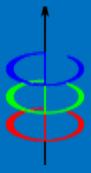




Bio/Resume

DOST Balik-Scientist





SPAWAR





USN (Naval Aviator)



Development Approach



Use DOD Model in development by phases

UAV GCS

INORGANIC UAV CONOPS

HDR Antenna

Ku-Band TCDL C² Data

TCS Level 4 吕

Airborne Science Program

UAS Technology Roadmap

Precision Navigation

Multi-UAV Navigation

Long Range Tactical UAV

UAV & Payload Control Turnover to Sub

Draft

LOS Ku-Band TCDL

C2 & Sensor Data

NAVSEA

SOFRDT

Capabilities Enabled by this Technology : 4

Very low altitude, Terrain avoidance, Formation flight. Precision trajectories.

BLOS C²& Sensor Data

CONOPS

Roadmap

rmation flight with highly precise navigation capability, and vehicle to vehicle navigational cooperation Next-gen GPS-aided Significant improvement in long-term INS-based Navigational Accuracy, UAV SAR - Precision ASAG-3 flight tests demonstrate ability to repeatedly navigate a flight path with Nav Element less than +5m deviation (in altitude and lateral cross-track) error Advanced Capabilities for Small UAV's 2020 - New Product Introduction IPT METHODOLOGIES (Integrated Product IPT Leader - Project Manager Team) System Engineering QFD • Logistics REUSE Production Engineering DFMA Contracting PROCESS MAPPING Customer PHASE DTC Strategic Suppliers MAKE-BUY GATE • Finance **RISKS MITIGATION** Planning Customer Service ARO **Design Readiness** DRR * CONFIGURATION DEVELOPMENT POLICY TECHNOLOGIES

PROGRAM PRODUCTION 8 DEVELOPMENT PERFORMANCE PROTOTYPE MATERIAL PURCHASING RESOURCES MANPOWER ARCHITECTURE ENVIRONMENT TIME TABLES ORGANIZATION CHART BUDGET PLAN Organization COMPONENTS INFRASTRUCTURE TESTS MAKE-BUY CUSTOMER REQUIREMENTS

CUSTOMER DELIVERIES PRODUCTION MABILITY PRODUCT TESTS
DEVELOPMENT TOOLS **OUTPUTS** Itzhak Ben-Levy LEAN Expert ©

DoD Development Cycle

Phase -1	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Interfacing with Planning and the Regional Architecture	Concept Exploration and Benefits Analysis	Project Planning and Concept of Operations Development	System Definition and Design	System Development and Implementation	Validation, Operations and Maintenance, Changes & Upgrades	System Retirement / Replacement
Regional Architecture	Needs Concept Assessment Selection	Systems Project Engineering Planning Management Planning			Operations Changes and and Maintenance Upgrades	Retirement / Replacement
Stakeholde	tting Activities or Involvement sitation	Requi	stem frements	V	System alidation nitial oyment monard oyment monard oyment monard oyment monard oyne of the system o	
Project Manag	gement Practices		ligh-Level Design	System Integratio	- 1 S	
Risk Ma	anagement	W	Subsystem	-	- Jour	
Progra	m Metrics	Og	Requirements	Subsystem Verification	Mon	
Configuratio	n Management	all l	Detailed	Subsystem Integration	68	
Process I	mprovement	2.4	Design .	→ Unit Testing	15	
Decisi	on Gates			i c county	ecision Gate	
Trade	Studies		Hardare	Fabrication		
Technic	al Reviews	<u> </u>	Life Cycle	Time Line		
7.7	ceability	25				

<u>Type of Military UAV</u>

Classes of UAV

Class I < 150 kg Class II (150-600 kg) Class III (> 600 kg)



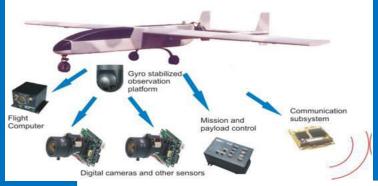




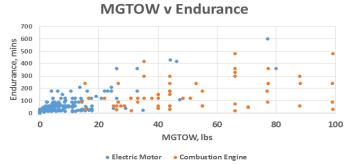
Military UAV

MUAV should address the following:

Payload



Endurance



Capabilities



Military UAV Capabilities

"The introduction of UAVs into the battlespace enables impressive new operational capabilities for any military forces across the operational mission spectrum. "

Quadrennial Defense Review 2007

These capabilities can be categorized in the (3)

broad mission-area types:

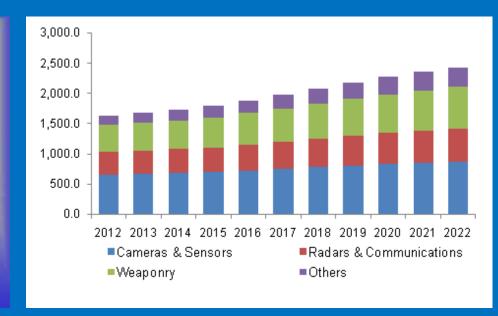
- ISR
- Strike
- Combat Support



MUAV Payload

A *payload* is the cargo or equipment a vehicle carries that is not required for flight, control and navigation





MUAV Development Objectives

The first objective of any militarized UAV is to satisfy military needs by providing a platform capability within their mission requirement time frame

The second objective is to develop a CONOPS for a baseline UAV in general. Program development stresses COTS system integration in order to meet its low cost requirement. Off-the-shelf EO, IR, SAR, navigation, systems, engines, and basic aircraft design integrated to produce an advance military grade UAV

Military UAV Issues

UAV operations depend on secure reliable comms.

