

The Accessibility Of a Super 8 Film Camera



Request For Proposal

— T23 —

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0. Abstract

The aim of this opportunity is to develop a mechanism that will afford the use of an analogue Super 8 Camera for those with physical disabilities in association with The Liaison for Independent Filmmakers of Toronto (LIFT). LIFT is an artist-run organization that provides equipment rentals, filmmaking classes, and serves as a community hub for independent filmmakers [1]. They are dedicated not just to affordable access to filmmaking, but also to the accessibility of filmmaking for people from all walks of life [2]. LIFT currently provides these services for both digital and analogue filmmaking [1]. Analogue film, which is created from the traditional photochemical process, and which does not possess the technological convenience of new digital cameras, nevertheless has advantages that would merit its use in many applications.

One of the many programs offered by LIFT, is an exchange that provides disabled filmmakers the opportunity to learn and experiment with different filmmaking techniques [2]. Adam Cohoon, an independent filmmaker and current participant of the program, wishes to work in the analogue medium for an upcoming film project [3]. He is wheelchair bound and has limited use of his hands and arms as a result of cerebral palsy, which makes operating an analogue camera independently near impossible[4]. The opportunity presented is to design a solution that would allow users with physical disabilities to operate an analogue film camera directly from their wheelchair.

The primary stakeholders involved in the opportunity are LIFT, who are interested in providing accessible means of using analogue film cameras to disabled filmmakers in their program, and Adam, who is interested in making use of such a design for a specific film project. Other stakeholders include other physically disabled filmmakers who could have an interest in potential designs, Adam's mentors and assistants who work with him, and film camera manufacturers who may be interested in how their devices are outfitted for accessibility.

Potential design solutions should allow the user to operate the device as far as recording and turning the camera on and off, while taking into account the user's range of motion. In addition, the solution should alert the user as to when the camera is recording, as well as be applicable to a variety of chair designs whilst being directed to the user's field of view.

Reference designs exist for digital cameras, such as the GoPro that Adam currently uses on his chair, but they are not compatible with the operation of an analogue film camera, which is bulkier and requires more manual actions. Furthermore, other reference designs, such as wheelchair mounts, do not support the Super 8 film camera models nor assist the user in the operation of the camera. Thus, a design solution is desired that will address the objectives as outlined in this Request for Proposal.

1. Introduction

The Liaison for Independent Filmmakers of Toronto (LIFT) is a nonprofit organization dedicated to facilitating excellence in filmmaking [1]. They regularly provide workshops and courses on filmmaking, access to affordable equipment, as well as studio space for independent filmmakers to use in the development of their projects [1]. Adam Cohoon (Figure 1), himself an independent filmmaker, suffers from cerebral palsy [4], a movement disorder that does not allow for the manual operation of an analogue camera. Currently, he makes use of a GoPro camera used for digital film. However, Adam has expressed the wish to work in the older analogue medium [3], which to the experimental filmmaker, represents a different set of benefits and challenges. For this reason, the opportunity of this RFP is to provide filmmakers such as Adam with accessibility to an analogue film camera such as the Super 8. The solution must be adaptable to differing setups so as to provide future disabled members of LIFT an opportunity to also be able to use Super 8 cameras.

This document will provide the relevant information, including background, stakeholders, engineering requirements, and detailed objectives that are necessary for the development of engineering solutions to the framed opportunity.

2. Background

2.1 The Liaison of Independent Filmmakers Toronto (LIFT)

Founded in 1981, LIFT has become an important community hub for filmmakers both local and international [1]. It is one of the foremost organizations of its kind, and aims to promote and sustain the media arts by providing equitable access to equipment and services, no matter the filmmaker's experience, ability, race, gender, age, class, or sexuality [1]. While providing access to a wide array of analogue and digital platforms, LIFT is primarily known for its collection of unique and rare analogue technologies for filming and film processing [2].

LIFT provides many resources and programs to its members, one of which being an exchange program for disabled filmmakers, in which they strive to provide participants with the opportunity and experience to use a wide variety of film platforms [2].

2.2 Adam Cohoon

Adam is an independent filmmaker who uses an electric wheelchair for movement. He was born with cerebral palsy so he has limited use of his hands and arms [4]. He is a part of LIFT's film accessibility exchange program [2]. For the development of a new project he desires the ability to use a Super 8 camera for a film project that he will be pursuing in the future [3].



Figure 1. Adam Cohoon

2.2.1 Cerebral Palsy

Cerebral palsy is a motor degenerative disorder caused by brain damage as a result of neurological injury in early childhood development [5]. This impairs body movement and motor skills by affecting the muscles [5]. The extent and type of movement impairment can vary between individuals [5].

In Adam's specific case, he has no use of his lower body rendering him wheelchair bound, and has minimal use of his hands. His range of motion can be characterized by the limits of his wheelchair armrests. The dexterity of his fingers is impaired by the angles of his hands; hence, he can only iterate things around him with his finger joints on his left hand. He has a 120-degree range of motion from centre to left [3].

2.2.2 The Electric Wheelchair

The electric wheelchair that Adam operates weighs 315 lbs, and is capable of a top speed of 10kph [3]. His movement is controlled by a small toggle centred in front of his wheelchair. Since the wheelchair does not house a rear mirror, Adam is not fully aware of his surroundings behind him. The dimensions of Adam's chair, specifically, are as follows [3]:

- The armrest is 36 cm long and 6 cm wide
- The widest section on the back of the chair, between the two motor wheels, is 47 cm
- The height of the chair is 103 cm
- The widest section in front of the chair, between the two front wheels, is 36 cm
- The base of the chair, from front wheel to back wheel, is 117 cm
- The length between the two handlebars is 65 cm

*Refer to Appendix A and B for information on wheelchair stability [20]

2.3 Super 8 Film Camera

2.3.1 An overview of the Super 8 film camera

A Super 8 film camera is a battery powered photographic camera, which takes a sequence of photos on Super 8 film. It is mainly used for amateur movies due to its small size and light weight [6]. Most traditional Super 8 film cameras (Figure 2) consist of an eyepiece at one end, the lens on the opposite side, and a handle located under the camera. There are various mechanisms on the body of the camera for manually focusing a frame and shooting a video.



Figure 2. A traditional Super 8 camera [7]



Figure 3. The new KODAK Super 8 film camera [8]

2.3.2 Braun Nizo Super 8 Camera

LIFT currently owns a large array of Braun Nizo Super 8 cameras, which are the cameras that will be used in this opportunity (Figure . They have dimensions of 23cm x 21cm x 7.5cm and a weight of 1400 grams [9]. The camera holds regular Super 8 film cartridges and is currently set up to be handheld. This section outlines the various features as well as the functionality of this camera.



Figure 4a. Left side view of the Braun Nizo Super 8 Camera[10]



Figure 4b. Right side view of the Braun Nizo Super 8 Camera[10]

1. Lens

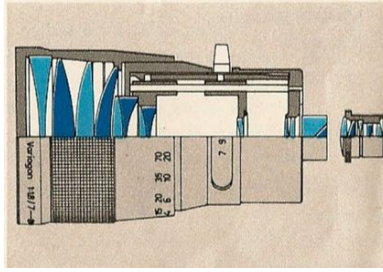


Figure 5. The inner structure diagram for schneider Variogon C mount[11]

1.1 Schneider Variogon C-mount

Focal length: 1:1.8

7-80mm zoom in addition

Zoom range: 1 to 11.4

Focusing range: 1.5m to ∞

Aperture range: 1.8 to 22

Horizontal picture angle: 42° to 3° 55'

1.2 Power zoom cut out ring

Twist the bar that will be attach to the right to cut out from zoom

1.3 Power zoom control button

Two zoom speed: press softly for slow zoom

press firmly for fast zoom

1.4 Automatic exposure button

Function by twisting the button to switch between automatic exposure mode and manual control mode. Push the button in to check the meter batteries.

1.5 Automatic lap dissolve (fade effect) switch

Press the switch to fade out from the current frame and press the switch again within 3.5s to fade into the next frame.

