EUROCKOT MULTI-ORBITAL MISSION (MOM)
LAUNCH OPERATIONS SUMMARY

Moscow, March 26-28, 2003

First Released: April 4, 2003

1. LAUNCH PARAMETERS

1.1. Launch Date

Launch Date is June 30, 2003, at 17:14 (Moscow Time) or 14:14 (GMT)

1.2. Projected Orbital Elemenets

The following are the projected orbital parameters for NLS-1 (CanX-1, DTUsat, Aalborg Cubesat) and NLS-2 (QuakeSat).

Parameter		**NLS-1**	**NLS-2**
LTAN Counting from Targeting		10832.75 sec	10837.0 sec
Absolute Velocity		7444.228 m/s	7445.301 m/s
Altitude		820.971 km	821.536 km
Trajectory Angle		-0.003°	-0.019°
Geographical Latitude		0.002°	0.003°
Geographical Longitude*		11.320°	13.305°
Status Vector in Greenwich Inertial Reference System	X	3965.037 km	3965.114 km
	Y	6008.800 km	6009.426 km
	Z	0.284 km	0.375 km
	V_X	0.939520 km/s	0.938675 km/s
	V_Y	-0.620795 km/s	-0.622791 km/s
	V_Z	7.358563 km/s	7.359587 km/s
Osculating Parameters		**NLS-1**	**NLS-2**
Apogee		840.755 km	846.921 km
Perigee		828.099 km	828.358 km
Semi Major Axis		7205.527 km	7208.640 km
Inclination		98.701°	98.702°
Eccentricity		0.0008782	0.0012875
True Anomaly		356.453°	344.948°
Long. of Ascending Node**		56.581°	56.583°
Argument of Perigee		3.549°	15.055°
Period of Full Revolution		6087.0 sec	6091.0 sec
Real Local Time		17h56m00.00s	17h56m00.00s
Average Local Time		18h00m00.00s	18h00m00.00s
Absolute Long. of Ascend. Node		-171.63°	-171.63°
Hour Angle		0.56	0.56
Angle of the sun to Orbital Plane		58.12°	56.11°

Important Note:

- Longitude of Ascending Node is the longitude of the ascending node as referenced to the rotating reference system that is then inertially fixed at the time of launch. Geographical Longitude is the longitude of the ascending node as referenced to Greenwich. Use this for simulations in STK as the Longitude of Ascending Node.
- Greenwich Inertial Reference System
  The origin of the system is located in the geometrical center of the earth. Axis OXg is located in the equatorial plane and is directed to Greenwich Meridian. Axis OZg is directed to the vector of angular velocity of the Earth's rotation. Axis OYg completes the third axis of a right-hand coordinate system and is directed along the vector product of OZg and OXg.

1.3. Projected Trajectories

The projected orbital trajectories and profile that shows the planned burns of the Upper Stage and the planned spacecraft releases can be found in Appendix 7.1 and Appendix 7.2

2. LAUNCH CAMPAIGN

2.1. Pre-Launch Operations and Timeline

2.1.1. Timeline

Detailed timeline for the Launch Campaign is as follows:

Description of operations	Days until Launch
Spacecraft, ground-support equipment, and personnel leaves Canada	To Be Confirmed
Spacecraft, ground-support equipment, and personnel arrives at Moscow Sheremetyevo International Airport	–42
Arrival of the spacecraft and ground-support equipment at the Technical Complex. Unloading and transfer to the preparation zone. Autonomous preparation of the spacecraft.	–35 to –18 May 26 to Jun 13, 2003
Transfer stand with "MIMOSA" separation system to the SC preparation premise. Mounting SC "MIMOSA " on the separation system (using hoisting device of SC).	–17
Mounting "MOST" separation system on to SC and separation system assembling stand. Mounting SC "MOST" on the separation system (using hoisting device of SC).	–16
Mounting separation systems "NLS-1", "NLS-2", "Cube Sat TiTech", "Cube Sat UT" with SC on the adapter	–14

system. **Last day of Access to NLS-1 and NLS-2** Electrical checks.	
Mounting "Monitor" SC simulator on the adapter system.	–13
Transfer Upper Composite (SC & Adapter) to the SH integration premise. Mounting Upper Composite (SC & Adapter) on the Upper Stage. Installation of elec. Connection between Adapter and Upper Stage. Mounting on-board batteries on the Upper Stage. Integration of thermal Insulation on Upper Stage. Electrical checks.	–12
Final close-out (Red-Green Tags) SC. Mounting of HF flaps onto IMT. Space head assembling.	–11
Assembly of space head.	–10
Electrical checks of the space head. Preparation of the space head for transportation to the launch complex.	–9 to –8
Transportation of the space head to the launch complex.	–7
Assembly of the space rocket.	–7 to –5
Electrical checks of the space rocket.	–4 to –3
Filling of the space rocket. Electrical checks of the space rocket after filling.	–2 to –1
Set of readiness of the space rocket. **Launch June 30, 2003, 17:14 (Moscow), 14:14 (GMT)**	**0**

2.1.2. Personnel Availability

Launch support personnel will be available at the Payload Processing Facility to perform pre-flight maintenance of the NLS-1, NLS-2, and its spacecrafts. The tentative plan for NLS-1 and NLS-2 launch support personnel is as follows, subject to change.

L–35 to L–22

NLS-1 and NLS-2 will tentatively be maintained by MOST launch support personnel. The activities during this period will be limited to trickle charging the batteries on the NLS-1 and NLS-2 PPODs and spacecrafts, as required.

L–22 to L–0

NLS-1 and NLS-2 launch support personnel will be at Plesetsk to perform the final pre-flight checkouts and maintenance, including charging the spacecraft batteries and the PPOD batteries. Launch support personnel will also be available at the Launch Control Complex during the Launch activities.

2.1.3. Personnel Clearance

The Russian Authority must clear all personnel that plan to be present at the Plesetsk Technical Complex. The following are the updated clearance requirements:

Given Name
Surname
Date of birth
Place of birth
Citizenship
Passport number
Expiration date (must be valid until Dec 2003)
Position and organization
2 photos (for badge)
Photocopy of info page of passport

In addition, to take any pictures, the person(s) must be specially authorized and the photo equipment must be registered. Please provide a list of make, model and serial number of all of the photography equipment that you wish to bring.

