



Loading Image...



[Show Menu](#)

- [History](#)

VELARIUM

THE AWNING

Owain Roberts and classicist Norma Goldman answer to questions

Question for Goldman: How many people lived in Rome when the Colosseum was active as an arena?

~Angie

Answer: Estimates vary, but the most reliable sources, based on the number of houses and apartments and the size of the town covering [the 7 hills of Rome](#) give a figure of about a million toward the end of the first century when the Colosseum was built, increasing in the second century to possibly a million and a half. That means that with 45,000 to 50,000 in the audience, it was 1/20 of the population that could attend at one time; tickets (pieces of broken pottery giving gate entrance and assigned seat area) must have been highly sought after, [The Peoples](#) lining up for tickets as they do today for a world series game.

Question for Goldman: How many people did it take to build the Colosseum, and how many bricks or stones did it take? ~Amanda

Answer: I'm sure that the construction crews involved thousands of slaves to lift and transport the materials. I'm sure that thousands of skilled and semi-skilled workers were involved in handling the construction materials. If one adds the slaves that were working in the quarries to cut the stones, one gets at least 20,000 to 30,000 people involved. How many bricks or stones went into building the Colosseum? I have no way of making that estimate. It's something I have never counted as far as stones, but I would say that from the quarries at Tivoli, which is about 20 miles from Rome where the travertine was quarried, there were 240,000 cartloads of stones brought just for the exterior facade alone. And if you consider that on every cartload there must have been 30 to 40 stones, maybe 50 stones, you get some idea if you multiply that out of just for the exterior facade.

Question for Goldman: Many box seats on several levels contain matching sidewall joist holes approximately 4-by-4 at about 7 and 12 feet above floor levels. Guides say no wood was used and these do not represent flooring requiring crotching or lying. Could this possibly be true? ~Martin

Answer: There was no wood used in the seating area of the Colosseum. It was all a matter of concrete barrel vaulting to hold the marble seating that was installed. Each seat was called a locus, and one was assigned a particular locus in a particular section in a particular deck, all according to rank and class. And as far as I know, no wood was involved in the construction of the seats.

Question for Goldman: Was the status of sailors enhanced because of their role in covering the Colosseum?

~Jack

Answer: Sailors were young men, sometimes even young boys, impressed into the Roman navy from any and

all the countries that Rome conquered around the Mediterranean world, and as far away as Britain. They served for 15-30 years before gaining their "diploma", which gave them freedom from slavery; they became free citizens, and their children were born then as free citizens and could rise in society to become part of the class of knights. Those sent to Rome to work the awning must have been considered very privileged to see the "big city" and all its attractions. They handled huge awnings of cloth equivalent to the size of sails on the "present" day tall ships", and that must have been a great honour. But the ones who came for the mock naval games called the naumachiae, must have considered them a kind of Disney-land reconstruction of ships, and tragically the naval war games fought on them were fought to the death.

- [More](#)


Question for Roberts: Were the Roman sailors as skilled as others who lived during that time period?

~Andrew

Answer: Any sailor, Roman or otherwise, has skills at least comparable with any other highly trained worker but these tend to be a total mystery to landsmen. This has always set the sailor apart from other men. His skill comes in two categories. Technically he is master of the equipment which he uses, that is the ship and all of the gear. From experience gained over long hard years he knows how to make sound decisions on when to use that gear and how to handle his ship, even in serious life-threatening situations. This is the part which mystifies landsmen but is a common bond between sailors. Roman sailors made possible the rigging of large awnings over amphitheaters since they represented the only large body of skilled workers remotely capable of envisaging the problems that needed to be over-come.

- [Visit](#)

Question for Roberts: Which of the methods used in the NOVA program did you favor? ~Mark

Answer: Though I prepared rigging methods for both systems, the one proposed initially by Prof. Rainer Graefe of Innsbruck University, Austria, had my support. It was the only system for which there is substantial evidence about the masts and furling method used. The evidence is found in the contemporary iconography  Roman sailing ships showing masts, yards, sails, and rigging. Such a system also would have made use of the valuable skills of those who sailed them.

Question for Goldman: Were there any other stadiums in antiquity that used awnings? ~Peter

Answer: Oh, yes. Every public amphitheater or stadium where people would have to sit out in the sun was tented with some kind of awnings. This was a pampered audience, and in the entire Mediterranean, people did not want to sit out in the hot sun. So there is evidence for awnings in most theaters, in almost all of the amphitheaters, and even in the stadium.

Question: Did the Romans borrow construction techniques for the Colosseum from even more ancient cultures? ~Elaine

Answer: Well, I think all technology builds on what was known previously. One doesn't go out and begin to say, "I'm going to do a building the size of the Colosseum," and have it come like Athena out of Zeus's head, full-blown. The arch had to be invented before the arched entrances could be designed. Certainly all of technology that had preceded it-- the building of columns, the whole idea of brick work to face concrete-- all of that had been done before the Colosseum was built.

