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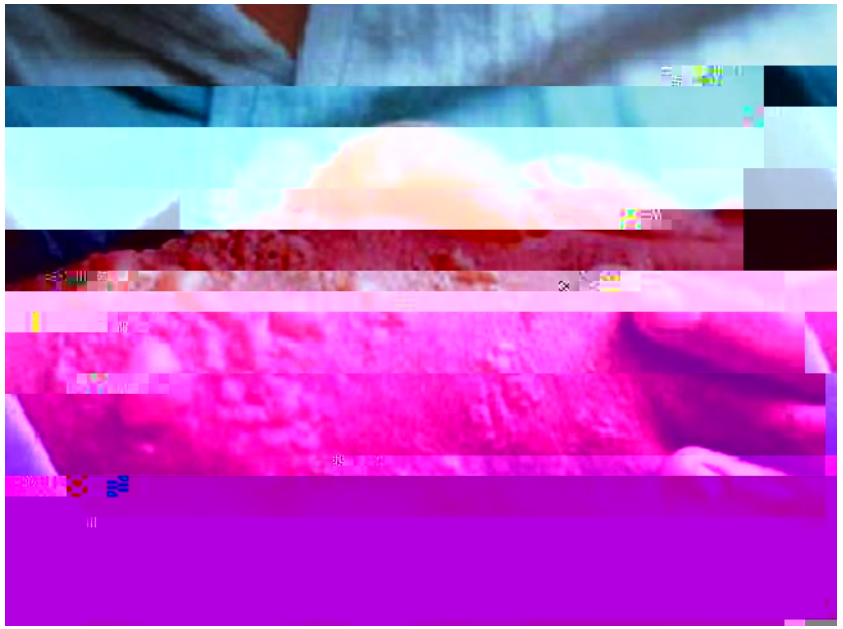
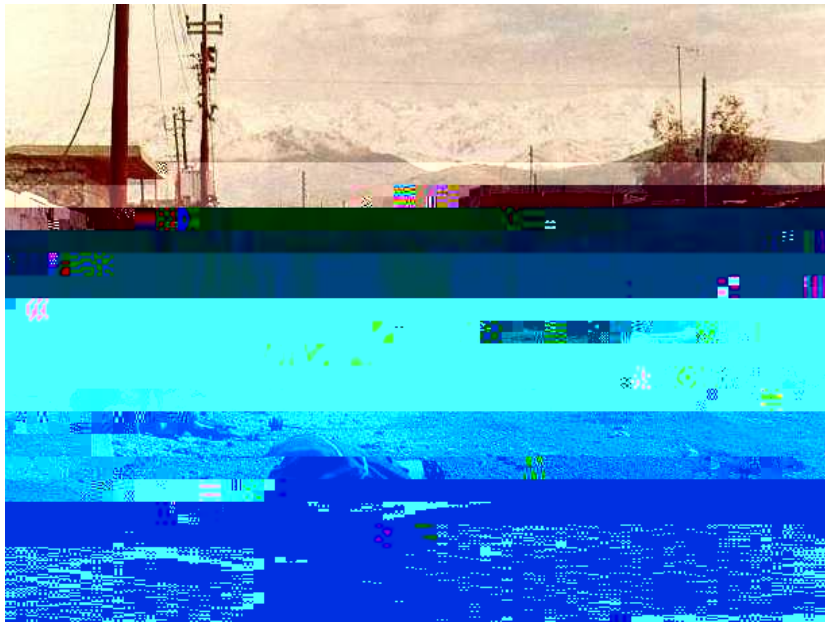
Objectives of CBRN attacks with CBRN materials against soft targets

- Killing or injuring people
- Creating mass panic, even with less toxic substances
  - Even less lethal agents may have such effects: Imagine several UAS flying above a soccer or football stadium obviously spraying/releasing substances
- Variety of CBRN materials suitable, e.g.:
  - Less lethal agents such as irritants
  - Toxic industrial materials such as chlorine, hydrogen fluoride or other acids
  - Chemical or biological warfare agents
  - Radiologicals

