CONTENTS

· Foreword-----------------------------------------000AA1

SECTION I - GENERAL

· About Airsoft----------------------------------000AA2
  o Introduction--------------------------------000AA3
  o Safety--------------------------------------000AA4
  o Legality------------------------------------000AA5
  o About Propane/Duster Gas---------------------000AA6
· The Basics Of Gameplay-------------------------000AA7
  o Structure-----------------------------------000AA8
  o Honor System-------------------------------000AB8
  o Mandatory Rules----------------------------000AB9

SECTION II – WEAPONS OVERVIEW

· Secondary Weapons----------------------------000AD6
  o Spring Operated
  o Electric Operated
  o Gas Operated
· Primary Weapons-----------------------------000AD7
  o Spring Operated
  o Electric Operated
    • Gearbox Versions
      · V1
      · V2
      · V3
      · V4
      · V5
      · V6
      · V7
      · V8
  o Gas Operated
  o Other
· Specialty Weapons-----------------------------000AD1
  o Grenade Launchers---------------------------000AD2
    • Modular Launchers
    • Stand Alone Launchers
    • Muzzle Mounted Launchers
  o Rocket Launchers-----------------------------000AD3
    • Deep Fire M27 Launcher
· Non-Firearm Weapons---------------------------000AC6
  o Grenades----------------------------------000AC7
    • Deep Fire MK II
    • Escort MK II
    • RAP4 Pineapple
    • Thunder B
    • Airsoft Innovations Tornado and Crash
  o Mines---------------------------------------000AC8
    • M181 Claymore
    • Mad Bull Powder Shot
  o Knives--------------------------------------000AC9
· Ammunition-----------------------------------000AC1
SECTION III – WEAPON OPTIMIZATION

- Overview
- Optimization
  - Poor Man's Chronograph
  - Hop Up adjustment

SECTION IV – WEAPON CUSTOMIZATION

- Overview
- Clips/Magazines
- Optics
- Lasers
- Mock Suppressors
- Tracer Units

SECTION V – UPGRADE PARTS

- Automatic Electric Gun
  - Gearbox Parts
  - Gearbox wiring
- Automatic Electric Pistol
- Gas Powered
- Spring Powered

SECTION VI – EQUIPMENT

SECTION VII – GLOSSARY

- Common Terminology

SECTION VIII – SOURCES

- References

SECTION IX – AUTHORS

- Contributors

SECTION X – VERSION HISTORY

- History
This Universal Airsoft Manual’s purpose is to inform, educate, and interest the general population in the sport and surrounding activities of Airsoft. The Universal Airsoft Manual, henceforth referred to as “The Manual”, is not intended to be used for military training, encouraging the use of firearms or combat tactics, encouraging or participating in illegal activities, or any other purpose other than an informational source relating to the sport of Airsoft. In The Manual, Airsoft replicas will be referred to as “weapons”; this term does not denote any type or form of lethal device in any way.

In addition, by reading The Manual, in part or in whole, it is recognized that no persons shall hold The Manual or its authors liable for any actions taken as a result of reading The Manual. All participants in Airsoft should **ALWAYS** wear protective gear while participating in any activity associated with Airsoft, and follow all local and federal laws and statutes.

Airsoft is a sport. It is not inherently ill-intended, however, at any time a participant, henceforth referred to as an “Airsofter”, may create an unsafe environment for themselves and others. Use common sense and follow all appropriate safety precautions when Airsofting.

Lastly, The Manual does not claim complete accuracy of any facts discussed within. The Manual is intended to be a community effort, originally hosted on the Airsoft Retreat Forums. If any individual recognizes inconsistencies within The Manual, please notify the compiler, Karland Paez, at the email address listed below, and the information will be corrected.

The format of The Manual is a simple combination of text, pictures, and footnotes. The number of the footnote correlates with each information source listed in the Sources section of The Manual.

Any individuals may contribute to this effort to centralize as much information on Airsoft as possible.

-Karland Paez
Author
webmaster@downpourproductions.com
SECTION I – GENERAL

ABOUT Airsoft

Introduction

“Airsoft is a game in which participants eliminate opponents by hitting each other with spherical non metallic pellets fired from a compressed-air gun (or Airsoft gun) powered by gas, manual spring-load, or electrically powered gearbox.”

Airsoft consists of three central components; the Airsofters, the Airsoft equipment, and the scenario/staging area.

Any individual may become an Airsofter! When a good attitude is employed, and the Airsofter practices the skill of the sport, nothing prevents any individual, regardless of age or gender, from joining the wonderful sport of Airsoft.

Perhaps the most important components of Airsoft are the weapons with which the sport is preformed. See the “Weapons Overview” section for more information on specific weapons and their operation.

Safety

Airsoft equipment includes safety gear. Safety gear MUST ALWAYS consist of at least a pair of goggles to protect the Airsofter’s eyes. Goggles that can be purchased to be worn during Airsoft usually meet or exceed either the ANSI Z87.1-2003 rating or the ASTM F-1776-99 rating, the former being the same requirement OSHA requires of construction sites in the United States.2

Estimates:

1. The ANSI z87.1-2003 rating denotes protection from a 6.35mm steel ball traveling at 150 fps

2. The ASTM F-1776-99 rating denotes protection of at least 11.8 joules of impact (about the same as a .68 caliber, 2.84 gram paintball traveling at 300 fps)
The most popular weight of ammunition in Airsoft is arguably the .20g round. A .20g bb traveling at 300 fps will exert a force of approximately 1J. Goggles meeting either the ANSI or ASTM requirement provide more than sufficient protection from a 6mm or 8mm plastic BB traveling at or around 300 fps.

Goggles contain either clear plastic or wire mesh lenses. Although there has been concern over the fact that ammunition traveling at higher velocities (400 fps) may fragment and pass through wire mesh goggles, opinions are still mixed on the reliability of mesh goggles.

The use of additional safety gear, including full-faced masks (as opposed to simply eye goggles), knee/elbow pads, and gloves is left to the discretion of the individual Airsofter or specific arena rules.

Legality

For as long as there has been war between humans, there have been those who wish to emulate. Airsoft is no exception; emulating police actions and military scenarios with accurate weapon replicas is exciting and physically healthy when applied in an appropriate way.

Notice the key word in the above paragraph; appropriate. In general, there is nothing wrong with owning an Airsoft weapon and participating in Airsoft games. There have been documented cases of people losing their lives because they chose to brandish their Airsoft weapon as a real-steel weapon.³

The above pictures illustrate the realism of many Airsoft replicas. The left picture is of the KWA G17 full-metal gas blowback Airsoft handgun. The picture on the right is a real Glock 17 9mm. Unless an individual (i.e. a nervous police officer) examines the weapon closely, it is easy to assume both weapons are identical at a distance.
In simple terms, **USE COMMON SENSE**! Always treat an Airsoft weapon as if it were a real firearm. If the suggestion of common sense is not sufficient, consider the following list before you attempt any questionable Airsoft activities.

1. Once again, **TREAT ALL Airsoft EQUIPMENT AS IF IT WERE IT’S REAL-STEEL COUNTERPART**. This includes not only handguns and rifles, but mines, grenades, and rubber knives. Always point your weapon in a safe direction with the safety on, and never put your finger on the trigger, point your weapon, or disengage the safety until you are sure you wish to destroy the target. Staying in this mindset avoids misfires and aids the Airsofters in professional weapon handling, as well as avoiding upsetting bystanders.

2. Never brandish your weapon in a non-Airsoft setting. When transporting your weapon, always secure it in a discreet case or bag, as to avoid alarming bystanders. Once again, treat your weapon as if it were a real steel; you wouldn’t walk around town carrying a fully loaded G36, right?

3. If the police become involved, **IMMEDIATELY cease all activities** and put your weapons down slowly. Raise your hands in the air and comply with the officer’s instructions while informing them of the nature of your activity. **DO NOT** attempt to hide or cover up what you’re doing; it is much more desirable to be yelled at by the police than to receive a .40 S&W slug into your body.

4. Only play on private land. Playing on public land is not only illegal, but it is a sure-fired way to get the police called. Be sure to have the permission of the land owners before you play. If for any reason the land owners wish you to leave, do so immediately. It is also advisable to warn neighboring properties of your activities before you begin.

5. **NEVER SHOOT AT A BLIND MAN (NON-PLAYER). EVER.** Unless there are mitigating circumstances (i.e. reasons of self defense, nothing to do with Airsoft), shooting or even pointing an Airsoft weapon at anyone that isn’t involved with an Airsoft game is considered assault with a deadly weapon in many states, which is a felony. In other words, don’t do it.

6. **SILENCERS ARE ILLEGAL WITHOUT REGISTRATION.** So assuming that an Airsofter has not registered with the ATF or paid the $200 transfer tax (and most haven’t), then any device that degrades a real steel weapon report by even 1dB is considered a Class III restricted item, and is illegal. See the “Silencers” section for more details.
7. There is a very obvious legal issue that thus-far has been absent from this section of The Manual; the blaze orange tip. To quote Title 15, Chapter 76, Section 5001:

“(a) Acts prohibited It shall be unlawful for any person to manufacture, enter into commerce, ship, transport, or receive any toy, look-alike, or imitation firearm unless such firearm contains, or has affixed to it, a marking approved by the Secretary of Commerce, as provided in subsection (b) of this section.

(b) Distinctive marking or device; exception; waiver; adjustments and changes (1) Except as provided in paragraph (2) or (3), each toy, look-alike, or imitation firearm shall have as an integral part, permanently affixed, a blaze orange plug inserted in the barrel of such toy, look-alike, or imitation firearm. Such plug shall be recessed no more than 6 millimeters from the muzzle end of the barrel of such firearm.”

Put plainly, the law states that the blaze orange tip is required for sales and import purposes. This indicates that it is legal for an Airsofter to paint or remove the orange tip on their weapon once it is in their possession if they do not sell, market, transport, or ship it. The article goes on to state that the law affects all replica weapons manufactured after November 5, 1988.

**H ow e ve r,** this does not mean that it is OK to parade around in public with your painted weapon! It simply means that if an officer sees your weapon laying in your home with the orange removed (and he knows it’s an Airsoft replica), then it is very unlikely the officer would arrest you. If you bring your weapon into public, PAINTED OR NOT, expect confrontation with the police!

It cannot be stressed enough the importance of discreetly transporting your weapon from home to the playing area. In addition, it is strongly suggested that if the weapon comes with a removable orange tip to attach said tip when transporting the weapon, even if the weapon is secured in a car trunk or carry case. If the weapon has the orange tip painted over, use colored tape to clearly indicate a replica firearm.

Remember, there is no substitute for simply not brandishing your weapon and transporting it discreetly to the playing site. Criminals use painted Airsoft guns to
imitate real guns, as well as real guns painted to imitate toy guns. The police are aware of both instances, and will consider ANY object they observe as a weapon to be dangerous.

Now, the question may be raised, “Why did my gun that I ordered online not arrive with a blaze orange tip?” The answer is that either the company you bought it from has broken the law, or the more likely case in that your gun was directly imported from overseas and shipped straight to you. It is a reality that every once in a while a weapon slips through Customs unpainted. Have you broken the law? According to the law, yes, but the likelihood of you being arrested for the Airsoft dealer’s mistake on your private property is very slim.

NEW YORK IS AN IMPORTANT EXCEPTION. If the Airsofter resides within New York City, Title 10 Chapter 1 of the New York City Administrative Code states:

“1. It shall be unlawful for any person to sell or offer for sell, possess or use or attempt to use or give away, any toy or imitation firearm which substantially duplicates or can reasonably be perceived to be an actual firearm unless:

(a) the entire exterior surface of such toy or imitation firearm is colored white, bright red, bright orange, bright yellow, bright green, bright blue, bright pink or bright purple, either singly or as the predominant color in combination with other colors in any pattern; or
(b) such toy or imitation firearm is constructed entirely of transparent or translucent materials which permits unmistakable observation of the imitation or toy firearm’s complete contents,”

The local laws of New York City stress the importance of checking your own local code before acting. Respecting a particular area’s laws will prevent negative opinion of the sport of Airsoft, as well as preventing legal punishment.

In conclusion, use common sense when handling your weapon, and do not assume everyone else around you knows what you are doing until you inform them yourself.

About Propane/Duster Gas

For specific weapon information, please refer to the “Weapons Overview” section.

Gas powered weapons are powered by compressed gas, among these being “Green Gas”. Carl, the owner of the company Airsoft Innovations made an Airsoft changing discovery; “Green Gas” did not have a chemical composition of CH2FCF3CH3 (as advertised), but actually C3H8, more commonly known as propane! In the words of Carl;
“I can't exactly recall when I first made my discovery as it was quite awhile ago. I don't even have emails dating back that far. If I recall, I had been messing around with propane at the end of winter in 2004. I'm guessing I was doing my first experiments in February-March of 2004. Players had pretty much known that green gas was flammable for quite some time so that made me look to propane.

I matched pressure between green gas and propane pretty quickly because it was pretty easy to measure. I just made an adapter for a gauge to compare propane and GG pressures at various temperatures. My second test clinched it for me. I compared the density of GG and propane at atmospheric pressure. Basically I weighed fixed volumes of both gases with an electronic balance. Both gases are denser than air so it's possible to calculate the density of a test gas by weighing the mass of a volume of the gas in question and adding that weight to the weight of air. I got within 2% of the density of propane which was well within my limits of experimental error so I decided to get the gas tested at a lab at the university I was attending that spring (probably in April).

While my test was working it's way up their schedule I continued to develop and product test my V1 propane adapter.

I think the V1 adapter first went up for sale online in June. I had started informal sales directly to local players in May.”

Contrary to some individual's skepticism, propane, although flammable, is completely safe to run gas weapons with. Propane is non-toxic in its gaseous form; it is only lethal if inhaled in great quantities, in which propane displaces the air in the lungs, and the victim suffocates. This is only possible if a victim were to inhale large amounts of propane exclusively; much more than is from using propane in Airsoft required to fire an Airsoft gun.
Propane combusts to form CO2 and H2O, however if an incomplete combustion occurs due to lack of oxygen, CO, or carbon monoxide may result. Because combustion of propane does not and should not ever occur in an Airsoft setting, this is not a concern of the Airsofter.

The two main differences between commercial propane and Airsoft “Green Gas” are that propane contains a harmless odor to aid in leak detection that “Green Gas” does not, and “Green Gas” contains a silicone lubricant that propane does not. Because propane is also a refrigerant, not adding silicone lubricant results in the gas operated weapon “drying out”, causing performance issues. Adding silicone lubricant to the neck of a propane bottle before injection is an easy remedy to the problem.

Propane is appealing over “Green Gas” because it is readily available (due to the nature of weak canisters, “Green Gas” is now illegal to transport through regular shipping), extremely cheap (usually $3/canister compared to $12 for “Green Gas”), easy to transport, and in some cases the smell of the leak detection odor is appealing to simulate a gun smoke smell.

In addition to the propane discovery, Airsoft Innovations also markets a “duster gas” adapter which, when attached to electronics cleaning compressed gas cans, provides a substitute for Hfc134a gas.

THE BASICS OF GAMEPLAY

Structure

The game typically consists of one or more players making up two or more separate teams. While specific objectives vary, usually the most prominent objective of Airsoft is to eliminate opposing players by shooting them with a weapon.

Because Airsoft ammunition does not leave any visible markings to signal a hit on an Airsofter, the Airsoft community has adopted an “honor system”, in which players are expected to be of good character and call themselves out when appropriate. Judges may or may not be present to attempt to aid in gameplay.

