The Smart Mortar System should be evaluated for its cost and feasibility. The suggestion is that this goal can be started by funding and performing the following three military munitions development research studies:

SMART MOTAR Research Test Event, Part One - WARHEAD:

Some of the warheads for the Smart Mortar should be fabricated. The opinion is that these warheads would cost about $6000.00 each to fabricate. This cost includes materials costs, plus the fabrication of metal parts for the warheads. It is expected that, if the Smart Mortar System was adopted as a U.S. Military Munition, that the cost for these warheads will drop as they are brought into large quantity production. The opinion is that the large quantity cost per warhead would be about $800.00 per warhead. The suggestion is, for this initial research project, that 15 warheads should be fabricated. One feature of the Smart Mortar System is that the Smart Mortar has the capability to deliver the warheads to the target with a targeting accuracy of about +/- 2 feet. Thus, it would be helpful to evaluate effects of the Smart Mortar warhead when targeting accuracy is included in the research. To start, simply drop a warhead from a helicopter at a mortar munitions test range and video record the impact and detonation. Repeat this test 2 more times. The opinion is, with a 4 ½ pound charge of C-4 in the warhead, that if a helicopter released it from an altitude of 15,000 feet above the impact point, that the detonation of the warhead would not pose a danger to the helicopter. With respect to accuracy evaluation potentials for the warhead, it is necessary that the impact location some test warheads must be carefully controlled. This accuracy of impact control cannot be achieved from a warhead that is simply dropped out of a helicopter. The suggestion is that (on the issue of controlling the flight of a warhead in essentially free-fall) the warhead itself is not particularly large. A test warhead could be permanently attached to the top of a moderately sized 4-motor 4-rotor electric drone. This drone would have the feature that an operator, via radio link, could control the motors and rotors of the drone, and that the drone would have a down-looking camera with radio link, so that the operator controlling the flight of the drone would be able to see, via a monitor, what is the impact point that the warhead is flying toward. Of note, the drone would not need to have sufficient lift to support the warhead, actually, the drone motors should be, as much as feasible, spun up to a rotation speed so that the warhead can “fall down” through the air at about the same airspeed vs time falling profile that the warhead would have if the drone were not attached. The only function of the drone, would be that the operator could send control signals to the rotors of the drone to add translational inputs to the downward flight of the warhead so that, as the warhead fell from the sky, its trajectory could be adjusted if necessary (using the drone), so that the warhead would have its impact and detonation at a point very close to the desired target location (the hope is that the drone would give targeting accuracy of about +/- 2 feet). The suggestion is, drop 1 or 2 warheads directly onto a pickup truck. Drop a warhead directly in-between two pickup trucks separated by about 40 feet. To evaluate enemy soldier effects of the warhead, create a scene where there are items that are substitutes for a human soldier. The suggestion is that these substitutes should be PVC pipes 9 feet in total length, these pipes would be about 10 inches in diameter. The pipes would be placed with about 3 feet of their length buried and 6 feet protruding out of the ground. These pipes would be filled with wet sand. There would be a scene of 10-20 of these pipes randomly distributed in a circular area about 50 feet in diameter. Drop a warhead directly into the middle of this area, repeat this again. Then drop a warhead about 60 feet away from the outer edge of this circle and do another test where the impact is about 100 feet away from the test pipes. Thus, 4 separate scenes with these pipes would need to be created, that would be 4 scenes, 20 pipes per scene, and use of 4 warheads. After detonation, evaluate the pipes for shrapnel impacts and blast effects. The warhead should be tested for its effect on reinforced structures. Create a reinforced concrete slab 6 inches thick 12 feet by 20 feet. Dig a trench and bury 10 feet of this slab in the ground. The effect would be a vertical wall of reinforced concrete 6 inches thick and protruding 10 feet out of the ground. Drop a warhead 60 feet from this wall, then 20 feet away, then 4 feet away. Evaluate the warhead effect on this wall. Make another reinforced concrete slab 10 feet wide by 10 feet long by 8 inches thick. Place concrete foundations in the ground. These foundations would be cubes of concrete about 4 feet by 4 feet by 4 feet. Construct columns on these foundations. These columns would be constructed of cinder blocks, these columns would be about 2 feet wide by 2 feet deep by 10 feet high. Lift the reinforced concrete slab in a horizontal orientation and place it on these columns. This slab would be a test example of a reinforced roof structure. Drop a warhead on this roof. Then drop 2 more, attempting to have the impact site for each drop to be close to exactly in the center of this test roof. It is hard to estimate the cost of this testing without experience in munitions testing. The estimate is $20,000.00 for creation of all the test drop scene areas. $30,000.00 total cost for use of the helicopter for these test drops. $35,000.00 for personnel and recording activities of the staff at the munitions testing facility. It would be very useful to drop a warhead on a 30-40 foot fiberglass boat. It would be very useful to drop the warhead onto the water about 20-30 feet away from a 30-40 foot fiberglass boat floating in this water. For the facility and the boats and the personnel and the recording and the helicopters for the boat testing, prediction is total cost for water/boat testing will be $95,000.00

