Super 35; Is It Super 35?

By Tak Miyagishima

There have been lingering thoughts regarding the question "Super 35; Is It Super 35?." The era of simulcasting television in both 4 x 3 (1.33:1) and 16 x 9 (high-definition television, advanced television, etc.) aspect ratios and how best to prepare for this is now. For the producers and their production companies, there are many questions that require answers so intelligent decisions can be made. This paper presents a better understanding of the available negative area for 4 perf, 3 perf, and Super 16 formats for the future in preparation for both 4 x 3 and 16 x 9 aspect ratios.

It has now been over a decade since Super 35, as we know it, was introduced into the industry by the late John Alcott, BSC, when he photographed *Greystoke, The Legend of Tarzan of the Apes* in that format, as an alternative to normal 2x anamorphic (Fig. 1). Since then, Super 35 has been making the rounds. Some praise it as the only way to photograph an anamorphic release, whereas others will not touch this format unless persuaded to do so.

The first half of this paper will cover Super 35 used in theatrical presentations; the second half will cover today and tomorrow.

What is Super 35?

To get a better grasp of Super 35 (Fig. 2), it should be explained that in this format the lenses are centered on the film, to photograph the entire area between the perforations rather than on what is referred to as Academy Center (Fig. 3), which is offset 0.050 in. from the center of the film, allowing space for the analog sound track area. This 0.050 in. offset was established by the Motion Picture Academy at the advent of sound. Consequently, the Super 35 image photographed is 0.980 in. wide, whereas the image photographed on Academy Center is only 0.868 in. wide.

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When photographing in the Super 35 format, the image area used for extracting the release print for 2x anamorphic release is 0.945 x 0.394 in., and for 1.85:1 it is 0.945 x 0.511 in. However, to the best of my knowledge, there is no film shot in Super 35 and released in 1.85:1. Also, keep in mind that when photographing in Super 35 an optical printing process is required to reach the release print stage. For the anamorphic process this image is squeezed 2x and then enlarged 1.75x to fill the projected area of 0.825 x 0.690 in. required for theaters (Fig. 4). Alternatively, for the 1.85:1 format, the Super 35 image of 0.945 x 0.511 in. is modified to fill the projected area of 0.825 x 0.446 in. (Fig. 5). This means that an extra expense must be added to the final production cost. It also means that the printed negative is a duplicate of the original negative.

Whenever Super 35 is discussed, mention must be made of Techniscope (Fig. 6), a system introduced in the 1960s, that photographed an image height of two perforations. It was introduced to compete with the anamorphic system and advertised as saving 50% of the negative and developing costs.

This 2 perf system used an aperture size of 0.839 x 0.355 in. for extracting a release print having an area of 0.298 sq. in. The area of the Super 35, 0.372 sq. in., is 25% larger. Now when the Super 35 image is compared with the standard 2x anamorphic 0.825 x 0.690 in. projected image, we find that the standard 2x image area is 53% larger than the Super 35 image area.

The main reason for Techniscope's demise was that the smaller negative area, when projected in the theaters, produced a final image of inferior quality. Movie patrons were too astute, and consequently, even though there were savings in the developing and negative costs, this photographic system faded away. There are still some special occasions where the feasibility of using the system proves beneficial: it doubles the running time when a camera is required to be in an inaccessible location, i.e., photographing the *Titanic* in its final resting place.

At the time John Alcott pursued Super 35, he knew that the lenses, film, lights, and equipment had improved to the point that the increase of 25% in image area compared with that of the earlier Techniscope would give a much better image and come close to duplicating the quality of an anamorphic originated film. The final judgment of the quality of Super 35 seen on the screen will be left to the viewers and users.

When composing in the Super 35 format, there are two main ground glass markings used by directors of photography. The first is referred to as "symmetrical" (Fig. 7) and the second as "common head room" (Fig. 8).

