



How Space Operations Command is Enabling a Digital Service

14 Aug 2023

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Highest Overall Classification:

UNCLASSIFIED

VIA VINCIMUS



Introduction / Topics

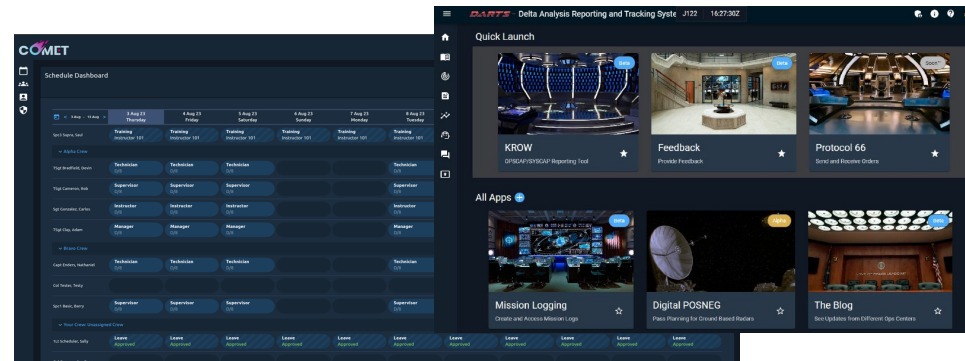
- Space Operations Command (SpOC) Deputy Commanding General for Transformation (DCG-T) Directorates supporting & empowering Guardians to move the USSF towards becoming a Digital Service
 - Innovation, Digital Transformation, and Science & Technology Directorates
- Delta Combat Development Teams (CDTs) & Supra Coders
 - Showcase: Crew Scheduling Tool for Space Operations
- SpOC Digital Transformation Tools, Processes, & Innovations
- Transformation Challenges & Opportunities

Innovation Directorate (DCG-T/IN)



- IN LOEs supporting warfighting operations & the CSO's *Vision for A Digital Service*
 1. Support services to build & enhance Delta Innovation / Combat Dev Team (CDT) efforts
 2. Drive innovation, process improvement, ECM, and community engagement solutions & methods
 3. Promote an innovative, professional, and resilient digital force (e.g. Supra Coders)
- IN promotes an innovation culture to achieve a competitive advantage by:
 - Enabling CDTs, Supra Coders, and Innovators at SpOC through innovation resources & guidance
 - Building key innovation relationships & partnerships with HQ USSF, USSPACECOM, SSC, STARCOM, AFRL/RV, SPACEWERX, Allies, Industry, Academia, and many more
 - Discovering operational pain points and promoting innovative & sustainable processes and solutions

- 4 Divisions
 - CDT Support (2x)
 - Community Engagement (3x)
 - Innovation Capes Integration (1x)
 - CI2/ECM (2x)



Innovation in SpOC is characterized by speed, impact, and sustainability to improve the performance and competitiveness of space operations.



2023 DAFITC

Crew Scheduling



What is COMET?

COMET is the solution to operational crew management. It will bring Space Force scheduling and training management into the digital age, getting crews off hard to manage spreadsheets and manual documentation. COMET will enable training sections to create and track courses and empower units to efficiently generate schedules with qualified operators. All while members can view live changes and updates anywhere without needing a government device.



Tech Stack

- Backend- Nodejs and MongoDB
- Frontend- React Typescript
- Hosting- Platform 1



Current COMET Features

Unit Management

- Crew Configuration
 - Position Configuration
- Unit Member Management

Schedule Management

- Schedule Creation
 - Schedule Change Requests
 - Schedule Management

User Homepage

- User homepage with upcoming special commitments, Announcements, and pending schedule change requests

Monthly Updates

- User homepage
 - Quick view of upcoming commitments completed.
- DX - Test Suite
 - Test suite partially refactored to facilitate/enable quicker testing.