Gameplay usually takes place on private land, most likely a privately-owned Airsoft field, much like a paintball field. Due to this fact, rules regarding weapon strength and scoring procedure vary from field to field.
Honor System

Unlike paintball's color-filled paintballs, Airsoft plastic bbs cannot guarantee hit detection. Therefore, it is understood within the Airsoft community that an honor system will be followed at all times.

The system is simple: identify yourself immediately when hit, and encourage others to do the same. If someone does not call their hits, it is more likely they did not feel the hit rather than they are cheating.

**Shoot them again!** Ammunition is cheap and does not require cleanup like paintballs, so it is better to overshoot an opponent slightly than to start an argument that ruins a game.

If a player consistently breaks this honor system, consider banning them from future Airsoft activities with your group. An Airsofter's group should only consist of trustworthy, fun-loving individuals who understand that Airsoft is truly about having fun, not about who is the best.

Mandatory Rules

Rules will vary from situation to situation, as well as field to field, however there are a few standard rules that should **ALWAYS** be followed, no matter what scenario, area, or group you are dealing with.

1. **ALWAYS WEAR EYE PROTECTION.** Do not **EVER** violate this rule, for **ANY** reason! If goggles are found to be unsatisfactory or hard to play with, purchase or borrow another pair. Eyesight is not worth losing to a $0.001 plastic bb.

2. Always follow the honor system. Violating the system ruins the game for you and everyone else, and usually ends up in a verbal argument, or due to the nature of the sport, something worse.

3. Respect fellow players. This is not to say that trash talking the enemy isn't allowed. Respecting a fellow player draws the line between military simulation and realizing Airsoft is just a game. Do not physically fight, overshoot, or throw dangerous things at a player in the interest of role-playing.
SECTION II – WEAPONS OVERVIEW

Primary Weapons

Electric Operated

Gearbox Versions

Perhaps the very first thing advertised about a particular AEG is which version of gearbox it contains. Tokyo Marui designates their gearboxes with version numbers to quickly describe their shape, function, and compatible aftermarket parts.

V1

The first version gearbox was designed for Tokyo Marui's first AEG, the FAMAS F1. This gearbox must use a specialized motor, the EG560, and will not accept any other aftermarket motors without modification. Currently, the FAMAS F1 is the only gun that contains the V1 gearbox.

V2

This is a very common gearbox, and a very simple design for first-time modifiers to work on. There are numerous aftermarket parts and a wealth of tutorials and information available on the function and upgrade process of the gearbox. Problems such as the gearbox shell cracking when used with powerful mainsprings, and the possibility of improper motor mounting led to the design of the V3 gearbox. However, the V2 gearbox is still widely used and upgraded easily. Many common weapons such as the M4 and the Mp5 contain the V2 gearbox, but as with all guns, specific designs vary.
V3
Considered by some Airsofters to be the pinnacle of gearboxes, the V3, like the V2, is widely used in many weapons. Nearly all the parts in the V3 are cross-compatible with the V2. The gearbox shell is thicker than the V2, and is considered much more able to take strong mainsprings. An interesting design point of the V3 is the motor cage, which secures the motor to the gearbox shell, nearly eliminating the need to adjust motor height. Weapons with the V3 gearbox common to them include the MP5K, AK-47, and G36.

V4
Like the V1, the V4 is a “specialty” gearbox, and is currently only found in the PSG-1. The gearbox's unique design causes the piston to be cocked back before each shot, instead of during the shot, which helps in accuracy when sniping. Due to the rare nature of the gearbox, aftermarket support is relatively rare. Certain customized M4s have been reported to be using the V4 gearbox.

V5
Just like the V4, the V5 was designed specifically to be housed in a unique shaped weapon, in this case, the Uzi. No other weapons use this version to date.

V6
The V6 gearbox is a substantial design overhaul of the previous V3 and V2 models, moving all wires to the exterior of the gearbox, as well as the entire trigger mechanism. The plastic wiring harness can be completely removed from the gearbox, allowing quick and easy upgrades or replacements to the wiring or firing components. The anti-reversal latch is also located on the opposite side of the gears as the V2 and V3, as well as the cylinder head nozzle being positioned higher than the V2 and V3. Most other parts are V2 and V3 compatible, such as the gears, cylinder, piston, and spring guide. Weapons that currently use the V6 include the P90 and the Thompson M1A1.

V7
This gearbox is another specialty gearbox, designed specifically for the M14 rifle. Like the V6, the trigger mechanism is housed on the outside, however it has been reported that the trigger mechanism is more complicated than that of the V6.
At first glance, the V8 gearbox may be mistaken for a V2, however upon closer inspection, strange black gears and several external differences on the outside may be observed. This is due to the V8 gearbox possessing the ability of effective 3-round burst, simulating real-steel firearm capability. Currently, however, the only weapon to carry this gearbox is the Type 89.

Specialty Weapons

Sometimes a regular AEG will not be sufficient to fill a specific role when extra firepower is required. These weapons require patience, training, and a different mindset than a standard Infantry wielding an AEG.

Grenade Launchers

Nearly all grenade launching devices are centered around 40mm grenades, which carry the compressed gas and ammunition used in firing. The role of the actual launcher is simply to house the shell and activate the 40mm grenade. On the base of a 40mm grenade, a small button is pushed when the trigger is pulled on the launcher, expelling the gas from the shell.

Most, if not all grenade launchers, are exactly the same in effectiveness. It is the quality of the grenade round itself that determines the power and effectiveness of the weapon.

However, in terms of tactical usefulness, there are several different grenade launchers to fill a specific role. Prices and build materials will vary between each model and brand name, so any Airsofter that wishes to purchase a grenade launcher is encouraged to research a specific model before purchase, considering the usually 3 figure cost of a launcher.

A 40mm grenade round
Modular Launchers

Grenade launchers designed to be attached to a primary weapon, such as the M203, allow the use of a primary weapon with an RIS, while still retaining the usefulness of a grenade launcher during a firefight. Most modular launchers are breech-loaded, and must be reloaded after every shot, due to their compact size.

Because longer launcher barrels increase accuracy only slightly, some modular launchers come as small as a canteen.

Stand Alone Launchers

Weapons designed from the ground up as grenade launchers are often wielded by dedicated grenadiers. The stand alone launcher allows for faster reloads usually because a primary weapon does not interfere, and in the case of the CAW revolver launcher, multiple rounds on board. Stand alone launchers are usually much more expensive, but again, it depends greatly on build material and specific manufacturer.

Muzzle Mounted Grenade

This special type of 40mm grenade round screws on to a threaded barrel of a gun, and when the gun is fired, the bb activates the grenade. This instantly turns any weapon with a threaded barrel into a grenade launcher, without the need of a physical launcher.

Rocket Launchers

Some rocket launchers are designed to take 40mm grenade rounds, which although would technically classify them as grenade launchers, their appearance groups them together with rocket launchers.

Most rocket launchers in the Airsoft community are in fact not manufactured by Airsoft companies, but homemade devices. Pneumatic pump and air pressurized rocket launchers are easy to build for relatively cheap, with tutorials for such projects all over the Internet. Explosives should **NEVER** be used in the production of such replicas.
However, manufactured rocket launchers do exist, but are generally rare or sporting a high price tag.

**Deep Fire M72**

This launcher is designed to fire 40mm grenade rounds. It is of full metal construction, leading to a very realistic replica. It also has enough space to house a 57mm Nerf football, however due to its power source being a 40mm grenade, some Airsofters have considered this weapon unnecessary, since homemade Nerf Pocket Vortex launchers can be built for a fraction of the cost.

**Hand Grenades**

Several manufacturers sell different types of hand grenades, of various operation and price. Most are designed to be re-usable, however the design of some brands makes this process difficult. In this guide, the term “detachable parts” refers to all parts that could be lost during operation, and not parts that require tools to remove. The main grenade body does factor into this count. All grenades are powered by some kind of compressed gas.

**Deep Fire MKII**

<table>
<thead>
<tr>
<th><strong>Power Source</strong></th>
<th>Up to Green Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reusable</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Adjustable Timer</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Max bb Load</strong></td>
<td>Filled body</td>
</tr>
<tr>
<td><strong>Build Material</strong></td>
<td>ABS</td>
</tr>
<tr>
<td><strong>No. of parts</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>Manufacturer</strong></td>
<td>Deep Fire</td>
</tr>
<tr>
<td><strong>Approx. Price</strong></td>
<td>$60.00</td>
</tr>
</tbody>
</table>

Based off the WWII design of grenade, the Deep Fire MKII is similar to other grenades in the respect that it has a shell that separates on detonation, however instead of two pieces, the shell separates into four. The interior design makes loading of the grenade relatively simple, however it suffers the same drawback of
most hand grenades, in that it has a high count of detachable parts.

<table>
<thead>
<tr>
<th>Escort MKII</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Source</strong></td>
</tr>
<tr>
<td>Up to Green Gas</td>
</tr>
<tr>
<td><strong>Reusable</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td><strong>Adjustable Timer</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td><strong>Max bb Load</strong></td>
</tr>
<tr>
<td>28</td>
</tr>
<tr>
<td><strong>Build Material</strong></td>
</tr>
<tr>
<td>ABS</td>
</tr>
<tr>
<td><strong>No. of parts</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td><strong>Manufacturer</strong></td>
</tr>
<tr>
<td>Escort</td>
</tr>
<tr>
<td><strong>Approx. Price</strong></td>
</tr>
<tr>
<td>$55.00</td>
</tr>
</tbody>
</table>

The Escort grenade is filled with gas, and fires out of the bottom in a directional pattern. A rubber plug attached to a cord bursts out, releasing the bbs. Although the cord may break after many uses, the only part that can be lost during normal use is the pull-pin. However, due to the directional fire pattern, some Airsofters consider this grenade impractical when throwing.

<table>
<thead>
<tr>
<th>RAP4 Pineapple</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Source</strong></td>
</tr>
<tr>
<td>Up to Green Gas</td>
</tr>
<tr>
<td><strong>Reusable</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td><strong>Adjustable Timer</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td><strong>Max bb Load</strong></td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td><strong>Build Material</strong></td>
</tr>
<tr>
<td>ABS</td>
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<tr>
<td><strong>No. of parts</strong></td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td><strong>Manufacturer</strong></td>
</tr>
<tr>
<td>Real Action Paintball</td>
</tr>
<tr>
<td><strong>Approx. Price</strong></td>
</tr>
<tr>
<td>$45.00</td>
</tr>
</tbody>
</table>

The RAP4 grenade is quite possibly the most realistic grenade on the market, although this is not necessarily a good thing. Along with bbs, the grenade is able to be loaded with powder disks to simulate smoke. The internal timer is also adjustable from 1 to 8 seconds. After each firing the rubber seals must be replaced, and combined with the high count of 6 detachable parts, many Airsofters do not favor the RAP4.
This grenade approaches the Airsoft armory with a different concept; non-reusable shells. While this may seem backward at first thought, the design of the Thunder B yields a powerful blast with only 2 detachable parts (the pull-pin and detonator). The weapon is armed by inserting a 12g CO2 cartridge available at any WalMart. Then the thin plastic can is filled with the shrapnel desired. The manufacturer recommends the use of flour because of it being easier to spread than bbs. The detonator assembly is screwed on to the thin plastic body, and when the pin is pulled, the CO2 cartridge is punctured, cracking the thin plastic shell in a loud pop under pressure after a few seconds. The grenade is sold with 3 plastic shells for $35, and with 12 replacement shells sold in packs for $25, the price could be considered a good deal.

In terms of realism, the Tornado grenade falls furthest from the tree. However, as of 2009, it is the only grenade that is fully reusable with only 1 detachable part, being the pull-pin. It is also the only grenade that features a safety; removing the screw on cap from the bottom renders the grenade completely safe. The grenade has the option of using a sound disc insert (purchased separately) to turn the weapon into a distraction device. Many Airsofters agree this is the best hand grenade available, however the price is so high it is equivalent to purchasing an AEG or GBB.
Land mines are both unique and functional in terms of Airsoft, unlike the many grenades that Airsofters may consider impractical.

**M181 Claymore**

<table>
<thead>
<tr>
<th>Power Source</th>
<th>Spring/9v battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reusable</td>
<td>Yes</td>
</tr>
<tr>
<td>Activation</td>
<td>Tripwire/Remote</td>
</tr>
<tr>
<td>Max bb Load</td>
<td>Filled body</td>
</tr>
<tr>
<td>Build Material</td>
<td>ABS</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>CHORTLE</td>
</tr>
<tr>
<td>Approx. Price</td>
<td>$125.00</td>
</tr>
</tbody>
</table>

The Claymore mine is reportedly very powerful, launching bbs as far as 30ft, which is much more than a directional mine requires at ankle-level. The choice to use remote detonation or tripwire detonation allows for varied usage to keep enemies guessing. The only drawback of this weapon is the high price tag.

**Mad Bull Powder Shot**

<table>
<thead>
<tr>
<th>Power Source</th>
<th>Up to CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reusable</td>
<td>Yes</td>
</tr>
<tr>
<td>Activation</td>
<td>Step on it</td>
</tr>
<tr>
<td>Max bb Load</td>
<td>0 (powder)</td>
</tr>
<tr>
<td>Build Material</td>
<td>ABS</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Mad Bull</td>
</tr>
<tr>
<td>Approx. Price</td>
<td>$50.00</td>
</tr>
</tbody>
</table>

The mine is operated by injecting gas through the port located on the bottom side. The mine is then filled with a powder, such as flour, and when the mine has pressure applied to the top, the powder explodes everywhere. Made of high-impact ABS, the weapon supposedly stands up to being stepped on repeatedly. However, the mine is about the size of a CD, meaning effective use may be limited.

**Knives**

Real, sharpened knives are never to be used during an Airsoft game, as this is extremely dangerous. However, to aid in military simulation, objects that act as
knives are usually implemented into the game.

The premise is simple; a flexible, durable length of material used as a knife can be used to “tap out” players. Some rubber knives are very realistic. The knife should always be flexible and soft as to avoid injury, but also durable to stand up to hard usage. A good compromise is rubber knives.

Other knives made of foam, cardboard, or even duct tape have been used successfully. Plastic should never be used; although it may seem safe, plastic is actually very stiff and can be very painful upon impact.

Ammunition

Quality

Without a shadow of a doubt, the most important factor when choosing an ammunition to use is quality. Not all Airsoft ammunition is the same; on the contrary, nearly every permutation thinkable exists in ammunition.

Ammunition is usually 6mm in size, with inner barrels of weapons usually less than .1mm larger in bore. Therefore, there is little room for error when a bb passes through.

These facts presented assume that the ammunition is to be used in a standard Airsoft rifle or pistol; the rules change when talking about grenades, mines, and shower launchers.

Inspecting an ammunition before purchase, if possible, is the best choice in deciding which ammunition to use. If it is not possible to see firsthand the ammunition, there are many good sources on the Internet to give an idea of the hierarchy of bb quality, including Airsoft Retreat.

Although opinions will vary, it has been found that the following bb categorization is safe:
Good

- Airsoft Elite
- G&G
- KSC
- Matrix
- Inertia
- TSD
- Excel
- SIIS
- Goldenball
- Maruzen
- Marushin
- ICS
- Bioshot
- Bioval
- Straight
- Marui

Poor

- Usually anything from a non-Airsoft store
- Cybergun
- Softair
- CYMA
- Lasersoft
- Airstrike
- Ammo that comes packaged with a cheap gun

It is impossible to categorize every brand into simple “good” and “poor” groups. The above list does not take into account the many, many brands that fall somewhere in-between “good” and “poor”. When in doubt, inspect the ammunition, and test it in your gun, preferably against a well-established brand. You never know, you may discover a great no-name brand!

