



U.S. AIR FORCE



AFRL

Trust in Autonomy and AI

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Autonomy Definition

Joint Concept for Robotic and Autonomous Systems (JCRAS) The level of independence that humans award a system to execute a given task. It is the condition or quality of being self-governing in order to achieve an assigned task based on the system's own situational awareness (integrated sensing, perceiving, and analyzing), planning and decision-making. Autonomy is a spectrum of automation in which independent decision-making can be tailored for a specific mission, risk level, and degree of human-machine teaming.



by Kris Duda

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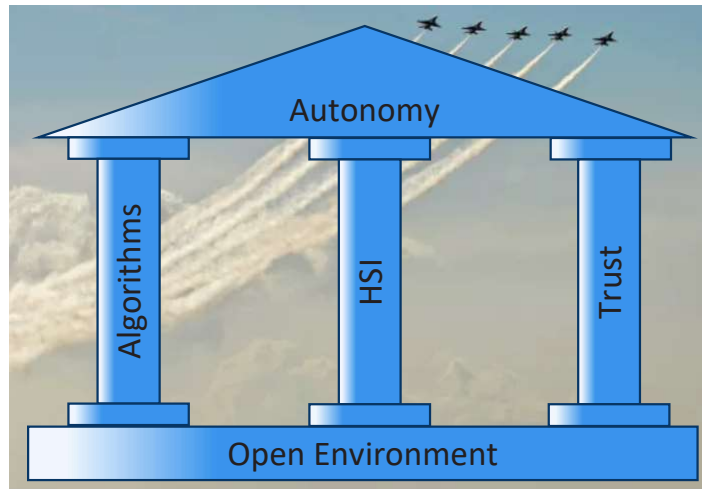
Battle of Princeton 1777 by Gonzalo Alonso

Autonomy is the freedom to select a course of action required to achieve a higher authority's objective(s)



