

UCAR

Unmanned Combat Armed Rotorcraft



Human Machine Interaction Concepts for the Unmanned Combat Armed Rotorcraft (UCAR)

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LOCKHEED MARTIN





- UCAR Overview
- UCAR Video
- HMI Design Challenges
- Options for HMI Solutions
- Questions and Answers

DARPA System Concept



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UCAR System Concept

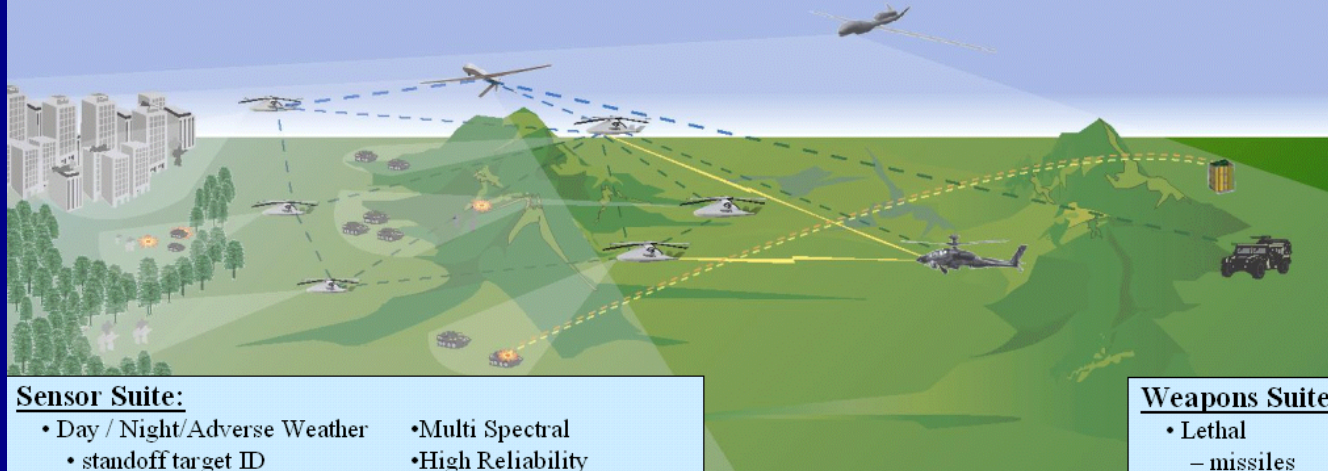


Command & Control:

- Platform
 - Top-level mission planning
 - Dynamic retasking
 - Autonomous operation
 - Collaborative mission execution
 - Low altitude autonomous flight

Air Vehicle:

- Day / Night & Adverse Weather
 - Similar capability to manned system
- Modular Payload
- Survivable
 - Enhance team survivability
- Performance – range, speed, endurance
 - Compatible w/manned system
- Affordable
 - Flyaway cost
 - O&S cost
- Robust Capability



Sensor Suite:

- Day / Night/Adverse Weather
- Multi Spectral
- standoff target ID
- High Reliability
- BDA, IFF
- Distributed / cooperative

Weapons Suite:

- Lethal
 - missiles
 - rockets/gun
- Non-Lethal

Command and Control from Air or Ground

Non-expendable, Lethal VTOL using heavy fuel

Global deployment, use with Army initial entry force

System integrity consistent with use over populated areas

System Ao > 90%

Source: <http://www.darpa.mil/tto/programs/ucar.html>

DARPA Goals and Objectives



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UCAR Goals & Objectives



Demonstrate the capability to affordably and effectively identify and prosecute masked ground targets at ranges that limit threat capability to engage friendly forces

- Develop Key Technologies
 - Key technologies to enable the next generation of autonomous & collaborative operations, enhanced survivability at altitudes above nap-of-the-earth, low-altitude autonomous flight, and standoff target identification
- Technologies that are broadly applicable to Objective Force manned and unmanned aviation systems*
- Demonstrate
 - The capabilities represented by the key technologies in a UCAR demonstration system in FY06 (Phase III)
 - Mature
 - If the capability offered by UCAR is compelling
 - Demonstrate the capability to perform armed reconnaissance, attack, and other core aviation missions in an Objective Force system-of-systems environment
 - Mature the UCAR system capability to a level that is suitable for entry into SDD

