Managing the autonomous air traffic of the future... today

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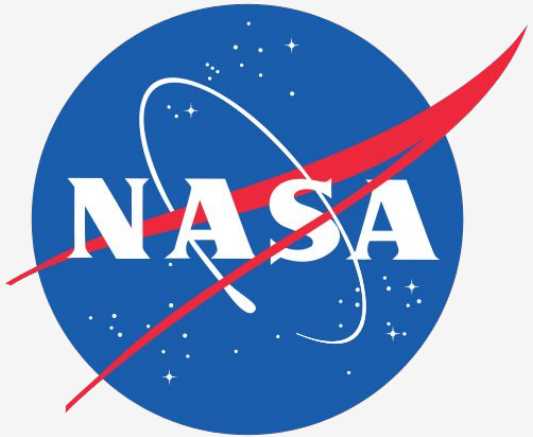
San Francisco, CA
23 Sept 2019



Low Altitude UAS Operations

FAA small UAS forecast: 2.4M hobbyists, 450K commercial by 2022

Over 1M registered UAS Operators currently

Vehicles are automated and airspace integration is necessary

New entrants desire access and flexibility for operations current users want to ensure safety and continued access, regulators need a way to put safety structures in airspace

In today's airspace there are no tools, procedures, or rules to handle this future

Operational concept and software being developed to address beyond-visual-line-of-sight (BVLOS) UAS operations at low altitude, not controlled by ATC/ATM

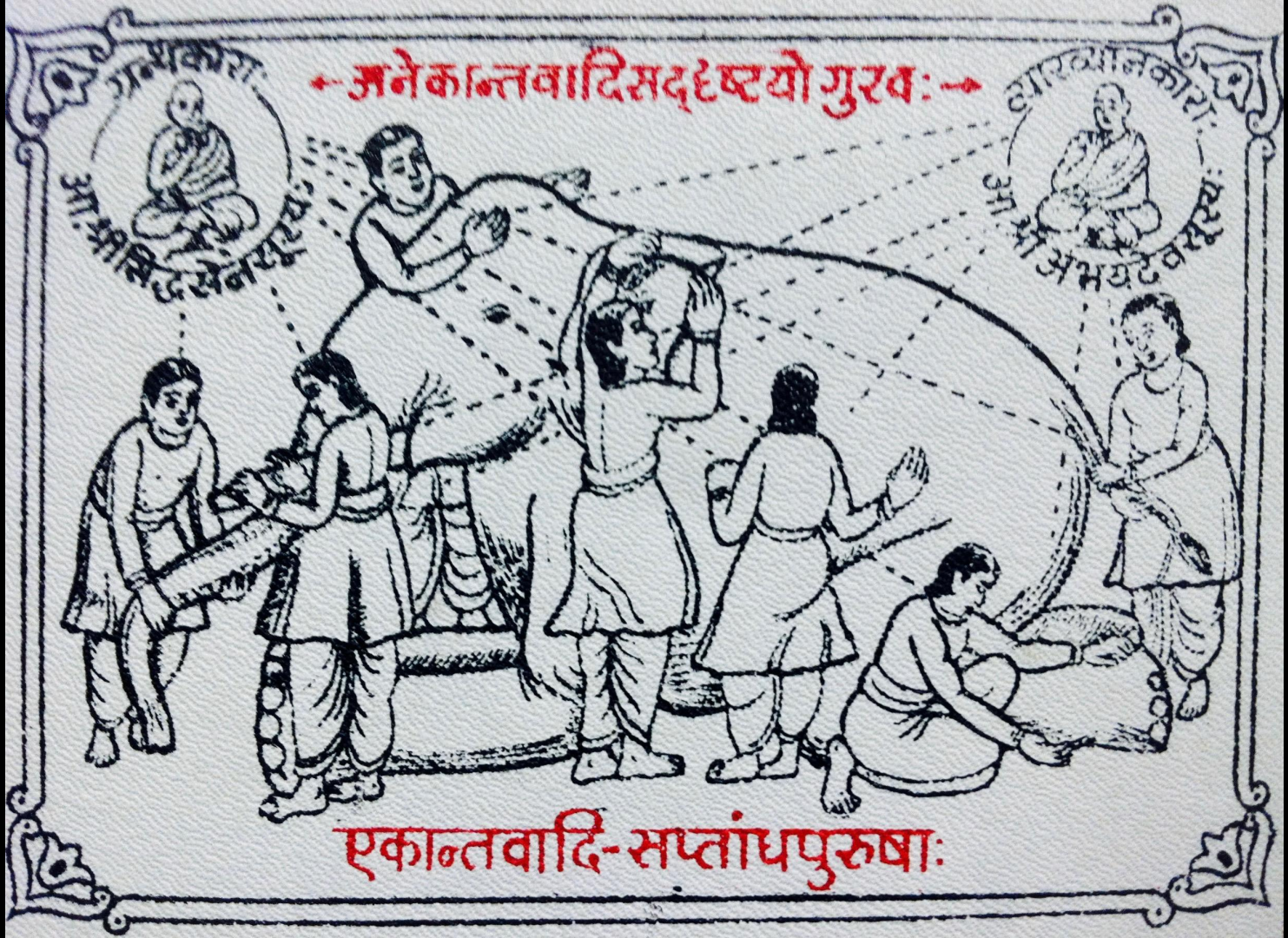
What is UAS Traffic Management?