Another important factor relating to quality of ammunition is something called manufacturer’s tolerance. See “tolerances” below for more.

At the right is a perfectly formed bb surface. Notice how there are no knicks, seam lines, burs, or cracks in the bb surface, which will translate into a smooth, even, consistent shot. This type of bb is the only type that should ever be used, especially in tightbore barrels, where there is even less room for error per shot.

*A smooth, even surface*
The yellow bb on the left is of extreme poor quality. A bur and visible seam mark will undoubtedly interfere with accuracy and consistency when the shot is fired.

A bb should always be smooth and even, because if it is not, any burs or seams on the bb surface can fill that .1mm gap and cause inaccuracy, jamming, or even damage to an inner barrel.

**Tolerances**

In manufacturing, there is a concept called tolerance. A manufacturer's tolerances describe an acceptable margin of error in the sizing and shape of parts made.

Airsoft ammunition is no exception. Ignore gimmicky bb labels claiming “Perfect 6.00mm sphere!” or other such nonsense; it simply isn't true. Tolerances are a reality of production.

So what's the big deal? Well, any Airsofter who wants consistency and accuracy from their gun should buy and use a brand of ammunition with the lowest tolerances possible. For example, Company A has a sample group with tolerances of ±.08mm for all bbs measured. Let's assume the median is 5.95mm, which is a benchmark number for Airsoft ammunition.

Eight hundredths of a millimeter may not seem like much, but what it means in reality is that the first bullet could be 5.87mm in diameter, and a second could be 6.03mm. For a stock inner barrel with an inner diameter of around 6.08mm, this may not be a problem, but this does not take into account the fact that many brands of bbs with loose tolerances also have loose quality control (i.e. seams and burs), which add unaccounted size. Also, the trajectory and stability of a 5.87mm shot fired the same way as a 6.03mm shot will differ significantly.

Now imagine if there were a 6.03mm aftermarket tightbore barrel installed in our example gun, and we fire a 6.03mm shot. Assuming a margin of error of ± .02mm for the barrel, we could potentially be firing a 6.03mm bullet through a 6.01mm barrel. See the problem?

Now say Company B's sample group has a margin of error of ±.01mm for all bbs measured. Assuming the median was 5.95mm, this means every bb will fall between 5.94mm and 5.96mm in size. This means that as long as .01mm is truly the margin of error, Company B's ammunition will have far better performance than Company A's ammo.

The only true way to find out an ammunition's quality is for an Airsofter to test it themselves. Company's claimed specifications should never be relied on.
**Weight**

Airsoft ammunition, just like real steel ammunition, comes in different weights. Ammunition weight is measured in grams (g).

While every bb should be of the highest possible quality no matter what, there is no specific weight of ammunition that is suitable for every gun or purpose. Generally, the higher fps a gun attains, the heavier the ammunition should be used. Adjustment of the Hop Up affects ammunition choice as well; higher Hop Up settings require heavier bbs.

Once again, the only true way to find out which ammunition weight is best for a particular gun is to test it first hand. For a complete list of brands and weights, see “ammunition index”.

Note that it is impossible to compile a completely accurate weight usage, as there are dozens of factors within each weapon itself that determine which weight of ammunition works the best. The only way to select an ammunition that fits each need is to test it out firsthand.

**Biodegradable Ammunition**

Unlike Paintball, Airsoft unfortunately does not use a universally biodegradable ammunition. To some, the thought of scattering small plastic pellets across the environment is a troubling idea. Thus, biodegradable ammunition was needed to fill a niche. Excel brand ammunition was the first to release a biodegradable bb.

Most biodegradable ammo is made up of various starches and resins, that break down over a period of months or years instead of centuries when exposed to the elements. In times past, biodegradable ammunition was considered low-quality and frowned upon, for reasons of unreliability, poor accuracy and consistency, and exaggerated claims of biodegradability.

However, as of 2011, there are several well-established companies producing biodegradable ammo, with many more up-and-coming manufacturers offering up their products. Bioshot and G&G are two well-recognized brands that produce very high-quality biodegradable ammunition. It should be noted that, as of this writing, Ultimate BB .20g have the fastest known disintegration rate at an astonishing 4-6 weeks. This extreme breakdown rate requires careful storage away from easily overlooked elements, such as sunlight.

It should also be noted that Bioval brand ammunition is **NOT** what would be considered biodegradable ammo; rather, Bioval uses a special manufacturing process that allows for less pollution in their production of bbs. Package labels in the past have led to the misconception that Bioval produces biodegradable ammo.
Tracer Ammunition

Tracer ammunition is used in conjunction with a “tracer unit” for an effect that mimics real steel tracer rounds. The flashbulb inside the tracer unit activates the tracer round’s light-adsorbing material, causing it to glow in the dark. In low-light situations, a glowing bb shooting through the air creates a spectacular display and aids in accuracy by Kentucky windage.

8mm Ammunition

Although the overwhelming majority of the Airsoft market is based on 6mm ammunition, a few manufacturers, most notably Marushin, have created weapons with 8mm bore sizes. Because of the heavier weight of the larger ammunition, the ammunition usually impacts with greater force than 6mm. 8mm bbs come in various weights, just like 6mm.

7mm Ammunition

A strange example, at least in these modern times, of Airsoft munitions is 7mm pellet ammunition. This type of ammunition was shaped more like a conventional .177 caliber lead pellet rather than the spherical bb that is typical in Airsoft. This ammunition was used in certain types of spring powered guns from the 1980s, with the example in the picture weighing .25g. Although unique and perhaps more stable in theory than a typical bb, no current manufacturer produces such a weapon to fire the strange projectile. In addition, the examples chambered in 7mm were extremely
underpowered compared to today's weaponry, in and around the 70fps neighborhood. What was once perhaps considered state-of-the-art may now be classified as nothing more than a curio item. Thank you to justpistols.uk for the information; see the sources section at the end of the Manual for more detail.

000AD8

Ammunition Index

This section will attempt to compile a complete list of brands according to the weight and size of ammunition they manufacture, along with comments from the author. Each brand’s name will be colored according to the type of ammunition they manufacture:

Key:
- Black Denotes “regular” plastic
- Green denotes biodegradable
- Purple denotes tracer
- Blue denotes both biodegradable and tracer
- Red denotes metal

6mm

.12g

1. 1st Target Delight
2. 1st Target Bio
3. Airstrike
4. BCB Airblister
5. Cybergun
6. CYMA
7. HFC
8. Lasersoft
9. Matrix
10. Matrix Glow-in-the-dark
11. P Force
12. Sansei
13. Softair
14. STTI
15. TFC
16. Tokyo Marui
17. UK Arms

Extremely common, maybe even more so than .20g. Although frowned upon by most Airsofters as useless beyond extremely low powered guns, this weight is actually quite useful for mines, grenades, and launchers, where the desired effect is not accuracy, but spread. If an ammunition’s weight isn't marked, it's most likely a .12g. Usually found in sporting goods stores and gas stations, under labels such as “Lasersoft” and “Cybergun”, most often accompanied by outrageous claims of high precision and unsurpassed quality (i.e. bullshit). It should also be noted that some lower-end companies mark their .12g ammunition with “.24cal”, which should not be confused as a weight figure.
.14g

1. 1st Target

Not sure why the community needs another random low-weighted ammo. Just get .20g or .12g.

---

.15g

1. UHC
2. 1st Target Smooth
3. 1st Target Color

Rare. Found packaged with some Airsoft guns. As of 2011, I don't know if it's even possible to buy this weight on it's own. Theoretically could provide slightly better accuracy and stability than .12g, but probably isn't worth the time to scrounge some up since it's still very light weight.

---

.16g

1. 1st Target
2. TFC

I reference “.14g”.

---

.17g

1. SIIS

From what I gather, a tracer bb in this weight was produced by SIIS.

---

.18g

1. 1st Target Color
2. 1st Target Smooth

May be useful for lower powered spring guns looking for better accuracy, but why bother?

---

.20g

1. 1st Target Color
2. 1st Target
11. Blaster Devil
12. Crosman
13. Echo 1 USA
23. HFC
24. ICS
25. King Arms
33. King Airsoft
34. King Airsoft
Super King
<table>
<thead>
<tr>
<th>Weight</th>
<th>Brand/Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>.22g</td>
<td>1. Western Arms</td>
</tr>
<tr>
<td></td>
<td>A rare weight that Western Arms produced for their guns. Unless it's of superb quality, I don't really see a need for it.</td>
</tr>
<tr>
<td>.23g</td>
<td>1. AIM TOP</td>
</tr>
<tr>
<td></td>
<td>2. Airsoft Elite</td>
</tr>
<tr>
<td></td>
<td>3. Echo 1 USA BB</td>
</tr>
<tr>
<td></td>
<td>4. Matrix</td>
</tr>
<tr>
<td></td>
<td>5. Matrix Bio-degradable</td>
</tr>
<tr>
<td></td>
<td>Like what the .15g is to the .12g, .23g should, again in theory, provide better accuracy than .20g ammo. More than likely, very little difference would be noticed when compared to .20g weight. More common than .15g, this weight can be found online at some Airsoft retailers.</td>
</tr>
<tr>
<td>.25g</td>
<td>1. AIM TOP</td>
</tr>
<tr>
<td></td>
<td>11. Matrix</td>
</tr>
</tbody>
</table>
Considered by some the weight for serious Airsofters, it provides excellent stability and accuracy when used in a quality gun, surpassing the .20g. Upgraded weapons usually preform better with these bbs, however, due to their heavier weight, if a stock weapon contains a quality Hop Up bucking, it is possible to attain better accuracy with this weight. Some fixed Hop Up guns are rated for this weight. Generally only available from Airsoft retailers. Beyond this weight class is usually reserved for upgraded guns, as it takes high fps with reinforced internals to throw this ammunition accurately.

**.27g**

1. Bioval BBBMax

Bioval puts a unique translucent .27g ammo that is considered very high-quality.

**.28g**

1. G&G Biodegradable
2. G&G P.S.B.B.
3. WE
4. Echo 1 USA BB
5. Matrix

Same story as the .15g and .23g, but with slightly more merit, since it has heavier weight. Power upgraded guns may benefit from the extra weight over the .25g.

**.29g**

1. Maruzen Super Grand Master
2. KSC Grand Champion

Maruzen’s Super Grand Master brand of ammunition, weighing .29g, is regarded by many as the definitive highest-quality bb ever made. Sold in packages of 500pcs for upwards of $20, they now are rare and highly sought-after in the sniper rifle arena. Most online stores that have them listed have been out of stock for a long time. KSC produces a rival to the SGM called the Grand Champion.
.30g

1. Bioval
2. Matrix
3. Madbull
4. HFC
5. Tokyo Marui Superior Grade

Heavy weight sniper ammunition. Not much else to say. Generally only available from Airsoft retailers. Past this weight is usually reserved for sniper rifles, as the only thing unique about each subsequent weight is just that; more weight. HFC makes bbs made from aluminum in this weight.

.33g

1. 1st Target
2. P Force

There have been aluminum bbs floating around the internet labeled under “P Force”. Why anyone would want these is beyond me.

.36g

1. Straight
2. Madbull
3. WE

Straight brand ammunition is rare and sought-after, often cited in sniper circles. Madbull's heavyweight bbs are considered garbage by some, and acceptable by others. They should be considered an economical choice for sniper ammunition.

.40g

1. Madbull Ultimate Heavyweight
2. Matrix
3. WE

.43g

1. Madbull Ultimate Heavyweight
2. PHX
3. TFC
4. WE
.46g

1. Madbull

.80g

2. Bioval

These are metal bbs, although for what, I cannot say. Maybe for extreme target practice or hunting small game. Do people really do that with Airsoft guns?

.88g

1. Piper's Precision Products

Airsoft ammo for Armageddon. Made of steel. Used to blow up a TV with Piper's Precision Vulcan M134A1. No one in their right mind would ever use these for a skirmish, or really anything else for your gun's lifespan sake. What were they thinking??

8mm
SECTION III – WEAPON OPTIMIZATION

Overview

A weapon manufacturer may claim that, at the time of purchase, a particular weapon has been “highly tuned” or “reinforced”. However, usually these combinations of words are merely marketing ploys.

There is no doubt that brands such as Tokyo Marui, Classic Army, and G&G will provide sufficient quality in their weapons. However, it is the responsibility of the Airsofter to maintain and tune their weapons to optimize their performance in the field. Tuning a weapon takes patience and time, however most would consider the task relatively easy.

Optimization

Poor Man's Chronograph

Most likely the area of greatest interest for a particular weapon is the answer to the general question of “how powerful is it?”. While the answer relies on many factors within the gun, the speed at which the weapon fires is generally what is sought after.

Traditionally, the speed of a weapon is taken using a chronograph. The electronic sensors in the chronograph measure an approximate FPS for the weapon. However, a well-tuned chronograph can be costly and out of the realm of an Airsofter's pocketbook.

Thus, the Poor Man's Chronograph was created, first by Red Wolf Airsoft10, and later rehashed by Airsoft Retreat member, Cheesehead11. By firing a single shot through the side of an aluminum can, a rough estimate of a weapon's fps can be assessed. The procedure for using the system is simple.

The Airsofter will need:

1. Airsoft weapon to be tested
2. .20g ammunition
3. Undamaged, empty aluminum soda cans manufactured by The Coca Cola Company
Set up the aluminum can upright on a firm, flat surface, with no additional support. Load the weapon with .20g ammunition. The ammunition must be .20g ammunition, because this test is configured for the use of .20g ammunition. The aluminum can recommended for this test is branded under The Coca Cola Company. Other soda cans may work. Whatever brand used, the can must be empty and undamaged.

Hold the weapon’s muzzle approximately 1 inch from the center side of the can. This is the first testing site. Be sure to hold the weapon level, to ensure straight on penetration.

Fire a single shot. Examine the impact area of the can. The weapon’s fps depends on whether the shot penetrated zero, one, or both sides.

If the weapon does not penetrate both sides, the test is finished. If the weapon does penetrate both sides completely, put a second can into place, albeit this time on its side.

Position the weapon so that the muzzle is 1 inch from the center bottom of the weapon. This is the second testing site. Fire one shot. If the shot passes through the bottom completely, continue to each testing site in order, until the bb fails to pass completely through. The final site the bb is able to pass completely through indicates an approximate fps:

1. Side center (1 side) – 290fps
2. Side center (Both sides)-340fps
3. Bottom Center – 385fps
4. Bottom Edge – 450fps
5. Top Center – 470fps
6. Top Edge – 500fps

Using a combination of the last site able to pass through and how well the shot penetrates the next site, it is possible to gauge an approximate fps for any given weapon up to 500fps.

000AB4
Hop Up Adjustment

Although power in the form of high fps is essential to intimidation and brush cutting, a weapon that fires at 500fps is worthless if it cannot hit a target.
Accuracy and range are controlled primarily by the Hop Up of a weapon, which could be either good or bad. The bucking could be perfectly seated and adjusted, allowing for a smooth, consistent weapon, or contain rips and be poorly seated, leading to strange flight patterns or even jams of ammunition.

The simplest way of adjusting Hop Up is by using a vice to secure the gun. This is not mandatory however; with a steady hand and firm resting place the adjustment can be completed to an Airsofters liking. Before any adjustment of a Hop Up, be sure that the bucking and Hop Up chamber are in good, working condition.
First the weapon's maximum range must be assessed. With the Hop Up completely off, face a target that is at least 100ft away and fire an aimed shot at it. Adjust your physical proximity to the target accordingly, until the bb begins to fall low of where you aim.