2.1.4. Security

There will be no special security arrangement for NLS-1 and/or NLS-2.

2.1.5. Ground Operations

After arrival at Plesetsk and before the integration with the Upper Stage, the NLS-1 and NLS-2 and their GSE will be kept at the Payload Processing Facility in a Class-300,000 cleanroom, Room 111A as shown in Appendix 7.4.

Note that this room will be shared with the Japanese Cute-1 and X-I.

L–35 to L–15

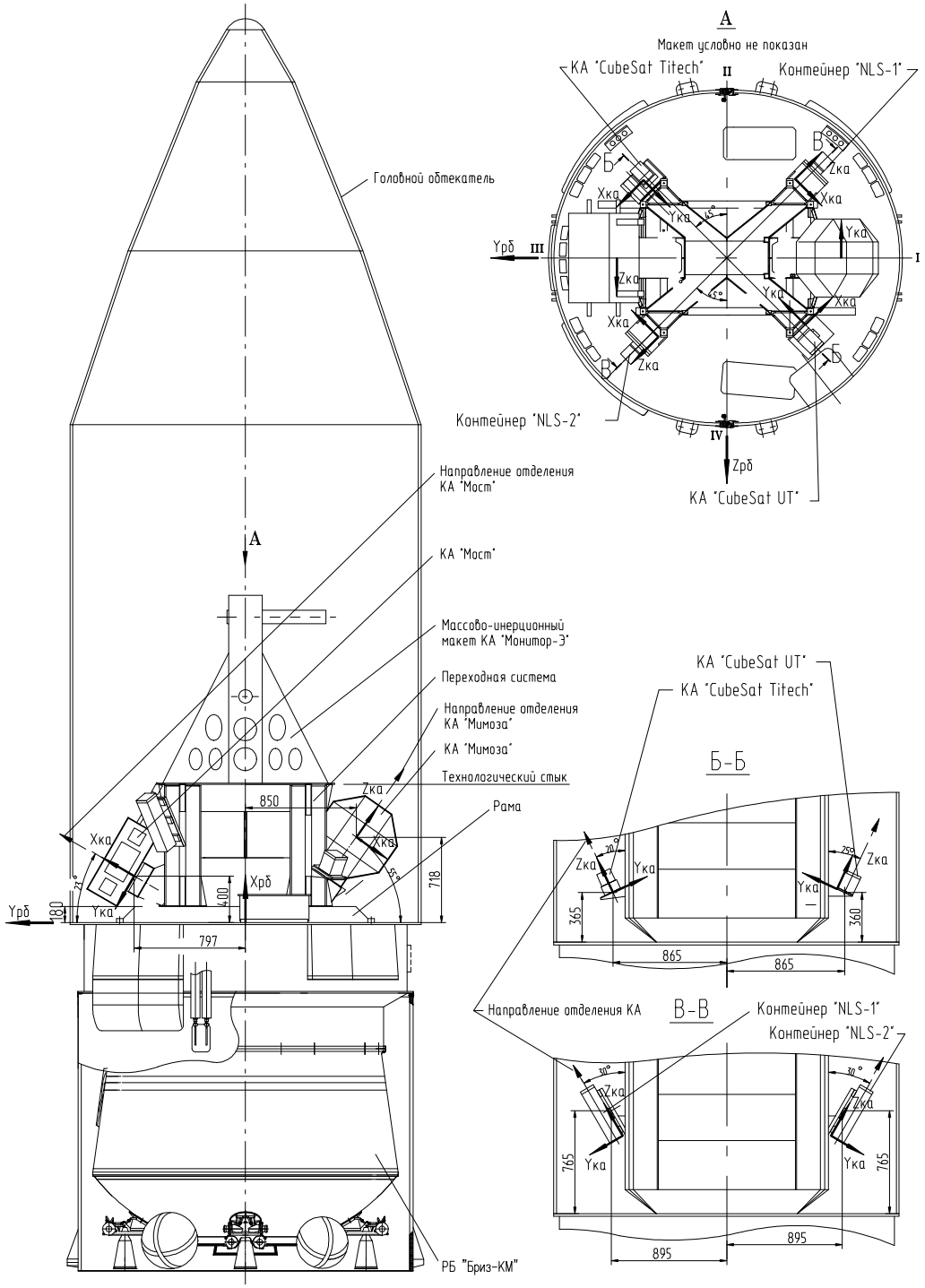
Launch support personnel will be performing Individual Operations on the NLS-1 and NLS-2, which will involve post-arrival decontamination, post-arrival checkout, pre-flight checkout and maintenance. The Individual Operations activities will be performed in within Room 111A, as shown in Appendix 7.4. Photography and/or Filming will be permitted during Individual Operations, so long as the viewing is strictly limited to Room 111A. There is no word on whether Webcam that is broadcasting in realtime is allowed, however Khrunichev have suggested that it should be OK during Individual Operations. Khrunichev suggest bringing the Webcam and then asking for permission on site.

L–14

Joint-Operations begins. The NLS-1 and NLS-2 (as well as the Cute-1 and X-I) will be decontaminated to Class-100,000 before they are moved into onto the Joints-Operations area Room 101B, as shown in Appendix 7.4, where they will be attached onto the Upper Stage. For NLS-1 and NLS-2, the Joint-Operations activities will involve UTIAS personnel holding the NLS-1/2 launch tubes while Khrunichev personnel secures it onto the Upper Stage. **Note that this is the last chance for access to the NLS-1 and NLS-2.** Photography and/or Filming is

permitted during Joint-Operations, however all materials must be cleared by the Russian Authority before being released. The process to clear photo/film usually takes minutes.

The following figure shows how the NLS-1 (CanX-1, DTUsat, Aalborg Cubesat) and NLS-2 (QuakeSat) will be situated on the Upper Stage.



2.1.6. Support Infrastructure

Electricity

North American electricity (110V, 60Hz) and North American sockets will be available from a generator at the Technical Complex (the Payload Processing Facility) and Launch Control Complex. The Hotel is expected to have only 220V, 50Hz electricity. North American-to-European plug adapter should be part of the GSE.

