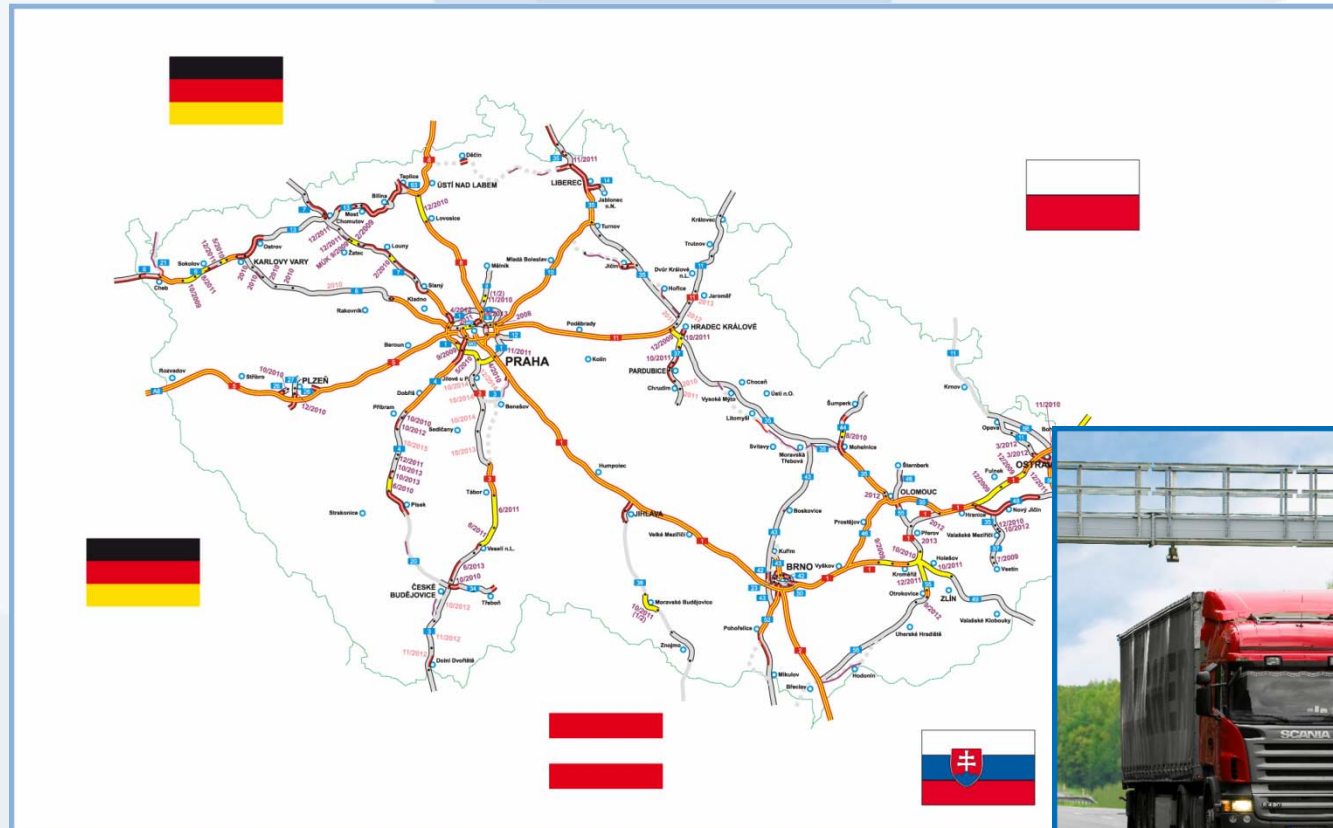


UAV Road Surface Monitoring and Traffic Information



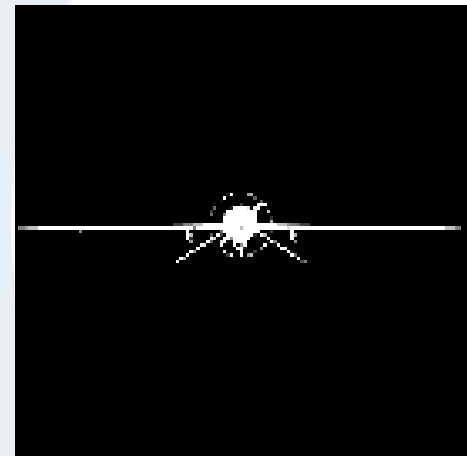
iTSS
Czech and Slovak Intelligent
Transport Systems & Services

Czech Road and Motorway Network



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, ...)



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 ...)



