

Rocket Firing Range

Order of business is launching, and the first piece of equipment is a sturdy base, a firing battery, some switches. Equipment of this type is available to be home-built by one of the members. Such a rocketeer, but an organized club will soon learn to avoid long delays between launches. At this time members can elect to purchase or construct more "Misfire Alley" range, or a multiple position range. Each system has its own advantages and members should fully consider its own needs and available

Range Operations

In either case, as the launch operations expand more rocketeers and spectators will be present on the range during firing operations. At this point, safety considerations dictate that one individual, the Range Safety Officer (RSO), have overall responsibility for the activity on the range. The RSO must decide if the conditions are safe for a launching before the countdown can begin. He must be sure that:

1. The model on the pad is safe for flight,
2. The engine is a NAR Safety and/or Contest Certified type,
3. The sky is clear of conflicting aircraft,
4. The rocketeers and spectators are at a safe distance, (see the safety code)
5. The rocketeers and spectators are attentive to the fact that a rocket is about to be launched, before he allows the launch countdown to begin.

When a rocket of questionable stability is on the pad the RSO must either order it removed or clear the spectators and models back to a safe distance before permitting its launch.

Range Layout

Independent of the type of firing system employed, the basic range layout will remain the same. (See figure below). The range itself is a large, open area relatively clear of trees and other obstacles. Its size depends on the power of the models to be flown, and a guide to field size can be found in the launch site dimension table following the NAR Safety Codes. Selection of a field of the recommended size or larger will not guarantee that all rockets with properly functioning recovery systems will land within the range area, but only that a malfunctioning rocket will not be likely to impact outside the recovery area should a recovery system failure occur.

The exact set-up of the "Firing Area" will depend on the type of launch system chosen. However, the Firing Area is generally located at the center of the range so that it does

not have to be moved if the wind shifts during the launch session. On extremely small fields the Firing Area may be located nearer the upwind edge of the range so that models will drift down over the range area. However, the Firing Area should never be located along the edge of the range area, to avoid problems caused by malfunctioning rockets impacting outside the range area. The designated Firing Area should be marked off with rope barriers at all launches where more than a few rocketeers or spectators will be present, to avoid the hazard of having an inattentive modeler or uninformed spectator wander into the Firing Area during a launching.

Modelers readying their rockets for flight use the "Prep Area". For large launch sessions or contests the Prep Area may be equipped with folding tables as a convenience for the modelers. Unless the launch is a small one, with few spectators present, the Prep Area should be roped off to keep spectators from disturbing (i.e., stepping on) the models. The Prep Area is generally located downwind from the Firing Area since marginally stable rockets will usually tend to "weathercock" and fly into the wind. Thus the area upwind of the Firing Area is generally more hazardous than the other three sides. At all

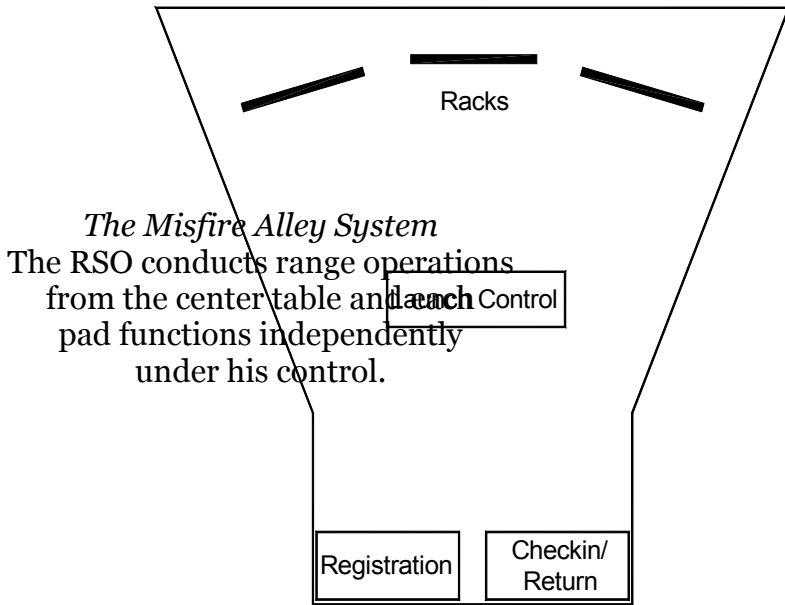
A Generalized Model Rocket Range

launches where high power rockets are to be flown, this area should be kept clear of rocketeers and spectators.

If the launch site is located in an area where large numbers of spectators would be likely (such as a public park) or if advance publicity makes it likely that there will be a large number of spectators, a specially roped off "Spectator Area" should be provided. For safety reasons, the Spectator Area should not be upwind of the Firing Area. Since spectators at rocket launches are already showing some interest in the hobby, a table with club information packets encouraging them to join your section can be located in the Spectator Area. A club member should wander through the Spectator Area occasionally, answering questions, explaining model rocket safety, and promoting your Section.

Misfire Alley Range

The Misfire Alley system is an "individual responsibility" system. Everyone who wants to fly at a club function provides his own personal launcher, firing system, and firing battery; or he arranges to use the system provided by another club member. Each participant sets up his own launch system in an area designated by the RSO. Usually the launching stations are placed in a straight line or U-shaped arrangement, with each launch pad located at least 5 meters from the next one. A large sign adjacent to each launcher designates the launching station by number. Each participant is free to prepare his own models for flight in the area of his launching station, without interference from other participants. Since he is located at least 5 meters from the next nearest launcher, he may continue preparing his model while other rockets are being launched. When large models are being flown, the RSO may require that all persons on the range stand and observe the flight path in order that they will be immediately aware of any malfunction, and that rocketeers in adjacent firing stations leave their areas during the actual firing.