Communication Services

Communication services between the Technical Complex (the Payload Processing Facility), Launch Control Complex, etc., and Canada, Denmark, and U.S. sites will be arranged per the cost schedule below. This information is preliminary and subject to change pending full price listing from Khrunichev Telecom. VAT is 20%.

Telecommunication Service	Cost
Telephone Interface Suitable for outgoing calls only. This is a "domestic telephone" which shares a common number. Telephone jack is RJ-11 at the hotel, and RJ-45 at the Payload Processing Facility, Launch Complex, and Launch Control Complex.	
Installation	US$ 250 +VAT
Monthly User Fee	US$ 50 +VAT
Rental of Telephone Unit	US$ 15 +VAT
Direct PSTN Line Includes a PSTN telephone number to allow a domestic telephone to receive incoming calls. One PSTN line can also be associated to several domestic telephone	
Installation	US$ 300 +VAT
Monthly User Fee	US$ 150 +VAT
Dial-Up Internet Access Internet access through dial-up is available. Dial-up is available through any of the telephone line. The dial-up connection is 64 kbps, V.90 protocol. The modem pool is at the Payload Processing Facility and is capable to accept 12 simultaneous connections.	
Monthly Unlimited Dial-up Internet Access	US$ 150 +VAT
Direct Internet Access Direct Internet access to Moscow ISP is available, bypassing the modem-pool. The connection is 64 kbps.	
Monthly Unlimited Direct Internet Access	US$ 1500 +VAT

In order to reduce costs, we are considering sharing these communications lines with the Japanese Cute-I and X-I teams, if possible.

Cellular phone coverage is only available at the Town of Mirny. GSM coverage is covered through Northwest-GSM. Cellular phone coverage is not available

outside Mirny. Note that cellular phone brought into Russia from abroad requires special custom declaration at the time of arrival.

2.2. Launch Operations

2.2.1. Personnel Availability

UTIAS personnel will be at the Launch Control Center to monitor the progress of the launch and to dispense the any information pertaining to the launch, including the orbital parameters.

2.2.2. Launch Operations Support

This pertains to communication lines to and from the Launch Control Center at the Town of Mirny. Data and Communication lines should be arranged to external ground stations (Canada, Denmark, and U.S.) and secured at least 3 hours prior to the scheduled launch time (or launch window), per the cost schedule in 2.1.5. Real-time launch broadcast can be made available, but it will incur significant costs.

Availability of orbital parameters is as follows.

Availability	Description
Format 0 30 min after Lift-Off	LV Launch Date (Universal Coordinated Time, in MM/DD/YY), LV Launch Time (Universal Coordinated Time, in HH:MM:SS.SS)
Format 3 60 min after Separation	Date of SC separation (Universal Coordinated Time, in MM/DD/YY), Time of SC separation (Universal Coordinated Time, in HH:MM:SS.SS), Roll Angular Velocity (deg/s), Yaw Angular Velocity (deg/s), Pitch Angular Velocity (deg/s)
Format 4 65 min after Separation	Period (sec), Orbit eccentricity (-), Orbit inclination (deg,min,sec), Right Ascension of Ascending Node (deg,min,sec), Argument of perigee (deg,min,sec), Argument of Separation Point Latitude (deg,min,sec)

Note that the exact orbital parameters for the CanX-1, DTUsat, AAU Cubesat, and QuakeSat will not be available, since detailed parameters of the spacecrafts are not available. Khrunichev will supply the MOST orbital parameters (which separates 135 seconds earlier) and will attempt to predict the NLS-1/2 parameters as accurate as possible.

Gyro pulse are available, however it may not be sensitive enough to detect the NLS-1/2 launch pulse. All of the telemetry stream from the Upper Stage will be available at the Launch Control Center and is updated every 10 seconds.

2.2.3. VIP Personnel

There will be a limited number of VIP personnel that will be invited to stay at a bunker that is closest to the Launch Pad. Person(s) invited will be asked to prepare and to practice a short speech that will be broadcasted along with speeches from high-ranking Russian Officials.

It is not clear whether NLS-1 and/or NLS-2 personnel will be able to participate.

2.2.4. Launch Delays

In case of launch delays such that the 15-minutes launch window expires, the launch will be re-scheduled for the following day, at the same time.

2.3. Post-Launch Operations and Timeline

The current plan to transport the GSE from Plesetsk back to Moscow is by truck. The truck cannot accommodate any additional personnel. The MOST team is currently arranging to have a car that will accompany the truck convoy and the GSE. The road trip from Plesetsk to Moscow will take approximately 2 days, including a 1-night stopover.

All other launch personnel will have to take the train back to Moscow.

3. TRANSPORTATION

3.1. Spacecraft

NLS-1 (CanX-1, DTUsat, Aalborg Cubesat) and NLS-2 (QuakeSat) will be transported along with the MOST spacecraft.

Importation Fees and Customs Duties for the Spacecraft shall be distributed among the UTIAS, DSRI, and QuakeFinder, per the Memorandum of Understanding.

For security purposes, all S/C shipping containers will have seals and locks to confirm that it was never opened during Customs Processing

3.2. Ground Support Equipment

GSE for the NLS-1 (CanX-1, DTUsat, Aalborg Cubesat) and NLS-2 (QuakeSat) will be transported along with the GSE for the MOST spacecraft.

Importation Fees and Customs Duties for the GSE shall be distributed among the UTIAS, DSRI, and QuakeFinder, per the Memorandum of Understanding.

3.3. Customs Fees

The following is the breakdown for the fees that is associated with importation and exportation of the NLS-1 (CanX-1, DTUsat, Aalborg Cubesat), NLS-2 (QuakeSat), and the associated Ground Support Equipments, current as of March 28, 2003.

