SUPERVISED AUTONOMOUS FUNCTION EXECUTIVE SAFE™

An Autonomy Enabler

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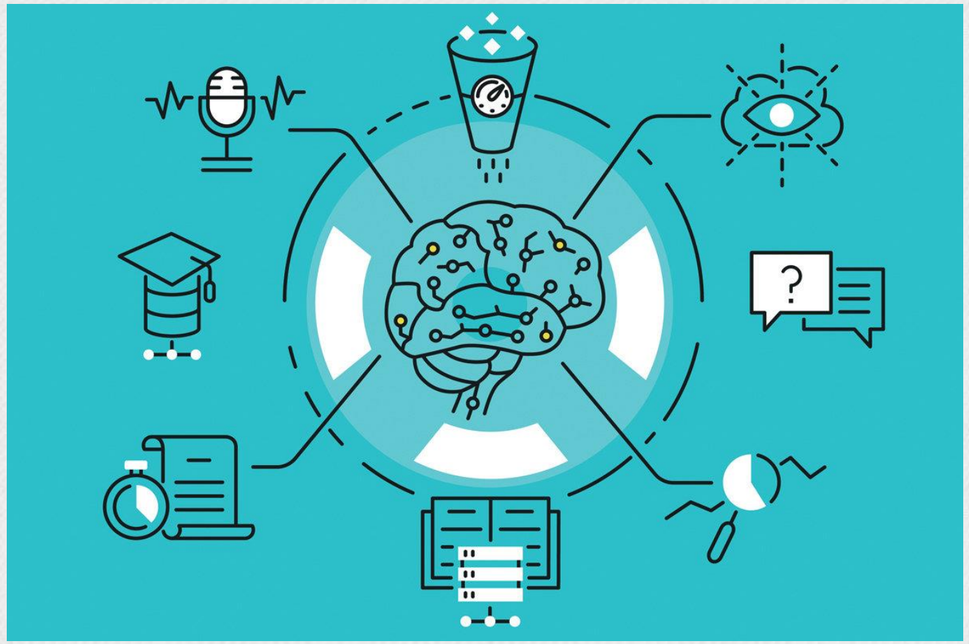
MTSI
MODERN TECHNOLOGY SOLUTIONS, INC.®
Innovative Technical Solutions for the 21st Century

The Problem

How do we certify?

Artificial Intelligence



Machine Learning

DoD Artificial Intelligence Principals:
Responsible, Equitable, Traceable, Reliable, **Governable**

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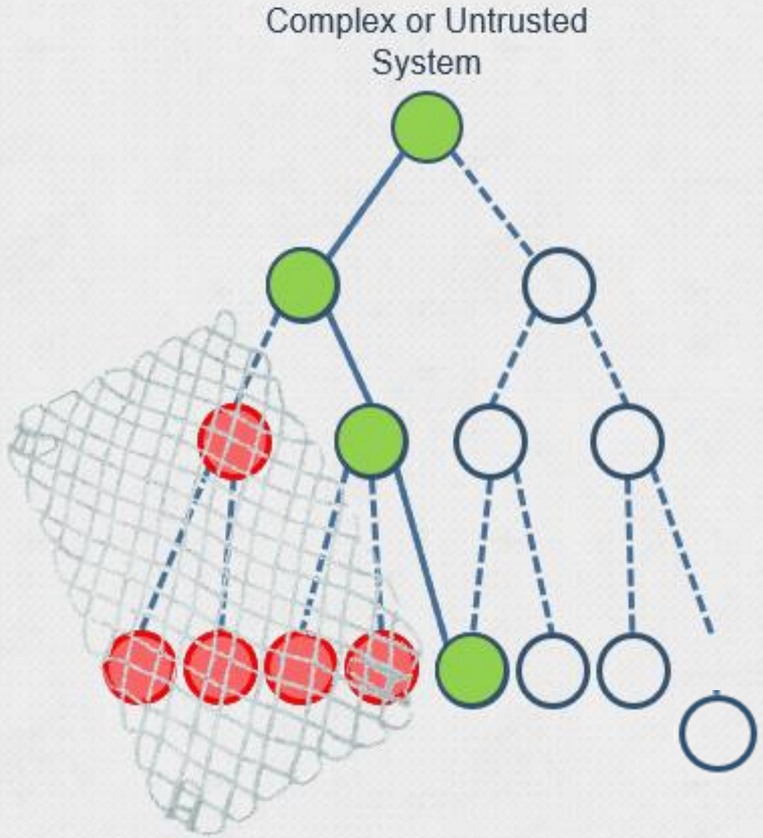
THE SOLUTION : SAFE™

Supervised Autonomous Function Executive (*SAFE*™)

Simple and deterministic Multi-Monitor Runtime Assurance software that restricts vehicle from violating user selected criteria

A safety net around untrusted systems.



