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Motion Picture Industry Conversion from Film to Digital Technology

Systems Engineering Integrative Project
LMU SELP
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1. Objective Statement

- Show that a Systems Engineering approach can benefit the movie industry's conversion to a digital platform.
- SE management techniques can help coordinate the industry's conversion to a digital platform

2. Background

- Movie industry is currently in transition
 - About 10% of national theaters are purely digital, and growing.
 - Growth needs direction
- Industry at a crossroads
 - Lack of direction towards standardization
 - Lack of cooperation within the industry
- Key Players

Key Players

- **Digital Cinema Initiatives, LLC (DCI)**
 - Created in March, 2002
 - Joint venture of the major studios; Disney, Fox, Paramount, Sony Pictures Entertainment, Universal and Warner Bros. Studios.
 - Primary purpose is to establish and document voluntary specifications for an open architecture for digital cinema that ensures a uniform and high level of technical performance, reliability and quality control.
- **The National Association of Theatre Owners (NATO)**
 - Largest exhibition trade organization in the world, representing more than 29,000 movie screens in all 50 states, and additional cinemas in more than 40 countries worldwide.
 - Membership includes the largest cinema chains in the world and hundreds of independent theatre owners.

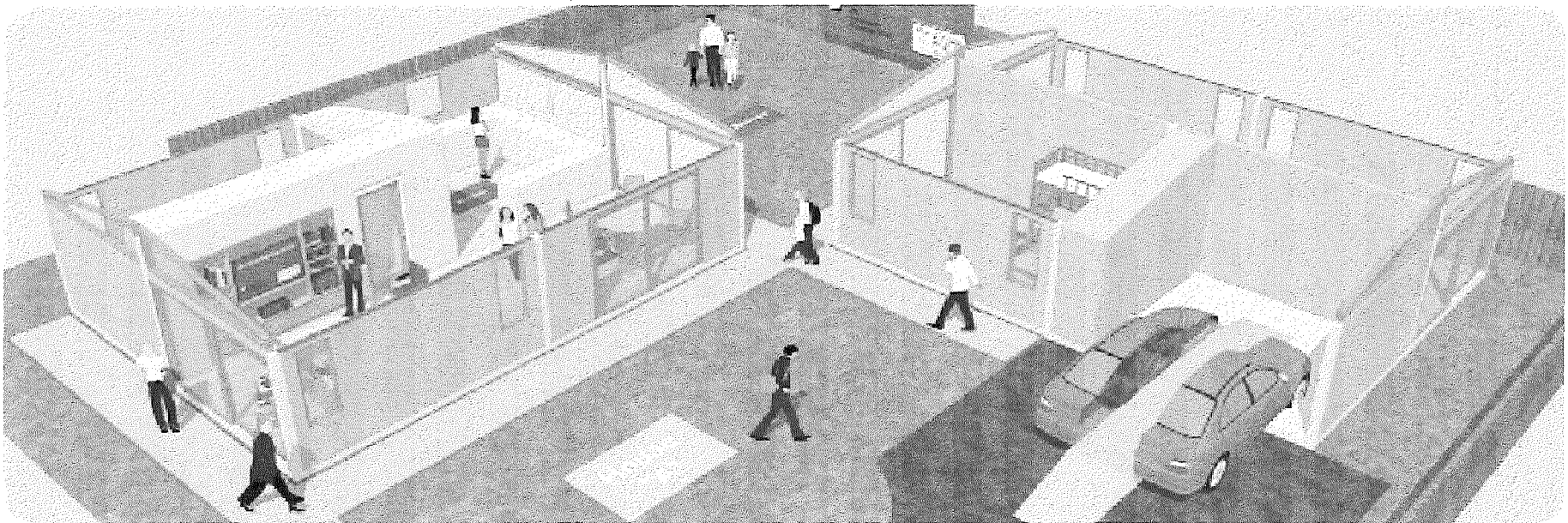
Key Players

- Entertainment Technology Center (**ETC**)
 - Non-Profit Research and Development Center
 - Brings together the top entertainment technology and consumer electronics companies to explore opportunities for new consumer entertainment offerings today and into the future.
 - Bring next generation consumers to the table to understand the impact of new technology on the consumer and all aspects of the entertainment industry
 - Promote technology development and implementation, the creative process, and existing business models.
 - Anytime/Anywhere Content Lab (**AACL**)