Description of Fees	Costs
Customs Clearance Fee for import of NLS-1, NLS-2 and GSE (at Moscow)	US$ 2550

This is the fee paid at the time of arrival (when the team arrives in Russia) to Express Service (the company contracted for importing the equipments) to process the import paperwork	
Customs Clearance Fee for export of NLS-1 and NLS-2 (at Plesetsk) and the GSE (at Moscow) This is the fee paid at the time of departure (for NLS-1 and NLS-2: when the Launch takes place; for the GSE: when the team arrives in Russia) to Express Service (the company contracted for importing the equipments) to process the export paperwork	US$ 350
Customs Procedure Fee on Arrival This is fee paid at the time of arrival (when the team arrives in Russia) to the Russian Customs to have them do the paperwork for the S/C and GSE.	US$ 43
Customs Procedure Fee on Departure This is fee paid at the time of departure (when the team leaves Russia) to the Russian Customs to have them do the paperwork for the S/C and GSE.	US$ 5
Customs Fee This is the actual fee paid to the Russian Customs for having the S/C and GSE in Russia. This fee is on a monthly basis, and is calculated based on the month in which the equipment(s) resides in Russia, and not by the exact date or numbers of days. NLS-1 (CanX-1, DTUsat, Aalborg Cubesat), NLS-2 (QuakeSat) and the associated Ground Support Equipments will arrive on May 26. Although in theory the Launch occurred in June, however the Russian customs will only receive the launch confirmation on July 1, so therefore all of the equipments will have to pay the fee for the months May, June and July.	US$ 365/mo US$ 1095 /total
Total Customs Fees	US$ 4043

3.4. Personnel

3.4.1. Transportation between Moscow and Plesetsk

Available transportation of personnel from Moscow to Plesetsk is as follows:

Description of Fees	Costs
Charter Airplane The AN-72 cargo plane can accommodate up 8 passengers. This flight will be shared between the Canadian MOST Team and the Czech MIMOSA Team, and all available seats are reserved for the members from both teams. The	US$ 100 / pax

flight time between Moscow and Plesetsk is approximately 1h30m. There is no meal service on the flight, however lavatory is available.	
Trains There are two daily trains from Moscow to Plesetsk, 4pm and 7pm departure. All other personnel are requested to take this train. The train trip will take approximately 18 hours.	US$ 80 /economy; US$ 160 /cabin

3.4.2. Transportation between Mirny and the Technical Complex

Mirny is a small town within the perimeter of the Plesetsk Military Base, and is located approximately 30 km from the Technical Complex.

All transportation between the Hotel and the Technical Complex will be under the strict supervision of Russian Authority, and all launch support personnel must be escorted by the Russian Authority.

The pre-arranged transportation is available twice a day, once in the morning from the Hotel to the Technical Complex, and once in the afternoon from the Technical Complex back to the Hotel.

3.4.3. Movement within Mirny

There are strict zones in which launch support personnel are allowed to move freely within Mirny, as shown below. Movements outside of these zones are strictly prohibited and/or require escort.

3.4.4. Movement within the Technical Complex

Activities within the Technical Complex will be strictly monitored by the Russian Authority.

4. ACCOMODATION

4.1. Moscow

Hotel accommodation is available at the Proton Hotel.

Eurockot will arrange for the stay in Moscow, as required.

4.2. Mirny, Plesetsk

Hotel accommodation is available at a rate of US$70/night (VIP rooms, 8 available), US$50/night (32 rooms available) and is payable by cash or Visa/MC; no Amex. Because of the limited availability of rooms, personnel planning are required. Hotel also has laundry service.

Cafeteria is available at the hotel, providing set-meals at the following rate: US$15 for breakfast, US$25 for lunch, and US$15 for dinner. These meals can also be delivered to the Payload Processing Facility. Additional restaurants and bars are also

available in Mirny, as well as small stores and markets. However, Eurockot cautions about possible health issue with improperly maintained food at the local markets.

Foreign Exchange service is available at a bank near the hotel. U.S. or Euro funds are accepted; all personnel must bring the total sum required for the entire planned stay; there is no ATM or capability to wire additional funds from abroad.

Eurockot will arrange for the stay in Mirny, as required. Eurockot will also arrange for daytrips or outings for days where no personnel are required at the Payload Processing Facility (such as after L–14)

5. SUBMITTED QUESTIONS

1. What are the projected launch time (time of day) and orbit elements --so we can correctly model the orbit.
    - June 30, 17:14 (Moscow Time), 14:14 (GMT+3)

2. How will we get quick notification of the actual launch parameters soon after the launch? Will it be by phone call? e-mail? web site? Can we get an update soon after the Breeze passes over Plesetsk on the first rev?
    - Phone, Fax, Email connections available

3. What form will the notification be? 2 line element set? Keplarian elements? (we need to practice getting and using these numbers so the process is smooth and error free)
    - <u>Format 0 – 30 minutes after lift off:</u>
      LV Launch Date (Universal Coordinated Time, in MM/DD/YY), LV Launch Time (Universal Coordinated Time, in HH:MM:SS.SS),
    - <u>Format 3 – 60 minutes after separation:</u>
      Date of SC separation (Universal Coordinated Time, in MM/DD/YY), Time of SC separation (Universal Coordinated Time, in HH:MM:SS.SS), Roll Angular Velocity (deg/s), Yaw Angular Velocity (deg/s), Pitch Angular Velocity (deg/s)
    - <u>Format 4 – 65 minutes after separation:</u>
      Period (sec), Orbit eccentricity (-), Orbit inclination (deg,min,sec), Right Ascension of Ascending Node (deg,min,sec), Argument of perigee (deg,min,sec), Argument of Separation Point Latitude (deg,min,sec)
    - Exact orbital parameters for the nano-SC will NOT be available, since detailed parameters of the S/C are not available. However Khrunichev will supply the MOST orbital parameters (which separates 135 seconds earlier) and will attempt to predict the NLS-1/2 parameters as accurate as possible.
    - Gyro pulse are available, however the available sensors may not be sensitive enough to detect the NLS-1/2 launch pulse.
    - Telemetry stream from the Upper Stage will be available at the Launch Control Center and is updated every 10 seconds

- Line of communications from the Launch Control Center to the Outside (UTIAS, DSRI, QuakeFinder) should be arranged 3 hours prior to Launch

4. If there is a launch delay, what is the typical recycle time—e.g. next day, same time, or something different?
   - 24 hours delay, same launch time

5. What is the approximate launch window? (minutes, hours?)
   - +15-minutes

6. Will this verification of deployment be available to us before we expect to see QuakeSat come "over the horizon" in California?
   - See Item #3 above