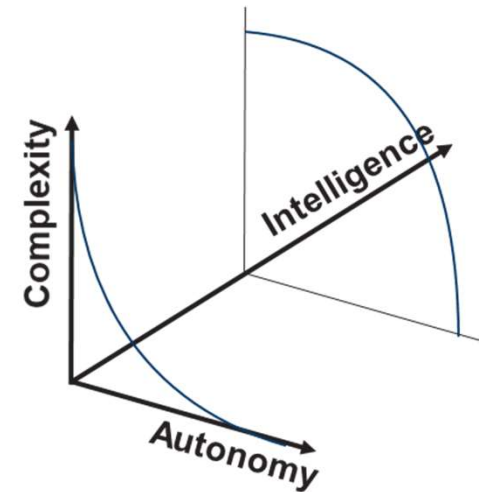
Autonomy Framework

- Framework



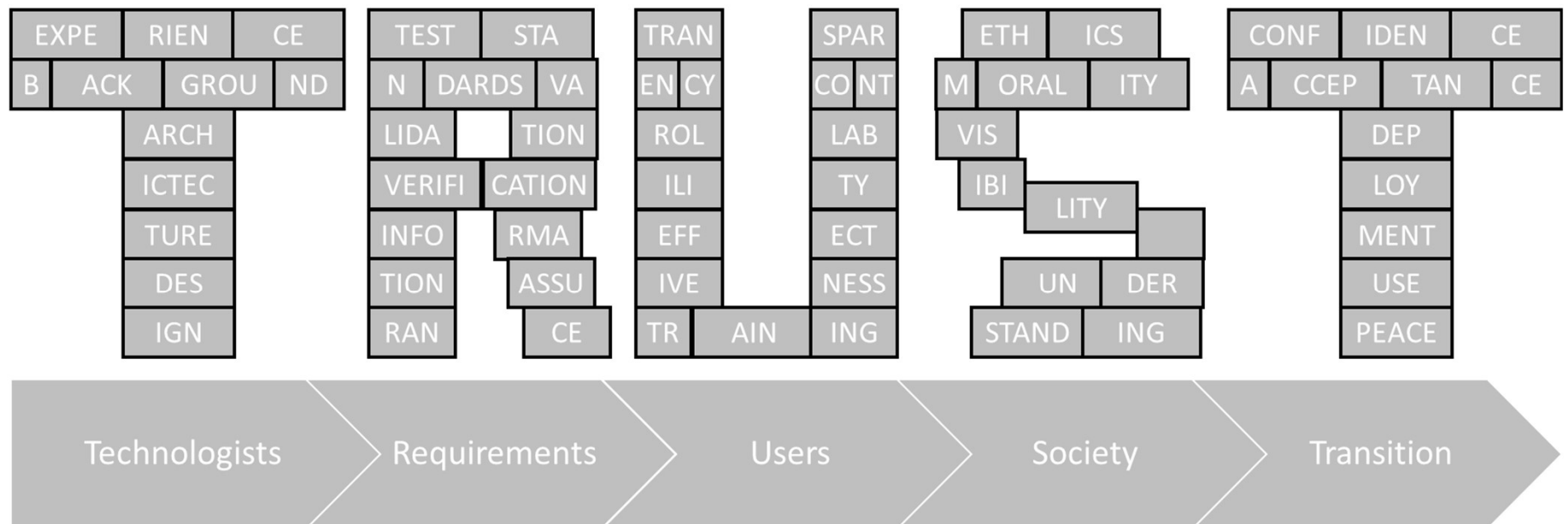
- Objectives

- Increase speed and quality of decisions in combat and business operations
 - Augment manned operations
 - Create and manage overwhelming complexity
- Accelerate pace of deploying advanced capabilities into AF weapon systems





Building Trust



What concerns me?

- Greediness
- Brittleness
- Opacity
- Ulterior motive

Questions?

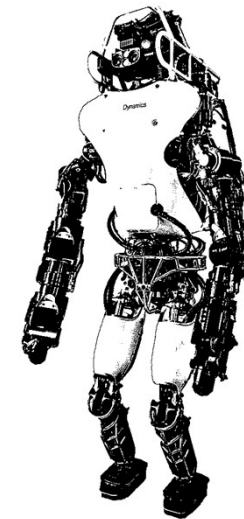
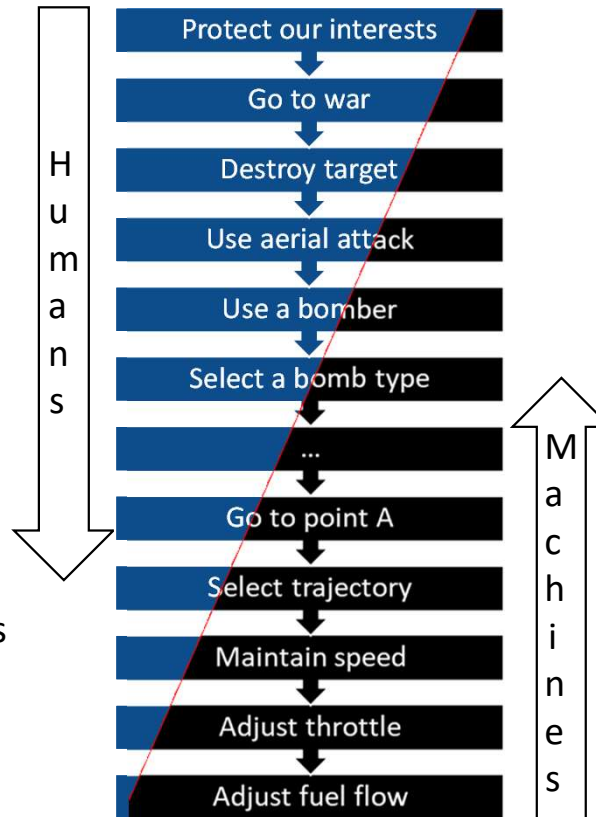




~~Delegation of Authority~~ Human Machine Teaming



Decision making on wicked problems
Context recognition
Fine manipulation
Haptic sensing



Decision making on tame problems
Computation
Data collection and processing
Image recognition