Question for Goldman: What made the Romans actually build the Colosseum? ~Martha

Answer: The Flavian Emperor Vespasian conceived the idea and put 4 teams of construction workers onto the job. First of all it was a propaganda ploy to return to the people land that Nero had usurped for the private lake in his private pleasure park on the ground of his Golden House. Vespasian was making the Flavian dynasty (a name like the Windsors in England) much beloved as the ruling house in this concern for the people. Second, it was to show to the entire world the power and might and ability of the Roman workforce -- its grandiose size and monumental shape and a symbol of Roman majesty. Third, it put to work an enormous labor force, solving vast unemployment problems. Finally it kept the people happy and entertained. They already got free "bread"; now they got the circuses. It served its purpose well.

Question for Goldman: How did they go about flooding it for mock sea battles? ~Marc

Answer: There has always been a debate about whether the Colosseum itself was ever used for sea battles. I think that after Domician added the substructures, which would be after he came to the throne in A.D. 81, there never could be sea battles in a flooded naumachiae-- that's the Greek word for sea warfare. There never could have been, again, the flooding of the Colosseum. But before that substructure was added, the poet Martial says that the amphitheater could change from dry land to the sea very quickly, and we know that there were water courses which run through that valley because there is still water running under San Clemente today, so that very easily the engineers could have induced water into it, and they could have emptied the water by the same channels that took the original lake that was drained in order to install the Colosseum in the first place. So yes, in the first two years there could have been sea battles there.

Question for Roberts: It seems that either method needs further support beams closer to the stage area. Is there any evidence to support any more beams further down toward the center? ~Gary

Answer: There's no evidence at all within the walls of any amphitheater or the Colosseum for further beams or pillars, and the supports for the masts that are used on the outside edge or on the top of the wall-- that is, the holes in the walls there-- these must be particularly high to do the job of supporting the horizontal beam which is sticking out on not all of the arena, but much of the arena. As you will have seen, it's not necessary to have full cover over an arena. As long as about two-thirds of the arena is getting some shadow, it's adequate for the people who are watching there. There was no evidence of support within the arena.

Question for Roberts: Why couldn't the suspension system be used, but use the bottom ropes to suspend a series of ropes through the rings on the awning, allowing the awning to retract from the center to the edges? ~Larry

Answer: Yes. I'd thought of this when I was working on the idea in the first place, of using a pulley system attached to the underside of a suspending rope. The big problem with this is that we are using natural fibers, and even with well-organized systems, the natural fiber rope stretches and stretches and stretches, and you are in a situation where you could never get sufficient tension and keep sufficient tension for rope, which is harnessed underneath for moving the sails or the awnings to work decently. The other problem is that you need to pull on the rope to draw a canopy in or out. You need to pull against something solid in order to change the direction of the rope to the sail, if you understand. If the part of the block, the pulley that the rope is going through, is attached to a rope which also gives, you have a situation which is far too flexible for it to work properly. This might have worked if the Romans had had steel wire cable, which they did not, of course. But if you have steel wire cable, you can then set up a very rigid system, and beneath that, you can then run a flexible awning system which you can draw it in and out. That's the reason why we didn't do that eventually.

Question for Roberts: Is it a possibility that the Romans constructed a giant circular piece of cloth that was held taut over the Colosseum like a lid on a jar-- no complicated system of ropes? ~Abby

Answer: How do you propose to hold the lid over this? You cannot just float this in the air. You have to have a system which supports it. You also, of course, have to have a system which can close it off, because you get winds which would make the thing blow away over Rome somewhere, perhaps.

It's not a system that can be controlled properly, and if you think of the Colosseum itself in particular, the size of it would be quite enormous and quite beyond controlling in this way. The beauty of the system which we think was in use was that it worked in segments and could be in small pieces, like a ship having six or eight sails on each mast, and is then able to take in each sail in turn as is required. And I think this is the flexibility that was built into the system which we eventually devised, which we think was used.

Question for Goldman: What does the word "Colosseum" mean? ~Greg

Answer: Interestingly enough, the building that we today call the Colosseum was never called the Colosseum in its own time when it was used as an amphitheater. It was called the Flavian Amphitheater. The word "Colosseum" means, as the English etymology would suggest, "very, very large." And the building had next

to it a colossal statue of the Emperor Nero over 100 feet high. When the Emperor restored to the people of Rome the land and gave back to them this marvelous gift of the amphitheater, because it stood next to the colossal statue, now with the head of Nero removed and the head of the sun god Apollo put on instead, with rays coming out from the head, the name "colossal" that applied to the statue eventually was applied to the Colosseum. But it wasn't called that until the writer Bede called it that in the eighth century, A.D. Before that, it was always called the Flavian Amphitheater.