1.6 Variable segment diaphragm lever

Providing different time exposure

1.7 Diopter compensating device

+/- 5 diopters

2. Film

2.1 Unexposed film indicator

2.2 Time lapse switch

*Further information provided in section “2.3.3 general application: 2. Time Lapse”

2.3 Film speed switch

Frame rates: 18, 24, 54 frame/s + single frame

Film stock:

tungsten light: 13~23 DIN(16~160 ASA)

daylight: 11~21 DIN(10~100 ASA)

black and white: 11 to 21 DIN (10~100 ASA)

*ASA scale: ISO arithmetic scale *DIN scale: ISO log scale - Measure of the film's sensitivity to light

2.4 Color temperature filter switch

3. Socket

3.1 Extend power socket

use for portable storage battery

3.2 Flash socket

3.3 Remote control socket

3.4 Portable tape recorder socket

use for sync-pulse cable

3.5 Cable release socket

4. Battery

4.1 Fold-back handle & Battery storage

6 X 1.5V AA batteries

5. Overall Control

5.1 Power switch

5.2 Film type display

5.3 Drive mechanism trigger

-The start and end button for filming

-Must be held during the filming operation

*All above information in 2.3.2 refer to reference [11]

2.3.3 General Application of Braun Nizo Super 8 Camera



Figure 6. The display of the viewfinder[11]

1. Viewfinder

1.1 Focusing

In helping with the focusing the lenses, a split-image rangefinder is added to the viewfinder. By adjusting the diopter-compensating device beside the eyepiece, the rangefinder will provide the range of the area that is focused. The outline of the object will be sharp when the camera is correctly focused [11].

1.2 Signal lamp

When filming is started, a red signal lamp will appear on the viewfinder indicating that it is recording [11].

1.3 Lens aperture

A scale will also shows on the viewfinder indicating the lens aperture. The exposure can be set either automatically or manually. When set to the automatic mode, the build-in exposure system will adjust according to the film type. In manual mode, the scale can be adjusted by turning the knot (1.4 in the diagram) [11].

2. Time lapse

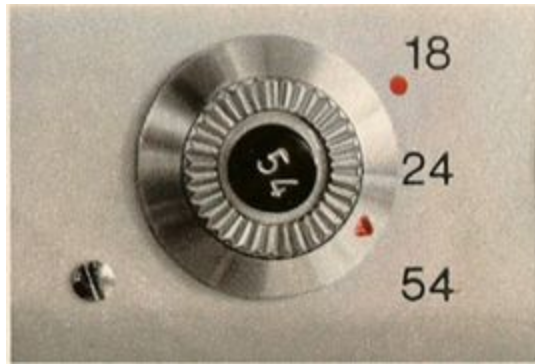


Figure 7a. Timelapse Knot[11]

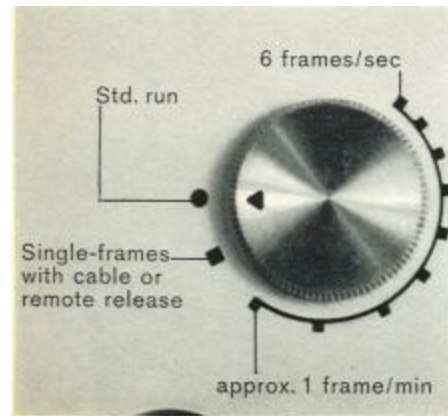


Figure 7b. Frame Rate Knot[12]

2.1 Time lapse

The Nizo allows the automatic setting of the time lapse from 6 frames per second to one frame per minute.

2.2 Quick action range

The 54 frames per second frame rate enables the camera to capture objects moving at a high speed.

2.3 Slow motion

To obtain the slow motion effect, the camera will first capture the movement at the 54 frames per second frame rate and then project at 18 frames per second [11].

3. Variable shutter

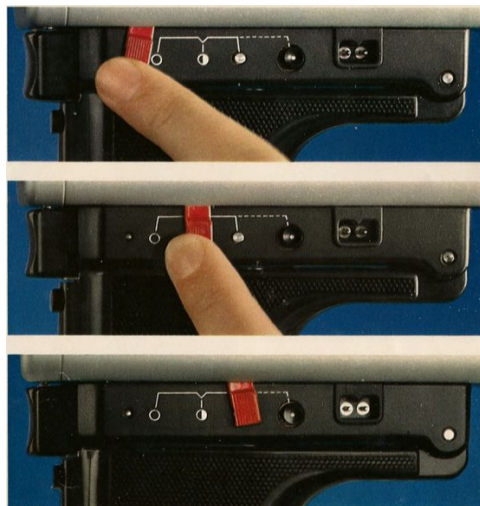


Figure 8. Variable segment diaphragm lever[11]

3.1 Mode 1: Fully closed sector

The variable shutter is a circular disc located in front of the film aperture with an open sector. Gradually closing the sector while taking pictures will produce a fade out effect. By doing the reverse, a fade in effect can be produced.

3.2 Mode 2: Particle opening sector

Mode 2 will set the opening sector to open at a smaller angle. This mode acts as a grey filter when shooting under excessive light.

3.3 Mode 3: Open sector

With the mode, the sector will be completely open until the time lapse switches the current frame to the next frame.

*All the above information in refers to reference [11]

2.3.4 Kodak Super 8 Film Camera

KODAK recently produced the new Kodak Super 8 film camera which added the following features to the traditional Super 8 camera and enhanced the accessibility of the product.

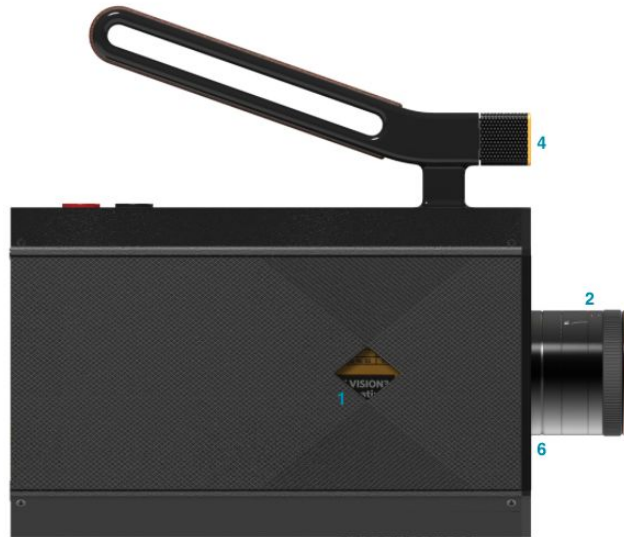


Figure 9a. Right side view of KODAK Super 8 Camera with labeling[13]



Figure 9b. Left side view of KODAK Super 8 Camera with labeling[13]

1. Film

Film Gauge: Kodak Super 8 Film

Kodak vision3 500T Color Negative film 5219/7219/SO-219[14]

Warm-up Times: 14 Celsius Rise: 1hr 55 Celsius Rise: 1.5hr

*refer to APPENDIX C. for method of storage

Kodak vision 3 200T Color Negative Film 5213/7213[15]

Film Load: 50ft(15M) cartridge (Approximately 3600 frames per film)

Speed: 9, 12, 18, 24, 25 FPS(frames per second)

2. Lens

Mount: C-mount

Focal Length: Fixed focal length 6mm 1:1.2 Ricoh lens

8 – 48mm zoom in addition

Focus: Manual Focus

3. Viewfinder

3.5'' display

+/- 45degree allowable swivel

4. Integrated microphone

5. Top-handle grip & pistol grip

6. Built-in exposure meter

7. Control Panel: viewfinder

Settings adjusted via jog wheel

*All above information in 2.3.4 refer to reference [16]

2.3.5 Super 8 Film Camera as an Opportunity

The current designs of Super 8 Film Cameras are not accessible for people with physical disabilities.

Handheld: The pistol grip is designed for users to obtain a more stable hold to the camera. Holding onto the grip could pose a challenge.



Figure 10.



Figure 11.

The current condition of Adam's hands[3] A person filming with a Super 8 film camera[11]

Eyepiece: Adam, and other filmmakers with limited arm mobility, are not able to hold onto the camera and place the eyepiece onto their eye. This problem will not be applied to the new KODAK Super 8 (Figure 3) in which the eyepiece in the traditional design is replaced with a digital viewfinder [13]. This enables the user to operate the camera without holding the camera to their eyes.

Lens focusing: Since the range of Adam's arm motion is limited, the adjusting of the focus of the lens by means of a turnable bar could become a challenge.

