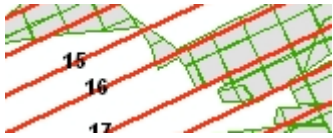
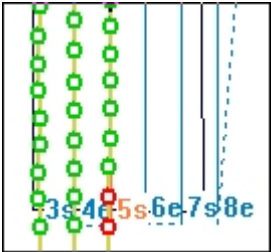








### 2.1. IMAGING SUB-SYSTEM

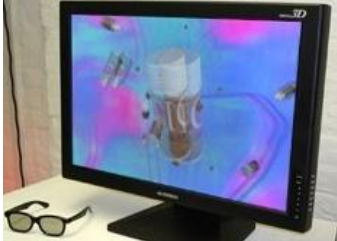
No	COMPONENT	SPECIFICATIONS		
1	Software <b>EnsoMOSAIC FlightPlan</b>	<ul style="list-style-type: none"> <li>Numeric flight planning in MS-Excel</li> <li>Graphical flight line design in ArcView 3.x or 9.x</li> <li>Exporting the flight lines into the navigation software NavCam</li> </ul>		
2	Software <b>NavCam</b>	<ul style="list-style-type: none"> <li>Display of flight track and route and the position of the aircraft.</li> <li>Display of the deviation from the planned flight line for the pilot</li> <li>Control image grabbing</li> <li>NavCam runs on all Windows OS</li> <li>Manual</li> </ul>		
3	Software <b>NovAtel Connect</b>	<ul style="list-style-type: none"> <li>Configure and initialize the GPS</li> <li>Upgrade firmware</li> </ul>		
4	<b>Battery, 12 V</b>	<ul style="list-style-type: none"> <li>For testing the in-flight equipment on the ground</li> <li>For running the in-flight equipment disconnected from aircraft power source</li> <li>2 pieces to produce 24 V</li> </ul>		
5	<b>Battery charger</b>	<ul style="list-style-type: none"> <li>To charge the car batteries</li> </ul>		
6	<b>Camera mount</b>	<ul style="list-style-type: none"> <li>Constructed locally to fit the airplane to be used for imaging</li> </ul>		
7	<b>Laptop computer</b>	<ul style="list-style-type: none"> <li>With fixed serial port or USB port for GPS and trigger signals</li> <li>With external display port for navigation display</li> <li>Intel 1.8 GHz processor</li> <li>RAM 1 GB</li> <li>Hard disk 70 GB</li> <li>Win XP / Win 7</li> </ul>		
8	Camera <b>Nikon D3X</b> Configuration RGB  OR EQUIVALENT CANON, MINOLTA, ETC.	<ul style="list-style-type: none"> <li>36 x 24 mm CMOS sensor, 24.5 Megapixels (6048*4032).</li> <li>Colour depth 14 bits (RAW) or 8 bits (JPG).</li> <li>The sensitivity of the sensor is equal to 100 – 1600 ASA (ISO).</li> <li>JPEG or RAW storage format into compact flash memory</li> <li>Shutter speed between 1/8000 and 30 seconds, manual or automatic selection.</li> <li>Aperture and focus can be set manually or automatically.</li> <li>With battery, AC-adapter and battery charger</li> <li>With lenses AF-S Nikkor 50mm/1.4 G and AF Nikkor 28mm/2.8 D</li> <li>With a protective case for the camera and accessories</li> <li><b>Calibrated</b></li> </ul>		
9	Memory cards <b>Sandisk or equivalent</b>	<ul style="list-style-type: none"> <li>Capacity 32 GB</li> <li>2 units</li> </ul>		

