# **TAS-S Overview:** Bridging Gaps Between Makers and Users

*Lancaster University, Cranfield University*

Researchers: Dr. Anders af Wåhlberg, Pierre Ciholas, Dr. Oscar Gonzalez Villarreal, Dr. Yi Li , Alvaro Lopez, Dr. Luke Moffat, Dr. Andrew Sogokon, Dr. Zhuangkun Wei, Dr. Zhengxin Yu, Dr. Burak Yuksek.

Engineering and Physical Sciences Research Council

TAS-S

## What is Autonomy?

The ability to effectively conduct a mission with varied levels of absence of human intervention including completely unsupervised operations.

## Autonomous System

- Perceive environment
- Make decision
- Actuate a movement

**Coordination**
- Homogenous / heterogenous fleet operations.
- Resource sharing between assets.
- Maximising the operation effectiveness, safety and security.

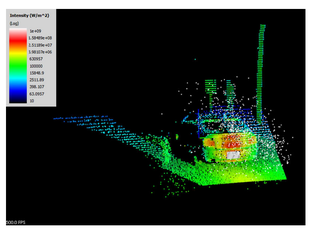
**Control**
- Command tracking with minimum error and appropriate dynamics.
- Adaptation mechanism for different conditions.
- Verifiable closed-loop dynamics and stability for trustworthiness.

**Decision Making**
- Making predictions about physical and environmental phenomena.
- Trustworthy and reliable actions as the system and environment changes

**Learning Enabled**
- Acquiring environmental data and behavioural adaptation in real-time.
- Provable safety and robustness.

**Dynamic**
- Real-time adaptation capability.
- Responsive for environmental, dynamical and operational variations

## UKRI TAS-S Trustworthy Autonomous System node in Security

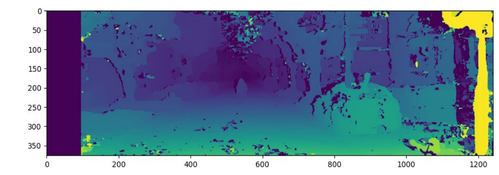


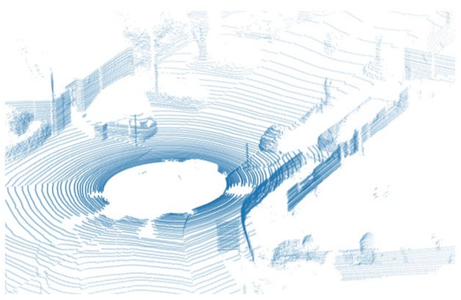
What is trust is performative?
From lack of alternatives
What ways can trust be done differently?

How and/or why do publics trust processes such as this?