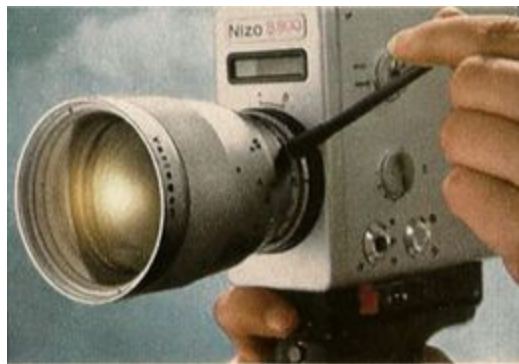


Figure 12. Adjustment of the focus of the lens[11]

Setting adjustment: Many setting adjustment button are local on both side of the camera. Most buttons require accurate adjusting to obtain the expected output due to their small size. High control of hand mobility is need to operate the buttons. Moreover, Adam has even less control with his right hand than his

left hand; therefore, his left hand becomes his dominant hand and this makes the control buttons located on the right side near impossible to be operated.

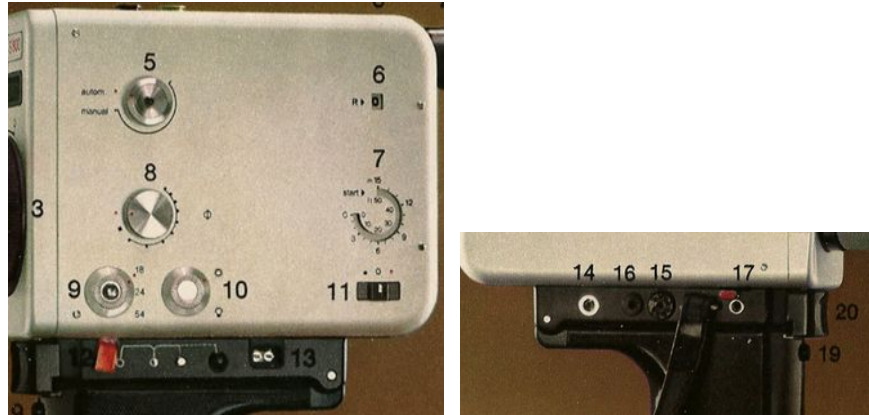


Figure 13. Control mechanisms on both side of the camera [11]

Field of view: Adam shoots videos while traveling on his wheelchair, which means his field of view is also limited with the Super 8 camera.

3. Stakeholders

3.1 Liaison for Independent Filmmakers of Toronto (LIFT)

LIFT has several stakes within this project. One of their values is to ensure that access to different equipment and resources are available to independent filmmakers. After Adam has completed his project, it could be beneficial for LIFT to have such an attachment for other filmmakers.

- LIFT hopes to provide and benefit from a meaningful exchange
- Want a technology to assist those with physical impairment, this could allow for their equipment to be more accessible [2]
- Want Adam to be able to use their available equipment effectively and safely [2]
- In line with their mission to make film development more accessible
- Is one of the primary stakeholders

3.2 Adam Cohoon

Adam is an independent filmmaker in Toronto with cerebral palsy. He is planning to execute a three (3) day long project that will require the use of a Super 8 camera. He has mentioned that he would like certain specific setups for the attachment, with the first being that he would like the attachment to be on the left hand side of the chair [3]. Secondly, he does **not** want any form of video assistance to allow him to see what he is filming, as he is concerned that it would be a safety hazard if he were to get distracted by the content he is filming [3]. However, it is also important to notice that some of Adam's GoPro film work appear tilted due to the lack of access to a viewfinder.

- Wheelchair bound filmmaker with cerebral palsy
- Has only limited use of his left hand
- Desire to use analogue film and values quality of the films created
- Is one of the primary stakeholders

3.3 Adam's Mentor and Assistants

Throughout the filming process, Adam will have access to his mentor and assistants to aid him with any type of problem that can occur during filming. The problem may include some basic operation of the camera, such as changing cartridges, attaching the camera to the wheelchair, or lining up the camera. The range of the problem is dependent on the design of the solution. It should also be noted that the top speed of Adam's chair is 10kph, thus, anyone helping him with filming needs to keep up with the speed that Adam is moving at while making sure the camera is in focus.

- While filming, Adam will have people who are working with him assist him
- They may or may not have experience in filmmaking
- Responsible for basic setup of the camera

3.4 Other physically disabled filmmaker

Even though the primary stakeholder is Adam Cohoon, the solution is also expected to help the general community of physically disabled filmmakers who are interested in using an analogue film camera.

- The design could make a difference in their lived experience
- The design could account for a variety of movement related disorders

3.5 Film Camera Makers

Manufacturers of analogue cameras could have an interest in how their devices can be outfitted for accessibility. It could be in their best interests to appeal to the specific market that is the community of filmmakers with accessibility needs.

3.6 Design Teams

This opportunity is relevant to an engineering design team who wishes to design for accessibility and is interested in filming technology. The opportunity would allow first year University of Toronto Engineering Science students to apply the knowledge they have learned thus far, and connect with the film community of Toronto in a meaningful way.

- Groups who wish to design for accessibility
- Groups who wish to apply the knowledge taught in first year Engineering Science

4. Design Requirements

4.1 High Level Objectives

4.1.1

To design a modular attachment that will be able to connect a Super 8 camera to a wheelchair, whilst ensuring the safety of both the user and the camera.

4.1.2

To allow for the use of the Super 8 film camera while being housed within the attachment.

4.2 Design Requirement Chart

OVERARCHING CONSTRAINT: the solution designed must be for the housing and operation of a Super 8 camera.

| Detailed Objectives | Constraints | Metrics | Criteria |
|---|------------------------------------|--|--|
| 1. Create a detachable mechanism to hold the Super 8 camera | Must be detachable from the chair | BOOLEAN Is design detachable from the chair, Yes or No | The less steps/time to detach the better |
| | Must be detachable from the camera | BOOLEAN Is the camera detachable, Yes or No | The less steps/time to detach the better |
| <i>Justification: From LIFT, we learned that most independent filmmakers experiment with a wide variety of platforms, digital and analogue [1]. Therefore, an analogue film attachment should not be permanent so as to allow for them to freely exchange. Additionally, it was learned from Adam that a permanent attachment, no matter how small, would be perceived to impede on the capabilities and free space of their chair, when the camera is not in use [3]. Finally, LIFT does not wish to permanently physically alter their Super 8 cameras [2].</i> | | | |
| 2. To have the design | Must last at least three | Amount of physical | The longer lasting |

| | | | |
|---|--|--|-------------------------------|
| be durable in terms of the risks ¹ associated with being attached to the Chair | consecutive days on a wheelchair | deterioration over 3 days of use/ 72 hours (i.e. cracks, breaking) [3] | the better |
| | Should be reusable | Number of times of reuse (measured in attachment tests) | The longer lasting the better |
| <i>Justification: Adam's upcoming project will be three days long [3]. Therefore, in the foreseeable future, this is the absolute minimum amount of time the attachment will have to last. However, given LIFT's ongoing exchange program, the intent is that this attachment will hopefully be used for multiple projects in the future.</i> | | | |
| 3. To not have the design infringe on the safety or capabilities of the user | Must not compromise the stability of the chair | REFER to APPENDICES A and B | the less the better. |
| | Must allow for a field of view for the user in 90 degrees in either direction from centre of the chair must be visible (assume at eye level) | The percentage of clearness of area within the user's field of view(%) | the less the better |
| | Must not be extended beyond the width of his wheelchair base, from wheel to wheel (refer to section 2.2.2) | The width of the area that the assistant device occupied(ft) | Less is better |
| <i>Justification: Any sort of attachment should not affect the safety of the person driving the chair. As learned from Adam, having any camera in front of his eye level while driving is distracting and dangerous [3]. Finally, having an attachment that extends beyond the current bounds of his wheelchair would limit his ability to maneuver (ie. through doors), as his spacial awareness would be compromised.</i> | | | |
| 4. Create a modular | May be modular such | The variety of | The more versatile the |

¹ Risks include: colliding with the surrounding environment and resisting wind due to the possible max speed of the chair (10 kph).

