

The Home Forum.

Putting the POW! in the Fourth of July



FEW THINGS ARE as tempting as a baseball stadium's perfect grass. The Oakland A's have just defeated the Kansas City Royals, and thousands of happy Oakland fans are flooding the outfield. Parents chat on blankets, kids chase one another, and truly dedicated fans

visit the spot where Miguel Tejada plays shortstop. But when the music starts, all eyes turn toward the sky.

The darkness above the stadium is suddenly full of light - bright fronds of silver, glowing rings of green, sparkling blasts of red. The colorful explosions are perfectly timed, aerial drumbeats to the music. On the field, a chorus of "oohs," "aahs," and "wows!" burst from the audience. The biggest crowd-pleaser is a shell that explodes into a perfect smiley face.

How do they DO that?

Jeff Thomas is the man behind the "boom." Mr. Thomas has been a pyrotechnician (PYE-roh-tek-ni-shun) for more than 30 years. Pyrotechnicians are

specially trained in the use of fireworks. The company he works for, Pyrospectaculars, has been putting on fireworks shows for the Oakland A's for 20 years. The company has also created shows for Super Bowls and Olympic games.

Before the A's show, Thomas gives me a backstage tour. A parking lot behind the stadium has been closed off. Thomas and his team have set up rows of wooden frames full of thick plastic tubes. It looks more like a plumbing project than sky-high entertainment.

"This is the main aerial site," says Thomas. A smaller site is in a closed-off section at the top of the stadium. During the 18-minute show, about 500 fireworks shells will be fired. A large show like this one costs \$30,000 to \$40,000.

Thomas reaches into one of the tubes (called mortars) and feels around for the shell. "The first rule of safety is, never stick your face over a mortar," says Thomas. I'm expecting a rocket-shaped object, but he lifts out what looks like a ball covered in plain brown paper. When fired, this five-inch-diameter sphere, called a shell, will shoot 500 feet into the sky and burst into a brilliant green "chrysanthemum."

Nearby, steel tubes poke out of a sand-filled garbage can. The show's "big guns" launch here. Thomas pulls out a hefty paper-covered tube. "We call this one 'the salami,'" he says. "It is a multiple-stage shell. Because it is so big, we use a metal mortar instead of plastic."

A boom gives them a boost

Fireworks are carefully controlled chemical reactions. All fireworks use black powder (the modern name for gunpowder) to shoot them into the air. Black powder is usually made of potassium nitrate (saltpeter), charcoal, and sulfur. Each ingredient is stable on its own. But when combined to make black powder, a flame or electrical spark sets off a rearrangement of the molecules and atoms in these three ingredients. As this occurs, gas and heat are given off. The explosion pops the shell into the air.

All the fireworks have a fuse connected to an electronic "match." The match lights the "lifting charge" at the bottom of the shell.

The shell's fuse keeps burning even after the lifting charge shoots the shell into the sky. After a second or two - when the shell has



JAVIER ECHEZARRETA/EFE/AP

WHO'S THE FLASHIEST? Fireworks lit up the sky near the port of San Sebastian in northern Spain last August. The display was part of a weeklong fireworks competition.

reached the right height - the fuse ignites the black powder in the center of the shell. This is called the "bursting charge." Packed around the bursting charge are "stars" - balls or cubes with special chemicals that burn to give the firework its color, sparkle, or movement.

When the bursting charge explodes, it ignites the stars and flings them out in all directions. By packing the stars in different ways in the shell, a firework can be designed to look like a palm tree, a willow

tree, a chrysanthemum, or a huge ring. The amazing aerial "smiley face" is the result of specially packed stars.

Some fireworks, like "the salami," have several stages. As one stage explodes, it lights the fuse of the next stage. The salami delivers three bursts of light in the sky over the stadium.

How do you time blasts to the music?

The hundreds of shells scattered across the parking lot are connected by wires to an electronic firing system. (I am very careful not to trip over any of the wires.) Thomas's control system seems simple - it's a laptop and a square silver box set on a table under a sunshade.

The entire show has been worked out on a computer program. The program has a time code based on the recorded music that will play during the show. The time code tells the firing system in the square silver box exactly when to fire each shell.

Continued on next page

Name that firework

Chrysanthemum They explode into a big, fat, flowery pattern; unlike a 'round' shell, the burning 'stars' leave a lighted trail.

Comet They create a straight streak of color through the sky, and fling out small, bright stars that trace crazy paths.

Palm tree After it explodes, streamers of light curve down like palm fronds.

Ring Creates a giant hula-hoop shape.

Round They burst into a big sparkling ball; these are the most common shells, also called 'peony' shells.

Roundel They burst into a circle of salute shells that explode in sequence.

Salute These are the ones that explode with a white flash - and a loud bang.

Serpentine They send streaks of color zigzagging through the sky, sometimes ending with exploding stars.

Set Pieces Long-burning chemicals are fixed to latticework frames to make giant sparkling signs or images.

Willow tree Long-burning chemicals curve down through the sky like the branches of a willow tree.

P.S.T.



PAMELA S. TURNER

READY: A parking lot holds racks of plastic tubes, each with an aerial shell. The fireworks show was at the Oakland A's baseball stadium.