For symmetrical, as the term suggests, the composition is centered on the film frame, and the lenses are used in their optimum position. The term common head room is used when the directors compose for Super 35 1.85:1, and from this extract the anamorphic format taking the top upper portion of 0.394-in. height and the entire 0.531-in. height for the TV format, thus using the same top line for both formats.

When shooting in this common head room format, the extracted area for the anamorphic release is not centered on the film. Thus there will be resolution as well as illumination fall-off in the upper corners, because these corners are farther away from the optical center of the lens than the lower corners. Another problem associated with the common head room format is that when zoom lenses are used, the operator is required to tilt the gear head while zooming to correct an image that would otherwise "wander" during the zoom.

During preproduction when decisions are made to release your production in the normal anamorphic format and Super 35 is being considered, the pros and cons of the systems should be studied taking all factors into account. In order to aid in this decision, the arguments put forth for both cases are listed below.

Pros and Cons of Super 35 vs. 2x Anamorphic

1. In Super 35 every frame is required to be optically step printed. In this process the Super 35 negative is squeezed 2x and magnified 1.75x to produce an anamorphic image. The result is an additional cost of approximately $25,000 per feature to the production, depending on the difficulty of the optical process.

2. The Super 35 format results in larger grain on the screen due to a smaller negative area. On a 25 ft high screen, the image would be magnified 761.42 times, resulting in a 579,762 increase in area over the 0.945 x 0.394 in. original negative image area of 0.372 sq. in.

3. The perspective of photographing in this system should be studied because shorter focal length lenses would be used. When photographing in the anamorphic system, the angle of view of each lens covers the same as a lens having half the focal length, i.e., a 50-mm anamorphic lens would be compared to a 25-mm spherical lens. Consequently, for Super 35, shorter focal length lenses are used to cover the identical field of view. However, in the vertical plane, there would be no change since the squeeze is only in the horizontal plane and not in the vertical plane.

4. The laboratory chosen to process Super 35 should be selected very carefully:

- Check out quality of their optical printer lenses, i.e., color, illumination, magnification.
- Resolution: not every laboratory produces the same result.

Super 35. Many perceive this to be a simpler format to use with virtually unlimited choice of equipment, thus resulting in savings in the camera package.

Anamorphic. Choice of equipment is also unlimited. The only objection may be the physical size of the lenses and not the availability of equipment.

Super 35. There is a myth that sets are smaller when photographing in this format, resulting in a smaller lighting package; another cost saving.

Anamorphic. The truth is the set sizes would be virtually the same unless shooting common head room, in which case the sets used to photograph Super 35 would be much larger. This means more lighting is required when shooting Super 35.

Super 35. Greater depth of field is claimed as an advantage of Super 35 because shorter focal length lenses are used for this format, making focus

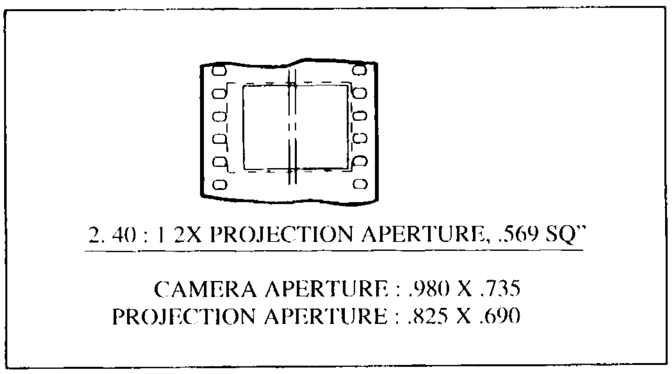
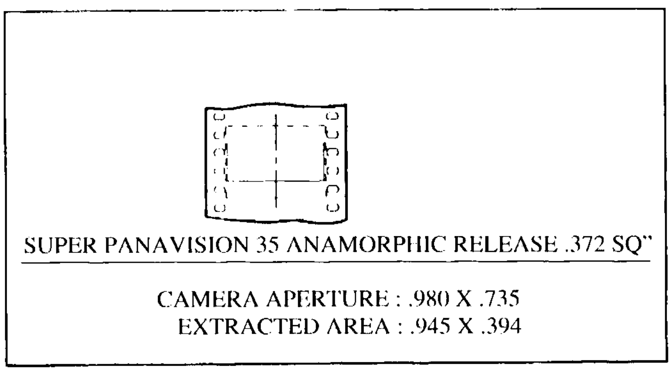


Figure 1.