Question for Roberts: I think the idea of the booms is a good one, but could they have had a smaller set of awnings covering the important people? ~Rob

Answer: Yes. It was known that people of importance would, in fact, have their own set of canopies set up over their important seats towards the front of the arena. The way it was set up generally would never, in fact, have covered all the arena, and probably the front row except with the sun at various angles all of the time. So those sitting at the front would have had their own canopies; yes, there is evidence for that.

Question for Goldman: The Romans are portrayed as leading lives of excess. Is this accurate? ~Scott

Answer: It is dangerous to generalize about all Romans. There were some who valued the old virtues of hard work and ethical conduct, but yes, during the Empire there was the same materialism that prevails today -- people of a leisure class with too much money and time who required constant entertainment. The Colosseum provided that kind of entertainment, repulsive as it seems to us today.

Question for Goldman: Regarding the mast erected to support the sails, is there any evidence to suggest that they might have been metal-banded for increased strength or height? ~Todd

Answer: That's a hard one to answer because we don't have any of the masts that have been preserved. There was iron metal. There was not the kind of steel that we have today. The iron would only have increased the weight of it. It might have made them more capable of holding the weight of the rope and the cloth attached to the rope, but I would not be able to answer that with any surety because no masts have been preserved.

Question for Goldman: My main concern is once the canvas-- what was the weight, i.e., ounces per yard?-- was in place, whatever method was used, was water drainage/collection and uplift a problem? How was this avoided? ~Howard

Answer: The awnings were not put out on days of wind or rain. These were sunscreen awnings. They were not intended as protection from the rain. They were retractable. We know that from the poets who tell us that when the days of wind came up, the awnings could not be put out, and we have evidence that there was a captain of the crew of sailors who read the winds from telltale signs-- just the way one has little strips of cloth on the sheets, the lines of the ships to tell the wind direction-- and the strength of the wind. And when there were windy days, the sails were not put out at all. So there was no reason to have to deflect water. They were just not out for that purpose. They were sunscreen awnings, not rain screen awnings. The weight has been estimated at 24 tons at 1 pound per square yard of average-weight cloth.

Question for Roberts: At the beginning of your program, the architect, Chris, had shown us a drawing of the Colosseum as it might have looked if the Romans had put a concrete roof on it using their system of arches. Would it be possible to use the same concept, but instead of using concrete maybe the Romans could have constructed an arched wooden structure and then put canvas over that? ~Nicole

Answer: Well, you have the same problems in that even if you make it out of timber, it's not going to weigh as much, but it's going to weigh a considerable amount. The wooden structure as such would have been enormous. I don't know if wooden arches of that size you would require to laminate timber of that size, and the laminating would be done by fastening through a number of timbers which were shaped to curve. It's a colossal job that's being asked, and I think, frankly, that it would never have been attempted because of the practical difficulties in this. Having then put an arch up, you put a canvas cover over that, which again would be an enormous quantity of cloth. It would flap, it would fray, it would really need to have a means of furling it. I have no idea what system could be used with a permanent wooden framework in place in the shape of an arch. I don't think this is really a line that should be pursued, to be honest.

Question for Goldman: Weren't there structures outside the Colosseum to which block and tackle were thought to be used to raise the sail roof from outside the Colosseum? ~Shawn

Answer: There are 160 bollards -- these are large, upright stones at ground level -- 57 feet out from the Colosseum. They ring the entire Colosseum, and there has always been controversy over whether these were part of a crowd control mechanism or whether they were involved in the raising of the ropes on which the sails would be extended. I always thought that because they are gouged so that some kind of windlass or winding device could have been installed on the surface that faces the Colosseum, this argued for them being involved in the mechanism to raise the ropes, and I really still like that argument even though it has been argued that they are not deeply sunk enough to counterbalance the enormous pull that would be required to make them taut. One of them has been excavated, and it was found that they were not deeply set into the ground. That would argue for them being part of crowd control and not part of raising the awning mechanism, even though I argued for that in my article in "Archaeology" magazine.

Question for Roberts: Could a wooden circle with pulley attachments have been raised by ropes from outside the structure through the tops of the masts, lifting the wooden circle from the center floor to the center near the opening, and then sails pulled along these ropes? Like the spider web theory, the roof would have sloped down and in toward the center. ~Sean

Answer: Yes. This is making the system more rigid, isn't it? If you could invent a wooden circle perhaps about the same band as the area where the activity was taking place, and suspended that, you might then have been able to work a system of drilling can drawing canopies in and out. We come back to the problem, that we are dealing here with natural fiber ropes, and the constant weight of a wooden circle, however light you tried to make it, would in fact have been putting a constant tension on these ropes. Natural fiber ropes, hemp, stretch; they continue to stretch; and you have to keep adjusting them, and you're into a constant battle on this one. And frankly, I don't think a system this requires a great deal of ropes is supported like that is really a good way to go around this.