Impact on soft targets - examples





Ghabili, K., Agutter, P., S., Ghanei, M., Ansarin, K. Shoja, M., M. (2010): Mustard gas toxicity: the acute and chronic pathological effects. Article in Journal of Applied Toxicology 2010; 30: 627-643.

https://www.amnesty.org/en/latest/news/2016/09/chemical-weapons-attacks-darfur /

Objectives of CBRN attacks with CBRN materials against critical infrastructure

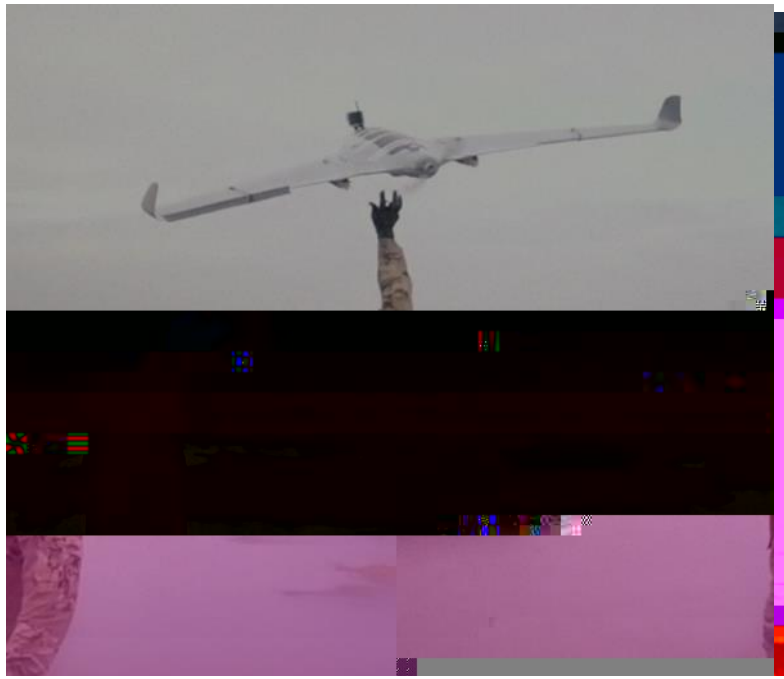
- A CBRN attack on critical infrastructure will – in most cases – be intended to create a **long lasting contamination** and damage

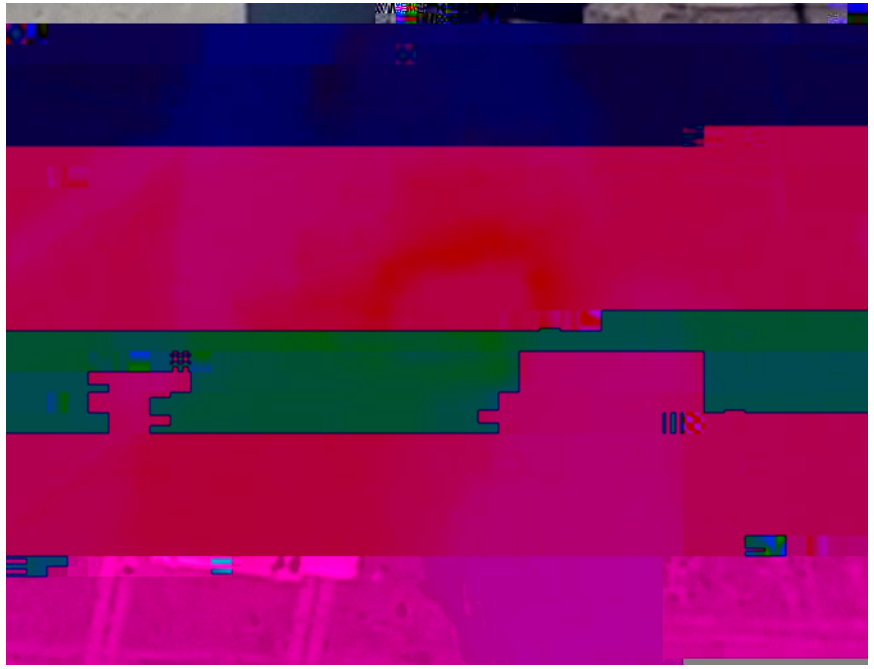
  Typical agents for this purpose: Radiological devices or highly persistent blister or nerve agents such as sulphur mustard or VX