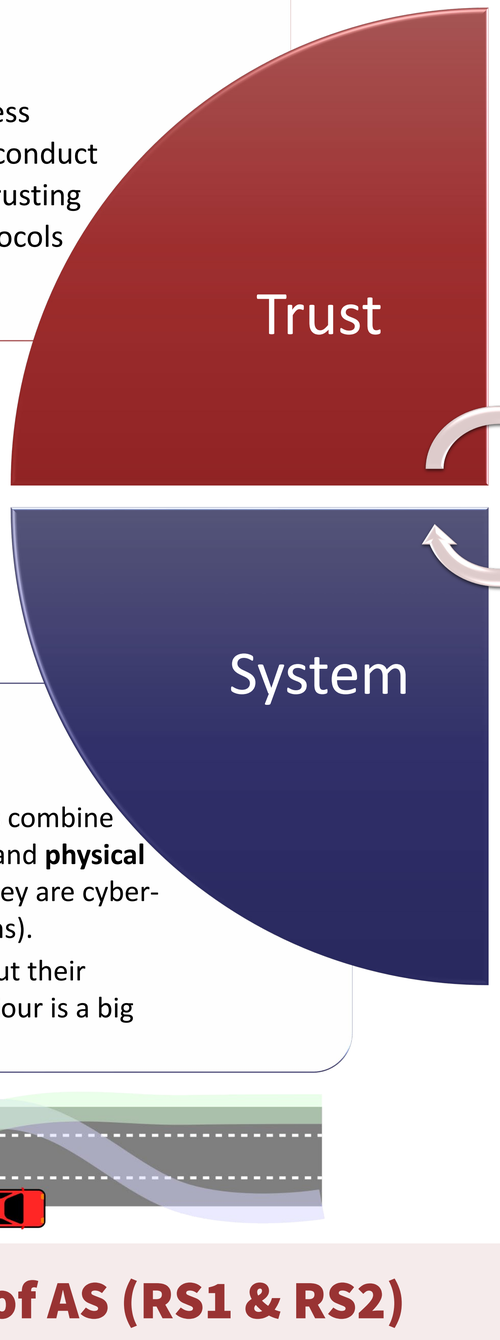
Factoring in resistance and dissent

- Expectation meeting reality
- Risk perception
- Verifiability
- Societal Readiness
- Trust as ethical conduct
- Other ways of trusting
- Indigenous Protocols

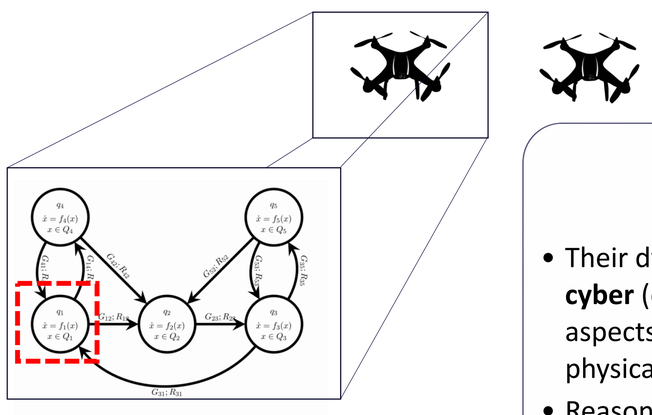




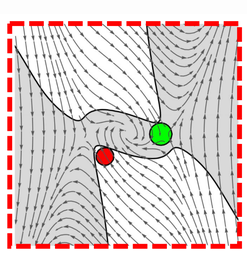
- Co-ordination & control
- Decision making
- Dynamic
- Learning enabled

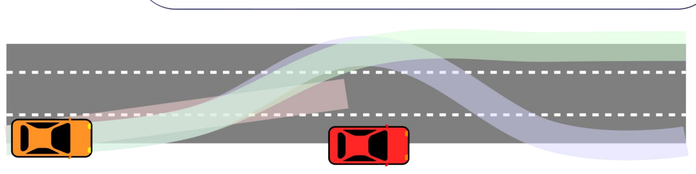



- Autonomous systems are often **networked** and operating in environments where they are exposed to attacks.

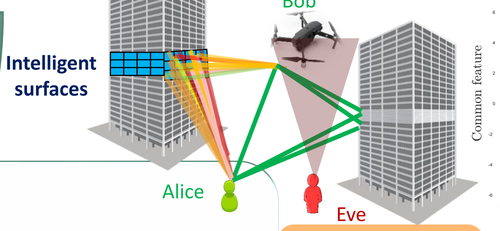


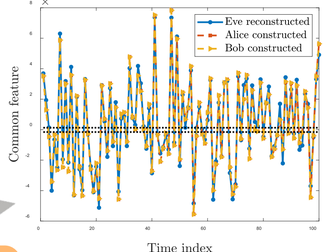
- Their dynamics combine **cyber** (digital) and **physical** aspects (i.e. they are cyber-physical systems).
- Reasoning about their physical behaviour is a big challenge.





- Security of Autonomous systems are from different layers, with specific attack vectors and countermeasures.