Key Players

- **AACL**

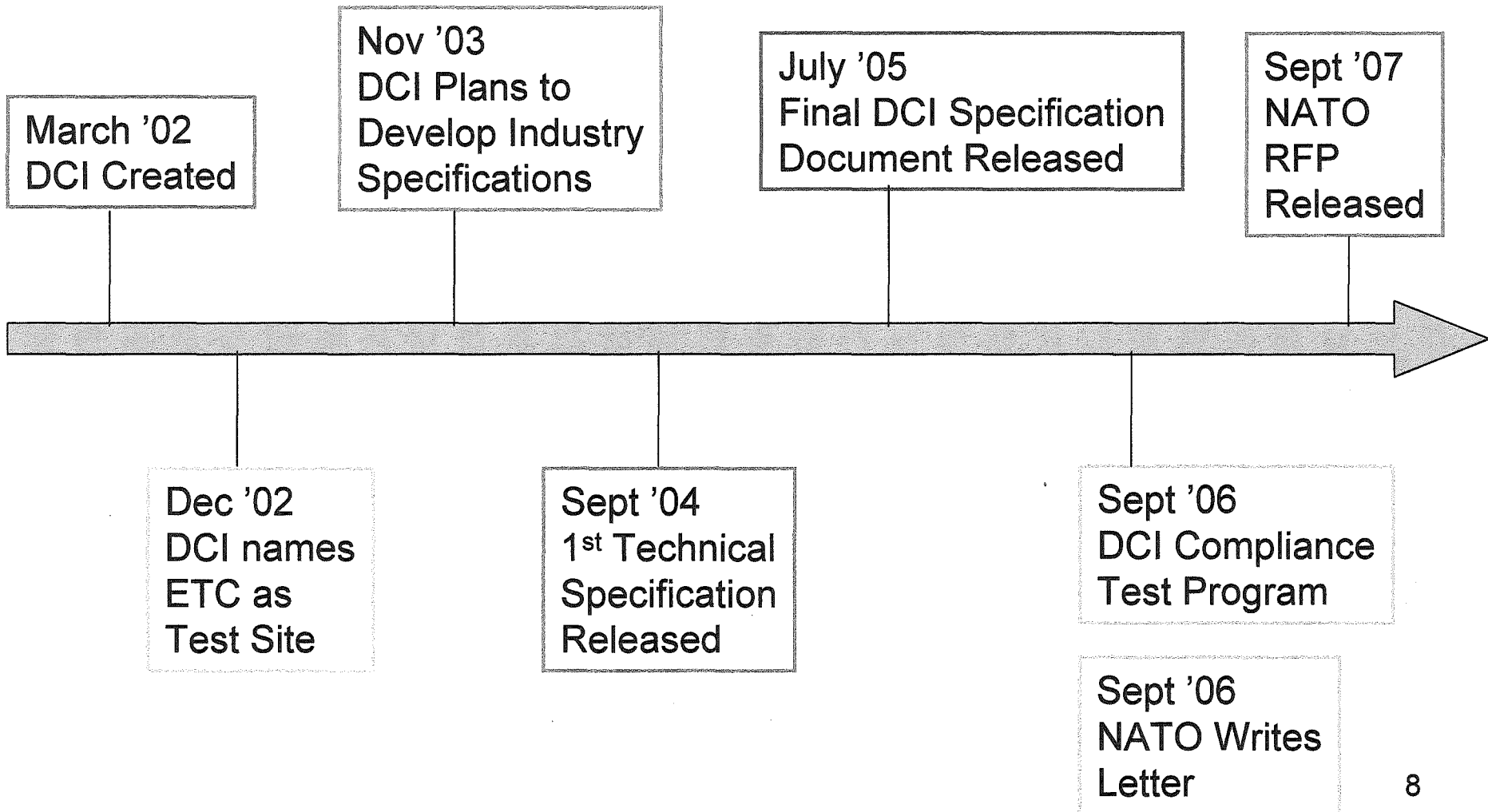
- A modular, state-of-the-art, research and testing site where the industry can explore how consumers interact with high-quality entertainment in an integrated environment.
- Is neutral to the technology outcome
- Works with university students to provide the next-generation-consumer POV
- Has studio sponsors with access to one-of-a-kind resources including professional content.



Key Players

- The Society of Motion Picture and Television Engineers (**SMPTE**)
 - Leading technical society for the motion imaging industry.
 - In 61 countries worldwide.
 - Members include engineers, technical directors, cameramen, editors, technicians, manufacturers, designers, educators, consultants and field users in networking, compression, encryption and more.
 - Publishes ANSI-approved Standards, Recommended Practices, and Engineering Guidelines, SMPTE Journal and its peer-reviewed technical papers.
 - SMPTE holds conferences and local Section meetings to bring people and ideas together, allowing for useful interaction and information exchange.
 - **Developing industry standards**
 - **Enhancing education through seminars, exhibitions, and conferences**
 - **Communicating the latest developments in technology**
 - **Promoting networking and interaction**
 - Historical Perspective
 - Military background.
 - Created to bring in the new era of motion pictures, and eventually television.

Historical Events in DC Development

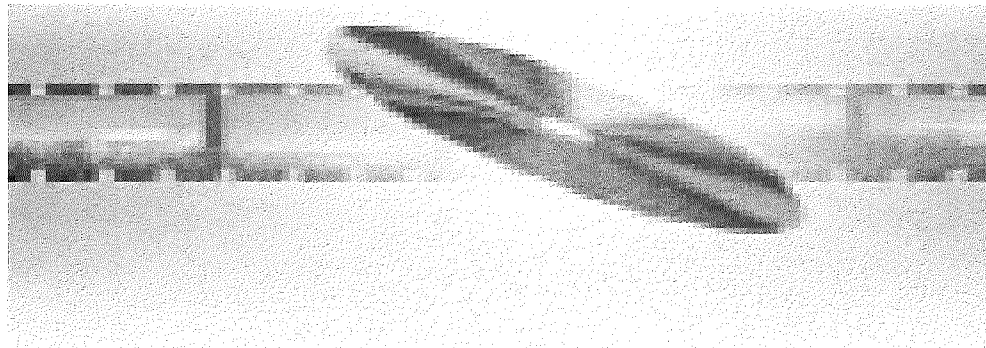


3. Issues

- Conversion to DC has created a number of issues
 - Standardization
 - Current standards created by DCI
 - DCI is commercial technical consultant, funded by major studios
 - DCI Compliance Test Program
 - Current test plan has not been proven
 - Interoperability
 - Non-existent with established standards and testing
 - Some successes and some failures
 - Finance
 - Who will pay for all this?