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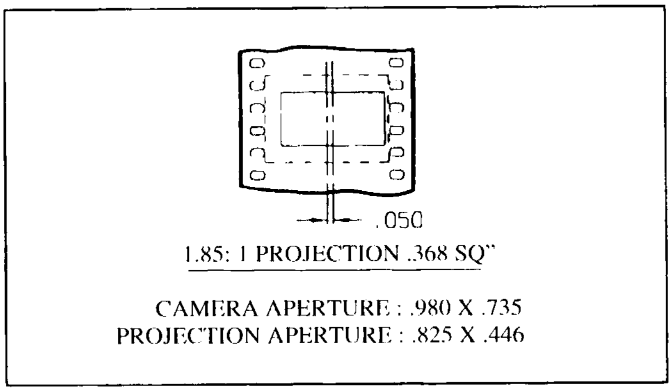

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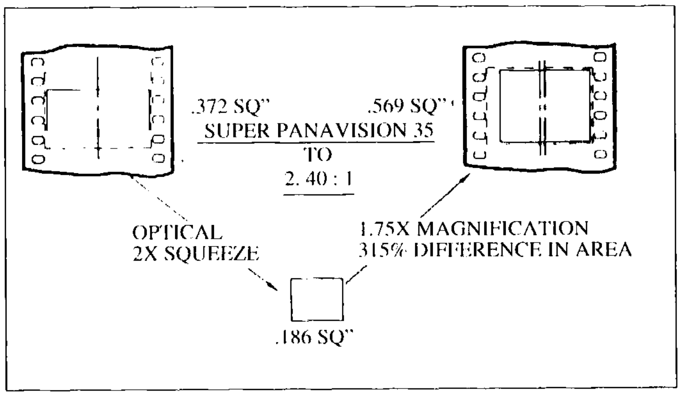

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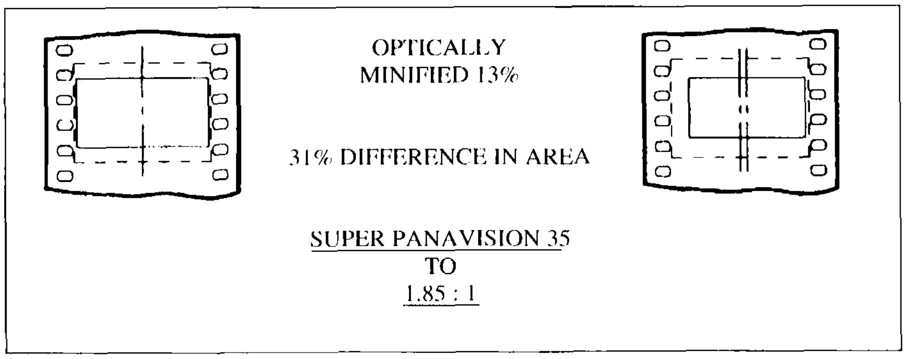


Figure 5.

error much more tolerable.

Anamorphic. The above statement is true if taken literally without giving much thought to the statement. Shorter lenses do give more depth of field than longer lenses; but keep in mind that, when using shorter lenses, because of their greater depth of field, it is much harder to see optimum focus. Since lenses used in anamorphic photography are of longer focal length, which have less depth of field, it will be much easier to realize critical focus.