| | | | |
|---|--|--|-------------------------------|
| solution such that the camera can be placed to the user's directed field of view i.e(left side of the chair, center, right side etc..) | that the camera can be placed to user's specified location | different places that the device can be placed with the camera (number of different areas) | better |
| | Should be able to attach to different wheelchairs and possibly different vehicles for LIFT's future use. | The variety of different platforms to which it may be attached | The more versatile the better |
| <i>Justification: The benefit of having a design be modular is that it allows for greater accessibility to those who have different needs. For example, currently Adam wishes for the camera to be on the left hand side of his chair, while another user may require for it to be centre [3]. Secondly, the hope is the design solution will be provided to LIFT so they will be able to benefit others such as Adam, who may have different dimensions on their chairs [2].</i> | | | |
| 5. Allow user to use the device within their range of motion | Must be operable from the range of motion of the user | Distance from hands Degrees of rotation needed to operate | The smaller the better |
| <i>Justification: As the design is for accessibility, it should be ensured that the design is accessible to those with limited mobility. This means that the analogue camera is operable from the range of motion of the user.</i> | | | |
| 6. To alert user when camera is in use | Should show when the camera is on and recording through some form of non-intrusive signal | Clarity of signal BOOLEAN: Is the signal seen from the perspective of the user? Yes or No | The more apparent the better |
| <i>Justification: It is considered an inconvenience not to know if the camera is recording while the user is driving, as such an error would require a retake [2].</i> | | | |
| 7. To design a way for the Drive Mechanism Trigger to be activated whilst connected on the | Must allow the user to start and stop recording from a mechanism that does not need to be held | BOOLEAN: Does it start and stop recording as to the user's discretion? | The simpler the better |

| | | | |
|--|--|---|--|
| mount | down for the duration of the film. | Yes or No | |
| <i>Justification: This is necessary for the camera to be in use, as can be seen in section 2.3.2 under FILM, the Drive mechanism trigger must be held down as to record film [11]. This results in a requirement for some functionality that would engage the Mechanism trigger while filming.</i> | | | |
| 8. To allow for the design to be versatile, applicable to various wheelchair designs | Must be able to attach to Adam's wheelchair | Number of wheelchair styles with which the camera is compatible or possibly any additional vehicles | The more the better |
| <i>Justification: Versatility of the design should also be considered since the stakeholders not only include Adam Cohoon, but also other physically impaired filmmakers [2].</i> | | | |
| 9. For the design to ensure the quality of the film created. | Should mitigate any shaking or instability. | BOOLEAN: Is the shot just as steady as the GoPro mounted on the same wheelchair? Yes or No | The greater the quality of the resulting film the better |
| | Should allow for a clear shot, without parts of the user's body or wheelchair appearing in the frame | BOOLEAN: Is the user or wheelchair in the shot? Yes or No | The clearer the shot the better |
| <i>Justification: This objective is to help ensure that the user is able to get clear shots without the user in the shot (unless desired) and to allow for more stable shots; this will benefit in the quality and production of the film [3].</i> | | | |

5. Reference Designs

The following are some examples of designs that exist to support various camera models on a wheelchair. It is important to note that all of the following designs fail under our overarching constraint that the mount should be compatible with housing a Super 8 camera.

5.1 GoPro

Adam currently uses a GoPro, fixed to the armrest of his chair with Velcro and Duct Tape (Figure 6). A GoPro is the only video recording device he can use independently. The GoPro only requires Adam to push a button on a remote with his left hand to operate. The light, either red or blue, on the camera indicate the filming state. The means by which he changes his field of view is by turning his wheelchair, while the camera focuses itself. Knowing that the GoPro would capture the range about the same range that his eyes can capture, he would estimate the area that he wishes to include in the frame[3].



Figure 14a. Front view of Adam's current GoPro set up, between his wheelchair steering controls and his armrest.[3]



Figure 14b. Birdseye view of Adam's current GoPro set up[3]

This design fails under the following design requirements:

- Objective 9: Through the observation of Adam's film works with GoPro, the image sometimes appear slightly tilted and the composition of the picture is not well established. In addition, visible shaking of the camera is noticed while Adam's wheelchair is moving.

5.2 Mount 'n' Mover Camera Mount

There exists, on the market, various wheelchair mounting systems for digital cameras. The design made by Mount'n Mover (Figure 15) [17] is a simple mount positioned at the front of the chair. As a result, users such as Adam who have limited mobility will not be able to use the device. Additionally, the robust front-mounting swinging arm would obstruct the view of a filmmaker who is driving. The attachments for this design include the tray model (shown in Figure 7) and a camera plate which supports a tripod.

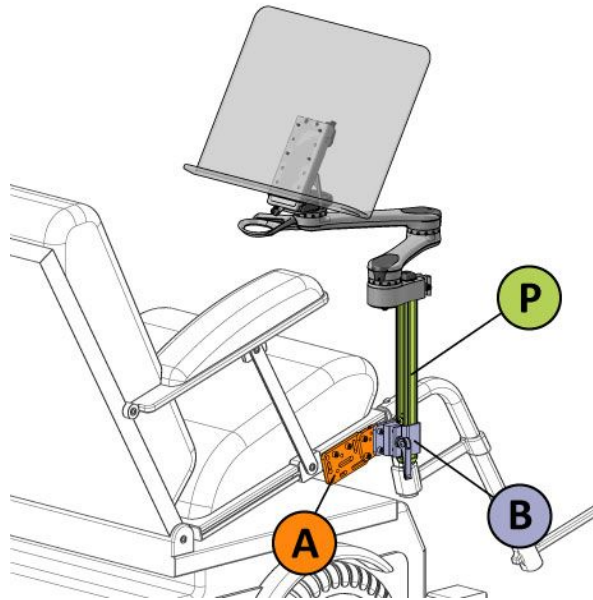


Figure 15. Diagram of Mount 'n' Mover Camera Mount wheelchair setup [17]

This design fails under the following design requirements:

- Objective 1: the design violates our constraint that the attachment must be detachable, while this design requires to be screwed on.
- Fails the Overarching Constraint as a Super 8 cannot be housed.
- Objective 7: the design does not account for the necessity to hold down the driver mechanism, this would not allow for the use of a Super 8.

5.3 Robo Arm Mount

Various designs by Broadened Horizons accommodate for paraplegics (Figure 16) and quadriplegics (Figure 17) [18] by incorporating buttons and remotes that connect to operations on a camera. Unfortunately, these automated features would not be compatible with a Super 8 camera given it is an analogue video recording device rather than a digital camera.



Figure 16.

A hook up for a digital camera for paraplegics [18]



Figure 17.

Hook up for quadriplegics [18]

This design fails under the following design requirements:

- Objective 1: the design violates our constraint that the attachment must be detachable, while this design requires to be screwed on.
- Objective 7: the design does not account for the necessity to hold down the driver mechanism, this would not allow for the use of a Super 8.

6. Conclusion

This Request for Proposal, in framing the given opportunity, seeks engineering solutions to improve the lived experience of filmmakers who suffer from a variety of physical disorders. It had been established, working with LIFT and, more specifically, with Adam, that proposed solutions would satisfy both Adam's stakeholder values in regards to his projects, as well as LIFT's values in providing more accessible access to analogue cameras for the disabled. As existing reference designs do not satisfy the objectives as outlined, teams will have to take into account each stakeholder's requirements in designing a compatible solution. This document will serve as a guide for this process.

7. Appendices

APPENDIX A

For Appendices A and B they do not refer to an attachment on a wheelchair in any respect, but it refers to the differing adjustable parts of a wheelchair. They show configurations that are the least stable in the rearward and forward stability of the chair respectively. These can be used in order to guide the decision with regards to the placement of the attachment

ISO 7176-2:2001(E)

8 Tests for rearward dynamic stability

8.1 Wheelchair preparation

Prepare the wheelchair as specified in clause 6 with the following additions: set the rear-wheel position, castor attachment to frame, seat position, back position, seat-to-back angle and leg-to-seat angle in their least stable configuration for the wheelchair in the rearward direction according to Table 1.

Table 1 — Rearward stability

| Adjustable wheelchair component | Least stable |
|--------------------------------------|--------------|
| Rear-wheel position, fore-aft | Forward |
| Castor attachment to frame, fore-aft | Back |
| Seat position, fore-aft | Back |
| Seat position, vertical | High |
| Seat-back position, recline | Back |
| Seat position, tilt | Back |
| Back position, fore-aft | Back |
| Leg to seat angle | Minimum |

APPENDIX B

9 Tests for forward dynamic stability

9.1 Wheelchair preparation

Prepare the wheelchair as specified in clause 6 with the following additions: set the rear-wheel position, castor attachment to frame, seat position, back position, seat-to-back angle and leg-to-seat angle in their least stable configuration for the wheelchair in the forward direction according to Table 2.

