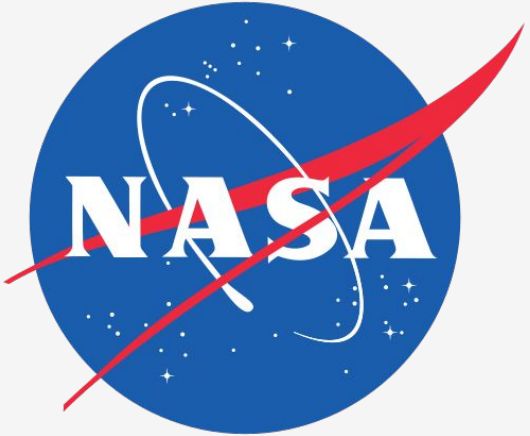
Joseph Rios
Chief Engineer
NASA UTM Project

Global Security Exchange 2019



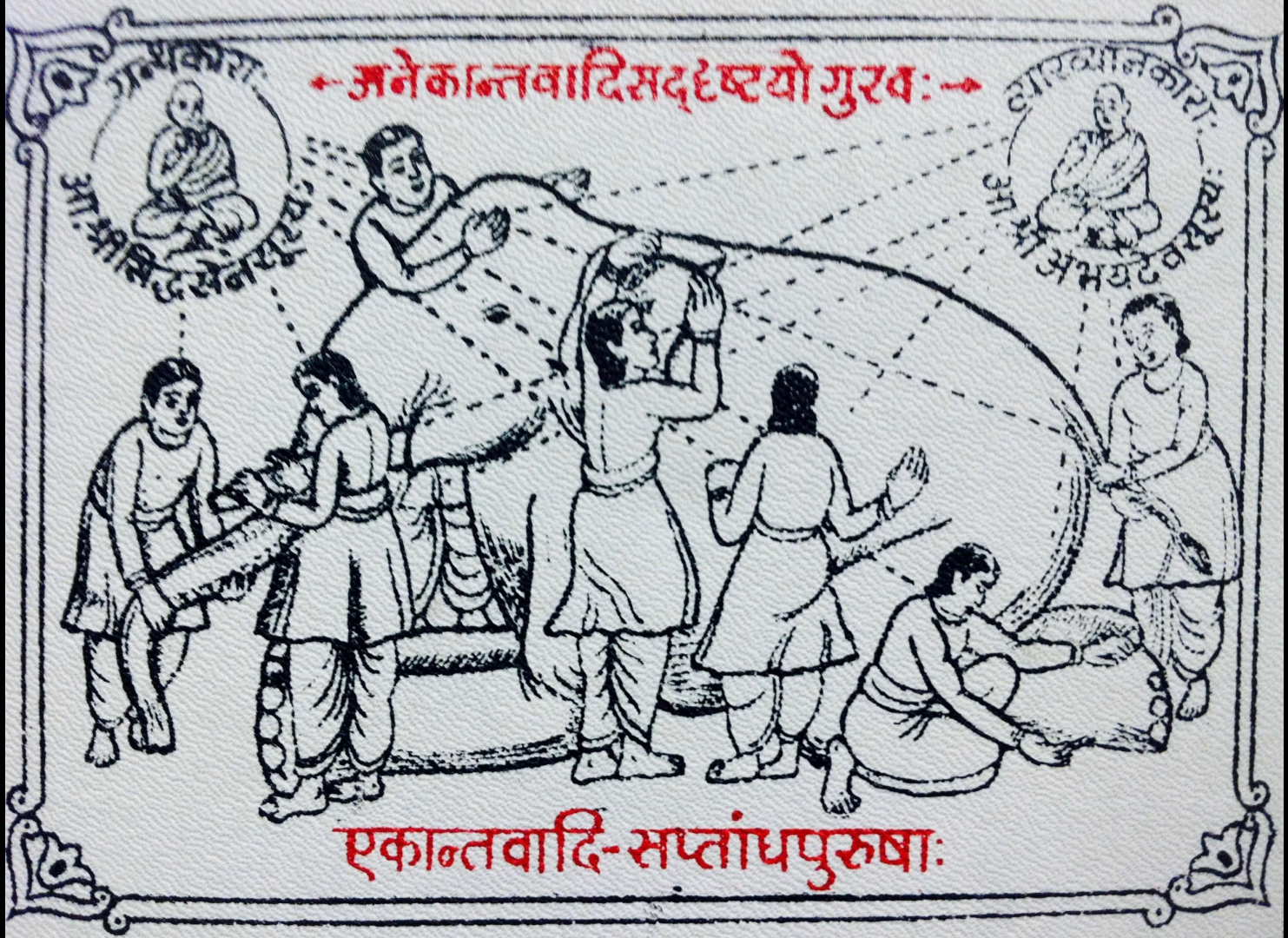
What is UAS Traffic Management?

