Display Fireworks Facts

What is the average length of a 4th of July Fireworks Display?

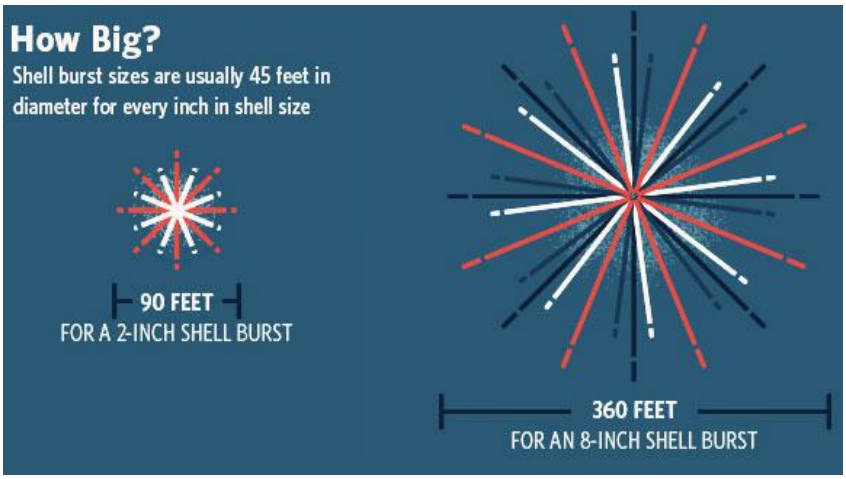
The average 4th of July **fireworks** display lasts between 15 and 25 minutes. The length of the fireworks display does not necessarily translate to quality of the show. For a given budget, the shorter you keep your display, the better it will be.

How fast does a fireworks shell travel when fired from a mortar?

The larger the **fireworks** shell, the faster its muzzle velocity is when leaving the fireworks "gun" or mortar. The graphic below shows the approximate muzzle velocities of fireworks of different sizes.

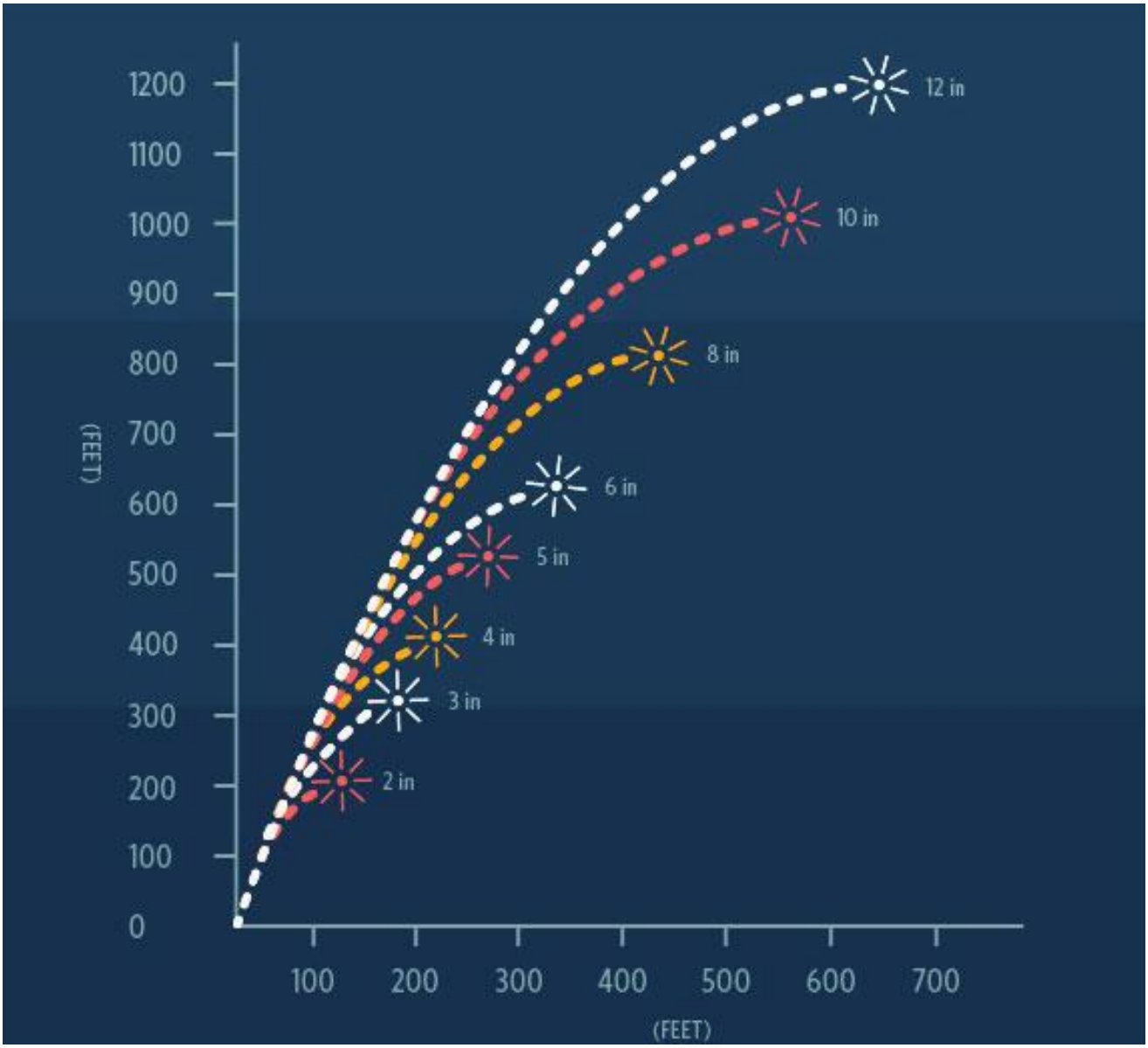
How large is the burst diameter of a fireworks shell?

