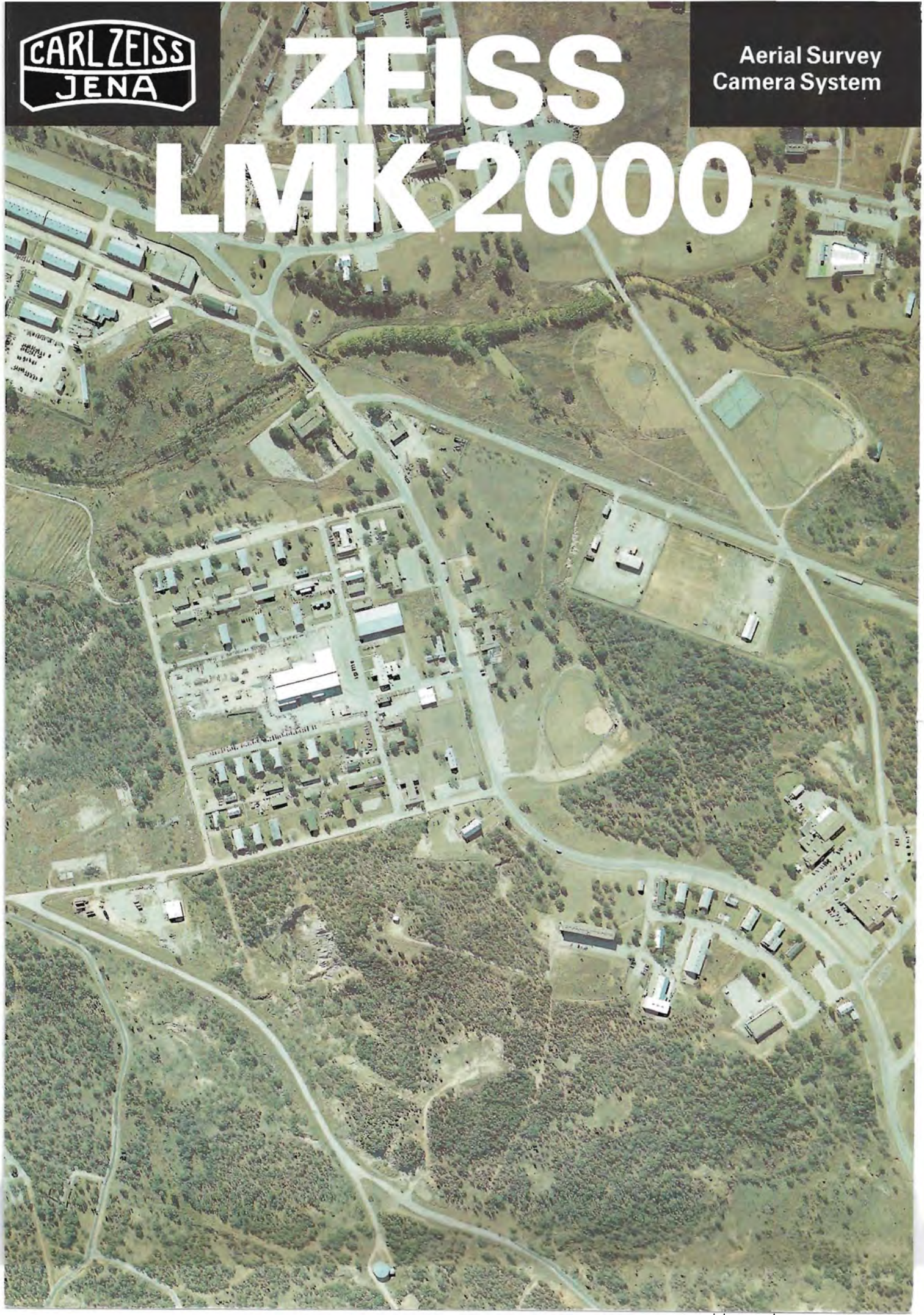
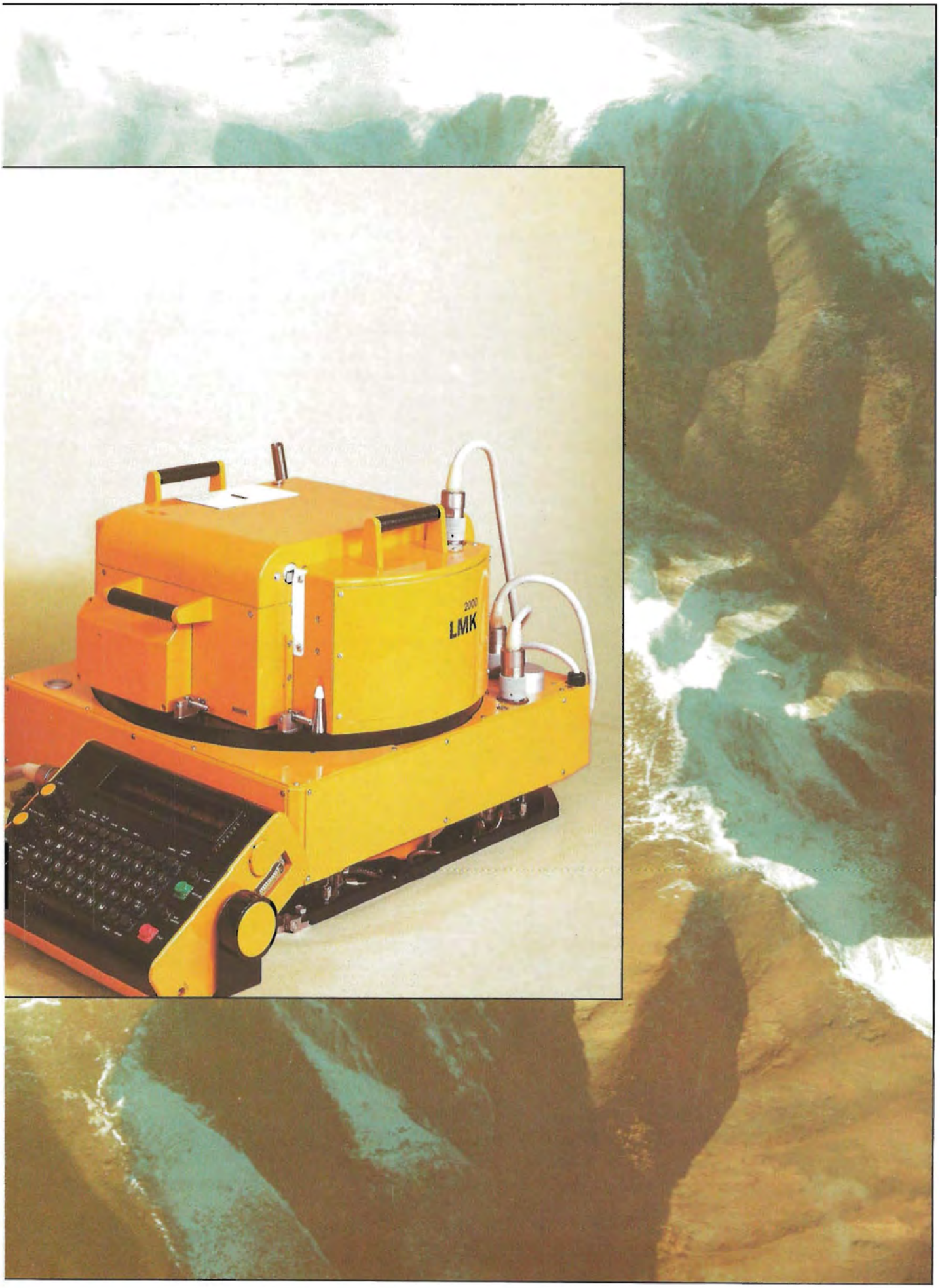
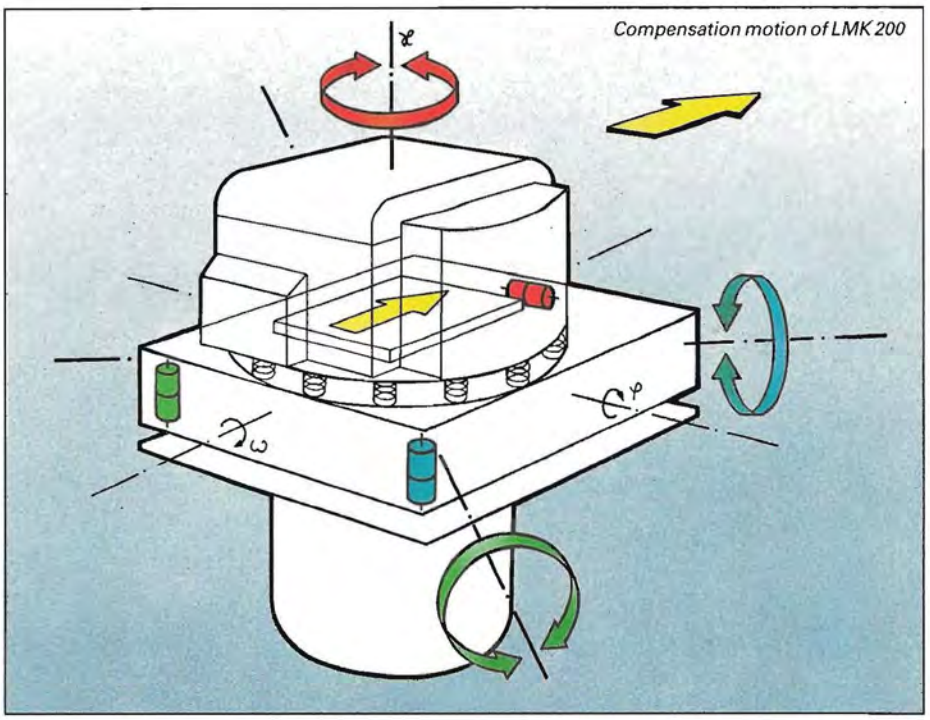
CARL ZEISS JENA

