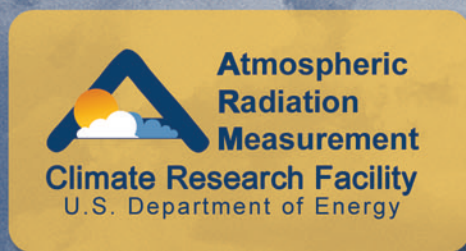


Tower Camera Handbook



January 2005



Work supported by the U.S. Department of Energy
Office of Science, Office of Biological and Environmental Research

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Contents

1.	General Overview	1
2.	Contacts.....	1
3.	Deployment Locations and History.....	1
4.	Near-Real-Time Data Plots	2
5.	Data Description and Examples	2
6.	Data Quality	4
7.	Instrument Details	5

1. General Overview

The tower camera in Barrow provides hourly images of ground surrounding the tower. These images may be used to determine fractional snow cover as winter arrives, for comparison with the albedo that can be calculated from downward-looking radiometers, as well as some indication of present weather. Similarly, during spring time, the camera images show the changes in the ground albedo as the snow melts. The tower images are saved in hourly intervals. In addition, two other cameras, the skydeck camera in Barrow and the piling camera in Atqasuk, show the current conditions at those sites.

2. Contacts

2.1 Mentor

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2.2 Instrument Developer

Three different models of the Axis cameras are deployed at the North Slope of Alaska (NSA) site: Axis 200+, Axis 2420, and Axis 2120. The camera manuals may be found on the Axis website: www.axis.com.

3. Deployment Locations and History

The tower camera is deployed at the Barrow facility in the NSA locale. Status as of January 27, 2005:

Camera name	Location	Current image	Camera	Historical photos?
Tower camera - Barrow	NSA-C1	ftp://ftp.arm.gov/pub/www/incoming/nsacam/brw_tower.jpg	Axis 200+ (to be replaced with 2120)	Yes: ARM data archive under "Catalog Data", "NSA", "Surface Meteorology"
Skydeck camera - Barrow	NSA-C1	ftp://ftp.arm.gov/pub/www/incoming/nsacam/barrow.jpg	Axis 200+ (to be replaced with Axis 2120)	No
Tower (piling) camera - Atqasuk	NSA-C2	ftp://ftp.arm.gov/pub/www/incoming/nsacam/atq_tower.jpg	Axis 200+ (to be replaced with Axis 2120)	No

4. Near-Real-Time Data Plots

Real-time data plots from the tower camera are available online at the following URLs:

- <ftp://ftp.arm.gov/pub/www/incoming/nsacam/barrow.jpg>
- ftp://ftp.arm.gov/pub/www/incoming/nsacam/brw_tower.jpg
- ftp://ftp.arm.gov/pub/www/incoming/nsacam/atq_tower.jpg.

5. Data Description and Examples

5.1 Data File Contents

One data stream, twrcam40m.a1, is produced using the tower camera in Barrow. The hourly images (in jpg format) from a single day are compressed into a tar folder. For example, the file nsatwrcam40mC1.a1.20040701.000000.jpg.tar, when untarred, contains the hourly jpeg images from the (40-meter) Barrow tower for July 1, 2004. There are no variables in the data files. The time stamp is in Universal Time (UT or GMT).

5.1.1 Primary Variables and Expected Uncertainty

This section is not applicable to this instrument.

5.1.1.1 Definition of Uncertainty

This section is not applicable to this instrument.

5.1.2 Secondary/Underlying Variables

The following variables can be deduced using the Barrow tower camera images:

- Visual record of sky conditions on southerly direction
- Fractional snow cover

5.1.3 Diagnostic Variables

This section is not applicable to this instrument.

5.1.4 Data Quality Flags

This section is not applicable to this instrument.

5.1.5 Dimension Variables

This section is not applicable to this instrument.

5.2 Annotated Examples

Below are examples from the two cameras installed in Barrow and one in Atqasuk.

