DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE SPECIAL OPERATIONS COMMAND (AFSOC)

MEMORANDUM FOR NOTRE DAME SENIOR AEROSPACE ENGINEERS

FROM: The Office of Dr. Thomas Juliano, Commander
Advanced Aircraft Design Center, University of Notre Dame

SUBJECT: Tactical Insertion Glider for Engagement and Resupply (TIGER) Program

Good morning:

We seek a system of complementary aircraft: a mothership and one or more aerially launched gliders to strategically deliver troops and supplies behind enemy lines with little advanced notice. This document outlines the basic requirements and mission objectives for your prototype, remote-controlled design.

Aircraft design requirements: This design proposal calls for two independently functional aircraft: a powered aircraft to carry the glider to its release altitude (the carrier, or mothership), and one or more unpowered gliders to silently deliver various payloads to a target zone (the glider, or daughter). We are looking for a responsive system with a high rate of climb and payload delivery with maximum mission radius. As there is no need for enhanced maneuverability or short takeoff distances, we are limiting the designs to fixed-wing aircraft as opposed to vertical take-off and landing (VTOL) vehicles. Other general requirements for the prototypes include:

1. They must take off from the ground --- no hand launching.
2. Your power plant for the mothership will be supplied by AFSOC, and the same components will be provided to all teams: an electric motor, a propeller, and a battery pack, along with control electronics (servos, receivers, GPS, etc.). The aircraft can be designed to fly with either a pusher or puller type propulsion system.
3. Care should be taken when designing the internal volume of the aircraft. The following items must be accommodated:
   a) Motor speed controller and battery pack,
   b) the radio control receiver and receiver battery,
   c) all the servos required for vehicle control (maximum 9),
   d) and the micro-controller and GPS used for the acquisition of flight information.

Note: only items (b) and (c) must be included on the glider.

4. The glider must be launched mid-flight from the mothership. Both must return and land under pilot control and intact.
5. Additionally, the glider must be capable of carrying various payloads, described below.

Aircraft safety requirements: The primary concern is safety, both in designing and building the aircraft and in their flight performance. For this reason, your aircraft must have/pass the following safety considerations to be considered for evaluation:

1. An easily accessible arming fuse securely mounted to the outside of the aircraft. This fuse will keep the motor battery disengaged until ready for flight.
2. Wingtip markings that show the location of the CG (empty and with payload). These markings will allow for onsite determination of static stability of the aircraft.
3. Pass a Technical Inspection given by one of our contracted pilots as described further on the class website. Part of this inspection will involve hand launching the glider to ensure it performs adequately.

The payload: The glider payloads simulate equipment and personnel. They may be secured to the exterior of your aircraft or mounted internally; if mounted externally the payload must not contact the ground during takeoff or landing. The payload is fixed and not designed to be jettisoned from the glider during flight. However, the payload must be removable, and the aircraft must be able to fly with and without it. There are three payloads, of which the glider will only be required to fly one at a time:

1. six golf balls, representing troops;
2. two baseballs, representing jeeps;
3. fifty ping-pong balls, representing ammunition and medical supplies.

A single glider may be designed to handle all three payload configurations, or multiple specialized gliders may be built to carry one or more payload types.

Mission profile: The system (carrier, glider, and payload) must start at rest at the take-off end of the runway. A 20-second countdown begins when the motor is throttled up. The system will use this time to climb to release altitude. At the end of the countdown, the motor must be throttled to idle. Once the system’s flight is stabilized, the glider may be released (dropped, jettisoned, launched, etc.). A timer (counting up) will begin at release and time the duration of the glider’s flight. There is no set course for the either the climb or glide phases. Both the carrier and glider must land intact to complete the task. Upon landing, the payload of the glider must remain secured in its

original configuration. The carrier may restart its motor for descent and landing.

Before attempting the payload mission, the mothership will be flown alone, without glider or payload, to test flight characteristics and performance. There is no score awarded to this mission.

Before attempting an air launch, the glider(s) will be tested with a hand launch. They must glide controllably both with and without payload. There is no score for completing these check-outs.

System evaluation: The metric for system success will be:

$$S = t_1 + t_2 + t_3 \quad (1)$$

where S is the score and t_1, t_2, and t_3 are the times that the glider stays aloft after being released from the mothership with each of the three payloads. The system with the highest score will be deemed the winner of the design challenge.

Mission logistics: To facilitate a timely evaluation the following practices will be observed. With the successful completion of the pre-flight inspection of both aircraft, the team will be allowed to attempt the mission. A successful mission constitutes a landing without any significant damage to either aircraft, as determined solely at the discretion of the Flight Line Judge. Additionally, the payload of the glider must be safely secured upon landing and may not be contacting the ground if it is externally mounted. A non-successful landing will result in a non-score for that flight mission, and the mission must be reattempted. Once the three scoring missions have been flown successfully, the team will be allowed to attempt re-flights as time allows. Normal queuing procedures will be used. The flight queue will begin with the first team completing pre-flight inspection and will continue in order of completion of pre-flight inspections. The previous day's flight queue position will carry over to the following day if necessary. Teams will have a total of five minutes to load the payload and checkout the aircraft systems as fully functional with the pilots. There is no work allowed on the aircraft after the loading/checkout time or the team will forfeit their position in the queue. The RC receiver should be turned on externally or left on during this time. Any teams not able to complete staging in the allotted starting time will forfeit their flight position.

We sincerely look forward to the unique and exciting designs you have to offer. If you have any questions, please feel free to contact our staff.