Appendix A
Mission Need & Operational Requirements

THEY	WE
HOW MUCH	**WHAT IS**
TIME	URGENCY
DOES THE ENEMY NEED TO ACCOMPLISH THEIR OBJECTIVES ?	**IN PREVENTING THE ENEMY FROM REACHING THEIR OBJECTIVES, AND WHAT ARE THE CONSEQUENCES IF THEY DO?**

FIGURE A1   The Enemy Determines the Our Response Time.

As in all conflicts, it is the attacker that sets the response of the defender. This is whether the attacker is a strepococcocal meningitis infection or an invasion of a hostile army. This means the defenders must neutralize the enemy force before the enemy achieve their objectives, else the defenders suffer the consequences of permitting the hostile force to accomplish their goals.

ENGAGEMENT PARAMETER	SYSTEM ELEMENTS WHICH PREVENT ENEMY FROM GENERATING OUR LOSSED
Number of Enemy Engagements per Our Loss	Observables, countermeasures, ECM, Maneuverability
Number of Enemy Encounters per Engagement	Information Transfer Denial, Observables, Acceleration
Number of Enemy Engagement per Sortie	Observables, C^3I
NUMBER OF ENEMY COMBAT SORTIES PER OUR LOSS	AVOIDANCE OF ENEMY CONTACT <u>AND</u> CONVERSION

FIGURE A2   Factors <u>PREVENTING</u> The Enemy's Ability To Generate Our Losses

The first consideration to consider with respect to the system elements, are those elements that prevent the enemy from generating unacceptable losses in the defender's force. This involves some of the weapons elements, but not a significant number. The principal is one of active defense, that is if attacked, destroy the attacker. That is a Cannon Fighter capability.

ENGAGEMENT PARAMETER	SYSTEM ELEMENTS WHICH ALLOW US TO ACHIEVE OUR GOALS
Number of Our Engagements per Enemy Kill	Weapon, Pilot/Vehicle interface, Guidance, And Maneuverability
Number of Our Encounters per Engagement	Situational Awareness, Data Transfer, C^3I, Engagement Capability, Agility
Number of Our Engagement per Sortie	Situational Awareness, C^3I, Surveillance, Data Transfer, And Speed

FIGURE A3   Factors <u>CONTRIBUTING</u> To Our Ability To Generate Enemy Losses

Where the Cannon Fighter comes into its own, that is generating losses in the hostile forces without suffering serious losses itself. In doing so quickly and effectively the Cannon Fighter minimizes the number of sorties, and therefore exposure to enemy fire. Thus friendly losses are significantly reduced. The product of four probabilities determines mission success:

$$\text{Mission Success} = P_{S_{out}} \bullet P_{S_{in}} \bullet P_C \bullet P_A$$

P_S = Enroute Survivability (Outbound & Inbound)

P_C = Probability of Command

P_A = Probability of Succesful Attack

The cannon can aid the probability of enroute survivability by having an airborne target attack capability, but it is not a primary role. However the key success for the cannon fighter system comes from its ability in the Probability of Command and the Probability of Successful Attack. Joint Stars, Joint Rivet, AWACS and a ground observer are key elements in the first two probabilities in the probability chain.

$$P_{command} = P_{\substack{know \\ target \\ location}} \bullet P_{\substack{give \\ target \\ location \\ to aircraft}} \bullet P_{\substack{acquire \\ target when \\ location \\ provided}} \bullet P_{\substack{moving \\ to targrt \\ location \\ when \\ acquired}}$$

The integrated flight, fire and weapon control and target acquisition system coupled with aircraft maneuverability provide the latter two probabilities. These probabilities show that no matter how effective the weapon is on the test range, all can be negated if the location of the target is not known or if there is an inability to communicate the targets position.   The probability of successful attack is composed of two elements, one positive and one negative:

$$P_{\substack{successful \\ attack}} = P_{\substack{you \\ attack \\ the \\ target}} - P_{\substack{the \\ target \\ attacks \\ you}} = P_{YAT} - P_{TAY}$$
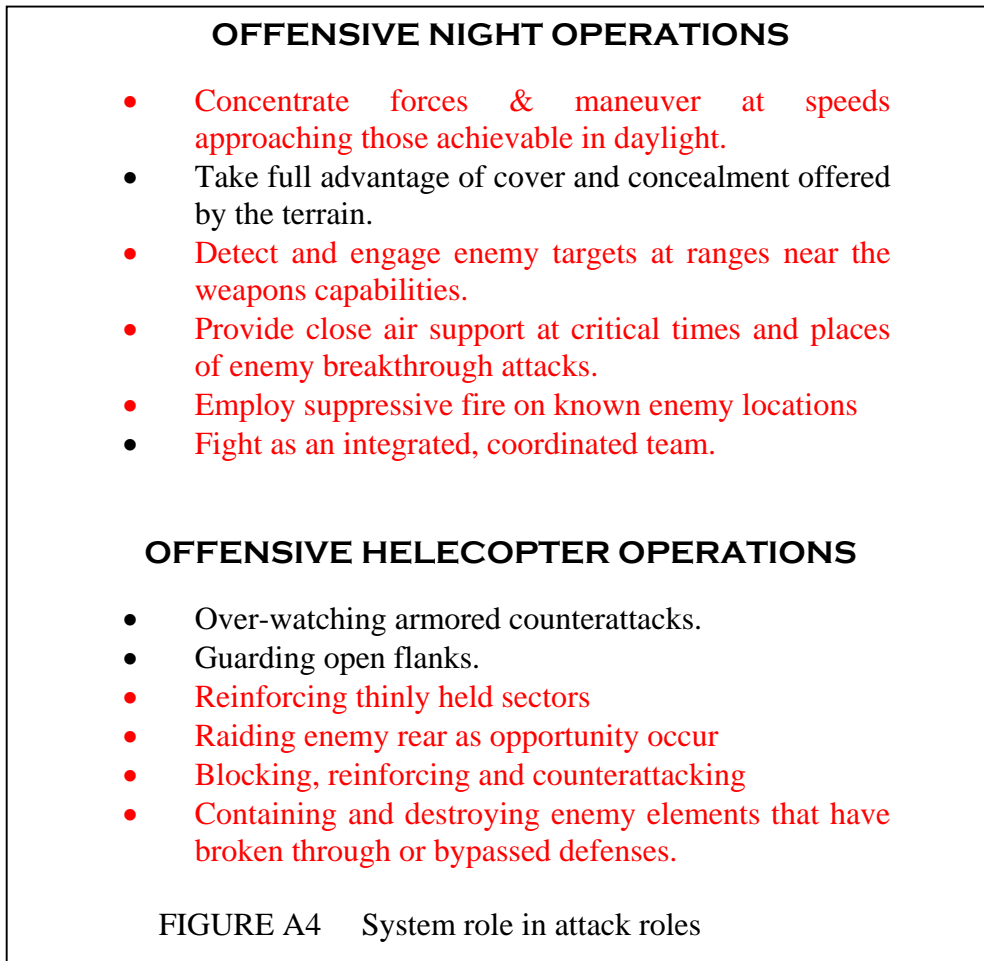
Each of these probabilities consists of several elements where the Cannon Fighter is superior.

$$P_{YAT} = P_{\substack{identify \\ target}} \bullet P_{\substack{availability \\ of\ correct \\ ordnance}} \bullet P_{\substack{establish \\ attack \\ pattern}} \bullet P_{\substack{firing \\ on \\ target}} \bullet P_{\substack{hitting \\ target \\ when \\ firing}} \bullet P_{\substack{damage \\ or\ destroy \\ target \\ when\ hit}}$$

This probability is determined by the effectiveness of the system, not the cannon alone. The IFFC system provides the first four, the IFFA system and projectile provide the fifth, and the projectile provides the sixth. The cannon itself is a part of the IFFC system and its aiming abilities. Together the system provides a launch and leave system with a high probability that the probability that you attack the target is very high compared to conventional ordnance.

$$P_{TAY} = P_{\substack{target \\ identifies \\ attacker}} \bullet P_{\substack{target \\ tracks \\ attacker}} \bullet P_{\substack{firing \\ if \\ tracking}} \bullet P_{\substack{hitting \\ attacker \\ if\ fires}} \bullet P_{\substack{damage \\ attacker \\ if\ hit}} \bullet P_{\substack{diversion\ or \\ destruction \\ if\ hit}}$$

This probability is determined by the aircraft observables and maneuverability. In this case the standoff distance the cannon provides and the two shot kill probability means that the target may not survive long enough to launch a successful attack before it is destroyed. In briefing the government, the following charts were used to illustrate the capability of the Cannon Fighter in Offensive and Defensive actions, day or night.

OFFENSIVE NIGHT OPERATIONS

- Concentrate forces & maneuver at speeds approaching those achievable in daylight.
- Take full advantage of cover and concealment offered by the terrain.
- Detect and engage enemy targets at ranges near the weapons capabilities.
- Provide close air support at critical times and places of enemy breakthrough attacks.
- Employ suppressive fire on known enemy locations
- Fight as an integrated, coordinated team.

OFFENSIVE HELECOPTER OPERATIONS

- Over-watching armored counterattacks.
- Guarding open flanks.
- Reinforcing thinly held sectors
- Raiding enemy rear as opportunity occur
- Blocking, reinforcing and counterattacking
- Containing and destroying enemy elements that have broken through or bypassed defenses.

FIGURE A4   System role in attack roles

The Cannon Fighter can play just as decisive a role in Defensive operations

DEFENSIVE NIGHT OPERATIONS

- Concentrate forces at speeds approaching daylight operations.
- Move on or between battle positions
- Engage enemy targets at ranges near the weapons capabilities
- Provide mutual support between battle positions.
- Fight at night as an integrated coordinated combined arms team.
- Destroy enemy artillery and air support.

DEFENSIVE HELECOPTER OPERATIONS

- Guarding open flanks.
- Reinforcing in case of enemy counterattacks
- Deepening penetration
- Sweeping around flanks to engage reserves
- Over-watching or firing on enemy tanks and ATGM's.

FIGURE A5   System role in defensive roles

The defensive operations focus on mobility and fire concentration. The charts emphasize the quick, lethal hit capability of the gun/projectile/and control system, give a real time target acquisition and targeting system.