I'M EXPECTING A ROCKET, BUT HE
LIFTS OUT WHAT LOOKS LIKE A BALL
COVERED IN BROWN PAPER.

Continued from previous page

Things still can go wrong. "We sometimes have a few duds left in the mortars at the end of a show," says Thomas. "But the biggest problem is fog." Spectators can't see a show in the fog. "We also have to watch the wind, so shells aren't blown to the wrong place. Rain actually isn't a problem, except for the spectators!"

The Chinese invented fireworks about 2,000 years ago. Fireworks spread to Europe about AD 1200. Gunpowder was later used for guns and cannons, but fireworks as entertainment also spread. In Europe and early America, pyrotechnicians were called "illuminators." It was often a family business, with secrets passed from generation to generation.

Pyrospectaculars is a family business. Manuel Souza started the company shortly after he came to the United States in 1905. Mr. Souza ran his fireworks business out of his kitchen in San Leandro, Calif., with the help of his wife and their 12 children. Souza's great-grandson, Jim, designed this fireworks show for the A's.

"When you design a show," Thomas explains, "you listen to the music and decide what kind of shell you need when." Shells are test-fired to find out exactly how long it is from ignition to explosion for each kind of shell. "We put that information into the computer. The computer figures out when to fire the shell so it will appear in the sky at just the right time."

Thomas has about a dozen pyrotechnicians to help him at the A's show. Most are there for safety reasons. They keep an eye

on the launching pads. "Many pyrotechnicians do this as a part-time job, because they love fireworks," says Thomas.

The 'dead man' safety control

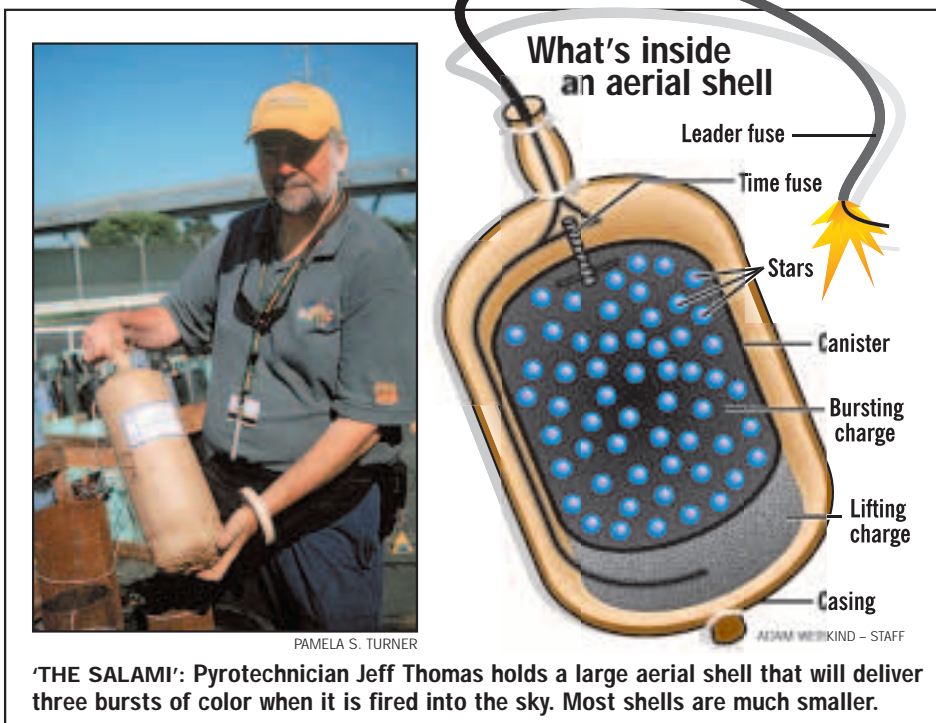
When it's time to make all those "oohs" and "aahs," you might expect a pyrotechnician to push a big red "start" button. But in a fireworks show, it takes a special button to keep everything from stopping.

Thomas shows me the "dead man control" on the firing system. It looks like a joystick with a red button on top. Even when the computer and the firing system are set to go, no shell will fire if the red button isn't held down. "Someone always has to be right here, watching the shells," says Thomas. "If anything happens to the pyrotechnician, if he runs away or something, the entire show stops - instantly."

Tonight's show goes off without a hitch. Palm trees, comets, rings, roundels, and serpentes light up the sky. As "Twist and Shout" plays over the stadium speakers, the plain brown salami leaves its garbage-can launching pad. It is transformed into a vast shower of multicolored sparkles over the heads of the awed crowd.

Tonight, Thomas enjoys the show from home plate. Soon, though, he'll have few chances to relax: He'll be supervising 60 July Fourth fireworks shows across northern California. Even on July 5, you won't find him lounging by the pool. "Believe it or not," he says, "the day after the Fourth, I'm shooting off more fireworks shows!"

Pamela S. Turner



'THE SALAMI': Pyrotechnician Jeff Thomas holds a large aerial shell that will deliver three bursts of color when it is fired into the sky. Most shells are much smaller.