From this position, begin to turn up the Hop Up. Continue testing shots until your weapon fires in an even, consistent manner, as far as possible. If the shot curves upwards or is inconsistent, this could be due to overhop. If the shot fails to reach the target, this could be due to not enough Hop Up.

If adjustment does not seem to have any effect, or has an undesirable effect regardless of the adjustment, the weapon's Hop Up bucking may be damaged or poor quality.

With enough patience and adjustment, Hop Up will seriously affect the quality of your weapon, and the enjoyment of the game.
SECTION IV – WEAPON CUSTOMIZATION
Advanced AEG Upgrade Guide - SVX
Version 2.4

Section 1 : Weapon Archetypes (Determining what upgrade path to take)
  Part I - High Reliability-tuned Weapons
  Part II - High RoF Setups
  Part III - High Power Setups
  Part IV - Hybrid Setups

Section 2 : Parts Information (Transmission, Compression, Electrical, etc...)
  Part I - The Mainspring
    A) Mainspring
    B) Spring Guide
  Part II - Transmission
    A) Gearsets
    B) Pistons
    C) Bushings/Bearings
  Part III - Compression
    A) Pistonhead
    B) Cylinder
    C) Cylinderhead
    D) Air Nozzle
  Part IV - Electrical
    A) Battery
    B) Motor
    C) Trigger Switch
    D) Selector Plate
  Part V - Barrel
    A) Inner Barrel
    B) Hopup Assembly
    C) Hopup Packing
  Part VI - Misc
    A) Tappet Plate
B) Anti-Reverse Latch  
C) Cutoff Lever

Section 3: Part Selection (Parts combinations)  
Part I - Reliability  
A) 320FPS  
B) 360FPS  
C) 400FPS  
Part II - RoF  
Part III - Power

Section 4: Compatibility Issues (Things to avoid)

Section 5: Shim/AoE/Dissassembly Links

Appendix: Specific gear ratios, spring rates, and other detailed parts specifications.  
- CA/G&G M14 Parts Compatibility  
- Exact Gear Ratios  
- Gearset ID  
- Tightbore Shootout by Hissing Sid  
- Motor Shootouts by TehFish and Dirius

-----------------------------------------------------------------------

Section 1: Weapon Archetypes  
Part 1- High Reliability-tuned Weapons  
Part 2- High RoF Setups  
Part 3- High Power Setups  
Part 4- Hybrid Setups

Pt. 1 High Reliability-tuned Weapons  
This is the goal of most Airsofters - to simply give their gun a little more power, and a lot more durability. Most of the time they just want to bump the power to 330, 360, 380, 400, or 420 FPS, and have the gun not break. With the correct parts and installation, you can run an AEG at up to 20 RPS (rounds per second) at these power levels, lay on the trigger all day, and not have anything break for a long time.  
I'll get into details later, but it's basically about as simple as installing an FTK, and perhaps over-gearing for the spring. A 9.6v battery is all you need - a good one will give you plenty RPS.

Pt. 2 High RoF Setups  
This is my personal favorite. RPS is rarely restricted, and tends to produce the greatest intimidation factor.  
Most of these setups revolve around M100 springs. Getting around 25 RPS is easy, Getting up to 30 requires a basic understanding. Pushing 35, you need to know what you're doing. Techs that can breach 50-60RPS are few and far between, but it is possible and has been done.  
Lightweight pistons, polished parts, MOSFET switches and Short-stroked gears come into play in this department. Simply running an overpowered LiPo pack in a near-stock AEG is a recipe for
disaster, and will get you laughed at when your gun breaks.

Pt. 3 High Power Setups
The target audience for this section is the Semi-Only AEGs being converted for DMR use, at 400 to 550 FPS.
This isn't too difficult to do, but you should only be using a high-powered AEG in semi-auto mode.

Pt. 4 Hybrid Setups
These are the setups that exceed 400FPS @ 20+RPS, or 500+FPS with blistering rates of fire. The amount of skill and knowledge required to setup such a platform is beyond the scope of what can be learned from reading a guide. There is more to a gun than a bucket of parts, and if you have to ask, you are not ready.

Section 2 : Parts Information (Transmission, Compression, Electrical, etc...)
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B) Hopup Assembly
C) Hopup Packing
Part VI - Misc
A) Tappet Plate
B) Anti-Reverse Latch
C) Cutoff Lever

Part I - The Mainspring (Upgrades here will directly improve FPS)
A) Mainspring
This is the core of any upgrade; choosing the right spring. Generally, you want an "Irregular Pitch" or "Progressive Rate" spring, such as PDI or Guarder The softer coils in these springs compress first, putting less stress on the first piston tooth.
Springs usually shoot 'hot' when first installed – cheaper springs can shoot as much as 40-50 FPS over their rated strength when brand new. Guarder SP springs have a pretty gentle break-in, in my experience they only lose 10-20 FPS from their first shot chrono.

Most brands are labeled by "Mxxx", meaning "xxx" Meters Per Second. Simply multiply by 3.28 to get the FPS. PDI labels their springs by a percentage (using a stock Marui M85 as 100%). Multiply the full % by 2.8 to get approximate FPS.

I personally have taken a liking to Guarder SP-type springs. They are very consistent and have a fast, minimal break-in. The SP rating is accurate when used with a stock barrel, decent hopup, a non-bearing spring guides, and non-bearing pistonhead. See the APPENDIX for Spring Charts (manufacturer claims).

B) Spring Guide

This part keeps your mainspring from jumping into your gears. With fast RoF setups or springs over M110, it's a good idea to have a metal or Polycarb one. Don't be cheap here - I've seen a lot of these break, even with stock springs.

Most guide either have a bearing or a washer at the base of the guide rod. This allows the Mainspring to twist and rotate, rather than possibly develop kinks, which could cause the spring to break apart. Also, a bearing or washer functions as a spacer, precompressing the spring and giving you 5-10 more FPS.

Pretty much any brand (metal) will work, but if it's Polycarb make sure it's an ANGEL clear one. Be sure to loctite the guide shaft to the base so it doesn't vibrate apart.

Part II - Transmission (Upgrades here will improve RoF, and are the greatest factor in overall reliability)

A) Gearsets

There's a lot of options on gears out there. I recommend either Guarder (about $35 shipped from eHobby on Ebay) or HurricanE for a low cost option (HK retailers have them). For maximum performance, get Prometheus. The extreme tuners at AirsoftMechanics always have problems with Systema and Phenix gearsets - but Prometheus is the gold standard.

Here's the hierarchy of speed ratios and torque ratios. Starting with gearsets that optimize ROF when paired with weak springs (such as M100), and moving to ratios that optimize ROF with stronger springs (M120 and above).

Ultra-High Cycle: Made by Systema either in a gearset or FTK. These gears have built-in bearings, and are the *second* highest ratio available, HOWEVER. They are very expensive, hard to find, and very FRAGILE. The gears are made of lightweight aluminum and skeletonized, and direct feedback from users has indicated these gearsets do not last long even when paired with a weak M100 spring.

It is interesting to note the Ver.1 (FAMAS) Tokyo Marui stock gears are set at a faster ratio than any other in production (even the Systema UHC).

High Speed: Available in many brands. Available in Helical cut. Gear ratio is approximately 15% faster than stock, depending on manufacturer.

Standard/Original Ratio: Available in many brands. Available in helical cuts. These gears are capable of powering up to M130 springs with very fine tuning.

Torque Up: Available in many brands. Available in Helical cuts. This ratio lets your motor work easier, and may give you more battery life.

"Super, Double, Triple, etc." Torque Up (abbreviated 'STU'): Different manufacturers use different terminology. These ratios further reduce motor strain, and cut down top-end ROF. Available from several brands. Available in Helical cut.
INFINITY TORQUE (abbreviated 'IFTU') or ULTRA TORQUE: These are nearly ALWAYS Helical Cut. This gear ratio uses a unique Spur/Sector Gear tooth geometry for a powerful torque increase, requiring a HALF-CUT PISTON (SEE APPENDIX). These gearsets can easily power M170 springs and beyond.

WHAT ARE HELICAL GEARS?
Helical simply refers to the gear teeth being cut diagonally (Helical) rather than straight (aka 'Flat'). Diagonal teeth are stronger, but only if shimmed correctly to ensure a PERFECT MESH.

WHEN DO I NEED A HALF-TOOTH (aka 'helical') PISTON?
'Helical piston' is a misnomer. The correct term is 'Half Tooth'. You only need a Half-Tooth Piston to match an IFTU gearset (SEE APPENDIX).

B) Pistons
The piston is usually the first point of failure when you push your AEG too hard. Any piston labeled as Version 1, 2, 3, or 6 is identical, even if the other Versions aren't spelled out. That is because the V2 is the de-facto standard for AEG pistons. PSG1/SR25/AEP and other incompatible pistons should be labeled as such.

Full-aluminum pistons have strong metal teeth, but they are heavy, and can cause a gearbox case failure and accelerated sector gear wear. Additionally, the aluminum is often not of very high quality, and simply gets ground in to harmful shavings by the gears, especially when the piston itself does not engage and mesh properly with the gears.

The DeepFire full-tooth pistons are a hybrid, nylon body and a full rack of Ti-coated aluminum teeth. Good in theory, but in practice the nylon body tends to fail far before the teeth themselves do (the teeth cave into the piston itself and stop meshing with the sector gear). There are two guarantees with the DeepFire Ti piston:
1. It will last several thousand rounds of absolutely any abuse you can throw at it.
2. No matter what you do, even if you DONT abuse it, it will fail after several thousand rounds.

Next, the Prometheus EG Hard Piston. It's a heavily overbuilt Polycarbonate body with 7 metal teeth. It's pretty heavy, but extremely durable. It can always be lightened by 'swiss-cheesing' or drilling holes in it. It's also recommended to remove the second tooth from the open end.

The last type to mention is PolyAcetal, made by G&P. These pistons perform very well in my experience, similar to polycarb.

Personally, my favorite pistons (in order of preference) are the Prometheus EG Hard, G&P white PolyAcetal, and Guarder. At least one of those is always available at almost any retailer. The most critical part of piston life is it's installation rather than brand; the Engagement Angle and mesh must be inspected.

C) Bushings/Bearings
These hold the gear axles and center them in the gearbox holes. Most Clone and Marui AEGs have plastic/nylon/Delrin bushings stock. These are fine with stock setups, but they tend to cause extra friction with upgraded setups. They can deform slightly from heat or pressure, and are also more difficult to shim.
Most gearboxes have 6mm bushing holes. The bushings have 'flanges' that are 8mm across, which fit on the inside of the gearbox so that the bushing doesn't fall out. Some Classic Army AEGs have 7mm Bearings stock.

The two best upgrades for standard 6mm gearboxes are Ball-Bearing inserts or Metal Bushings. **Ball-Bearings** provide the least amount rotational resistance (giving a better RoF) but can break down if used with springs heavier than M100's. If a bearing blows out while your AEG is running, it is nearly guaranteed to cause a catastrophic failure that will probably take out your piston and gears as well. 7mm bearings are much stronger, and 8mm bearings are indestructible by Airsoft standards. **Bushings** are simply lugs of metal with axle holes drilled in them. They can handle any amount of stress an AEG gearbox can create.

**Part III - Compression**

A) **Pistonhead WARNING - READ SECTION 4**

The pistonhead is a multifunctional upgrade part. The right one can make your gearbox shoot stronger, quieter (or LOUDER), cycle faster (or SLOWER), and last longer. In any case, your stock one is probably crap by comparison.

The 'Do's and Don'ts' are found in SECTION 4. The different pistonhead types:

- **Polycarbonate, ported flat**: The most common, and cheapest type. They get the job done with no frills. They can crack, but they will not put undue stress on the gearbox case.
- **Polycarbonate, silent type**: Much less common. These look like 'mushrooms' because of the domed face. They are designed to make your shots quieter, but I own one and it doesn't do much. In a side-by-side comparison, these can give you a fraction of a percentage increase in RoF, but that could be explained by the leaky seal of the Systema model (which caused an FPS drop).
- **Polycarbonate, airbrake**: The only production model I've seen is the Silent Headset made by ANGEL. "In Canada, they worship these like Jesus and Mary", said another Airsofter. I'm willing to give them a shot. If anything, it should still provide an excellent air seal.
- **Polycarbonate, silent-boreup**: The original was made by Systema. They are 'domed' like a Silent headset, but they are **wider** than a standard pistonhead. These require a 'Boreup' cylinder and cylinderhead (both are wider than standard also). The idea, is to move more air per shot, either for super-long barrels or for simply more power. Like the original Silent Headset by Systema, these... blow. It's possible to rectify the problem by installing a proper O-ring. Guarder and Classic Army also make Boreup Kits now. No word on their quality.
- **Aluminum, ported flat**: These are the Devil! DO NOT USE! If you are breaking pistonheads, you are doing something wrong anyway. More info in "Comparability Issues".
- **Aluminum, silent type**: They're just like the polycarb silent-type, but heavier. Heavy is bad.
- **Aluminum, Silent-Boreup**: Again, heavy = bad. And they're expensive.

**WHAT IS PORTING?**

Porting refers to those little air holes on the piston face. These are good - they channel some air to the inside edge of the O-ring, 'inflating' it. This provides a tighter seal, leading to more pressure in front of the Pistonhead - that's a good thing.

**WHAT DOES 'BEARING' MEAN?**

The Bearing they are talking about goes inside the Piston. It's the anchor point for the Pistonhead. It is similar to the Bearing Spring Guides; it allows the spring to twist and relieve kinks, and also precompresses the Mainspring for a tiny FPS boost. Some Pistonheads (like a stock Marui) have a
simple washer or spacer unit. Washers are cheaper than Bearings, and might not be as effective at relieving Mainspring kinks. Any washer or spacer will also preload the Mainspring, depending on how thick it is.

B) Cylinder
Making changes here usually doesn't make much of a difference. The most common type is Brass. Chrome-plated and Teflon-coated Cylinders are also available. Theoretically, they would give you a better seal, with less friction to slow down the piston.

WHAT 'TYPE' OF CYLINDER DO I NEED?
When you extend your Inner Barrel, you may need to change your Cylinder to match the air volume. The longer the barrel, the more air you need to push a BB all the way down the barrel. If there wasn't enough air, FPS could be lower than expected due to the infamous 'barrel suck'. Using a Cylinder too big is a subject that still remains to be resolved.
An M16 or G3, for example, need a full-volume, unported Cylinder. While an MP5k (with a barrel the length of my pinky), uses a Cylinder with a port near the middle. See the APPENDIX for a more detailed Cylinder Guide.

C) Cylinderhead WARNING - READ SECTION 4
The Cylinderhead seals the end of the cylinder, and funnels the air pressure into the Air Nozzle so it can be fed into the Hopup system. Some are padded better than others, and some have better seals (Guarder for example, has double O-rings). Check SECTION 4 for additional information on what to avoid.

D) Air Nozzle
This little guy plays a big role. If it's out-of-spec, it could cause double-feeds, or failure to feed. It can also cause a loss of power if it's too short, and if it's too loose. Look for one with an internal O-ring (such as Guarder).
Metal air nozzles do tend to provide an excellent airseal, but they are not necessary, as a good Systema or Guarder airnozzle will do the same. Always compare the upgrade nozzle to the stock one, and make sure they are the same length, or it could lead to feeding and FPS issues.