UTM is an "air traffic management" ecosystem for small UAS in low altitude airspace

UTM utilizes industry's ability to supply services under FAA's regulatory authority where these services do not exist.

UTM development will ultimately identify services, roles/responsibilities, information architecture, data exchange protocols, software functions, infrastructure, and performance requirements to enable the management of low-altitude UAS operations.

Transparency **Security** **Safety** **Commerce** **Scalability**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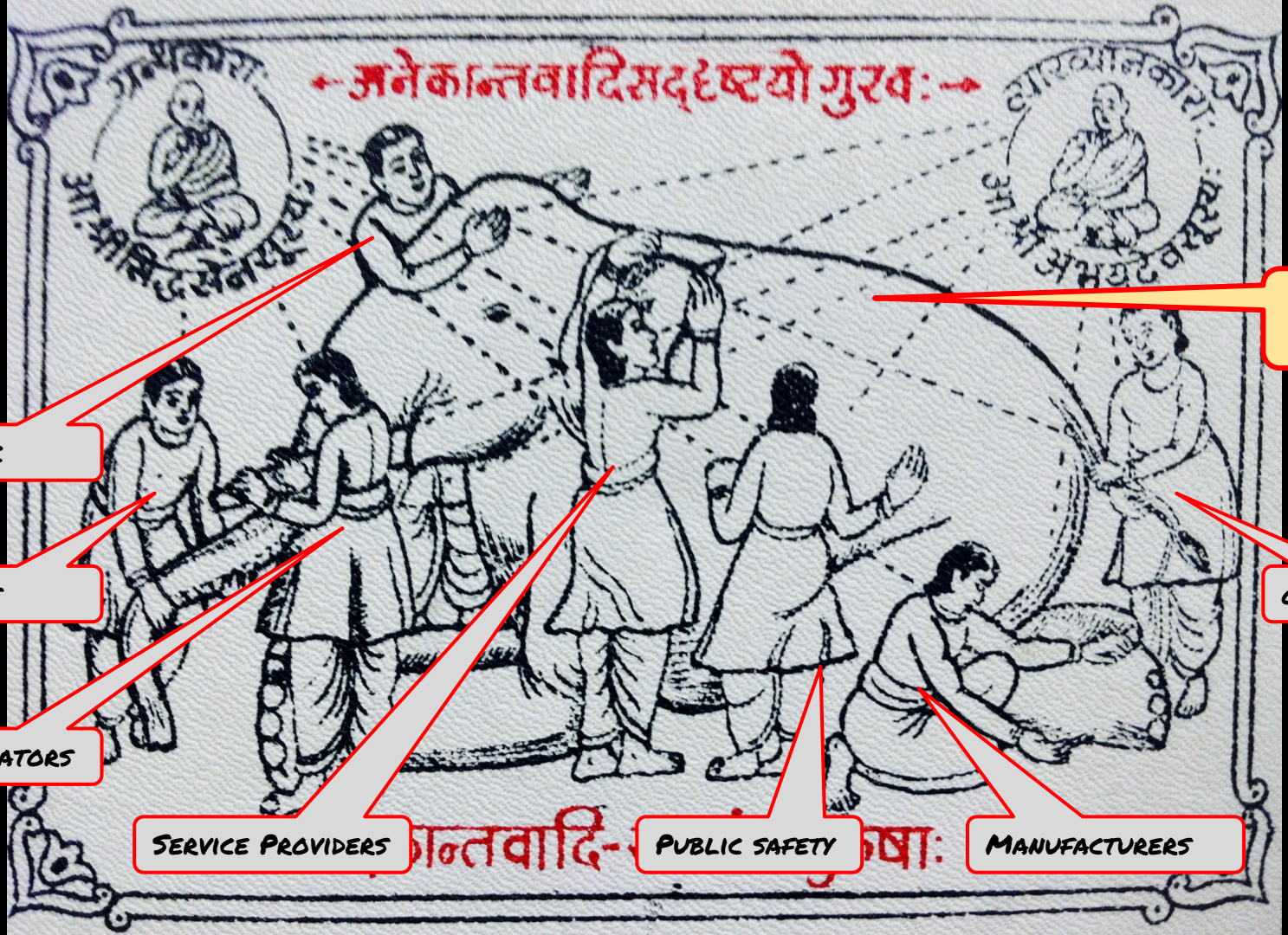