7. What telemetry might be available to confirm that NLS-2 (QuakeSat) has actually deployed? Attitude gyro impulse? Current pulse from the command? Radar signature?
   - Real-time gyroscopic impulse; see Item #3 above.
   - Availability of Russian radar tracking of satellites is NOT CONFIRMED; S/C might be too small to track
   - Availability of NORAD data is TO BE CONFIRMED

8. Will the NLS-2 be in the sun prior to deployment? How long? Can the Breeze roll slowly in the sun so all the spacecraft get some warming effect from the sun? If not, will the NLS-2 (QuakeSat) be in the shade or sunlight at the time of deployment? What is the expected temperature of the NLS-2 launching plate at the time of deployment? (ref. P-POD battery concern)
   - Results are not modeled due to unavailability of the NLS-1/2 thermal model.
   - Seems that the NLS-2 will see the sun (since the Breeze will orient MOST toward the sun; however like MOST, NLS-2 will also see deep-space and may cool down significantly
   - NLS-1 will see deep space at the time of deployment, so it may cool down if it is not already cold; however NLS-1 will see the Earth so it may help maintaining a warmer temperature.
   - A Mutual-Agreement between UTIAS and Eurockot is issued stating that each parties agrees to do their best to maintain the temperature at the NLS-1/2 / LV interface above 0ºC: Khrunichev will provide MLI blanket; NLS-1/2 will provide dimensions by April 7 so the Khrunichev can fabricate the MLI to fit the NLS-1/2; UTIAS will provide the appropriate thermal coating on the NLS-1/2 doors meeting $\varepsilon<0.1$ and $\alpha<0.4$ (NLS-1/2 to use the MOST Aluminized Polymide Tape which meets this specifications).

9. What will be the NLS-2 orientation to the velocity vector at time of separation? What is the booster orientation?
   - The booster orientation will be the same as for MOST deployment. Parameters available for MOST

- However this will also be a function of the accuracy of the deployment time, which is currently specified at ±10 seconds.

10. The small separation times and velocities of all the satellites means that all will initially be in the beamwidth of our ground station for several days after launch. Will the Russian space tracking system be tracking the satellite cloud and providing separate orbits in the days following the launch?
    - Availability of Russian radar tracking of satellites is NOT CONFIRMED; S/C might be too small to track
    - Availability of NORAD data is TO BE CONFIRMED

11. Is the launch planned to be televised on a Eurockot website? If not, could it be (via a webcam)?
    - Realtime webcam is applicable for individual customers operations
    - Realtime webcam is NOT applicable for joint operations and launch pad filming; film would have to be reviewed by Security prior to release. Review process usually takes a few minutes.
    - Audio and Video feed of the Launch to the Launch Control Center; can be broadcasted; however maybe expensive (see input from Khrunichev Telecom)
    - Suggest bringing webcam anyway and checking w/ security authority when the launch campaign begins.

12. We need the dimensions of the NLS-2 launch plate (for door opening clearance calculation) and some digital photos of the NLS-2 on the Breeze with the other satellites.
    - The launch plate ends at the feet closest to the door, and the distance between the front mounting holes (the holes closest to the door) to the end of the launch plate is 17 mm. It seems that the door for both NLS-1/2 will clear completely, so there should be no interference with the excess cut lanyard.

6. OPEN ACTION-ITEMS

All of these action items are tentatively due in the week of April 7, 2003.

6.1. Updated Interface Control Document

The ICD for both NLS-1 and NLS-2 will need to be updated to include actual spacecraft masses and mass tolerances. UTIAS will be responsible for revising and submitting the updated documents, whereas DSRI and QuakeFinder will be responsible for providing the updates pertaining to their respective spacecrafts.

6.2. Updated Spacecraft Safety Certificates

The S/C safety certificates for NLS-1 and NLS-2 that have been submitted will need to be updated to include document references. UTIAS will be responsible for

revising and submitting the updated documents with the help from DSRI and QuakeFinder.

6.3. Updated Lists of Launch Campaign Participants

Please see Section 1.2.3. above.

6.4. Telecommunications Plan

This is pending pricing information from Khrunichev Telecom. There is possible sharing arrangement with the Japanese to reduce costs, to be discussed at necessary.

6.5. Photos of Spacecrafts for PR purposes

Eurockot asks that photos for NLS-1 and NLS-2 spacecrafts be made available for Public Relation purposes.

