



AI-ASSISTED OPTIMIZATION OF TRAINING SCHEDULES (PUCKBOARD.AI)

• **ARTIFICIAL**
• **INTELLIGENCE**
• **ACCELERATOR**

DEPARTMENT
OF THE
AIR FORCE

MASSACHUSETTS
INSTITUTE
OF TECHNOLOGY

OVERVIEW

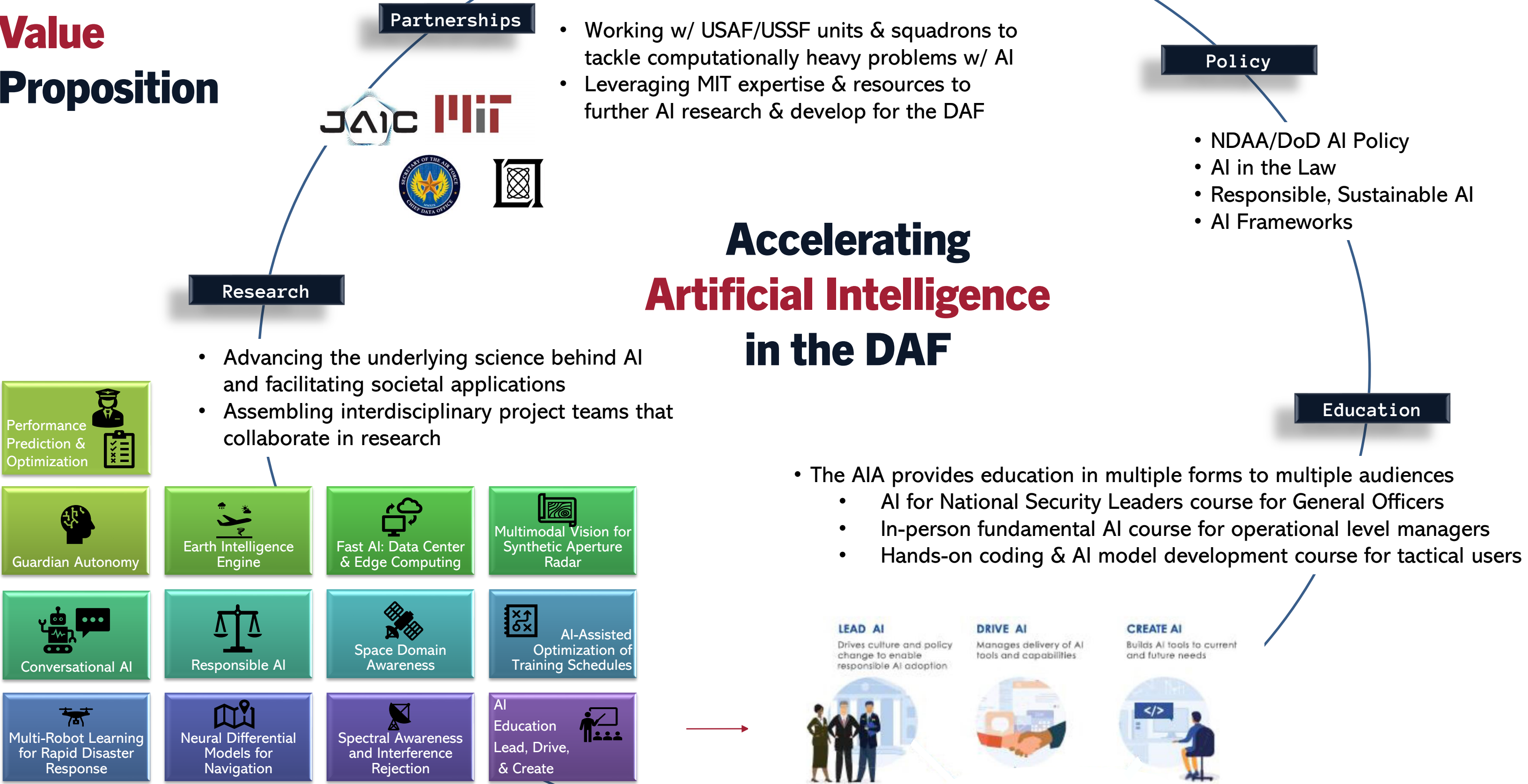


- What is the AI Accelerator?
- What is Puckboard?
- Puckboard Interface
- Puckboard.AI
- Puckboard Ecosystem