COMET Features



03 Aug 202321520:04:57 UTC

DateJulian DayTime



Your Schedule

< 3 Aug - 10 Aug >	3 Aug 23 Thursday	4 Aug 23 Friday	5 Aug 23 Saturday	6 Aug 23 Sunday	7 Aug 23 Monday	8 Aug 23 Tuesday	9 Aug 23 Wednesday	10 Aug 23 Thursday
Spc3 Supra, Saul	Training Instructor 101	Training Instructor 101	Training Instructor 101	Training Instructor 101	Training Instructor 101	Training Instructor 101	Training Instructor 101	Training Instructor 101

Announcements

[+ Create Announcement](#)

Title	Details	Author	Date Created
NEW COMET FEATURE!!!!	New Home page to see all your important information	Spc3 Saul Supra	Thursday, 2023-08-03

Rows per page: 5

1-1 of 1

Upcoming Commitments

Event Type	Start Date	End Date
Training - Instructor 101	2023-08-03	2023-08-17
Appointment - Picking u...	2023-08-18	2023-08-18

Rows per page: 5

1-2 of 2

Pending Schedule Change Requests

Type	Date Created	Rank	Last Name	First Name	Position	Crew	First Day	Last Day	Days
Leave	2023-08-03	Spc3	Supra	Saul	No position assigned	No Crew assigned...	2023-08-21	2023-08-25	5

Rows per page: 5

1-1 of 1



COMET Features



03 Aug 202321519:36:49 UTC

DateJulian DayTime



Unit Members

+ Add Member

COLUMNS FILTERS DENSITY EXPORT

Search...

Rank	Last Name	First Name	Role	DOD Id	Email	Crew	Position	Qual
TSgt	Bradfield	Devin	Supra Administrator	1455579925	devin.bradfield@spaceforce.mil	Alpha	Technician	
TSgt	Cameron	Rob	Supra Administrator	1410752650	rob.cameron.12@spaceforce.mil	Alpha	Supervisor	
Sgt	Gonzalez	Carlos	Supra Administrator	1555034349	carlos.gonzalez_arce@spaceforce.mil	Alpha	Instructor	
TSgt	Clay	Adam	Supra Administrator	1124974824	adam.clay.3@spaceforce.mil	Alpha	Manager	
Capt	Enders	Nathaniel	Supra Administrator	1512841160	nathaniel.enders.1@spaceforce.mil	Bravo	Technician	
Col	Tester	Testy	Supra Administrator	7777777777	00000000000000000000000000-developer@SupraCoder.mil	Bravo	Technician	
Spc1	Basic	Barry	Basic User	1111111111	barry.basic@spaceforce.mil	Bravo	Supervisor	
1Lt	Scheduler	Sally	Crew Scheduler	2222222222	sally.scheduler@spaceforce.mil	Unassigned	Instructor	
Col	Commander	Conny	Commander	3333333333	conny.commander@spaceforce.mil	Unassigned	Manager	
Col	Admin	Alec	Administrator	4444444444	alec.admin@spaceforce.mil	Unassigned	Technician	
Spc3	Supra	Saul	Supra Administrator	5555555555	saul.supra@spaceforce.mil	Unassigned	Supervisor	



COMET Features



03 Aug 2023
Date

215
Julian Day

19:41:02 UTC
Time



Crew Configuration

Crew Positions

[+ Create Positions](#)Technician ×Supervisor ×Instructor ×Manager ×

Crews

[+ Create Crew](#)

Alpha Crew

TechnicianSupervisorInstructorManager

Bravo Crew

TechnicianSupervisor

Unassigned Crew





COMET Features



COMET

03 Aug 2023

215

17:48:50 UTC

Date

Julian Day

Talking:

Calendar

Users

Profile

Shield

Back

Create Shift Cycles

Schedule Parameters

Assign Shift Cycles

Review

Next >

Shift Cycles

Day 5/2

Add Shift Cycle

Shift Cycle Name

Name

On Shift

Shift Hours

8

On Duration

Days

Off Duration

Days

+ Add Segment

1

2

3

4

5

6

7

Save Shift Cycle

Cancel

+ Create Shift Cycle

D



COMET Features



03 Aug 2023 **215** **19:40:12 UTC**
Date Julian Day Time



< Back

✓ Create Shift Cycles

2 Schedule Parameters

3 Assign Shift Cycles

4 Review

Next >

Set Schedule Parameters

Schedule Name

Sep Days

Schedule Start Date

09 / 01 / 2023

to

Schedule End Date

09 / 30 / 2023

Crews to be scheduled

✓ Select All Crews

✓ Alpha

✓ Bravo



COMET Features



03 Aug 2023 **215** **19:40:21 UTC**
Date Julian Day Time



< Back

✓ Create Shift Cycles

✓ Schedule Parameters

3 Assign Shift Cycles

4 Review

Next >

Alpha Crew

Shift Cycle

Day 5/2

Cycle Start Date

09/01/2023

Assign to Crew

Assign to Positions

Technician

TSgt Bradfield, Devin

Shift Cycle

Day 5/2

Cycle Start Date

mm / dd / yyyy

Supervisor

TSgt Cameron, Rob

Shift Cycle

Day 5/2

Cycle Start Date

mm / dd / yyyy

Instructor

Sgt Gonzalez, Carlos

Shift Cycle

Day 5/2

Cycle Start Date

mm / dd / yyyy

Manager

TSgt Clay, Adam

Shift Cycle

Day 5/2

Cycle Start Date

mm / dd / yyyy

Bravo Crew

Shift Cycle

Day 5/2

Cycle Start Date

09/01/2023

Assign to Crew

Assign to Positions

Technician

Capt Enders, Nathaniel

Shift Cycle

Day 5/2

Cycle Start Date

mm / dd / yyyy

Supervisor

Spc1 Basic, Barry

Shift Cycle

Day 5/2

Cycle Start Date

mm / dd / yyyy



COMET Features



03 Aug 2023
Date

215
Julian Day

19:40:26 UTC
Time



< Back

✓ Create Shift Cycles

✓ Schedule Parameters

✓ Assign Shift Cycles

4 Review

Submit

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Alpha Crew																							
Technician	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8
Supervisor	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8
Instructor	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8
Manager	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8
	Bravo Crew																							
Technician	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8
Supervisor	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8	D/8	D/8	OFF	OFF	D/8	D/8	D/8



03 Aug 2023 215 16:48:11 UTC

Date _____

Julian Day

Time

Schedule Dashboard

Selected Schedule: Today

[+ Create New Schedule](#)

[View All Schedules](#)



COMET Features



03 Aug 2023

215

16:50:55 UTC

Date

Julian Day

Time

Schedule Dashboard

Selected Schedule: Aug Days

+ Create New Schedule

View All Schedules

Member Schedule View

Crew Schedule View

	1 Aug 23 Tuesday	2 Aug 23 Wednesday	3 Aug 23 Thursday	4 Aug 23 Friday	5 Aug 23 Saturday	6 Aug 23 Sunday	7 Aug 23 Monday	8 Aug 23 Tuesday	9 Aug 23 Wednesday	10 Aug 23 Thursday	11 Aug 23 Friday	12 Aug 23 Saturday	13 Aug 23 Sunday
1Lt Scheduler, Sally			Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved
▼ Alpha Crew													
TSgt Bradfield, Devin	Technician D/8	Technician D/8	Technician D/8	Technician D/8					Technician D/8	Technician D/8	Technician D/8	Technician D/8	
TSgt Cameron, Rob	Supervisor D/8	Supervisor D/8	Supervisor D/8	Supervisor D/8					Supervisor D/8	Supervisor D/8	Supervisor D/8	Supervisor D/8	
Sgt Gonzalez, Carlos	Instructor D/8	Instructor D/8	Instructor D/8	Instructor D/8					Instructor D/8	Instructor D/8	Instructor D/8	Instructor D/8	
TSgt Clay, Adam	Manager D/8	Manager D/8	Manager D/8	Manager D/8					Manager D/8	Manager D/8	Manager D/8	Manager D/8	
▼ Bravo Crew													
Capt Enders, Nathaniel	Technician D/8	Technician D/8	Technician D/8	Technician D/8	Technician D/8			Technician D/8	Technician D/8	Technician D/8	Technician D/8	Technician D/8	
Col Tester, Testy													
Spc1 Basic, Barry	Supervisor D/8	Supervisor D/8	Supervisor D/8	Supervisor D/8	Supervisor D/8			Supervisor D/8	Supervisor D/8	Supervisor D/8	Supervisor D/8	Supervisor D/8	
▼ Your Crew: Unassigned Crew													
1Lt Scheduler, Sally			Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved	Leave Approved