Total Costs for Warhead Testing/Demonstration:

1. Warheads, total 15 at $6000.00/each = $90,000
2. Helicopter use, land $30,000.00, boats/water $30,000 total helicopter costs = $60,000.00
3. Test facility use, plus personnel, plus recording, plus creation of land scenes $35,000.

Test facility use boats/water facility, personnel, recording, creation of scenes $65,000.00

Total facilities cost land plus boats/water = $95,000.00

1. Drone cost 12 drones at $2000.00 each = $24,000.00
2. Drone cost fabrication of drone-warhead controllable flight device $500.00 each = $6000.00
3. Controlled drone-warhead controlled flight operations operator plus equipment for

All 12 controlled flights, $1000.00 per flight = $12,000.00

1. U.S. military admin costs to supervise and authorize this testing, total cost = $20,000.00
2. Total all costs for this Warhead Evauation/Demonstration = $307,000.00

SMART MOTAR Research Test Event, Part Two – FOCUS GROUP:

It would be exceptionally useful to obtain evaluation of the concepts of the Smart Mortar System from those who have been commanders at a distantly deployed small outpost activity. These persons were probably at the O-2 level when they had these commands, but they are probably now at O-3 to O-4 levels. The research plan would be to create a focus group of 6-8 of these former commanders of a distantly deployed outpost so that their thoughts and opinions could be collected. The suggestion would be to have 3 focus group events. One at Camp Lejune, One at Fort Bragg, and one at 29 Palms.

The focus group event would have some constraints. It would not be a focus group to design and optimize the Smart Mortar. Instead, the focus group objective would be to present the Smart Mortar as it is currently proposed to be and ask these former commanders their opinions about that version of the Smart Mortar.

This approach needs a consistent summary type of presentation of the Smart Mortar System to the commanders so that all the focus groups were evaluating the same issue. Follows is a format for this standardized description of the Smart Mortar System.