ZEISS LMK 2000

Aerial Survey Camera System







4

5

3

6

3 *Coloured film*

4 *Coloured-infrared film*

5 *black/white film, panchromatic*

6 *black/white-infrared film*

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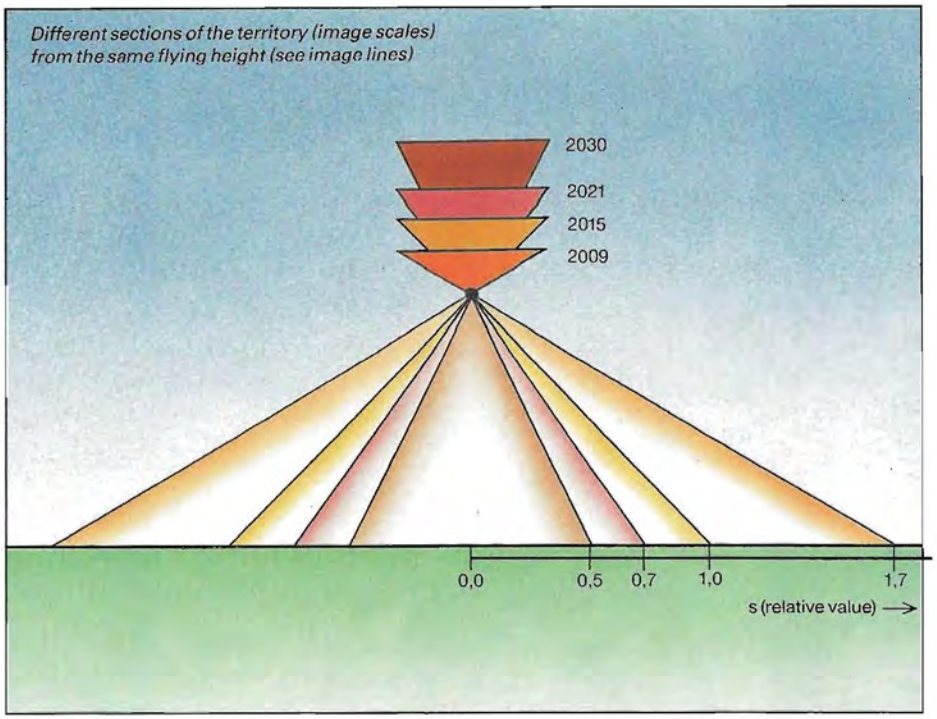
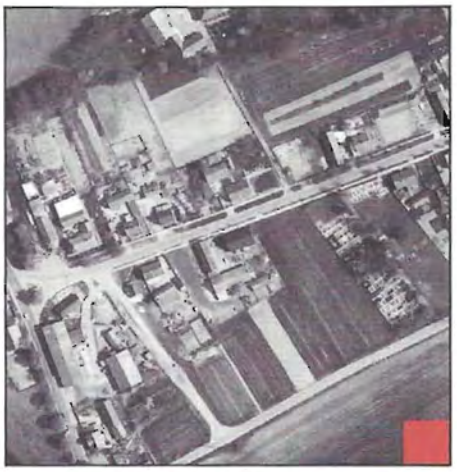
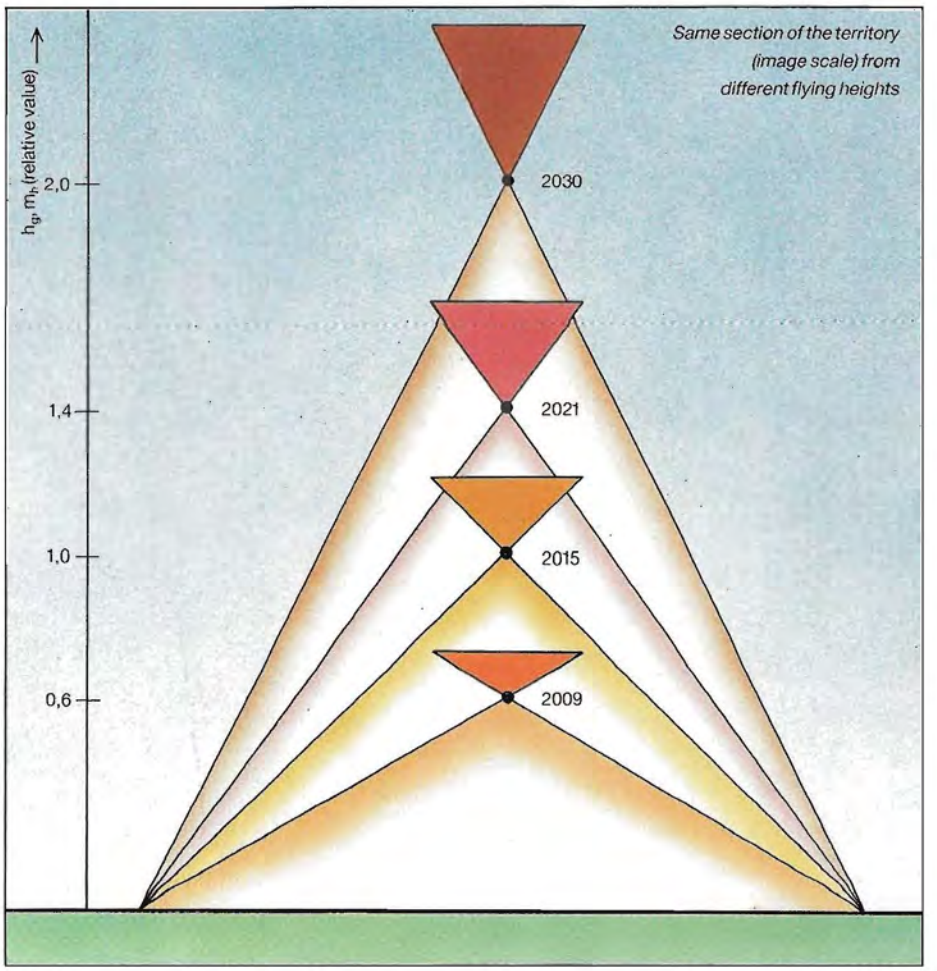
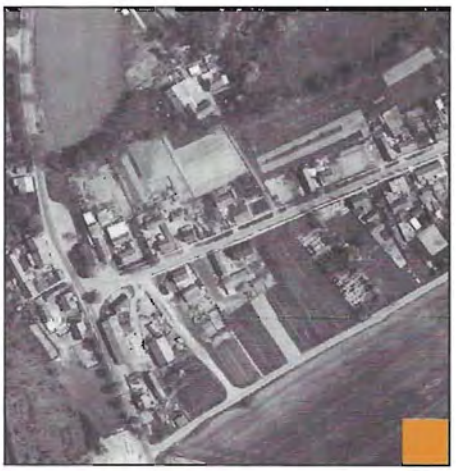
Arrangement and selection of lens cones









Structure of the system

The camera system comprises the following basic units:

Camera

– **Measuring camera** including the following functional units

optionally four **lens cones LC 2000** with lenses of different focal lengths, shutter, focal plane frame with recording devices and exposure meter.

Drive unit DU comprising two separate parts, **film drive** and **vacuum drive** for film transport and film flattening in the magazine.
Furthermore, the vacuum drive includes the control computers.

Film magazine MA 2000 with film pressure plate, film transport mechanism, components for forward motion compensation as well as data projectors.

Stabilized mount SM 2000 for fixing the camera in the aircraft, with components for dynamic stabilization of the position in three axis (including fast setting of drift and levelling) and for damping of vibration.

Support ring as connecting component of camera and stabilized mount SM 2000.

Intermediate rings in order to achieve floor clearance above an entrance window when changing to lens cones with longer focal lengths.