Question for Roberts: Was the sailcloth back then a similar fabric to the type you used in the experiment? ~Maureen

Answer: Roman sailcloth could be linen or cotton which was lighter. Evidence suggests that it came in rectangular pieces which needed joining, which is why the seams on the ancient sails stand out and in some cases have a patch-work appearance. For the experiment cotton was used. The construction of each awning, due to a misunderstanding by the sailmakers, did not include the typical Roman edge and panel reinforcement specified by me. Both for the strength and for visual effect this was a disappointment.

Question for Goldman: How were the Vestal Virgins chosen? ~Kathy

Answer: There were 18 Vestals at a time: 6 novices chosen as young girls of 10-11 years from the best senatorial families, families without stain in their backgrounds. 6 were the practicing Vestals, and 6 were "retired" and acted as teachers for the novices. Probably the Vestals themselves would have suggested names of novices, but the Pontifex Maximus would have had to make the final decision. The work of the Vestals was to tend the sacred fire of the hearth, symbolic of the home. They also had to prepare sacred ground grain for sacrificial rituals and to function as models of moral behavior, since they had to remain virgins for their 30 years of service. After that time they could marry, but few did. For breaking their vow of devotion to the order, they could be buried alive. They lived in palatial quarters in the Forum behind the round Temple to Vesta where the sacred fire was kept. They had their own box at the Colosseum, and witnessed from their ring-side seats these abhorrent "games", along with the rest of the audience.

Question for Goldman: How long was the Colosseum in use, and why did people stop using it? ~Irene

Answer: The games died out for several reasons. The gladiatorial games, which became abhorrent to Christian conscience, disappeared in the year 404. This was the last time there were gladiatorial games, although the staged animal hunts went on for another 50, 60 years. They really died out from lack of money to keep them going. It was an enormous expense to import animals from Africa. These poor beasts were deadly sick as they were transported across the sea, and then nursed back to health, but deliberately starved

before they would go into the amphitheater to fight against each other or against gladiators. Tremendous expense, and the money just gave out. And that's really, I think, why they died out: not so much from Christian conscience as from lack of funds to keep them going.

Question for Goldman: Did you consider the fact that bullfights are scheduled at 5:00 p.m., when there is half sun and half shade? This would support the first theory of sails and beams. ~Rosalma

Answer: Yes, and this does support Rainer's theories because he has done studies on the effect of the cast shadow from the opposite side of the arena. And the bullfights do start late in the afternoon, and the cheap seats are the ones that are still out in the sun, and the expensive seats are the ones that are in the shade, just like they used to be in the ballparks in the United States. The bleachers were in the sun, out of cover, and the people who could afford it sat in the covered part of the stadium.

Question for Goldman: The Colosseum is so enormous -- is it know how they handled crowd control?

~Victor

Answer: Yes, the network of entrances through 76 numbered arches assured that the peoples of each class, noble or plebian, citizen or non-citizen, would go directly via interior stairways and ramps to their assigned seat, just as in a modern stadium. The arch and area was indicated on a piece of broken pottery giving the proper deck and wedge-shaped section, assuring complete crowd control for entry and seating. Then for exit, these same ramps and stairways would assure a quick and easy egress with no mixture of classes. Outside there would have been a barrier consisting of chains between 160 bollards to keep people out before the opening. There were 80 arches in all, but the ones at the main axes were for the entrances of the gladiators, the emperors and magistrates and Vestal Virgins, and the one next to Ludus Magnus was the gate of death through which the corpses of men and animals were removed. All very well organized.

Question for Roberts: If you got a chance to do this experiment again, would you do it differently? ~Adriana

Answer: The experimental work is on-going though now at Innsbruck University. While there last year and with excellent help from the students on the course, I built to one-fifth scale, three different arrangements for furling the vela. The major future refinement would be a pruning down of the supporting rig and having greater faith in the natural flexibility of the horizontal yard to withstand destructive bending forces. Having performed the calculations on this it is clear that much longer yards could be used in a full-size situation without the need for support other than at the masts. The students also tried to improve on the other system suspended across the amphitheater but despite careful modelling could not get it to work. It would seem to be a blind alley if ancient materials are used.

Question for Roberts: I believe that the Romans used the archways in the Colosseum to string parallel ropes across the top. The fabric would then be attached to the ropes using rings. This design would cover the entire building and would fit all of the descriptions. Could this have been the way? ~Daniel

Answer: Yes. The trouble is, we're working here with a circular building, and you could certainly support ropes from the tops of the arches. All of these ropes would... as they come towards the middle, would be like the radials or the spokes of a wheel, and you'd run into this problem again that, first of all, you have great lengths of rope which stretch constantly. You have panels of cloth which would have to be tapered in order to fit between these radials, these spokes of rope. And you then have a problem that if you try to slide them back, because the inward end of the cloth is narrower than the wall end of the cloth, then you start drawing it back, it's not wide enough, in fact, to slide back along the ropes. The whole thing would start to pull in. This problem has been looked at. Whether we've used arches or whether we'd use masts, we'd run into the same problem, unfortunately, and there is no need, anyway, to cover the whole arena with a canvas because the walls are high and the sun moves around and where just a certain area of the arena is covered, it casts sufficient shadow for the people who are watching there.