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

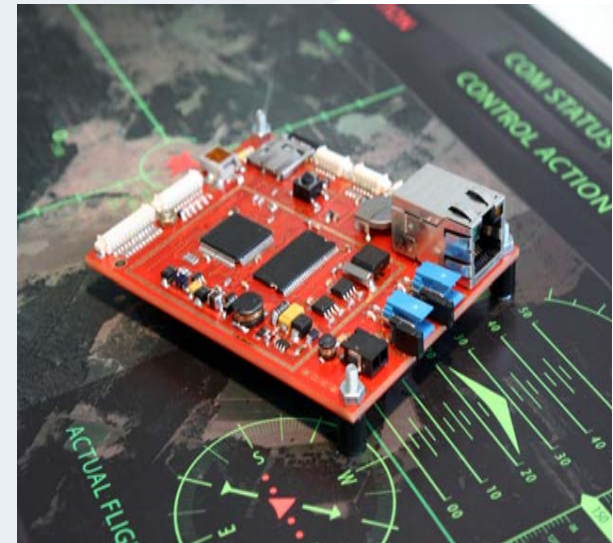
JAA/Eurocontrol, UAV TASK-FORCE

- 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

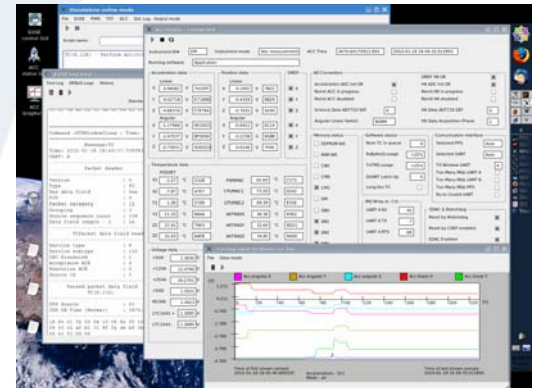
Mission #1: Roads Surface Condition Monitoring (in mountain regions)

- 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

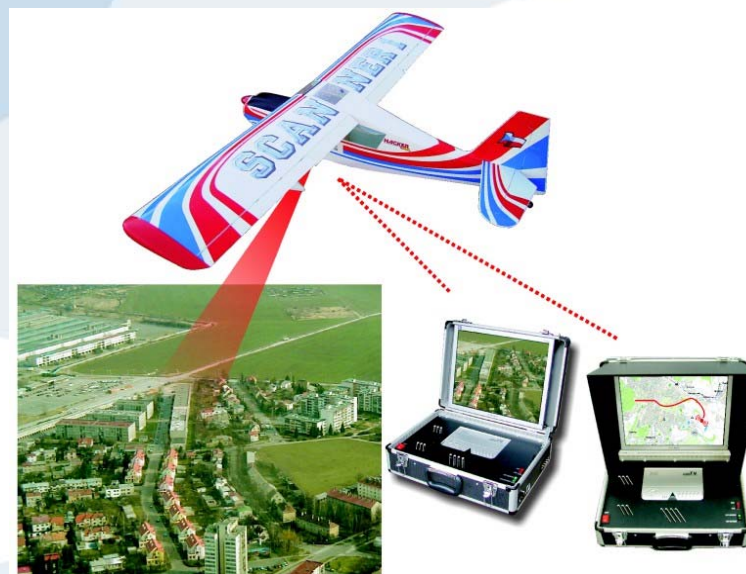
- During winter period continual missions to ensure actual state information
- Actual availability regarding weather forecast and actual conditions (temperature, snow-fall, ...)
- Emergency situations in case of snow calamity



HAES Scanner

Mission characteristics

- Payload: 10 kg
- Range: 25 km
- Altitude: 1000 m
- Speed: 80 - 150 km/h
- Endurance: 2 hr



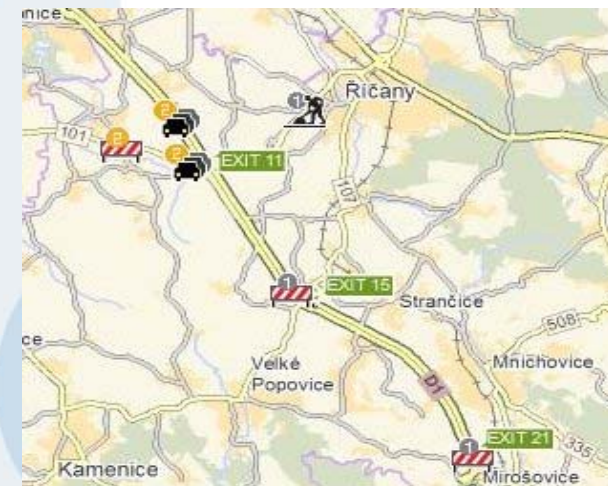
Mission #2: Highway Traffic Monitoring

- 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



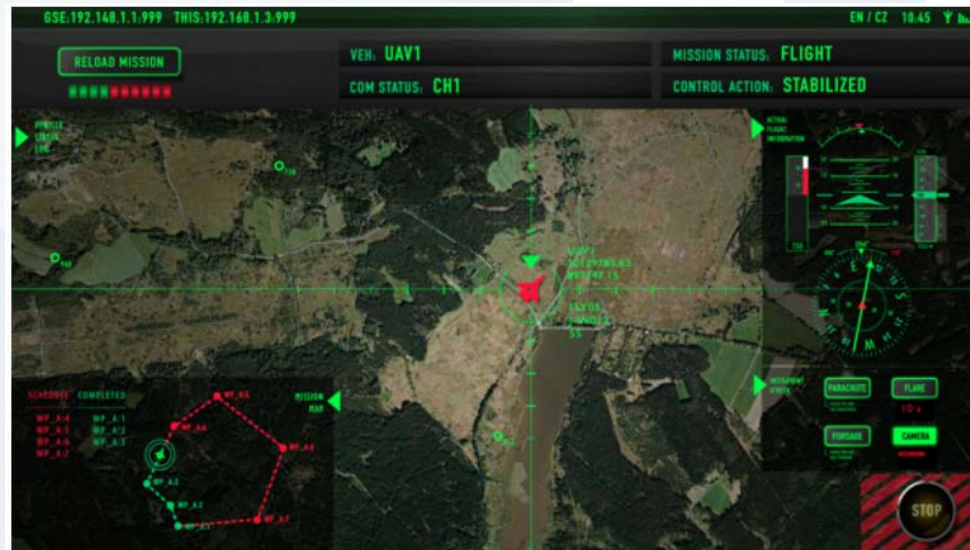
UAS Payload

- 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



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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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