Commitment Type:
Other

Commitment Name:
Emergency Leave

Available Members:
TSgt Clay, Adam
Col Commander, Conny

Member already has Shift Commitment(s) between 2023-08-01 and 2023-08-02

Save With Replacement

Save Without Replacement

Cancel



COMET Features



03 Aug 202321517:45:52 UTC

DateJulian DayTalking: Angel De La Cruz



Schedule Change Requests

Pending RequestsApproved RequestsDenied Requests

COLUMNS FILTERS DENSITY EXPORT

Search...

Type	Date Created	Rank	Last Name	First Name	Position	Crew	First Day	Last Day	Days	
Leave	2023-08-03	Spc3	Supra	Saul	No position assigned	No Crew assigned Crew	2023-08-21	2023-08-25	5	ApproveDeny
Other	2023-08-03	TSgt	Clay	Adam	Manager	Alpha Crew	2023-08-03	2023-08-12	10	Acknowledge

Rows per page: 201-2 of 2



Date Julian Day Talking: Angel De La Cruz

[View All Schedules](#)

Member Schedule View Crew Schedule View

Technician	TSgt Bradfield, ... D/8	TSgt Bradfield, ... D/8	TSgt Bradfield, ... D/8	TSgt Bradfield, ... D/8	TSgt Bradfield, ... D/8	OFF	OFF	TSgt Bradfield, ... D/8	TSgt Bradfield, ... D/8	TSgt Bradfield, ... D/8
Supervisor	TSgt Cameron, ... D/8	TSgt Cameron, ... D/8	TSgt Cameron, ... D/8	TSgt Cameron, ... D/8	TSgt Cameron, ... D/8	OFF	OFF	TSgt Cameron, ... D/8	TSgt Cameron, ... D/8	TSgt Cameron, ... D/8
Instructor	Sgt Gonzalez, C... D/8	Sgt Gonzalez, C... D/8	Sgt Gonzalez, C... D/8	Sgt Gonzalez, C... D/8	Sgt Gonzalez, C... D/8	OFF	OFF	Sgt Gonzalez, C... D/8	Sgt Gonzalez, C... D/8	Sgt Gonzalez, C... D/8
Manager	Col Commander... D/8	Missing Manager D/8	Missing Manager D/8	Missing Manager D/8	Missing Manager D/8	OFF	OFF	Missing Manager D/8	Missing Manager D/8	Missing Manager D/8

Technician	Capt Enders, Na... D/8	Capt Enders, Na... D/8	Capt Enders, Na... D/8	Capt Enders, Na... D/8	Capt Enders, Na... D/8	OFF	OFF	Capt Enders, Na... D/8	Capt Enders, Na... D/8	C
Supervisor	Spc1 Basic, Barry D/8	Spc1 Basic, Barry D/8	Spc1 Basic, Barry D/8	Spc1 Basic, Barry D/8	Spc1 Basic, Barry D/8	OFF	OFF	Spc1 Basic, Barry D/8	Spc1 Basic, Barry D/8	S

▼ Your Crew: Unassigned Crew



Date _____

Julian Day

Talking: Devin Bradfield



Search for member by DODID

7777777777

SEARCH

Member is already assigned to a unit

Pending Requests

Approved Requests

Denied Requests

 COLUMNS
  FILTERS
  DENSITY
  EXPORT

🔍 Search...