Table 2 — Forward stability

| Adjustable wheelchair component | Least stable |
|--------------------------------------|--------------|
| Rear-wheel position, fore-aft | Forward |
| Castor attachment to frame, fore-aft | Back |
| Seat position, fore-aft | Forward |
| Seat position, vertical | High |
| Back position, fore-aft | Forward |
| Seat-back position, recline | Upright |
| Seat position, tilt | Upright |
| Leg to seat angle | Greatest |

APPENDIX C

| | Short Term (less than 6 months) | Long Term (more than 6 months) |
|--|--|--|
| Unexposed film in original, sealed package | 13°C (55°F) RH below 60% | -18 to -23°C (0 to -10°F) RH below 50% |
| Exposed film, unprocessed | -18 to -23°C (0 to -10°F) RH below 20% | Not recommended. Process film promptly. |
| Process film | 21°C (70°F) RH 20 to 50% | 2°C (36°F) RH 20 to 30% |

[15] The method of storage for Kodak vision3 500T Color Negative film 5219/7219/SO-219

APPENDIX D

LIFT

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specialprojects@lift.on.ca

lift.ca

1137 Dupont Street Toronto, Ontario M6H 2A3
Canada

Adam Cohoon

416-710-0817

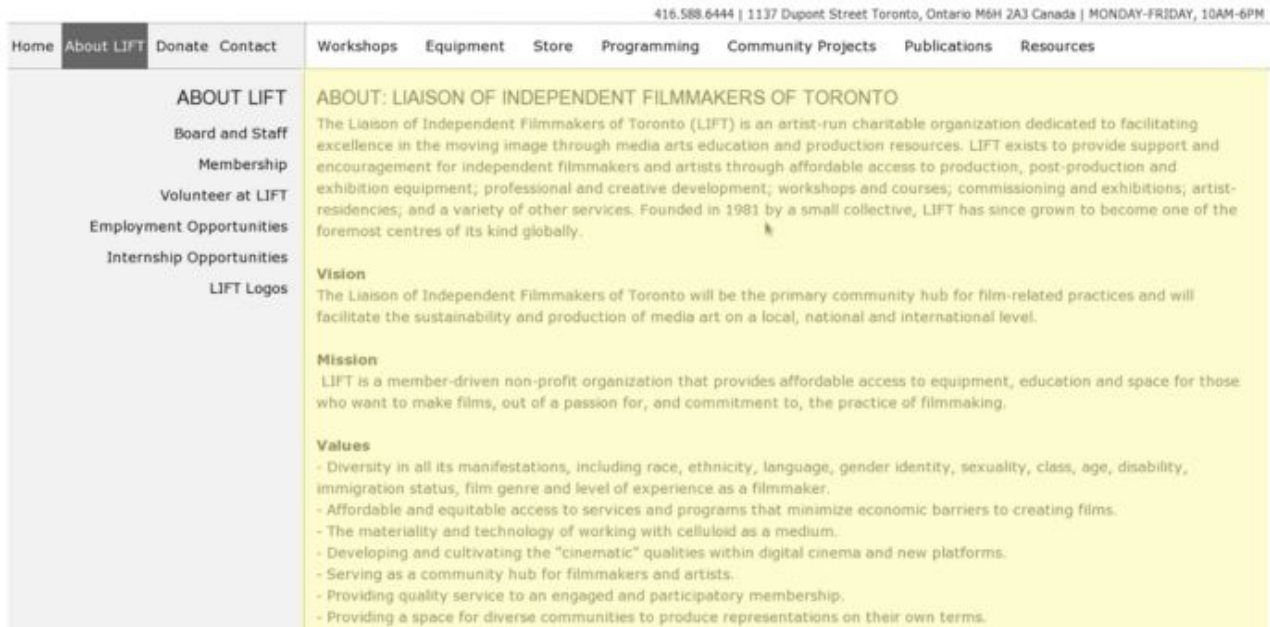
arcohoon@gmail.com

arc23 youtube channel:

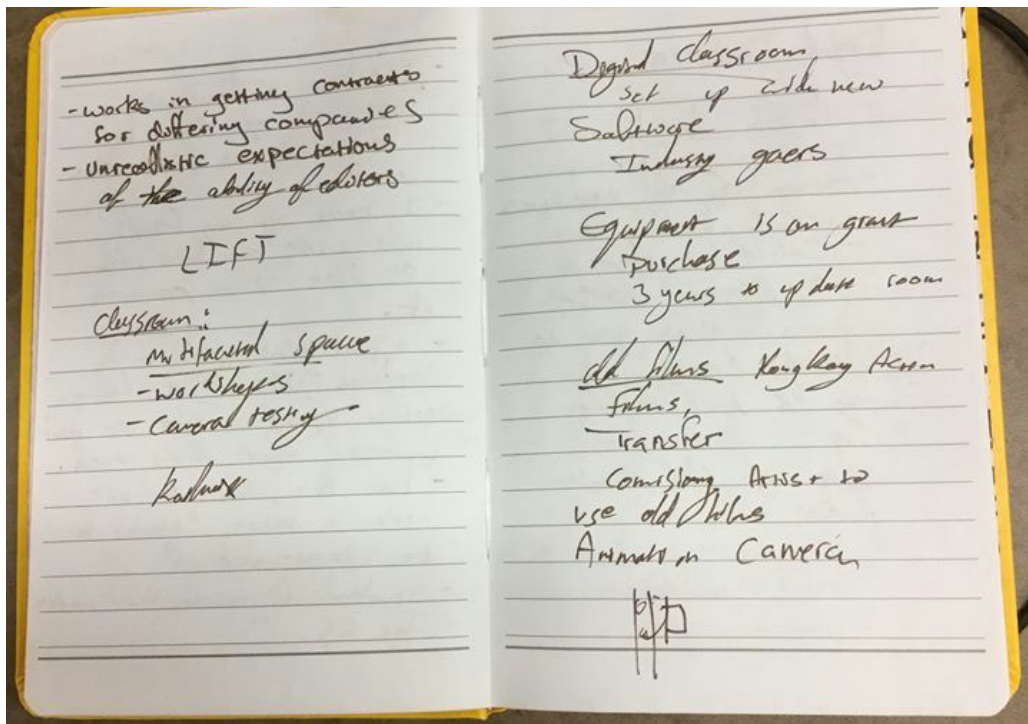
<https://www.youtube.com/user/arc23/videos>

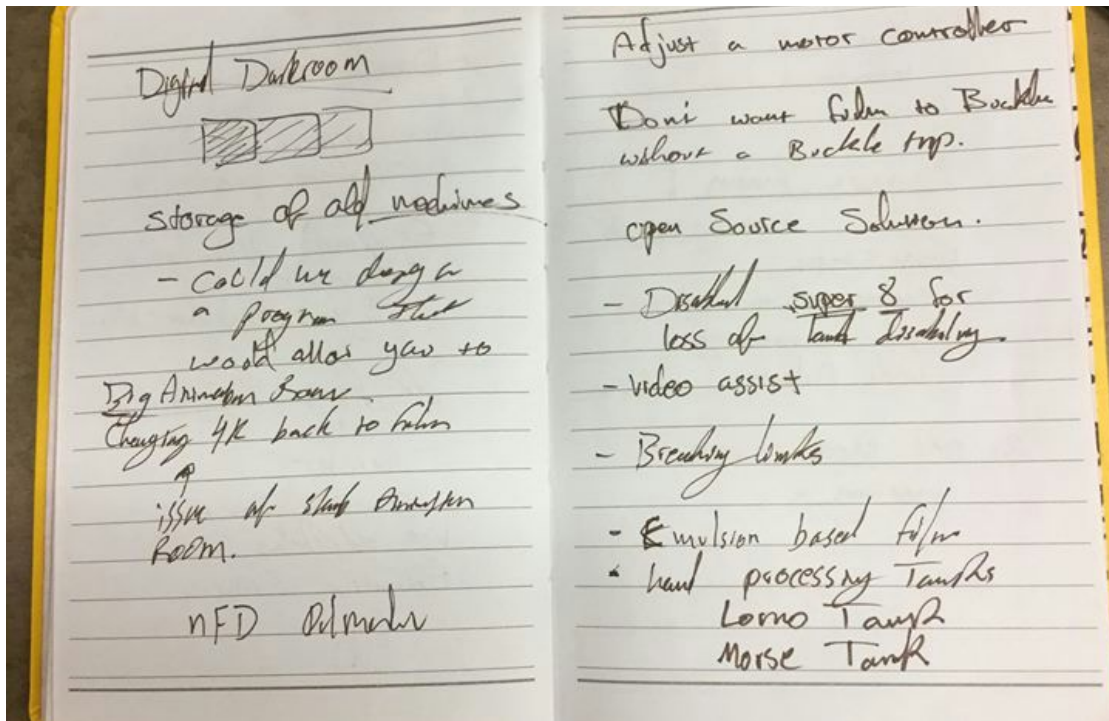
8. References

- [1] LIFT, "About: Liaison of Independent Filmmakers of Toronto". [Online]. Available: <http://lift.ca/about/about-liaison-independent-filmmakers-toronto>. [Accessed: 29- Jan- 2016].