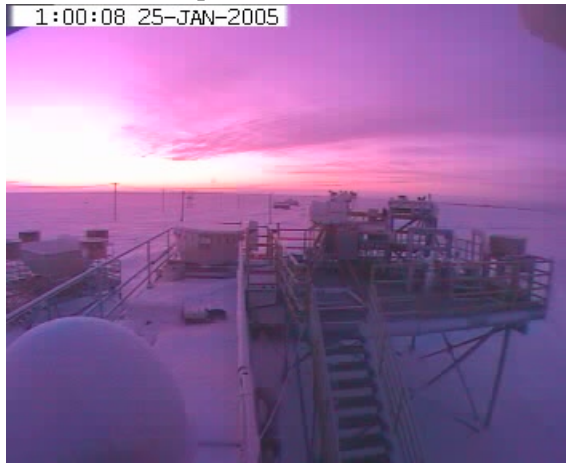


Figure 1. Image from Barrow skydeck camera. Visible is the instrument deck in Barrow, as well as conditions on the ground (complete snow cover), and general weather (partly overcast skies). Only current images are available from this camera.



Figure 2. Winter (Jan 28, 2005) and summer (July 12, 2004) images from the tower camera located at the top of the 40-meter meteorological tower in Barrow. Near the upper center of the image, the Barrow instrument site is visible next to the gravel road. Near the bottom of the summer image, there are cables visible that are running along the ground to a 5-meter tip tower, on which the downward-looking radiometer instruments are located. In the winter image only the base of the tip tower is visible, but not the cables. These images can be used to estimate ground snow cover, as well as the general weather. The images from this camera are available from the Atmospheric Radiation Measurement (ARM) Program's data archive in addition to the current view obtainable from the web.



Figure 3. Image from Atqasuk cam. In the center is the Atqasuk 5-meter tip tower, on which meteorological instruments are located as well as downward-looking radiometers. Behind the tower, on the horizon, is the Atqasuk instrument shelter, and Atqasuk village lights to the left of it. The image may be used to estimate snow cover and general weather conditions. Only current images are available.

5.3 User Notes and Known Problems

The cameras record only ambient light. In winter, the only images that are not completely dark will be those obtained near solar noon, approximately 22 UT.

5.4 Frequently Asked Questions

This section is not applicable to this instrument.

6. Data Quality

6.1 Data Quality Health and Status

This section is not applicable to this instrument.

6.2 Data Reviews by Instrument Mentor

This section is not applicable to this instrument.

6.3 Data Assessments by Site Scientist/Data Quality Office

This section is not applicable to this instrument.

6.4 Value-Added Procedures and Quality Measurement Experiments

This section is not applicable to this instrument.

7. Instrument Details

7.1 Detailed Description

7.1.1 List of Components

From the axis website:



[AXIS 2120](#)



[AXIS 2420 *](#)

Embedded camera	AXIS 2120	AXIS 2420 *
Compression	✓	✓
Frames per second	Motion JPEG	Motion JPEG
Indoor/outdoor use	Up to 30/25 (NTSC/PAL)	Up to 30/25 (NTSC/PAL)
Audio support	✓**	✓**
Motion detection	✓***	✓***
Pan/Tilt/Zoom control	✓	✓
Max video resolution		✓****
Image sensor	704x576 (PAL) 704x480 (NTSC)	704x576 (PAL) 704x480 (NTSC)
Zoom	1/3" Sony ExView HAD interlaced CCD	1/3" Sony ExView HAD interlaced CCD
Lens type	Manual	Manual with support for external control
Lens changeable	Varifocal (3.5-8.0 mm), DC-iris lens, CS-Mount	Varifocal (2.8-12 mm) CS-Mount, auto iris lens
Min. illumination Light sensitivity	✓	✓
Analog output	1 lux	0.5 lux *****
Ethernet networks		✓
Modem support	10/100BaseT	10/100BaseT
Serial connectors	✓	✓
Alarm input relay output	RS232	RS232, RS422, RS485
Other features	✓	✓

The Axis 200+ cameras will soon be removed from usage on the NSA site. The overview of 200+ from the axis website is as follows:

Direct digital camera, 24-bit color

Charge-coupled device (CCD): High-quality 1/3", 768 x 582 pixels

Lens mount: CS mount (C mount with C/CS ring)

Lens iris: Auto iris lenses supported

Illumination range: 5 - 5000 Lux (with delivered lens), 2 - 200.000 Lux (with F1.0 auto iris lens)

White balance: Automatic or fixed.