COMET Features



03 Aug 2023 215 17:48:28 UTC

Date Julian Day Talking:



Outprocessing

COLUMNS FILTERS DENSITY EXPORT

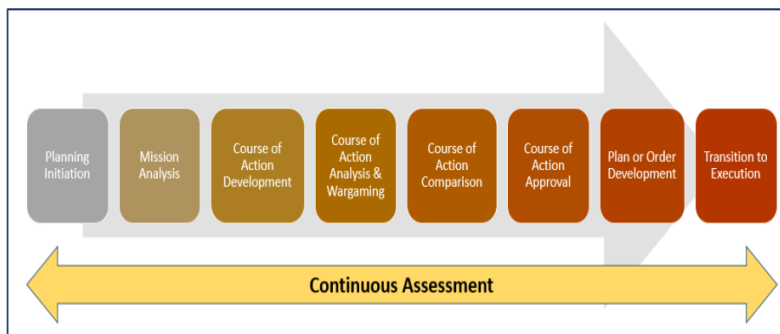
Search...

Rank	Last Name	First Name	Role	DOD Id	Email	
TSgt	Bradfield	Devin	Supra Administrator	1455579925	devin.bradfield@spaceforce.mil	
TSgt	Cameron	Rob	Supra Administrator	1410752650	rob.cameron.12@spaceforce.mil	 Remove member from unit
Sgt	Gonzalez	Carlos	Supra Administrator	1555034349	carlos.gonzalez_arce@spaceforce.mil	
TSgt	Clay	Adam	Supra Administrator	1124974824	adam.clay.3@spaceforce.mil	
Capt	Enders	Nathaniel	Supra Administrator	1512841160	nathaniel.enders.1@spaceforce.mil	
Col	Tester	Testy	Supra Administrator	7777777777	000000000000000000000000-developer@SupraCoder.mil	
Spc1	Basic	Barry	Basic User	1111111111	barry.basic@spaceforce.mil	
1Lt	Scheduler	Sally	Crew Scheduler	2222222222	sally.scheduler@spaceforce.mil	
Col	Commander	Conny	Commander	3333333333	conny.commander@spaceforce.mil	
Col	Admin	Alec	Administrator	4444444444	alec.admin@spaceforce.mil	
Spc3	Supra	Saul	Supra Administrator	5555555555	saul.supra@spaceforce.mil	

Digital Transformation and Analysis



- S9A supports warfighting operations
 - ...leading space operations assessments (SpOC OPORD 23-01)
 - Continuous process measures—military ops effectiveness (SDP 5-0)
 - Delta assessments, S4S tool, & campaign modeling on standalone network
- S9A propels digital transformation
 - ...providing tools & skills supporting CSO's digital vision
 - Digital workforce, headquarters, & operations
 - Data science solutions, visualization, automation, & advance analytics
- 3 Divisions
 - Business Analytics
 - Mission Analytics
 - Resources



Accelerating ops - defining force effectiveness, improving readiness

VIA VINCIMUS

16th EWS-Satellite Pairing Automation



Problem: Electromagnetic interference (EMI) can inhibit Joint operations. 16th EWS geolocates EMI for possible response using nearby reference signals

- Finding reference signals (satellite pairing) is time-intensive, human-centric, and uses trial-and-error.

Solution Delivered: In-house coded/developed web scraping dashboard automates satellite pairing process.

- Collects/consolidates pertinent information & enables rapid down-selection of possible satellite pairs.

Mission Impact: Eliminates from 1-12 hours of time spent navigating multiple websites and sources. Low-cost sustainment.

Automation enables focus on operations rather than web-searches

VIA VINCIMUS

4 SOPS-Thruster Anomaly Detection

Problem: Electric thrusters prone to aborts as they age; safety of flight concern / re-work in peacetime, risks mission during conflict

Solution Delivered: Data-driven, machine learning (ML) operational planning tool uses routine telemetry to predict aborts days in advance. Keys preventative maintenance/informs satellite maneuver plans.