10	Imaging electronics <b>EnsoMOSAIC</b>	<ul style="list-style-type: none"> <li>• EnsoMOSAIC installation case</li> <li>• Inverter, from 24 V to 240 V, power supply for camera and laptop</li> <li>• Converter, from 24 V to 12 V, power supply for GPS and control box</li> <li>• EM control box integrating GPS, laptop and camera</li> <li>• Available in 110V instead of 240V</li> <li>• Cabling</li> <li>• Weight 7 kg</li> </ul>		
11	GPS <b>Novatel FlexPak 6-L1</b>	<ul style="list-style-type: none"> <li>• Horizontal accuracy 1.8 meters. Vertical accuracy 1.5 – 2 times the horizontal accuracy.</li> <li>• real time Pulse Per Second (PPS).</li> <li>• GPS antenna (FAA certified)</li> <li>• Upgradeable with Omnistar VBS or HP, L1/L2, Glonass</li> <li>• The FlexPak6 is software upgradable, Upgrades by authorization code from Novatel</li> </ul>		
12	External display <b>Niceview 8" TFT SVGA</b>	<ul style="list-style-type: none"> <li>• TFT display of 8 inches</li> <li>• Display of the deviation of the aircraft from the flight line for the pilot</li> <li>• Connects to a parallel display port of the navigation laptop</li> </ul>		
13	<b>Orientation sensor</b>	<ul style="list-style-type: none"> <li>• XSENS MTI-G</li> <li>• GPS aided MEMS-based Attitude and Heading Reference System (AHRS)</li> <li>• Drift-free, GPS-enhanced, 3D orientation data.</li> <li>• Integrated with NavCam trigger control</li> <li>• Initial alignment with the camera.</li> <li>• Attached to the camera body or to the accessory shoe</li> </ul>		
14	<b>GIS software</b> <b>ArcView</b>	<ul style="list-style-type: none"> <li>• ArcView or compatible</li> <li>• Design of flight lines</li> <li>• Also needed in image processing sub-system for orthomosaic resampling</li> </ul>		
15	<b>Training, Imaging</b>  4 days	<ul style="list-style-type: none"> <li>• Basics of aerial imaging and camera operation</li> <li>• Estimation of flight parameters</li> <li>• Design of the flight lines</li> <li>• Compilation of NavCam input files</li> <li>• Electricity systems</li> <li>• Installation of the camera</li> <li>• Operation of laptop computer for navigation and camera triggering</li> <li>• Aircraft navigation and camera triggering with laptop and NavCam</li> <li>• Communication with the pilot</li> <li>• Camera operation</li> <li>• Verification of flight track</li> <li>• Control of image quality</li> </ul>		

## 2.2. IMAGE PROCESSING SUB-SYSTEM

No	COMPONENT	SPECIFICATIONS		
16	<b>Software</b> <b>RapidCal</b>	<ul style="list-style-type: none"> <li>• Definition of calibration targets</li> <li>• Calculation of camera internal orientation</li> <li>• Create camera calibration certificate</li> </ul>		
17	<b>Software</b> <b>RapidPreprocess</b>	<ul style="list-style-type: none"> <li>• Transformation of 3 image bands into the same coordinate system</li> <li>• Conversion of raw images into TIF with proper Bayer treatment</li> <li>• Adaptive modelling of hot spots and lens vignetting</li> <li>• Normalizing modified CIR camera images</li> <li>• Transformation of &gt;8 bit images to 8-bit with logarithmic transformation</li> <li>• Calculation of ideal (distortion free) images</li> </ul>		
18	<b>Software</b> <b>EnsoMOSAIC</b>	<ul style="list-style-type: none"> <li>• Automatic location of tie points from overlapping images applying feature extraction</li> <li>• Image rectification by block adjustment</li> <li>• A set of spectral corrections</li> <li>• Automatic DEM generation for internal orthorectification</li> <li>• Output mosaic resampling with internal DEM</li> <li>• Runs on Windows 2000/XP/Vista/7.</li> <li>• Processes large, medium and small format images</li> <li>• Processes single flight line imagery for corridor mapping</li> <li>• Does not require initial orientations from IMU, optional</li> <li>• Software manual</li> </ul>		
19	<b>Software</b> <b>RapidSeamline</b>	<ul style="list-style-type: none"> <li>• Improvement of orthomosaics for urban areas</li> <li>• Create cut lines for images</li> </ul>		
20	<b>Computer PC</b>	<ul style="list-style-type: none"> <li>• Minimum RAM 1 GB, CPU 0.5GHz, disk 100 GB</li> <li>• Recommended RAM 4 GB, CPU 2 GHz, disk 500 GB</li> <li>• Min 17" monitor</li> <li>• MS Windows XP / 7</li> </ul>		
21	<b>Training</b> <b>Image processing</b> 3 days	<ul style="list-style-type: none"> <li>• Camera calibration</li> <li>• Organizing the data on hard disks</li> <li>• Creating EnsoMOSAIC image block</li> <li>• Automatic and manual tie point measurement</li> <li>• Entering ground control points</li> <li>• Spectral corrections</li> <li>• Image rectification through block adjustment</li> <li>• Mosaic resampling</li> <li>• Quality control and error correction</li> </ul>		