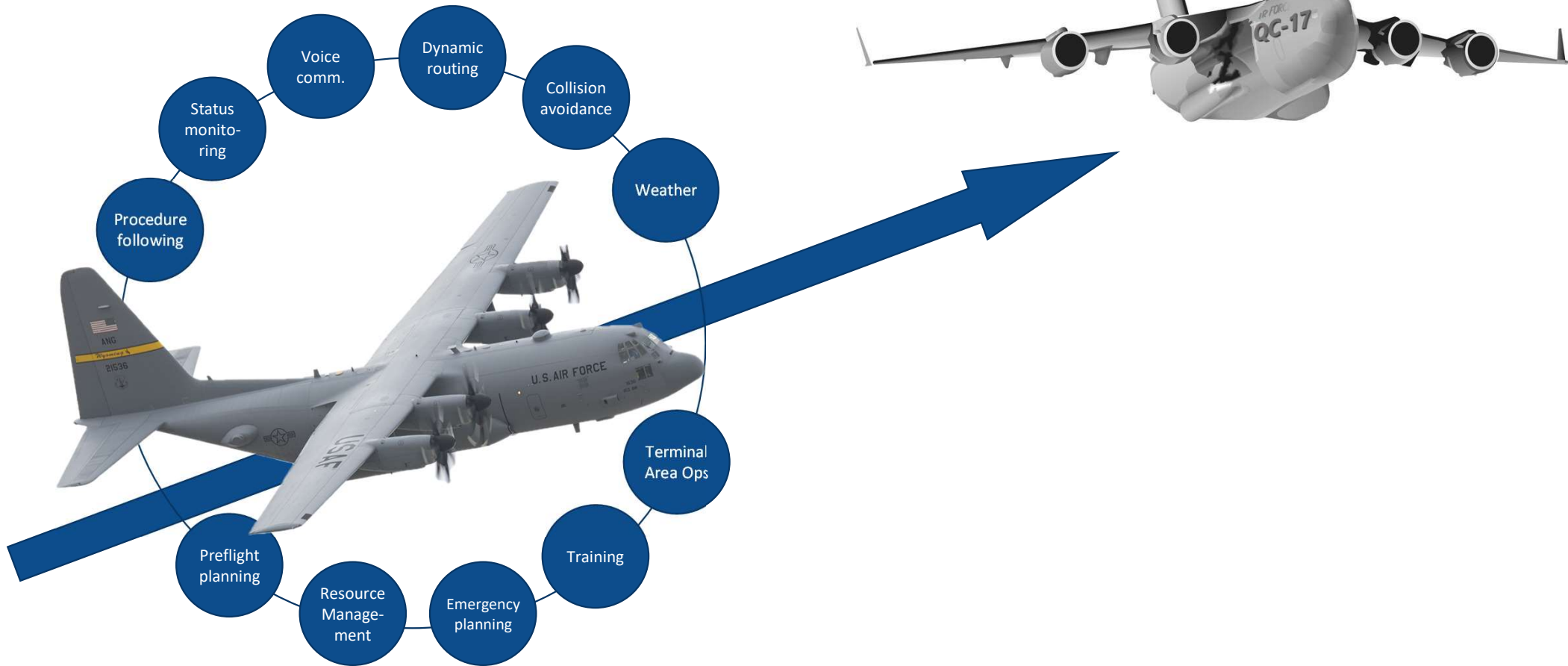


Progressive Autonomy Implementation

Autonomy Role	Description	Automotive Example	Aviation Example
Shadow mode	Background data collection – no interface with operator	Tesla	
Advisor	Observe and provide recommendations but has no direct ability to implement them	Lane departure warning Googlemap	Stall warning Procedure following
Assistant	Implement certain low risk, limited authority tasks	Lane assist	Communication manager System monitoring
Co-pilot	Conduct singular task(s) in parallel or on behalf with human	Emergency braking, lane following	Formation flight Rejoin
Temporary pilot	Conduct most of the required tasks during a portion of the mission or in the right environment	Level 3	Refueling Dog-fighting
Primary pilot	Conduct entire mission – or mission segment; human can become “co-pilot” there to offload certain tasks, remain engaged... or get an elevated role	Level 4	Unmanned aircraft



