

Chapter 3

Operational Mission and Task Concepts

The study group reviewed current Air Force roles and missions and determined how UAVs might contribute to the significant capabilities that already exist in manned systems. Each Air Force mission (AFM 1-1) was reviewed for its applicability to UAV development. Further, the study group considered UAV contributions to “core competencies” and “Air Force Capabilities” promulgated by the Secretary of the Air Force and the Chief of Staff.

A number of driving factors were considered along with the UAV’s contribution to mission success. These included platform characteristics, degree of autonomy in vehicle/flight management, reliability and maintainability, airspace deconfliction procedures, abort procedures, deployment considerations, strike (lethal) versus support, remote versus forward basing, information and mission systems processing survivability, weapons integration and employment, and human factors (C², training, selection, etc.).

From the expanded mission list shown below, the first nine missions were selected as both being critical to Air Force needs and being representative of the 22 missions for purposes of technology considerations. Detailed descriptions of the mission concepts are included in the Panel reports in Volume II.

- Counter Weapons of Mass Destruction
- Theater Missile Defense—Ballistic Missiles/Cruise Missiles
- Fixed Target Attack
- Moving Target Attack
- Jamming
- Suppression of Enemy Air Defenses
- Intelligence, Surveillance and Reconnaissance (ISR)
- Communications/Navigation Support
- Air-to-Air
- Base Defense
- Strategic Attack
- Space Control
- Special Operations
- Area Denial
- Decontamination & Defoliant Dispensing
- Combat Search and Rescue
- Trans/Post SIOP Missions
- Refueling Tanker
- Cargo Transport
- GPS Augmentation
- Information Warfare
- Humanitarian Assistance

The study group reviewed the DARPA Unmanned Tactical Aircraft (UTA) initiative and some of the industry responses to “uninhabited” vehicle solutions, the Army’s recent Tactical UAV (TUAV) program selection (Alliant Techsystems), and the QF-106 and QF-4 drone programs. The group concluded that there are opportunities for proof-of-concept work in the near-term with some of these programs. Especially attractive are demonstrations of multiple aircraft connectivity scenarios, communications jamming, and lethal (weapons delivery) application of UAVs. Clearly, some of these UAV concepts will best complement manned systems and should be considered supportive platforms, whereas others can evolve to autonomously accomplish pre-planned and dynamically tasked missions autonomously.

3.1 Key Missions and Tasks

The first nine UAV mission concepts in the list above have great practical and technological potential for strengthening the Air Force capabilities by complementing the existing force structure. These missions are selected because:

- they address Air Force needs and requirements as articulated by senior leadership,
- they are operationally useful for Joint needs,
- the technology base exists to support successful mission accomplishment,
- they are representative of the design, development and enabling technology needs for platforms, mission systems, weapons, and human systems for all 22 missions.

The remainder of this section provides a brief description of the missions/tasks as a preface to the system discussions to follow.

Counter Weapons of Mass Destruction (CWMD). High on any critical task list for the Air Force is the capability to locate and destroy weapons of mass destruction (WMD). Operational concepts include the use of UAVs in this force application role—a strategic attack mission—to assist in the determination of possession, manufacture, storage, and movement of nuclear, biological, and chemical (NBC) material and devices by adversaries. UAVs would complement other forces in performing this difficult and complex task, taking advantage of long-term presence in close proximity to the targets.

For the far-term, the UAV would destroy WMD without dispersing the hazardous materials. The strike would be carried out by a dual-equipped UAV (multi-spectral sensors and weapons) or the surveillance UAV flying in conjunction with weapons-carrying UAVs. If a strike decision is made, precision guided penetrating weapons or specialized kill mechanisms that prevent contamination would be utilized. Battle damage assessment would be necessary to determine status and future actions.