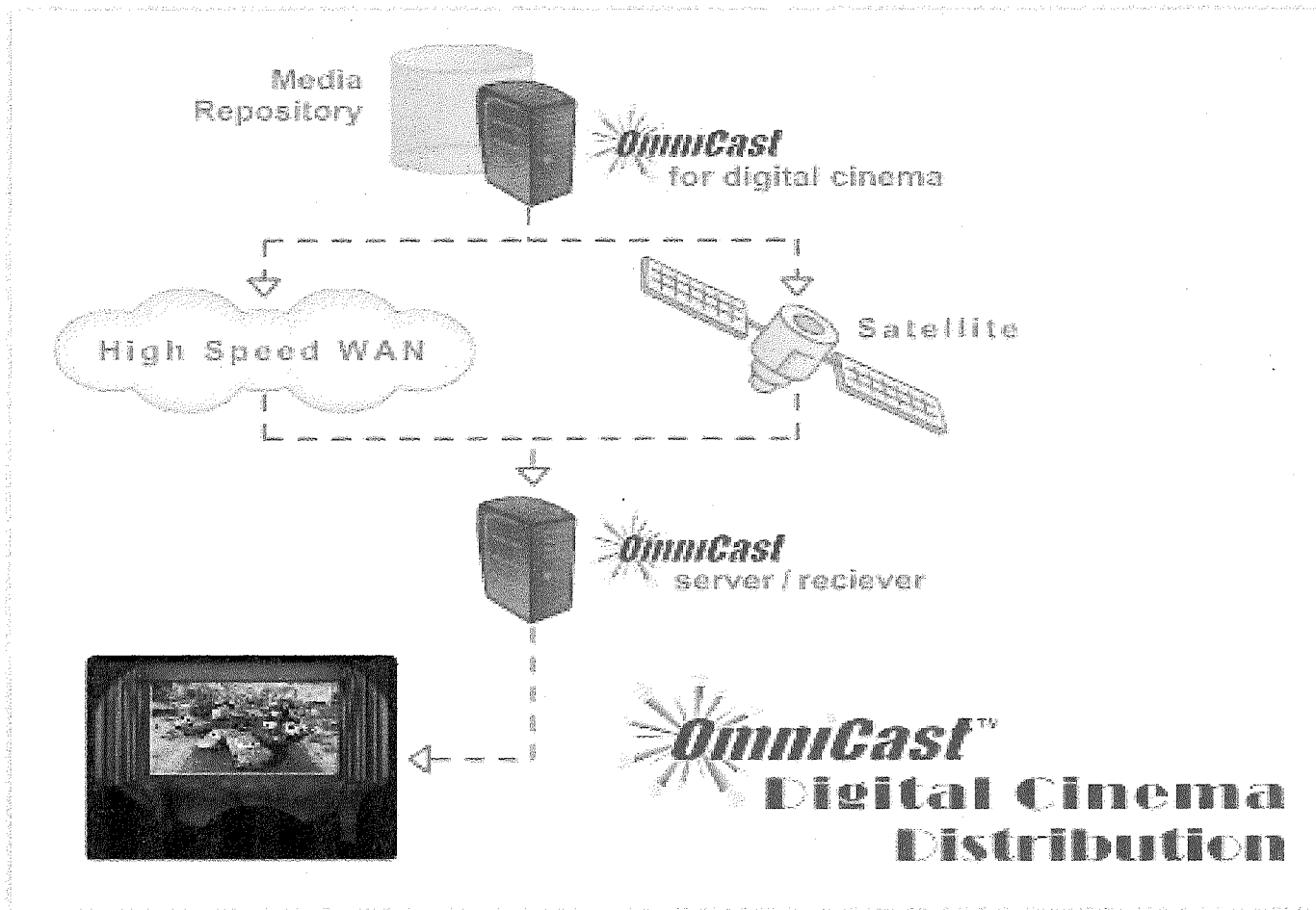
4. Description of Processes

- Technology developments in the movie industry have matured to the point of implementation.
 - Digital image compression



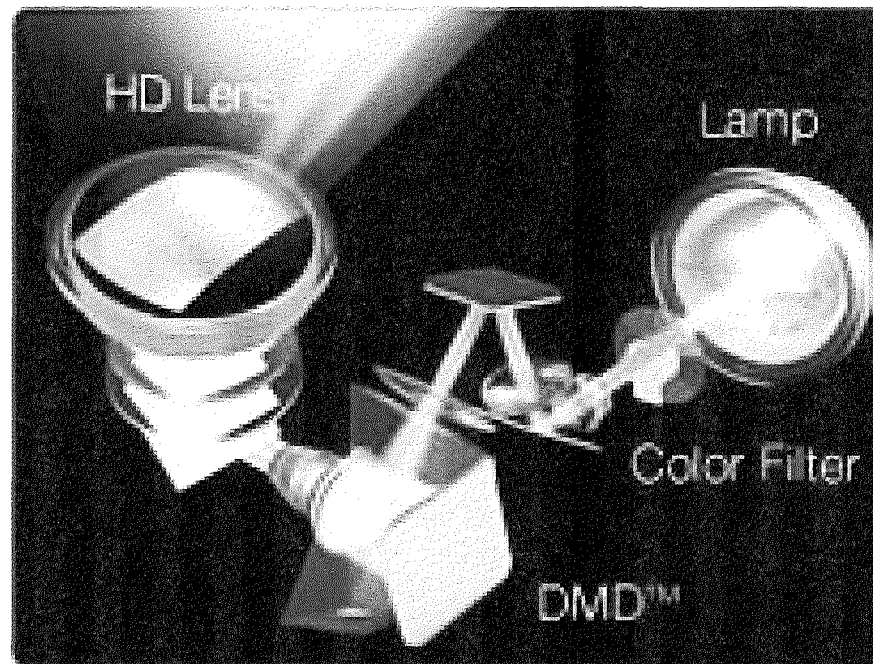
4. Description of Processes

–High-speed data networking and storage



4. Description of Processes

- Advanced digital projection



The Technology is There

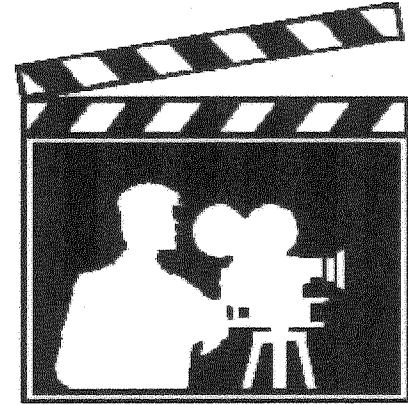
- Digital Image Compression
- High-Speed Data and Networking
- Advanced Digital Projection

Overview of Processes

- 3 phases of movie making
 - Production
 - Distribution
 - Exhibition

Production (Video Capture)

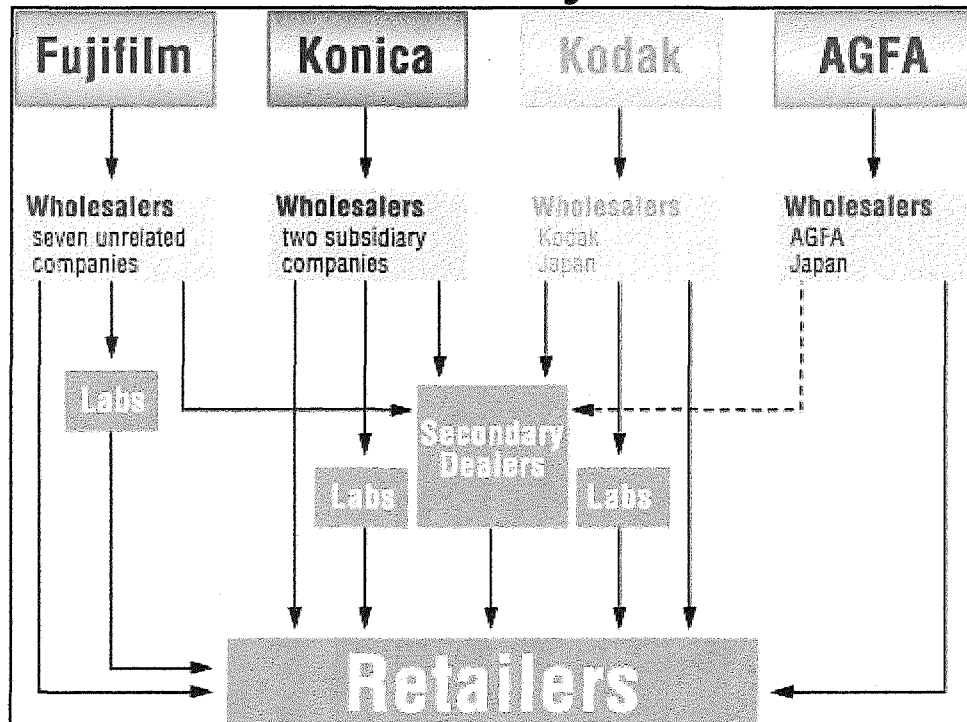
Production is the actual making of the film. Cinematographers, camera operators, and gaffers work together to capture the scenes in the script on film. Cinematographers compose the film shots to reflect the mood the director wishes to create.



