

Understanding Post- Production Change

A Case Study in Close Air Support in Desert Storm

Aditya Singh, PhD Student

Dr. Zoe Szajnfarber, Professor and Chair

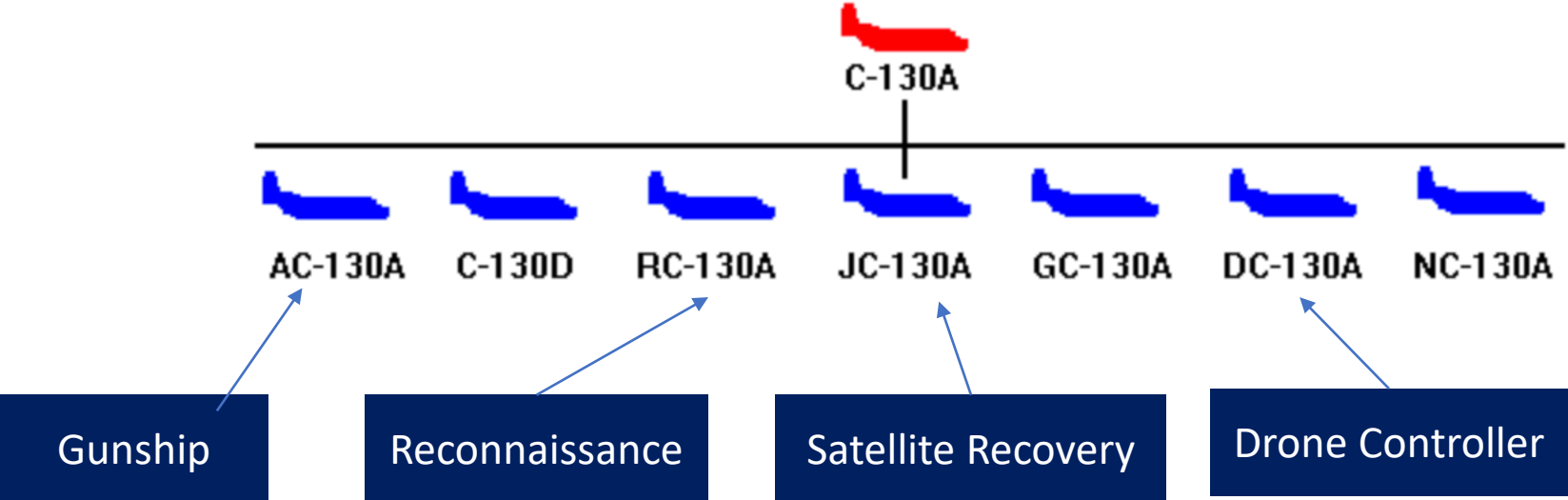
The George Washington University

School of Engineering & Applied Science

Department of Engineering Management & Systems Engineering

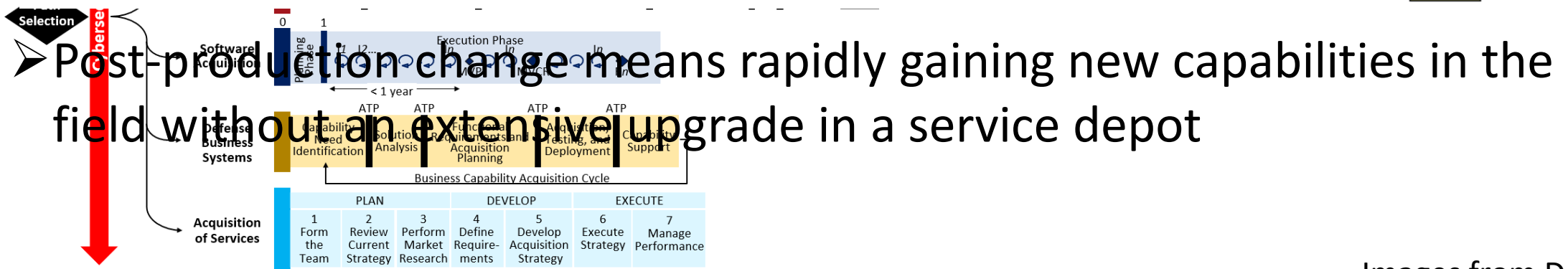
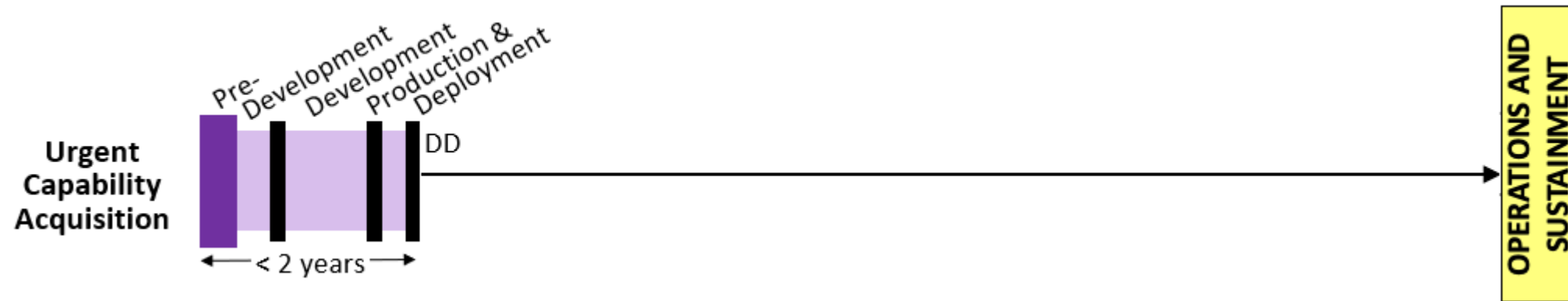