Part IV - Electrical
A) Battery
If you care about your RoF at all, get a decent damn battery. Intellect Bros and Elite are considered the gold standard (and quite inexpensive). If you can find something better (i.e. recommended to you by an R/C'er), use it. R/C'ers are very knowledgeable when it comes to batteries. Even if you don't care about RoF, a QUALITY 8.4v will last longer, and give you more shots per game, as well as working far better in the cold weather.
Now, once you get into the good cells, Voltage is the biggest factor in RoF. MaH is a secondary factor; (this is a rule of thumb) higher MaH batteries tend to have higher quality, higher discharge rate cells.

B) Motor
Make an upgrade here for RoF or trigger response time. The hottest motors on the market right now are the new Systema Magnum, and Systema Turbo. It's not clear which is truly the best for high-speed setups, or at what point the Magnum is provides more power output than a Turbo. Systema claims the Turbo is designed for springs up to an M130.
If you are on a budget, other good motors include the G&P 'M120 High-Speed', ICS Turbo3000k, old Systema STU, and the Eagle Force Hummer series. Guarder has recently introduced upgrade motors as well. See the APPENDIX for a shootout between some motors by TehFish. I personally recommend the new Systema's if you've got the money, otherwise the T3k for Torque, and G&P M120 HS for Speed and regular torque, and a Guarder Revolution for speed. The old STU and Eagle Force are also supposed to be very good, but the extra price isn't worth it, IMO.

C) Trigger Switch
The trigger switch is nothing but two open prongs, and a third contact connected to the trigger that bridges them. Systema and Guarder make enhanced Switch Assemblies that have better wire equipped. These upgrades have a minimal impact on RoF. If you really want to cut down on resistance, upgrade to a MOSFET switch. See Section V: Links.

D) Selector Plate
Another upgrade of minimal gain. The biggest reason to upgrade this part would only be for the mechanical durability itself, rather than a reduction in electrical resistance. A modification to the selector plate may be made, to convert a regular AEG into a semi-auto only DMR.

Part V - Barrel
A) Inner Barrel
This is a good first upgrade. They can be a little pricey, but you will see a positive return. A tightbore will require you use good BBs for the rest of the weapons' life, but this just makes an even better accuracy improvement. Some barrels have Titanium or Teflon coatings, others are just plain Brass or Steel. MadBull barrels appear to be good for a budget upgrade. Premium barrels include PDI, KM TN, Prometheus, and Dees.
Also note that tightbores offer a substantial FPS boost, between 5FPS to 20FPS depending on the difference in quality.

B) Hopup Assembly
In some cases, upgrading your hopup assembly can produce a dramatic effect on power and accuracy. Some are just badly designed, or badly put together. Others may have simply been out-of-spec or badly worn. The advantage comes from having less places for air to leak, and less parts to misalign.
The most common Hopup Assembly upgrades are One-Piece kits for Armalites, and Metal Hopup Chambers for other guns such as the AK and G36 (though AK's and G36's usually have a very good seal stock).

C) Hopup Packing
One of the FIRST upgrades that should ever be done, and also one of the cheapest. Many AEGs come stock with very inconsistent Hopup Nubbings and Sleeves. The Nubbing is the cylindrical part that is pushed into the Sleeve through the Hopup Notch on top of the barrel. The Sleeve seals around the notch and prevents the Nubbing from falling into the barrel.
Very good ones are made by Guarder, Systema, and Prometheus. Also, if you can find a FireFly Kurage, or Big-Out H-Hop, these last two are new developments in Hopup technology. They have a gap along the middle of the bucking, so that the Hopup Nubbing engages the sides of the BB instead of the very top. This causes a more precise, vertical spin, further reducing 'slicing' or curving shots (which happen when the Hopup spin is not perfectly vertical).
Part VI - Misc
A) Tappet Plate
Some AEGs simply come with brittle Tappet Plates. Other times, a stock Tappet Plate may be too weak to deal with extremely high rates of fire (been there). Guarder makes very good ones. Also, ANGEL makes clear Polycarbonate Tappet Plates.

B) Anti-ReverseLatch
Another part that's very hard to get wrong, and even harder to break. Usually all that happens is the ARL Spring gets worn out. At that point, just get a Spring Set for $5.
If you do need a new one, get a Guarder, Prometheus, or Systema.

C) Cutoff Lever
Sometimes these get worn out also, but it is incredibly rare. Replacements are made by a couple manufacturers.

Section 3 : Part Selection (Parts combinations)

INTRO

Part I - Reliability
A) 320FPS
B) 360FPS
C) 400FPS

Part II - RoF
A) +20RPS
B) +25RPS
C) +30RPS
D) +35RPS

Part III - Power
A) 400FPS
B) 450FPS
C) 500FPS
D) 550FPS

INTRO

Part I - Reliability
320 FPS
This is stock-level performance for most AEG's, excluding Marui.
RECOMMENDED: Have backup piston and spring guide on hand. Sometimes stock shimming is so bad, its enough to make a tech weep, but won't directly kill the gun at this power.
REQUIRED: Parts that aren't absolute crap. Sometimes stock guns will lose power due to compression issues, or hopup parts either wearing out or being improperly installed.

360 FPS
RECOMMENDED: Metal bushings/bearings, metal spring guide, polycarb piston
REQUIRED: Decent compression components
400 FPS
RECOMMENDED: Metal bushings, upgrade piston, Guarder or better gearset, EG1000/T3K/M120HS or better motor, Metal Cylinderhead, Upgrade Pistonhead
REQUIRED: EG1000 motor clone or better, preferably standard ratio gears, good compression, metal spring guide

Part II - RoF
320 FPS: Most high speed setups focus on using M100 springs. While providing low resistance, these setups often require short-stroking at high RoF.
Stage 1 (+20RPS): Reshim, Bushings, High Discharge Battery.
Stage 3 (+30RPS): +Combination of Motor and Battery to attain raw speed.
Stage 4 (+35RPS): Piston AoE and teeth mods are critical to success. Wiring, trigger, and connectors need to be able to handle high current.
Stage 5 (+40RPS): +High Speed Gearset shimmed to perfection, in addition to raw motor and battery power.

360FPS
Stage 1 (33RPS): Reshim, Bushings, high-end Piston with AoE and teeth mods, high-end Standard Ratio Gearset - Shortstroked 3 teeth, 130m/s rated spring, high-end motor, and High Discharge Battery. Recommend MOSFET.

400FPS This setup utilizes a higher rate spring with raw motor and battery power to ensure a rapid cycle rate without short-stroking. An extremely precise piston setup and absolutely perfect gear shimming is required to prevent failure of those parts.
Stage 1 (30RPS): Reshim, Bushings, high-end Piston with AoE and teeth mods, high-end Standard Ratio Gearset, 110m/s rated spring, Bearing Pistonhead, Bearing Spring guide, high-end motor, and High Discharge Battery. Full barrel/hopup upgrades to maximize FPS output. Recommend MOSFET.

Part III - Power
15-20RPS (RoF is a non-issue here, this is focused on DMR builds. A good tightbore + H-hop should be a priority.)
Stage 1 (400FPS): Metal spring guide, bushings, a decent piston, EG1000/Turbo3000/G&PM120 or better motor
Stage 2 (450FPS): +Quality gearset (ratio depends on motor/battery)
Stage 3 (500FPS): +Quality TU or IFTU gearset (depending on motor/battery), hard hopup, Promy/Guarder/Systema/etc piston, upgraded piston/cylinderhead set
Stage 4 (+530FPS): Acceptance that either a piston, pistonhead, or worse will eventually break in the middle of a game.

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Section 4 : Comparability Issues (Things to avoid)

Part I: Piston/Cylinderhead matching.
1. Do not mix Boreup/Standard parts. This includes Pistonheads, Cylinders, Cylinderheads, and
Air Nozzles. "NB" denotes 'Non Boreup' parts. "BU" sometimes denotes 'Bore Up' parts - sometimes parts won't be marked at all, and you just have to use deductive reasoning.

2. Do not use flat-faced Aluminum Pistonheads with flat-faced Cylinderheads. Doing so sends excess energy straight into the weakest point in your gearbox case - the front end. You have been warned.

3. Do not use flat-faced Pistonheads with 'funneled/tapered' Cylinderheads. Most Silent-type cylinderheads are funneled/tapered. Use a Silent-type pistonhead with funneled/tapered Cylinderheads. The Silent-type Pistonheads are designed to take all the force of slamming into the Cylinderhead on the edges, or rim, of the Pistonhead. A flat-faced pistonhead will eventually get it's rim/edge broked, cracked, or snapped off.

4. Do not use a domed/Silent-type Pistonhead with a flat-faced Cylinderhead. This is a no brainier. Besides having the Pistonhead trying to bend the Cylinderhead, the extra length of the pistonhead may push the Piston and Sector Gear teeth out of alignment in the pre-engagement state. Bad, bad, bad.

**Part II: CA Yellow Pistons**

1. The second tooth (from the 'insert spring' end) does not quite mesh correctly with the Sector Gear. Simply file off the entire thing to avoid excess stress or deforming to the piston.

2. The last tooth (metal) is out-of-spec. It's too big, and stresses the Sector Gear teeth. Either file the metal tooth smaller or replace it with any other brand's metal tooth.

Do those mods, and you should have a good piston. Many people use theirs stock with no problems, but it's a game of chance if you do.

**Part III**

**Part IV: Hopup/AirNozzle Fit Adjustment**

**Part V: Systema Motors**

Systema Magnum and Turbo motors are prone to shorting out through the anodized motor endbell. Read about the solution here:


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**Section 5 : Shim/Disassembly/Other Links**

**Shimming links**

http://pageproducer.arczip.com/daedalus03/workshop.html - The explanation of a correct shim job (with the best pictures). I can't link directly to the Shim Guide, you have to click the picture.

**AoE and Short-Stroke Guide**


**Angle of Engagement discussion**

stripped and broken (re: 'the entire rear end of my piston broke off!') pistons.

**Disassembly/Teardown links**

M4 (Marui) disassembly: [http://www.mechbox.com/site/m4/m16-upgrades/m733-disassembly-video.html](http://www.mechbox.com/site/m4/m16-upgrades/m733-disassembly-video.html)
   -(reassembly: [http://www.mechbox.com/site/m4/m16-upgrades/m733-resassembly-video.html](http://www.mechbox.com/site/m4/m16-upgrades/m733-resassembly-video.html))
   -(reassembly: [http://www.mechbox.com/site/m4/m16-upgrades/m733-resassembly-video.html](http://www.mechbox.com/site/m4/m16-upgrades/m733-resassembly-video.html))
MP5 (Marui) disassembly: [http://www.mechbox.com/site/upgrades/mp5-upgrades/mp5-disassembly-video.html](http://www.mechbox.com/site/upgrades/mp5-upgrades/mp5-disassembly-video.html)
   -(reassembly: [http://www.mechbox.com/site/upgrades/mp5-upgrades/mp5-reassembly-video.html](http://www.mechbox.com/site/upgrades/mp5-upgrades/mp5-reassembly-video.html))
AK (Marui) disassembly: [http://www.mechbox.com/site/ak-47-upgrades/ak47-disassembly-video.html](http://www.mechbox.com/site/ak-47-upgrades/ak47-disassembly-video.html)
G36 disassembly: [http://www.mechbox.com/site/upgrades/g36-upgrades/g36c-disassembly-video.html](http://www.mechbox.com/site/upgrades/g36-upgrades/g36c-disassembly-video.html)
   -(reassembly: [http://www.mechbox.com/site/g36-upgrades/g36c-reassembly-video.html](http://www.mechbox.com/site/g36-upgrades/g36c-reassembly-video.html))
   -(reassembly: [http://www.mechbox.com/site/mechbox-upgrades/version-3-mechbox-upgrade-video.html](http://www.mechbox.com/site/mechbox-upgrades/version-3-mechbox-upgrade-video.html))

**General**

[http://pageproducer.arczip.com/daedalus03/workshop.html](http://pageproducer.arczip.com/daedalus03/workshop.html) - A great collection of material, really cool stuff, CHECK IT OUT!!!
Advanced Gearbox Tuning
http://www.Airsoftmechanics.com/phpBB/ - DO NOT WASTE THESE GUYS' TIME if you are a noob. I swear I will flame you to death myself.

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APPENDIX : Specific gear ratios, spring rates, and other detailed parts specifications.

CLASSIC ARMY AND G&G M14 GEARBOX PARTS

V2/V3 Gears
V3 Spring Guide
V6 Cylinder Head
AUG Airnozzle
Short Motor
Standard Cylinder
Standard Spring
Standard Piston
Standard Piston Head
G&G M14 Proprietary Tappet Plate (might be a V6)
7mm Bushings/Bearings
AUG Hop Up Unit
509mm Barrel
Standard Hop Up rubber

WHAT ARE 'PRO-WIN' AND 'PGC' GEARBOXES?

ProWin are the CNC gearboxes for M16-series AEGs. They are CNC'ed billet aluminum which is an order of magnitude stronger than any cast gearbox case. You won't be getting a snapped mechcase with one of these from a high-rate spring. Also, the Pro-Win's are set with 8mm Ball Bearings instead of 7mm or the standard 6mm. 8mm bearing a also an order of magnitude stronger than anything available on standard gearboxes - with 8mm you can run any spring rate and still enjoy the silky smooth RoF boost from ball bearings. Finally, the Pro-Win has an integrated hopup, which improves the air seal so much you get a minimum 20FPS increase.

The PGC is an in-line gearbox style for M249's and M60's. It was originally a replacement to the TOP bellows system allowing you to use standard AEG parts for reliability and performance. The CA M249 comes with a cast metal one, and the STAR M249 has a polycarbonate one. I know the CA is 8mm bearing, but IDK about the STAR.

Both gearboxes also have a hot-swap spring function. Throw a latch while the GB is still installed in the gun, and you can change the spring guide and spring out.

EXACT GEAR RATIOS

Quote from: Blake

Prometheus and Systema use different naming conventions for their gear sets. Here is a list of the gear sets and their ratios:

PROMETHEUS
High Speed 16.45
Standard Torque 18.72
Double Torque  23.78
Triple Torque  25.84
Max Torque    36.81

SYSTEMA
Ultra High Cycle  15.50
High Speed      16.45
Standard        18.72
Torque-Up       23.78
Super Torque-Up 27.50
Ultra Torque-Up  36.82
Infinite Torque-Up  45.00

PHEONIX
Super High Cycle 16.00
High Cycle      17.36
Powered         21.60
High Powered    23.44
Super Powered   25.65
Ultimate Powered 39.60

Quote from: SVX

TOKYO MARUI
Ver.1 stock  15.20
Ver.2/3/6 stock  18.72
Ver.7 stock  21.76

CLASSIC ARMY
Standard/Stock (stamped "CA") 18.72

GUARDER
Standard Flat Ratio  21.76 (ver.7 ?)
Guarder Infinity Torque-Up  45.00

GEARSET IDENTIFICATION
Guarder Standard Ratio Flat Gearset (Above)

Systema STU Ratio Helical Gearset (Above)

Guarder IFTU Ratio Helical Gearset (Above)

CYLINDER / BARREL MATCHING
No Hole: 450-580 mm barrel length
4/5 Hole: 364-460 mm barrel length
¾ Hole: 227-430 mm barrel length
½ Hole: 110-170 mm barrel length
BARREL SELECTION
Quote from: Hissing Sid
Anyway, on a day when I was bored I gathered up a whole pile of barrels that people had been foolish enough to leave at my house or which I had lying around. I also gathered up 2 mates to do the testing with me, to try to avoid subjective results. I've posted the results of the tests I did elsewhere so, suffice to say, there was no practical difference in accuracy between any length of the barrels I tested, ranging from a P90 barrel to an M16 barrel (IIRC).
When I chronoed the gun with each barrel there was a small power increase from the longer barrels, just as you'd expect.
The stock P90 was firing at 325FPS and, when fitted with the longest barrel, it was firing about 10FPS higher than that.

