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Spoofing Earth Observation Satellites through Radio Overshadowing

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Although satellite data is increasingly relied upon, many satellites don't have authenticated downlinks, which opens the door for spoofing attacks. My name's Edd Salkield, and I'm from the Systems Security Lab at the University of Oxford. I'm presenting Firefly, an analysis of the vulnerability and effects of spoofing attacks against current Earth observation satellite systems. In particular, we'll consider the effects of a motivated, modern adversary against NASSA's real-time forest fire API.

The current situation in space is that…

All the tools used in our attack will be published alongside our paper

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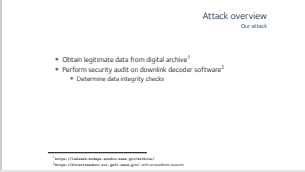

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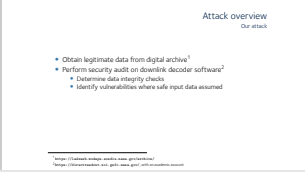

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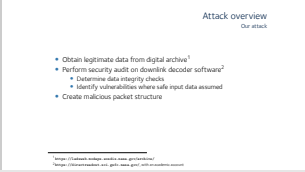

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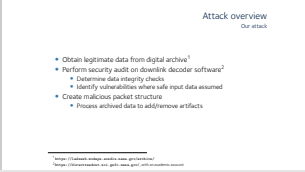

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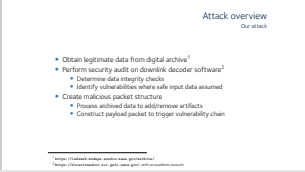

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Cryptography should be required in future satellites

We discuss the countermeasures in context

Multi-receiver data comparison

- Certain systems already have multiple receiver stations
- Protects against decoder exploitation
- Doesn't require any hardware modifications to the receiver

Timing analysis

- Triangulating the source effective in other systems such as aircraft
- Calculated position can be compared against orbital parameters
- Requires accurate clock synchronisation and multiple receivers

Physical-layer fingerprinting

- Analyse properties of the legitimate/overshadowed signal
- Only effective on the downlink

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Existing countermeasures are effective, but aren't viable in all scenarios

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Future research directions

This work confirms the real-world vulnerability of existing Earth Observing systems

Review of vulnerable satellites: dovetails with other conference work e.g. SAR systems

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Future research is required to:

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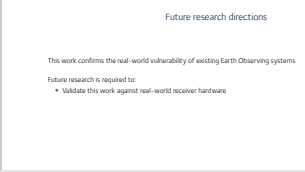

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