Value Proposition



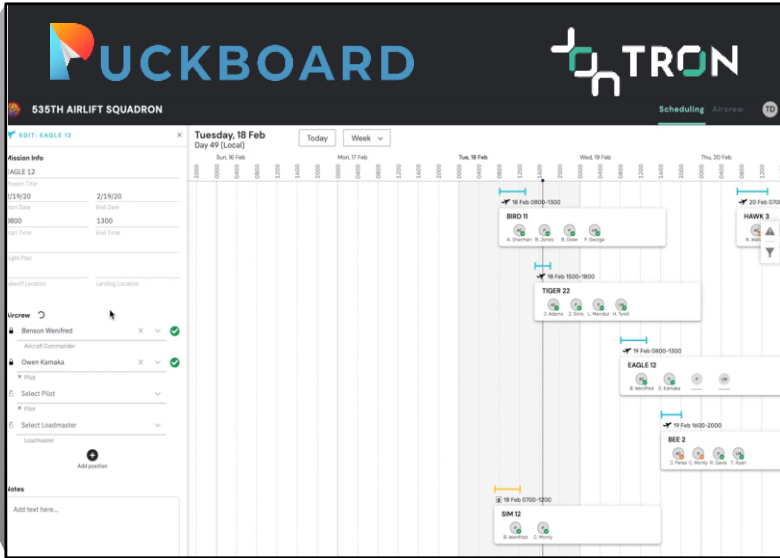
WHAT IS “PUCKBOARD?”



USAF schedulers are burdened by overly-manual processes

Modern web applications backed by optimization algorithms can bootstrap much of their workflow

AI/ML Schedule Optimization Algorithms



Reinforcement Learning

A diagram illustrating Reinforcement Learning, showing a sequence of states and actions represented by boxes and arrows.

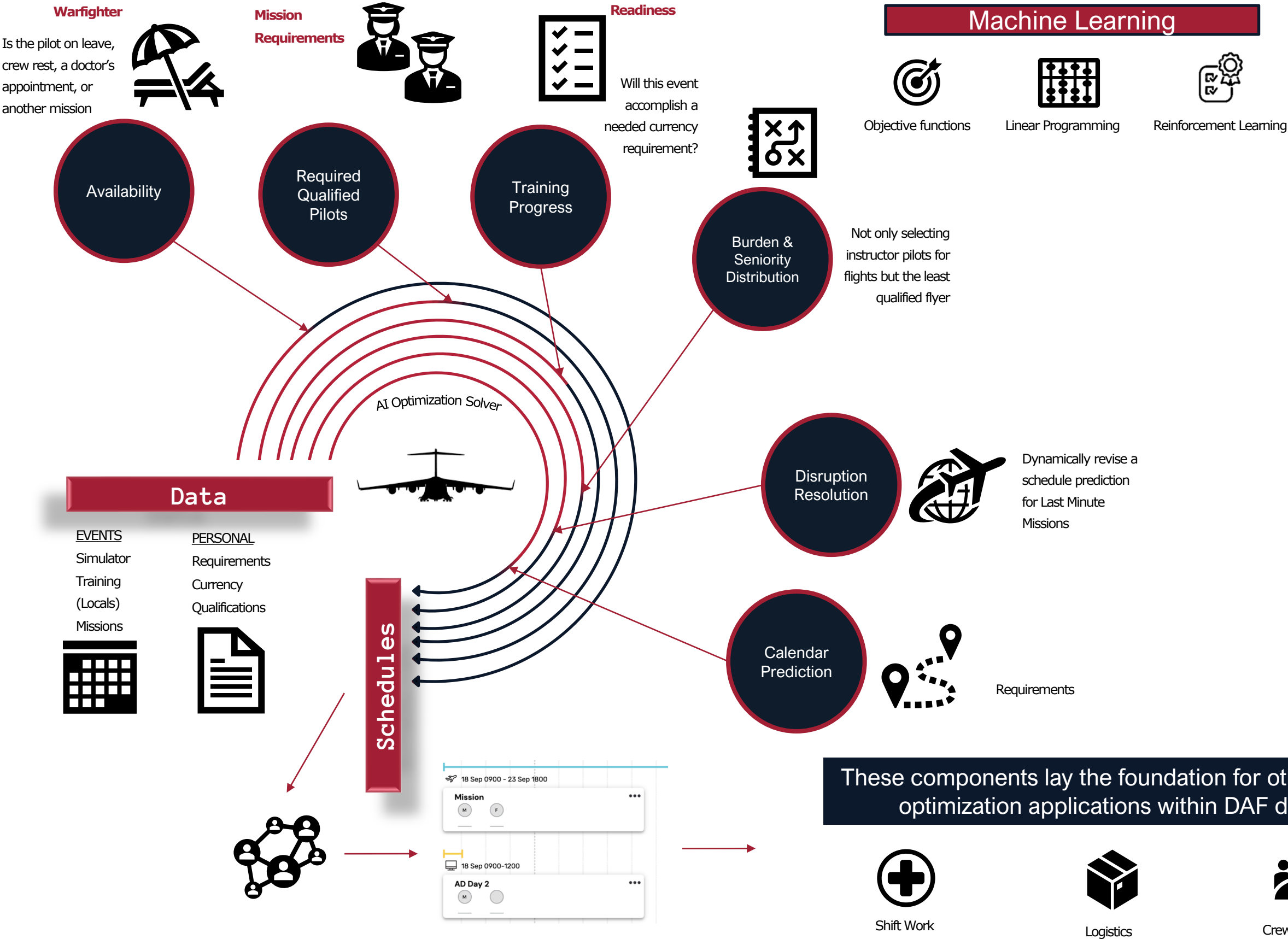
Integer Programming

A diagram illustrating Integer Programming, showing a graph with a feasible region and an objective function line.

