Participate:

It is possible to participate in the CAMS project by:

- Adding a camera to an existing network, if you are within about 150 km (100 miles) from existing CAMS cameras. Contact your local network coordinator.
- Starting a new network, if you have another person at 40-150 km distance to triangulate with. Contact Dr. Peter Jenniskens.

Hardware requirements:

Parts needed (Vendors listed below show the materials needed. Other vendors will sell the same materials, possibly less expensive; Also, be aware that specifications will change over time and these are just guidelines):

1. Computer: A dedicated (multicore) PC desktop or laptop running windows 7 or higher. Best a quad-core i7 proessor with at least 1 Terrabyte of hard disk storage. An i7 can handle 16 or 20 cameras. An i5 can handle up to 8 cameras.

2. The choices for harddrive are: Hard Drive (HD), Solid State Hard Drive (SSD), Solid State Hybrid Hard Drive (SSHD), or a combination. CAMS is very hard drive intensive, as it can collect around 5,000 x 1 MB files per camera per night or more. SSD are faster, but tend to have smaller capacity, are more expensive, and unrecoverable when they go bad. SSHD are much less expensive than SSD, but much faster than HD and they are more recoverable if they go bad. SSD or SSHD can be used for capture and then move the data to an HD or SSHD for more permanent storage. Optional External Hard Drive: An external USB, eSATA, or other kind of removable hard drive can be a useful flexible option for archiving.

3. Video framegrabber: There are several choices to make, depending on how many cameras you ultimately will want to deploy. Choosing a more capable framegrabber is better for expanding later to more cameras. It is important to use a video frame grabber that can produce 60 interlaced NTCS frames per second (or 50 PAL fps). For running 1-2 cameras, models like the EZ-CAP 116 or related EasyCAP DC60 style USB frame grabber will do. Be sure to purchase the EasyCap version compatible with your operating system (XP or Windows 7-10 32-bit or 64-bit). The more expensive of these items tend to be better and last longer. For running 4-16 cameras, we have written software that is compatible with the Sensoray models: Sensoray 2255 USB 4 channel grabber; Sensoray 812 PCIe 8 channel grabber (will not fit in small form factor computers); Sensoray 1012 Mini PCIe 8 channel grabber; and Sensoray 811 PCIe 16 channel grabber (will not fit in small form factor computers). Most popular is the Sensoray Model 812 8-channel framegrabber card. A PC can hold up to 3 such cards.

4. Camera: There are two choices: the 1/2 inch sensor diameter [Watec WAT-902H2 Ultimate](#) camera or the 1/3 inch sensor diameter Sony ExView HAD CCD II (with Sony Effio-E dignital signal procesor and no IR cut-off filter). Note: do not choose the Super HAD CCD II. The Watec is more sensitive but also much more expensive. When used with the right lens, the 1/3 inch cameras can produce good data that can match the Watec under certain circumstances.

5. Lens: For the Watec camera, choose the 12-mm f/1.2 Pentax C61215KP model lens (or equivalent) for non-zenith oriented cameras, together with a [C-CS mount](#) lens adapter. Choose the equivalent 8mm f/1.2 lens for zenith cameras. In this context, zenith means cameras pointing with an elevation angle of 74 or higher. For the 1/3 inch cameras, use lenses that are designed for such small sensor format, but use a slightly lower focal length to have the same field of view. We recommend the inexpensive options: 12mm f/1.0 or better f-number for elevation angles 30-44 degrees; 8mm f/1.0 or better for elevation angles between 44-74 degrees and 6mm f/1.0 for angles above 74 degrees. Do not use the 4mm f/1.0 lenses. They have too much distortion. 6-mm lenses can also disappoint. Best to try out lenses from the vendors to test if they are in focus over the full video frame.

6. Power supply: A 12V DC power supply for the camera. [Power supplies for up to 16 cameras](#) are offered by video security camera stores. You will need an extension cord to go from your 110V/120V outlet to the power supply box. You will need a number of DC Power pigtail male plug cables (same vendor) to go from power supply unit to camera. Alternatives exist, such as 8-camera power supplies.

7. Video cable: For each camera a 25ft (or sufficient length) video cable with BNC connectors, suitable for outdoor use, to go from camera to PC. It is also possible to use baluns at the camera and framegrabber and use an ethernet cable to transfer data and provide power to the camera.

8. Camera housing: A weather proof box with glass window and support struts to mount the cameras the the correct angles inside the box (for 4-16 cameras) or a smaller video security camera housing (1-2 cameras), or place the cameras in a dark room behind window (1-4 cameras).

9. Light sensor: A [dawn-dusk timer with two output ports](#) using a light sensor (used for outdoor christmas lighting, for example). Place it at the end of the extention cord, near the camera housing, to give power to the power supply of the cameras only during night time.

10. Heating cable: When using larger enclosure, it is advisable to have a 25W [heating cable](#) (draped inside the box) to prevent dew on the glass. Mount heating cable on the second output port of your dawn-dusk timer.

Instructions:

Computer: Hook up to internet and install TeamViewer. Install the EasyCap or Sensoray driver software (from disc supplied with EasyCap device). Contact us to provide the single-CAMS software and the scripts to run the cameras autonomously. Software will be installed on C-drive under new folder "CAMS" (C:\CAMS).

Video framegrabber: Put EasyCap in back USB port of computer or install Sensoray cards in PC.

Camera: For the Watec cameras: put the C-CS Mount adapter on the camera, then mount the lens. Camera set button gamma on "LO"- both white switches in back on middle position. Sony HAD box cameras are often ready to go. Follow camera instructions for installing software.

Power to the camera: Hook up the 12V DC power supply and dawn-dusk timer to the camera [careful with electricity]. Multiple cameras: hook up extension cord to dawn-dusk timer, then power supply to down-dusk timer. Install pigtail cables from power supply to camera.

Video out: Install bnc video cables from camera to framegrabber in PC.

Run Camera_Liveviewer program to see video feed. Adjust camera settings: set lens wide open at f1.2 and focus at infinity so that stars are sharp. Run Capture.exe to start capture video files in FF format. For multi-core PC's: run capture and processing at same time.

Camera calibration: Run CameraMovies to create movie of series of captured files. Select one file for starfield calibration using FTP_Meteor_Cal program. Then run FTP_Reprocess for all FF files to obtain apparent meteor trajectories (creates file: FTP_Detectinfo.txt).

It takes an evening's work by nearly anyone to set this up. Provide survey area coordinator once with gps location of your observing site by sending CameraSites.txt file.

After each night of observations, the scripts will upload the following files as a zip folder in the SETI Institute ftp CAMS dropbox. the CAL.txt file, the FTP_Detectinfo.txt file and an example bin file showing a star field to recalibrate the CAL.txt file if needed. Typical upload size per camera: 2-5 MB per camera per night.

More information: Single CAMS Manual (pdf), courtesy of Dave Samuels (photo right).