7. ATTACHMENTS

7.1. Path of the Rockot/Breeze-KM

7.2. Orbital Injection Profile

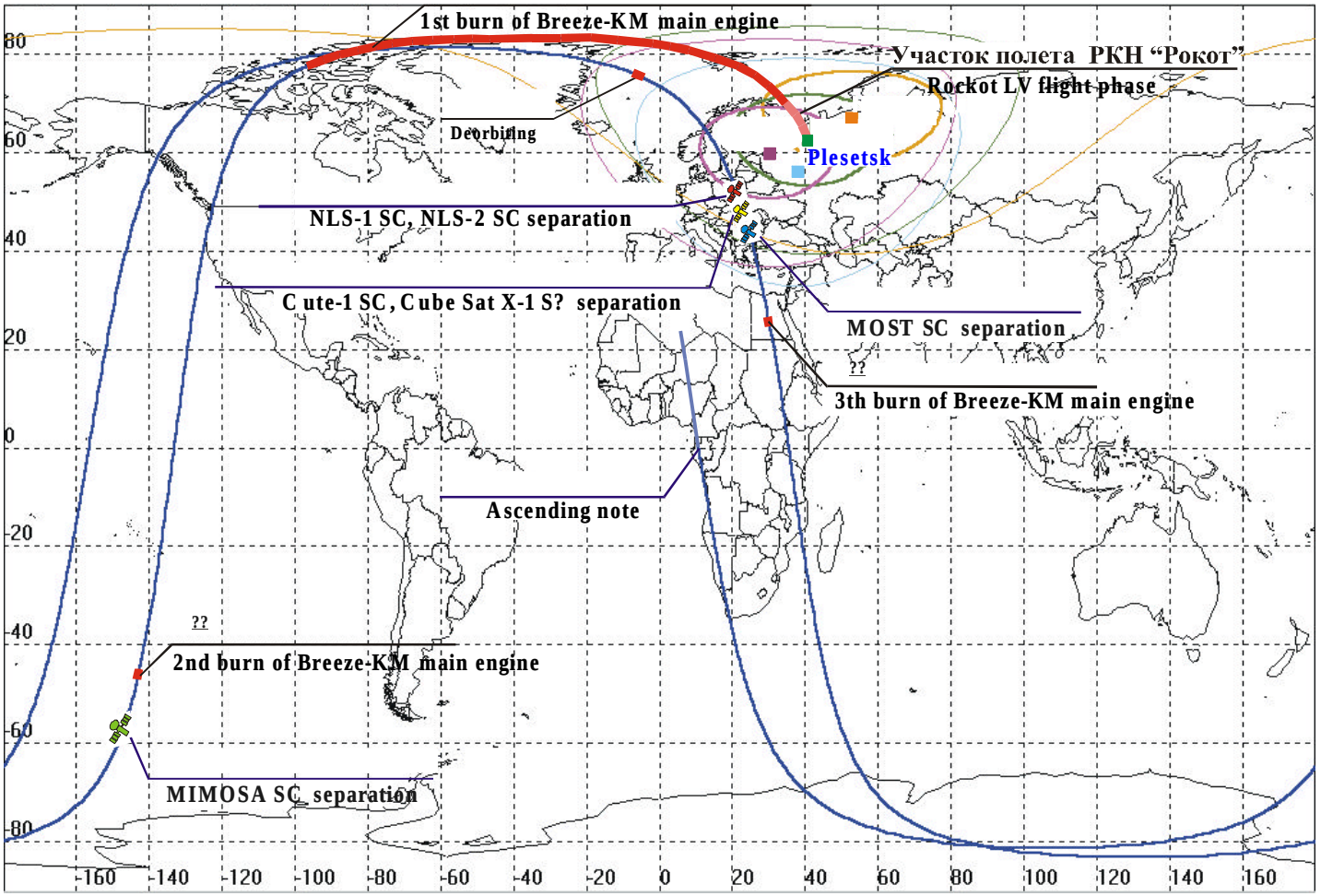
7.3. Map of the Town of Mirny, Plesetsk

7.4. Payload Processing Facility, Spacecraft and GSE Area

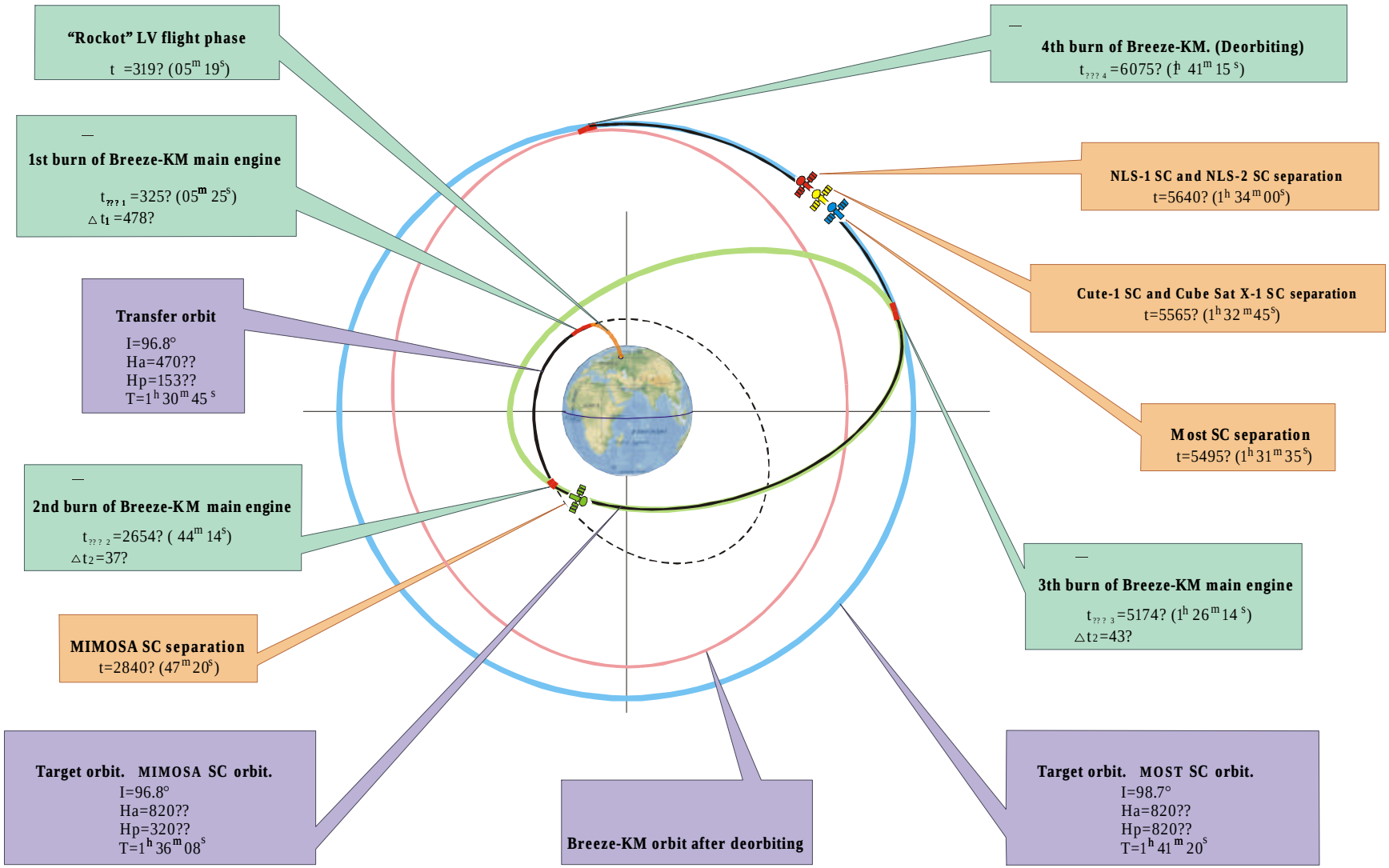
7.5. Payload Processing Facility, 2nd-Floor Office