- It is in this phase that there may be considerable impacts to future production depending on which technology is used.
- It depends on which type of movie camera will be used; a traditional film camera or a digital camera.
- These will be examined to show the advantages and disadvantages of each.

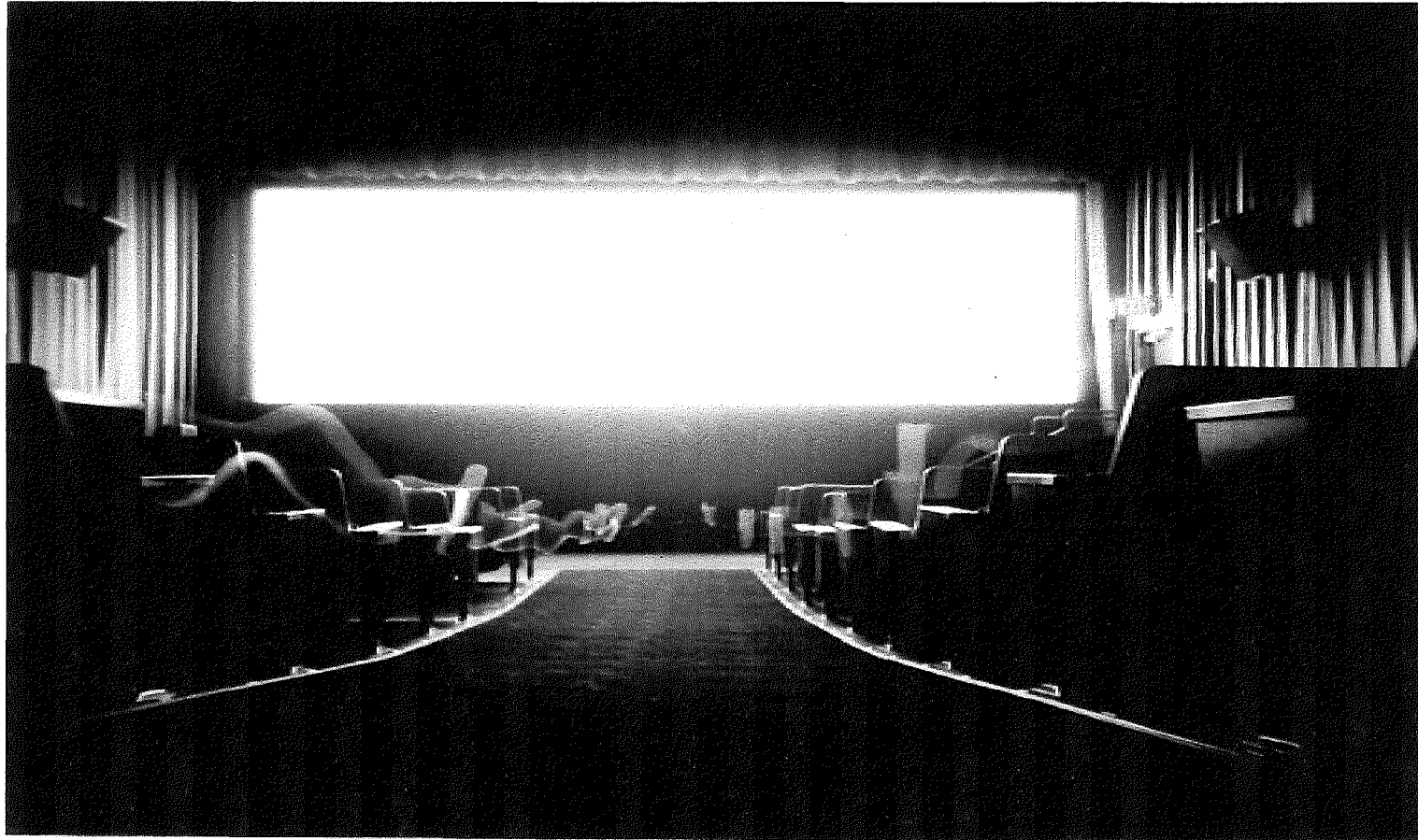
Distribution (Content Delivery)

- Movies are printed and delivered to theaters internationally.

