Chinese alchemists discovered gunpowder in the 8th century A.D. while they were carrying out experiments to find the elixir of life (potion that when drunk from a certain cup at a certain time, supposedly grants the person eternal life). They discovered that an explosive mixture could be produced by combining sulfur, charcoal, and saltpeter (potassium nitrate). The military applications were clear. New weapons were rapidly developed, including rockets and others that were launched from a bamboo tube. By the 10th century, gunpowder was being used to make fireworks and weapons. The Song army used guns against the invading Mongols in the early 13th century, but they were eventually overpowered by the greater might of the Mongol empire. The idea of guns spread to Europe and were important weapons in Europe’s conquest of the Western Hemisphere.

In his interview with NOVA, a documentary series for PBS, China expert Robin D. S. Yates, Professor of History and East Asian Studies at McGill University, describes the Song era and how it influenced the course of world history.

**Question:** What were some of the Chinese inventions of this period that had a profound influence on the course of civilization?

**Answer:** Gunpowder completely transformed the way wars were waged and contributed to the eventual establishment of might over right. In my own research, I have been able to refute the common notion that the Chinese invented gunpowder but only used it for fireworks. I’m sure that they discovered military uses for it. I have found the earliest illustration of a cannon in the world, which dates from the change-over from the Northern Song to the Southern Song around 1127, which was 150 years before the development of the cannon in the West. The Song also used gunpowder to make . . . flame throwers . . .

Needless to say, the cannon was used by the kings of Europe to fundamentally alter the social structure of the European world. It enabled kings to destroy the castles of the feudal lords. And it enabled, therefore, the centralized nation-state to develop.

By the end of the Song Dynasty, the Chinese invented multiple-stage rockets. If we hadn’t had that, maybe we would not have been able to put a man on the moon. It was that fundamental an idea. Joseph Needham, an historian of Chinese science and technology, also argues that the notion of an explosion in a self-contained cylinder also permitted the development of the internal combustion engine and the steam engine. Our basic modes of transportation would not have been possible without this Chinese invention.

**Question:** How did the Chinese invention of gunpowder move from East to West?

**Answer:** Although scholars often consider the Song Dynasty to have been very weak, its use of gunpowder was the reason it was able to hold off the Mongols for many decades. Eventually, the Mongols were able to capture Chinese artisans and use the latest gunpowder technology against the Chinese. The Mongols used those people who had a special knowledge of technology and employed them in their own armies as engineers. They carried that technology to the West very rapidly because it was very helpful in their conquests.

What was interesting with this transfer of technology is that it goes both ways. After the introduction of the cannon and gunpowder to the West, Westerners very quickly became expert with cannons. They cast bronze cannons that were eventually much better than those the Chinese could produce. The Western bronze cannon was then brought back to China by the Jesuits (Christian priests) in the 16th and 17th centuries. The Ming Dynasty, which fought the Manchus, employed Jesuit priests to cast cannons that were more advanced than the Chinese had at that time.
Document 3

Song military engineers found gunpowder to be helpful in siege warfare, leading to the development of early types of rockets, cannons, bombs, and mines.

The Wujing zongyao (“Collection of the Most Important Military Techniques”), a military manual from 1044 CE, records the first true gunpowder formula and describes how to produce it on a large scale. Gunpowder was first use in warfare as an incendiary, or fire-producing, compound. Small packages of gunpowder wrapped in paper or bamboo were attached to arrows and lit with a fuse.

Bombs of gunpowder mixed with scrap iron would be launched with catapults. Another use was “fire-sputting lances,” which were a kind of flame thrower using bamboo or metal tubes for their barrels.

Weapons involving gunpowder were extensively used by both the Chinese and the Mongol forces in the 13th century. Song efforts to continually improve their weapons were one reason they were able to hold off the Mongols for several decades. But the Mongols . . . were ready to adopt new and better military technology, often by capturing the Chinese engineers and gunners.

