WLRS: In-Sky-Laser-Safety

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Geodetic Observatory Wettzell
1. Neccessity and strategies
2. Current WLRS In-Sky-Savety equipment
3. Transponder
4. Conclusion
=> area [a] (1.6→40km) most critical
SLR In-Sky-Laser-Safety Strategies

Eyesave Tracking
- Laserpower
  - Divergence

Objekt Detection
- Active
  - Lidar
  - Radar
- Passive
  - Radar
  - Camera
  - Transponder

Applied at Wettzell Laser Ranging System (WLRS)-Site
WLRS Camera System

- Sky-camera mounted on telescope tubus
- Permanent monitoring through observer

but:

- Dependent on observers interpretation and constitution (night-shift, ...)

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but:
- Dependent on observers interpretation and constitution (night-shift, ...) → Not "really“ eyesave
• Honeywell Laser Hazard Reduction System (LHRS) as primary WLRS in-sky-safety device
• Officially approved system
• Covers hole range [a] (0.4-40 kilometers)

but:
• Clutter problems
• High acquisition costs
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• Not VLBI 2010 conform !!!
ADS-B

Automatic Dependent Surveillance - Broadcast is a European Aviation Safety Agency (EASA) approved sole working aviation surveillance system. Global implementation for Europe in 2015 [1]
ADS-B: Continuously broadcast GNSS derived position through aircraft undirected (up to 370km range)
Installation of:

• AirNav® RadarBox PRO (500,- €)
• Antenna and amplifier (200,- €)
• Computer MS Windows based
• USB interface
SLR 2.0 integration

• **Idl2rpc** [3] interface

  - ADS-B
  - `idl2rpc server`
  - `ethernet`
  - `idl2rpc client`

• Provided datastream

```
... az: 168.647604016445 el: 4.32813160650332 time: 55692.5650231481 name: MEA202
az: 299.992452458358 el: 1.77236662100212 time: 55692.5650231481 name: TUI982
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...```

- topocentric elevation angle
- topocentric azimuth angle
- timestamp
- identifier of the plane
To Do

- Verification of aircraft coordinates
- Include avoidance zones for each aircraft
Conclusion

• **ADS-B can not yet replace active radar**
  - still no legally binding for usage in aircraft
  - currently often just used at places where:
    - heavy sky traffic appears
    - no active radar is present

• **Transponder as redundant system**
  - covers hole range \[a\]
  - low cost
  - simple installation
  - network extension planned
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→ all in all: still no satisfying solution meeting fundamental station requirements