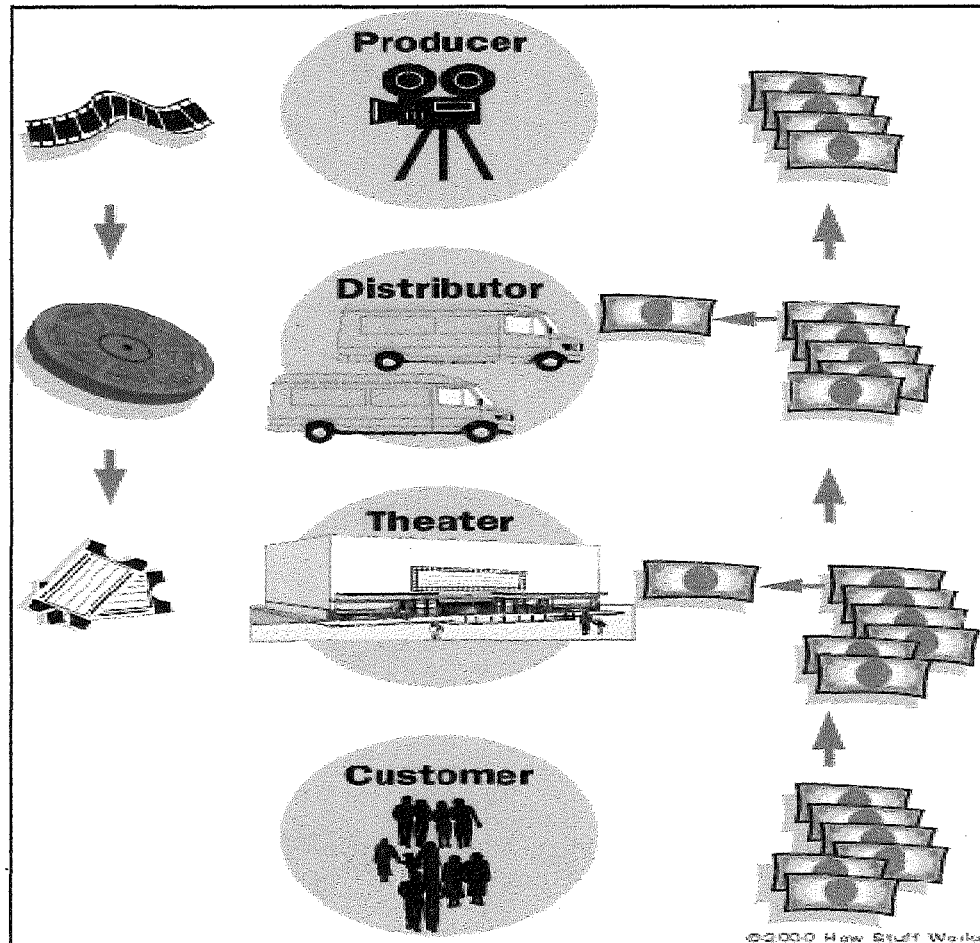


Exhibition

- Movie Projection



System View



5. Trade Study of Technologies

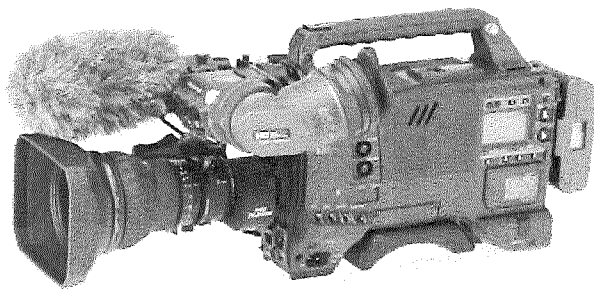
- Is DC worth the effort and development cost?
- The two technologies present a unique situation given that 35 mm film has evolved over the last 100 years.
- In contrast, DC is in its infancy with little experience and lacks an agreed upon architectural baseline
- However, the presumed potential benefits of DC are enough to gain industry interests.

Video Capture

- Acquisition for both film and digital movies differs mainly in the method of video capture.

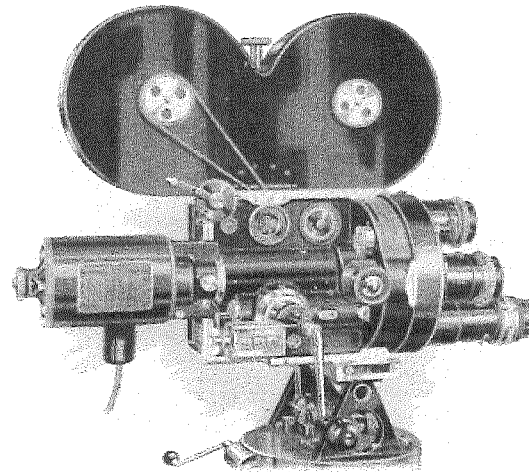
Digital Cameras

- No film reel
- Files require data transfer and storage
- Security issues



Film Cameras

- Film reel requires humidity and temperature control
- Massive storage for film reels
- 1 movie is approx 10,000 ft of film



Elements of optical system: viewing, patch-plate, window and prism, focusing mechanism.

Distribution

- **Physical Delivery or Data Transfer**

Digital Distribution

- VPN
- Satellite
- Security Issues
 - Keys and Encryption
- Easy entry into industry for independents
- Low Overhead
- Global Availability

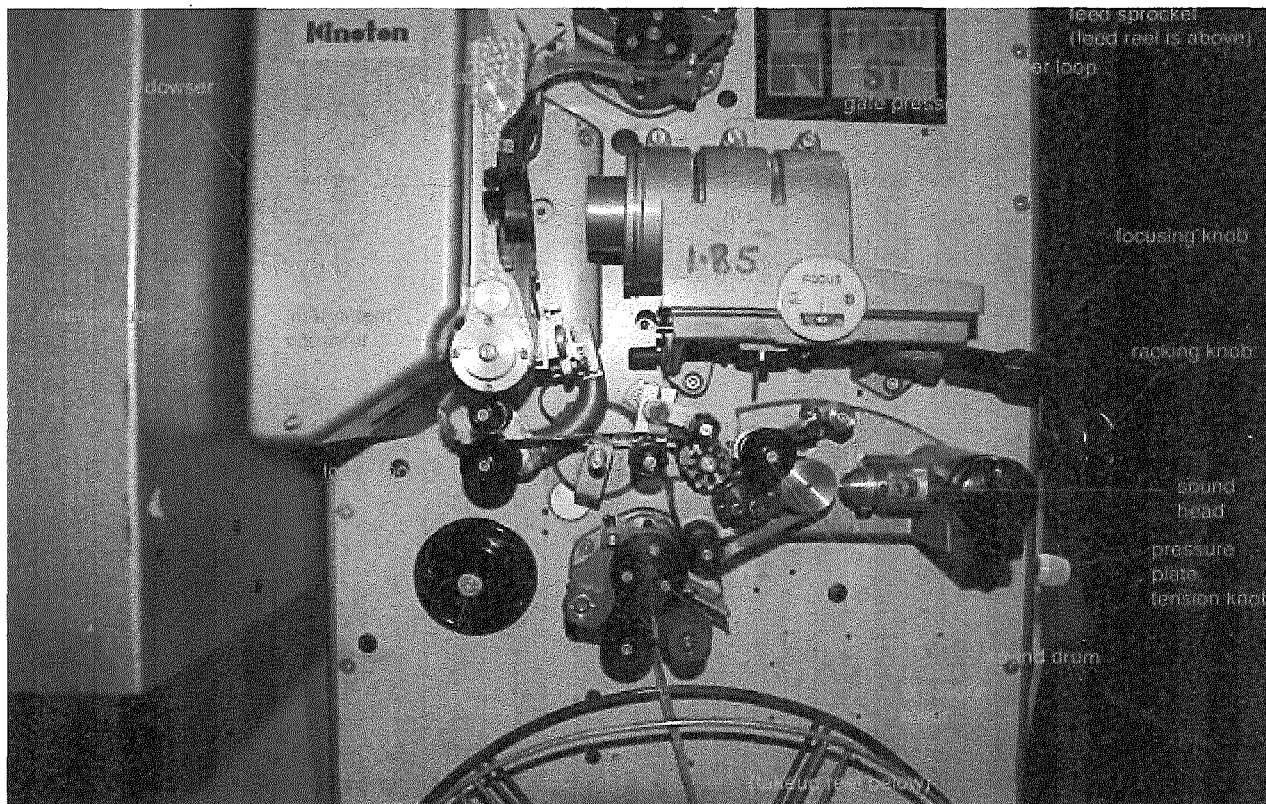
Film Distribution

- Physical Delivery
 - International
- No Data Security Issues
- Massive Storage for Film Reels