  - Water resources may also be targeted with less lethal substances. Although there will be a dilution effect, the **psychological impact** will result in the situation that nobody will use the water anymore.

- Combination with explosives and CBRN agents: Attacking also first responders, rescue services: removal of debris, urban search and rescue, re-building becomes very difficult **due to the contamination**!

  – Requires urban search and rescue capabilities under CBRN conditions....





Levels of technology for CBRN attacks

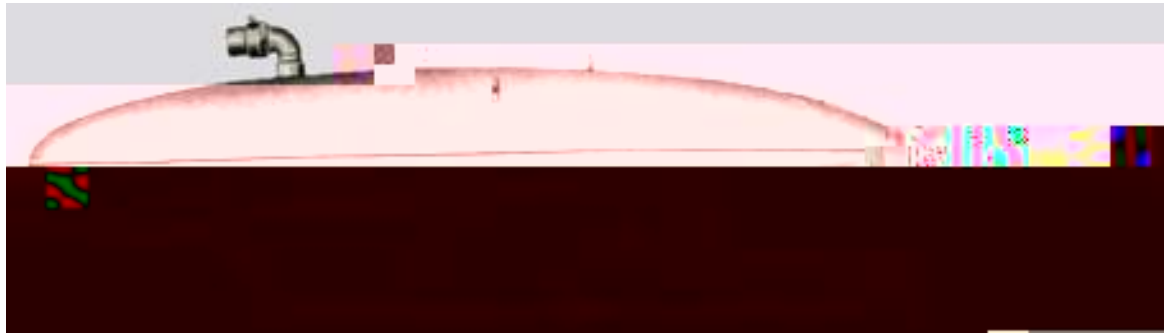
Enhancing UAS with CBRN payloads: Typical means of dispersal and dissemination

- **Explosives** for dispersal (including modified military ordnance)
  - **Bombs, bomblets, dispensers**
  - **Grenades, mines, mortars**
  - Missiles, rockets
  - Pyrotechnic dispersal
- **Bulk containers, cylinders**
-