Source: from A Visual Sourcebook for Chinese Civilization, Patricia Ebrey, University of Washington

Document 4

The following is selections from History Channel's documentary “Mankind: The Story of All of Us”

Gunpowder certainly has to be ranked among the most important inventions of man . . . The Chinese first learned to make fireworks . . . By the 1200s they used a hollow bamboo tube that spewed out flame . . . Gunpowder spurred a complete arms race that ultimately led to the building of cannons that battered away the walls of fortresses. This begins to move to the west (Europe). It changes how people relate to one another. It changes how kingdoms are built and how they are torn down . . . It changes the way we subject the people who don’t have it. In the gun, you have brought fear and placed in the hands of an individual. The individual soldier becomes more and more powerful, more and more deadly. As soon as somebody develops a weapon, someone else develops a defense to that weapon. This is the self-perpetuating arms race that we are still caught up in. There is really no part of our human experience that hasn’t been influenced by this invention.
Chinese Invention: Printing

Document 1

Paper and printing were possibly the most important Chinese inventions. The Chinese invention of moveable type, credited to Bi Sheng in the year 1045 AD, did not significantly change Chinese society. Three hundred years later in Europe, Gutenberg's development of moveable type changed the Western world. Why? The Chinese language uses 3000 to 5000 characters in an average newspaper. The English language, in comparison, uses 26 characters in an average newspaper. Clearly, moving 5,000 characters on a printing press took much longer than moving 26. Still, the invention of moveable type furthered Chinese technology and its role in the advancement of human civilization. Large-scale printing in the 10th century made books readily available in China for the first time. The spread of books greatly increased the spread of literacy (ability to read and write). When books could be made faster, they became cheaper and even the average person could afford them. This led to increased knowledge for human civilization overall and, therefore, more technology and inventions.

Document 2

In his interview with NOVA, a documentary series for PBS, China expert Robin D. S. Yates, Professor of History and East Asian Studies at McGill University, describes the Song era and how it influenced the course of world history.

Question: Were there major non-military inventions during the Song Dynasty that had an impact worldwide?

Answer: Printing and movable type were certainly two of them. Printing was actually invented by the Buddhists in the eighth century for dissemination of religious images and texts. But in the Song Dynasty, the government promoted the publication of the Confucian texts called "The Canons." These texts had to be studied by examination candidates. Once you passed the examinations you were eligible to become an official. So many copies of the Confucian texts were published at this time. In addition, the government popularized the use of printing for the dissemination of technical manuals, such as agricultural manuals and works on medicine. Eventually, private printing presses started, which fundamentally altered the world of letters and dissemination of knowledge.

In the 11th century, a famous literary artist by the name of Shen Gua records the invention of movable-type printing by a man by the name of Bi Sheng. It was this invention that was eventually taken over to the West and used by Gutenberg for the printing of the Bible. Needless to say, this had a profound effect on the nature of knowledge and the development of literature. So this is probably the number-one invention of the Song Dynasty.

Question: Was movable type another example of technology moving from East (China) to West (Europe), or was it an example of an innovation developing in the East and West simultaneously?

Answer: It's very unclear, but it does appear that there was a transfer from East to West. The Mongol invaders of China were able to use their highly developed organization and cavalry to conquer all of Central Asia, including parts of India, the Middle East, and Europe. So the invention was probably transferred to the West as a result of the opening up of the trade routes and the lines of communication established by the Mongols. I'm not saying that Gutenberg actually had access to a Chinese press; that's highly unlikely. Rather, he probably got wind of the idea of printing through some unknown and lost source. It's rather ironic that Gutenberg was recently voted the man of the millennium, when it was the Chinese who actually invented the technology.
Document 3

... China was the unrivaled world leader in technological development. ... The impact of these inventions on Western Europe is well known. Printing not only eliminated much of the opportunity for human copying errors, it also encouraged the production of more copies of old books and an increasing number of new books. As written material became both cheaper and more easily available, intellectual activity increased. Printing would eventually be held responsible, at least in part, for spread of classical humanism and other ideas from the Renaissance. It is also said to have stimulated the Protestant Reformation (a religious movement in Europe during the 16th century), which urged a return to the Bible as the primary religious authority.

Source: Lynda Shaffer from the World History Bulletin, Fall/Winter, 1986/87

Document 4

Movable Type ▼

Traditionally, an entire page of characters was carved into a block of wood from which prints were made. Pi Sheng, a Chinese alchemist, came up with the idea of creating individual characters that could be reused whenever needed. Later, a government official created rotating storage trays for the characters.

As you have read, Tang rulers restored China’s system of scholar-officials. Thus, education and printed materials became important to a larger part of Chinese society.