New security issue for both methods is the hand-held V-Cam

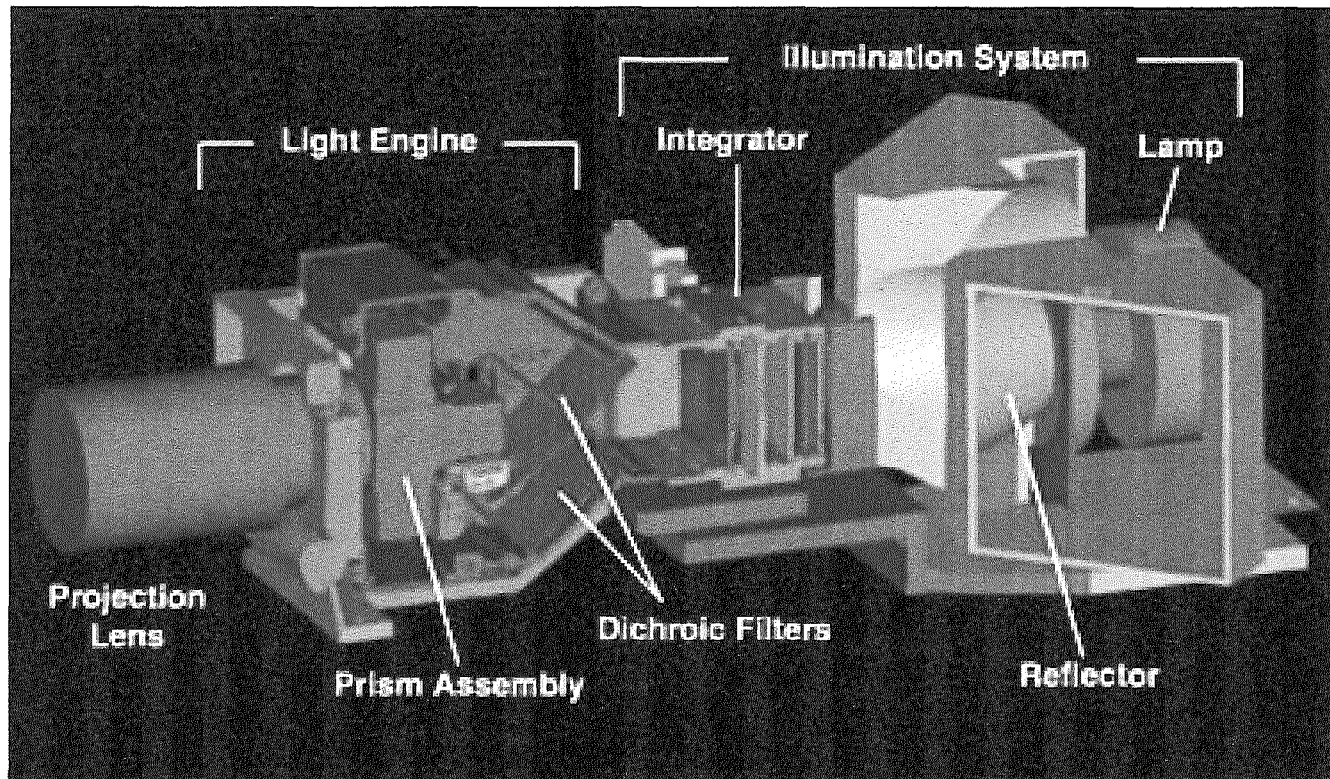
Exhibition (Projection)

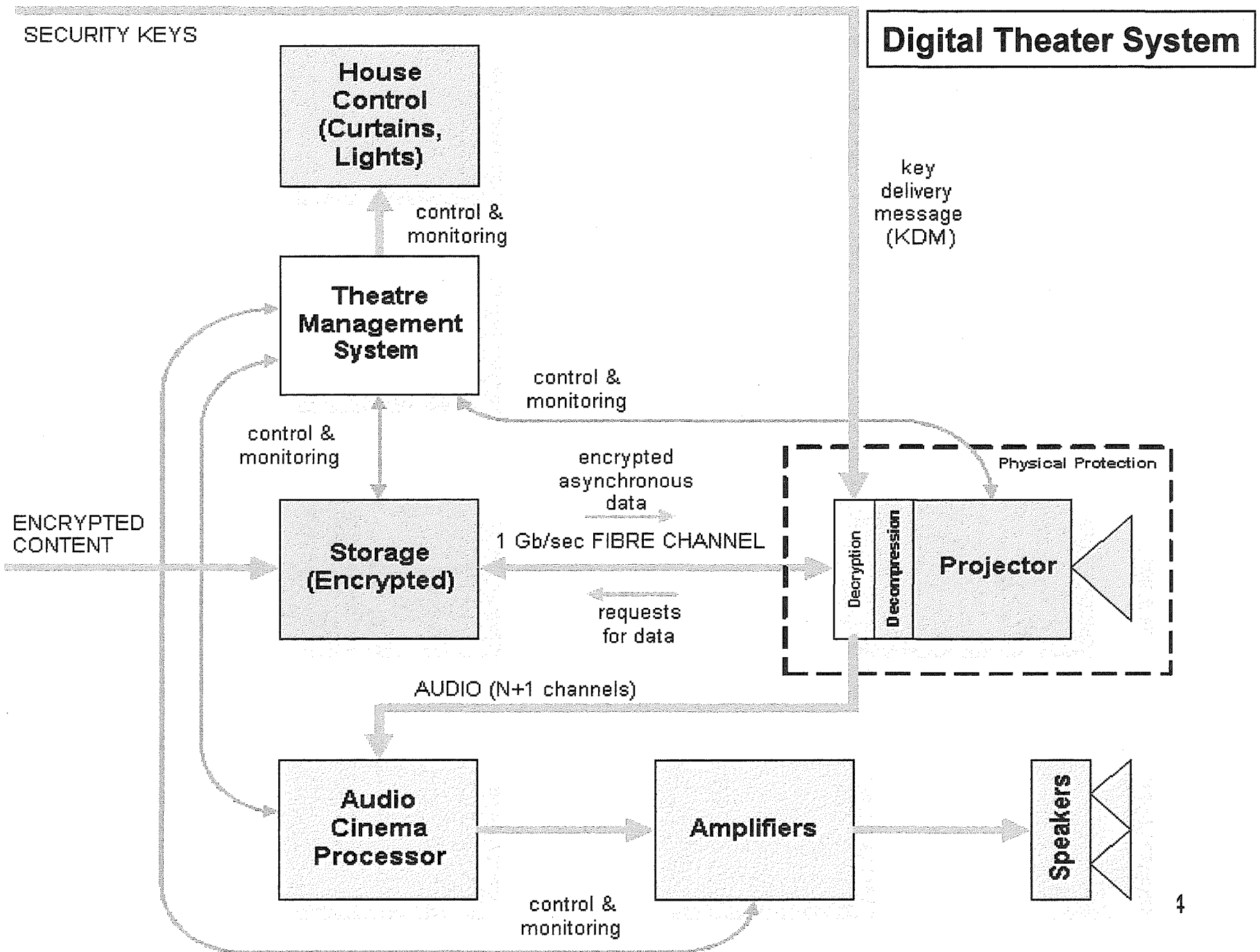
- Film Projection
 - Requires loading of film reels for each movie in each theater
 - Projectors require mechanical maintenance