Research Motivation

C-130A Variants



Systems are tasked with capabilities not originally designed for

What is Post-Production Change?



Images from DAU [2]

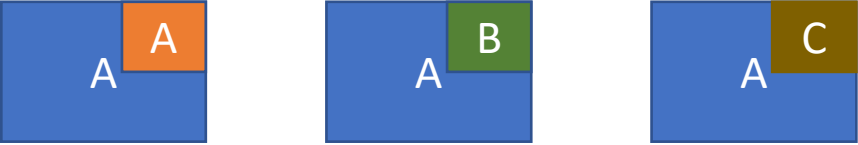
Post-production is an urgent need for the warfighter

Enablers of Changeability

Modularity

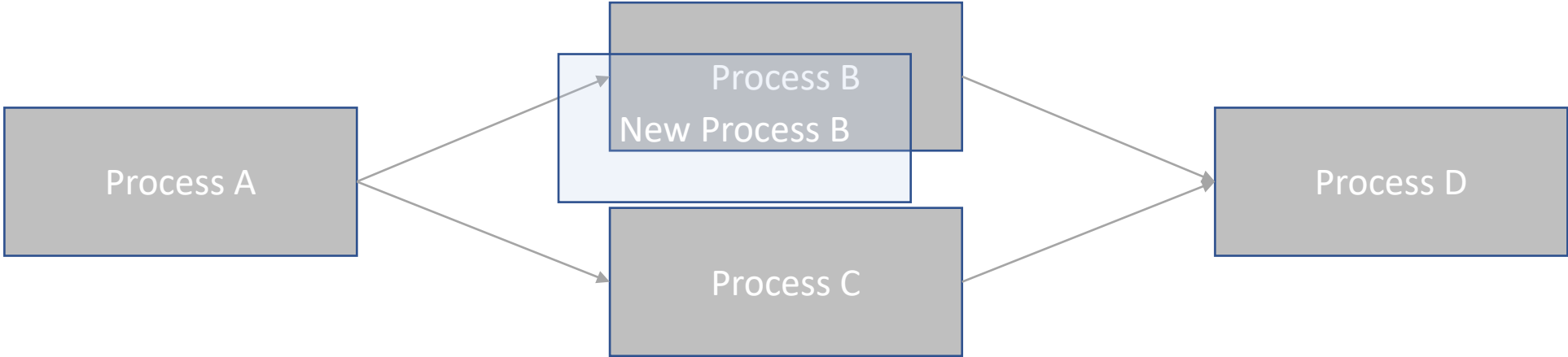


Component Sharing Modularity



Component Swapping Modularity [3]