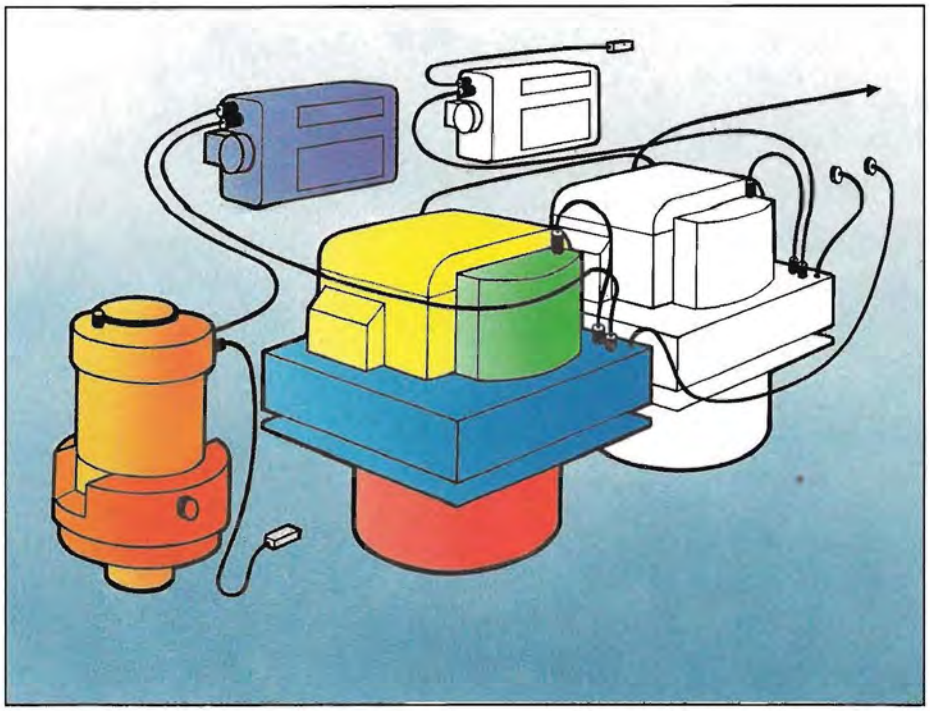
Control Unit
optionally either with

Control Unit CU 2000 with vertically aligned optical finder system for determining the drift and the v_g/h_g-ratio (flight speed/flight height over ground), defining the cycling rate and the speed of the forward motion compensation (FMC) or with

Navigation and Control Unit NCU 2000 with finder telescope having an inclined tube for visual navigation, all other functions are similar to those of the CU 2000.
The two units use the same type of **mount**.

Central Module CM 2000 contains the main computer as the central functional unit and permits entering of given flight parameters and additional information to be imaged on the film edge. The entered and computed data as well as errors are indicated on a control display.

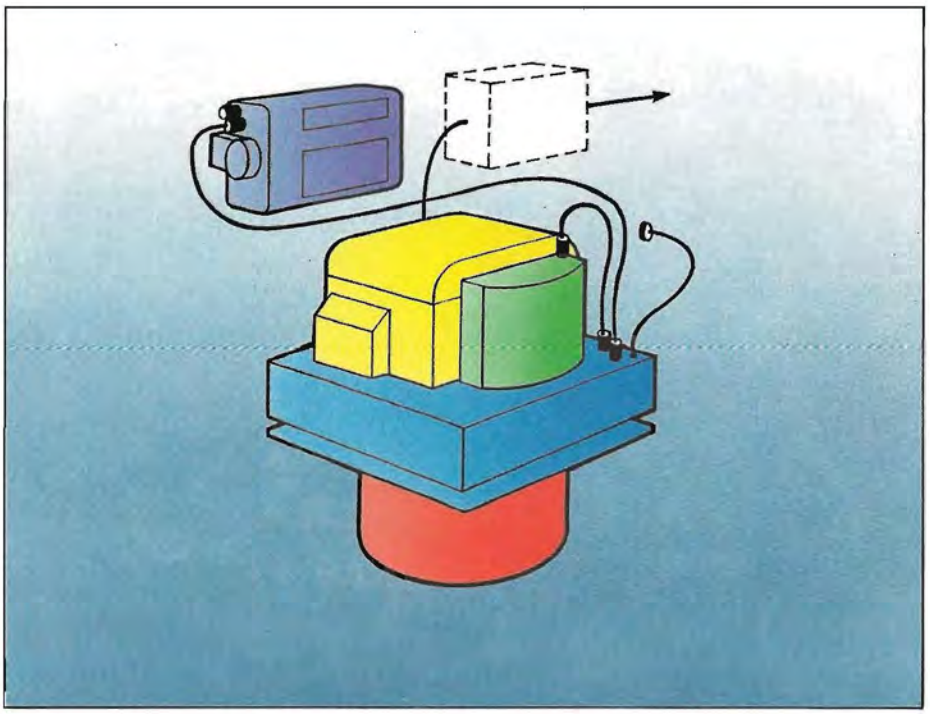
Image sequence indication for the pilot.



Equipment for two-men flight
(pilot=navigator/operator)
Navigation:
with instruments of the aircraft
Photographing:
Camera with CU 2000 and CM 2000
Image sequence indication for the pilot

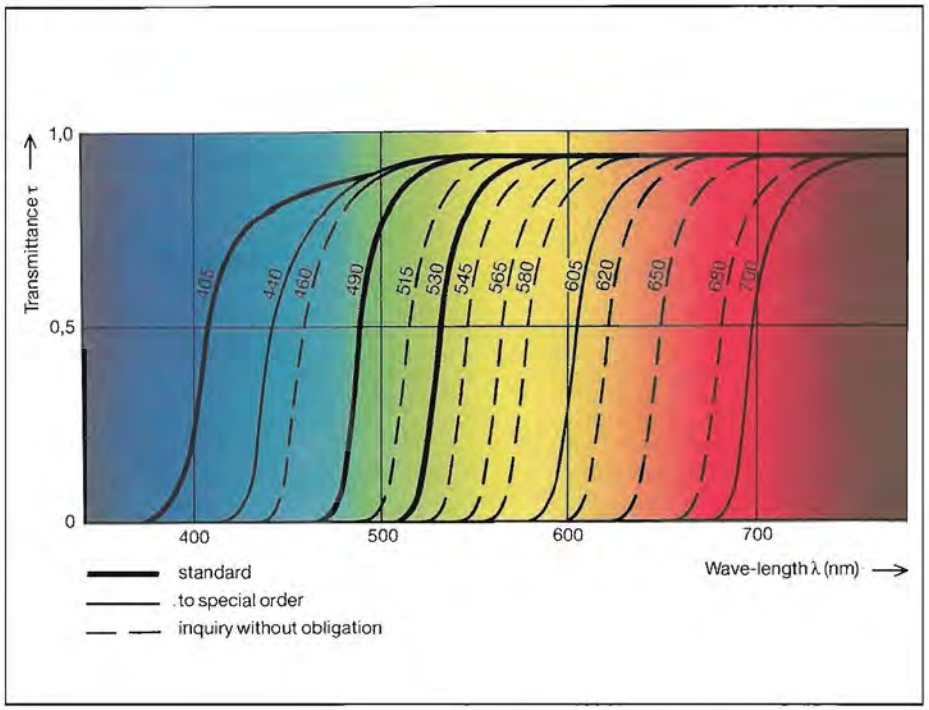
Multi-camera operation

Each camera with its own CM 2000.
Transmission of drift- and v_g/h_g-data through connection cables between the cameras from one control unit.



Equipment for one-man flight
(pilot=navigator=operator)
Navigation:
with instruments of the aircraft or supported by external positioning systems
Photographing:
Camera with CM 2000; control by an external navigation system or by intervalometer operation via fixed setting values