Although autonomy and other technology developments can minimize communications bandwidth requirements, large BW is still required for downlink communication, sensor data, HD imageries and information regarding the UAV's status, position, and system's health.

Although continued system and technology development is expected to make progress in this area, the issue itself will not go away. Continued attention to this subject, therefore, is essential

<u> Military UAV Issues</u>

- <u>Competition with legacy and other new systems for funds.</u> As a relatively new type of military weapon system, UAVs are in competition for funds with new and traditional systems
- The program start-stop-start syndrome. The
 unfortunate practice of starting a military program
 and then, when IOC is about to commence,
 canceling it in favor of a supposedly more promising
 "pet" project, has plagued the AFP UAV procurements
 for years. Each such sequence adds years of delay in
 equipping the operating forces with UAVs.

Military UAV Issues

Reluctance of one military Service to use the UAV system of another. This is the "not invented here" syndrome, it is an understandable characteristic of some validity. A commander feels most secure in owning and completely controlling a system that is fundamental to accomplishing the service's mission.

But there are obvious cost and operational advantages for the AFP if multi-service use can be achieved—overall system development costs are reduced, and UAV force levels can be increased more rapidly

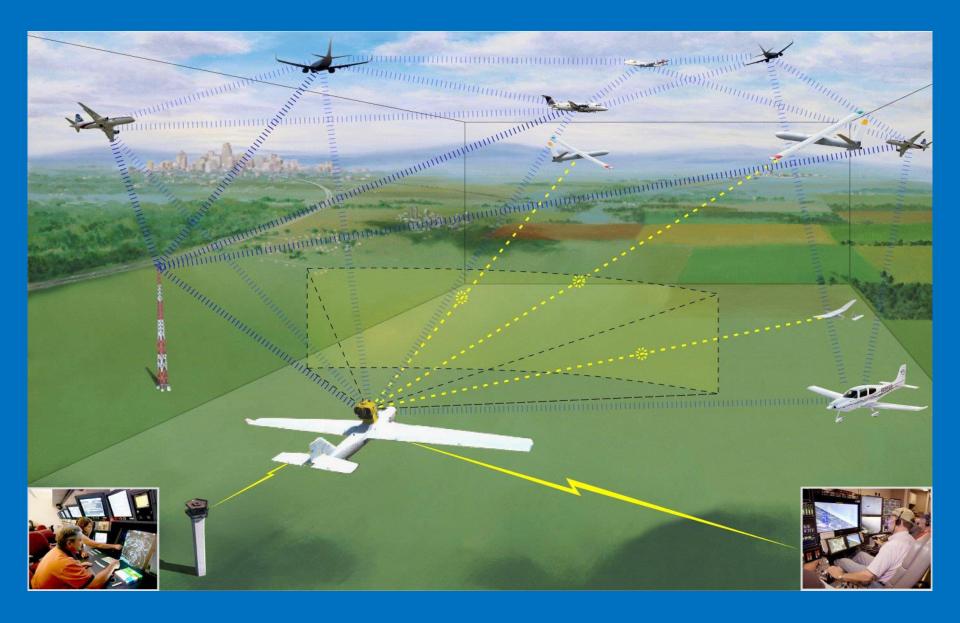
Military UAV Issues EMC/RFI

- With the proliferation of the high speed devices that synchronize modern digital circuits, an increase in their switching speeds and lower circuit voltages, increasing susceptibility RFI is greater
- EMC increasingly became a source of concern. The US DoD became aware of EMC as a growing problem and issued directives to the manufacturers of digital electronic equipment, which set out the essential manufacturer requirements before their equipment could be sold to the DoD

Military UAV Issues

 MIL-STD-461B- MILITARY STANDARD: **ELECTROMAGNETIC EMISSION AND SUSCEPTIBILITY** REQUIREMENTS FOR THE CONTROL OF **ELECTROMAGNETIC INTERFERENCE (01 APR 1980)., This** standard covers the requirements and test limits for the measurement and determination of the electromagnetic interference characteristics (emission and susceptibility) of electronic, electrical and electromechanical equipment. The requirements shall be applied for general or multiservice procurements and single service procurements, as specified in the individual equipment specification, or the contract or order.

UAV & National Air Space





Autonomous Flight Systems Laboratory



A Risk Based Paradigm and Model for **Unmanned Aerial Systems in the National Airspace**

Christopher Lum Blake Waggoner **Juris Vagners** Tad McGeer

University of Washington Missile Defense Agency Kristoffer Gauksheim University of Washington **University of Washington** Aerovel

March 29, 2011 2011 AIAA Infotech@Aerospace Conference St. Louis, MO

Way Forward

- Adhoc Committee: Composed of AFP and DND Representatives
- Draft of Joint Memorandum of Agreements between all Services
- Draft MOA with DOST
- Develop a Joint Military CONOPS
- Develop a Joint Military UAV Development Plan/Roadmap
- Create a UAV R&D Branch within each Services R&D Centers

Questions???