Once again, the larger the fireworks shell, the larger the burst diameter. This is one of the reasons the larger shells must travel higher before the explode, as shown in the plot above. The general rule is 45 feet in diameter for every inch of firework caliber. The graphic below clarifies this point:



How high does a fireworks shell go when fired?

The graphic below shows the approximate heights and travel distances for a fireworks shell when fired at a 75-degree angle. Keep in mind, most fireworks shells are fired vertically, and only when similar shells are simultaneously fired from the same position, or in a finale, will you get fireworks that are fired at a trajectory other than 90 degrees.



Can Fireworks Left in a Hot Car Explode?

The short answer is, being left inside a hot car will not cause fireworks to explode. According to the Department of Geosciences at San Francisco State University, the temperatures can reach in excess of 140F inside a car when the outside temperature is around 95F. See chart below for times and temperatures. All consumer fireworks used in the United States undergo and pass a thermal stability test (literally in an oven), as required by the Consumer Product Safety Commission. Fireworks should only ignite if a flame is present. The temperatures required to ignite a fuse are hundreds of degrees higher than the inside of a hot car on a hot day.

Estimated Vehicle Interior Air Temperature vs Elapsed Time

	Outside Air Temperature (F)					
Elapsed time	70	75	80	85	90	95
0 min	70	75	80	85	90	95
10 min	89	94	99	104	109	114
20 min	99	104	109	114	119	124
30 min	104	109	114	119	124	129
40 min	108	113	118	123	128	133
50 min	111	115	121	126	131	136
60 min	113	118	123	128	133	138
1 hr +	115	120	125	130	135	140

via Department of Geosciences, San Francisco State University IJR

Will Fireworks Damage Car Paint?

Yes, it is certainly possible. The possibility can be broken down into two distinct cases, the first would correspond to burning material hitting the car, which could severely damage the paint depending on the amount of time it was burning while in contact with the vehicle. The second case would be "fallout" from the fireworks, such as cardboard shell casings, inserts, etc., that land on the car and either cause physical damage from the impact or the combusted chemicals eating away at the paint if left unwashed for an extended period of time.

Will Fireworks Work in the Rain?

In most cases, yes. Here is one better for you, fireworks can actually burn underwater! Fireworks contain their own fuel and oxygen source, which means they can burn independent of the oxygen in the air. Here is a great slow motion video of a model rocket engine burning under water: https://youtu.be/czwBWB5u6Hg and here is a video showing fireworks rockets under ice in a pond: https://youtu.be/YyFip6NRz1E. The only instance when it wouldn't work is when the firework composition becomes completely saturated with water, so in other words, if it was left to soak for a long period of time and the composition started to get wet.