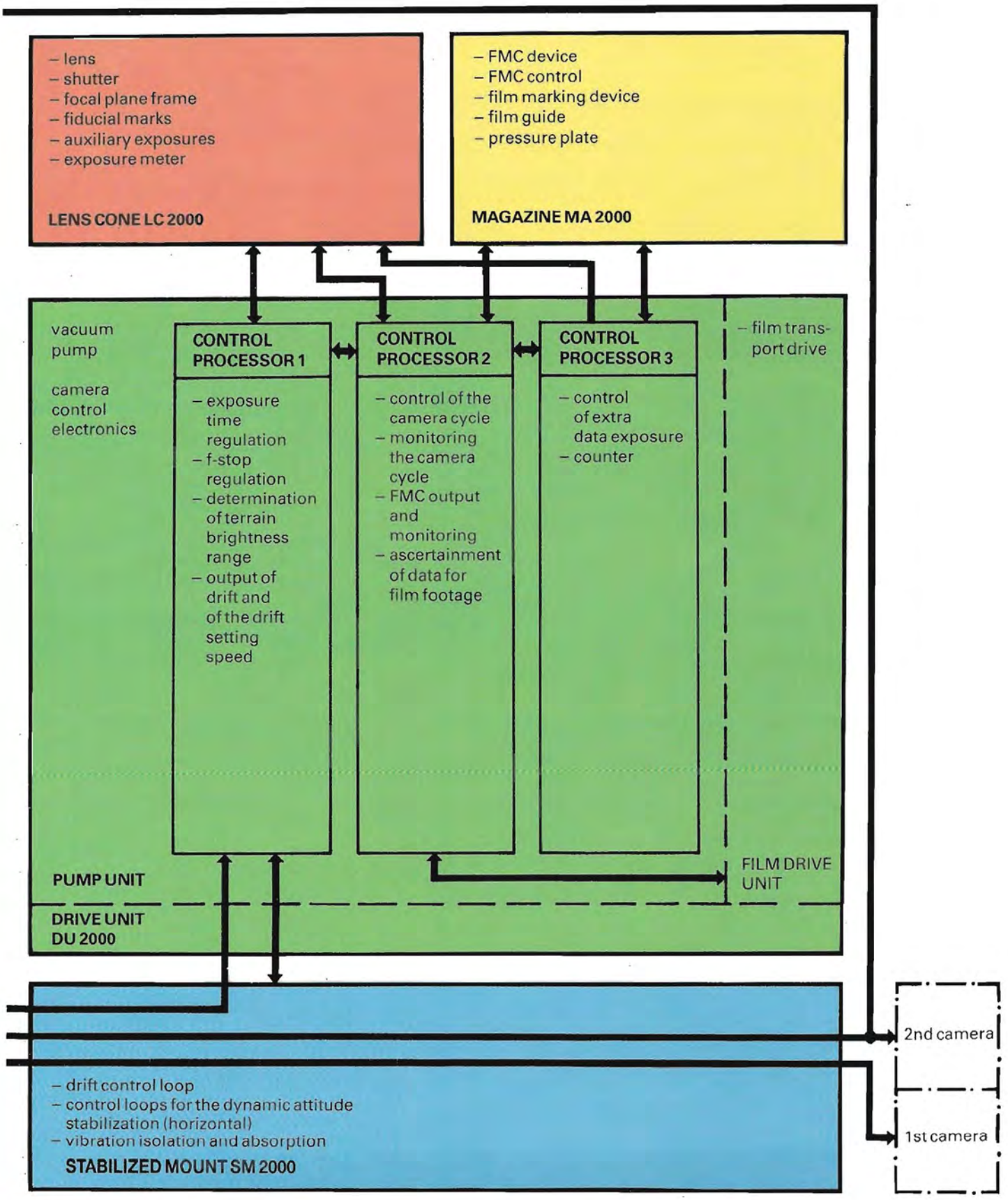
Filters

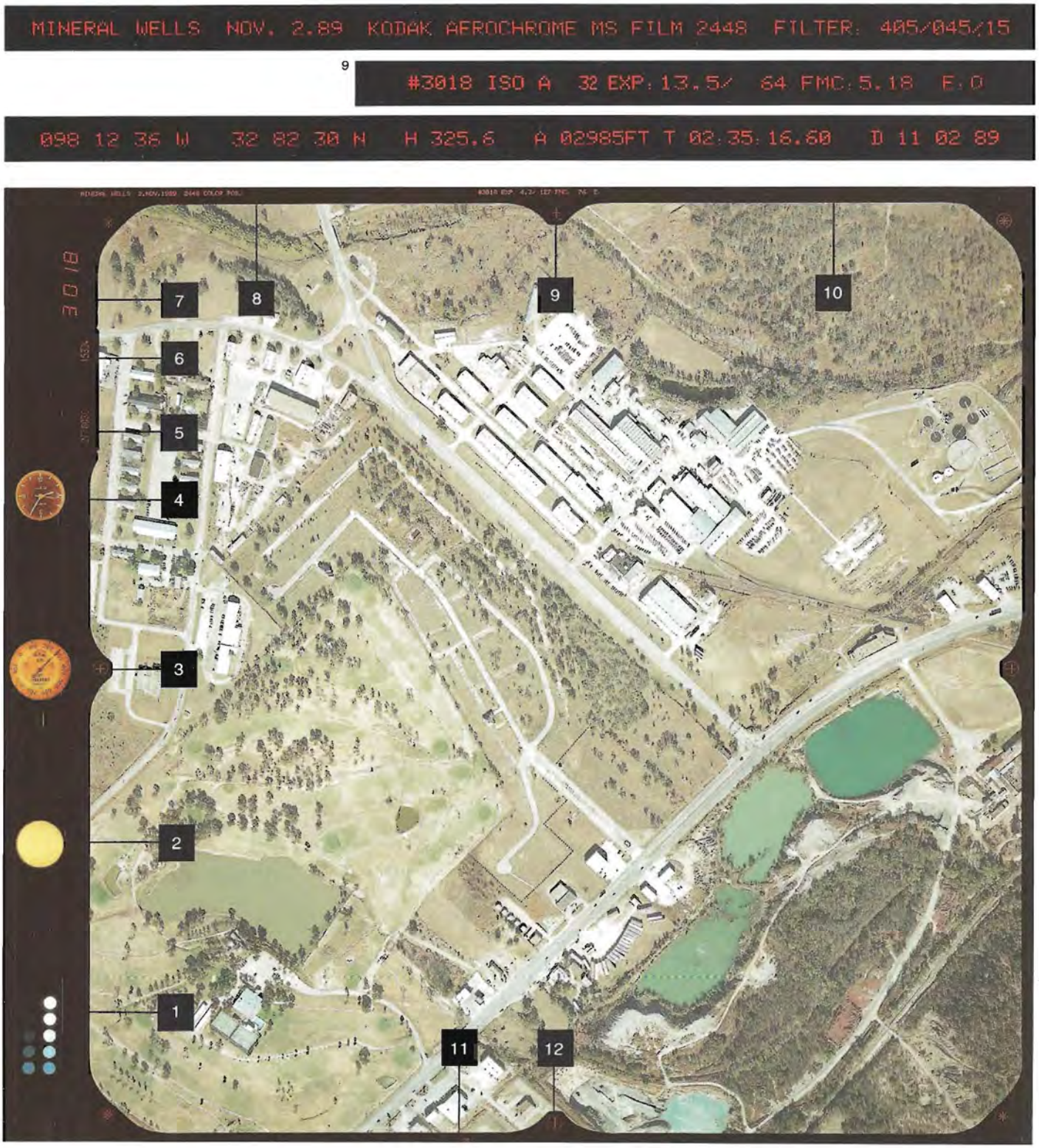


The filters serve for eliminating contrast-reducing atmospheric stray light or for limiting the spectral range, e.g. for infrared and coloured infrared photographs. Filter change is easily possible during the flight. As an additional optical element in the photographic ray, all filters meet highest demands on flatness and plane-parallelism. They are all antiflex-coated and provided with a colour-neutral graduated density layer for an additional improvement of high distribution in the image plane.
For various tasks, filters with special edge wavelengths between 405 nm and 700 nm can be supplied.

Shutter and stop

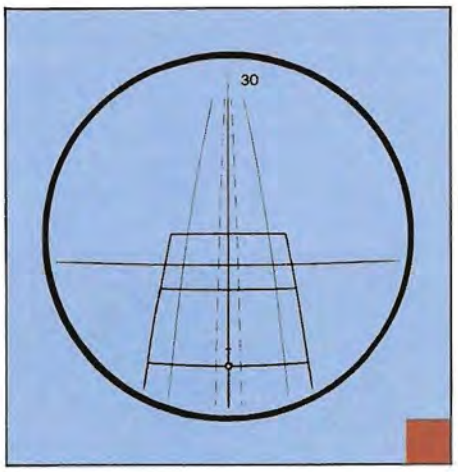
The lens cones are equipped with standardized rotary disk shutters which can be easily exchanged by the user without dismantling the lens being necessary, i.e. without disturbing the interior orientation of the lens cone. They have a high efficiency. The exposure time is electronically regulated in the wide range of $\frac{1}{60}$ s to $\frac{1}{1000}$ s.
The shutter stops are adjustable in small steps.
Exposure time and stop are either automatically controlled or entered as fixed values at the CM 2000. The modification of efficiency, when changing the stops, is automatically considered.

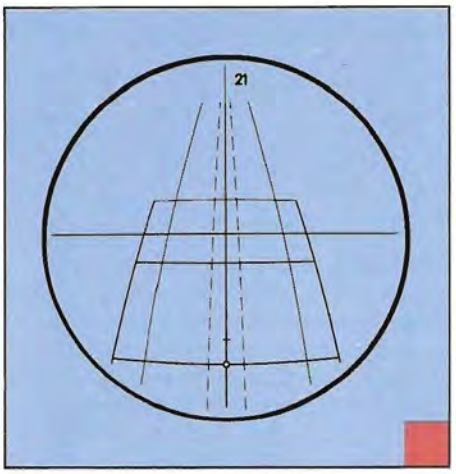


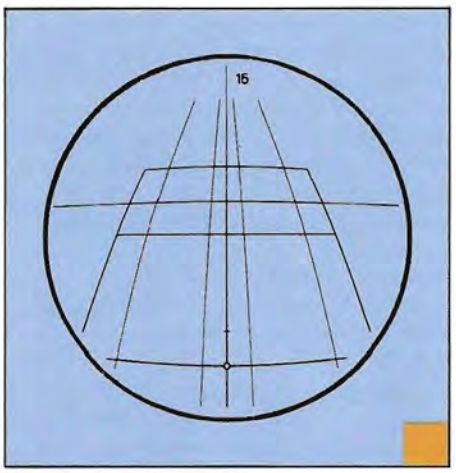


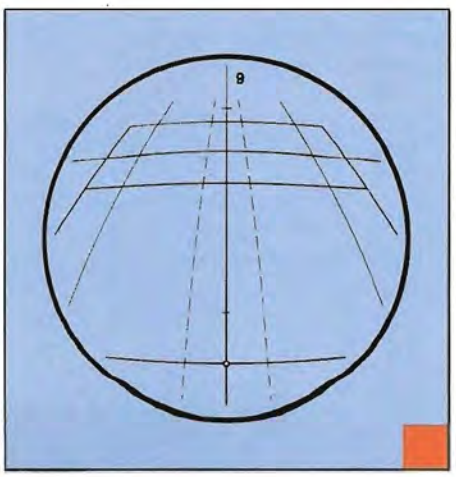
1 Grey wedge
2 Note pad
3 Altimeter
4 Clock
5 Serial number of lens cone
6 Calibrated focal length
7 Actual frame number
8 Project data to be entered via the CM 2000 keyboard
9 Functional data referred to the photo (actual frame number, set value of film sensitivity, stop number, exposure time, compensated amount of image motion, coded error indication)
10 Navigation data from a navigation system of the aircraft (geographical coordinates, flight direction, flying height, time, date)
11 Serial number of the magazine
12 Fiducial mark

Navigation and Control Unit NCU 2000









The navigation unit combines the function of the control unit with elements of visual navigation. The unit in the form of a vertical telescope uses the same type of mount as the control unit CU 2000. The beam path within the telescope head is deviated so that view is under an angle of 36° to the vertical axis. Top and bottom lengths are adjustable and can be matched to the seating height for the operator or to the thickness of the aircraft floor.

