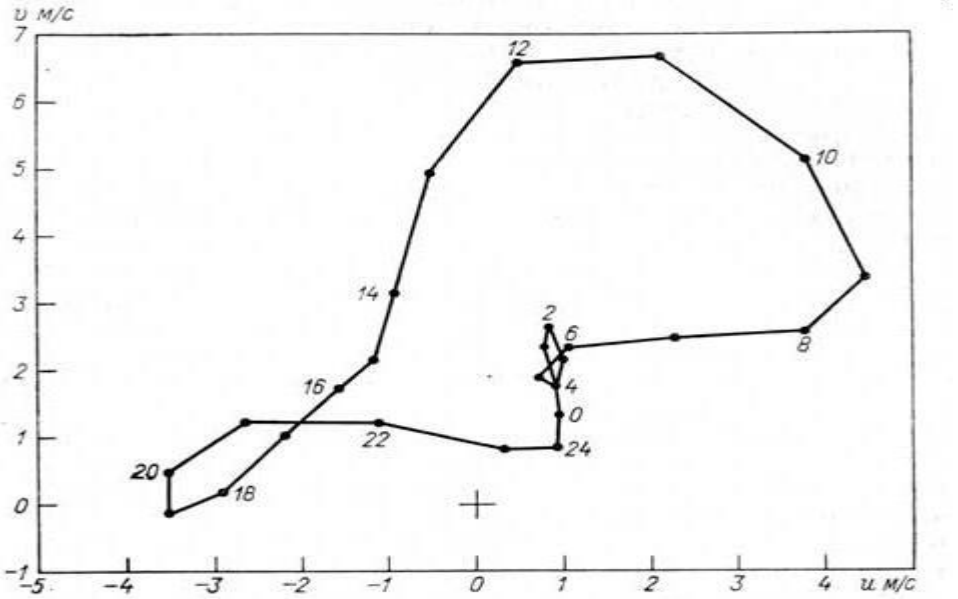


Fig. 7. The hodograph of the vector of the horizontal wind speed according SA "Viking-1" in 20 Martian days. The numbers at the locus designated hours of the day counted from midnight, u, v — West and South wind components, respectively.

Infra wave

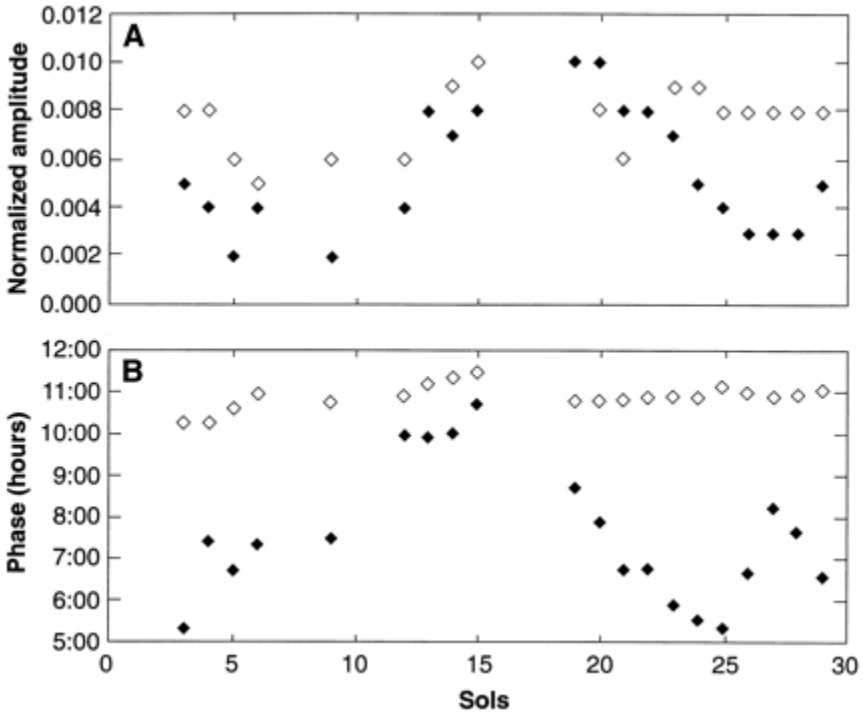


Fig.7. (A) the amplitude of the diurnal (black diamonds) and semi-diurnal (light rhombs) of the pressure waves for the first 30 sols. The amplitude is normalized relative to the average pressure for the day. (B) Phase in LST, the diurnal (black diamonds) and semi-diurnal pressure waves.