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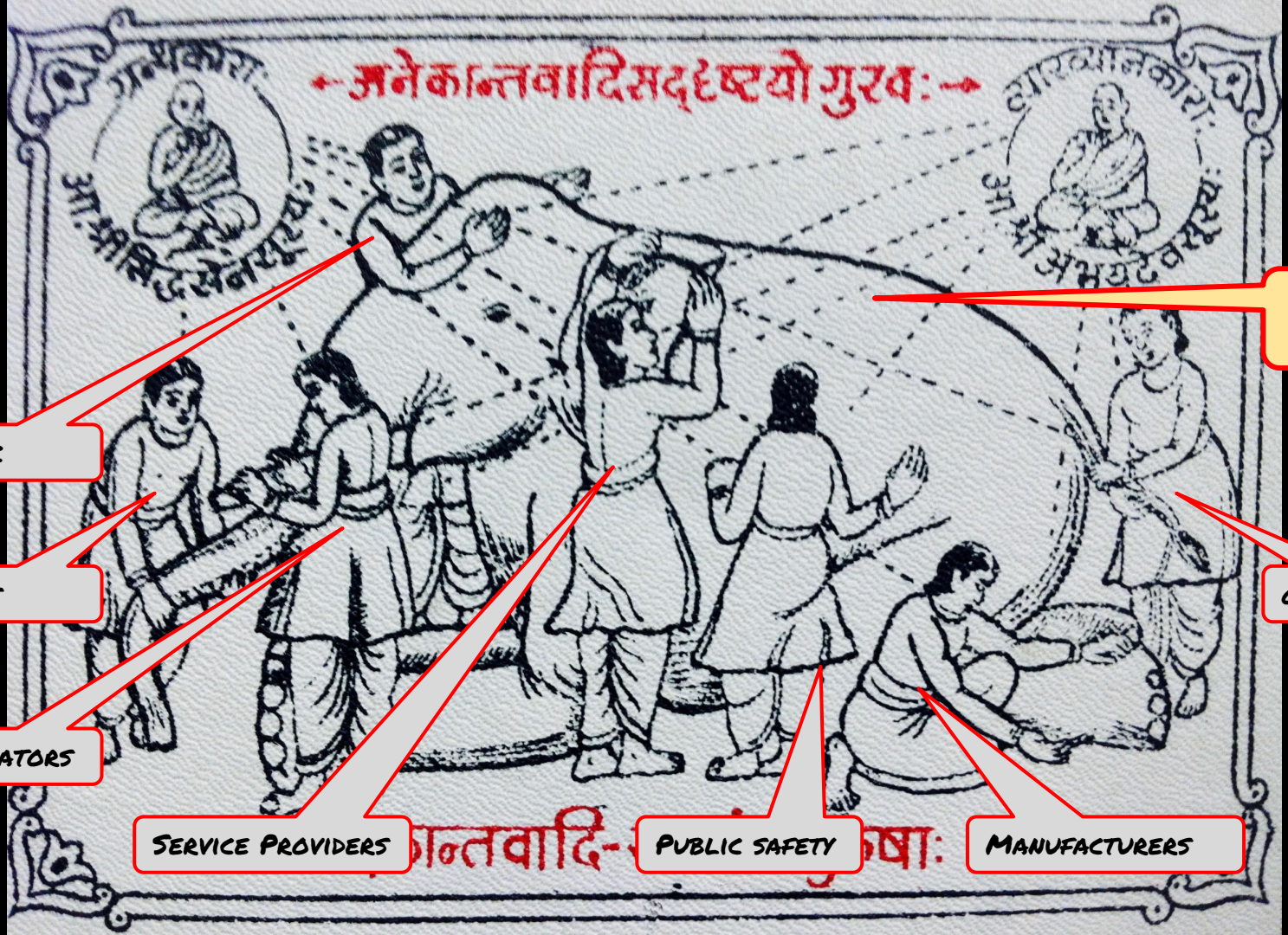
अनेकान्तवादिसदृष्टयो गुरवः
UTM
PUBLIC
PILOTS
REGULATORS
SERVICE PROVIDERS
PUBLIC SAFETY
MANUFACTURERS
OPERATORS