The v_g/h_g-ratio is determined by means of the luminous travelling grid whose speed can be varied.

According to the type of used lens cone, a special grid plate is inserted into the visual field. This plate contains all auxiliary lines and points necessary for navigation, such as a course line in the centre of the image which is used for determining the drift.

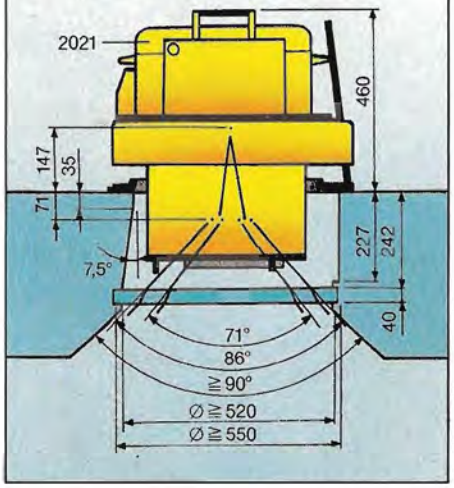
In addition to the set drift angle, the telescope can be turned azimuthally in 90°-stops. Thus, side view navigation and updating of the drift correction angle in back view are possible.

The operating elements correspond to those of the control unit CU 2000.

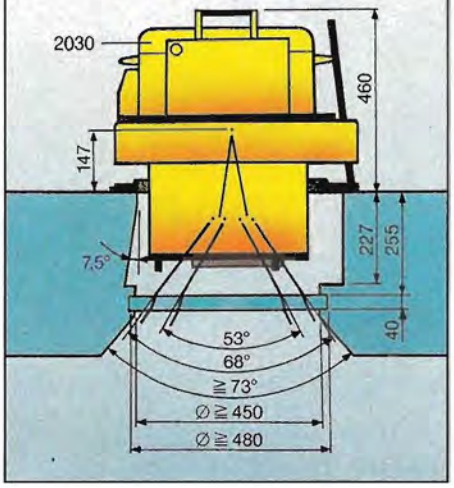
An optical image indication is located within the visual field of the eyepieces.

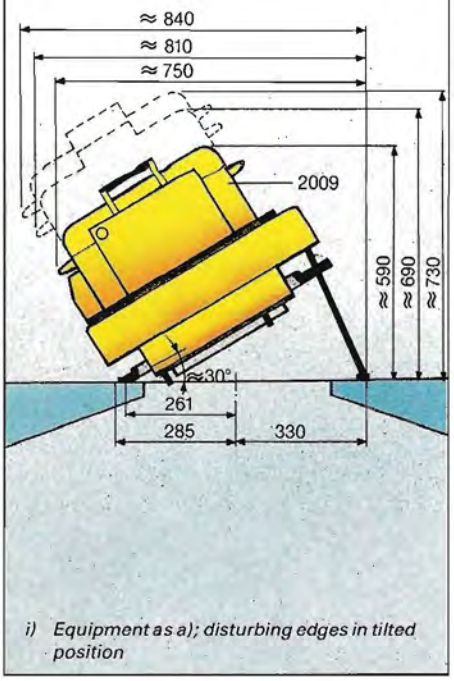
The NCU 2000 can also be run independently of the camera – as a navigation unit only. In this case, neither the travelling grid nor the optical image indication are illuminated.

e) LMK 2021, also LMK 2030



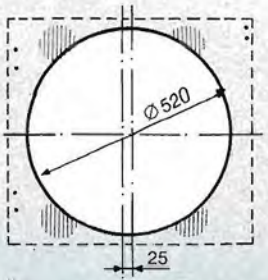
g) LMK 2030



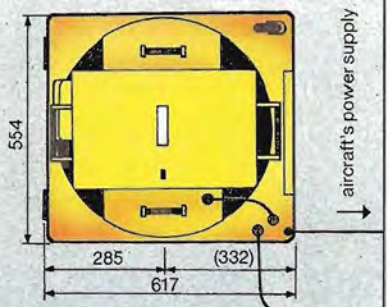


i) Equipment as a); disturbing edges in tilted position

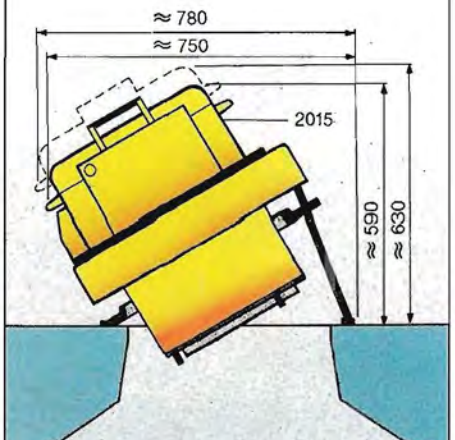
f) Bottom opening and fixing points for e) and g)