### 2.3. IMAGE UTILIZATION SUB-SYSTEM

No	COMPONENT	SPECIFICATIONS		
22	Monitor <b>Planar SA2311W</b> Stereoscopic 3D or Zalman M220W	<ul style="list-style-type: none"> <li>• 3D display resolution 1920 x 1200 (active 3D) or 1920 x 600 (per eye, passive 3D)</li> <li>• Interface DVI + VGA</li> <li>• Size 24 " diagonal</li> <li>• With polarized or active lenses (2 pieces)</li> </ul>		
23	<b>Computer PC</b>	<ul style="list-style-type: none"> <li>• Minimum RAM 1 GB, CPU 1 GHz, disk 100 GB</li> <li>• Recommended RAM 4 GB, multi-core CPU 2 GHz, disk 500 GB</li> </ul> Graphics card: <ul style="list-style-type: none"> <li>• Minimum for passive stereo: OpenGL support</li> <li>• Recommended for active stereo: NVIDIA Quadro 4000</li> </ul>		
24	<b>Software</b> <b>EnsoMOSAIC 3D</b>	<ul style="list-style-type: none"> <li>• XYZ – point cloud from oriented images</li> <li>• 3D visualization</li> <li>• 3D digitizing into external database (e.g. into ArcGIS)</li> <li>• DEM calculation</li> <li>• Calculation of contours</li> </ul>		
25	<b>Training</b> <b>Image utilization</b> <b>3D</b>  3-5 days	<ul style="list-style-type: none"> <li>• Hardware and software setup</li> <li>• Stereoscopic viewing</li> <li>• Introduction to 3D analysis</li> <li>• Importing image orientations</li> <li>• Calculating point clouds</li> <li>• Calculating elevation models</li> <li>• Calculating contours</li> <li>• Volume calculations</li> <li>• 3D-digitizing</li> <li>• Internal and external databases</li> </ul>		

#### 2.4. MAINTENANCE AND SUPPORT

No	COMPONENT	SPECIFICATIONS		
26	Maintenance and support for EnsoMOSAIC, EnsoMOSAIC 3D NavCam, RapidCal, RapidPreprocess, RapidSeamline	<ul style="list-style-type: none"> <li>• All new software versions and documentation, delivered electronically or through Support Area Services.</li> <li>• Access to EnsoMOSAIC bulletin board for user support</li> <li>• Maintenance of e-mail address for contacts with the Customer</li> <li>• Technical support for the Software by e-mail, telephone and internet.</li> <li>• Right to order at hourly fee the following additional maintenance and support services:               <ul style="list-style-type: none"> <li>• Analyzing and processing data of the Customer</li> <li>• Solving user errors and operator-related problems</li> <li>• Project planning and implementation for imaging and image processing</li> <li>• Training in Software operation</li> <li>• Software development specified by the Customer</li> </ul> </li> </ul>		