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

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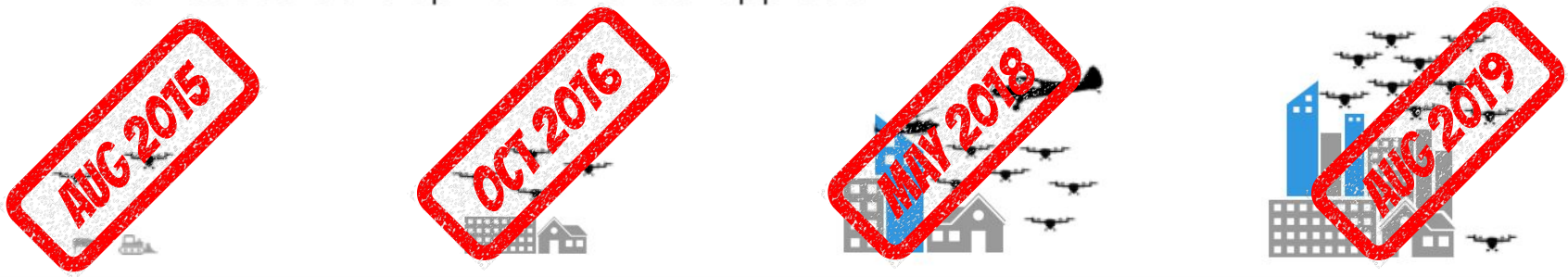