Dust vortices (devil)

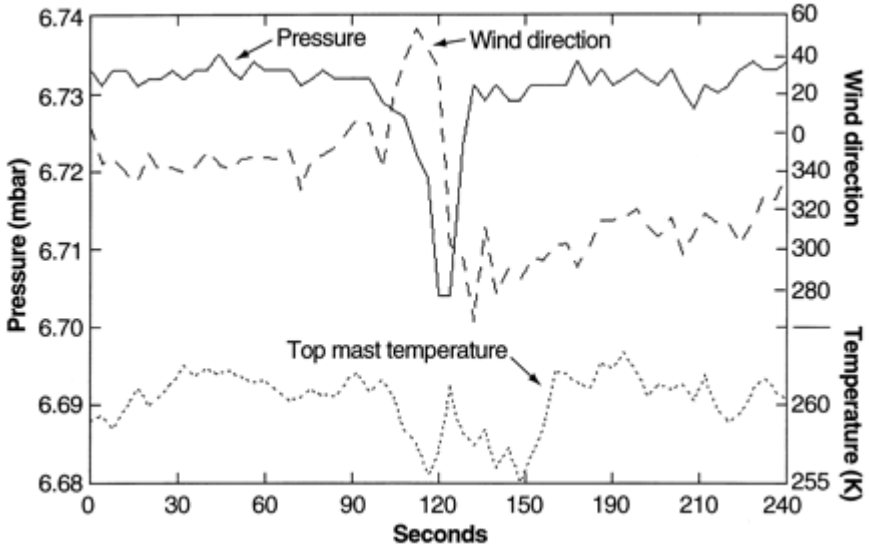


Fig.8. Changes of pressure, temperature and wind speed associated with a small vortex that passed over the landing site Pathfinder. The measurements were performed with an interval of 4 seconds.

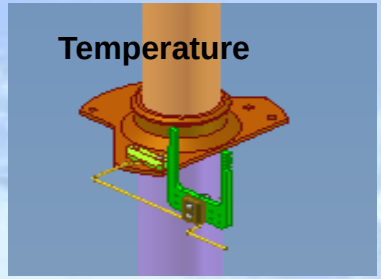
Summary

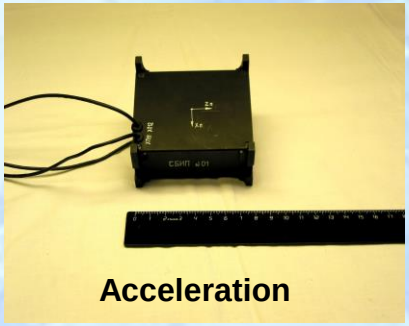
- **Scientific data:**
- Vertical profile (ρ) with a height of 200 km to the surface .
- Vertical profile (T,P) the lower atmosphere.
- A continuous profile of the ground-based measurements (T,P,W,H).
- The gradient of surface temperature and humidity (determines the exchange of heat and momentum between the atmosphere and the surface).
- Determination of heat balance of the soil-atmosphere interface.
- Dynamics of the magnitude and direction of zonal and global winds.
- The ripple of the temperature gradient in the upper layer of the soil.
- The radiation flux of solar radiation at the surface.
- Vertical distribution of aerosol in the lower atmosphere.
- The dynamics of lifting, transport and deposition of dust.
- The dynamics of development of Martian storms.
- The albedo of the surface at the landing site.
- Acoustic effects in the lower atmosphere.

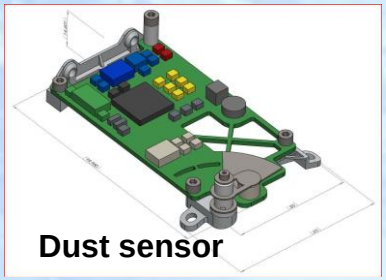
- **Technical data:**
- The dynamics and the speed of descent of the lander (overload and angular velocity)