Develop Technologies for autonomous rotorcraft

Investigate armed unmanned capabilities to support warfighter

Demonstrate and mature technologies through series of demonstrations

Position program concepts for transition to use

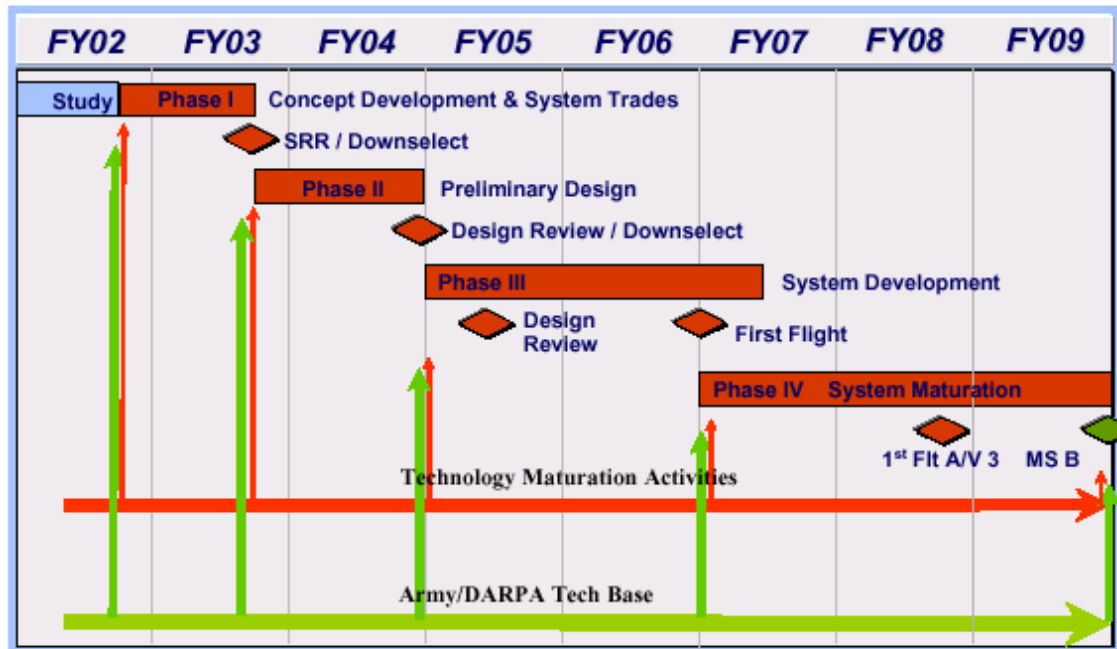
Source: <http://www.darpa.mil/tto/programs/ucar.html>

DARPA Program Schedule



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Program Schedule



Phase I – 4 teams, Phase II – two teams, Phase III & IV – one team

Phase 1:
4 Contractors
Initial Concepts and
System Trades

Phase 2:
2 Contractors
Preliminary Design
of Demonstrator

Phase 3 and 4:
1 Contractor
Series of Risk
Reduction
Demonstrations and
Design Maturation

Source: <http://www.darpa.mil/tto/programs/ucar.html>

UCAR – Transformational Program



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Unmanned Combat Armed Rotorcraft - A Transformational System -



UNMANNED / MANNED INTEGRATION

- Cooperative mission execution to exploit the strengths of all systems
- Reduces risk to manned platforms
- Relieves manned platforms of the need to perform the dull, dirty, and dangerous missions

AUTONOMOUS

Advances in state-of-the-art

- Mission planning & execution
- Collaboration among platforms

SURVIVABLE

- Advances in state-of-the-art to enhance survivability at low altitude

LETHAL

- Able to ID targets at long range
- Immediate prosecution of time-sensitive targets

AFFORDABLE

- Reduced acquisition, training, and support cost

UCAR – Transformational Program:

**Provide Army with
unmanned rotorcraft
to support Future
Force**

**Force multiplier for
warfighter**

**Position for transition
to Army program in
2009**

Source: <http://www.darpa.mil/tto/programs/ucar.html>

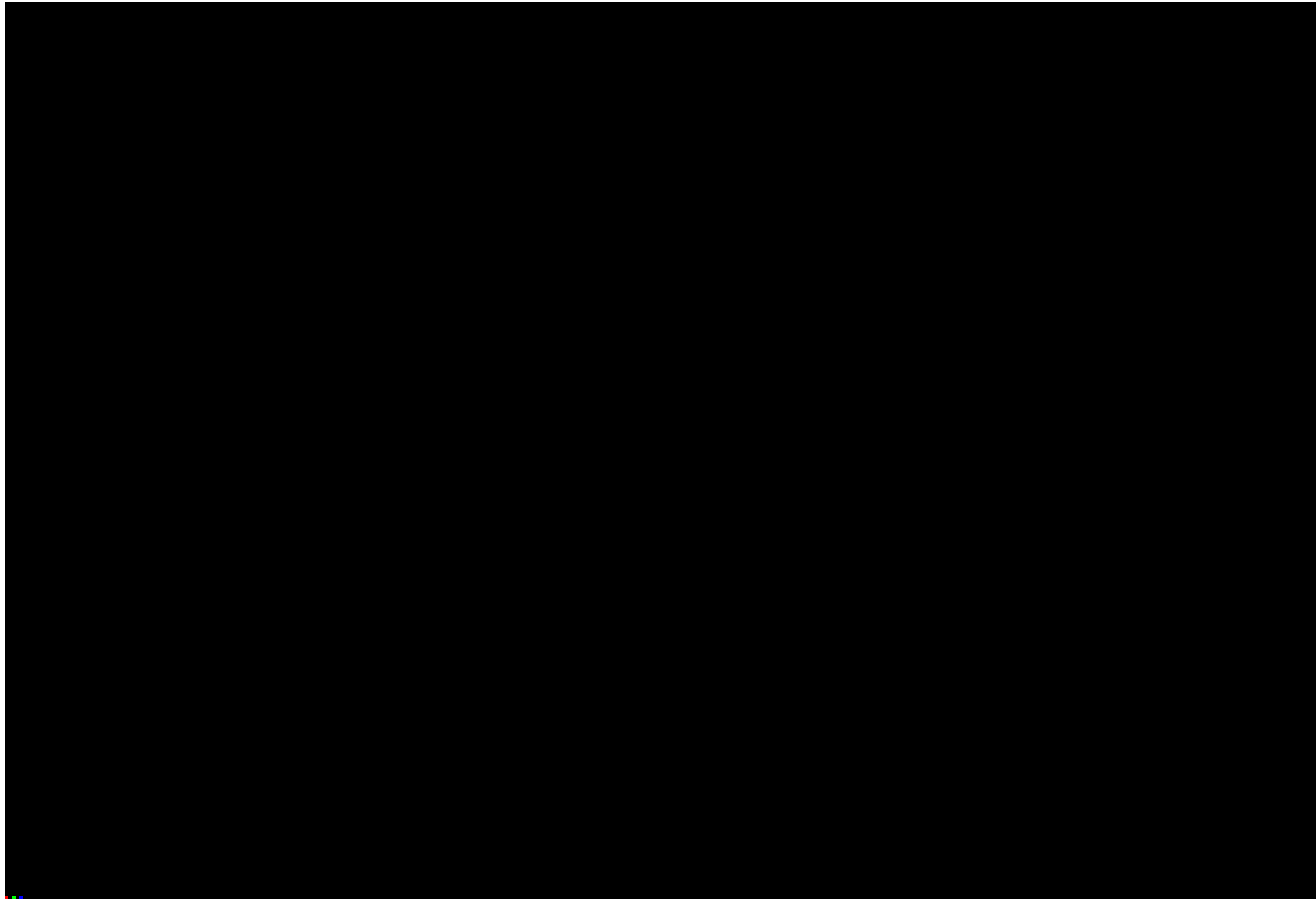
The LM Team Vision ...

“The Wolves of War”



Our UCAR Objective System is Envisioned to be a Ferocious Pack of Relentless, Cunning, Intelligent, Lean, Staunch, Deadly Wolves – Efficient in Their Missions and Responsive to the Warfighter’s Intentions

- **Relentless** - Persistent in the pursuit of their goals ... Built to do the ‘Dull, Dirty and Dangerous’ missions
- **Cunning** - Intelligent use of tactics, techniques, and procedures ... Sly use of multi-spectral survivability and LPI/LPD sensors and communications
- **Intelligent** - Agile 3-D quickness at low altitudes ... Battlespace reasoning ... and mission re-planning on the run
- **Lean** - Affordable, durable, economical ... Horizontally-integrated into the DoD’s support structure ... Low personnel and training burdens
- **Staunch** - Trusted and dependable performance ... Behavior is expected and understood
- **Deadly** - Employs all weapons available, both on-board and off-board ... Matched to the targets with awesome precision



Lockheed Martin UCAR Public Release Video – 9 min.



UCAR objectives drive design to allow multiple UCAR vehicles to be controlled by single operator.

Operators are already engrossed in high workload environments.

- **Workload issues** –

- C2 of multiple vehicles by single operator
- Managing workload to allow for C2 of vehicles

- **Context tracking** –

- Maintaining awareness of UCAR vehicles as well as ownship situations.
- Operator switching between situations, and returning to original tasks

- **System trust** -

- Introducing new operational concepts to warfighter
- Incorporating autonomy that is effective, predictable and controllable

Phase 1 of UCAR Program conducted Trade Studies looking at options for System Designs

Human Machine Interface one of critical areas reviewed. Results of Trades still Competition Sensitive. Some key attributes listed here:

- **Channels of Interaction** –
 - Think outside the standard interface routes, are there other ways to get information to operator, within constraints of environment.
 - Integrate as much as possible with current C2 systems
 - Develop a modular architecture that can be ported to multiple host platforms
- **Work with automation, do not rely on it** –
 - Automation provides reduced workload, but adds new challenges
 - Must work with engineers providing automation to insure user needs are met
- **Test Concept with Operators, demonstrate to customers** –
 - First concepts need to adapt to evolving requirements
 - Be adaptable – everything can change!

Questions - sure
Answers - perhaps