अनेकान्तवादिसदृष्टयो गुरवः
UTM
PUBLIC
PILOTS
REGULATORS
SERVICE PROVIDERS
PUBLIC SAFETY
MANUFACTURERS
OPERATORS

UTM core operating principles

Technical Capability Levels (TCL)

Risk-based development and test approach

TCL 1

- Remote Population
- Low Traffic Density
- Rural Applications
- Multiple VLOS Operations
- Notification-based Operations

TCL 2

- Sparse Population
- Low-Mod Traffic Density
- Rural / Industrial Applications
- Multiple BVLOS Operations
- Tracking and Operational Procedures

TCL 3

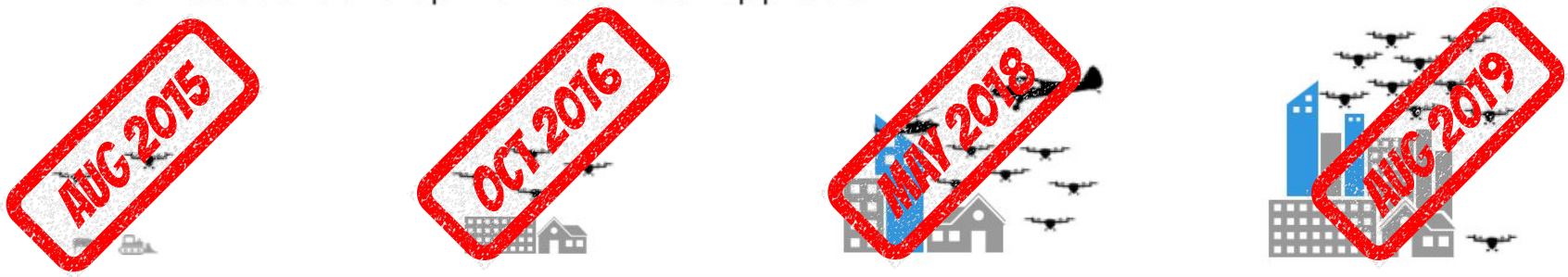
- Moderate Population
- Moderate Traffic Density
- Suburban Applications
- Mixed Operations
- Vehicle to Vehicle Communication
- Public Safety Operations

TCL 4

- Dense Population
- High Traffic Density
- Urban Applications
- Dense BVLOS Operations
- Large Scale Contingency Management

Technical Capability Levels (TCL)

Risk-based development and test approach



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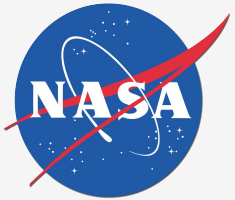
4 Small UAS Over Downtown Reno