Because the image is magnified much more on the screen, a larger circle of confusion is used for the 2x lenses when figuring out depth of field. Therefore, for Super 35, a circle of confusion of 0.001 in. is used, and for 2x anamorphic a circle of confusion of 0.002 in. is recommended.

Super 35. It is easier to compose for TV, making the video transfer much simpler than going through a panning and scanning procedure.

Anamorphic. Panning and scanning is necessary for both.

Super 35. Many people contend that the major advantage of Super 35 over 2x is the sharpness of the Super 35 spherical lenses over the 2x anamorphic lenses.

Anamorphic. To explain the major benefits of 2x, the projected image area of both formats should be compared in reference to the final presentation.

To maintain parity, the lenses used to photograph Super 35 are required to be three times better quality than the 2x lenses because of the much greater magnification of the final image on the screen. Consequently, any advantages that the spherical lenses have over anamorphic lenses are negated.

Super 35. There are many more focal lengths available, thus allowing the cinematographer more freedom of choice.

Anamorphic. It is true that the 2x system is limited in the availability of focal lengths for the director of photography's repertoire. This shortcoming can be easily overcome by studying the system and being more selective in lens choice.

Advantages of 2x Anamorphic Photography Which Cannot Be Overcome by Super 35:

1. Negative area 53% greater—0.569 sq. in. compared with 0.372 sq. in.

2. Less magnification when projected. On the 25 ft high screen, the Super 35 image (0.945 x 0.394 in.) is magnified 761.42 times, resulting in an area increase of 579,762. The anamorphic image (0.825 x 0.690 in.) on the same screen is magnified 434.78 times. This then results in an area increase of ~189,034 times. As can be seen by comparing the two numbers, the difference is quite staggering. (Table 1.)

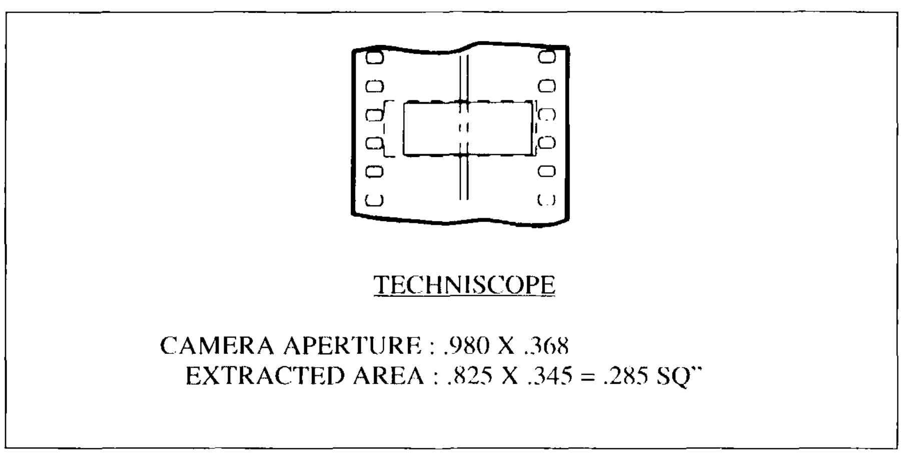
3. Another myth that has prevailed over the years pertains to the cost of a 2.40:1 anamorphic production versus a 1.85:1 production. It has been quoted that an anamorphic production package is far more expensive than a Super 35 production package. In reality, the cost difference is quite negligible, and this includes the lighting package as well. It will be shown that the set size is really dependent on the director of photography and the director on how they prefer to present their production. With the expense of the optical print added into the process, the cost between the two comes close to being equal.

4. By virtue of the wide screen aspect ratio of 2.40:1, this system has been considered aesthetically more pleasing to the eye. The image using the longer focal length lenses in 2x anamorphic photography or the shorter focal length lenses in Super 35 photography should be considered for the final image on the screen.