Gamma: 0.45

Optical filter: Quartz low-pass filter with infrared (IR) cut filtering.

Delivered with a basic wide angle lens. Focus can be adjusted from 0.02 in (0.5 mm) to infinity. The lens can be replaced with any industry-standard C or CS lens.

Focal length: 5.5 mm

Apperture: Fixed F2.0

Thread: M12P0.5 mm

Angle of view: Approx. 51 deg. horizontal, 39 deg. vertical

Axis 2120 description from the axis website:

Camera

- Digital, 24-bit color

Image sensor

- 1/3-inch Sony super HAD interlaced CCD.
- HxV: 768x495 (NTSC),.
- Resolution (pixels): 704x480 (NTSC)

Exposure

- Backlight compensation
- Automatic Gain Control (AGC)
- Automatic and fixed White Balance
- Electronic shutter: 1/60s -1/10.000 sec. NTSC

Sensitivity

- Illumination range: 1 – 200,000 Lux with F1.0 DC-Iris lens. About 1 to 5,000 Lux with fixed iris lens.

Lens

- Standard CS mount lens fitting
- DC-Iris vari-focal (zoom) lens 3.5–8.0mm eqv. to 25-55mm on a 35mm camera

Image

- Image frame rate: up to 30 frames/s at 352x240 resolution. Up to 12 frames/s at 704x480 resolution.
- JPEG still images and Motion-JPEG video

Axis 2420 description from the axis website:

Camera

- Digital, 24-bit color

Image sensor

- 1/3-inch Sony super HAD interlaced CCD
- HxV: 768x495 (NTSC)
- Resolution (pixels): 704x480 (NTSC)
- Horizontal resolution: 480 TV lines

Exposure

- Backlight Compensation
- AGC
- Automatic and fixed White Balance

- Electronic shutter:
1/60 - 1/10.000 sec. (NTSC)
Sensitivity
 - Illumination range: 1 to 200 000 Lux with F1.0 DC-Iris lens. Excellent in low light situations.
- Video Output
- 1.0V (p-p) 75 ohm, sync negative
- Signal-to-Noise Ratio
- 50dB (AGC off).

The cameras are at present housed in Pelco (pelco.com) enclosures, model number EH4718-1, with a window defroster HK47-1.

7.1.2 System Configuration and Measurement Methods

This section is not applicable to this instrument.

7.1.3 Specifications

This section is not applicable to this instrument.

7.2 Theory of Operation

This section is not applicable to this instrument.

7.3 Calibration

7.3.1 Theory

This section is not applicable to this instrument.

7.3.2 Procedures

This section is not applicable to this instrument.

7.3.3 History

This section is not applicable to this instrument.

7.4 Operation and Maintenance

7.4.1 User Manual

This section is not applicable to this instrument.

7.4.2 Routine and Corrective Maintenance Documentation

This section is not applicable to this instrument.

7.4.3 Software Documentation

This section is not applicable to this instrument.

7.4.4 Additional Documentation

This section is not applicable to this instrument.

7.5 Glossary

See the [ARM Glossary](#).

7.6 Acronyms

AGC	Automatic Gain Control
ARM	Atmospheric Radiation Measurement (Program)
CCD	charge-coupled device
DC	direct current
GMT	Greenwich Mean Time
IR	infrared
UT	Universal Time

See the [ARM Acronyms and Abbreviations](#).

7.7 Citable References

This section is not applicable to this instrument.