- Four layers of security
- **Attacks vectors** – Information leakage, Spoofing, Jamming, Tampering of privilege
- **Countermeasures**- Cryptography, (quantum, physical, mathematical), authentication, Federate differential privacy

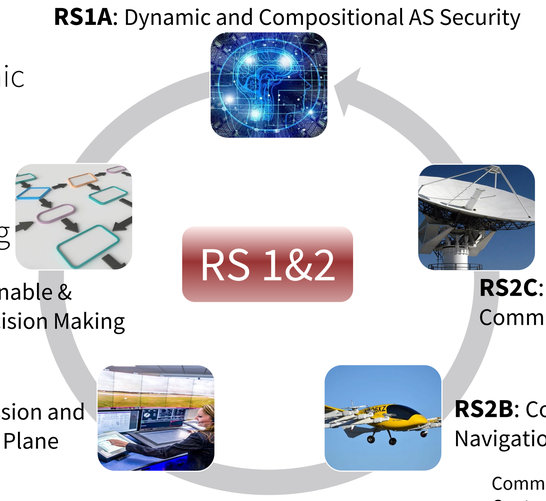
| | |
|---|---|
| App Layer | Learning based method to prevent malicious uses, protect data privacy |
| Network Layer TCP, UDP | Internet protocol and socket security |
| Access Layer Virtual, Mac | Authentication against spoofing and sniffing |
| Physical Layer: control, comms | Protect channels from contamination (jamming, spoofing), and prevent information leakage |



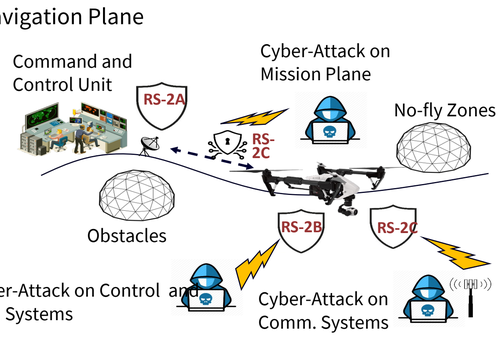

## Secure Usage and Operation of AS (RS1 & RS2)

## Secure Operation and User of AS (RS2 & RS3)

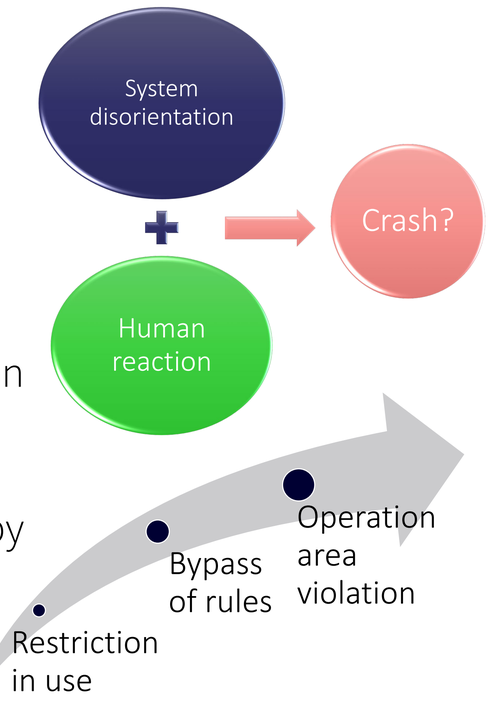
### RS1: Secure Usage
- Adaptive and dynamic ML framework
- Robust learning & Detection
- Safe decision making




### RS2: Secure Operation
- Mission
- Control and Navigation
- Communication




### RS3: Secure User
- Individual Behavioural Adaptation
- Organizational Processes
- Ethical & Legal Security Ecosystem




- If an attack disorientates a vehicle, how does the human react?
- How should the system react to an attack situation to enable the human to safely handle the situation?
- Can autonomous systems be misused through violation of rules by provision of faulty information by users?

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