Theater/Cruise Missile Defense (TMD/CMD). The role of Aerospace Control is enhanced by UAVs participating in the mission of counterair, defending against theater and cruise missiles. In the very near-term, long-endurance UAVs that have surveillance, reconnaissance, and attack capability could augment manned systems in the TMD Theater Ballistic Missile (TBM) mission. These long-endurance UAVs would provide Joint Force Commanders with a flexible asset able to support the TMD TBM mission with long loiter time, multi-spectral near-real-time wide area surveillance, complete C³ linkage, survivable deep penetration into enemy territory, and coverage in high numbers at altitudes that provide advantageous geometries for intercept of the hostile missile. Weaponized UAVs may also supplement existing and next-generation attack assets. In the mid- to long-term, very low observable (VLO), very high altitude long-endurance UAVs could further augment the TMD TBM mission and cruise missile defense resources.

Fixed Target Attack. Combat UAVs would be employed to attack high value fixed targets in the force application role, supporting operations in the missions of strategic attack, interdiction, and close air support. Given the location, type of target, and desired weapons effects from ISR and C² nodes, a target attack mission would determine attack axes and tactics to optimize target acquisition, weapons effects, collateral damage, and terminal guidance (GPS aided, electro-optical [EO], infrared [IR], or millimeter wave [MMW]).

Moving Target Attack. Sensor-carrying high-altitude endurance (HAE) UAVs complement other ISR assets. UAVs would operate at long range for long periods, providing ISR of enemy territory. The ISR assets would be linked in a flexibly cross-linked C² architecture, cueing loitering weapons platforms to attack identified targets. The weapons platform would be a manned strike fighter in the near-term and an attack UAV in the future. Typical missions covered by moving target attack are interdiction, strategic attack, and close air support.

Jamming. The UAV could operate as a high altitude, long endurance/low observable electronic support measures/electronic countermeasures (ESM/ECM) platform supporting multiple strike/bomber attack operations in standoff or close in orbits. Long endurance would permit the UAV to support multiple strike force packages or single aircraft strikes at varying geographic locations. The vehicle would have the ability for pre-planned orbit navigation or ground and airborne dynamic re-tasking in support of revised targeting. A second mid-term jamming concept would be a high speed penetrating UAV that preceded or accompanied strike vehicles, providing jamming against fire control tracking radars found around protected enemy targets. An adjunct to the jamming UAV might be a decoy UAV which replicated the signature (radar cross section [RCS], infrared signature, and radio frequency [RF] transmitters) of a fighter aircraft.

Suppression Of Enemy Air Defenses. UAVs could detect enemy air defense systems and pass detection and precision location data to elements of the SEAD network that would deploy attack weapon systems and bomb damage assessment systems. In the near-term, UAVs would augment the “total” force by collecting emitter data on enemy air defense systems; manned aircraft would deliver weapons. In the near- to mid-term, however, a SEAD attack vehicle is feasible. The persistence of UAVs can serve to curtail or disrupt enemy defense system effectiveness.

Intelligence/Surveillance/Reconnaissance. UAVs bring to ISR missions the helpful capabilities of flying close to the target and enjoying flexible positioning, long dwell, and loitering. If further aided by very low observability to facilitate overflying of enemy territory, UAVs have the potential for significant contribution to the Air Force goal of providing “the ability to supply responsive and sustained intelligence data from anywhere within enemy territory, day or night, regardless of weather, as the needs of the warfighter dictate.” This is equally applicable when the “enemy territory” is “crisis territory” and the situations are Operations Other Than War (OOTW).

UAV Communications Node (UCN). The UAV-based multi-band, multi-mode communications relay and switching/gateway node contribute to the force enhancement role by supporting early entry and force buildup, linkage between remoted battlestaffs and warfighting line-of-sight communications, and backup and surge support for fast moving fighting forces. Currently, most theater C² and strike assets have only limited capability for servicing unattended ground sensors (UGS). The value of such support is manifest in most offensive operations phases when a tactical communications network is limited in keeping pace with the fast moving forces, not only in physical speed but in power, frequency, bandwidth, available channels, and avoidance of interference. Forces separated in widely dispersed enclaves beyond line-of-sight communications would be assisted.