- [2] C. Kennedy, "Opportunity for community outreach", 1137 Dupont St, Toronto, ON M6H 2A2, 2016.





[3] A. Cohoon, "Super 8 modification interview", Robarts library, 130 St George St, Toronto, ON M5S 1A5, 2016.



[4]A. Cohoon, "Life Bloored", *YouTube*, 2016. [Online]. Available: https://www.youtube.com/watch?v=XywDJLTi_4. [Accessed: 31- Jan- 2016].

Uploaded on May 2, 2007

<http://arcnwspr.blogspot.com/> - Life Bloored, I Duct taped a camera to my electric wheelchair, a very fast drive - My name is Adam Cohoon I am 24 years old. I moved to Toronto around five years ago. I live on Bloor Street in the Annex. I was born with cerebral palsy. I use an electric wheelchair to get around the city.

My short video is a sped up trip of my favourite strolling route through my neighbourhood. The route goes from my apartment building along Bloor to Bathurst then back along the other side of Bloor Street. All at an accelerated speed to turn a half an hour journey into a video of just a few minutes.

The video captures the route from my view I enjoy this route but the neighbourhood is not totally wheelchair accessible there some shops that has steps in order to get into them. Some of the curbs in the neighbourhood are steep too.

The video is also about how this neighbourhood has really influenced my love of the arts, whether it is visual, music, film or video. I have really come to enjoy them. I am constantly exposed to them right in my area and just grew to really appreciate them.

In the video I also add my sense of humour. Throughout - arcohoon@hotmail.com

| | |
|----------|--------------------------|
| Category | People & Blogs |
| License | Standard YouTube License |

[5]K. Stern, "Definition", *Cerebral Palsey*. [Online]. Available: <http://cerebralpalsy.org/about-cerebral-palsy/definition/>. [Accessed: 31- Jan- 2016].

Definition of cerebral palsy

While cerebral palsy (pronounced seh-ree-brei pawl-zee) is a blanket term commonly referred to as "CP" and described by loss or impairment of motor function, cerebral palsy is actually caused by brain damage. The brain damage is caused by brain injury or abnormal development of the brain that occurs while a child's brain is still developing — before birth, during birth, or immediately after birth.

Cerebral palsy affects body movement, muscle control, muscle coordination, muscle tone, reflex, posture and balance. It can also impact fine motor skills, gross motor skills and oral motor functioning.

What is cerebral palsy?

Cerebral palsy is the result of a brain injury or a brain malformation. Individuals with cerebral palsy were most likely born with the condition, although some acquire it later.

It was once thought that cerebral palsy was caused by complications during the birthing process. While this does happen, it is now widely agreed that birthing complications account for only a small percentage, an estimated 10 percent, of cerebral palsy cases.

Current research suggests the majority of cerebral palsy cases result from abnormal brain development or brain injury prior to birth or during labor and delivery. Accidents, abuse, medical malpractice, negligence, infections, and injury are some known risk factors that may lead to cerebral palsy.

Cerebral palsy causes physical impairment

An individual with cerebral palsy will likely show signs of physical impairment. However, the type of movement dysfunction, the location and number of limbs involved, as well as the extent of impairment, will vary from one individual to another. It can affect arms, legs, and even the face; it can affect one limb, several, or all.

Cerebral palsy affects muscles and a person's ability to control them. Muscles can contract too much, too little, or all at the same time. Limbs can be stiff and forced into painful, awkward positions. Fluctuating muscle contractions can make limbs tremble, shake, or writhe.

Balance, posture, and coordination can also be affected by cerebral palsy. Tasks such as walking, sitting, or tying shoes may be difficult for some, while others might have difficulty grasping objects.

Other complications, such as intellectual impairment, seizures, and vision or hearing impairment also commonly accompany cerebral palsy.

Every case of cerebral palsy is unique to the individual

Every case of cerebral palsy is unique to the individual. One person may have total paralysis and require constant care, while another with partial paralysis might have slight movement tremors but require little assistance. This is due in part by the type of injury and the timing of the injury to the developing brain.

[6] Kodak, "Super 8mm Film History", 2016. [Online]. Available: http://motion.kodak.com/US/en/motion/Products/Production/Spotlight_on_Super_8/Super_8mm_History/default.htm. [Accessed: 31- Jan- 2016].

Camera Films

- KODAK VISION3 500T Color Negative Film 5219/7219
- KODAK VISION3 250D Color Negative Film 5207/7207
- KODAK VISION3 200T Color Negative Film 5213/7213
- KODAK VISION3 50D Color Negative Film 5203/7203
- EASTMAN DOUBLE-X Black & White Negative Film 5222/7222
- KODAK TRI-X Black & White Reversal Film 7266
- Spotlight on Super 8
 - Super 8mm Film History
 - Super 8mm Products
 - Super 8mm Tips

Super 8 mm Film History

In the spring of 1965, a revolutionary new movie film format was introduced and the world of movie-making hasn't been the same since. Home movies suddenly became accessible to the masses much the same way that the Brownie camera made still photography available. Here's how it all started:

1923

This is when the story of practical "home movies" really began. 35mm film was the standard for theatrical releases but it was cumbersome, expensive, and dangerous due to its flammable nature. The 16mm "Cine Kodak" Camera, used by advanced amateurs, weighed about 7 pounds, had to be hand cranked at two turns per second during filming, and was cost prohibitive.

1932

"Cine Kodak Eight" format was introduced. Utilizing a special 16mm film, which had double the number of perforations on both sides, the filmmaker had to run the film through the camera in one direction then open the camera and reload and expose the other side of the film. After processing, the lab slit the film lengthwise down the center and spliced one end to the other yielding 50 feet of finished 8mm movie film.

1950s

Despite the challenges, 8mm home movie cameras were becoming a common sight on vacations and at family parties and special events.

[7] Musee, "Camera Super 8". [Online]. Available: http://sylvain.laribe.free.fr/Musee/HTML/camera/Camera_Super8.htm. [Accessed: 31- Jan- 2016].

[8] Kodak, "Kodak Launches Super 8 Filmmaking Revival Initiative at CES 2016", 2016. [Online]. Available: <http://www.kodak.com/ek/US/en/consumer/Product/ProductResource/?producttaxid=4294969683>. [Accessed: 31- Jan- 2016].

[9]“Nizo 800 P Professional,” - *Super8wiki*. [Online]. Available at: http://Super8wiki.com/index.php/nizo_800_p_professional. [Accessed: 11-Feb-2016].



Side View

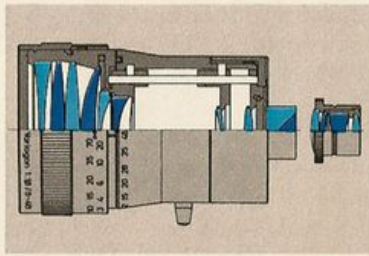
Specifications

| | |
|-------------------------------------|----------------------------------|
| Model | Nizo professional |
| Format(s) | Super8 (silent) |
| Manufacturer | Niezoldi & Krämer / Braun |
| Made in | Germany |
| Produced | 1974-77 |
| Lens(es) | f1.8/7-80mm (62mm filter thread) |
| Zoom | Manual/Auto Zoom with 2 speeds |
| Macro | Yes |
| Frame rates | 18,25,58 + single frame |
| Exposure | Manual/Automatic |
| Focus | split image |
| Film speeds (ASA/ISO) | 25/40, 100/160 |
| Shutter degree | variable |
| Sound (striped) | No |
| Sound (two-band) | Yes / Impulse and Pilot Tone |
| Sound (optical) | No |
| Weight | 1400g |
| Dimensions | 23cm x 21cm x 7,5cm |
| Power supply | 6 x AA / external |
| Original price (\$US) | aprox. 1.185 |
| Original price (£) | aprox. 734 |
| Original price (DM) | 2.000 |
| Original price (Yen) | approx. 170.480 |
| Recent prices on eBay (\$US) | >= USD 300 |
| Recent prices on eBay (£) | -- (06/2010) |
| Recent prices on eBay (€) | EUR 150 (06/2010) |

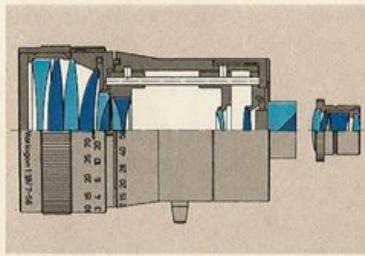
[10]“Nizo Super 8,” *Vimeo*. [Online]. Available at: <https://vimeo.com/71823734>. [Accessed: 10-Feb-2016]

[11] "Nizo® camera S480 S560 and S800," [Online]-*Apecity*. Available at: http://www.apecity.com/manuals/pdf/nizo_brochure.pdf. [Accessed: 10-Feb-2016].