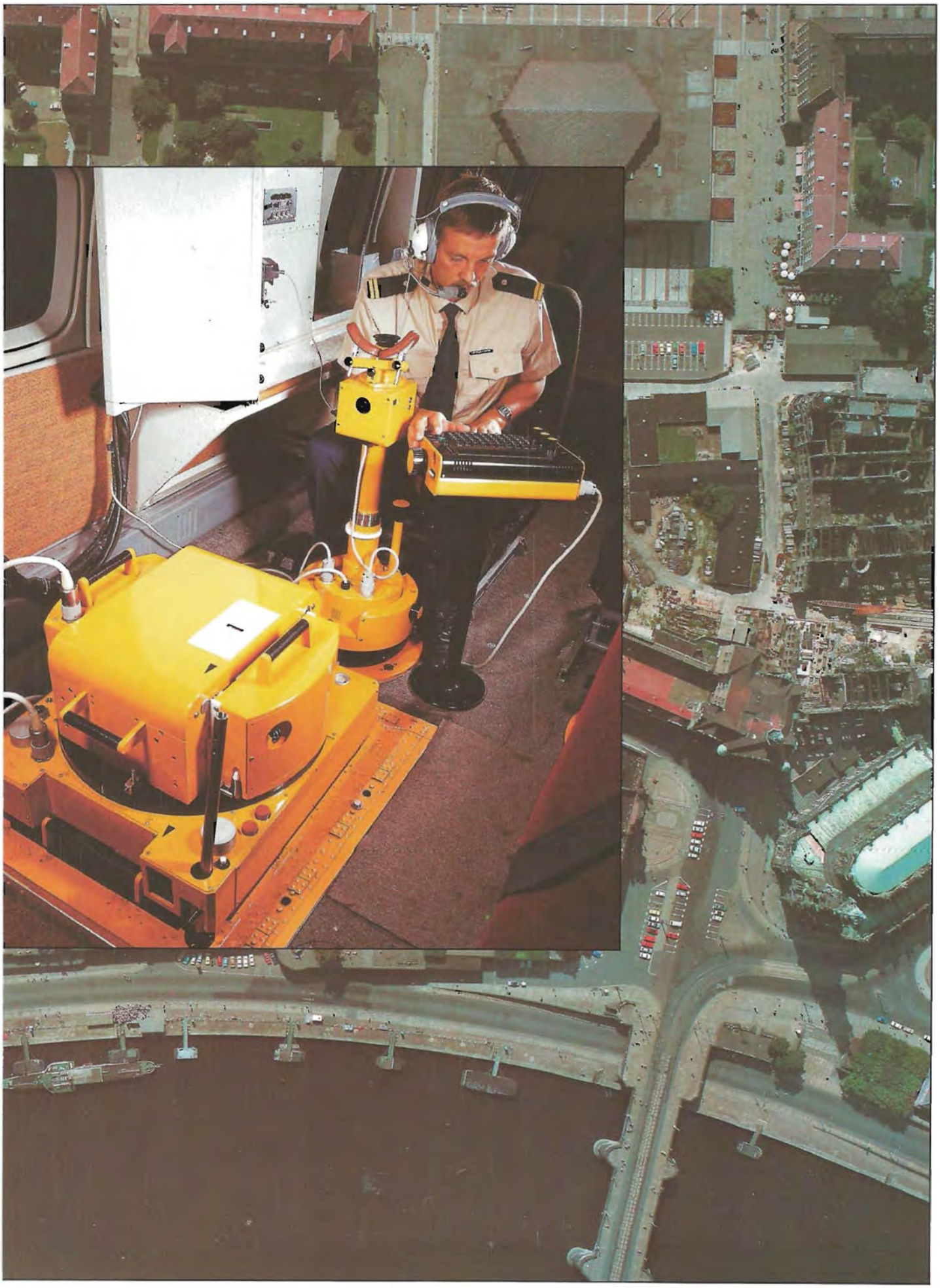


h) Ground plan of the camera



k) Equipment as c); disturbing edges in tilted position





Central Module CM 2000	
Setting of exposure parameters:	
Shutter speed	
– manual setting (nominal values)	1/80, 1/85, 1/125, 1/175, 1/250, 1/350, 1/500, 1/700, 1/1000 s
– automatic setting	1/64 ... 1/1024 s (continuously)
Stops	
– LMK 2030	f/5.6; 6.8; 8; 9.5; 11; 13; 16
– LMK 2021	f/5.6; 6.8; 8; 9.5; 11; 13; 16
– LMK 2015	f/4; 4,8; 5.6; 6.8; 8; 9,5; 11; 13; 16
– LMK 2009	f/5,6; 6,8; 8; 9,5; 11
Film sensitivity	
– aerial photo	ISO A 3 to 800
– correction factors for	
• fiducial marks	0.1 ... 9.9
• auxiliary data	0.1 ... 9.9
Density range Δ D	0.1 ... 9.9
Longitudinal overlap	1 ... 99%
Display of exposure parameters:	
Shutter speed (nominal)	1 ... 1/9999 s
Stop	f/4 ... 16
Object contrast ΔlgE	0.1 ... 9.9
Gradation recommendation	0,1 ... 9,9
Frame number	
– current	001 ... 999
– per strip	01 ... 99
Film supply indication	999 ... 001
Elektrics	
Operation voltage	23 ... 30 VDC
Power consumption	
– when switched on	9 A
– during the cycle, maximum	20 A
Weight	
Stabilized Mount SM 2000 with support ring	35.0 kg (77.2 lbs)
Drive unit DU 2000	11.5 kg (25.4 lbs)
Lens cone LC 2030	34.6 kg (76.3 lbs)
Lens cone LC 2021	34.5 kg (76.1 lbs)
Lens cone LC 2015	40.8 kg (89.9 lbs)
Lens cone LC 2009	27.3 kg (60.2 lbs)
Magazine MA 2000, empty	17.9 kg (39.5 lbs)
Control Unit CU 2000 with mount	25.4 kg (56.0 lbs)
Navigation and Control Unit NCU 2000 with mount	26.4 kg (58.2 lbs)
Central Module CM 2000	5.5 kg (12.1 lbs)

* on special order

Scope of Supply

Standard Equipment

Aerial Survey Camera System
LMK 2009 with CU 2000 **or** NCU 2000
Aerial Survey Camera System
LMK 2015 with CU 2000 **or** NCU 2000
Aerial Survey Camera System
LMK 2021 with CU 2000 **or** NCU 2000
Aerial Survey Camera System
LMK 2030 with CU 2000 **or** NCU 2000

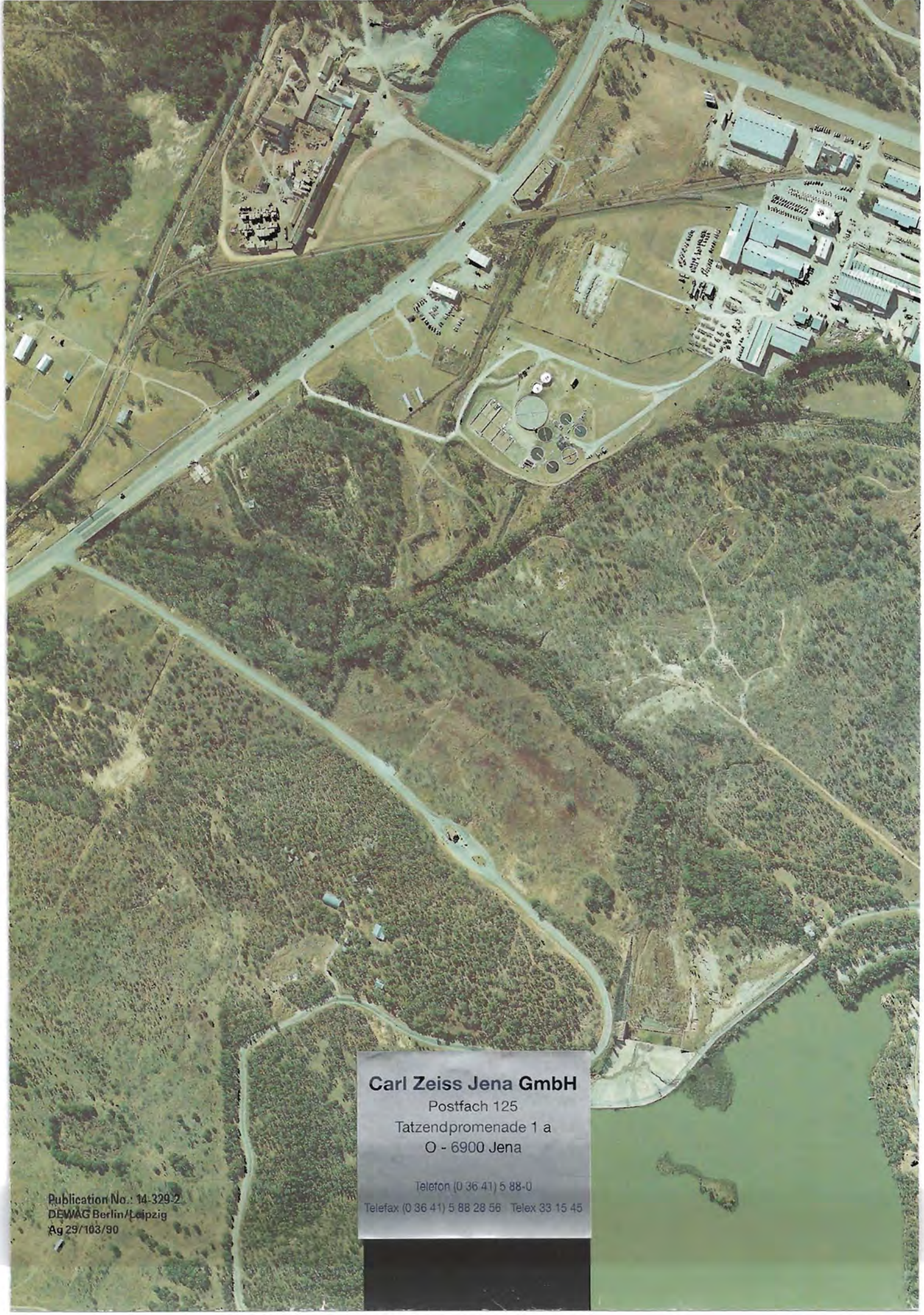
Typical Scope of Equipment

1 Lens cone (LC 2009 **or** 2015 **or** 2021 **or** 2030)
1 Stabilized camera mount SM 2000
1 Vacuum drive
1 Film drive
1 Support ring
2 Magazines MA 2000
1 Central Module CM 2000
1 Wall holder for CM 2000
1 Control Unit CU 2000 **or** 1 Navigation and Control Unit NCU 2000
1 Mount for control unit
3 Filters (405 nm, 490 nm, 530 nm) connection cables, tools, accessories for cleaning, storage containers documentation

Accessory units (to be delivered on special order)

Lens cone LC 2009 with 3 filters
Lens cone LC 2015 with 3 filters
Lens cone LC 2021 with 3 filters
Lens cone LC 2030 with 3 filters
Magazine MA 2000
Stabilized camera mount SM 2000 with various tools
Navigation and Control Unit NCU 2000
Intermediate ring 2015-9
Intermediate ring 2021/30-9
Intermediate ring 2021/30-15
Optical image indication 2000 for the pilot
Filter 700/0.33/9
Filter 700/0.45/15
Filter 700/0.70/21
Filter 700/0.60/30
Connection cable for multi-camera operation
Film spool 168
Extension cable for connecting the optical image indication 2000 to the CM 2000
Filters with wavelengths of 440 nm as well as of 605 nm for all lens cones can be produced on special request after having placed an order.

In the interest of technical progress we reserve the right to change specifications of our products.



