*Bangkok, 10-11 December 2019*

# Working Group on the Trans-Asian Railway Network

*Sixth meeting*

Agenda item 6: Inspection and monitoring of railway infrastructure using aerial drones

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## BACKGROUND AND SCOPE

*"Activities to enhance the planning, design, implementation and operationalization of policies, systems, programmes and measures on transport related technologies"*

ESCAP Transport Division and IRT, Monash University:

- Explore the applications of aerial drones for the inspection, monitoring and proactive maintenance of railway infrastructure;
- Identify long-term sustainability benefits;
- Outline technical risks and limitations;
- Discern legal and regulatory implications.

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# TECHNICAL CAPACITIES AND BENEFITS

## I. Trackside vegetation management

- Proactively maintain sight line visibility at curves;
- Maintain clear visibility of railway signs and signals;
- Maintain integrity of railway communications and electrical distribution lines;
- Reduce fire hazard potential;
- Remove vegetation that can interfere with rock fall and land slide detection equipment.

## II. Infrastructure and asset inspections

Long stretches of open-air track, confined spaces such as tunnels and culverts and high-risk assets such as bridges can be inspected safely, at reduced cost and with more precision.

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## COST SAVINGS

- Labour cost per drone less than $300 in 2017;
- A few hundred drones can monitor 200,000 km of tracks at a fraction of the cost of deploying fixed cameras or “boots on ballast”
- Reduces the need for track occupation/possession and inspections can take place without disrupting operations;
- Exact savings have not been systematically estimated. Examples from other sectors show:
  - Inspection of onshore wind-turbines: ⬇ 50%
  - Chimney flue inspections: ⬇ 90%

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## SAFETY BENEFITS

- Safe access to assets traditionally requiring abseiling or climbing;
- Remote inspection of track sections which lack clear accessible safety zones;
- Ability to collect data from areas previously inaccessible by conventional methods;


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## TECHNICAL LIMITATIONS AND RISKS

- Risks posed by live overhead lines, overhanging vegetation and passing trains;
- Loss of satellite positioning signal and/or ability to control the drone beyond line of sight or beyond the reach of telemetry;
- Physical collisions with rolling stock, other drones or stationary objects/equipment;
- Interference with on-board compass;
- Cyber-security;
- Ground station security.

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## LEGAL AND REGULATORY ENVIRONMENT

- Drone flights traditionally perceived as a type of aviation with special characteristics;
- Traditional principles of manned aviation are not entirely suitable for this type of activity;
- Requirement to maintain visual sight of the drone at all times can be restrictive for railways;
- Licensing, registration and authorization processes typically not flexible enough for the railway environment;
- Airspace access limitations;
- Privacy and data ownership limitations;
- Lack of clarity on incident reporting, liability and insurance.

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## EXAMPLES OF CURRENT USE

- Current drone applications are found in Australia, China, India, the Russian Federation, Singapore and Japan, among others.
- Drones have shown to be effective for the monitoring and control of vandalism, theft, trespassing, suicide attempts, structural inspections, vegetation management.
- Several examples of unmanned aerial traffic management systems under development (e.g. Singapore)

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# POLICY CONSIDERATIONS AND WAY FORWARD

I. INFORMED DECISION-MAKING

- Cost-Benefit Analysis and estimation of actual cost savings could be warranted in the face of increasing drone deployment. Perhaps initially in pilot countries and in cooperation with selected railway companies;
- The applications and potential benefits could then be translated for the entire Trans-Asian Railway network with more specificity.

II. POSSIBLE OPERATIONAL MEASURES

- Inclusion of the special case of infrastructure in national regulation and definition of reasonable training and licensing requirements tailored to that sector could be considered;
- Definition of a common operational environment for flights beyond visual line of sight in special categories such as railways, including consideration of unmanned air traffic control systems for drone corridors along the right of way of railways.

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# POLICY CONSIDERATIONS AND WAY FORWARD

III. RESPONSES TO DATA RELATED SENSITIVITIES

- Incorporation of drone operations into national data-related policies and legislation;
- Clear and enforceable legislation on the ownership and management of data collected by commercial drone use.

IV. LEGAL AND REGULATORY MEASURES

- Application and enforceability of airspace regulation concerning sensitive locations accessible by rail lines;
- Identification and codification of industry best-practices for safe flight planning and operation and incorporation into national guidelines;
- Formulation of a clear and enforceable incident reporting, liability and insurance regime.

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# THANK YOU

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