7.6. Payload Processing Facility, Secure Storage Area

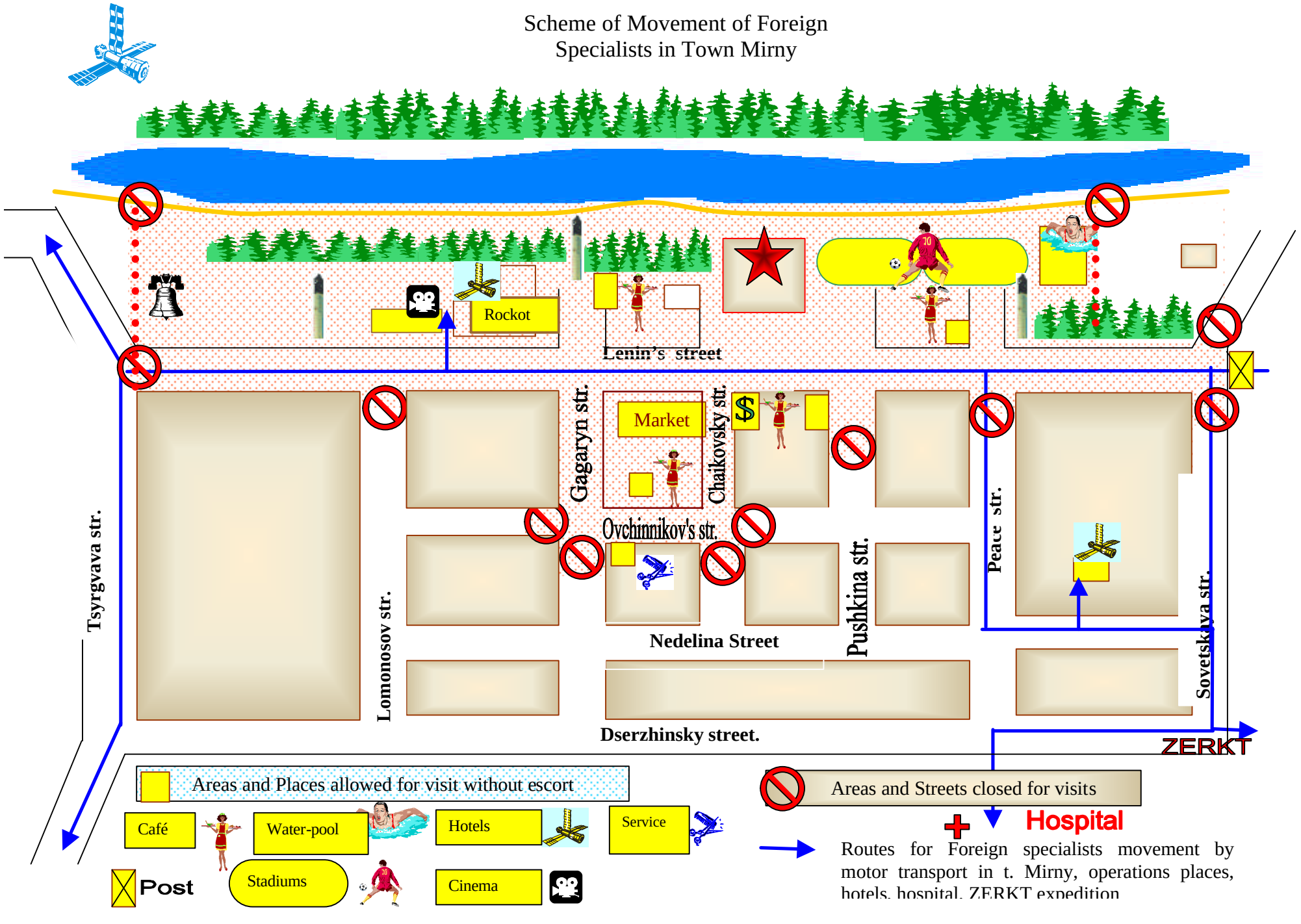
ROCKOT/BREEZE-KM path for MIMOSA, MOST and Nano SC



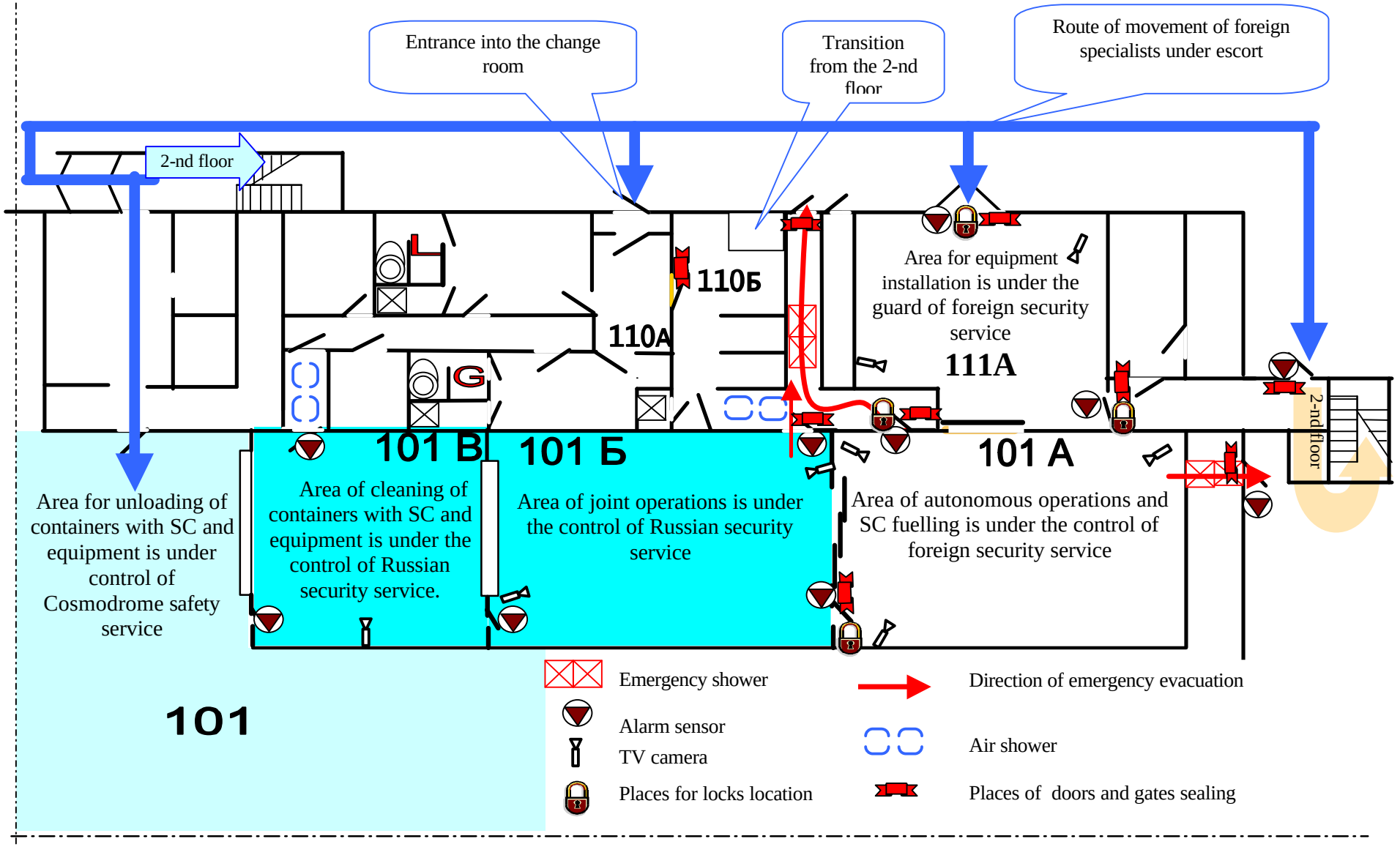
Profile of MIMOSA SC, MOST SC and nano-SC injection by Rockot