Next I tested tightbore barrels. I happen to have a whole bunch of 460mm G3 barrels so I was able to test similar barrels. I wasn't testing an MP5K 6.03 barrel against a 6.04 M16 barrel. They were all G3 barrels. I had (again IIRC) a Systema brass 6.04, a KM TN 6.04, a stock Marui Brass 6.08, a TK twist barrel and a Prometheus 6.03.
Everything went as you'd expect. The tighter the barrel the better the groups. The only oddity was the TK twist barrel. That would score some good groups and then just lose it completely for a few shots.
At 20m The 6.03 could shoot almost through the same hole. The 6.04s were shooting 1" groups. The Marui barrel was shooting 3" groups and the TK barrel would put 3 or 4 shots through the same hole then put another 2 into the wall 3ft to the side of the target.
What about power?
The stock barrel was shooting about 330fps. The 6.04s were shooting about 332-333 and the 6.03 was shooting about 333-334. A small difference but a repeatable, definite one. The TK barrel was, alas, shooting way down at about 315.
I suppose it's possible that the TK barrel would have blossomed into a beautiful butterfly if I'd fettled the gun to increase the power back up to 330fps but, pah. Life's too short.

MOTOR SELECTION
Quote from: TehFish
G&P M120 "HiSpeed" vs. TM EG1000
Testing Platform - WGC-Custom M4A1 New Type(G&P) It has been opened a few times. All internals have been checked, it has been reshimmed and relubed, and it is running a TM piston, polyurethane o-ring, and custom brass type-0 cylinder. Other than those parts it is stock.
gear ratio - standard(approx. 18:1)
Spring - 140% according to PDI's scale. (EDIT: Similar to a standard M110 rather than an M100)
Battery - Intellect 9.6v 1400mAh mini battery. 8x IB1400 2/3A cells

Motors tested - G&P M120 High Speed, Tokyo Marui EG1000, and two Classic Army stock motors("High Performance...High Torque")

Measured using a computer microphone, an audio real time analyzer to graph the .wav, and pixel analysis with Microsoft Paint.

G&P M120 High Speed ~ 18.9 rounds per second
Tokyo Marui EG1000 ~ 15.5 rounds per second
first Classic Army ~ 13.1 rounds per second
second Classic Army ~ 13.3 rounds per second

Quote from: Dirus

**G&P M140 "Hi-Torque"**

I'm one of the few people that have actually bought one of these motors. It was suggested to me on these forums over the Systema Super Torque Up for my high-FPS DMR setup. Despite the motor being called "M140", there is no way this motor can pull a M140 spring without max/infinite torque gears.

When upgrading my GR-25, I was trying everything I could to get around buying another motor, but in the end, it was required. Upgraded the wiring, battery, shims, bushings, you name it. Upgrade list is quite long, so I'm only listing relevant parts.

**Setup 1 (G&G GR-25, Prometheus Triple Torque gears, 10.8V battery, unknown discharge rate)**

-- Guarder SP160 530FPS spring: Pulls it half-way, then locks up.
-- Prometheus MS150 400FPS spring: Pulls it fine, not very impressive trigger response time.

**Setup 2 (G&G GR-25, Prometheus Triple Torque gears, 12V 35A discharge battery)**

-- Guarder SP160 530FPS spring: When fully charged, it might be able to pull off 1-2 shots, but locks up half-way. It is then unrecoverable until mechbox is opened and spring tension released.
-- Prometheus MS150 400FPS spring: Pulls it fine, slightly better trigger response.

**Setup 3 (AE MP5 v3.5, Prometheus Torque gears, 8.4V battery)**

-- Systema M120S 400FPS spring: 17 rounds per second, no problems.

**Setup 4 (AE MP5 v3.5, Prometheus Torque gears, 10.8V battery)**

-- Systema M120S 400FPS spring: 24 rounds per second, no problems.

As a torque motor, it's not up to the task of handling DMR setups, where the Systema STU motor supposedly would have worked. It performed well with the midrange/400FPS springs however.

***END OF GUIDE***

000AA9

**Gearbox Wiring**

The following is a guide written by meancivicsi taken from Airsoft Retreat Forums. Some of the content has been edited for spelling and grammar. All intellectual credit goes to meancivicsi.

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I get alot of questions about Mosfets rewiring etc etc. So i decided to put together a guide to help clear up some common issues people might have and to show how to make your own mosfets capacitor banks etc etc.

**WIRE SELECTION!**

There are many different wire types, all of which have advantages and disadvantages. Here are the main types you should consider using in your AEG.

**Solid Wire**

Pros - Very thin
- Low resistance
- handles more amperage than comparable gauge stranded wire
- very stiff, easy to route through gearbox and such

Cons
- breaks easily
- very stiff, can be bad in some cases

**Hook-up Wire**
Pros - pretty flexible
- thinner than silicone wire
- easy and cheap to come by
- tough insulation

Cons
- 16ga wire sometimes too thick for Ver 2 gearbox
- not the top performer in low resistance and amperage rating dept

**Teflon coated mil-spec wire**
Pros - Standard OEM wire in Systema, Prometheus, and Tokyo Marui
- Very Strong insulation
- Super thin, 16awg teflon wire is thinner than any other 16awg wire
- typically has silver coated copper conductor
- low resistance
- pretty stiff, routes easily through gearboxes and aeg bodies

Cons
- pretty stiff not as forgiving if you measure out the lengths wrong
- expensive

**Silicone wire(deans wet noodle)**
Pros - very low resistance
- very flexible

Cons
- very expensive
- silicone insulation tears very easily
- hard to solder
- extremely thick

**Speaker wire**

dont use it unless you have to.

**Wire size**

Wire size is typically measured in the American Wire Guage system. In this system the smaller the #, the larger the wire. The Guage is determined by the size of the CONDUCTOR only and not the overall size of the wire.

Most AEG's come with 18 or 16 AWG wire. 16awg wire is best for most AEGs since it handles 75 Amps. If you have room you may try 14awg but the benefit will be minimal.
Connectors

_Tamiya(large and small)_
These connectors suck ass. they are worn out after about 50 cycles of being put together and pulled apart.

They are also a huge source of resistance and allow a mere 15amps or so to pass through them

_Deans Ultra plugs(T-connectors)_

Last a long time and can handle alot of power as they are very low resistance.
Switch to these connectors right away!

typically 10 pairs can be had on ebay for $4! Or one set can be bought at a local R/c hobby shop for about $3.

Here is a guide..To add deans plugs is simple.

*Cut off worthless Tamiya Plug (if this is the battery , be sure to only cut one lead at a time to avoid short circuit.)
You can also clamp the deans plug in a vice or clip to hold it while soldering at this time

Typically the battery uses the female end and the male end goes to the AEG harness

* Now pretin each of the deans plug terminals. Do this by adding a bubble of solder to each of the terminal tabs.

*Next put a piece of heatshrink on each wire to be soldered. Then attach the + wire to the vertical tab, and the - wire to the horizontal tab.

Should look like this.

Then heat the shrink tubing to cover the exposed terminals!!

The video shows how to do this as well.

_Tools_
- soldering iron/irons
- wirestrippers
- heatsink
- voltmeter
- wet cellulose sponge
- sandpaper
- flux
- helping hand tool
- heat gun
- glue gun
- pliers

_Capacitor Banks_
Capacitor banks can improve your trigger response and rate of fire.

Electrolytic Capacitors store energy and release it on demand. This will fill in voltage drops seen when you initially pull the trigger, and when the AEG is cycling through some shots.

When the voltage drops, the capacitor releases its stored energy and helps smooth out the current. Once the voltage drop is gone, the capacitors fill up once again.

The improvement is nominal though, and to get a noticeable difference you need a pretty large bank. Not all AEG's have room for this so keep that in mind.

If you can fit them in though, there really is no disadvantage to using them. Installing a capacitor bank is simple. Just find a suitable location for them, and solder them in parallel into your AEG wire system.

They are polarized so get the +/- correct. The (-) side is shown by having a stripe running down the cap on one side.

I usually make my capacitor banks removable so I can switch them from gun to gun.

You can buy capacitors at Radio Shack, from an online store, or in old unused electrical devices such as disposable flash cameras.

Here is a schematic:

**FUSES**

Fuses come stock in most AEG's. They heat up and break the circuit when there is an overload of current. I typically don't run any fuses in my AEG's since I can rewire one in 15 minutes. But if you are concerned about your setup, here are some:

- Glass or plastic automotive fuses
  These are found in most stock AEG's. When they trip, you just pop in a replacement.

- Polyfuses (resettable)
  These fuses gradually expand when heated to the point where they no longer conduct electricity. Once the current is removed, they contract and cool to the point where current can flow again. Once they trip however, they are tripped again very easily unless given sufficient amount of time to cool.

Glass fuse and a Polyfuse

**Motor connectors**

There are three main options here.

- Good standard motor connectors - not the best because of high resistance.
gold plated motor connectors - allow more contact between connector
and motor tab which decreases resistance

Best
Solder wire directly to motor tab- best option but must desolder every time motor is removed(sux for ver2 GB owners)

Mosfets
A mosfet is a switching transistor that can handle high loads and carries very little internal resistance. There are many benefits to using these and there are really no drawbacks to using them.
- They can do these great things...
  - increase ROF
  - Allow use of higher voltage batteries
  - save your trigger contacts from ever burning up
  - increase trigger response
  - increase overall efficiency of your electrical system

It is really easy to make one if you have some soldering skills. (watch the video for some soldering tips.)

Here is a good soldering guide that i had nothing to do with making...
http://www.kpsec.freeuk.com/solder.htm

Here is what you need to make the Mosfet unit itself...
100ohm resistor
20-30k ohm resistor
suitable mosfet ( I always use IRL1404z)

You may also want to find plenty of heatshrink tube in various sizes and the wire that you are going to use for the gate wires.

The Mosfet has three pins. Gate , Drain , and source.(see first picture)

You need to put the 100 ohm resistor on the gate pin, and the 20-30k ohm resistor(pull down resistor) between the gate and source pins.

I like to cover the mosfets heatsink with heatshink tubing. I do this because the heatsink has the same electrical value as the drain pin, and i don't want anything to short out by touching it.

I also cover the pulldown resistor.

First i attach the pull down resistor...
and then the gate resistor ...

After that you are good to get started. rewiring. First you must desolder the trigger contacts and attach the gate wires. I typically use the small wires found inside of ethernet cable.

Desolder each trigger contact and attach a gate wire to each of the trigger contact tabs. it should look like this.
then you can add new wires that go straight from the battery to the motor.

No all you need to do is find a spot to put the mosfet. When you find it, clip the negative wire in half and take the side that runs to the motor. attach this side to the center pin of the mosfet(drain pin)

then attach the other end of the negative wire, the one that goes to the battery, to the outer "source" pin.

Then finally attach one gate wire to the gate resistor on the mosfet, and the other gate wire needs to be spliced somewhere into the positive wire.

Bam you have a mosfet system!

P.s. quick pictographic diagram

Wait what about active braking?!?!?
Ok that's easy too. All you need to do is add a p-channel mosfet.

The benefit of active braking, is that the motor will "brake" or stop as soon as you let off the trigger. This helps the piston stay forward and avoid putting stress on the gears and such. It also makes for an amazingly crisp trigger pull.

The guys at www.Airsoftmechanics.com pioneered all of this, and made up schematics for us to use! Props to Gandolf(Terry) and PsypherVII.

There are many ways, even some better ways to do this. But here is how i do it, and it works.

Here is a n-channel and P-channel mosfet. I start by gluing them together back to back. here it is...

Then i bend the P-channel's gate pin to meet up with the N-channels gate pin.

Then i bend both drain pins(center pin) together and solder them as well...

then I add the pull down resistor between the n-channel's gate and source pin as usual.

and finally add the gate resistor(100ohm) to the N-channel mosfet's gate pin.

Now You simply wire this in the same as you would a standard mosfet. The only difference is, you need to take the mosfet's source pin, and splice it into the positive wire.

Here are some active braking mosfets in various stages of development...
WHERE TO GET PARTS!

www.digi-key.com
n-channel mosfet search part # IRL1404ZPB-ND
p-channel mosfet search part # SPP80P06PIN-ND
polyfuses'
MF-RHT650-ND(use two in paralell)
MF-RHT750-ND(use two in paralell)

Radioshack and Fry's have resistors and capacitors of all kinds as well as digikey

Ebay has all kinds of parts and wire! Use it ! Don't be scared!

references
- www.Airsoftmechanics.com
- www.digi-key.com

****END OF GUIDE****
SECTION VI - EQUIPMENT
1. aftermarket –adj- Relating to Airsoft, any part or accessory of a weapon purchased separately from the weapon itself, usually from a different manufacturer.
2. Airsoft –n- Recreational game consisting of players firing at each other with Airsoft guns, usually in military simulation.
3. Airsoft Retreat –n- Popular website among Airsofters that contains information, reviews, and discussion concerning Airsoft.
4. ASR –n- see Airsoft Retreat
5. Automatic Electric Gun –n- Referring to any of various battery powered weapons.
6. Automatic Electric Pistol –n- A subset of the AEG, the AEP is classified as a high-powered electric pistol.
7. bb –n- Ammunition used in each Airsoft weapon, commonly in weights of .12g, .20g, or .25g, although many weights exist.
8. barrel crown –n- see crowning
9. battery –n- Power source for any AEG or AEP, usually consisting of either Ni-Cd, Ni-MH, or Li-Po rechargeable battery cells.
10. bevel gear –n- Gear in the gearbox of an AEG that is first in the sequence, engaging the spur gear.
11. bore –n- The inner diameter of the inner barrel of a weapon.
12. bucking –n- A small rubber sleeve placed over the inner barrel in the Hop Up chamber, pushed into the inner barrel by the Hop Up nub to create the Hop Up effect.
13. bushing –n- A small circular eyelet made of plastic or metal, usually removable, located within an AEG’s gearbox where the gears’s axles are seated.
14. chrono –v- Slang term to denote the use of a chronograph.
15. chronograph –n- Device used to measure the fps of moving objects; in the case of Airsoft, a fired bb.
16. crowning –v- Procedure done to an inner barrel that tapers the interior of the muzzle, allowing air to escape gradually as the weapon is fired, increasing accuracy.
17. Deans connector –n- Common electrical plug to connect, among other things, the battery to the electrical system of an AEG, often with better results than the Tamiya connector.
18. duster gas –n- Common electronic compressed air found at many retail stores, used to clean dust from computers, among other uses; used as a substitute for Hfc134a Airsoft gas.
19. feet per second –n- Measurement of the speed a bb travels once fired out of a weapon.
20. fps –n- see feet per second
21. g –n- The measurement of grams.
22. gearbox –n- Mechanical box within AEGs that is powered by the motor and houses the gears and compression system of the weapon.
23. GBB –n- Gas Blow Back
24. Green Gas – Chemical composition C3H8, used to power gas powered guns.
25. Hfc134a – Compressed gas with lower power than Green Gas, found to be replaceable with PC duster gas.
26. Hop Up – System located at the rear of the inner barrel that puts a backspin on the bb as it is fired from the weapon, allowing greater range and accuracy.
27. mechbox – see gearbox
28. metal oxide semiconductor field effect transistor – An electrical plug-in to regulate electrical flow between the battery and motor of AEGs, controlling ROF and bypassing trigger contacts.
29. metal body – Denotes the exterior of a weapon to be comprised of some kind of metal.
30. MOSFET – see metal oxide semiconductor field effect transistor
31. motor – A powerful device, powered by the battery, that spins at a high rate, engaging the first gear in the firing sequence, the bevel gear.
32. NBB – Non Blow Back
33. overhop – The curving effect on a fired bb due to too much Hop Up being applied.
34. Poor Man's Chronograph – Simplistic system of firing at an aluminum soda can to attain an approximate fps rating.
35. propane – Chemical composition C3H8, identical to Green Gas and used by many Airsofters as a substitute.
36. pull pin – Safety pin of a hand grenade that is pulled to release the spoon.
37. rate of fire – The rate of shots able to fired, usually measured in rounds per second/rounds per minute.
38. real steel – Referring to the actual weapon/firearm the Airsoft weapon is based upon.
39. RIS – Rail Integrated System, referring to the presence of a rail system on a weapon for mounting lasers, flashlights, or grenade launchers.
40. ROF – see rate of fire
41. rps – see rate of fire
42. sear – In terms of spring rifles, the metal bracing piece that retains the mainspring when the rifle is cocked, and released when the trigger is pulled.
43. sector gear – Gear within the gearbox of an AEG that is last in the sequence, engaging the piston.
44. shim – A small, thin metal washer used to buffer the gears of a gearbox from the gearbox wall, allowing for more efficient spin of the gears.
45. shim – The adjustment of shims within the gearbox to attain better power usage and efficiency of gear turn. Also known as shimming and shimjob.
46. spoon – A thin metal lever on a grenade that, when the pull pin is removed, falls off and allows the detonator to activate.
47. spur gear – Gear within the gearbox of an AEG that is second in the sequence, engaging the sector gear.
48. stock – The supportive length of material on the back end of a weapon, used for shouldering the weapon during firing.
49. stock – The quality of a weapon having no upgrades from the time of purchase.
50. Tamiya connector – Standard plastic connector to link the battery of an AEG to the wiring system, comparable to Deans connector.
51. **tightbore** – n- An inner barrel with a smaller bore, usually smaller than 6.08mm, purchased usually as aftermarket.
52. **tolerance** – n-A manufacturer's margin of error relating to physical properties of a product.
REFERENCES