Air Force mission and training scheduling is an immensely complex, time-consuming, and manual process that can be significantly aided by modern web and algorithm technologies



Optimization
Solver
Breakdown



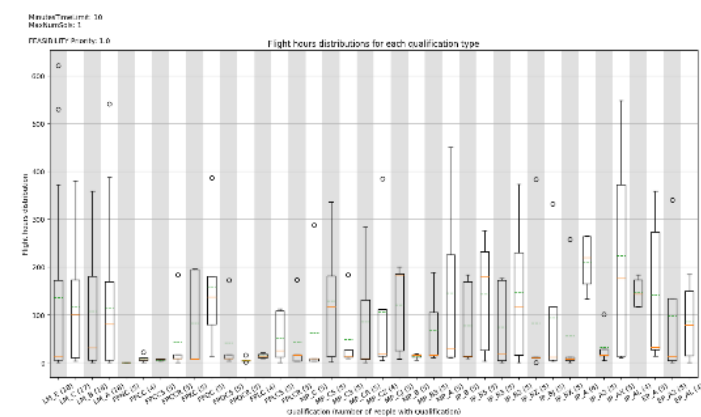
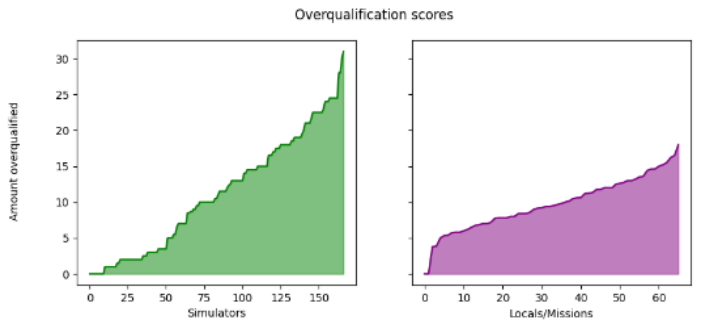
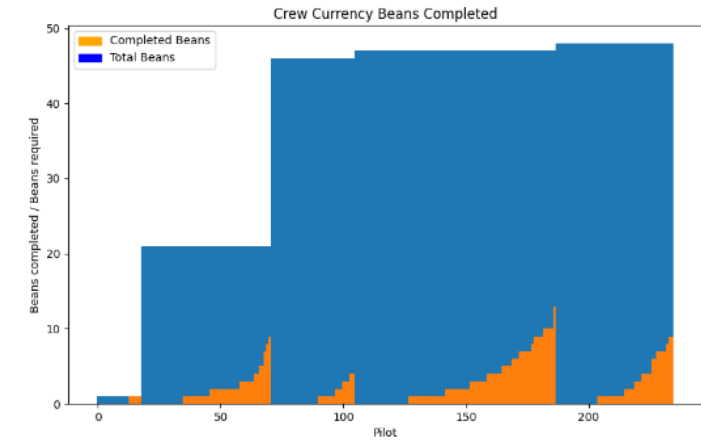
Using AI to Solve Air Force Problems

This solver uses two Machine Learning techniques, Reinforcement learning and Linear programming to generate an optimized schedule