Question for Goldman: Is the Colosseum ever used for events now, other than as a tourist attraction?

~Roberto

Answer: Several hundred years ago the popes began the preservation of the Colosseum as a sacred place,

there having been so many people killed there, and stations of the cross were planted on a Via Dolorosa built around the edge of the arena inside, with shrines and a little chapel at one end, with a Christian cross in the center. When the Colosseum became a public monument, the Cross was moved to the side podium, the stations of the cross removed, the chapel closed, all the shrubbery, trees, and plants which were growing inside and splitting the walls removed, the solid floor of the arena excavated, and the substructure laid bare, as you see it today. About 10 years ago there was an exhibition of modern technology on a narrow wooden walkway constructed over the long axis of the arena, and the cry of outrage was so loud, even though the show brought in a hundred thousand dollars the first week, that I doubt that such use will ever be repeated. The Pope still celebrates a memorial to the victims in a symbolic march around the exterior each year.

Question for Goldman: Was the Colosseum the original "sports stadium"? Were there other big gathering places? ~Liam

Answer: The Circus Maximus in Rome, a long oval-shaped race-course with a spine down the middle, designed for chariot races, in the valley between the Palatine and the Aventine Hills, probably began with seats cut into the hillside for viewing spectacles of all kinds. When the formal race-course was built with starting gates, permanent stone viewing stands, private boxes for the officials and a more private imperial box high up in the palace area on the Palatine for the royal family, the Circus Maximus could eventually accommodate 250,000 spectators at one sitting, more than 5 times the number that could be accommodated in the Colosseum.

Nero built an enormous Circus next to the Vatican Hill where St. Peter was martyred, and the obelisk from Nero's Circus was eventually moved to where it now stands in the embracing arms of the piazza in front of St. Peter's. Domitian, Vespasian's younger son, built a smaller race-course, probably for foot-races, in the area known today as the Piazza Navona in Rome, and the shape of the Piazza echoes the shape of the race-course.

Question for Roberts: There may be a combination of both ideas. Use the booms to suspend the canvas as in the first experiment to give retractable characteristics, then stretch ropes across to the opposite boom to extend the canvas to the desired distance, depending on the weather, wind, etc., the ropes could be adjusted with the support of the booms for added stability. ~Jamie

Answer: Yes. It would be a nice way of controlling the booms in that position-- there's no argument about that-- by linking the ends of them with ones opposite with a rope that goes across. So you have the center of a spider's web, I suppose, at the middle, and what we found, the argument that would go against that is that we found that it was very convenient to be able to rotate the booms in towards the walls where the masts were supported in order to be able to work on the booms themselves. Now, that facility wouldn't be possible if we had rope linking across the arena from the ends of each of these booms. It's a facility for maintenance that would be essential, because everything, all the material that was used, would need constant maintenance. It's just like working a ship. With a ship, you are always checking ropes, checking for wear, and you need to be able to get at the stuff. Now the other way we can do it, the way we found to do it, was just swing these booms in until we could reach them, and I think that's probably what was done in antiquity. So I don't really like the idea of linking them across, just in order to try to extend the canvas. We can make the booms more than long enough, because the trees are long enough for this. And you don't have to have very thick wood towards the end of the boom, the inner end of the boom, because it's a good thing there to be thinner, because you're losing weight all the time; it's strong enough for the job. You could have very long booms and have them able to cast more than sufficient shadow over the arena. So I'm not totally happy about joining down the middle. It looks attractive at first glance, I must admit.

Question for Roberts: How complicated was the rigging that you did for the bullring roof compared to rigging that sailors of that time would have done? ~Trevor

Answer: The rigging used in the bullring experiment was based entirely on what is to be seen in the pictorial evidence from the Roman period. What was combined was the rig needed to support the yard, which was suspended like the sprit of a Roman sprit-sail rig, and the awnings furling lines or brails in evidence on the Roman square-sail rig. All gear would have been familiar to any Roman sailor who might have come to haunt

us.

Question for Goldman: What type of wood were the masts made of, and where were these trees found? ~Eric
Answer: There are pine trees and there are fir trees in the area around Rome, and I'm sure that these evergreen trees were the ones that were used because they do grow to great heights. And Rainer Graefe has made studies of the height that these trees have grown, and in his book, *Velu Erunt*, ("There Will Be Sails") -- and that's a good title, because that inducement was added on the graffiti "billboards" that were put up announcing that there were going to be gladiatorial games. In his book, "There Will Be Sails," Graefe describes how he studied the heights that trees grow to so that he could figure out how long the booms could be. They were usually conifer trees.