2. Safety Glasses USA – Article on safety glasses ratings http://www.safetyglassesusa.com/ansiz8712003.html
4. Aspen Daily News – Article on two teenagers who almost got shot by the cops by doing everything wrong possible http://www.aspendailynews.com/section/home/134032
8. New York State Legislature – Directory of New York State laws http://public.leginfo.state.ny.us/menugetf.cgi
16. Piper’s Precision Products .88g steel bb demonstration http://www.youtube.com/watch?v=BB5T7VNoxyw&feature=player_embedded
17. Just Pistol’s webpage, documenting 7mm ammunition and several 7mm guns http://www.justpistols.co.uk/7mm.htm
SECTION IX – AUTHORS

• Airsplat.com – Provider of Hop Up adjustment illustration
• Carl – Inventor of Airsoft Innovations Propane Adapter
• Cheesehead – Reviewer of the Poor Man’s chronograph
• Paez, Karland – Author, compiler
• RedWolfAirsoft.com – Founder of the Poor Man’s Chronograph
• SilentVectorX – Author of the AEG Upgrade Guide
• meancivicsi – Author of AEG Electrical Guide
SECTION X – VERSION HISTORY

V2.12 – 1/3/2011 Added 7mm section, biodegradable section, and tracer ammo section.
V2.1 – 12/31/2010 Pictures added back in, and ammunition section expanded
V2.0 – 12/30/2010 Revived! Hours of editing and reformatting to save this guide from the depths! Also expanded ammunition section.
V1.4 – Added AEG electrical guide, added gearbox version info, updated authors/sources, added to glossary
V1.3.1 – Fixed formatting, spelling, grammatical errors, changed font from Courier New to Bookman Old Style.
V1.3 – Specialty weapons (grenade/rocket launchers), non-firearms (grenades, mines, knives), Duster gas info, expanded glossary.
V1.2.1 – Added Version History section, adjusted formatting errors
V1.2 -Ammunition (quality, weight, 8mm), Mandatory Rules, added to Glossary
V1.1 -Added Glossary, Weapon optimization (Poor Man's Chrono and more), added authors.
V1.0 -Posted for the first time 6/14/2009
Alpha stage Started as private project 4/28/2009
THIS IS A LIST OF AIRSOFT GUN PRODUCTION DATES THAT WILL BE IMPLEMENTED SOMEHOW, SOMEWAY IN A FUTURE VERSION.

Up to 1980
Masudaya Bolt 888 [Arisaka Type 38]
Nakaya BS Winchester
Nakaya BS81
Nakaya BS52
Nakaya BS65
Nakaya BS Breaker
Nakaya BS Semiauto W
Masudaya BS Buffalo 08
Unknown Falcon 077
Matsushiro/Takatoku-Toys SS9000 [TM9000] (Cartridge, air)
Matsushiro/Takatoku-Toys SS5000 [TM5000] (Cartridge, air)
Matsushiro/Takatoku-Toys SSW7000 [TM7000] (Cartridge, air)
Maruzen Marksman Government (air, singleshot)

1980
Eedai Sturm Ruger Mark 1 (cartridge, air)
Eedai .44 Automag 180 (cartridge, air)
Unknown Luger MS-1
Unknown Walther MS-2
Unknown Magnum MS-1
Yonezawa Mauser Mark II Custom (cartridge, air)
Masudaya SWAT M1 (air)
Masudaya Bolt 888 [Arisaka Type 38] Mark II (air, singleshot)
Masudaya Thunderbolt (air, singleshot)
Matsushiro/Takatoku-Toys SS Super X (cartridge, air)
Matsushiro/Takatoku-Toys SS Automag (cartridge, air)
Masudaya Detachable series (air)
Chiyoda Marksman Government (air, singleshot)

1981
Masudaya Assembly series (air)
Yonesawa Python 357 (air)

1982
Masudaya Aachin Extra (air)
Matsushiro Super Colt Government (cartridge, air)
Matsushiro Super Mauser Auto Custom (cartridge, air)
Matsushiro Blackhawk Custom (air)
Maruzen Remington M870 Wingmaster (cartridge, air)
Maruzen Remington Light Shotgun (cartridge, air)
Chiyoda S&W M59 (singleshot)
Falcon Toy S&W Revolver series (cartridge, air)
Falcon Toy Woodsman Match Target (cartridge, air)
1983
Maruzen KG9 (cartridge, air)
Kokusai Superweapon M16A1
Maruzen Mini UZI (cartridge, air)
Falcon Toy H&K MP5K (cartridge, air)
Masudaya Minuteman-10 (cartridge, air)

1984
Maruzen S&W M59 (cartridge, pushcocking)
Crown Revolver Series Python (air)
Crown Revolver series S&W M29 (air)
Kokusai Superweapon XM177E2
Maruzen Luger P08 (cartridge, pushcocking)
Kokusai Superweapon Remington M700BDL
Falcon Toy H&K MP5SD3 (cartridge, air)
Maruzen Government (cartridge, pushbutton)
Marui Blackhawk (air cartridge)
Marui M29 (air cartridge)
Marui Python (air cartridge)

1985
Chiyoda Marksman Government (air)
Marushin M1 Carbine series (air)
Marushin Walther P38 series (air)
Asahi/JAC Battlemaster (gas full auto)
Maruzen H&K P7M13 (cartridge, pushcocking)
MGC Beretta M93R (gas)
WA AR7 series (gas)
Chiyoda Wildey (cartridge, air)
Kokusai Government (air)
Maruzen SIG 226 (cartridge, pushcocking)
Asahi/JAC Sterling L2A3 (gas full auto)
Yonezawa Remington shotgun (air)
Yonezawa Government (pushcocking air)
Yonezawa Walther P38 (air)
Hudson M3A1 Grease Gun (air)
Masudaya ZAP20 (cartridge, air)
Masudaya Recoiler (air)
LS M16 series (air)
Kokusai M16A1 (gas)

1986
Yonezawa KG9 (air)
Chiyoda Marksman Government Terminator (air)
Marui Luger P08 (air)
Marui Walther MPK (air)
Marui Walther MPL (air)
LS Government series (pushcocking)
LS Thompson (air)
MGC S&W M76 Interceptor (gas full auto)
Marushin MP40 (air)
Kokusai Llama Omni (air)
Marui H&K MP5A3 (air)
Marui H&K MP5A2 (air)
Maruzen Ingram M10A1S (cartridge, air)
Maruzen Ruger Mini-14 (air)
LS Thompson Drum Magazine (air)
Falcon Toy H&K P9S series (air)
Maruzen Walther P38 (cartridge, pushcocking)
Maruzen Beretta M92SB-F (cartridge, pushcocking)
Asahi/JAC Mini Sterling (gas full auto)
Marushin Beretta M92F (air)
MGC S&W M59 series (gas)
Asahi/JAC M3A1 grease gun (gas full auto)
Maruzen Beretta M92SB-F 2-way Custom (air)
Maruzen S&W 44 Magnum M29 (gas)
Marui Walther P38 (air)
LS M16A1 Pump-action (air)
WA Jatimatic (Electric gas full auto)
Marui 44 Automag (air)
Sanei Browning High Power (air)
Asahi/JAC M60 LMG (gas full auto)
LS Uzi (air)
MGC Wilson series (gas)
Falcon Toy H&K MP5K (gas full auto)
Sanei Beretta M92SB-F (air)
Pointo Uzi Pistol (cartridge, air)
Chiyoda Marksman Government Commando 20 (air)
Marukoshi UX series (cartridge, air)
Marukoshi UX Super Luger P08 (cartridge, air)
Marukoshi UX Super Colt Government (cartridge, air)
Marukoshi UX Super Mauser Auto Custom (cartridge, air)
Marukoshi UX Super 44 Automag Caseless (air)

1987
Marui S&W M59 (gas blowback)
Marui Browning Hi-power (gas blowback)
Aashi/JAC Uzi (gas full auto)
Marukoshi Uzi Pistol (gas)
Marukoshi KG9 (gas)
Marukoshi Super 9 (air)
LS Beretta M92F series (air)
LS Improved Thompson Pump-action (air)
LS Mini-Thompson (air)
Hudson M3A1 Grease gun (gas)
Takana Mauser 98k series (air)
Maruzen KG9 (Gas)
Maruzen S&W M659 (gas)
Maruzen Uzi pistol (gas)
MGC Beretta M12S (gas full auto)
Marui H&K G3A3 (air)
Marukoshi Uzi pistol (gas)
MGC Calico M1000 (gas)
Marui Uzi (air)
Marukoshi Mini Uzi (gas)
Marushin Walther PPK/S (air)
Marushin Anschutz 1403 series (air)
Marushin Beretta M92F (gas)
Chiyoda Wildey Super Magnum 31 (air)
LS S&W M645 series (air)
Asahi/JAC Bushmaster (gas full auto)
Falcon Toy Ingram M11 (gas)
LS CZ75 series (air)
Tanaka Python series (gas)
MGC Browning series (gas)
Marui Vz61 Scorpion (air)
Maruzen 44 Automag (gas)
Maruzen Government (gas)
Asahi/JAC AR18 (gas full auto)
Maruzen Python (gas)
Kanamaru Charter Arms Revolver Series Bulldog (gas)
Marushin Beretta M84 (gas)
Pointo S&W M645 (gas)
LS AK74 series (air)
Marui H&K G3A4 (air)
Marushin S&W M29 (gas)
Marushin Mauser 98K series (air)
Marui M645 (air)
Kokusai SIG P220 (air)
Toytec Calico M100 (gas full auto)
Marui Nambu 14 (air)
Hudson Madmax series
Pointo Bullfight (air)
Yonezawa Beretta M92F (air)
Yonezawa Baby Browning (air)
Yonezawa Colt Pocket (air)

1988
WA Combat Commander series (gas)
MGC Ruger 10/22 series (gas)
MGC CZ75 series (gas)
Asahi/JAC Ingram MAC 10 (gas full auto)
Marui Walther MPL (gas blowback)
Maruzen Ingram M10A1S (gas full auto)
Falcon Toy Bren Ten (gas blowback)
Marushin S&W M36 (gas)
Marushin M1 carbine (cartridge, gas blowback)
Marushin Uzi (cartridge, gas blowback)
Marushin MP40 (gas)
Asahi/JAC FNC (gas full auto)
LS AK74 series (gas full auto)
Chiyoda M559R Tiger 23 (air)
Tanaka Detective series (gas)
Kokusai S&W M19 Revolver series (gas)
LS Sten Mark 2 (gas full auto)
Maruzen Steyr AUG-SA (air)
Maruzen Steyr AUG (gas full auto)
Falcon Toy H&K MP5SD3 (gas full auto)
Marui H&K MP5A3 (gas blowback)
Replica Marushin Browning 1910 (gas)
Replica Marushin Colt 25 Auto (gas)
Marushin S&W M10 Military and police (gas)
Tanaka PM series (gas)
Pointo Government series (gas)
Marushin PM series (gas)
MGC M16 series (gas full auto)
Marui Hardballer (gas)
Kokusai M16 series (gas full auto)
Asahi/JAC FAL L1A1 (gas full auto)
Marukoshi SIG P210 (air)
Maruzen Walther PPK/S (gas)
Marui Desert Eagle 44 (gas)
Replica Marushin Mauser HSc (gas)
Kokusai Government (gas)
Marukoshi CZ75 (gas)
Marukoshi Walther P5 (gas)
Yonezawa Walther MPL (electric gas full auto)
MGC S&W M645 series (gas)
Toytec Calico Pistol (gas full auto)
Asahi/JAC M16 series (gas full auto)
Yonezawa S&W M61 Escort (gas)
Yonezawa AMT380 (gas)
Yonezawa Ingram M11 (gas)
Yonezawa H&K VP70 (air)
Yonezawa Automag (air)
Yonezawa Beretta M12S (air)
Yonezawa H&K MP5K (gas full auto)
Sanei Walther P38 (air)
Sanei Luger O08 (air)
Sanei Woodsman Sports (air)

1989
Marui Desert Eagle 44 (air)
Marui Government (air)
Replica Marushin Walther PPK (gas)
Kanamaru Remington Derringer (gas)
Marukoshi CZ75 (air)
Replica Marushin Remington Derringer (gas)
LS SIG P220 (gas)
Marui M16A1 (air)
MMC M16A2 series (gas full auto)
Fujimi Mauser M712 (gas full auto)
Fujimi Government (air)
Pointo CZ75 series (gas)
Tanaka S&W M10 series (gas)
Falcon Toy Luger P08 (gas)
Marushin S&W M586 (gas)
MGC H&amp;K MP5K (electric gas full auto)
Kokusai S&amp;W M10 Revolver series (gas)
Maruzen Remington M870 Bulldog (gas)
Marushin Government mark IV (cartridge, gas blowback)
Sanei Beretta M93R series (gas)
Yonezawa COP Derringer (gas)
Replica Marushin Government (gas)
Marukoshi Beretta M93R series (air)
Marushin Beretta M92F (gas)
LS M16 series (gas full auto)
Marukoshi Government (air)
Sun Project Government (gas)
Maruzen S&amp;W M4506 series (gas)
Yonezawa Government series (gas blowback)
Tanaka Government series (gas blowback)
LS S&amp;W M29 (air)
LS Python (air)
LS SIG P220 (gas)
Yonezawa S&amp;W M745 (air)
Yonezawa S&amp;W M29 series (gas)