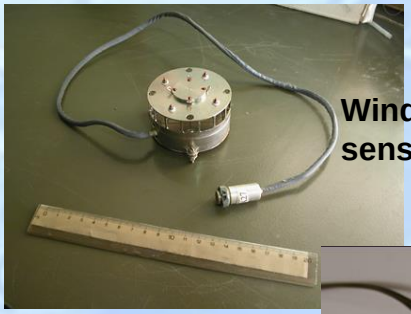
Обозн.	min	max	Событие
	Тразделения		Разделение ПМ и ДМ, подрыв ЭДУ1х4
	Тразделения + 1мин		Включение радара в режим прогрева
	Тразделения + 3мин		Включение метеокомплекса
Татм	Тразделения+30мин		Вход в атмосферу Марса
T_1	Татм+183 с	Татм+208 с	Ввод 1-го каскада парашютной системы, таблица 2
T_1 + 2 с	Татм+185 с	Татм+210 с	Отстрел крышки контейнера ПС
T_1 + 17 с	Татм+200 с	Татм+217 с	Ввод 2-го каскада парашютной системы
T_2	Татм+210 с	Татм+227 с	Отстрел аэродинамического экрана
T_2 + 3 с	Татм+213 с	Татм+230 с	Раскрытие опор, открытие блока клапанов ЭПКП (вакуумирование ТД)
T_2 + 5 с	Татм+215 с	Татм+232 с	Работа ДМТ (демпфирование угловых скоростей); закрытие блока клапанов ЭПКП, открытие клапанов ЭК2, и блока клапанов ЭПКВ (заполнение магистралей ТД топливом)
T_2 + 10 с	Татм+220 с	Татм+237 с	Включение радара в режим измерений
T_3	Татм+224 с	Татм+241 с	Открытие блока клапанов ЭПКП – пуск и прогрев ТД, закрытие ЭК2
T_3 + 3 с Тотделе	Татм+227 с	Татм+244	Отделение ПС и заднего кожуха, резка ВЧ-кабеля МНА заднего кожуха, пауза в управлении ДМТ
	Тотделения+ 1 с		Управление ДМТ, БУ ПРТ, ТДУ
h=~250 м	–20 с	–9 с	Интенсивное торможение
	–8 с	–2,5 с	Спуск с постоянной вертикальной скоростью
Ткасан	0		Касание поверхности Марса, отключение ТД (закрытие блока клапанов ЭПКВ и ЭПКП), отключение БУ ПРТ; открытие ЭК1, ЭК2, ЭПКПр (начало продувки)
T_0 + 5 с	+5 с		Закрытие ЭПКПр, ЭК1, ЭК2 (конец продувки)

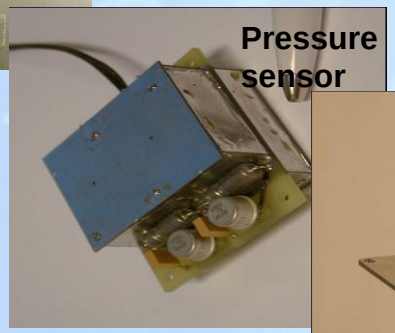
Payload Метео

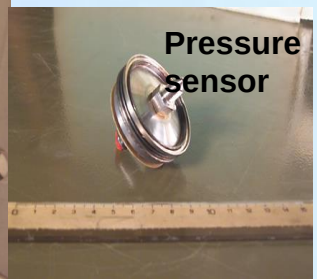


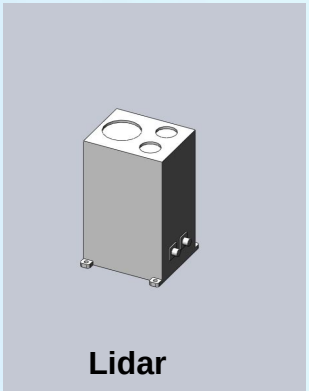




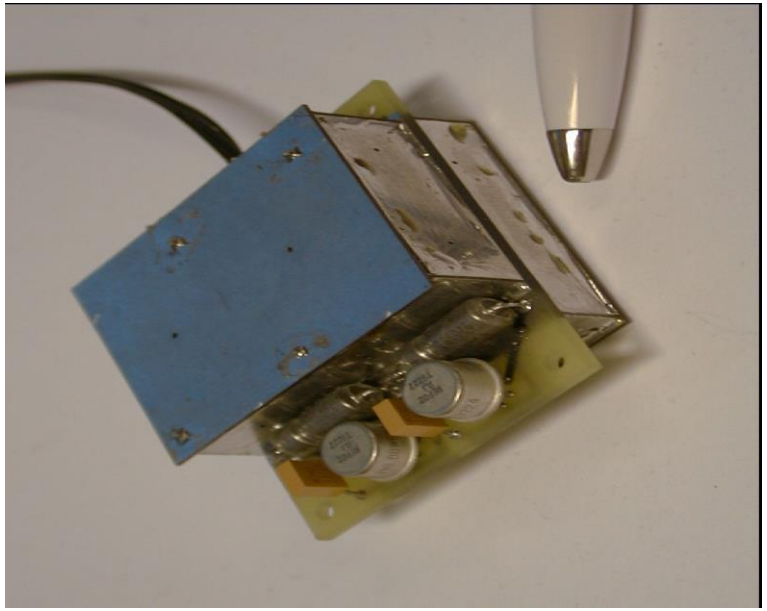








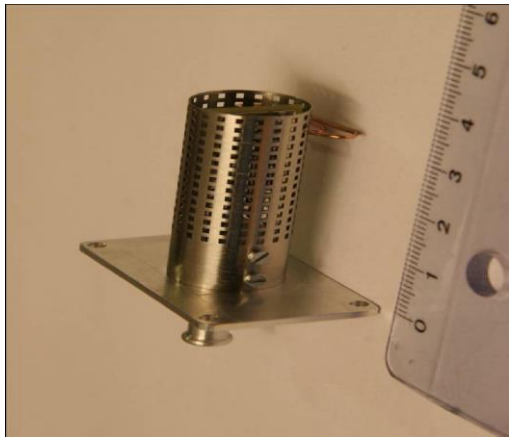
Pressure sensors



The name of the parameter	Значение
The range of measurement, Pa	0.5-1015
Sensitivity, Pa	2 %RH at +20 °C, 4 %RH at -40 °C, 8 %RH at -70 °C
Operating frequency, Hz	10
Nonlinearity, %	не хуже 5
The update rate, Hz	10
Communication interface	RS422
Dimensions, mm	85x60x40
Power Consumption, W	0,17
Temperature range,°C	-55 до +70
Weight, g	110