How are the different colors of fire made in fireworks?

The different colors of fire are made by taking advantage of different compounds releasing energy in differing wavelengths of light. A flames color is dependent on the type of color generating compound that is used in that particular formula. Different chemical compounds release different wavelengths of light when their electrons change energy states. Here is a listing of the main color producing elements and their corresponding color:

***Strontium* compounds make RED Fire**

***Barium* compounds make GREEN Fire**

***Copper* compounds make BLUE Fire**

***Sodium* compounds make YELLOW Fire**

When the color producing compounds grab the energy (usually in the form of heat) from a combustion reaction, they become "excited" and will eventually lose that energy and go back to their original "ground" state. When they fall back to their ground state, they will release the energy in the form of a particle of light. The frequency (~color) is dependent on the amount of energy that it lost going back to its ground state.

The addition of Aluminum, Titanium, or Magnesium will have an effect of brightening the colored flame (since it raises the temperature of the reaction), but also lessens the purity of color. Different combinations of these color producing elements will theoretically give you almost any color you can imagine. This is by no means instructions on how to make fireworks. It's much, much, much more complicated than described above, hence the reason there are no formulations shown here. There are many factors that go into actual formula making and should not be attempted unless you have the background, knowledge, licensing, and experience to safely handle pyrotechnic materials.

"Fireworks" in Different Languages

Albanian: fishekzjarr
Croatian: vatromet
Danish: fyrvaerkeri
Dutch: vuurwerk
English: fireworks
Estonian: ilutulestik
Filipino: mga paputok
Finish: ilotulitus
French: feu d'artifice
German: Feuerwerk
Icelandic: skotelda
Indonesian: kembang api
Irish: tinte ealaine
Italian: fuochi d'artificio
Norwegian: fyrverkeri
Polish: fajerwerki
Portuguese: fogos de artificio
Romanian: focuri de artificii
Spanish: fuegos artificiales
Swahili: fireworks
Swedish: fyrverkerier
Vietnamese: phao hoa

Why are Fireworks used in America on the 4th of July?

"It ought to be solemnized with pomp and parade, with shows, games, sports, guns, bells, bonfires, and illuminations, from one end of this continent to the other, from this time forward forever more." Those are the words of John Adams, in a letter he wrote to his wife on July 3rd, 1776, referring to Independence Day. America has celebrated with fireworks ever since.

When and Where were Fireworks Invented?

Many historians believe that fireworks originally were developed in the second century B.C. in ancient Liuyang, China. It is believed that the first natural "firecrackers" were bamboo stalks that when thrown in a fire, would explode with a bang because of the overheating of the hollow air pockets in the bamboo. The Chinese believed these natural "firecrackers" would ward off evil spirits.

Sometime during the period 600-900 AD, legend has it that a Chinese alchemist mixed potassium nitrate, sulfur and charcoal to produce a black, flaky powder – the first "gunpowder". This powder was poured into hallowed out bamboo sticks (and later stiff paper tubes) forming the first man made fireworks.

Fireworks made their way to Europe in the 13th century and by the 15th century they were widely used for religious festivals and public entertainment. The Italians were the first Europeans to manufacture fireworks and European rulers were especially fond of the use of fireworks to "enchant their subjects and illuminate their castles on important occasions."

Early U.S. settlers brought their love of fireworks with them to the New World and fireworks were part of the very first Independence Day – a tradition that continues every 4th of July when we celebrate as John Adams had hoped *"with pomp, parade….bonfires and illuminations from one end of this continent to the other."* Americans' spirit of celebration continued to grow and in the late 18th century, politicians used displays to attract crowds to their speeches.

While July 4th is still the "big day", Americans continue to use fireworks year-round to celebrate at festivals, special events, and sporting traditions such as the Olympics and Super Bowl.

Fireworks entertainment generates dollars as well as smiles. *Thunder Over Louisville* is one of the country's largest fireworks displays and an economic study conducted by the Derby Festival determined that Thunder generates more than $56 million for the local economy.

But more than anything else, when you think of the fireworks, you think of the Fourth of July and the celebration of our country's Independence. Fireworks have been with Americans since our nation's beginning!