

PROJECT DESCRIPTION

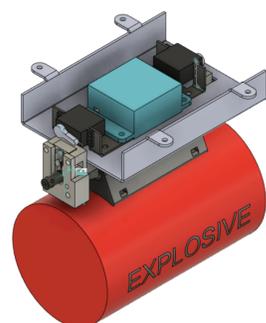
Avalanche mitigation is an important part of the safe operation of ski resorts, railroads, and other activities in the mountains. Currently, mitigation techniques include the use of explosives. These explosives are brought to their destinations high in the mountains by hand or by helicopter. Neither of these methods are both safe and financially viable. Delivering these explosives with a drone will prove to be safer than hand delivery, and more cost effective than a helicopter.

Arming and detonating explosives safely is difficult when done remotely. Many safeguards are in place to ensure this process is safe for those who launch the drone as well as the drone itself. The explosives are not armed until a specific sequence of events occurs. For customers, safety is the highest priority, and this fully remote system is safer than the existing methods for placing explosives. This product is more practical and safer for placing explosives and mitigating avalanches.



Requirements

- System is under 5 lbs
- Mechanical initiation
- Initiated by free-fall
- 2-step arming sequence
- No preload on the initiation spring
- Payload cannot accidentally initiate

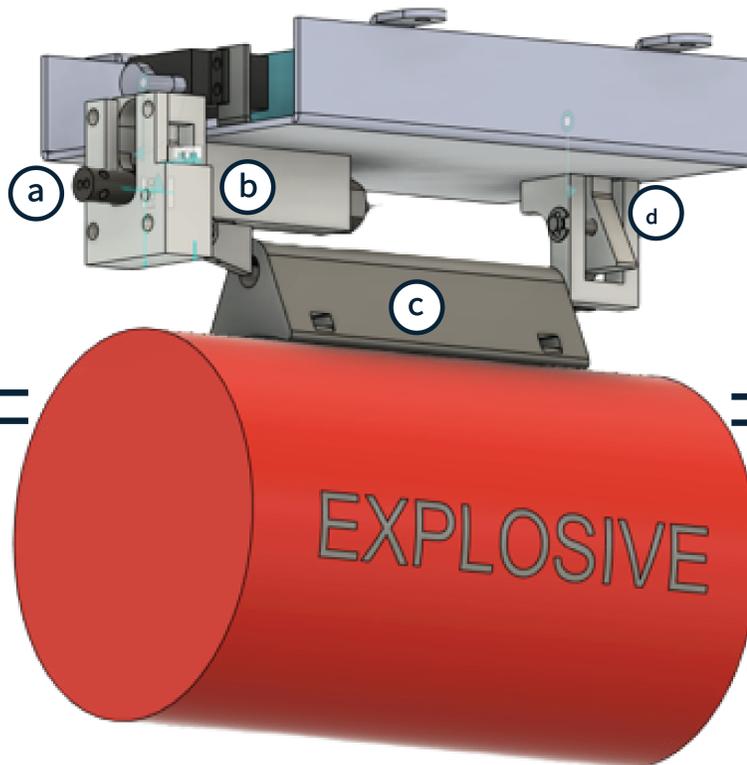


The assembly as shown from above.

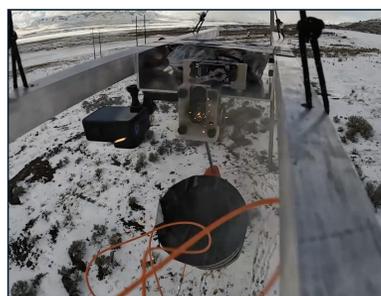


Different images of detonation.

- The payload is easy to load.
- The weight of the system is measured to be 4.75 lbs.
- The lever arm is strong enough to hold payloads up to 10 lbs.
- For the total length of the flight, the system will use less than 1.5 Wh.
- For safety, the system can be unarmed in one simple step on the controller.
- The firing pin needed a momentum of 0.21 lb-in/s and it exceeded it by three times.
- The system requires a 2-3 step arming sequence, ensuring that the payload can only be controlled by those who know the arming sequence.

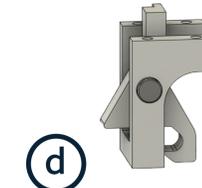
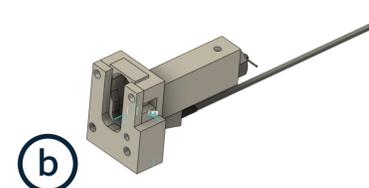


The assembly as shown from below.



Top down picture of the payload mid-drop, this is the moment after the primer is hit and the charge is initiated

DESIGN DESCRIPTION



- (a) Primer Housing: Houses the primer and shock tube.
- (b) Initiator: Lever arm compresses spring to strike primer. Primer is only strikable after arming sequence.
- (c) Guide sleeve: Mates the payload to the lever arm.
- (d) Retention mechanism: Holds the lever arm in place until drop.



Initial Design:

Arm cross-section: 0.08 in²
Sleeve cross-section: 0.1305 in²
Factor of Safety: **1.63**



Final Design:

Arm cross-section: 0.0278 in²
Sleeve cross-section: 0.1964 in²
Factor of Safety: **7.06**

- The design meets all requirements and constraints given by the sponsor.
- Learning the proper cross section to use for the guide sleeve to lever arm interface was of paramount importance. The cross-section needs to be tight enough to not slip off during initiation but not so tight that the guide sleeve sticks.
- The current version of the system uses a purely mechanical initiation. This type of initiation is safe, but other initiation methods exist that are even safer. Exploding bridge wire is a type of digitally controlled detonator that requires a very large voltage to detonate. This eliminates any possibility of accidental initiation from a premature drop or from environmental interference. An exploding bridge wire version of the system could offer the customer another option that would be more expensive but also safer.