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Specification

Stabilized Mount SM 2000	
Range of stabilization	
– at least (in any direction)	± 5°
– maximum	± 8.4° longitudinal (with 0° lateral) or. ± 6.2° lateral (with 0° longitudinal)
Drift	± 25°
Max. angular velocity to be compensated	10°/s
Degree of stabilization	≧ 10:1 (typical 30:1)
Nadir distance	≦ 1,0°

Lens cones	LC 2030	LC 2021	LC 2015	LC 2009
Nominal focal length	305 mm (12")	210 mm (8¼")	152 mm (6")	89 mm (3½")
Image format	228 mm × 228 mm (9" × 9")			
Field angle	53°	72°	90°	119°
Standard distortion	± 2 µm	± 2 µm	± 2 µm	± 5 µ
Filter – minimum degree of transmission in the centre of the AV-layer	60%	70%	45% (33%)*	33%
– edge position	405, 440*, 490, 530, 605*, 700* nm			

Magazine MA 2000	
Film width	24 cm (9½")
Film lengths	
for film thickness 0.08 mm	210 m (790 frames)
0.11 mm	150 m (555 frames)
0.15 mm	120 m (440 frames)
Film step	260 mm ± 2.5 mm
Flatness of pressure plate	± 8 µm
FMC speed	0.3 mm/s ... 64 mm/s

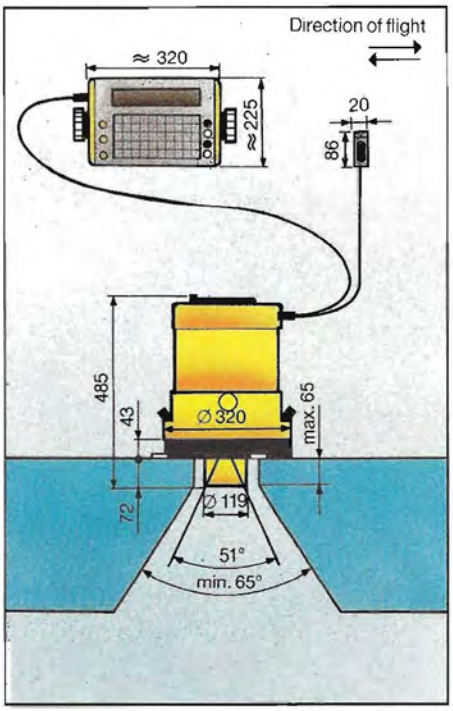
Control Unit CU 2000	
Focal length	142.5 mm
Size of visual field	50°
Travelling grid speed	0.5 mm/s ... 30 mm/s
Drift setting range	± 25°

Navigation Control Unit NCU 2000	
Total magnification	0.6×
Size of visual field	
– total	90°
– to the front	81°
– to the back	9°
Height of view	800 mm ... 1000 mm
Viewing depth (upper edge of the lens)	265 mm ... 465 mm
Setting range v_g/h_g	$3.5 \times 10^{-3} s^{-1}$ to $2.1 \times 10^{-1} s^{-1}$
Drift setting range	± 25°
Azimuthal stops	0°, 90°, 180°, –90°

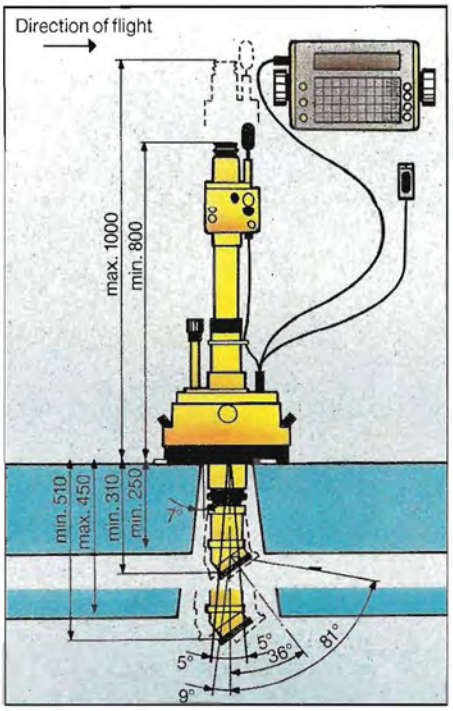
Our thanks to the following companies for placing the aerial photos at disposal:

INTERFLUG, DDR
J-Systems, Texas/USA
KLM-Aerocarto, Netherlands
Pacific Aero Survey, Japan
San-Io Aerial Surveys, San Diego California/USA

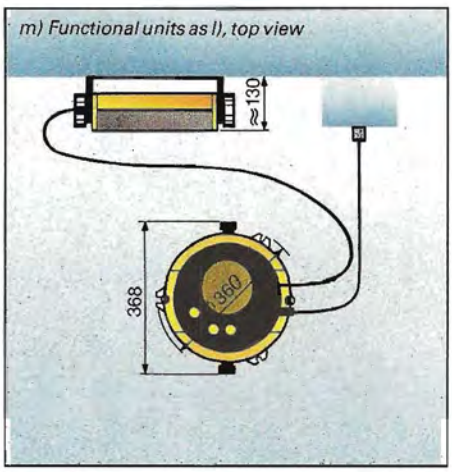
l) *CU 2000 Control Unit, CM 2000 Central Module and optical countdown*



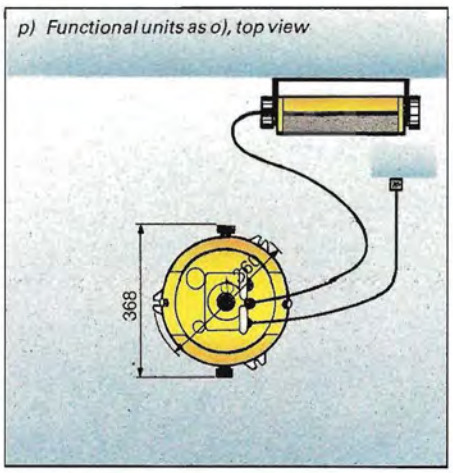
o) *NCU 2000 Navigation Control Unit, CM 2000 Central Module and optical countdown*



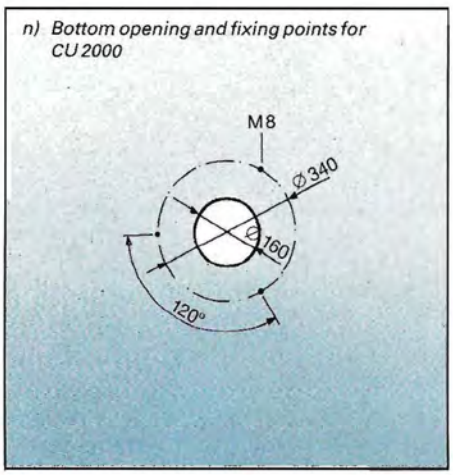
m) *Functional units as l), top view*



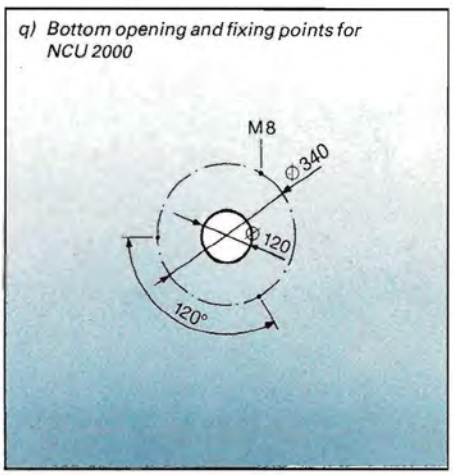
p) *Functional units as o), top view*



n) *Bottom opening and fixing points for CU 2000*



q) *Bottom opening and fixing points for NCU 2000*



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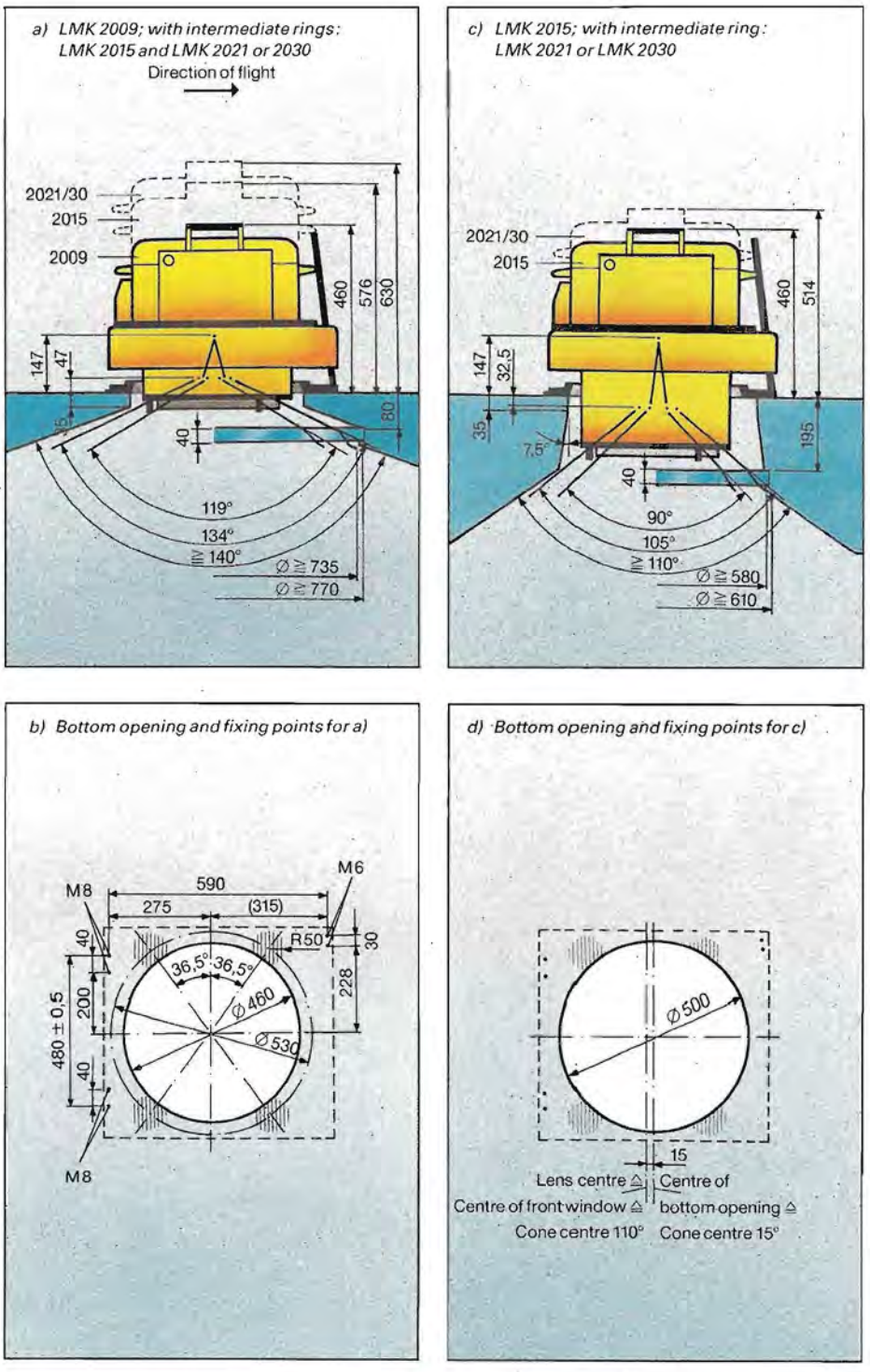
Installation conditions