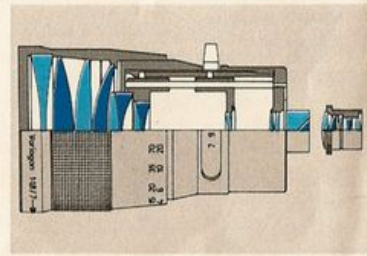




This is the lens of the Nizo S 480 camera:
Schneider Variogon 8–48 mm and
1.8 zoom range (ratio of extreme wide-
angle to telephoto setting): 1 to 6.
Focusing range: 1 m to ∞ .
Aperture range: 1.8 to 22.
Horizontal picture angle: 37° to $6^\circ 20'$.



This is the zoom lens of the Nizo S 560
camera:
Schneider Variogon 7–56 mm, f/1.8.
Zoom range: 1 to 8.
Focusing range: 1 m to ∞ .
Aperture range: 1.8 to 22.
Horizontal picture angle: 42° to $5^\circ 30'$.



This is the zoom lens of the Nizo S 800
camera:
Schneider Variogon 7–80 mm, f/1.8.
Zoom range: 1 to 11.4.
Focusing range: 1.5 m to ∞ .
Aperture range: 1.8 to 22.
Horizontal picture angle: 42° to $3^\circ 50'$.



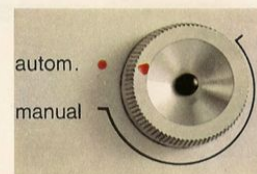
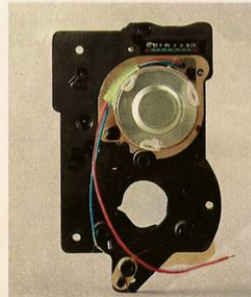
the zoom section and the basic lens,
diverts a small portion of the light to the
viewfinder and, via a mirror system,
to the CdS photoresistor of the automatic
exposure system.

On its way to the eyepiece, the light
traverses a rangefinder lens and goes
through a reversal arrangement. Both this,
and the eyepiece system, mean that the
viewfinder image appears at the eyepiece

magnified almost 20 times. The viewfinder
image is bright, clear and aberration-
free, corresponding with the picture seen
later on the projection screen. The
same conditions apply to exposure control,
which measure the same amount of light
for the automatic system and corresponding
aperture settings, to that which reaches
the film.

In the large bright viewfinder image you
will first note the split-image rangefinder of
the focusing system. This device does
not allow the eye any scope for estimating
what is "sharp" or otherwise, but this
can be overcome by adjusting the eyepiece
— as you would adjust binoculars — using
a diopter compensating device
(± 5 diopters) to suit individual eyesight.
You can tell when the focus is correct,
because the outlines of the subject appear
unbroken in the rangefinder circle.

An accurate focusing system is essential
in a camera with such efficient lenses.
When you operate the drive mechanism,
you will notice a signal lamp above the
viewfinder image. This shows whether the
film is being transported, and also



indicates that the end of the film has been
reached.

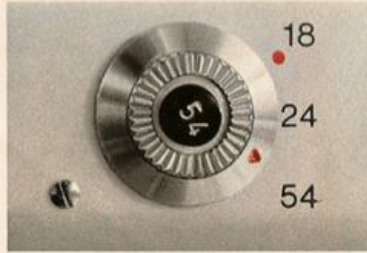
Underneath the viewfinder image is a scale
which indicates the lens aperture set
automatically by the exposure system. This
illustration of the special purpose
instrument made by Gossen shows the
interior. Like a good quality watch it
is ruby-mounted and it adjusts two blades
to give the correct aperture. When the
cartridge is loaded into the camera, the
exposure system is automatically set
to suit the film type. The exposure control
facility on Nizo cameras suits all
film types currently available on the inter-
national market. You can cut out the
automatic system and manually set to the
desired aperture on the scale. You will
also find a tiny pushbutton in the center of
the knob to check the condition of
the two 1.35 volt cells supplying the CdS
exposure control circuit.

Let's take an example. If you expose only one frame per minute with your Nizo camera, you can project later for 3.3 seconds at 18 frames a second and show what happened during one hour. This facility opens up a new world of creative filming.

an accessory called the Power Set. In one bag are contained an accumulator, its maintenance kit and a lead for connection to an external supply; the handle can be folded back and the camera fixed to a tripod.



A flower blossoms out in a few seconds. The sun plunges into the sea, producing colour effects that change as quickly as a firework display. You can film buildings and landscapes in which the sun, light and colour change rapidly to provide wonderful scenic effects. The Nizo camera will do all this for you automatically, even over a period of several days if you wish; camera observations like this over long periods of time can be obtained using



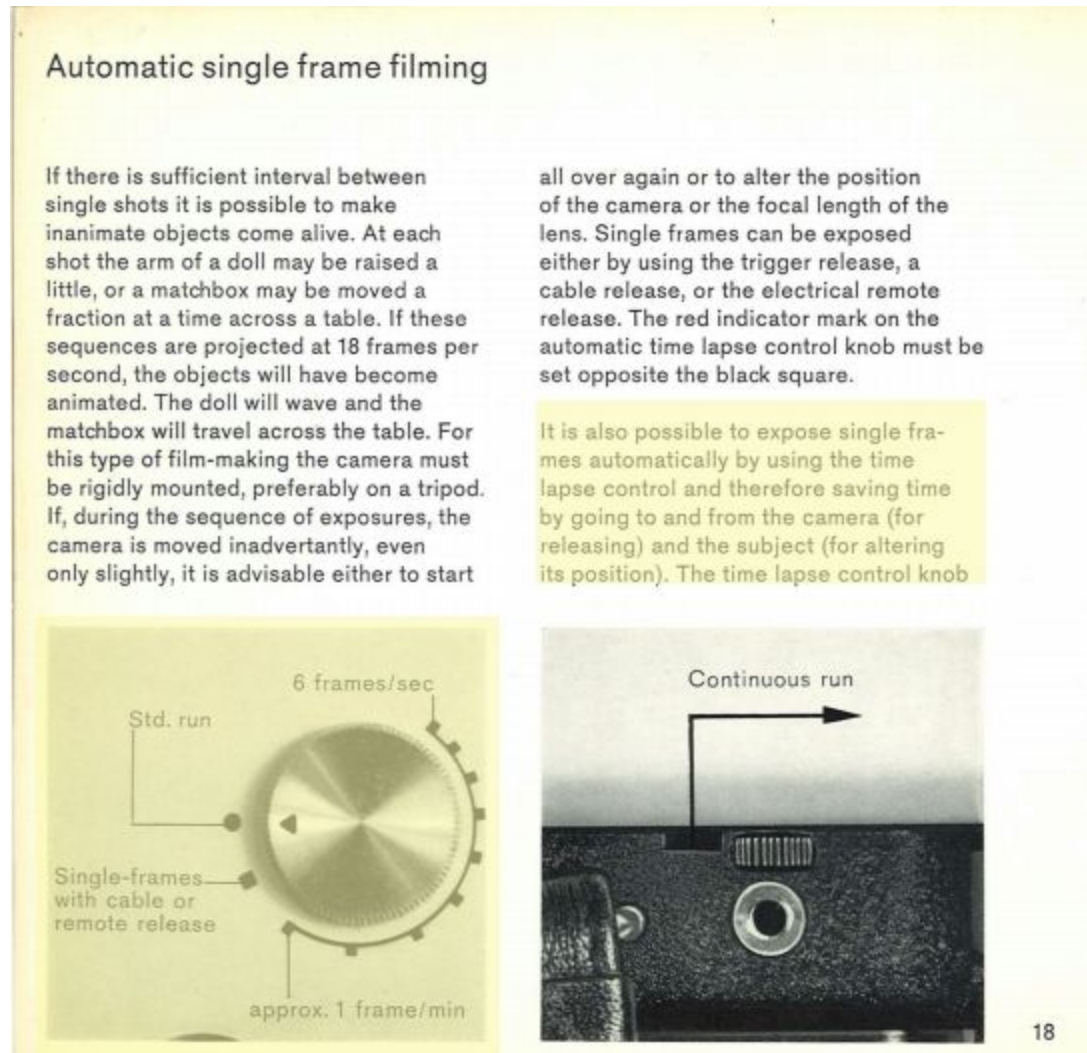
An additional component called the Magic Switch is supplied with the Power Set to enable you to set the quick-action range. A further facility is slow-motion. This is really triple quick-action filming at 54 frames a second for later projection at 18 frames a second. Slow-motion with the Nizo camera lets you follow very quick movements which are hard to watch with the naked eye.

