UAV Road Surface Monitoring and Traffic Information
New capabilities for Unmanned Aerial Systems

- Current usage (military operation service)
- Possible civil usage (possible missions)
- Legislative background
- Needs for suitable technologies (collision avoidance, BLOS communication, data processing, ...)

Czech Republic
Suitable UAS missions

- Any kind of monitoring or surveillance missions
- Substitution for satellite monitoring (weather monitoring, environmental monitoring, civil security, ...)
- Substitution for piloted flights (police monitoring planes or helicopters, fire guard planes or helicopters, dusting planes, coast guard planes ...)

Czech Republic
UAS advantages in comparison to satellite missions

- Rapidly lower purchase price, lower cost of operation and maintenance procedures
- Much better accuracy of acquisition data (picture resolution, ...)
- High maneuverability
- Wide availability
- Ability to accomplish a broad spectrum of narrow specified missions

Current satellite mission
UAS advantages in comparison to piloted missions

- Lower cost of operation and maintenance procedures
- Higher duration of flight
- Minimized risk of failure of human factor (lassitude, carelessness, …)
- Minimized risk of human losses in case of crash or accident

Common piloted police helicopter
JAA/Eurocontrol, UAV TASK-FORCE

- A CONCEPT FOR EUROPEAN REGULATIONS FOR CIVIL UAVs (2004)
- Airworthiness & certification
- Security
- Operations, Maintenance, Licensing
- ATM
- Aerodromes
Applicable technologies and technical needs

- Collision avoidance systems (Sense & Avoid)
- Terrain avoidance systems
- Beyond Line of Sight (BLOS) communication
- Bandwidth requirements
Proposed UAS missions

- **Mission #1**: Roads Surface Condition Monitoring (in mountain region)
- **Mission #2**: Highway Traffic Monitoring
- **Mission #3**: City Traffic Information and Management
Mission #1: Roads Surface Condition Monitoring (in mountain regions)

- Monitoring road icing and surface condition with respect to meteorological situation
- Prediction of danger traffic situations
- Gritting vehicles management
UAS Payload

- Electro-Optical/Infrared sensor (with ability see through clouds and fog)
- Surface temperature measurement system (thermal camera)
- Future development of necessary sensors
- Data processing must be specified
Scheduled UAS missions

- Mission planning according to the actual weather forecast
- Navigation by following way-points tracking roads in desired areas
UAS availability

- During winter period continual missions to ensure actual state information
- Actual availability regarding weather forecast and actual conditions (temperature, snow-fall, ...)
- Emergency situations in case of snow calamity
HAES Scanner
Mission characteristics

- Payload: 10 kg
- Range: 25 km
- Altitude: 1000 m
- Speed: 80 - 150 km/h
- Endurance: 2 hr
Mission #2: Highway Traffic Monitoring

- Highway traffic monitoring using UAS on-board camera
- Providing real-time video information for Uniform Traffic Information System
- The most important information: car accidents, traffic jams, road work information, weather conditions
- Desired characteristics: as quick as possible reaction on actual occurrence
Uniform traffic information system (Czech Republic)

- Road and Motorway Directorate (RSD)
- Uniform Traffic Information System (JSID)

**Inputs:** emergency calls (police, ambulance, …), toll-gates sensors/cameras, static cameras, radars

**Outputs:** radio, Internet, information panels, GPS, SMS/MMS
UAS Payload

- High resolution camera in daylight conditions, infrared imaging system in case of night operations
- Effective data processing of flow of moving vehicles
UAS availability

- Continual missions to observe actual situation
- Following way-points tracking highways
Mission #3: City Traffic Information and Management

- Monitoring of city traffic situation
- Insist on traffic during morning and afternoon peak time
- Monitoring of critical areas (highway exits, cross-roads, …)
- Adaptive semaphore algorithms regarding actual situation
UAS Payload

- High resolution camera in daylight conditions, infrared imaging system in case of night operations

- Key issues:
  - Optics
  - Chip resolution
UAS availability

- Daily continual missions insist on traffic peak time
Experience with using UAS

- Demonstration tests
Technological needs

- High performance UAV (all-weather operations)
- BLOS datalink
- Collision avoidance
- Terrain avoidance
- Suitable IR sensor (road surface analysis)
- Camera (sufficient optics, chip resolution)
Services delivered by UAS providers

- Analysis of mission with respect to technical aspect of deployment
- Mounting of required payload necessary to accomplish mission
- Transport to operation area and detailed mission planning
- Ensure UAS operation service and necessary maintenance procedures
- Providing gained data in given format
Looking forward to our co-operation!

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