CONOPs



Form and function both enable changeability

Research Goal & Setting

- Goal is to empirically test changeability strategies
- Many aircraft performing one mission in the same context provides a natural experiment to study post-production change
- Close Air Support (CAS) functions taken from doctrine
 - Effective Weaponneering
 - Effective Targeting & Marking
 - Flexible Control & Prompt Response

CAS in Desert Storm provides a natural experiment

Aircraft that Performed CAS in Desert Storm

Design Optimized for CAS



F-16



F/A-18



AV-8



A-10

Multi-role and role specialist aircraft were changed

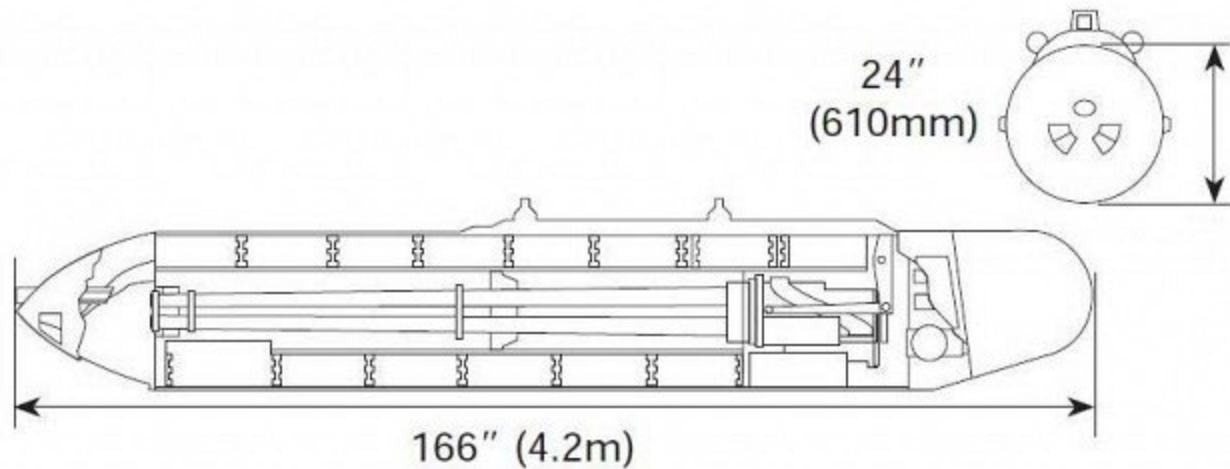
Overview of Changes

	A-10	F-16	F/A-18	AV-8
Effective Weaponering	D	X	D	D
Effective Targeting & Marking	X	X	D	D
Flexible Control & Prompt Response	/	/	X	X

D – Design met needs effectively, X – change was needed to meet needs effectively, / - need not identified

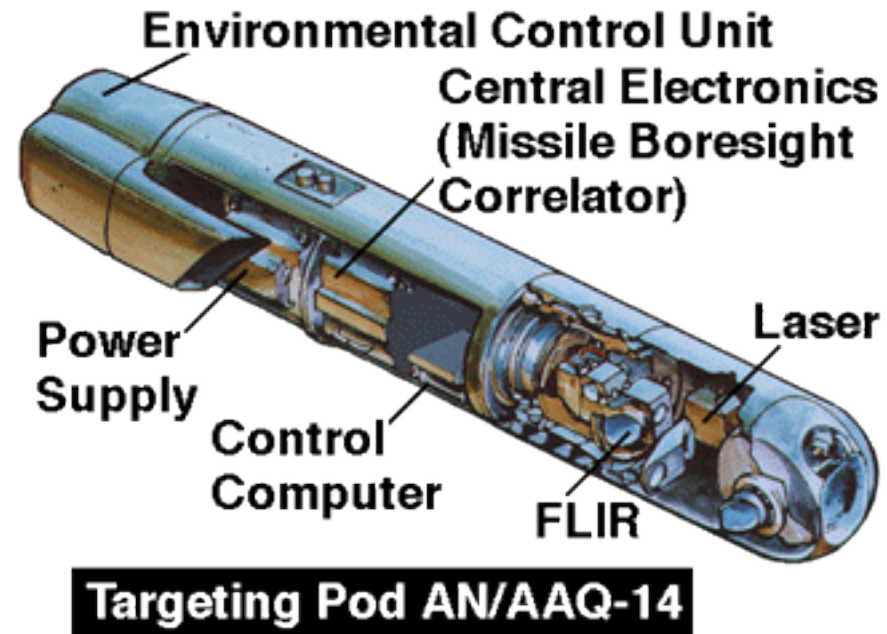
Analyzed changes in the three CAS functions