The RSO, who is centrally located and has a clear view of all participants, spectators, and launching stations, as well as the area surrounding the range, gives a range safety clearance by announcing to all participants "Pad number 5 is clear to launch." The modeler at station 5 then arms his firing system, either he or the RSO gives an audible 5 second countdown, and the modeler launches his rocket.

The only range equipment which the club must supply is a Public Address system or bullhorn for the RSO, so that his announcements may be heard by everyone on the range, numbered

signs for each launching station, and a barrier to keep spectators out of the Firing Area. None of this equipment is expensive, difficult to build, or difficult to transport, and it requires virtually no maintenance. The Misfire Alley system avoids the problem of appointing a club member to keep the firing panel and launch racks in good shape. Each rocketeer is responsible for keeping his own launch system in working order, and he has only himself to blame if it fails to function properly. However, a disadvantage of the Misfire Alley system is that it requires each rocketeer to purchase his own launch system, thus taking away some of the monetary advantage of joining a club to save his money.

A small club whose members already own simple launch systems should certainly consider the misfire alley system, especially during the early growth stages of the club. Some larger clubs have also found that this system meets their needs. Other clubs find that the launch rack system is more suitable when membership increases or for large contests where rocketeers will be traveling on public transportation and carrying a personal launch system would be inconvenient.

Launch Rack System

The Launch Rack System attracts new rocketeers to the club by allowing them to get involved in the hobby without investing in their own launch system. A single rack, consisting of nothing more than a wood sawhorse with holes drilled in the crossbar to accept 6 or 8 1/8" x 36" launch rods, will not require a great financial investment on the part of the club. A firing panel, with individual launch cables running from the battery

through a firing switch on the panel to each launch position on the rack can also be easily constructed at low cost from parts available at any electronics supply store.

Launch Rack Firing System

Generally, the rack launcher is set up about 5 meters in front of the firing table, and a multiple position firing panel is located on the firing table. The Launch Control Officer (LCO), acting under instructions from the RSO, launches each model from the rack in sequence. When the rack is empty, the LCO removes the “safety key”, making it impossible to launch a rocket accidentally. The RSO then announces that the “rack is safe for loading.” The next group of rocketeers then goes out to the pad to load their models on the rods. The LCO does not arm the panel by inserting the safety key until he is instructed to do so by the RSO, who has determined that all rocketeers have left the pad area.

On busy ranges, several rack launchers (spaced at least 5 meters apart), are controlled from the same firing table. With this arrangement one rack can be loaded while the second is being fired, making range operations more efficient by allowing rockets to be flown almost continuously.

Hybrid Launch Range

Some clubs have devised a launch system incorporating most of the benefits of the Misfire Alley and Launch Rack systems while eliminating some of the disadvantages of each system. The result is the Hybrid System, in which there are 4 to 20 pad areas, each located at least 5 meters from the next, controlled from a central launch system and power supply. This system gives the RSO absolute control over the firing operation, but allows each rocketeer to set up his model on the pad without interference from the modeler next to him.

In this system, the RSO and LCO work at the central launch control table. Each alley has its own pad, as in the Misfire Alley system, but all pads are controlled from the Launch Control table, as in the Launch Rack system. In Figure 4, access is allowed from the rear of the pads only. This keeps the Launch Control, Registration, and Check-In areas free of unauthorized people, further enhancing safety. This setup has the added benefit of preventing modelers from tripping over and fouling the launch cables.

Tracking Systems

If the launch session is to include altitude tracking of models, two tracking stations separated from each other by a distance of 300 meters will be required. A discussion of the equipment and techniques used for altitude tracking is beyond the scope of this manual. Plans for altitude trackers, and discussion of tracking methodologies may be found in the *Handbook of Model Rocketry* and in several Technical Reports available from NARTS. Generally, the two tracking stations are located to the south of the firing area to minimize the possibility of the trackers having to track a model across the sun.

The trackers at each station must have some way of being warned to get ready a few seconds before the model is to be launched, and to relay their tracking angle measurements to the Data Reduction Officer after each flight. To allow communications

between the Launch Control table and the trackers, walkie-talkies are generally used.

Other Range Features

As the number of rocketeers and spectators attending your launches increases, many other additions can be made to make your range more comfortable and convenient to use.

When running a contest, a bulletin board can be used to post up-to-the-minute contest results. This allows participants to know what performance they must beat in order to move into first place, and allows spectators to get more involved in the excitement of the contest.

A “Range Store” selling various rocketry supplies is a great convenience for the modeler who forgets something, or needs to make an on-the-field repair. If the club already maintains its own supply of parts and engines for sale to club members, this “store” can be brought out to the range and manned by club members during the flying session. For large gatherings, the local hobby shop may be agreeable to the idea of bringing out a carload of rocket supplies to sell on the range. Some hobby shops have found that range store sales at large contest are so profitable that they will donate trophies for the contest in exchange for the privilege of operating the exclusive range store.

A refreshment stand, with cold soda in summer and hot chocolate in winter, can be a profitable operation for your section. At all-day launches, or weekend regionals, you can add snacks or sandwiches if there is no restaurant within easy traveling distance of the range.

At each launch you will discover more little things you could add to the range to make its operation more fun.

This page intentionally left blank.