5. The anamorphic images are far more pristine, unlike in Super 35, where each frame is optically printed, thus reducing its image quality.

Preparing for the Age of 16 x 9 HDTV

With digital broadcasting just over the horizon and with the mandated airing of the 16 x 9 format, programmers should be more informed about how a



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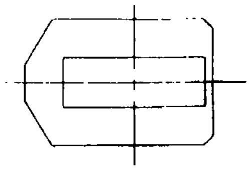

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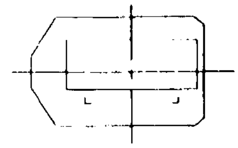

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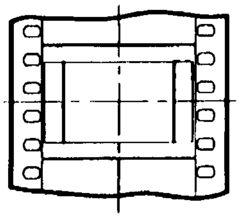

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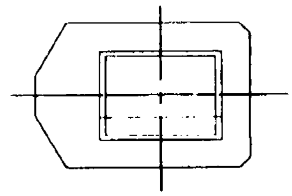


Figure 10.

show is to be produced for today and how it is going to be aired tomorrow. The decision today will be very different from how the programs will be seen in the future.

We at Panavision have taken it upon ourselves to meet with any parties, such as producers, directors, cinematographers, etc., interested in gaining a better understanding of how to get the ultimate image of their product for the future.

Currently, there are three primary formats in which studios have produced their product.

Method 1 (Fig. 9). During the past few years, many productions have been shot in the 16 x 9 format with the 4 x 3 (1.33:1) aspect ratio taken out of the center using the same height for today's programs. Because this 4 x 3 image is 33% smaller in width, directors and cinematographers found that, regarding content, they were having a very difficult time composing for both formats. Another problem, as far as the production personnel were concerned, was that their work was being judged by what was being seen on the 4 x 3 format and not the image in the overall 16 x 9 format. This then meant that the effort was placed on what is seen today on the 4 x 3 monitor and not for future 16 x 9 images. Consequently, the remaining 33% (16.5% on a side) was being neglected in some cases, thus diluting the efforts of shooting today to protect for the future.

Method 2 (Fig. 10). Because of the problem above, some productions are now considering alternative formats for their 16 x 9 and 4 x 3 origination, i.e., what is referred to as a common

Table 1—Comparison of Image Area—Theatrical Presentation*

Description	Projected Area	Area (Sq. in.)	Magnification 25 ft high Screen	Magnification 30 ft high Screen
70mm	1.912 x 0.870	1.663	118,906	171,225
2x anamorphic	0.825 x 0.690	0.569	189,036	272,212
1.85:1	0.825 x 0.446	0.368	452,452	651,531
Super 35 2x	0.945 x 0.394	0.186	579,762	834,858
Super 35 1.85:1	0.945 x 0.511	0.483	344,668	496,322
Super 35 70mm (2.2:1)	0.945 x 0.430	0.406	486,750	700,919

*Compares the increase in area of each originated systems when it is projected in the theaters of today.

Table 2—Comparison of Image Areas HDTV (16 x 9) and 1.33.1 (TV) from HDTV (16 x 9)

Description	HDTV Trans.	Area (Sq. in.)	1.33:1 Trans.	Area (Sq. in.)
4 perf Super 35	0.945 x 0.531	0.502	0.706 x 0.531	0.375
3 perf Super 35	0.910 x 0.511	0.465	0.680 x 0.511	0.347
4 perf Academy	0.825 x 0.464	0.383	0.617 x 0.464	0.286
3 perf Adacemy	0.825 x 0.464	0.383	0.617 x 0.464	0.286
Super 16	0.488 x 0.274	0.134	0.364 x 0.274	0.100

head room format. In this format, the smallest circle (area) that the lenses are designed to photograph is considered as the maximum size used. In this circle, the largest 4 x 3 rectangle is inscribed. Then, using this 4 x 3 rectangle, the 16 x 9 aspect ratio is drawn using the common head room approach.