Mission Impact: Decreases orbital analysts' workload, eliminates missed/failed burns. Operators can accurately predict thruster anomalies 4 days in advance and take corrective actions without user impact.



XIPS Engine (Boeing Satellite Systems)

Photo by: Melvin R. Carruth, NASA Test Laboratory

Extending prediction timeline and creating sustainable handoff



JTFSD NSDC-High Interest Maneuvers



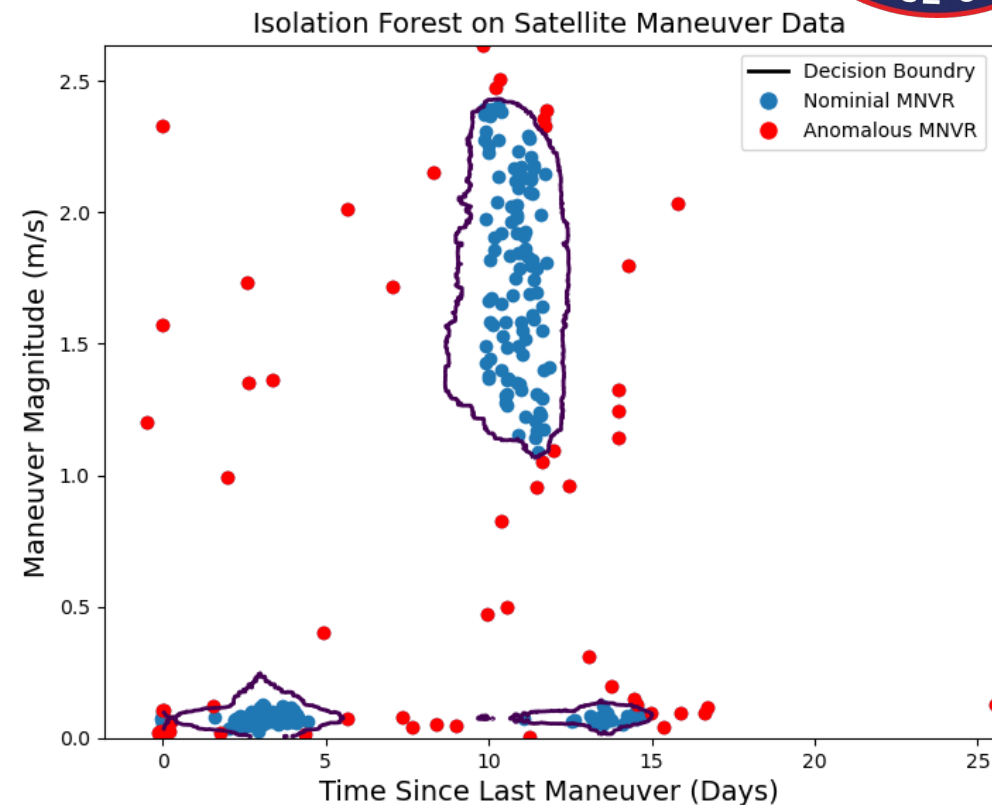
Problem: Satellite maneuvers can often be divided into types or patterns of behavior. Traditional anomaly detection has been done manually and focused on standard statistical metrics (susceptible to skewing).

Solution Delivered: Utilized advanced AI/ML techniques to detect anomalous satellite maneuvers.

- Algorithm provides a means to characterize satellites patterns of behavior.
- Highly resilient algorithm to data poisoning.

Mission Impact: Increased Space Domain Awareness (SDA) on high priority Resident Space Objects (RSOs).

- Algorithm provides timely, maneuver classification.
- Significantly reduced workload of space Guardians when assessing satellite maneuver status.