AI in Legacy Platform





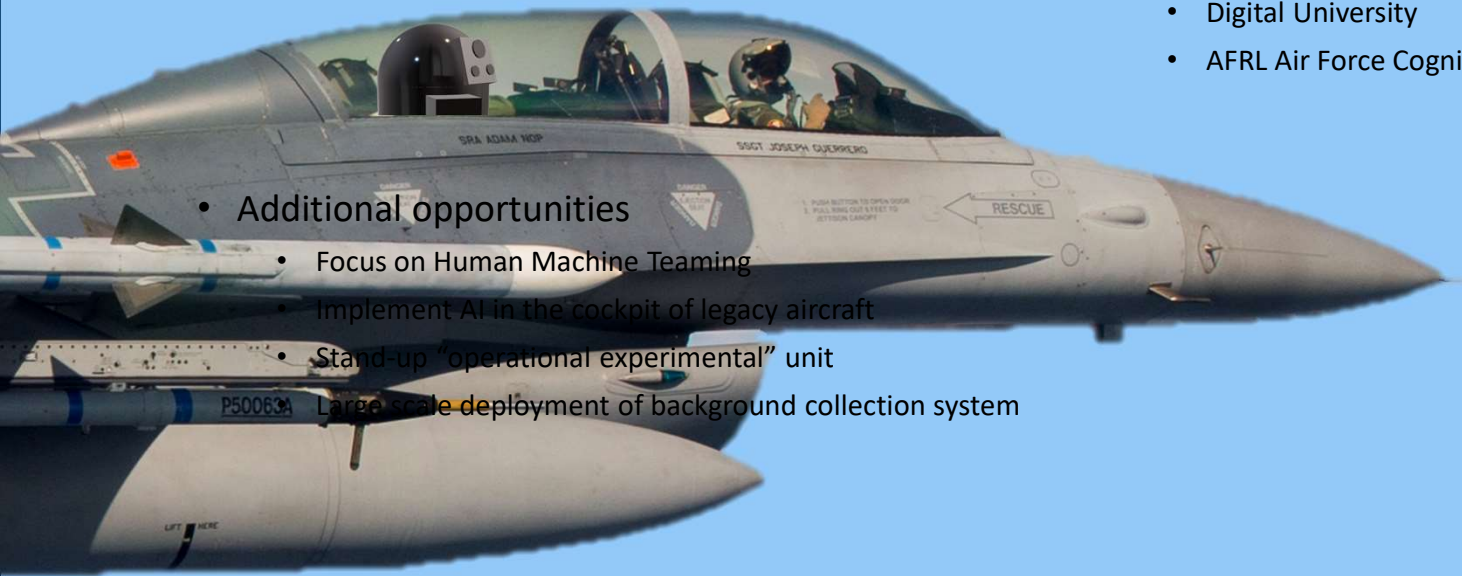
Implications of Having AI as a “Teammate”

- Life cycle of AI is much shorter than traditional systems or sub-systems
 - Data
 - Models
 - Hardware
- AI offers the possibility to
 - Be highly customized
 - Continue to learn (adapt) after deployment
- AI creates new challenges
 - Significant dependence on high quality data
 - Reliance on synthetic data
 - New attack surface
 - Traditional Testing and Evaluation process
 - Composition of the units



Increasing Readiness Using Autonomy and AI

- AI is poised to impact every DAF activities
 - Combat operations
 - Business operations
- Current efforts to accelerate AI
 - MIT AI Accelerator
 - Data Strategy – VAULTIS*
 - Digital University
 - AFRL Air Force Cognitive Engine
- Additional opportunities
 - Focus on Human Machine Teaming
 - Implement AI in the cockpit of legacy aircraft
 - Stand-up “operational experimental” unit
 - Large scale deployment of background collection system



we just need a place to put it

The future is here, ~~it's just not evenly distributed~~ – William Gibson