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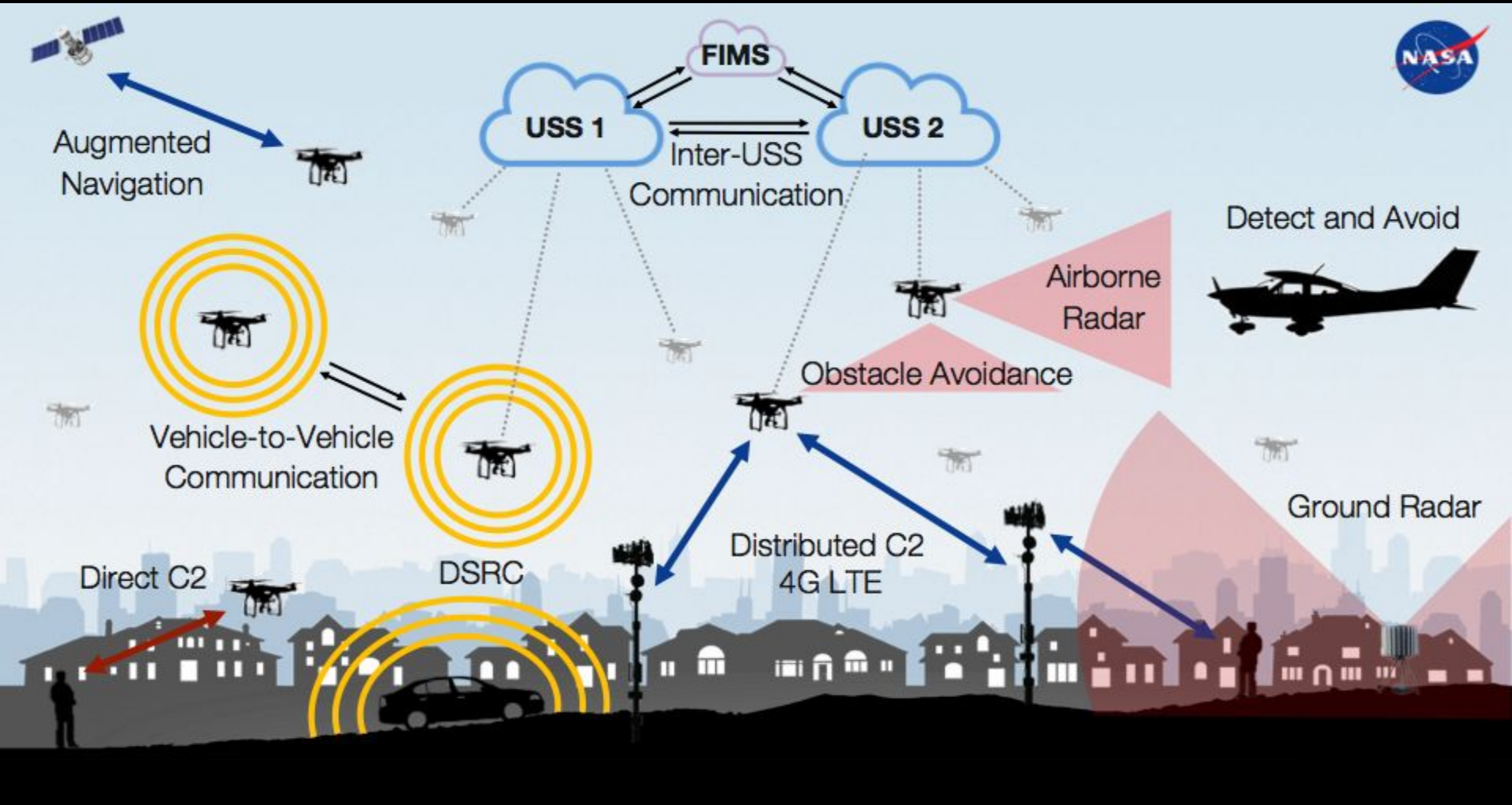

FIMS
USS 1
USS 2
Inter-USS
Communication
Augmented
Navigation
Detect and Avoid
Airborne
Radar
Obstacle Avoidance
Vehicle-to-Vehicle
Communication
Ground Radar
Distributed C2
4G LTE
Direct C2
DSRC