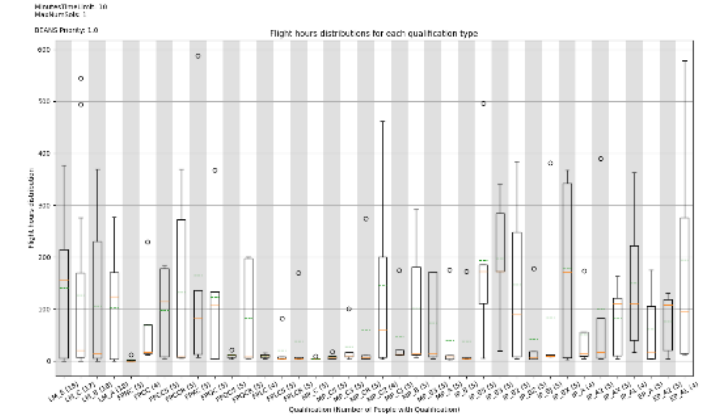
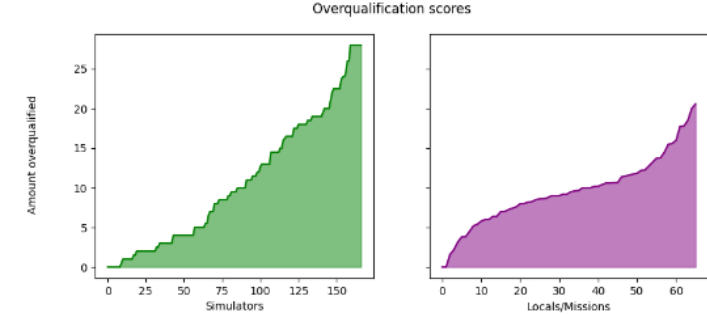
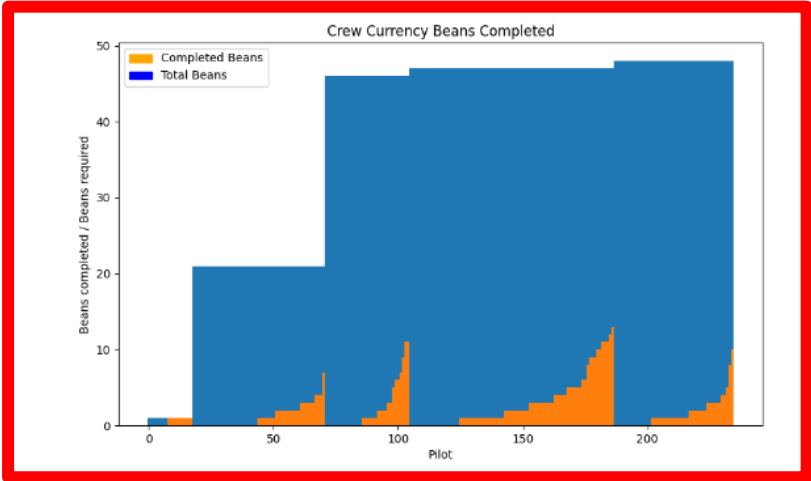
COMPETING OBJECTIVES



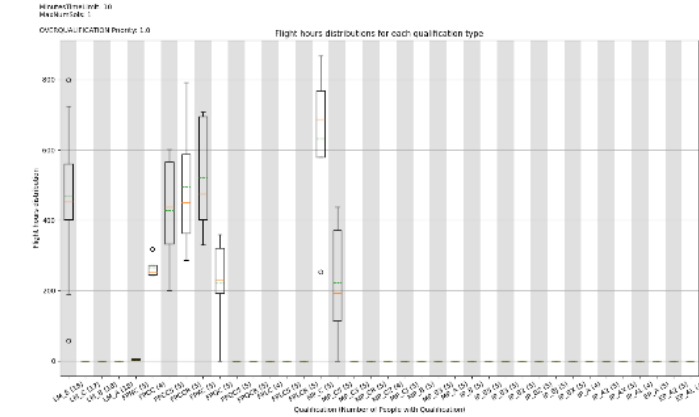
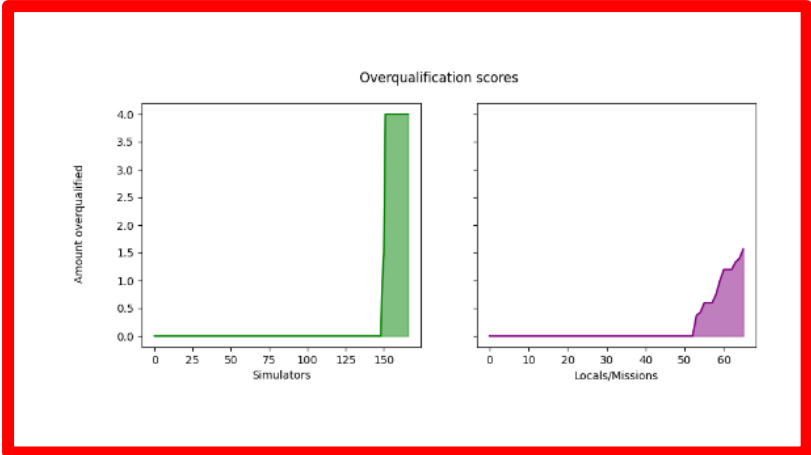
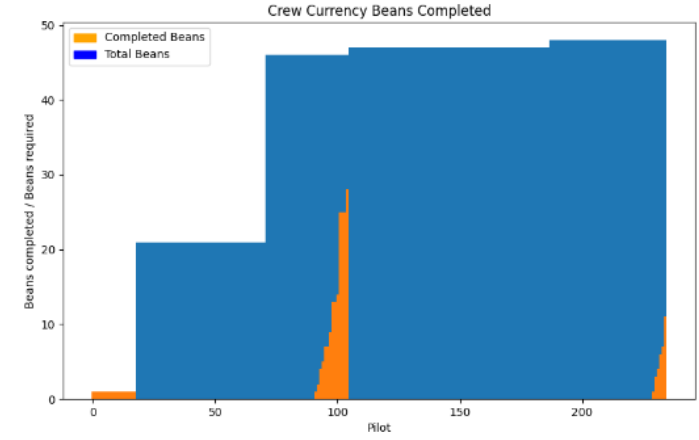
Feasibility