1. The Smart Mortar is a system that consists of a collection of parts and a group of soldiers with special training and experience in how to setup and use the Smart Mortar.
2. The Smart Mortar would be delivered to an Outpost as a “Package Deal”
3. This “Smart Mortar Package” includes an “Armor House.” This Armor House is about the size of a 2-car garage. It is armored with composite (that is, light weight) armor. The armor is designed to repel small arms fire and small explosives. The reasoning behind an Armor House is that the enemy forces, when they understand what the Smart Mortar System is doing to them and their capabilities, they will probably attempt to degrade and/or destroy the Smart Mortar components.
4. The Armor House will contain the pneumatic cannon in its front half. This front half will have a movable cover in its roof so that the cover can be opened for use of the pneumatic cannon to launch Smart Mortars, and then this cover could be closed to protect the pneumatic cannon. The back half of the Armor House would contain two rooms where the operators of the Smart Mortar would control it. This gives these operators protection against actions by enemy forces and protects them in the case where there is a “catastrophic launch fail” event where the warhead of a Smart Mortar detonates either in the pneumatic cannon or immediately after launch.
5. There would also be a smaller Warhead Armor House that is used to contain the warheads of the Smart Mortar. This allows separation of the explosives to an area removed from the persons and equipment of the outpost.
6. There would be another Airframe Armor House that would be delivered that would contain a supply of the Smart Mortar airframes. This Airframe Armor house would have a preparation area where Smart Mortars could be put together into their final active munition form and would include facilities to charge up batteries in the Smart Mortar Airframes in preparation for them to be launched.
7. These smaller Armor Houses would each be about the size of a full-sized Chevrolet Suburban.
8. This package of Armor Houses and supplies would be delivered to the Outpost either by helicopter, or they would travel with a set of special armored dump trucks that had an attached crane. This dump trucks would travel to the Outpost and would use their attached cranes to off-load the Smart Mortar components.
9. The Smart Mortars would all use the same type of warhead.
10. Control of a Smart Mortar would include that it was given two targeting values. These values are range and bearing. Range is distance from the cannon to the target. Bearing is degrees off from “true North” of the line that runs directly from the cannon to the target. For the purposes of the Smart Mortars, the cannon would be the controlling item that sets the definition of where exactly is the “true North” line.
11. Upon launch, a Smart Mortar would communicate with the Armor House and establish sufficient information for the Smart Mortar to align itself to the current landscape and to set out the location of the target. After this initialization, the Smart Mortar would “sign off” from the Armor House and the Smart Mortar would continue its mission to the target as a “fire and forget” munition, in that the Smart Mortar would set itself into a condition where it would not send to and would not respond to any forms of communications that are sent to it.
12. Instructions for use of the Smart Mortar include that it is to be deployed against enemy forces and enemy assets located inside of a circle of 8 miles diameter centered on the Outpost.
13. Any enemy forces and assets are acceptable targets for the Smart Mortar, there are not limits on how small or how large a target needs to be.
14. Targeting decisions for use of the Smart Mortar are at the discretion of the on-site commander of the outpost. These decisions include whether to use a Smart Mortar, how many Smart Mortars to use for a given Smart Mortar Mission, the sequencing of use of Smart Mortars, timing of use of Smart Mortars, patterns of Smart Mortar use, etc.
15. It is noted that the Smart Mortar System exists to create an area of zero enemy forces and zero enemy assets inside a circle of 8 miles diameter centered on the Outpost. Smart Mortars are not set out for offensive or major initiative uses, in general.
16. Enemy forces and/or assets located outside of this 4 mile limit on Smart Mortar use are not acceptable targets for Smart Mortar use, in general. Including that enemy forces close to the 4 mile limit and most likely acting to remove themselves or travel to a location outside of the 4 mile limit should be allowed that safe passage, and, in general, Smart Mortars shall not be used to target enemy forces that are leaving the 4 mile exclusion zone around the Outpost.
17. The on-site commander at the Outpost is given an initial supply of 200 Smart Mortars. The general use suggestion for the Smart Mortars is that their maximum use rate should be at a rate of 200 Smart Mortars every 2 days. The general operating rules will be that if an Outpost commander uses up his supply of Smart Mortars, he needs only to request more, and another set of 200 Smart Mortars will be sent to the Outpost.
18. An Outpost with a Smart Mortar is not considered as a “lone Castle” on its own. At any point, the commander of an Outpost can request Combat Air Support and this will be provided in the normal manner for Combat Air Support. The concept here is that the Smart Mortar allows the Outpost to have fewer requests for Combat Air Support because the Smart Mortar gives the Outpost an enhanced ability to remove “enemy related problems” on its own without any outside help. But this, in no way, means that the Outpost is alone, or separated, or not defended with the full U.S. military support, always available as needed, conditions allowing, as per normal military procedures and policies.