Question for Goldman: Do you think the blood and gore shows that took place in the Colosseum have any parallels to today's extreme sports, or violent talk shows? ~Charlene
Answer: Absolutely! There seems to be an appeal in human nature (something we try to hide under the carpet, but surely there) to the violent aspect of human activity. Look at the number of murder mysteries written and presented in the public media in film and television. One of the statistics in the Newsweek book on the Colosseum says that a young person will have witnessed 27,000 violent deaths on television and in film by the time he or she is an adult. Look at the slowdowns on the opposite side of the expressways when there is an accident. People are fascinated by death, and the ancient Romans had this terrible flaw in their character that they made the killing of captives, criminals, slaves, or anyone who bucked the system, a source of entertainment. Look at the popularity today of the Demolition Derbies, the fights in the hockey games, the wrestling match absurdities.

Question for Goldman: What was the most populated event that took place in the Colosseum? ~Scott

Answer: I would imagine that the climactic event of the day was the gladiatorial contest between two popular heroes. By the way, the games went on all day, so this business of the cast shadow in late afternoon does not apply, because the games did begin early in the morning; people stayed the whole day-- there were criminals, condemned criminals who were put to death in the morning. There were animals that were brought in, exotic beasts both to be paraded around and then to fight against each other or hunted, caught, and killed. Then there were the gladiatorial games in the afternoon, where teams of men who had been trained in a particular kind of warfare-- these had been men who had been captured in war who were then put into training camps to refine their war skills in the particular way in which they fought from the countries they came from or to learn new skills-- they were teamed up against each other to fight. And then the climax of the day, and I think the most popular event, would be when the most famous gladiator who fought in one style was pitted against another gladiator who fought in a different style. For instance, there was a style of costuming where the gladiator was completely armored, covered, protected who fought against the almost nude *Retarius*, the man who fought only with a net and trident. And to have these unequal gladiators fight against each other would have been the climactic event, and these gladiators became so popular, they were like the screen stars-- the women swooned over them. The popularity of them extended to the gambling, the betting that was put on on one or the other winning. The popularity made them the idols of the day. They had short, happy lives.

Additional Q & As

Additional questions and replies from Owain Roberts and Norma Goldman will be posted here starting on May 28.

Question for Goldman: Which of the solutions shown in the program to cover the Colosseum is best supported by archaeological evidence? ~Don

Answer: The archaeological evidence from the top of the Colosseum with the extruding corbels with sockets for the masts and the matching holes in the cornice and from coins indicating the masts all around the top show undeniable evidence that the masts to support the robes and the system of awning mechanism did exist.

Whether the horizontal timbers to support the "sails" were there, as described by Graefe, is not so documented, and my own opinion is that that system would have been cumbersome, difficult to install, expensive (although for the emperors, nothing was too expensive), and would not have covered the most important members of the audience, the nobles who sat down front, closest to the arena, except when the cast shadow gave shade, as it does today in the modern bull-ring when the sun is lower on the horizon. Graefe's extensive work on all amphitheaters has to be considered with respect, and he is best of all authorities to document the feature on the cast shadow and on the length of timbers from trees. My own theory is that the rope oculus system is more practical, although we did not have time in the film to see the longer sails retracted, as the literary evidence implies, for the poets write about days when the winds are so strong that the "sails cannot be put out." I favor a system of extending the sails on ropes going through rings sewn to the edge of the cloth, just as is done on ships. One of my Italian architect friends in Rome reminds me that in a building in use for over 400 years, there might have been many different versions of the awning changed to suit the times.

Question for Goldman: How long did it take to build the Colosseum and how much did it cost? ~Chloe
Answer: Between seven and eight years in all. It was probably begun about 73-75 A.D. and was almost completed in 79 when Vespasian died, for Vespasian's older son Titus dedicated it in 809 with 100 days of games on one day of which 5000 men and animals were said to have been slaughtered. Titus only ruled two years and Vespasian's second son Domitian is said to have added the bronze shields at the top and the substructures (after which there never could have been mock naval games) for dressing rooms, dens for animals, storage for sets and scenery, elevators and ramps. No one will ever know how much in cash was poured into the project, but it was money well-spent, since it assured the popularity of the ruling family, and the royal treasury had not bottom. Vespasian had a limitless work force, having brought back from the Jewish War an estimated 100,000 slaves, probably put to work in the quarries at Tivoli, for there were 240,000 cartloads of travertine estimated alone for the exterior. There is evidence of skilled work done in stone yards for pieces brought already cut and finished to be installed, as is done today in modern construction projects.

Question for Goldman: Was the Colosseum considered an architectural wonder at the time, or was it standard, if grand, for that time? ~Athena

Answer: Absolutely it was considered magnificent in its time, and this is the whole message that was to go out to the whole Roman world, that the Romans were capable of building this enormous structure that was perfection itself in architectural design, in planning, in scope, in execution.