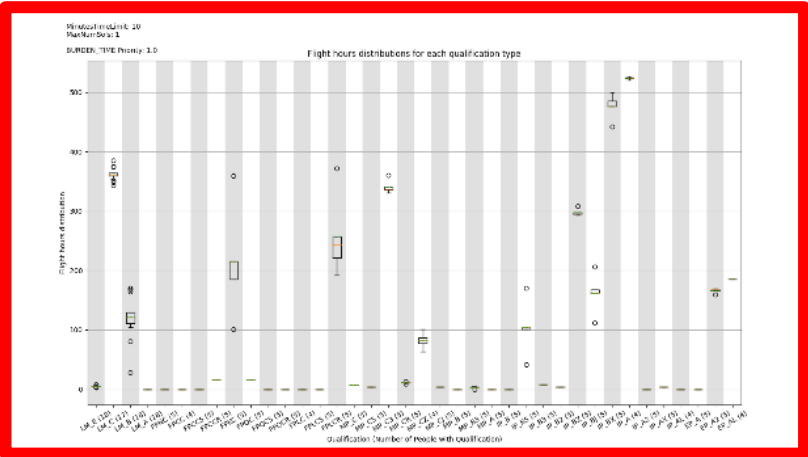
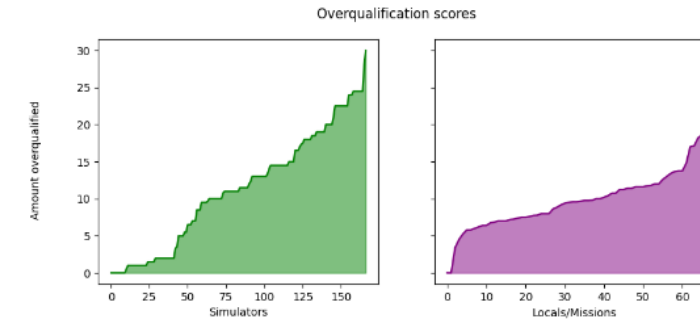
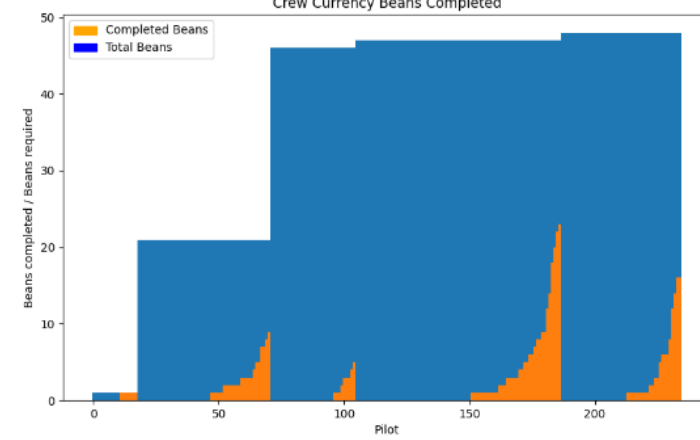
Training Currency