1990
Falcon Toy Galil series (gas full auto)
WA Walther P38 series (gas)
Asahi/JAC Steyr AUG (gas full auto)
MMC L85A1 series (gas full auto)
Marui Centimeter Master (gas)
Gunze Commander (air)
Toytec M203 grenade launcher (gas full auto)
Marukoshi Super 9 Pro series (air)
Pointo Walther PPK (gas blowback)
Asahi Bushmaster Ultra Custom (gas full auto)
Marui XM177E2 (air)
MGC Beretta M92F series (gas)
LS Omega 10mm Auto (air)
Replica Marushin Walther P88 (gas)
Replica Marushin Remington Derringer (gas)
Sanei SIG P226 (has)
Tanaka Beretta M1934 (gas blowback)
LS L85A1 (air)
MMC L85A1 series (air)
LS SIG P220 (air)
Marui Omega 10mm Auto (air)
Marukoshi SIG P210 (gas)
Kokusai S&W M29 Revolver series (gas)
Marui Beretta M92F (air)
Marui Browning Hi Power Competition (air)
Fujimi M92F (air)
Aoshima Desert Eagle 357 series (air)
Asahi MG34 (gas full auto)
Pointo S&W M639 (air)
Pointo Commander (air)
KTW SPAS 12 series (air)
LS L85A1 (gas full auto)
Gunze S&W M5904 (air)
Asahi/JAC New Uzi (gas full auto)
Chiyoda Wildey (gas)
LS Colt Double Eagle (air)
LS Government (air)
Marui Wilson Super Grade (gas)
Toytect P90 (gas full auto)
Marui Colt Double Eagle (air)
Sun Project Muzzelite (gas full auto)
Digicon Beretta M92F series (gas)
Marushin Mauser 98k series (gas)

1991
Marui FA-MAS 5.56-F1 (electric)
Asahi M249 Minimi (gas full auto)
LS S&W M19 (air)
WA S&W M6904 Series (gas)
Kokusai S&W M5904 Series (gas)
Sheriff SPAS 12 Series (gas)
Asahi/JAC MP40 (gas full auto)
LS S&W M4506 (air)
Maruzen Beretta M93R series (gas full auto)
Marushin CZ75 (cartridge, gas blowback)
Gunze LAR Grizzly Winchester Magnum (air)
Maruzen Remington M870 (gas)
Pointo Centimaster Master (gas blowback)
Sherrif Highlander Magnum (gas)
Asahi/JAC H&K MP5 series (gas full auto)
Tanaka Colt 380 Government series (gas blowback)
LS Beretta M93R (air)
Kokusai Python series (gas)
Tanaka Luger P08 series (gas blowback)
LS S&W M586 (air)
Marushin Anschutz 1403 series (gas)
MGC Glock series (gas blowback)
Marui Automag III (air)
LS Nastoff 45 Auto (air)
Asahi/JAC M16 Limited Series (gas full auto)
Pointo Luger P08 (Air)
Sun Project Remington XP-100 (air)
Sheriff M16A1 (gas full auto)
Gunze SIG P226 (air)
Marui Centimeter Master (air)

1992
Tanaka S&W M4505 series (gas blowback)
Asahi/JAC Micro Uzi (gas full auto)
Marui Steyr M-GB (gas)
WA Full Auto 9 (electric blowback)
Falcon Toy Type 56 (gas full auto)
Marui M16A1 (electric)
Hobbyfix M16 series (gas full auto)
KSK L85A1 series (gas full auto)
Asahi/JAC H&K MP5 Fine Version Series (gas full auto)
Pointo Winchester M92 series (gas)
Yonezawa S&W M4506 (air)
Marui Glock 17 (air)
Marui Glock 17L (air)
Marushin Beretta M9 (cartridge, gas blowback)
Aoshima Beretta M93R series (gas)
Marui H&K MP5A5 (electric)
Yoneda Condor 10 (air)
Falcon Toy AK47S (gas full auto)
Maruzen APS-1 series (air)
Kokusai Mini Uzi (gas full auto)
Pointo Beretta M92SB Compact (air)
Marushin Mossberg M500 series (gas)
JAC Browning Hi-Power (gas blowback)
Gunze Socimi SMG 821 (electric)
Chiyoda Wildey 15 (gas)
Maruzen Remington M870 series (cartridge, gas)

1993
Toytec M134 Vulcan (electric)
Asahi M134 Vulcan (electric gas full auto)
Gunze S&W M586 (air)
Marui H&K MP5A4 (electric)
Yonezawa/KHC Browning Hi-Power DA (air)
MGC H&K P7M13 (gas blowback)
Falcon Toy Spectre (gas full auto)
Marui XM177E2 (electric)
Tanaka Winchester M1897 shotgun series (gas)
Tanaka Wz63 (gas blowback)
WA Beretta M92 series (gas)
Kokusai Gold Medalist series (air)
KHC Maverick M88 (air)
Sun Project Remington M700 series (air)
KHC Government series (air)
Marushin Mossberg M500 series (air)
Marui FA-MAS SV (electric)
Marui SIG P228 (air)
WA Beretta M29 series (gas blowback, magna)
Asahi WA2000 (gas)
Asahi/JAC AR15 series (gas blowback)
Asahi/JAC BAR M1918A2 (gas full auto)
Marui H&K MP5SD6 (electric)
MGC High Capacity series (gas blowback)
Yonezawa/KHC S&W M4504 (air)
KTW L96A1
Maruzen Ingram M11 (gas full auto)
LS Omega 10mm (gas)
LS Commander (gas)
KHC Beretta M12S (air)
KHC Remington M31 series (air)
Maruzen APS-2 series (air)
Crown Gas Revolver series Python (Gas)

1994
KHC Glock 17 (Air)
Tanaka Beretta M935 (gas blowback)
Marui M16A1 VN (electric)
JAC Steyr AUG (electric)
Marui AK-47S (electric)
Marui AK-47 (electric)
Marui H&K MP5SD5 (electric)
Marushin Beretta M92F series (electric)
MGC Government (gas blowback)
Falcon Toy H&K MP5SD3 (electric)
Marui H&K P7M13 (air)
Endoo Remington M700 series (air)
Kokusai Glock 17 (air)
Kokusai M16 series (gas blowback)
SIIS Desert Eagle 44 series (air)
WA Government series (gas blowback, magna)
Crown Revolver Series S&W M29 (gas)
MGC Beretta M92F (gas blowback)
Marui H&K G3A3 (electric)
KHC Beretta M92F (air)
KHC SIG P228 (air)
Marui H&K G3A4 (electric)
Marui Sturm Ruger KP85 (air)
Marushin S&W M49 (gas)
Toytec P90 (electric)
Falcon Toy H&K MP5K (electric)
JAC Thompson (gas full auto)

1995
Marui H&K MP5K A4 (electric)
Tanio Koba USP (gas blowback)
Marui M655 (electric)
MGC Beretta M93R series (gas blowback)
TOP M60 LMG series (electric)
Marui G3 SG/1 (electric)
Marushin Detonics .45 series (gas)
Marui Desert Eagle .50AE (gas blowback)
WA Desert Eagle .44 series (gas blowback, magna)
KSC Beretta M93R series (gas blowback)
KHC Colt 25 Auto (air)
KHC Browning Baby (air)
Marui H&K MP5SD4 (electric)
Marui CZ75 (air)
Tanaka SIG P226 series (gas blowback, magna)
Tanaka H&K P8 (gas blowback, magna)
Marui PSG-1 (electric)
Maruzen Ingram M11 (gas blowback)
KHC H&K USP (air)

1996
Marui M653 (electric)
TOP Type 64 (electric)
Marui Python series (gas)
Tanaka H&K USP (gas blowback, magna)
Maruzen Uzi Pistol (gas blowback)
Marui MC51 (electric)
Marui H&K MP5KA4 PDW (electric)
Marui SIG550 (electric)
KSC SIG P230 series (gas blowback)
Sun Project M16A2 (gas full auto)
Digicon H&K MP5A5 (gas full auto)
Tanaka SIG P220 series (gas blowback, magna)
WA Beretta M84 series (gas blowback, magna)
Tanaka Luger P08 series (gas blowback, magna)
Tanaka SIG P228 series (gas blowback, magna)
Tanaka SIG P229 series (gas blowback, magna)

1997
Marui Steyr AUG Special Receiver (electric)
Marui H&K USP (air)
Maruzen Walther PP (gas)
WA Ingram M11 (gas blowback, magna)
Tanaka 9mm handgun (gas blowback, magna)
Marui H&K MP5A4 Navy (electric)
Marui SIG551 SWAT (electric)
KSC Cougar M8000 series (gas blowback)
Marushin Uzi (electric)
Marui CAR-15 (electric)
Marui AK Spetsnaz (electric)
Maruzen KG9 (gas blowback)
KSC TMP series (gas blowback)
KHC Desert Eagle 44 (air)
Digicon Digicon Eagle Series (gas)
Maruzen Remington M1100 series (cartridge, gas blowback)
Marui Steyr AUG Military (electric)

1998
Marui S&W M19 Series (has)
Youth Engineering H&K MP5A5 (gas full auto)
Marui M16A2 (electric)
KTW Ithaca M37 series (air)
Marui SPAS 12 series (air)
WA Sigma (gas blowback, magna)
WA High Capacity series (gas blowback)
Tanaka Browning Hi-Power (gas blowback, magna)
Sheriff Remington M24 series (air)
KSC H&K Mk23 Series (gas blowback)
Maruzen H&K USP series (gas blowback)
Marushin Beretta M92F Maxi series (gas)
KHC SIG P226 (air)
KHC M4525 (air)
KHC SIG P228 (gas)
KHC Beretta M92F (gas)
KHC Desert Eagle 44 (gas)
Shin Nihon Mokei/MGC Compact 45 series (gas blowback, magna)
Shin Nihon Mokei/MGC Hardballer series (gas blowback, magna)
Marui Uzi (electric)
KSC STI Series (gas blowback)
Maruzen PPK/S series (gas blowback)
Marui M8000 Cougar (air)
KTW SPAS Junior Series (air)
Sun Project Browning High Power (gas blowback)
Sun Project H&K MP5 series (gas full auto)
Kokusai Glock 17 (gas blowback)

1999
MaruZen Remington M870 series (gas)
Marui HK51 Carbine (electric)
Marui M4A1 (electric)
KSC M9 series (gas blowback)
Marushin Beretta M84 Maxi series (gas)
Asahi Blazer R93 (air)
KSC Glock series (gas blowback)
Tanaka Glock 17 (gas blowback, magna)
Maruzen Walther P99 (gas blowback)
Marui M92F Military (air)
Mauri M3 Super 90 Series (air)
Marui M92F Military (gas blowback)
KTW Walther P99 (air)
Marushin CZ75 Maxi (gas)
Marushin Mossberg M500 Maxi series (gas)
Tanio Koba 10/22 series (gas blowback)
Hudson Tokarev TT33 (gas blowback)

2000
WA Beretta M8045 series (gas blowback, magna)
Marui M4A1/RIS (electric)
Tanaka PM series (gas, Pegasus)
Arii Thompson (air)
Arii L85A1 (air)
Arii AK47 series (air)
Digicon Straight Custom series (gas)
KSC Sig Pro series (gas blowback)
Marui Thompson M1A1 (electric)
Tanaka Python series (gas, pegasus)
Tanaka S&W N Frame series (gas, Pegasus)
Marushin S&W M629 Classic (gas)
Marushin Walther P38 Maxi series (gas)
WA S&W Shorty Forty series (gas blowback, magna)
Maruzen Government Series (gas blowback)
Marushin M1 Carbine Maxi (gas)
Marui Tactical Master (gas blowback)
KSC M92 Elite (gas blowback)
Marui M203 grenade launcher (air)
Marui Glock 26 series (gas blowback)

2001
KSC CZ75 (gas blowback)
Marui SR-16 M4(electric)
Marushin Government Maxi (gas)
Tanaka S&W J Frame Series (gas, Pegasus)
Marui FN P90 (electric)
Digicon Target Series (gas)
Marushin Mauser M712 Maxi (Gas)
Maruzen Type U-SMG (gas blowback)
KSC Ingram M11A1 (gas blowback)
Marui US SOCOM (air)
KTW Enfield No.4 Mk1 (air)
Marushin Winchester M1892 Maxi series (gas)
Marushin Mauser M712 carbine (gas)
Marushin Luger Mk1 Maxi (gas)
Tanaka Super Redhawk Series (gas, Pegasus)
Maruzen H&K MP5K (gas blowback)
Marui Tactical Launcher (air)
Hudson M3A1 Grease Gun (Gas blowback)
Arii Compact 45 series (air)
Arii S&W M6906 (air)

2002
Tanaka Mauser 98k (gas)
Marui Beta Spetsnaz (electric)
TOP M249 MINIMI series (electric)
KTW SP2340 (air)
Marushin Colt Anaconda Maxi series (gas, 8mm)
Marushin Randall Custom (gas)
WA S&W Sigma (gas blowback, magna)
Marushin Super Redhawk Maxi series (gas, 8mm)
Marui FN P90TR (electric)
Marui Government (air)
Marushin M Trading Super P29 series (air)
Marushin M Trading G33 series (air)
Marushin M trading Super P8 series (air)
Marushin M Trading P99 series (air)
Tanaka Glock 17 (gas)
Geneth G2000 (air)
Marui H&K MP5 RAS (electric)
Marushin Raging Bull Maxi series (gas, 8mm)
Marui US SOCOM (gas)
KTW Arisaka Type 38 (air)
Tanaka Detective Series (gas, Pegasus)
Marushin Detonics 45 Maxi series (gas, 8mm)
KSC Beretta M93R II series (gas blowback)
Maruzen Scorpion (gas blowback)
Asahi L96A1 (air)
Smokey's Barrett M82 (cartridge, pushcocking, 8mm)
Shoei MG42 (gas full auto)
Marui PC356 Limited (air)
Marui H&K G36C (electric)

2003
Marushin Taurus PT92 (gas, 8mm)
KSC S&W M945 Series (gas blowback)
Marushin Bren Ten Maxi (gas, 8mm)
Hudson Jericho 941 (gas blowback)
Marui M733 (electric)
Marushin 44 Automag Clint 1 (gas, 8mm)
Tanaka SIG P226 railed frame (gas blowback, magna)
SIIS Beretta 92 series (air)
SIIS Model Eagle 50 AE series (air)
SIIS Model 1911-A1 series (air)
SIIS Model P99 series (air)
SIIS Model P226 series (air)
SIIS Model M4525 series (air)
SIIS Model Double Eagle Series (air)
SIIS Model G17 series (air)
Marushin Remington Derringer (gas, 8mm)
Marushin M1 Carbine Maxi (gas, 8mm)
P.W.D. D&L MR-30PG (air, 8mm)
Cybergun/Sunny S&W Sigma SW40F (air)
Marushin 8mm Police Revolver (gas)
Tanaka Remington M700 series (gas)
Maruzen Walther P38 (gas blowback)
WA Beretta M1934 (gas blowback)
Cybergun/Sunny Walther P99 (air)
Cybergun/Sunny SIG P2230 (air)
Cybergun/Sunny Taurus Millenium PT111 (air)
Marui VSR-10 series (air)
Marui G3SAS (electric)