This list of Smart Mortar concepts and principles would be handed out as a document to all the members of the focus group and they would be encouraged to discuss their opinions about the Smart Mortar. Again, the encouragement would include not to try to optimize or change the Smart Mortar, but more along the lines of: “If this Smart Mortar existed, as described, would you want it at your Outpost?” “Would you want this Smart Mortar System if it meant that some other supplies would not be sent to your Outpost?” “Do you feel the Smart Mortar could actually allow an Outpost to create (over an interval of 1-12 weeks) a circle of 8 miles diameter that is fairly devoid of enemy persons and assets?” “Do you feel that the concept, ‘keep your stuff more than 4 miles from our Outpost and we won’t use our Smart Mortar against you’ would be a helpful situation in an active combat area in a foreign country?” etc.

The opinion in advance is that these commanders would be delighted to have this Smart Mortar system. It is the opinion in advance that these commanders would enthusiastically support the concept that the U.S. Outpost could create an area of 8 miles diameter where there is nothing present that has a potential to be a threat to that Outpost.

Costs for these focus groups would include (Cost item A) payments to the participant former commanders, (travel, per diem, coverage for their absence from their current assignments). Another cost would be (Cost item B) costs for those conducting the focus groups including their travel and per diem, and costs for the facilities where the focus groups would meet. Another cost (Cost item C) would be U.S. Military costs for authorizing and administering these focus group research events.

Considering 3 different focus groups meeting at three different locations, with 3 support/data collection persons, and 7 former commanders per focus groups, then estimation of total costs:

Cost Item A: $4000.00 per commander = $84.000.00

Cost Item B: $5000.00 per researcher = $45,000.00

Cost Item C: $6000.00 per location = $18,000.00

Total costs for the Focus Group Evaluation of the Smart Mortar System = $144,000.00

SMART MOTAR Research Test Event, Part Three – LOW VELOCITY AIRFRAME ACTIVITIES:

Using the proposed design parameters for the Smart Mortar System, the airframes of the Smart Mortar will spend 95% of their time in gliding flight at about 40 mph of airspeed.

An airframe that can function at an airspeed of 40 mph does not need to be an exceptionally strong and highly capable combat aircraft. Significant useful data can be obtained in flying and optimizing the airframes of the Smart Mortar using models that simply do not need to possess high stress large forces capabilities.

With use of nothing more than the normal gravitational pull of the planet Earth, airspeeds at 40 mph are easy to achieve.

Thus, with an elevation, for example, of 200 feet and giving the Smart Mortar airframe simply a straight down drop, the airframe will be travelling at 40 mph of airspeed in about 90 feet of vertical flight. In 120 feet of vertical flight it will have sufficient excess airspeed to perform a nose-up pitch maneuver and bring itself into level flight. Depending on its glide angle, this airframe could travel along trading altitude for maintenance of an airspeed above its stall speed for 300 to 900 feet of horizontal travel.

As the airframe began to be at 20-40 feet of altitude above the ground, since its airspeed is only 40 mph, it is easily feasible for it to deploy a parachute that would cancel its flight speed and also allow it to continue down to ground contact at an impact speed low enough that the airframe and the equipment and flight controls inside the airframe would most likely not be damaged.

For example, one could take sections of ¾ inch thick pressure treated plywood 3 feet wide by 3 feet tall and glue them together to create a cube of pressure treated plywood 3 feet by 3 feet by 3 feet. Using CNC controlled wood cutting router type bits, this cube of pressure treated plywood could be shaped into the proposed airfoil shape of a Smart Mortar. If this air foil was created to be about ¾ inch smaller than the desired airframe, then this CNC shaped wooden form could be wrapped with plaster to a plaster thickness of ¾ inch. The plaster could be shaped and smoothed. Around this plaster outer shell could be placed a fiberglass woven fiber winding in the same manner as is used to create fiberglass boats. The outer surface of this fiberglass could be smoothed as it was drying and hardening so that when the fiberglass fully hardened, it would be a completely adequate airframe skin for a flying device travelling at a maximum airspeed of 60-80 mph. If this whole fabrication was placed into a tank of water, the plaster would lose its integrity and become detached from the wooden form and the fiberglass form so that the fiberglass shell could easily be separated from the underlying pressure treated plywood frame.