NASA TCL4

18 June 2019



Concept(s) of Operation

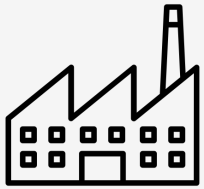
APIs

Specifications

Software Testing Approaches

Component and Service Requirements

Field Testing Results and Analysis



Regulator/ANSP

Industry

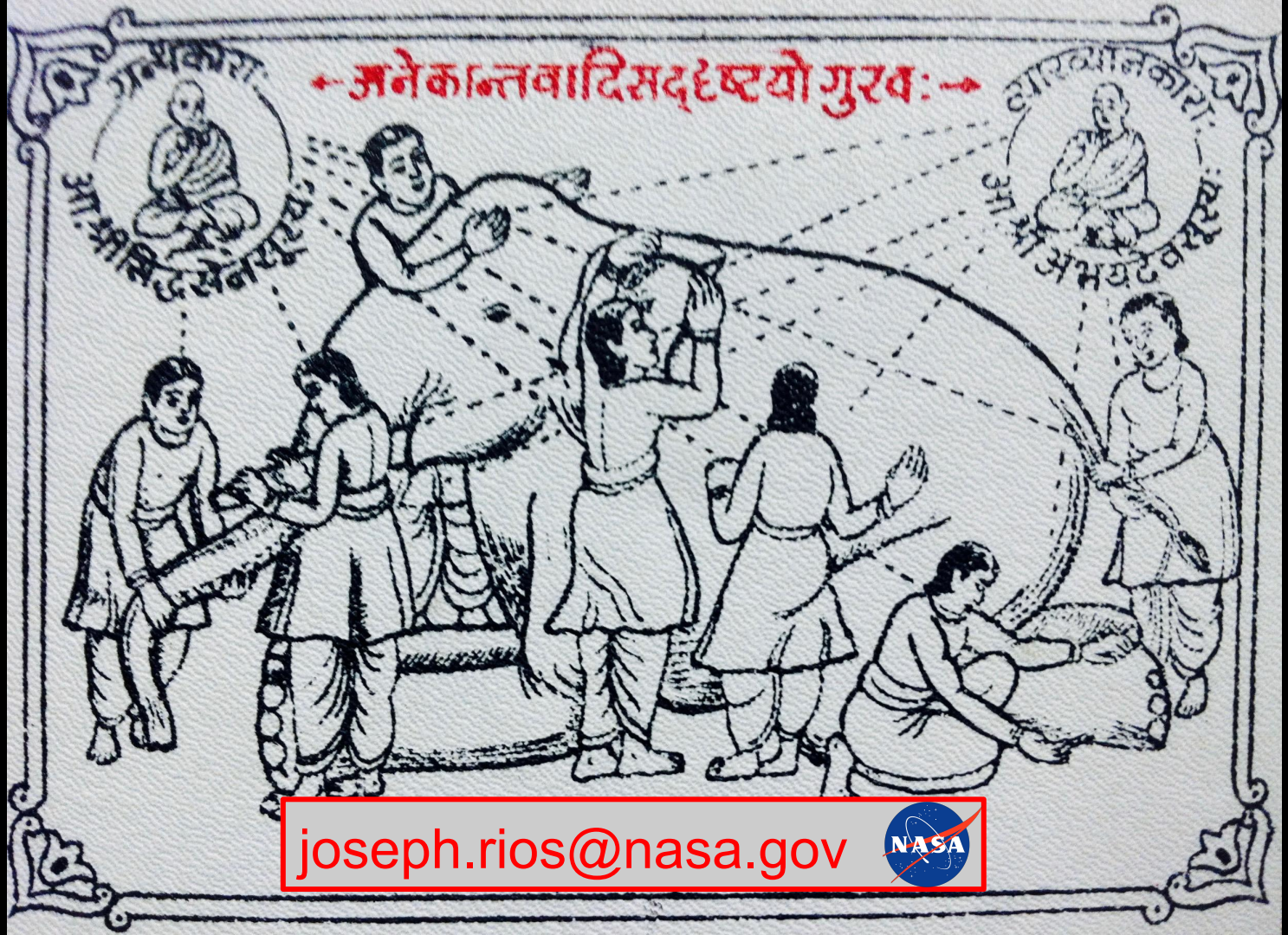
Example SDOs

C-UAS System confusion matrix

		Actual: **Bad Drone**	Actual: **Good Drone**
Predicted/Sensed	**Bad Drone**	*True Positives* Mostly the domain of the C-UAS system, somewhat supported by UTM when it returns a negative operation lookup.	*False Positives* C-UAS system can correlate sensed operation with known UTM operation, reducing the chance of false positives.
	Good Drone	*False Negatives* UTM should provide all "good drone" information to reduce false negatives.	*True Negatives* UTM helps to confirm drones are where they should be and who they say they are.

increasing specificity

Likely UTM's key impact for C-UAS systems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Bibliography

Images

- Airplane by Will Sullivan from the Noun Project
- Industry by eragon from the Noun Project
- Drone by Alvaro Cabrera from the Noun Project
- romana klee, Anekantavada doctrine artwork, source image, Creative Commons Share-Alike License 2.0 , additional presentation elements added on top of image
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NASA UTM Docs

- https://utm.arc.nasa.gov/documents.shtml
- APIs: https://github.com/nasa/utm-apis/tree/v4-draft

Backup slides

NASA UTM Cybersecurity

Leveraged industry best practice of "shift left security" by incorporating cybersecurity early in our processes.

Categorization of our data early in Project to meet FIPS 199 and NIST SP 800-122 requirements.

Implemented NASA's Secure Coding Practices by making members of development team responsible for certain practices and socializing them with rest of team.

Detailed threat modeling of our system to aid design choices early in development.

NASA IV+V scans of our code base upon request, providing detailed origin analysis results.

Reno test range

NASA UTM Command Center

Corpus Christi test range

TCL4

- Furthering the tools and concepts for urban operations
- Comm+Nav, Detect and Avoid, Large scale contingency management, etc.
- Flights May-Aug 2019