Improving anomaly detection through skew-proof classification

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Challenges

Finding/Prioritizing Customers

- Frozen Middle - Culture challenges between visionary leaders and young workers



During Development

- Access to data challenging (classification, NDAs, air-gapped systems)
- Compute and development resources are tough to come by



Deployment and Operations

- There should be a hosting solution that can easily support ML/Automation pipelines
- Unique solutions defy standardized approaches / sustainment
 - Resourcing uses traditional requirements approach—not agile

Ensure data rights and data access are standard in new acquisitions

VIA VINCIMUS

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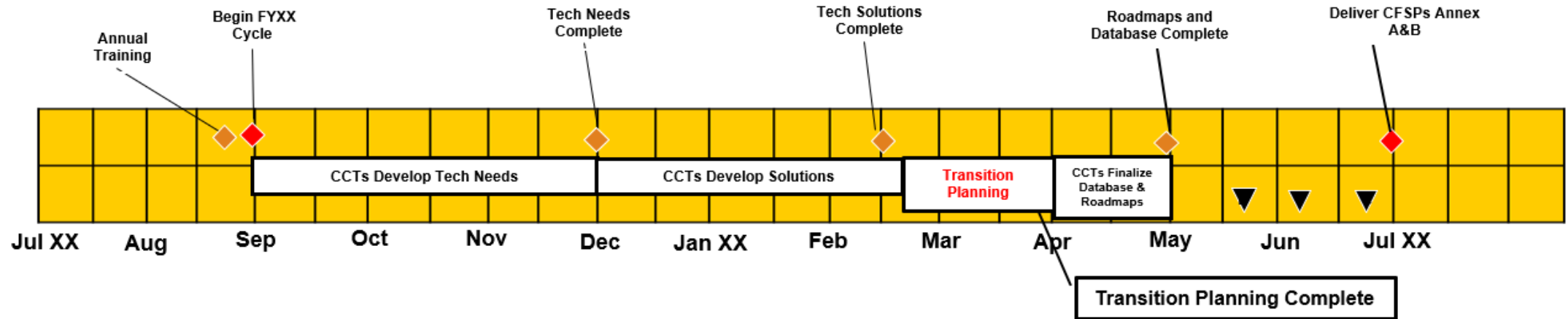
SpOC S&T Digital Transformation

I listened with fascination. I had always admired (Commanding General of the Army Air Forces Henry H.) Arnold's great vision, but I think then that I was more impressed than ever. This was September 1944. The war was not over; in fact the Germans were to launch the Battle of the Bulge in December. Yet Arnold was already casting his sights far beyond the war, and realizing, as he always had, that the technical genius which could help find answers for him was not cooped up in military and civilian bureaucracy but was to be found in universities and in the people at large.

- Theodore von Karmen
The Wind and Beyond,
p. 268



Introduction / Topics



The S&T Process follows AFI 61-101, Management of Science and Technology, 14 March 2013 and AFSPC Supplement to accomplish the following:

- Deliver to the Warfighter unique technological capabilities.
- Lays the technological foundation for the current and future Space Force.
- Produces evolutionary and revolutionary technologies focused on Service Core Competencies (referenced by the Space Capstone Publication).



Transformation Challenges & Opportunities

- **Competing resources & priorities for digital innovators (e.g. Supra Coder program and CDTs often have additional duties)**
- **Support mechanisms for leveraging DoD Software Factories requires internal expertise, funding, and buy-in (PM/technical/security limitations exist, e.g. releasability, hosting fees)**
- **Funding policies & guidance for software not aligned with modern day DevSecOps agile processes & methods**
- **Formal System Requirements vs Unit-level Pain Points**
 - Very limited enterprise resources for non-Program of Record digital tools development & operations
 - Transition & sustainment plans for mature digital tools is often undefined & buy-in support is limited
 - Digital tools with enterprise potential struggle with enduring ownership (“not made here or not directly traceable to an existing requirement” mentality stymies innovation & transformation).
 - Demonstrating defensible ROI & performance improvements for digital tools is difficult & needs to be planned for early
- **Small Business Innovation & Research program lacks sustainment mechanisms for ops**
- **Data rights & IP for digital tools ... Vendor lock limits innovation & flexibility**

Despite resource challenges & lack of formal requirements, HQ SpOC and Deltas are leaning forward to deliver digital tools, capabilities, and an innovative mindset to transform Space Force operations

Questions?