Method 3. Until now, photographing in the 4 perf (4 perforations per frame) system was the norm. However, as an alternative, the 3 perf system is another viable system being used today (Fig. 11). In this 3 perf system, as the term implies, the system pulls down 3 perfs per frame rather than the standard 4 perfs. This means 25% savings in negative and printing costs and 33% more shooting time. These cost savings, if deemed substantial, should be considered as an alternative method.

In the 3 perf system, the 16 x 9 format is photographed and the 4 x 3 format is taken from it using the same height, i.e., 4 perf Method 1. When photographing in 3 perf, note that because the camera aperture is limited to 0.980 x 0.546 in., the common head room format, as described in Method 2, is not recommended; but this will be left to the discrimination of the user.

For the 4 perf 16 x 9 format, the ground glass is marked 0.945 in. wide x 0.531 in. high, and the 4 x 3 is shown as 0.708 in. wide x 0.531 in. high, which is the same as the 16 x 9 format. For the common head room format, as described earlier, the dimensions are as follows: 4 x 3 (1.33:1) will be 0.832 in. wide x 0.624 in. high; and 16 x 9 will be 0.832 in. wide x 0.477 in. high. For the 3 perf system the 16 x 9 format will be 0.910 in. wide x 0.511 in. high; for the 4 x 3 taken from this, it will be 0.681 in. wide x 0.511 in. high. (Table 2.)

As you can see, there are several alternatives that can be considered to achieve "Shoot for Today and Tomorrow." The one that is adopted will depend on choices made by the craftsmen of our industry.

Until now, Super 16 has not been mentioned as an alternative to shooting in 35mm as origination. However, it needs to be presented so that decisions can be made using all of the available data. The negative area that is being scanned today for 16 x 9 from Super 16 is 0.470 x 0.264 in. This figures out as Super 16 having an image area of 0.124 sq. in. compared with Super 35, 3 perf, 0.910 x 0.511 in. (0.465 sq. in.) and Super 35, 4 perf, 0.945 x 0.531 in. (0.502 sq. in.).

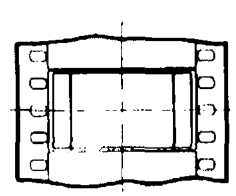
- Super 35, 3 perf is 3.75 times larger in area than Super 16.
- Super 35, 4 perf is 4.05 times larger in area than Super 16.

Given these alternatives, all of the pros and cons have to be evaluated:

1. Can the 16 x 9, with the 4 x 3 extracted from its center, be composed suitably so that the work of the cinematographer can be properly appreciated in today's market?
2. Will the producers see far enough in advance to shoot for tomorrow?
3. Will the creative community take to this format of protecting for tomorrow?

Today and Tomorrow

The biggest question that producers will have to answer is why they made the format choice for their shows. We all are aware that in the interim period, before 16 x 9 is fully implemented, the shows are going to be aired simultaneously. Does this then mean that Method 1 and Method 3 can be aired simultaneously in the 16 x 9 format so that viewers owning older monitors can view the 4 x 3 image and viewers owning new monitors can view the entire 16 x 9? If Method 2 is chosen as the production method, does it mean that both the 4 x 3 and the 16 x 9 image that is taken out of the 4 x 3 image (Fig. 10) have to be broadcast separately (one as 4 x 3 and



3 PERF
1.78:1, & 1.33:1

1.78:1 TRANSMITTED .910 X .511 = .465 SQ"
1.33:1 TRANSMITTED .680 X .511 = .347 SQ"

Figure 11.

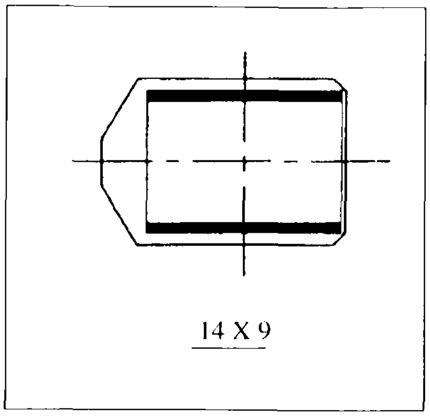


Figure 12.

the second as 16 x 9) and not simultaneously, thus adding to the cost.