Reno test range

NASA UTM Command Center

Corpus Christi test range

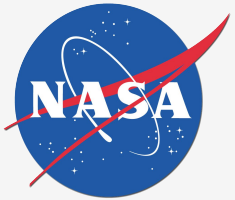
TCL4

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

4 Small UAS Over Downtown Reno

NASA TCL4

18 June 2019



Concept(s) of Operation

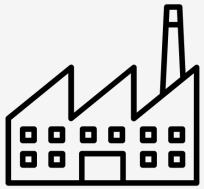
APIs

Specifications

Software Testing Approaches

Component and Service Requirements

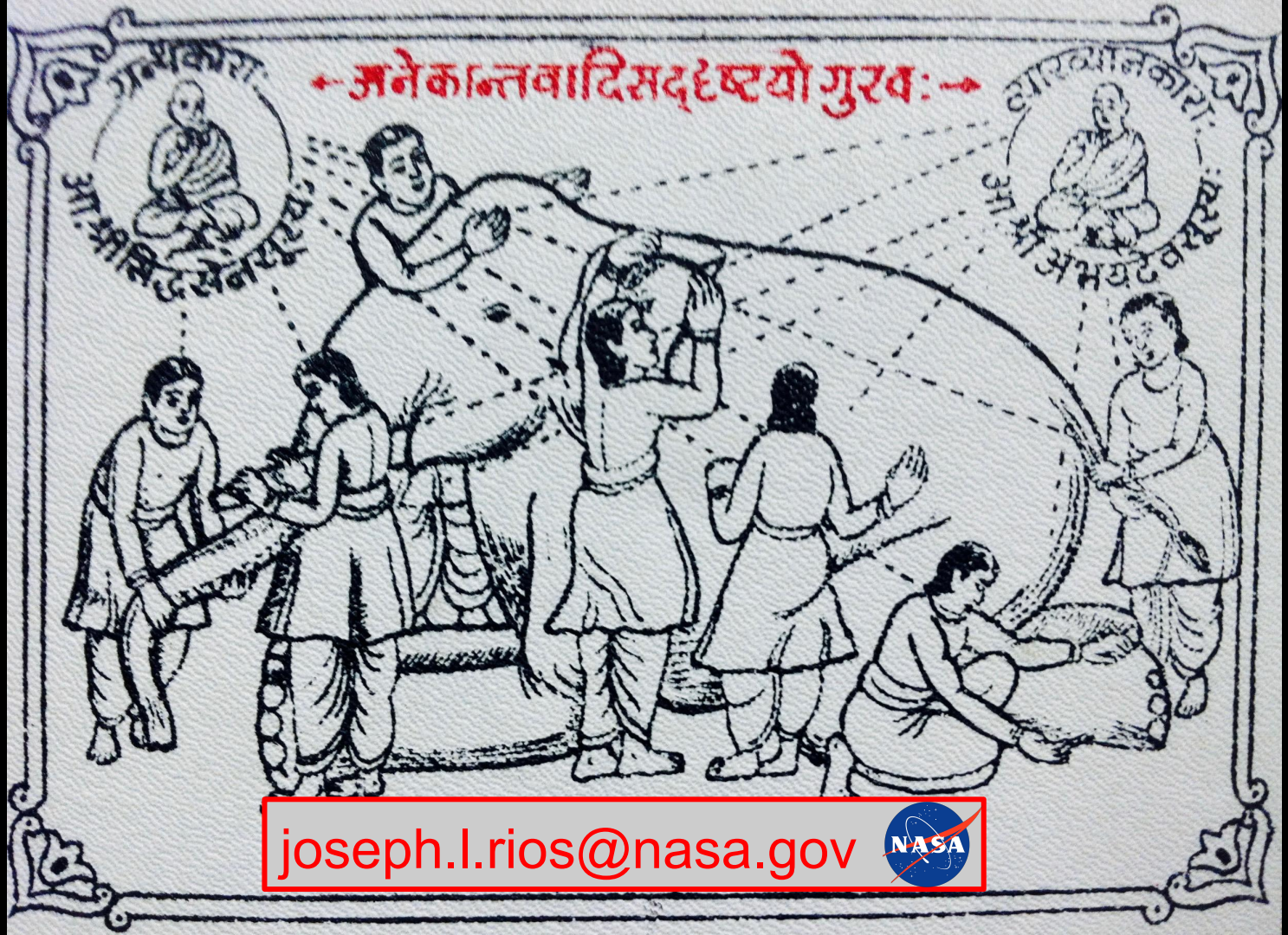
Field Testing Results and Analysis



Regulator/ANSP

Industry

Example SDOs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Bibliography

Images

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NASA UTM Docs

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