Appendix 7.3. Map of the Town of Mirny, Plesetsk

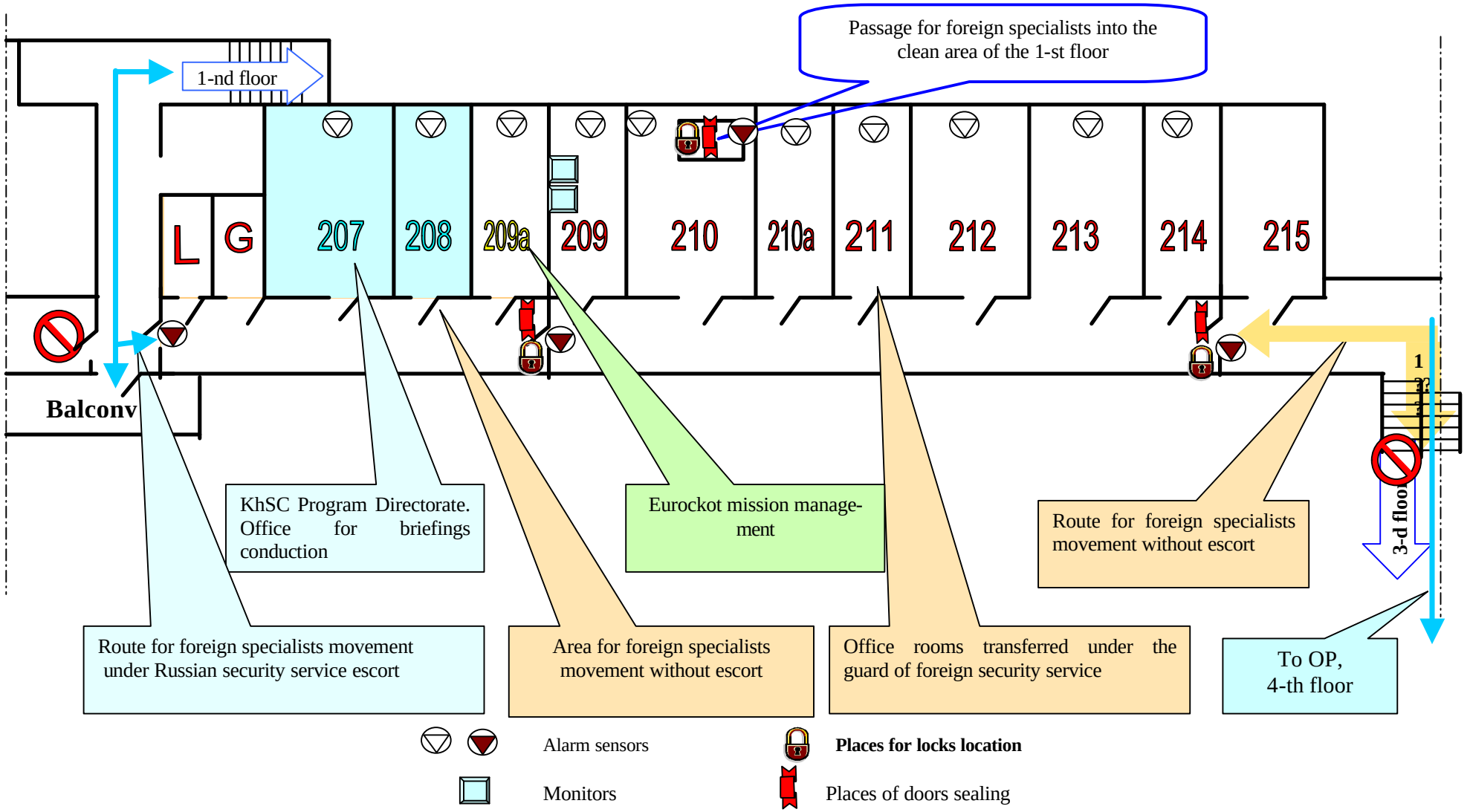


Scheme of rooms on the 1-st floor of the facility 130, area 32 T transferred to and the order of closing and sealing



Appendix 7.5. Payload Processing Area
2nd Floor Office Area

Plan
of rooms transferred to the 2-nd floor of facility 130, area 32T and the order of their closing and sealing



Plan
Of rooms transferred to Facility No1, area 133
and the order of their closing and sealing