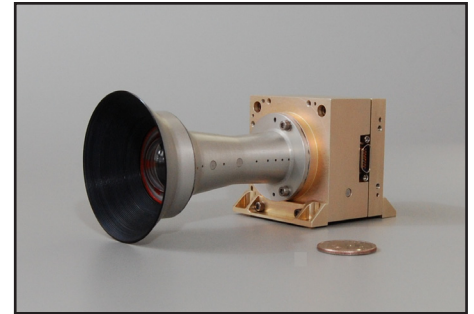


## Features

- Acquire still images and high-definition video
- Small lightweight cameras
- 2048 (H) x 1536 (V) active pixels
- 10 megapixel/second video rates
- 1/2 inch optical format
- Standardized optics interface
- RGB Bayer Pattern filter
- Low dark current
- Superior low-light performance
- Programmable gain and exposure
- Programmable window selection
- Row and column skip and binning modes
- Integral pixel companding
- Radiation tolerant design

## ECAM-C30

Color CMOS Camera, 3 Megapixel



ECAM-C30 Alternate Mounting Configurations

The ECAM Imaging System minimizes spacecraft overhead and flexibly delivers the features, performance, and reliability required to service a variety of applications, including:

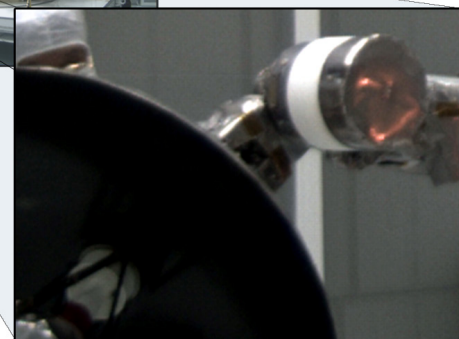
- In-flight engineering diagnostics
- Deployment/actuator monitoring
- Space situational awareness
- Science observations
- Public outreach

Leveraging the experience of more than a dozen science instruments delivered to deep space that have returned more than 700,000 images, the ECAM imaging system delivers cost-effective, short lead-time, high-performance, and reliable space imaging as a modular off-the-shelf solution.



QXGA (Full Frame)  
2048 x 1536  
2.5 fps

VGA  
640 x 480  
20 fps



The C30 utilizes a CMOS image sensor with integral RGB Bayer Pattern color filter array. The sensor outputs 10-bit pixels that are square-root companded to 8-bits before being transmitted to the DVR on a 100 Mbit/s serial link. Within the DVR, video is pre-processed and compressed in real-time, then buffered to memory for playback at a later time. Preprocessing typically includes Bayer Pattern interpolation and direct conversion to the YCbCr color space using a 5 x 5 filter kernel. The video is also reformatted as needed for input to either a JPEG (lossy) or Huffman First Difference (lossless) compressor.

The C30 is highly configurable. The exposure and gain may be adjusted to support widely varying scene conditions and the DVR supports automatic gain and exposure control. The C30 also supports windowing, allowing smaller format images and video to be acquired from anywhere within the scene. To acquire larger portions of the scene at lower resolution, binning and summing may be enabled. Video frame rate is fully adjustable, with the maximum supported frame rate varying with frame size.

Three standard lens options are available for the ECAM series visible-band cameras. ECAM optics are designed for the rigors of space flight, utilizing proven design and manufacturing methodologies with decades of heritage across more than a dozen missions. Our standard lens options have no moving parts, are athermalized to provide stable performance over a wide range of temperatures, and are built to withstand the hazards of launch and long-term operation in orbit.

The C30 includes mounting flanges that may be configured to mount the camera in one of four orientations.



#### MSSS FACTS

Headquarters: **San Diego**  
 Type: **Small Business**  
 Quality: **ISO9001:2008 Compliant**  
 DUNS Number: **62-680-9032**  
 CAGE Code: **OR9V5**  
 NAICS Codes: 333316, 336419, 541512, 541690, 541712, 927110

Version: 20130506  
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Parameter	ECAM-C30
Mass (without optics)	256 g
Dimensions	78(W) x 58(L) x 44(H) mm
Power Consumption	1.75 W (idle), 2.5 W (imaging)
Color Bands	RGB Bayer Pattern Filter 400-500 nm (blue) 500-575 nm (green) 575-750 nm (red)
Frame Size	QXGA 2048x1536, HD1080p 2048x1080, HD720p 1280x720, VGA 640x480
Pixel Size	3.2µm
Pixel Rate	10 Mpixel/s
Frame Rate	QXGA 2.5 frames/s, HD1080p 4 frames/s, HD720 8 frames/s, VGA 20 frames/s
Readout Type	Unbuffered (Buffered in DVR)
Companding	10-bit to 8-bit
Preprocessing	Performed in DVR
Compression	Performed in DVR
Data Interface	Spacewire
Supply Voltage	5 V
Design Life	Nominal 10 year (radiation determined)
Radiation Dose	5 years (GEO)
Recommended Operating Temperature	-20°C to 40°C

## Features

- Narrow, medium, and wide fields of view
- Athermalized design
- Rugged construction
- Broadband anti-reflective coatings
- Integral sunshade and baffling minimize stray light and lens flare
- Custom optics design services available
- Motorized focus and zoom available custom