There are 73 focal length millimeters between the extreme wide-angle and telephoto settings on the lens of the Nizo S 800 camera. The Nizo S 560 has 49 mm and the Nizo S 480 has 40 mm. Each focal length millimeter provides a different picture angle, giving fresh creative scope. These various focal lengths can be set easily and smoothly by the automatic power zoom—controlled by pushbuttons on top of the camera. And you can vary the speed of the

zoom: press the buttons lightly for slow and firmly for fast. The power zoom on the Nizo S 800 camera can be cut out, too, and "jumps" in focal length can be obtained by a lever movement.



[12]"How to Make Movies with the Nizo S 560 and Nizo S 800", 2016. [Online]. Available: http://www.apecity.com/manuals/pdf/nizo_s560_and_s800_manual.pdf. [Accessed: 12- Feb- 2016].



[13]Kodak.com, "Super 8 Camera | Kodak", 2016. [Online]. Available: <http://www.kodak.com/ek/US/en/consumer/Product/ProductResource/?producttaxid=4294969683>. [Accessed: 12- Feb- 2016].

[14]motion.kodak.com, "KODAK VISION3 500T Color Negative Film 5219 / 7219 / SO-219", 2016. [Online]. Available: <http://motion.kodak.com/KodakGCG/uploadedfiles/motion/TI2647.pdf>. [Accessed: 12- Feb- 2016].

KODAK VISION3 500T Color Negative Film 5219 / 7219 / SO-219

Kodak

TECHNICAL DATA / COLOR NEGATIVE FILM

April 2010 • H-1-5219t

KODAK VISION3 500T Color Negative Film 5219 / 7219 / SO-219 gives you control and flexibility at every phase of the filmmaking process—from capture through post, in both digital and traditional workflows.

VISION3 500T Film has outstanding skin tones and color reproduction, while adding technical innovations that improve product performance and increase product versatility. The proprietary, advanced Dye Layering Technology (DLT) provides noticeably reduced grain in shadows, allowing you to pull out an amazing amount of shadow detail. The proprietary Sub-Micron Technology enables 2 stops of extended highlight latitude, so you can follow the action into bright light-in a single shot-without worrying about blown-out details.

VISION3 500T Film is designed to extend the capabilities of the DI (digital intermediate) process. The improved grain provides better to signal to noise capabilities allowing the colorist to provide greater detail in shadows, while the extended highlight latitude enables improved digital "dodging and burning" to provide more details in highlights.

Warm-up Times

To prevent film telescoping, moisture condensation, and spotting, allow your film to warm to room temperature before use:

| Film Package | Typical Warm-up Time (Hours) | |
|--------------|------------------------------|---------------------|
| | 14° C (25° F) Rise | 55° C (100° F) Rise |
| Super 8 | 1 | 1 1/2 |
| 16 mm | 1 | 1 1/2 |
| 35 mm | 3 | 5 |

For more information about film storage and handling, see ANSI/PIMA ISO-18911, SMPTE RP131-2002, and KODAK Publicatio No. H-845, *The Essential Reference Guide for Filmmakers*, available online at www.kodak.com/go/referenceguide.

DARKROOM RECOMMENDATIONS

Do not use a safelight. Handle unprocessed film in total darkness.

[15]motion.kodak.com, "KODAK VISION3 200T Color Negative Film 5213/7213", 2016. [Online]. Available:

http://motion.kodak.com/KodakGCG/uploadedFiles/Motion/Products/Camera_Films/5213/Resources/5213_TI2653.pdf. [Accessed: 12- Feb- 2016].

KODAK VISION3 200T Color Negative Film 5213 / 7213

Kodak

TECHNICAL DATA / COLOR NEGATIVE FILM

July 2015 • H-1-5213t

KODAK VISION3 200T Color Negative Film 5213/7213 is a 200-speed tungsten film that provides the image structure of a 100 speed film with the versatility of a 200 speed product—offering you the benefits of two films in one.

Like other films in the KODAK VISION3 Film family, VISION3 200T Film features unrivaled highlight latitude, reduced grain in shadows, flexibility in post, and, of course, proven archival stability. Additionally, you'll find that this film performs superbly in both controlled interiors and in challenging high-contrast exteriors.

Experience the improved extreme exposure performance and consistent VISION3 Film family look. Enjoy the added flexibility and increased creative control that comes with all the detail captured in the extremes of exposure. Benefit from the value in time and money that can be realized both on set and in postproduction.

BASE

KODAK VISION3 200T Color Negative Films 5213 and 7213 have an acetate safety base with rem-jet backing.

Warm-up Times

To prevent film telescoping, moisture condensation, and spotting, allow your film to warm to room temperature before use:

| Film Package | Typical Warm-up Time (Hours) | |
|--------------|------------------------------|-------------------|
| | 14°C (25°F) Rise | 55°C (100°F) Rise |
| Super 8 | 1 | 1 1/2 |
| 16 mm | 1 | 1 1/2 |
| 35 mm | 3 | 5 |

For more information about film storage and handling, see ANSI/PIMA ISO-18911, SMPTE RP131-2002, and KODAK Publication No. H-845, *The Essential Reference Guide for Filmmakers*, available online at www.kodak.com/go/referenceguide.

DARKROOM RECOMMENDATIONS

Do not use a safelight. Handle unprocessed film in total darkness.

[16]Kodak.com, "Super 8 Camera | Kodak", 2016. [Online]. Available: http://www.kodak.com/ek/US/en/consumer/Product/Product_Specs/?contentId=4294993082&TaxId=4294969683. [Accessed: 12- Feb- 2016].

Technical Specifications

| FILM | |
|--------------------------|---|
| FILM GAUGE | SUPER 8 (EXTENDED MAX-8 GATE) |
| FILM LOAD | KODAK CARTRIDGES WITH 50 FT (15 M) |
| SPEED | VARIABLE SPEEDS (9, 12, 18, 24, 25 FPS) ALL WITH CRYSTAL SYNC |
| LENS | |
| MOUNT | C-MOUNT |
| FOCAL LENGTH | FIXED / 6 MM, 1:1.2 – RICOH LENS (OPTIONAL ZOOM 8-48 MM LENS) |
| FOCUS / APERTURE | MANUAL FOCUS & IRIS |
| VIEWFINDER | |
| VIEW FINDER | 3.5" DISPLAY THAT HAS A STANDARD DEFINITION VIDEO INPUT AND SUPPORTS SWIVEL +/- 45 DEGREES |
| EXPOSURE | |
| EXPOSURE CONTROL | <ul style="list-style-type: none"> • BUILT-IN LIGHT METER FOR SUPPORTED SPEEDS OF ALL KODAK FILM TYPES • MANUAL SPEED / MANUAL IRIS SETTING |
| POWER SUPPLY | |
| BATTERY & CHARGER | INTEGRATED BATTERY AND CHARGER VIA STANDARD USB WALL ADAPTER |
| CONTROL PANEL / SETTINGS | |
| CONTROL PANEL | VIA VIEWFINDER 3,5" TFT LCD |
| SETTINGS | VIA JOG WHEEL AS USER INTERFACE |

Reference designs

[17] Mount'n Mover, "Wheelchair Mounting - Mount'n Mover", 2012. [Online]. Available: <https://www.mountnmover.com/support/wheelchair-mounting/>. [Accessed: 30- Jan- 2016].

[18] Broadened Horizons, "Wheelchair Mounting - Mount'n Mover", 2012. [Online]. Available: <https://www.mountnmover.com/support/wheelchair-mounting/>. [Accessed: 31- Jan- 2016].

[19] *Wheelchairs — Part 2: Determination of dynamic stability of electric wheelchairs*, ISO Standard, 7176-2.

TITLE PAGE PHOTO

[20] *Pas De Deux*. Lontreal: Norman McLaren, 1968.