Minimal Qualification



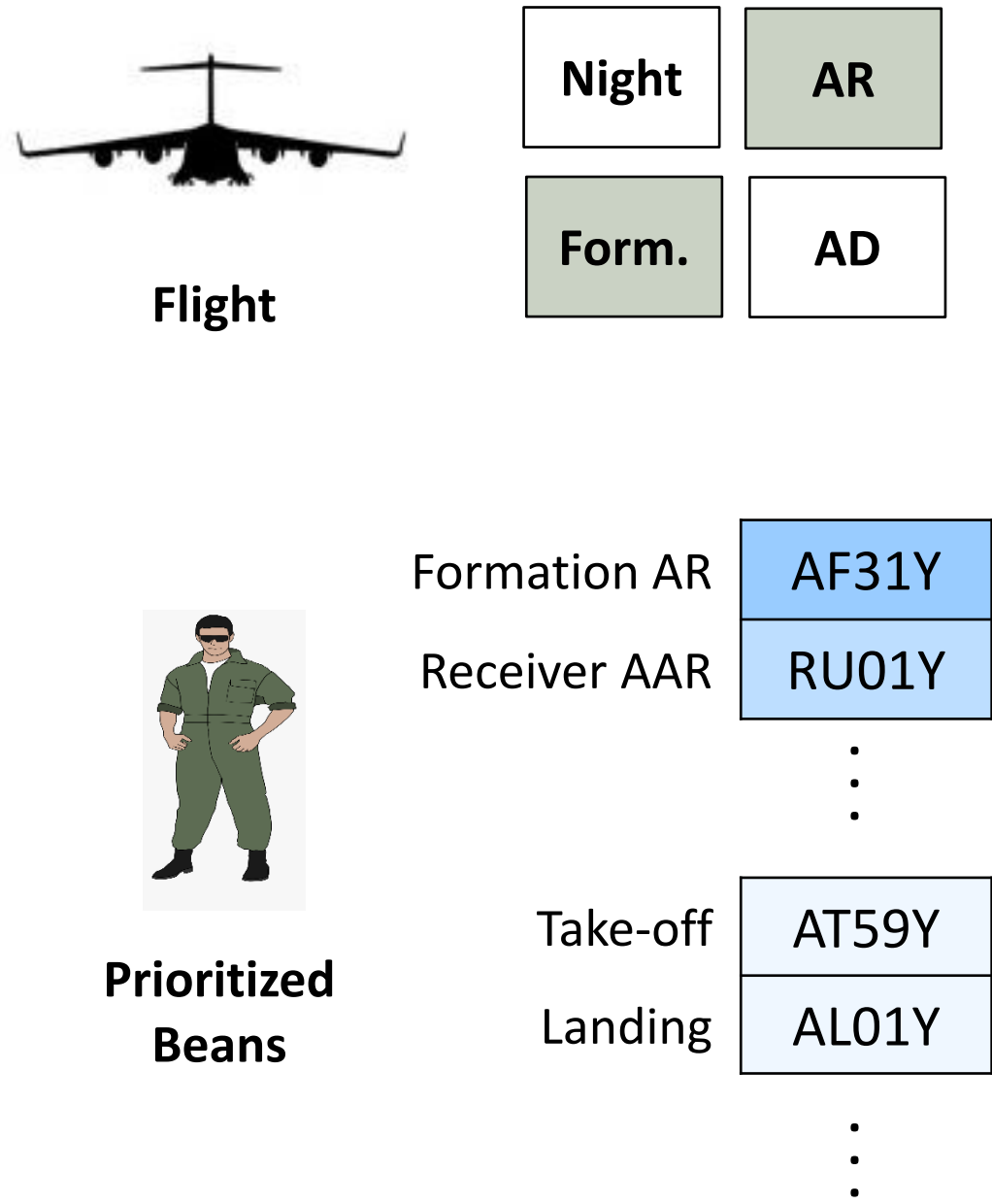
Burden Time



EVENT PRIORITIZATION

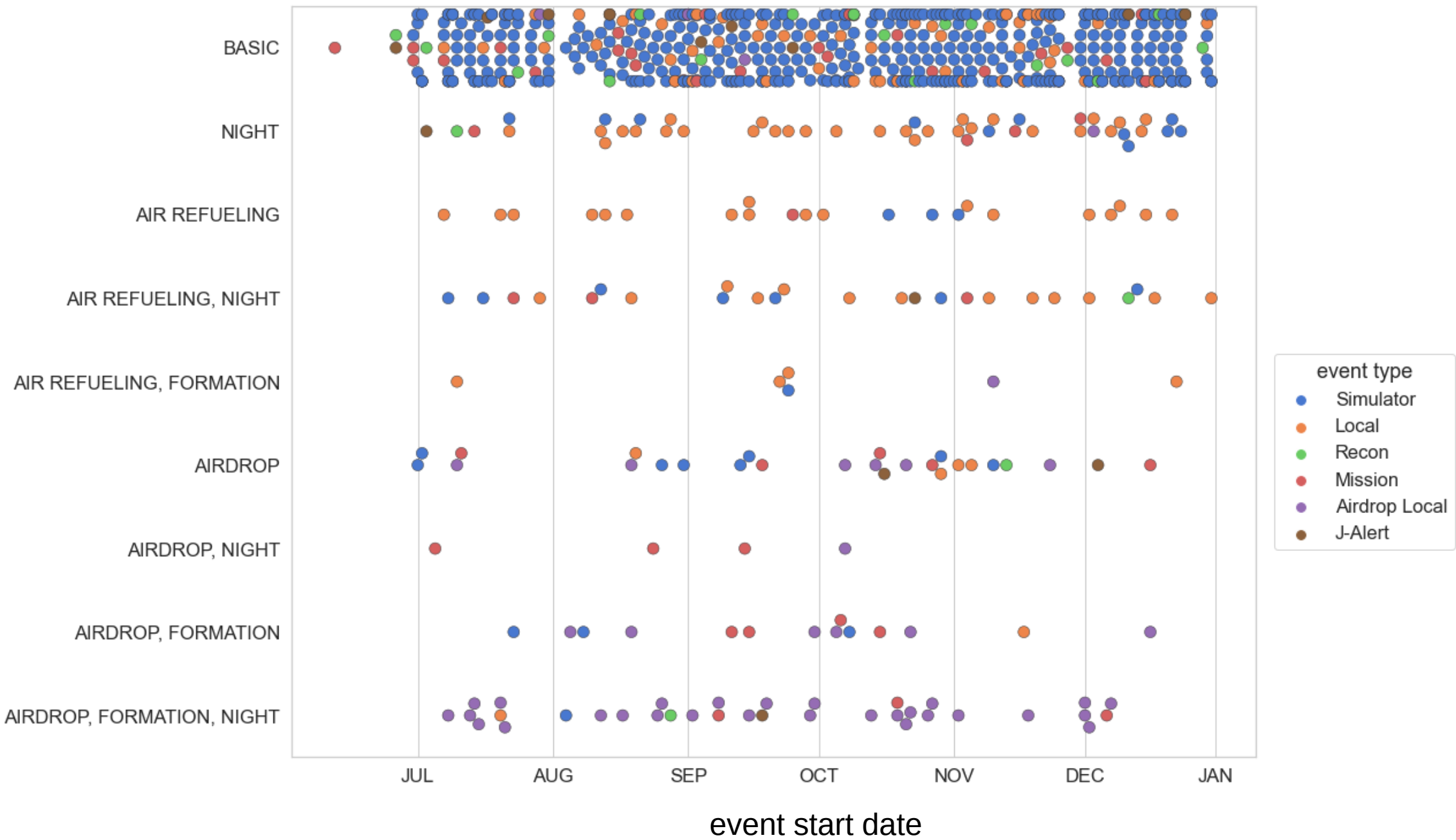


Event characteristics and event history can be used to prioritize training requirements



event characteristics

Events by Characteristic (sample semi-annual period)



EXAMPLE TRAINING EVENT PRIORITY FACTORS



Days remaining can be estimated from ARMS requirements and bean completions (note different requirements have different due dates but ARMS enters closest date only)

Enter beans with multiple requirements into the table multiple times (i.e. currency and volume requirements)

	Event characteristics	days remaining	Hist. Event %	Hist. event / day	# req. remaining
beanA-M	1	0	1	4.306	1
beanA-SA	1	150	1	4.306	8
beanB-Q	8	60	0.100	0.432	1
beanB-SA	8	150	0.100	0.432	2
beanC-SA	3	150	0.075	0.322	1
beanD-SA	6	150	0.112	0.481	4
beanE-R	4	27	0.065	0.279	1

Taken from ARMS

Calculated from historical squadron data by doing text searches and/or bean mapping

Event Characteristics Mapping:
1=Basic, 2=Night, 3=Night-AR, 4=Night-AD, 5=Night-AD-Form, 6=AD, 7=AD-Form, 8=AR, 9=AR-Form, 10=Form, 11=Sim

PUCKBOARD INTERFACE



Rolled out to 387 (USAF, USMC, USA, & USN) units

Currently tracking: Over 1,000 events daily

Giving time back to 15,667 Airmen
Includes medical squadrons, air battle managers, fighter squadrons,
etc.

TRON DEMO SQUADRON
Mission Data
Gantt
2 Week
Big Board
Crew Rainbow
Roster
SW

<
Jul 10 - Jul 23
>

Today