## FOV Comparison



Narrow FOV



Wide FOV

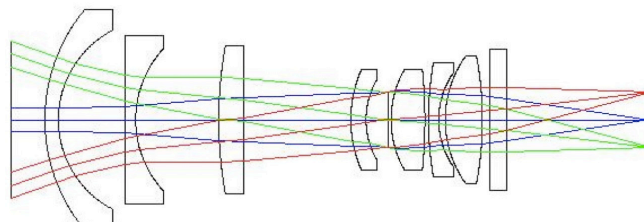
## ECAM Optics

### Standard and Custom Options

Three standard lens options are available for the ECAM series visible-band cameras, providing narrow, medium, and wide fields of view. ECAM optics are designed for the rigors of space flight, utilizing proven design and manufacturing methodologies with decades of heritage across more than a dozen missions. Our standard lens options have no moving parts, are athermalized to provide stable performance over a wide range of temperatures, and are built to withstand the hazards of launch and long-term operation in orbit.

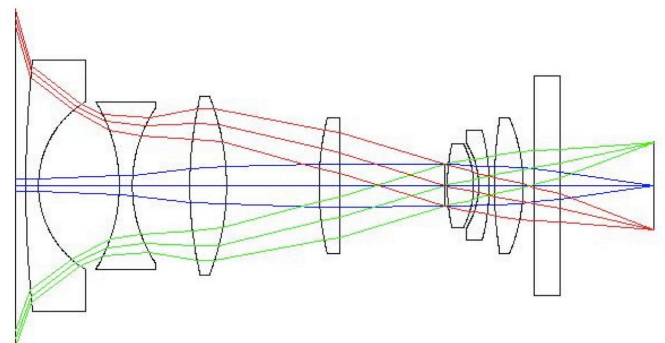


ECAM-NFOV

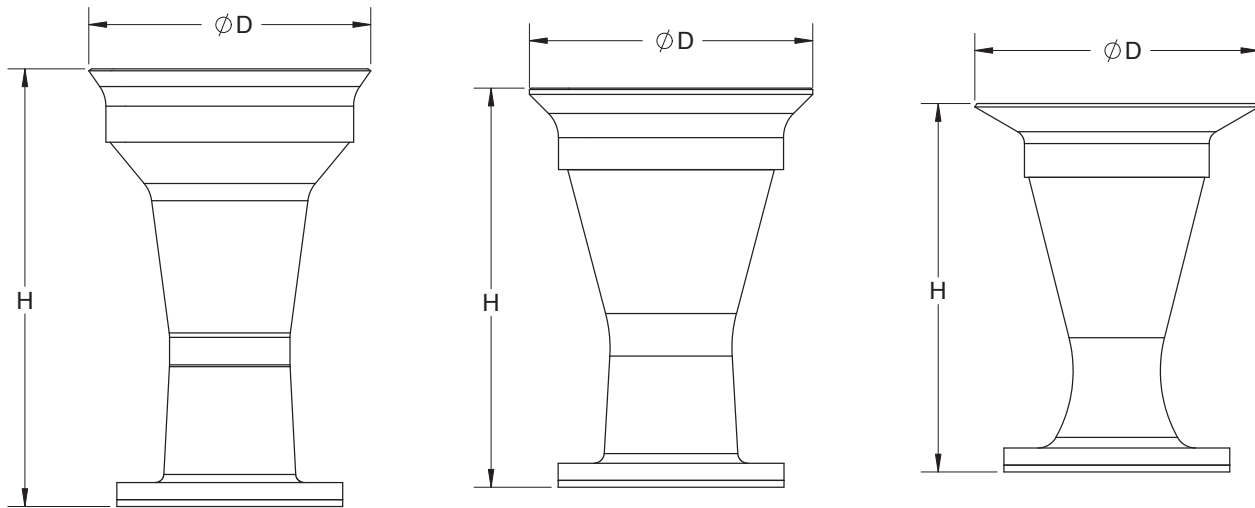


ECAM-NFOV  
Ray Trace  
Diagram

ECAM-WFOV  
Ray Trace  
Diagram



For missions with highly-tailored instrument requirements, MSSS provides custom optical design and manufacturing services. MSSS develops custom optics with fields-of-view from 15 to 180 degrees using standard refractive optics, with longer focal lengths supported using catadioptric and reflective telescopic optics. Additional capabilities for custom optical systems include motorized focus adjustment and zoom lenses.



**MSSS FACTS**

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Version: 20130506  
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Parameter	ECAM-NFOV	ECAM-MFOV	ECAM-WFOV
Mass	100 g	95 g	90 g
Dimensions	56 mm (D) x 86 mm (H)	57 mm (D) x 75 mm (H)	56 mm (D) x 69 mm (H)
Wavelength Range	400-700 nm	400-700 nm	400-700 nm
Effective Focal Length	12.6 mm	7.1 mm	4.7 mm
Focal Ratio	f/3.5	f/3.5	f/3.5
Horizontal FOV, C30	29 degrees	50 degrees	88 degrees
Vertical FOV, C30	22 degrees	38 degrees	63 degrees
Horizontal FOV, C50	25 degrees	44 degrees	77 degrees
Vertical FOV, C50	19 degrees	33 degrees	55 degrees
Radiation Dose	5 years (GEO)		
Recommended Operating Temp.	-55°C to 60°C		