Exhibition (Projection)

- Digital Projection System
 - Very low mechanical maintenance
 - No physical loading of film reels





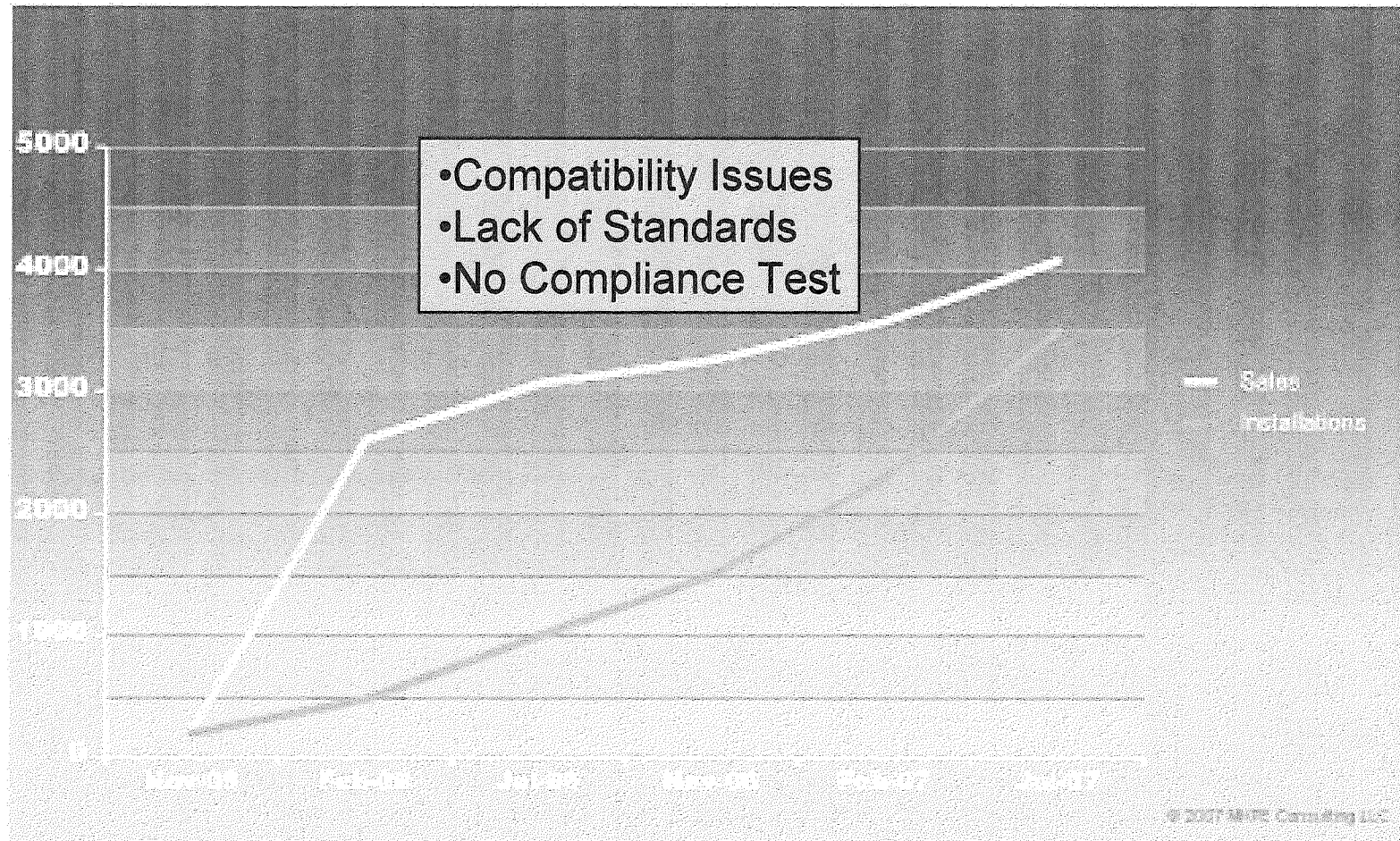
Cost

- Christie CP2000 Digital DLP Cinema™ projector
- Core Projector.....\$68,000
- Projector Stand.....\$2,000
- Lenses.....\$8,000 to \$11,000
- Lamps.....\$2,000 to \$10,000 (extra lamps required)
- Filters (one per Lamp).....\$100
- **Total.....\$81,000 to \$94,000 per Theater**

- **Christie CP 2000 Server.....\$30,000**

- Projectors can only project on one screen at a time.
- Moderate prices only account for the HW;
 - SLAs, security issues, upgrading new equipment, maintenance and repair, and training new technicians, Theater Management Systems.