Expand
OFF

L Z
New event

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
191 BACKUP C... (P) Crew: 0 / 5	192 LOCAL-AIR... (ACC) Perez Crew: 6 / 6 LONG MIS... (ACC) Chahal Crew: 1 / 1 → 4 Aug SIM-ADD2 (ACC) Thornton Crew: 2 / 2	193 LOCAL-AL (ip) Crew: 0 / 4 HICKAM C... (P) Boston Crew: 5 / 5 → 15 Jul SIM-ALD2 (ACC) Evans Crew: 2 / 2	194 LOCAL-VA... (ACC) Crew: 0 / 3 AUSSIE CH... (P) Crew: 0 / 5 → 22 Jul BRAVO (P) Crew: 0 / 5 → 14 Jul ALD1 (ACC) Crew: 0 / 2	195 LOCAL- AR... (ACC) Brantley Crew: 1 / 5 NIGHT AD... (LM) Crew: 0 / 4 CHANNEL (P) Crew: 0 / 5 → 16 Jul ADD2 LINK... (ACC)	196 LOCAL- BE... (ep) Messing Crew: 3 / 4 LOCAL-NIG... (LM) Crew: 0 / 4 → 16 Jul LOCAL- NI... (LM) Crew: 0 / 3 MISSION-G... (P) Crew: 1 / 5 → 23 Jul	197 LZSO (NR) Crew: 0 / 1 → 17 Jul DZSO (NR) Evans Crew: 1 / 1 → 17 Jul REDEPLOY (P) Crew: 0 / 5 → 22 Jul
198 BRAVO (P) Crew: 0 / 5 DZSO (P) Crew: 0 / 1	199 LOCAL-AL (LM) Crew: 0 / 4 CHALK3 (P) Crew: 0 / 5 CHANNEL (P) Crew: 0 / 5 → 21 Jul AR PROF (ACC) Crew: 0 / 2 ADD2-LINK... (ACC) Crew: 0 / 2	200 LOCAL-AR (ACC) Crew: 0 / 3 POPE 5-SHIP (P) Crew: 0 / 5 → 21 Jul	201 CANX-LOC... (ACC) Crew: 0 / 1 1A1 (P) Crew: 0 / 5 LM PHASE (LM) Crew: 0 / 1 ADD2 (ACC) Crew: 0 / 2	202 LOCAL- AL... (ACC) Crew: 0 / 4 NIGHT 2-SHIP (LM) Crew: 0 / 3 NIGHT 2-SHIP (LM) Crew: 0 / 3 1A2 (P) Crew: 0 / 5 ALD1 (ACC) Crew: 0 / 2	203 LOCAL- NT... (ACC) Crew: 0 / 3 AL VANILL... (ACC) Brechbuhl Crew: 3 / 3 CAPSTONE (P) Crew: 0 / 5 DZSO PICK... (P) Crew: 0 / 5	204