The trays allowed the typesetter to quickly find the characters. The typesetter would then order the characters in a tray that would be used to produce the printed pages. The two wheels held about 60,000 characters.
By the third century AD, Chinese scientists had studied and learned much about magnetism in nature. For example, they knew that iron ore, called magnetite, tended to align itself in a North/South position. Scientists learned to “make magnets” by heating pieces of ore to red hot temperatures and then cooling the pieces in a North/South position. The magnet was then placed on a piece of reed and floated in a bowl of water marked with directional bearings. These first navigational compasses were widely used on Chinese ships by the eleventh century AD. The invention of the compass largely helped the explorers during the Middle Ages discover the Western Hemisphere of the world.

The magnetic compass was first invented in China during the Han Dynasty (206 B.C.E.-220 C.E.). It was later improved upon during the Song Dynasty (960 C.E.-1279 C.E.) to determine the magnetic direction of north while experimenting on a compass. The magnetic compass was eventually traded on to the Arabs in the Islamic Empire. In the 1300's C.E., the magnetic compass was used by an Islamic astronomer to make a timekeeping device. The compass was eventually traded on to Europe, where it was worked upon and used by many scientists and sailors. At first, the compass helped Europeans navigate in the Mediterranean Sea and even in the English Channel, and it eventually helped them in sailing across the Atlantic, around Africa and to the Indian Ocean.

The magnetic compass, which was improved upon in Europe, was most important aboard ship. At sea, sailors could use these compasses to figure out which way they were headed, and they could use them to point their ship wherever they wanted to go. Although merchants had sailed these waters before, the compass made their travels much easier and faster, thus increasing their efficiency in trade. Perhaps the most important impact of the magnetic compass, however, was its use in discovering the Americas. In 1492, Christopher Columbus sailed due east, because he thought he was going to China. As we know, he stumbled upon America instead. After this came the significant European colonization in the Americas, where they wiped out most of the native population and used the land for themselves. Soon after this, Europe sailed around Africa and into the Indian Ocean, where they set up numerous trading posts and entered a world of rich exchange. Also, the magnetic compass allowed people to map out the world as they knew it, since they now knew what direction each country was in. Therefore, the magnetic compass effectively allowed Europeans to navigate across oceans and expand their empire, colonizing and trading everywhere they went.

In terms of art, the magnetic compass allowed the Europeans, Chinese and many other empires to travel across lands and trade tools, weapons, art and innovations as they went. Therefore, the magnetic compass ultimately allowed the culture of these empires to spread, especially European culture in the Americas. The magnetic compass impacted the geography of the world because with it, people were able to navigate to unknown places, set up colonies on unknown lands, and map out the world. The magnetic compass was especially important in technology, because it was a tool first developed in China, and then later improved upon by empires to fit the needs of their developments. The magnetic compass impacted economy because, in allowing the Europeans to reach the Americas and the Indian Ocean trade routes, trade increased and the prosperity of Europe grew. In the Colombian Exchange, the magnetic compass helped direct people to either the Americas, Europe or Africa.

11 Inventions That Changed History: The Compass

Magnetic compasses may have been made somewhat obsolete by satellites and global positioning systems, but their impact on early navigation and exploration was inestimable. Originally invented in China, by the 14th century compasses had widely replaced astronomical means as the primary navigational instrument for mariners. The compass provided explorers with a reliable method for traversing the world’s oceans, a breakthrough that ignited the Age of Discovery and won Europe the wealth and power that later fueled the Industrial Revolution. Most importantly, the compass allowed for interaction—both peaceful and otherwise—between previously isolated world cultures.

Source: http://www.history.com/news/history-lists/11-innovations-that-changed-history

The compass kept sea explorers from giving up on expeditions because they weren’t able to find the place they were going, and made it so that ideas could spread a whole lot faster. It used to take months to travel from one city to another, with the compass it made those previously tedious treks much easier and less confusing. The compass also allowed people to travel more often because they didn’t have to depend on nature and certain weather events that only happen during certain seasons. Example: Monsoon season, tides, the moon and stars and the sun along with migrating birds and animals . . .

. . . People depend on the compass and have depended on it for a very long time. The compass has been used by some of the most famous people in history: Chinese explorer Zheng He, who used the compass as a navigational device; Marco Polo, who is said to have carried a compass with him when he returned to Venice after twenty years serving the Kublai Khan Court; William Gilbert, a scientist and Physician of Queen Elizabeth I; King Edward III; Prince Henry of Portugal, also known as ‘The Navigator’; and Ferdinand Magellan, another Portuguese explorer. The Vikings used it, as did Arab traders and Pirates. The compass has crossed the world with its extraordinary power, and everyone from ruffians (people involved in crimes) to royalty has used it to guide the way to new places and back home.