Martial, in a whole group of poems that he writes about the spectacle, says that you can talk about your pyramids, you can talk about your hanging gardens of Babylon, but there was nothing in the world to equal the Roman amphitheater. So even in its own time, it had a reputation, and it was imitated in all of the great cities that the Romans built throughout the Mediterranean world, and even as far as up in England and in Germany.

Question for Goldman: What caused the ruin of the colosseum? What was the reason for not rebuilding?
~Travis

Answer: Some of the damage to the building was caused by lightning and fire, but the most significant damage was caused by earthquakes shaking the ground so severely that parts of the upper stories, and eventually the entire south wall fell. The fire and earthquake damage in the first through the sixth centuries A.D. were repaired by the emperors, but when the building was no longer used for gladiatorial events (last ones in A.D. 404) or staged animal hunts (last ones in A.D. 523), there was no reason to repair the damage. And the emperors had little money for such repairs. They needed the money for their bloody wars. When the very severe earthquakes of 847 and 1231 caused the most stones to fall, then the plunder and reuse of the stones for other constructions began. The steps of St. Peter's are made of reused Colosseum stones. The capital had been moved to Constantinople, and Rome was becoming a backwater town.

Question for Goldman: Why should we assume that the Romans used only one method to roof their arenas? Is it not reasonable to assume that they experimented with various methods? ~Nick

Answer: Yes, I agree, that in a building in use for over 400 years, there must have been several methods over the centuries of "tenting" the enormous structure. Covering the audience was the prime concern, and there could have been several revisions in the technology of just how to extend and retract the awnings. They could never have stayed in place, however, for that would have wrecked the top of the building, just as sails on a ship have to be reefed, for the winds at the top of the building are very strong and could wreck the building, along with the sails, on very windy days. There might have been changes in technology that made different plans possible at different times.

Question for Goldman: Is there any evidence to suggest that the Romans knew of and used suspension bridges? (which technology could presumably be adapted to a suspension roof)? ~Nick

Answer: Cris Wise's method for the awning is an adaptation of the suspension bridge idea adapted for use in an awning. For their bridges, however, the Romans used construction methods that were mainly based on stone and concrete pier support sunk into water or land with arches between to support the bridge atop. But David Macaulay shows a support of rope skeleton with an oculus in the center, and I agree with that system. In an earlier version, Macaulay shows a criss-cross of ropes going all the way across, and that also is a possibility (more like the suspension bridge idea of Cris Wise).

Question for Goldman: Were the bodies of humans killed in the arena simply tossed in a mass grave or were there family members who claimed the bodies? ~Eric

Answer: The bodies of men and animals killed in the arena were taken out through the Gate of Death at the east end of the amphitheater. From there the bodies of condemned criminals, slaves, and animals were dumped unceremoniously into a common pit. When the site was excavated at the end of the 19th century, the director said that the excavators could only work a few hours at a time, for the stench was still so strong. During the Empire when the gladiatorial games were at the height of their popularity, sometimes the sons of noble families, the second or third sons who could not inherit wealth or position, entered the arena as gladiators, but there is no documentation as to what happened to them after death. Perhaps the families were ashamed of them and did not claim the bodies. Perhaps the families did come to claim them and bury them in the family tomb. No reference has been found about this interesting subject. In any event, the gladiatorial armor -- helmets, swords, greaves, nets, tridents, etc. were all preserved, and these were handed on to subsequent gladiators. Helmets especially were precious, prized objects.

Question for Roberts: Why don't the boom structures show on the few remaining examples (of how it could be done beside the stamping limits)? Is it possible that the same type of boom could be used with all support gear underneath the cloth? Could the cover be deployed via end wheels at the far end of the booms (reducing complexity)? Could the structures on the outside of the Colosseum be knoches (I saw no holes to capture the end of poles)? Are there any indications that adjustable angle support braces running to the seating area 'could' have been used or 'pre-loaded overbuilt structures' like the ones you tried? Funny you made your test structures in a bull ring when rings may hold the possible answer (like on ship masts)? ~Paul

Answer: The drawings at Pompeii show the booms so there is some evidence of booms being used. No, I don't think it's possible for the same boom to be used with all support gear underneath the cloth. The cloth would drag over the tops of the booms. We did use pulleys or blocks at the very end of the booms in order to pull the sails of the covers backwards and forwards so that's already being done. He mentions structures on the outside of the Colosseum, I think Norma Goldman covered that quite well. There doesn't seem to be any structure outside, there are these stones outside the Colosseum but they're too shallowly fixed in the ground, and anyway they're not needed if the masts have all the strains vertically down them, the masts stand up by themselves. He says here he saw no holes to capture the end of the poles. Well, I'm afraid he'll have to look again. All these masts have got a hole at the top edge in some way of the Colosseum wall or the amphitheatre wall and then a support a little lower down rather like having a mast in a boat where the heel of the mast is against the keel in the hole there and the mast then rests against the beam at deck level, it's that sort of

arrangement. There aren't any indications for adjustable angle supports. There's nothing suggesting extra support for poles within the arenas. I don't understand what Paul means about rings on masts I'm afraid.

