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Prepared by Russia
Agenda Item: C.1

FUTURE POLAR ORBITING METEOROLOGICAL SATELLITES METEOR-3M

Summary and purpose of the WP

At present it is planned to develop and to launch the second satellite of the METEOR-3M series on sun-synchronized orbit in 2006. The instruments payload should consist of the imagers of visible (VIS), infrared (IR) and microwave (MW) range as well as IR and MW atmospheric sounders.
The satellites of METEOR-3M system will provide LRPT and AHRPT data direct broadcast to the user stations.

Action proposed: no action required.

FUTURE POLAR ORBITING METEOROLOGICAL SATELLITES METEOR-3M

Russia is now developing new series of polar orbiting meteorological satellites. The first polar orbiting satellite of this series named METEOR-3M N 1 has been successfully launched in December 2001. The next satellite of this series that should be launched in 2006 is designed for operational providing of hydrometeorological and heliogeophysical information. The primary mission objectives of METEOR satellites are quite similar to those specified for NOAA and EPS/METOP satellites.

In order to meet the requirements of the users (mainly in the field of operational meteorology and climate monitoring) the future METEOR spacecrafts being launched on sun-synchronized orbit will carry as mandatory payload the imagers of visible (VIS), infrared (IR) and microwave (MW) range as well as IR and MW atmospheric sounders.

In summer 2002 the original satellite sketching design was seriously revised. It is proposed to develop and to launch two satellites on the base of unified and rather heavy platform (of «Resurs» type) with a suite of operational and experimental instruments. Both these satellites should provide the flight demonstrations of key systems and be the predecessors of operational and complete METEOR satellite. Moreover both new spacecrafts will be equipped with supplementary instruments. In particular, it is planned to develop the locator (radar) “Severjanin” and multichannel optical scanning device KMSS of medium resolution (~ 100 m) on board the first new satellite. The implementation of these instruments should ensure substantial extension of forthcoming METEOR mission objectives. The table 1 summarizes the basic instruments embarked on board this satellite. Below a brief overview of basic instruments is presented.

Table 1

Basic instruments payload of the METEOR-3M N 2

Instrument	Application	Spectral Band	Swath-width (km)	Resolution (km)
MSU-MR	Global and regional cloud cover mapping, SST, LST, …	0.5 – 12.5 μm (6 channels)	3000	1 x 1
KMSS multichannel scanning unit	Earth surface monitoring	0.4-0.9 μm (4 channels)	100	0,1
MTVZA imager/ sounder	Atmospheric temperature and humidity profiles, sea surface wind	10.6-183.3 GHz (26 channels)	2600	12 – 75
IRFS-2 advanced IR sounder	Atmospheric temperature and humidity profiles	5-15 μm	2000	35

Radar (Severjanin)	Ice monitoring	9500-9700 MHz	450	0.4 x 0.5 0.7 x 1.0

METEOR-3M sounding instruments

In full analogy with NOAA, MetOp satellites the payload composition of the next METEOR-3M satellite should consist of the suite of 2 sounding instruments providing remote sensing of three-dimensional fields of temperature and humidity of the atmosphere (one is MW sounder and other is IR sounder).

MW sounder/imager MTVZA

One of the major sensors of sounding instruments suite is multichannel microwave (MW) conical scanning radiometer MTVZA. The primary mission of MTVZA measurements that is similar to NOAA/AMSU instrument is to provide all-weather atmosphere temperature and humidity sounding capabilities to support numerical weather prediction schemes of global and regional coverage.

The MW radiometer MTVZA, being designed and manufactured by the Space Observations Center, Rosaviakosmos is based on the technology of combining in space and time the multi-spectral and polarization measurements. The MTVZA operating frequencies are located both in the transparent bands of 18.7, 33, 36.5, 42, 48, 91.61 GHz as well as in absorbing lines of oxygen 52-56 GHz and water vapor 22.235 and 183.31 GHz. The important feature of instrument is that it provides the common field of view for imaging and sounding channels.

The performance tests of MTVZA instrument have been carried out in the framework of METEOR-3M N 1 commissioning phase. Basing of the tests results, the necessary technical modifications and refinements of MTVZA instrument design have been carried out and the next MTVZA device is installed on board oceanographical satellite SICH - 1M (planned to be launched in 2004).

Advanced IR sounder IRFS-2

The second component of METEOR-3M sounding system is IR atmospheric sounder IRFS-2 that is being designed as multi-purpose Fourier transform spectrometer.

The IRFS-2 operable spectral range extends from 5 to 15 μm. while spectral resolving power is about 0.5 cm^{-1} (after apodization). Now the manufacturing of space-borne IRFS-2 instrument is underway.

METEOR-3M imaging capabilities

Along with atmospheric sounding system the payload composition of METEOR-3M satellite should consist of the suite of imaging instruments providing imagery of clouds and land/ocean surfaces. The major sensor of this suite is multichannel scanning radiometer MSU-MR, see table 1. This instrument has 6 channels in VIS/IR and is designed as cross-track scanning radiometer with basic characteristics similar to those of NOAA/AVHRR/3. The multichannel scanning unit (named KMSS) is proposed as supplementary imaging instrument. This device should provide the imagery in 4 VIS channels (0.45-0.9 μm) of medium resolution (100 m).

The imaging mission in MW should be accomplished by MTVZA instrument. In full analogy with well known MW imagers SSM/I (DMSP) or MW sounder AMSU (NOAA) or imager/sounder SSMIS the successful implementation of MTVZA should ensure the retrieval of so called non-sounding products, namely total precipitable water, cloud liquid water (both over ocean), near-surface wind speed, instantaneous rain rate as well as surface temperature, sea ice concentration and snow cover.

Imaging mission will be also performed by supplementary "active" sensor i.e. radar (named "Severjanin"). This instrument is now under development. Its operating frequency range is 9500-9700 MHz, the swath band is about 450 km. Two modes of spatial resolution i.e. minimum or low (0.7 x 1.0 km) and optimum or medium (0.4 x 0.5 km) are foreseen.

The satellites of METEOR-3M system will provide LRPT and AHRPT data direct broadcast to the user stations. The operational products will be distributed by SRC "PLANETA" via widespread network of various communication channels (including on-line systems: web-site, FTR server, e-mail server).