Event started, not yet complete (as of 2022-07-10)

Event completed, crew rest not yet complete (as of 2022-07-10)

Sim mx; down 22 Jul-28 Jul

TDY

Pilots

EPs

- Bloom, O
- AKELLY, A
- Haque, A

lp

- Bloom

ACC

- APerson
- BOBA
- Brantley
- Brechbuhl
- Cash
- Chahal
- Cleaver
- Endo
- Evans
- Grogan
- Hardie
- Jackson
- Kusiak
- Lopez

Loadmasters

ELs

- Smith
- Dungess

LM

- AAlderAndAnother
- Adams
- Anderson
- A new Person two
- Bogle
- Clarke
- Cook
- Evans
- Freeman
- George

Local Expedited

- Bogle → 11 Jul
- Freeman
- Perez
- Conway
- Adams
- Cook
- Brantley → 12 Jul
- Messing
- Sims

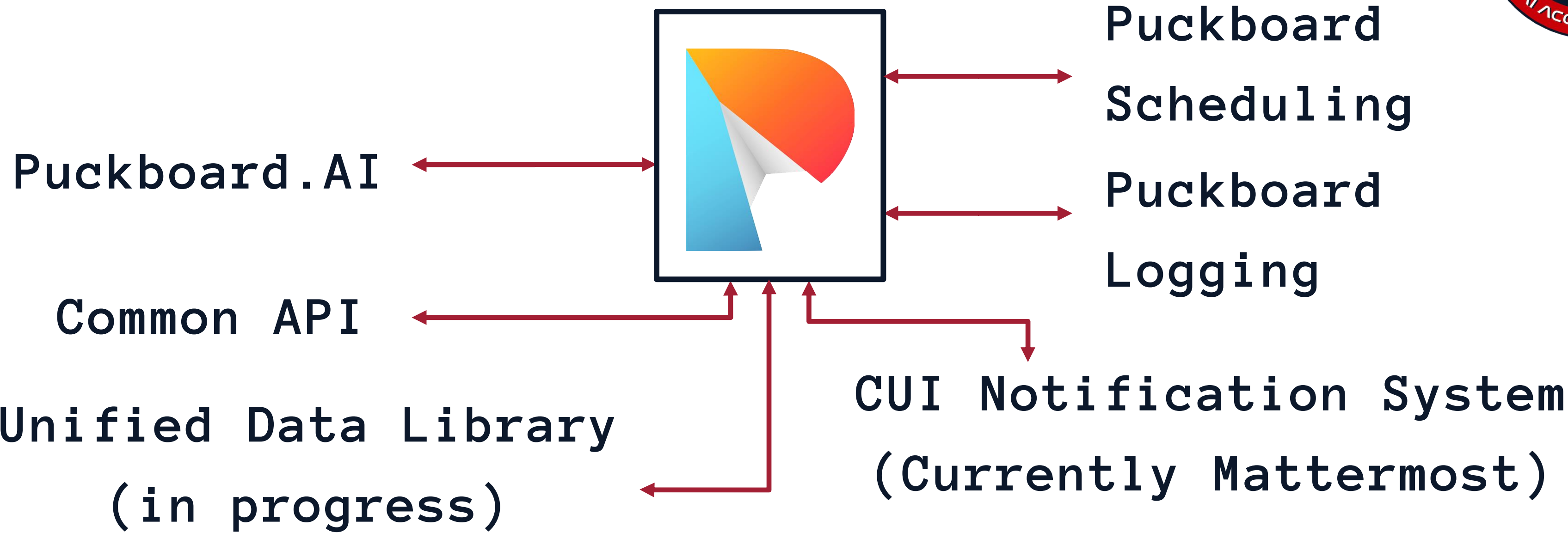
Altus Upgrade Queue

ACC

- Zell, C
- Ching-Nakama, U

- APerson
- BOBA
- Brantley
- Brechbuhl
- Cash
- Chahal
- Cleaver
- Endo
- Evans
- Grogan

PUCKBOARD ECOSYSTEM





Questions?

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