Question for Roberts: Wouldn't a net-like fabric reduce weight, allow wind tolerance and provide dappled shade adequate to the need? If the riggers were sailors, as am I, wouldn't they cast a net over the sea of air that would allow its fluid to pass, stow in a small area, dry quickly if wet and bear its own weight without heavy rigging? ~Gordon

Answer: Yeah, sure, except there's no evidence at all in the iconography of using net-like fabric. It would probably work perfectly well. The riggers were sailors and they probably just used what they were told to use, that is large canopies so that was that.

Question for Roberts: Use rope network, but NOT CONVERGING at center; rather use parallel ropes to a central cross-rope over stadium mid-line. Use the parallel ropes upon which to pull the "sails" towards center rope, just as done with the horizontal poles to support them. Sails could be deployed or retracted in a matter of minutes, as wind might dictate. This is suggested by looking at the picture of an early "roof" shown in program. It appeared to me that the supports were parallel, not convergent! What do you think? ~George

Answer: Good question. Roofs over stages were rectangular, that is the stages where people performed in theatres. But you didn't get that sort of arrangement in something like a Colosseum where you had an arena with seating all the way around. Your big problem with any rope system is stretch, it never stops. All the evidence is related to evidence of equal mast spacing to keep these parallel strips evenly spaced across the Colosseum, the masts would need gradually to be further and further apart as you go up towards the end and this doesn't happen, the masts are all evenly spaced. So the parallel strip system is a non-starter I suspect. There is absolutely no evidence towards it, except over stages.

Question for Roberts: Why couldn't the rope structure use a central ring-shaped rope anchored by ropes in V's to the masts. The canopy then could be one solid piece that irises shut by means of a rope through the inner part of the canopy. With this modification to the rope method, you would still have a means of retracting the roof by loosening the iris rope. It also would look much like the renderings you refer to in the story. ~Troy

Answer: Well we did, with Chris Wise's method, put in a central ring, it may not look too clear. And we ran ropes from the masts to the center ring and in fact cause his method was intended to be allowing the canopies to move backwards and forwards along the ropes to be furled and to be hauled out again but we sort of ran out of time and ran out of gear so we weren't able to set that part of it up. However, it is a problem because it's made entirely of rope. Troy suggests here that we could have one complete piece of canvas over there with a hole in the middle and we could draw that out of the edges. Well, the problem there is that if it's one solid piece of canvas, the circumference of the inner hole is a lot less than the circumference of the outer edge of the canvas. And unless it's made of elastic, you can't possibly pull the inner circle back towards the outer circle, it just wouldn't work I'm afraid. It just wouldn't stretch.

Question for Roberts: First, congratulations to all involved for devising two solutions that are both plausible and elegant. Regarding the problem with Chris's design in the wind: large parade banners and advertising banners strung across city streets are perforated with crescent-shaped slices to lessen the effect of the wind. Perhaps the fabric of the Colosseum roof was similarly perforated. Semicircular slits in the canvas would have a minimal (if any) effect on the shade provided, but they would allow the wind to pass through with less lifting effect. ~Michal

Answer: He suggests that perhaps perforated canvases would have worked well. Yes, because the packed canvases were already in segments we were actually getting that effect to relieve the pressure of the wind. Now the big problem here is that again when you've seen it in the film, there was no weight in the material or in the rope. That is there were no booms or pieces of wood so that when the wind got underneath it, it just lifted and flopped up and down. By having the booms in place, you can actually have a great damping effect on each of the canvases.

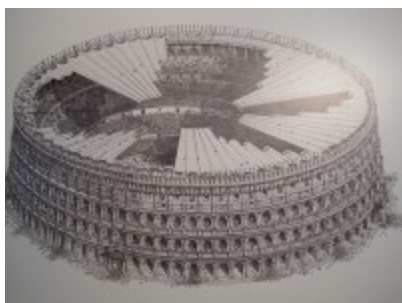
Question for Roberts: I have an idea. If you wanted to extend the horizontal beams farther. You could put in

vertical beams to make the horizontals stronger and be able to extend them farther. ~Daniel

Answer: That is absolutely true and the only problem is that there's never been any discovery of what you might want: that is, a line of circular holes somewhere around the edge of the arena to hold the posts which will support the ends of the boom. I think this system is entirely rope supported and is rigged rather like a ship might have been in which case you wouldn't need vertical posts coming out of the ground further into the arena.



PICTURES



An hypothesis of the velarium ([Maschke](#))



The masts of the velarium can be seen in this model



The supports are visible in this picture