Датчик влажности.

Наименование параметра	Значение
Диапазон измерений, %RH	0,5-10
Чувствительность, %RH	2-8
Рабочая полоса, Гц	0– 10
Нелинейность, %	не хуже 10^{-2}
Количество датчиков	2
Частота обновления информации, Гц	10
Габариты, мм	Ø25x53
Энергопотребление, Вт	0,05 (0,6 в течение 5 мин)
Температурный диапазон,°С	-135 до +50
Масса, г	95



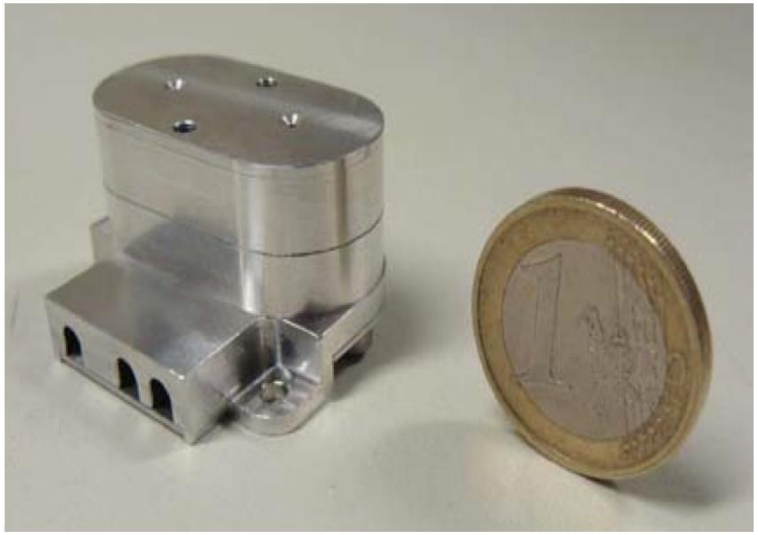
Solar Irradiance Sensor

Hannel	Wavelength	Use
1	Background reference	
2 3 4 5 6 7 8	190 - 1100 nm 710 - 730 nm 810 - 830 nm 930 - 950 nm 759 - 771 nm 315 - 400 nm 280 - 315 nm	Total luminosity reference H2O H2O H2O A Band - O2 UVA UVB
9 10 11 12	200 - 280 nm 200 - 310 nm 300 - 345 nm 440 nm	UVC Hartley Band - O3 Huggins Band - O3 Dust Optical Depth
13 14 15 16	600 nm 700 - 1100 nm 400 - 700 nm 245 - 290 nm	Dust Optical Depth IR VIS UV Redundancy
17,21,25,29 18,22,26,30 19,20,27,31	440 nm 700 - 1100 nm 400 - 700 nm	Dust Optical Depth IR VIS

Наименование параметра	Значение
Частота обновления информации, Гц	10
Поле зрения, град	±45
Количество частотных диапазонов	14
Габариты, мм	75*45*30
Напряжение питания, В	5-9
Интерфейс связи	RS422 или 485
Скорость передачи информации, кбит	128
Энергопотребление, Вт	0,4
Температурный диапазон работы, °C	-100 до +50
Масса, г	114

ODS

Наименование параметра	Значение
Поле зрения	±60 °
Габариты, мм	43x528x30
Напряжение питания, В	5-12
Интерфейс связи	RS485
Скорость передачи информации, кбит	128
Энергопотребление, Вт	0,5
Температурный диапазон, °С	-90 до +50°
Масса, г	80



Штанга метеорологическая

Наименование параметра	Значение
Высота штанги в раскрытом состоянии, м	1, 2
Габариты в сложенном состоянии, мм	380*124*90
Механизм раскрытия	Электродвигатель с редуктором
Температурный диапазон, °С	-90 до +50
Потребление (только во время раскрытия), Вт	2,5
Масса (штанга + мех. Раскрытия), г	370 +125 = 495

Блок управления Метео

Наименование параметра	Значение
Габариты, мм	160*110*60
Температурный диапазон, град.	-50 до +50°
Потребление, Вт	1,0
Масса, г	1335