Sales Growth Stabilized



Is DC worth the effort and development cost?

- YES
- Considerable cost savings to be realized
- Considerable sales growth
 - After standards issues are mitigated
 - After compliance testing program

6. Application of SE Process

- SE approach can help direct the conversion to a digital platform
- Thorough review of the industry
- Requirements are generated within the industry and reviewed for implementation.
- A trade study was performed to show that the current technology is mature enough to proceed in converting to DC.
- An SE approach dictates that once the requirements are established, or in this case everyone agreeing on converting to a digital platform, there should be a well documented and agreed upon process to make this conversion a reality.
- A SE approach will reach out to all stakeholders to consider upstream and downstream supply chain decisions. This is the key to the future success of such an endeavor.
- In evaluating the many different organizations, I found that they lack the cooperation required to establish a uniform set of processes.

7. Recommendations

- Need to establish an objective non-profit organization representing the industry.
- Financed by the industry or government
- Represent all stakeholders.
- Need more involvement from SMPTE
 - No comments on their behalf
- Better use of ETC

IPT Structure

- Define expectations of each stakeholder
 - Develop Memorandum of Understanding
 - Work on interface specifications
 - Open lines of communications
- Concurrent Development
 - Standards that all agree upon
 - Compliance Testing Program
 - Equipment Interoperability Issues
 - Financing-should be a shared venture

Lean Practices

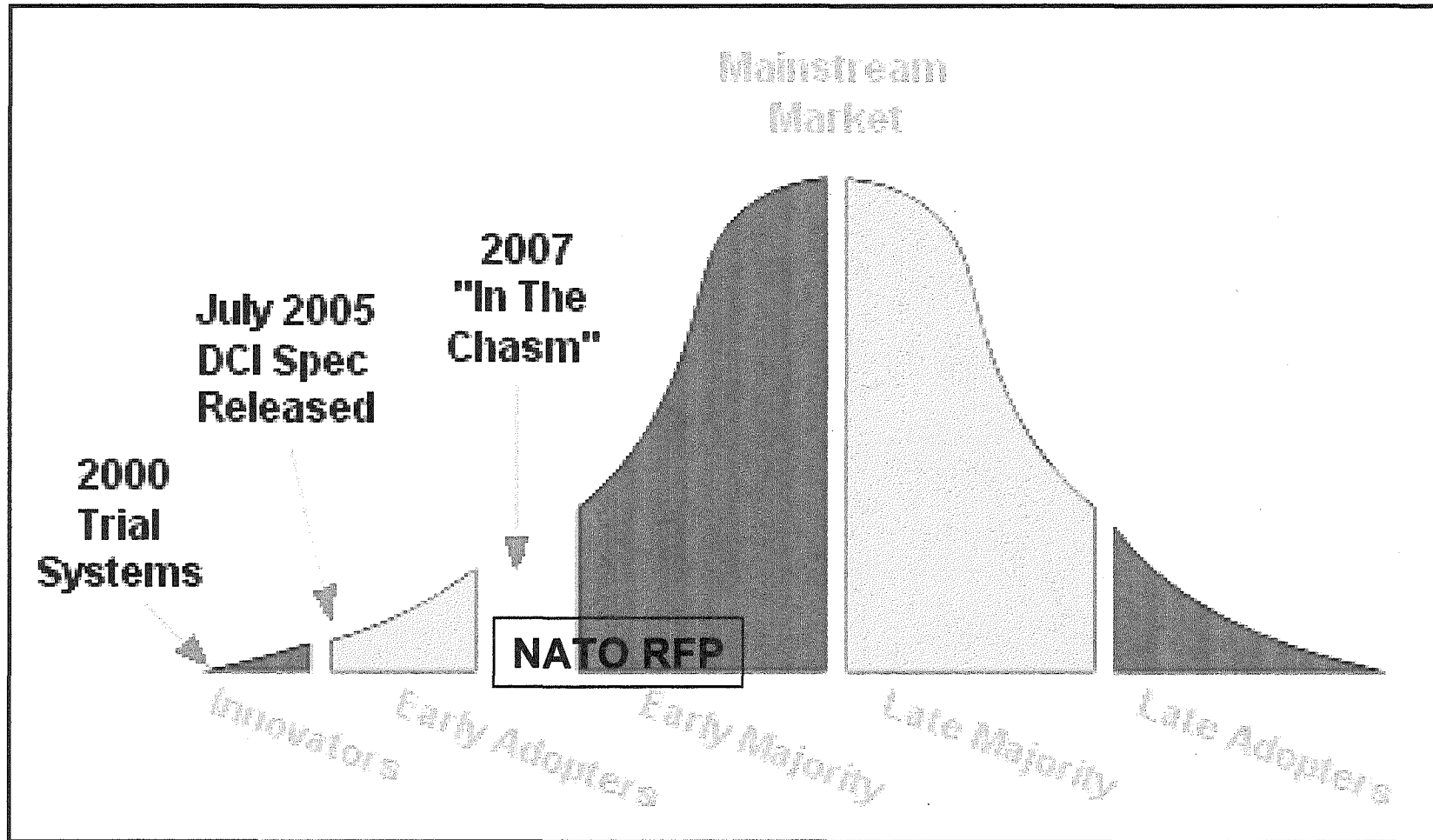
- Educate the industry
 - Avoid batch and queue using Flow discipline
 - Ensure smooth transitions between different processes, milestones, and phases.
 - Avoid any unnecessary delays that can create a ripple effect on subsequent tasks.
 - Review of upstream and downstream events will reveal any potential “glitches” in the system.

Lean Practices

- Perfection
 - Open ended process of evaluating the current processes and how they can be improved upon.
 - Standardization and interoperability of equipment will continue to evolve as new technologies are developed.
 - Review what is successful and what fails.
 - Modifications can be made where it is appropriate and most beneficial.

8. Conclusion

- Up-front SE approach can help change the culture of the industry to open lines of communications and help organize the shift in technology
- DC is young, the problem scenario above will eventually be solved, but it will require a degree of working together that has yet to be nurtured in this industry.
- SE will help to expedite improved systems and an improved supply chain.
- This requires bringing chain suppliers, system providers, manufacturers, exhibitors, and studios together to identify problems, to identify solutions, and to implement them.
- The goal is to distribute single-inventory movies internationally with the same essential functionality that we have today with film.
- Looking forward



Digital Cinema Technology Adoption Curve