2 March 1961

MEMORANDUM FOR: Chief, TISD

SUBJECT: An Analysis of the Logistics of "Cinemat"

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1. I have, as a result of considerable discussion within PIC on the subject of "Cinemat", undertaken a brief analysis of some of the logistic details required to operate the proposed system. I have used, as a basis for my analysis, a Staff Study entitled "Cinemat", prepared by [redacted] That Study proposes a multi-stage approach to the total "Cinemat" system. I shall deal primarily with the film supply problems that would result from the adoption of the first two phases of this system.

2. Phase One, as set forth in the subject Study, envisions the re-recording, only once, on 35mm film at a 2X to 4X magnification of each point on an input. To elaborate then, let us consider a possible input which would consist of 10,000 linear feet of 10" film per week. If this input may be assumed as reasonable, we may extrapolate as follows:

a. 10,000' x 10" weekly film input.

b. Multiplied by 4X (the "Cinemat" magnification factor) equals 40,000' x 40" per week film required for the "Cinemat" record.

c. Since 35mm film is 1.3" wide, we then have a requirement for 30 lengths (40" ÷ 1.3") of 35mm film, each length being 40,000'.

d. This amount of film represents approximately 240 miles of 35mm film required per week by the first phase "Cinemat" concept.

e. In 1200-foot spools, this 240 miles of film represents 1056 rolls of film per week. This is equal to approximately 10,560 pounds of film per week, and at [redacted] per roll STATINTL equal to [redacted] STATINTL

f. This represents an amount of film roughly [redacted] miles in length and one hundred and seventy three feet in width. (ANNUALLY)

3. If Phase Two is to be considered, our results suffer a marked change. Phase Two proposes that each point on the input film will be recorded 240 times. This number of frames results if you accept ten

seconds as the optimum average viewing time for an area and multiply that ten by the 24 frames per second of a movie projector. Let us accept 240 as a valid number, and to determine its affect on our earlier calculations, we need only multiply our Phase One results by 240. We get for our results:

a. 253,400 1200-foot rolls of film required per week.

b. 2,534,400 pounds of film per week.

c. 126.7 ten-ton truck loads of film per week.

d. 13,178,880 rolls of film per year.

STATINTL e. [redacted] of 35mm film per year - exclusive of waste.

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[redacted]

STATINTL PIC/TISD: [redacted] :jem(3591)

Even if the concept were off by a factor of 100 it amounts to

STATINTL [redacted] a year for film alone.

Are we ready for this?

tuse

4 March 1967

STAFF STUDY

CINEMAT

Evolution: An orderly step-by-step procedure utilizing in-house equipment as much as possible, supplemented by off-the-shelf equipment utilized by the movie industry today; not, revolution: A complete revamping of all systems.

Coming into being and on the horizons are many new collection systems, each with its own format size and all with ever increasing resolving capability.

Cinemat is a method of viewing to be used exclusively in 1st phase PI, partially in second phase PI, and about 50% of the viewing time in third phase PI. It is to be used as a part of the PI Cell.

1. THE PROBLEM

To enable the Photo Interpreter to view this multi-dimensioned photography to the limit of its respective resolution, as expeditiously as possible, with one viewer and when stereo is available to view the photography in stereo.

2. FACTS

A. Formats will be delivered in the future of dimensions from 70 mm to 10 inches with lengths from square to 60 inches.

B. Hi-Quality projection lenses for viewers which cover the larger formats are non-existent and if developed would be extremely costly.

C. A complete new family of viewers for each format should be made, or Cinemat, a new method of viewing which would take all formats.

D. When larger formats are scanned using a lens that does not completely cover the format it is difficult to assure that all photography has been viewed.

E. It is impossible for the first phase PI team to view the photography in stereo because of the time involved to find the conjugate images. Even second phase teams sometimes miss stereo pairs because of the non-standard methods of overlay.

F. Signal to noise ratio integrations of multi-recordings of the same image is now a proven fact. Motion picture projection is an inexpensive, rapid means of utilizing this phenomena.

G. Existing special effects optical printers utilized by the movie industry already have Koehler illumination and can be easily modified to provide phase contrast or spatial filtering image enhancement. They also are equipped to provide lap dissolves or fades which, to the Photo Interpreter, are density cuts and is another proven system of image enhancement. In addition, these printers are pin registered to + 2 microns.

It is recommended that the equipment to be procured to produce Cinemat be located in TISD, the printers in a dry lab, and the processors in the DMD lab. It is further recommended that the phasing to Cinemat be as follows:

PHASE I

1. That special effects printers be procured and modified to (a) Accept 70 mm to 10 inch format photography; (b) provide phase contrast or spatial filtering; (c) completely "mechanically scan", section-by-section, any format and punch a tape or optically record (similar to sound tracks) in order to relocate on the original format any of the sections recorded.

2. The printer to initially be operated at 2X a section at a time. By correlating the image quality meter the exact enlargement ratio can be determined anywhere from 1X to 4X, thus preparing the film to be enlarged to the limit of its resolution.

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3. The film to be viewed statically, a section at a time, on the modified in-house [redacted] viewers at either 10X in the case of 100 l/mm photography or 20X for 200 l/mm photography, thus enlarging the original take to the limit of human perception.

4. That three viewers be procured to present maps at scales 1:5,000,000 1:1,000,000 and to present the entire format of the photography utilizing the punched tape to drive a presentation of the frame format on the 1:5,000,000 and 1:1,000,000 presentation and to drive a cursor locating the section being viewed. This device can be made to operate well within the state of the art if the frame can be accurately located and described geometrically.

PHASE II

1. That each section of a frame be recorded 240 times, thus giving the PI 10 seconds viewing per section. When longer viewing time is required, either the section in question may be viewed: (a) Stop frame; (b) By running the projector backward, then forward, giving 30 seconds viewing time of any given section; (c) By making a closed loop clip of the section and running it continuously until the PI has completed his analysis.

2. That pin registered motion picture projectors be procured to project the film. This will give the PI his first dynamic viewing, allowing density cuts and enhancement techniques to be used.

PHASE III

Program computor to mathematically locate all areas with conjugate images. Command the printer to obtain stereo coverage; now the PI will be able to study all areas in stereo that are so covered.

PHASE IV

Program computor to command printer to not print those areas with redundancy or those areas with recent cover where no changes have occurred.

3. CONCLUSIONS

1. Phases I and II can be developed rather rapidly with Phase III following along in an orderly manner. Phase IV would be a matter of two to three years to develop but is within the state of the art and can be developed as soon as complete coverage once exists, and information is arriving at such a rate that makes this phase feasible.

2. Additional manpower required to operate such a system would consist of no more than five personnel. Four men to operate four printers and one man to operate two motion picture "Processors".

3. The cost of the Phase I portion of Cinemat, including 4 printers and 2 processors with modifications, is estimated at [redacted] That of STATINTL
STATINTL Phase II at [redacted] per projector needed. Phase III and IV cannot be estimated at this time.

4. Many questions remain to be answered and it is hoped that with the help of people in the motion picture industry these answers will be found. Some of these questions are:

a. What format should be used - 35 mm or 70 mm?

b. What projector should be used, or does this require a new design?

c. What existing lenses may be used to give 200 l/mm capability?

d. Will existing motion picture processors accord the film proper handling?

e. Can all modifications to existing equipment as suggested above be accomplished?

f. What type of computor will be needed for Phase IV? Is it available? What programs and information will it need and in what form?

g. Is the concept of Cinemat feasible in the eyes of the motion picture industry.

5. Proposals will be requested from various companies within the motion picture industry with the above courses of action as a guide to the preparation of the proposals.

[redacted]

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