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EVAA/SAFE UPDATE

- MTSI was imbedded with NASA team during development of Expandable Variable Autonomous Architecture (EVAA)
- EVAA has flown on several aircraft since 2010 and the basic Ground Collision Avoidance algorithms are fielded on F-16/35
- MTSI has a Software Usage Agreement with NASA
- MTSI has HWIL/SWIL conducting independent evaluation and is improving/maturing the software

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HISTORICAL BACKGROUND

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Performance Based Certification

F-16 Auto GCAS & ACAS

AvSP

1st Industry Standard

UTM & SASO

2018 Collier

Resilient Autonomy

Reference Implementation Development

Autonomy Safety Standards

NASA

Industry

DoD

MTSI Flight Demo CY22

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How EVAA/SAFE™ Works

EVAA

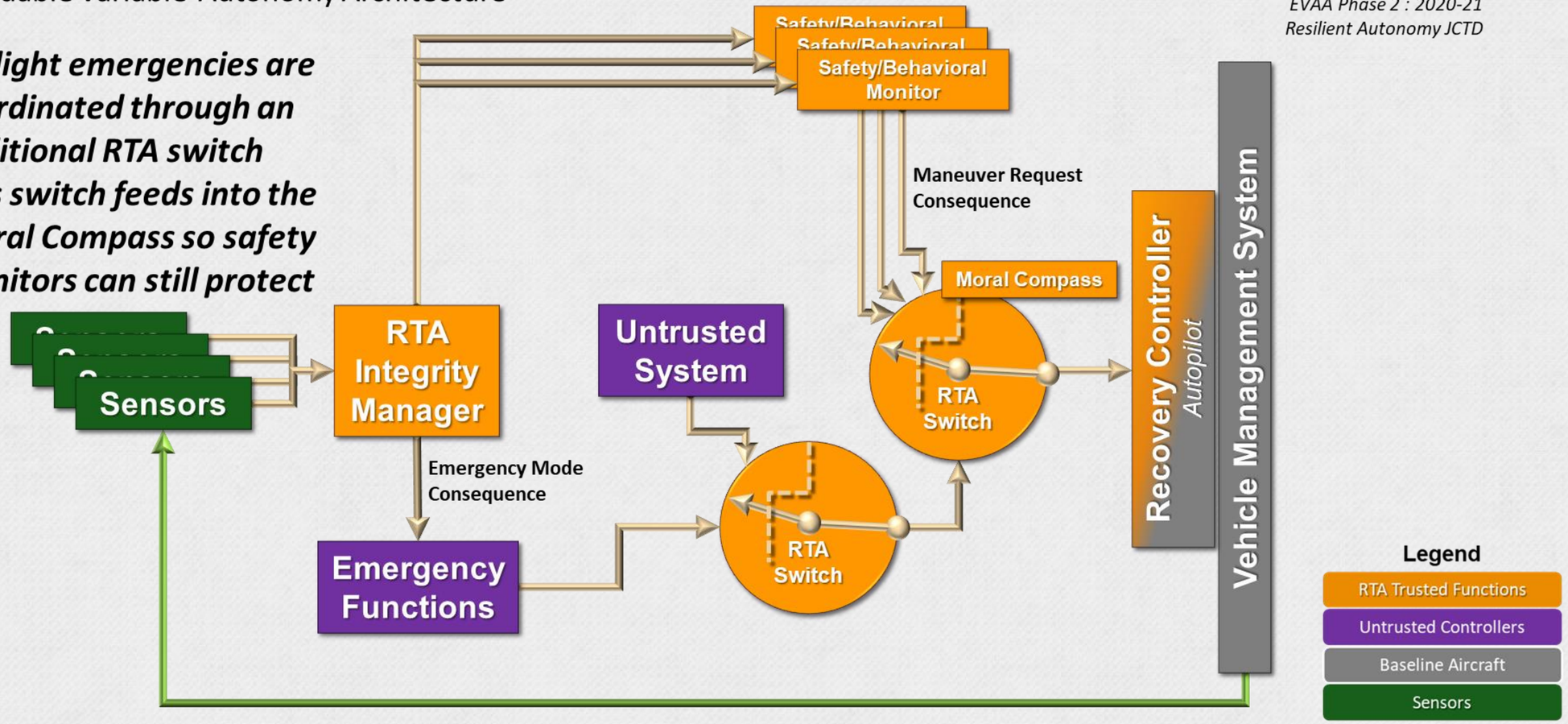
Phase 2 : Current Work

Expandable Variable-Autonomy Architecture

- ***In-flight emergencies are coordinated through an additional RTA switch***
- ***This switch feeds into the Moral Compass so safety monitors can still protect***

RTA Network

EVAA Phase 2 : 2020-21
Resilient Autonomy JCTD



RTA: RunTime Assurance

SAFE™ ARCHITECTURE

- **Microservices**
  - Easily scalable by adding more hardware
  - Publish / Subscribe means adding new services is easy and painless.
- **Robust**
  - Multiple Processes
    - If a component crashes, then all other components still work as intended.
  - Self-Healing by using heartbeats & hardware watchdogs.
- **Built using modern C++ best practices.**
  - Static Analyzers help detect bugs before they become an issue.
  - RAII handles memory management instead of the developer.
    - Eliminates an entire class of bugs.
- **Built with formal requirements**

SUMMARY

- SAFE™: Government owned software
- Demonstrated capabilities:
  - Ground Collision Avoidance
  - Air Collision Avoidance
  - Weather Avoidance
  - Forced Landing
- Architecture adaptable to ground systems
- MTSI flight demo planned for CY22
- Artificial Intelligence certification enabler
- Per NASA Software Usage Agreement, continued development/integration requires government sponsor