Here, we should pause a minute to consider what is going to be taking place in this interim period until the 16 x 9 format becomes a *fait accompli* in the U.S. (Fig. 12). Hopefully, it will mean that the entire 16 x 9 broadcast image will be seen on monitors of tomorrow much as the computers are doing today, so that the problem of underscanning no longer exists. For 4 x 3 monitors, this 16 x 9 image will be seen letter boxed, which means a loss of 5% on each side (underscan) would still have to be taken into account. In essence, instead of viewing a 16 x 9 image on the 4 x 3 monitor, an aspect ratio of 14.4 x 9 would be seen (using 5% loss on each side). Therefore, when shooting today, be aware that TV Transmitted and TV Safe are going to be around for many years and should be thought out for tomorrow's production.

I certainly hope that this information has provided some food for thought and will prove helpful in the future when the time approaches to make the best decision based on available information to "shoot for today and tomorrow." By the way, "tomorrow is today."

Conclusion

This paper has concentrated on showing how the captured image on the negative is utilized and then seen, albeit in our theaters or on our television monitors.

For theatrical exhibition, the captured anamorphic image for projection of 0.825 x 0.690 in. (0.569 sq. in.) compared to that of Super 35 0.945 x 0.394 in. (0.372 sq. in.) shows that it is 53% smaller than the anamorphic image. However, the most telling difference is when both images are projected in the newer theaters of today—some having screens 30 ft high.

In the text, it is noted that on a 25 ft high screen, the Super 35 image was magnified 761,042 times (25 x 12 ÷ 0.394), an area increase of 579,762 (761.42 squared). The anamorphic originated image was magnified 434.78 times (25 x 12 ÷ 0.690), an area increase of 189,034 (434.78 squared).

On a 30 ft high screen, the Super 35 image is magnified 913,780 times (30 x 12 ÷ 0.394), an area increase of 834,857.89 times (913.70 squared). For the anamorphic originated image project on the same 30 ft high screen, the magnification is 521.74 times (30 x 12 ÷ 0.690), an increase of only 272,211.72 compared to that of the Super 35 image of 834,857.89.

Recommendation

All of the questions regarding use of the captured image and how it is seen on the screen have been explained. It is left up to the user determining the final presentation to consider the following before production:

- Is the image desired produced by shooting with shorter focal length lenses and their inherent problems of perspective?
- Has the inherent increase in grain size been taken into account?
- Are the laboratory printer lenses being considered?
- Is the extra cost for the optical printer accounted for?
- Is the fact that there will not be an original negative for making prints considered? Keep in mind that there is a fall-off whenever an optical printing step has to be included (no lens exists that gives 100% replication).

With all the above to consider, my recommendation is to keep in mind that "Size Does Matter!"

THE AUTHOR

Tak Miyagishima joined Panavision in 1955. His projects include Ultra Panavision 70, Super Panavision 70, Panavision 35 anamorphic system, plus Panavision's many innovative cameras and systems. Under his guidance, the company has been honored, from 1955 to the present, with two Academy Awards of Merit (Oscar); in 1978 for the Panavision Panaflex Motion Picture Camera System, and in 1994 for the Anamorphic Taking System. Panasonic has also received numerous Scientific and Engineering Awards and many Technical Achievement Awards. Miyagishima is on the main Scientific and Technical Awards Committee of AMPAS.

He was the recipient of SMPTE's Fuji Gold Medal in 1991. His involvement with SMPTE includes serving as a member of the Projection Technology Committee, the Working Group on Telecine Practices, and the Committee on Film Technology.