Modularity Example: GPU-5/A Gun Pod



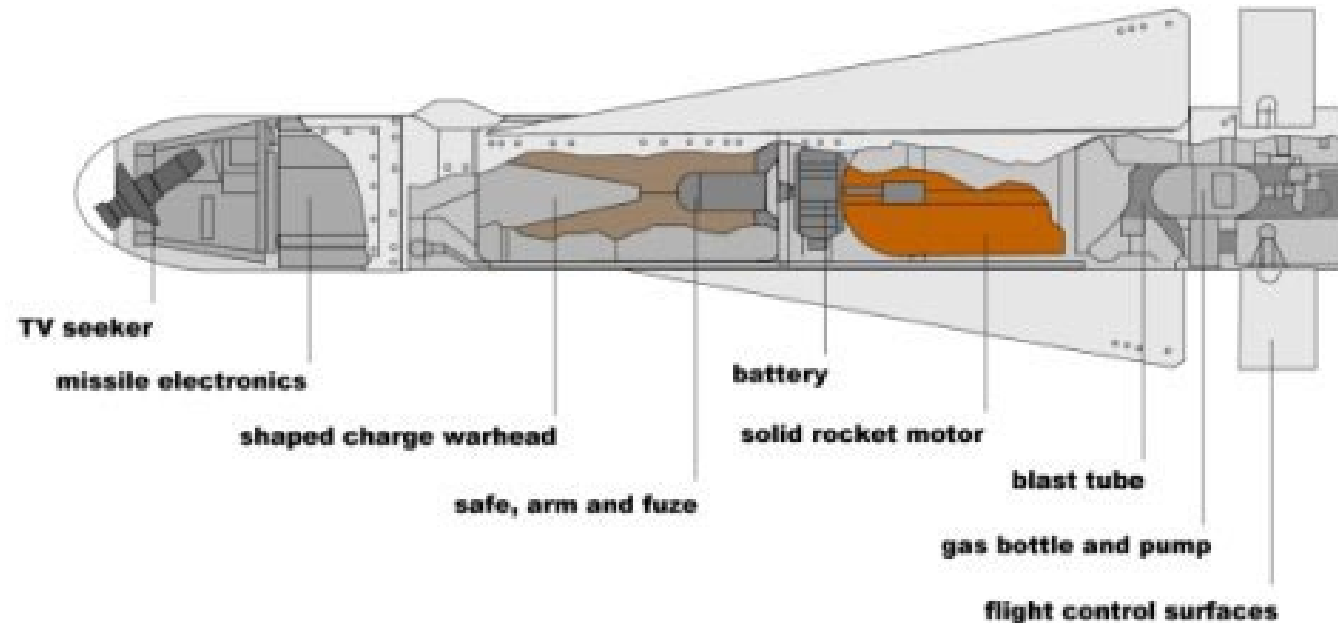
Pod was not properly integrated with the F-16

Modularity Example: F-16 LANTIRN



F-16s flew at night using LANTIRN pods

CONOPs Example: A-10 IR Maverick



A-10s used the infrared cameras on missiles to fly at night

Conclusions

- Utilizing changeability enablers requires careful consideration of how changes affect the overall system
- CONOPs changes are an important pathway of post-production
- There is an interaction effect between CONOPs innovation & the form of the system

Form and functional changes are interrelated



**Please direct questions or comments to Aditya Singh
(asingh25@gwu.edu)**

Works Cited

- [1] <https://www.proquest.com/openview/f0c8db7bd87e0fdc086e13fbe0ba523a/1.pdf?cbl=18750&pq-origsite=gscholar>
- [2] <https://aaf.dau.edu/>
- [3] <https://onlinelibrary.wiley.com/doi/10.1002/sys.20039>
- [4] <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/C479B2609FB06853CFEE1F15505338E1/S2053470119000076a.pdf/div-class-title-design-margins-a-hidden-issue-in-industry-div.pdf>
- [5] https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-03/3-03-D13-CAS.pdf