The fiberglass airframe that was “released” in this manner is now available to be instrumented and to have flight control sensors, hardware, and software placed.

This fiberglass airframe could then be dropped an initial height of 200 feet and it could use its attitude sensors, flight control surfaces, and flight control software to bring itself into stable gliding flight. The performance and parameters of this airframe could be monitored and stored. Since the parachute landing would not damage this airframe, it could dropped and recovered as described repeatedly and further testing could be performed.

And if modifications of the underlying airfoil shape are suggested by this testing to give an airframe with better parameters, then, starting with the CNC router bits and a new pressure treated plywood cube, a new airframe can be created.

These fiberglass airframes would not be created for free, but their cost of fabrication would be substantially lower than a process of creating another fully functional aircraft alloy aluminum airframe for each proposed optimization.

The suggestion for this airframe testing and optimization activity can be described:

1. Near to a research University (suggestion NC State University), let the U.S. military rent or purchase about 8 acres of land, arranged in a rectangular shape. Place on this property a robust 200 feet tall tower. We mention the rectangular shape to the land so that there is plenty of land available for the linear horizontal gliding flights of these test Smart Mortar airframes. These flights, in that they are test flights, include that there could be a catastrophic loss of stable flight and the Smart Mortar test airframe would head directly to the ground. Thus, there would need to be an area of controlled land where no persons were present so that if a Smart Mortar test vehicle did go directly into the ground, it would not hit anyone. Since these test airframes fly along in almost horizontal flight, the underlying test facility land form would need to be more long than it is wide, thus suggestion for a rectangular land plat.
2. Add a winch system that can lower a horizontal boom from the top of this tower down to ground level.
3. The airframe testing protocol includes creation of a fiberglass airframe shape as discussed above, then this airframe is attached to the horizontal boom that projects away from the tower. The test Smart Mortar airframe is connected to this boom while this boom is located at ground level. Once the fiberglass airframe is attached to the boom, then the winch raises the boom 200 feet straight up all the way to the top of the tower. A release signal is then sent to the boom and it releases the fiberglass airframe model. Upon release the airframe model is pointed straight down. The fiberglass airframe will begin increasing its airspeed under the influence of gravitational force. When the fiberglass airframe is travelling at about 110 to 115% of its stall speed, then the flight control software of the airframe will activate the flight control surfaces of the airframe to do a nose-up pitch maneuver. This nose-up pitch event will give the result that at about 100-120 feet off the ground the test vehicle fiberglass airframe will now be flying in stable controlled gliding nearly level flight.
4. Telemetry data is sent from the test airframe and, if desired, flight control commands are sent to the airframe and a process of optimization of the airframe continues.

Costs for this testing facility are not easy.

Suggestions for costs:

1. Land and permits = $120,000.00
2. Tower = $50,000.00
3. Tower Installation =$30,000
4. Test Building at the site $100,000
5. Telemetry capabilities = $40,000.00
6. CNC capabilities =$30,000.00
7. Fiberglass facility = $40,000.00
8. Support Personnel (3 persons) gov’t employees $120,000.00/ yr each
9. Researchers (3) (University persons, not necessarily permanent employees) $80,000.00 each

Suggestion is that this should be strongly considered as a permanent facility and long term memorandums of understanding between the facility and NC State University and the University of North Carolina at Chapel Hill, and Duke University. Opinion here is that these airframes will generate intense interest. There are many military uses for these airframes. It will be only a matter of time until it is seen that assisted launch so drones do not need to have engines or fuel sufficient to get them to altitude, plus all the advantages of low speed gliding flight will create interest and demand for the services of this test facility.