Air-To-Air Combat (Offensive/Defensive). The offensive and defensive threat associated with air-to-air combat in the future will consist of enemy manned aircraft as well as air-, ground- and sea-launched cruise missiles and ballistic missiles. It will be characterized by the necessity for quick and absolute dominance. UAVs would participate in air-to-air combat by air-to-air ambush and by high speed, high “g” interception. Each would be employed in a defensive or offensive role, depending on the target and scenario. As air-to-air UAVs enter the inventory, manned aircraft can be assigned to other missions.

3.2 Operational Mission/Task Summary

Nine UAV mission concepts have high practical and technological potential for strengthening the current Air Force capability by complementing the existing force structure. UAVs could, in the very near-term, gather target location data though manned aircraft would employ the weapons. Employment of weapons from UAVs is not a near-term technical issue but is limited by operational policy and procedural considerations. In the mid-term, some UAVs would gather target location data and other UAVs, in concert with manned aircraft, would attack the targets. In the far-term, UAVs would both gather target location data and attack the targets in autonomous areas of operation (kill boxes). Although air refueling has not shown significant benefits to any of the missions described in the study, it should be included in any comprehensive consideration of UAVs. Categories of UAV platforms as well as mission systems and weapons were established for each mission as shown in Table 3-1.

Table 3-1. Mission Summary

<i>Mission</i>	<i>Platform</i>	<i>Mission Systems</i>	<i>Weapons</i>
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CWMD	P-HAE (Find/Attack) C-MAE (Find/Attack)	NBC Sensors, Target Geolocation, UGS Relay	Penetrator Missile with Thermitic Warhead or Employing Sealant Foam
TMD/CMD	S-HAE (Find/Attack) P-HAE (Find) C-MAE (Attack)	SAR/MTI Radar, Air-to-Air Tracking Radar, EO/IR Imaging Fire Control	Hypervelocity Missile with IR Seeker and Kinetic Kill Vehicle w/ Divert Thrusters
Fixed Target	S-HAE (Find) P-HAE (Find/Attack) C-MAE (Attack)	SAR, EO/IR Imaging, Target Geolocation, Fire Control	Range of Choices Depending on Target Hardness; New Lethal and Small Warheads (Flying Plate, HPM, Thermite) for Future
Moving Target	S-HAE (Find) P-HAE (Find/Attack) C-MAE (Attack)	SAR/MTI Radar, Target Geolocation, Fire Control	Wide Area Submunitions or Homing Missiles such as TOW, Hellfire, Maverick in Near-Term; 3.5 in. Modular Missile for Future
Jamming	S-HAE	ESM Sensors, Escort/Area Jammer, Comm Jammer	N/A
SEAD	S-HAE (Find) P-HAE (Find) C-MAE (Attack)	ESM, Emitter Geolocation, Escort/Area Jammer, Comm Jammer	Weapon Dispenser on UAV, ARM, or Dispensing Submunitions in Near- Term, HPM Warhead or Submunitions on Hypervelocity Missile in Future
ISR	S-HAE (Find) P-HAE (Find)	SAR/MTI Radar, Air-to-Air Tracking Radar, FOPEN Radar, ESM, Emitter Location, Target Geolocation	N/A
UCN	S-HAE P-HAE	Comm Gateway/Relay, GPS Augmentation	N/A
Air-to-Air	S-HAE (Find/Attack) P-HAE (Find) C-MAE (Find/Attack)	Air-to-Air Tracking Radar, Fire Control	AIM-120 and AIM-9 In Near-Term, Hypervelocity Missile in Future
(ALL)		Command/Data Links, Nav/Positioning, Self-Protection, Onboard Processing, Sensor ECCM	GPS Weapon Initialization, Weapon Launch System

Legend: P-HAE Penetrating High Altitude Endurance UAV
S-HAE Standoff High Altitude Endurance UAV
C-MAE Combat Medium Altitude Endurance UAV