Low level technology: Spraying devices on small to medium size UAS

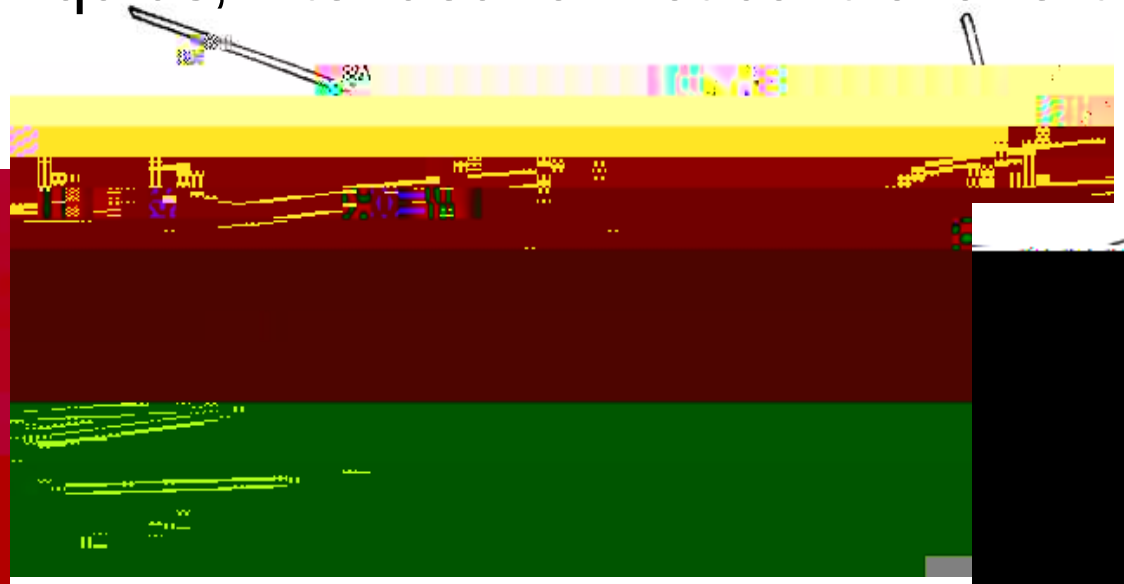
Spray tanks

- Spray Tanks are holding some hundred litres of chemical materials or a wet slurry of biologicals
- Systems may be either pressurized e.g. with a nitrogen bottle or unpressurized and dispenses the contents (up to 100l/second)
- Spray tanks can be mounted on high performance aircraft, cruise missiles, drones, etc.



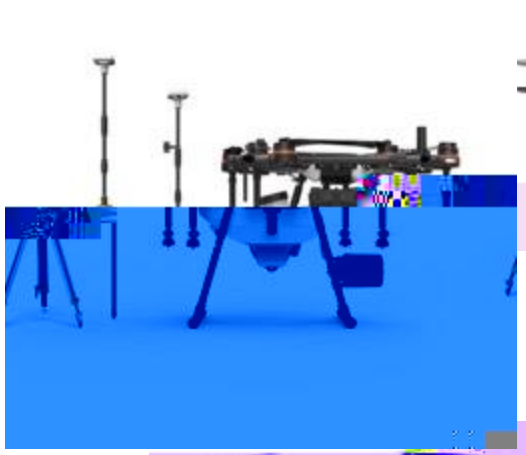
Patents and descriptions available for spray tanks: dual use issue

- Intended for law enforcement and first response
- Mixing and spraying of liquids, intended for riot control or extinguishing fire



Misuse of agricultural drones

- Availability of drones with payload suitable for CBR devices
- UAS crop dusters sprayers
  - Capacity/payload: around 10-25 kg
  - Some examples up to 100 kg



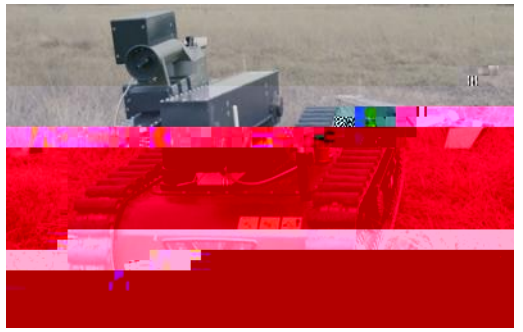
Drone swarms

- Drone swarms carrying CBRN payloads may be considered as a “Weapon of Mass Destruction”
  - Should be subject to international arms control

Combating drones

- Huge efforts world wide to develop appropriate capabilities
  - Pictures show the simulation of CBRN drones carrying small scale chemical payloads and forced landing

- Challenges: Drone swarms, controlled landing procedure, selection of landing zone (CBRNe hazard!)



Prevention and response

- International cooperation for developing proliferation control measures
- Compliance of the UAS industry („know your customer“)
- Implementation detection technologies to detect UAS and for early warning
- Include EOD (explosive ordnance disposal) procedures involving UAS borne improvised explosive and CBRN devices
- TTPs (techniques, tactics and procedures) for taking control over UAS carrying explosive or CBRN payloads
- Classical military air defense for larger UAS, adapted to the smaller size
- Using UAVs and UGVs countering UAVs and UGVs: Surveillance, monitoring and detection with appropriate sensors

Thank you for your attention!

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