Owing to its sturdy construction, small outer dimensions and minimum space requirements in manipulations, the LMK can also be installed in small aircraft.
Due to the modular system, the equipment version can be selected as an optimum solution with respect to the space available, flight staff and number of floor holes.
Control unit and navigation control unit as well as the various lens cones can be changed even during the flight without dismantling the mounts.
Special attention has been paid to a low weight of lens cone and magazine to facilitate their change. Appropriate guideways are used to prevent damaging of the focal plane frame and the film pressure plate even in case of rocking motions of the aircraft during flight.



The hatched areas represent the required rigid contact faces for the SM 2000 Mount

Control Unit CU 2000

The control unit comprises the approved fast, optical finder, the elements for determining and transmitting the drift as well as the functional units for shutter release.
All other display and setting elements are located on the operating panel of the central module CM 2000, which has to be installed within the operator's reach.
The finder image shows the natural motion of the terrain related to the flight direction.
By means of a course line and a travelling grid whose speed can be varied, drift and v_g/h_g-ratio (flying speed/altitude over ground) are determined and transmitted to control the camera.
The finder image is viewed by the operator from a distance of abt. 50 cm in a convenient seating position.
Release of exposure sequences or single exposures is by actuating a release button; the sequences can be terminated by actuating a stop button.
An image sequence indication located beside the finder gives the operator a continuous survey of the pulse sequences and the readiness for exposures.

Central Module CM 2000

The central module contains all elements for entering the exposure parameters as well as the elements for direct camera control. The module links control unit, camera and operator.
Display and keyboard are controlled by a separate computer. The display is a 19-digit, alphanumeric one. Date are displayed upon call, optionally. The keyboard with 10 functional keys serves for presetting the camera. The required data are entered via the alphanumeric keys. Operating mode, stop and shutter speed can be set by means of rotary switches.
Exposure sequences or single exposures are released – as with the control units – by actuating the release button; the sequence is terminated by actuating the stop button. Another key serves for film marking . By means of a snap switch at the side of the housing, the measuring unit (metric or inches) can be set.
From the entered data and signal sequences of the connected control units, the main computer of the central module calculates the control data necessary for the camera operation.
Via an IFSS interface these data are transmitted to the camera. Feedback of the camera control signals to the central module is also via this interface for further processing and error indication.

For installing the central module in the aircraft, the supplied shackle can be used.
The central module as well contains the optical image indication for controlling the camera cycle.

Film flattening and film transport

Film flatness is achieved by the film being sucked on to the film pressure plate located in the magazine. This plate is ground with high precision; a special cross-knurled surface ensures that film flatness is not disturbed by dust particles adhering to the pressure plate.
Film transport is by means of rubber rolls which only contact the film edges; thus, a mechanical stress of the film is, practically, eliminated. A marking device to be actuated from the central module CM 2000 serves for marking certain film sections.
The film still available is indicated as the number of photos to be taken still on the central module.
The vacuum pump and the drive motors are located in the drive units. The drive units are plug-in types so that changing of the lens cone and the magazine is facilitated during the photo flight.

Facilities for eliminating image motion

The elimination of any kind of image motion results in a considerable increase of productivity in the photogrammetric measuring process due to:

- the use of insensitive emulsions with a higher resolution, this means, at the same map scales:
  - higher flying altitudes
  - smaller image scales
  - larger model areas

  or for the same image scale:
  - better recognition of details
  - increased measuring accuracy,
- photographs taken under poor light conditions,
- the possibility of higher flying speeds,
- photographs taken from very low flying heights.

For that reason, modern aerial cameras use units compensating the forward motion as they have been introduced with the LMK for the first time.
Furthermore, the LMK 2000 is the first aerial camera equipped with an internal dynamic stabilization of the camera position which largely prevents image motion due to torsional vibrations.

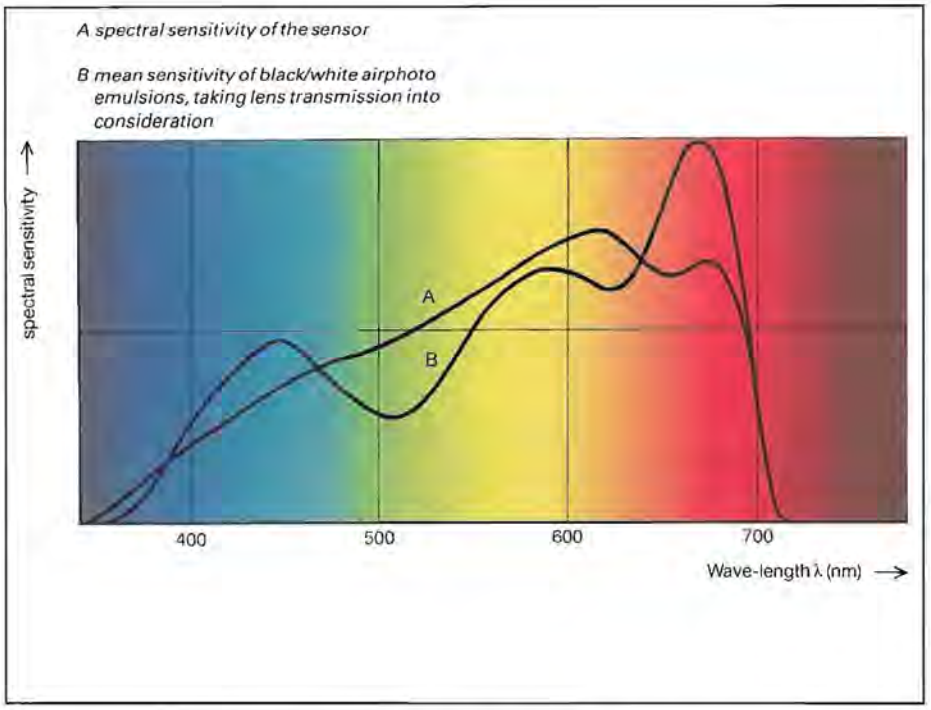
Dynamic stabilization of the camera position and damping of vibration

Despite the linear forward image motion, especially for long exposure times, images are considerably blurred, so that the above mentioned advantages do not have the full effect. This reduction in quality is caused by torsional vibrations of the camera which result in image blurring during the exposure. These vibrations mainly occur in heavy atmospheric turbulences.
The stabilized camera mount SM 2000 uses a gyro-supported stabilization system. The stabilization influences the three axis. Besides an considerable improvement of the image quality, the stabilization system ensures a proper vertical position of the camera. Thus, levelling is automated and no longer transferred from the control unit.
The drift angle set on the control unit is not influenced by vibrations about the camera axis. Short-period vibrations, mainly caused by the aircraft engines, are reduced by appropriate spring attenuation systems. Due to a good correspondence of the centre of gravity and the centre of the vibration, the transmission from translational to rotary vibrations has been minimized right from the beginning.

Forward motion compensation

The compensation is based on a rigorous solution independent of the field angle. The film pressure plate with the film sucked on to it is moved with the frame rate, relative to the focal plane frame, in flying direction, at the instant of shutter release.
In the centre of the shutter opening time, the fiducial marks are ultra-shortly flashed on to the film. Thus, inadmissible blurring of the fiducial mark image is avoided and the interior orientation is not damaged.

Exposure measurement and control



Automatic exposure control on the base of differential measurement means an increase in productivity by:
- avoiding underexposures not correctable any more
- sufficient detail information even in the shadows
- reproduction of the entire object in the optimum density range of the emulsion.

For exposure measurements, a narrow-angle sensor in the lens cone is used. As a preparation of the photograph to be taken and by use of maximum and minimum terrain brightness values measured, the object contrast is determined by the microprocessor and a recommended gradation is calculated after the desired negative density has been set. This value and the effective film sensitivity derived from it can be called at the display of the CM 2000. The minimum terrain brightnesses are used for the actual exposure measurement. Therefore, under-exposures even in the shadow areas are almost impossible, contrary to integral exposure measurement.
By using the same filter type in front of the sensor as is used for the camera lens (except the minus-green filter), the necessary filter factors are automatically taken into account. Furthermore, it is possible to determine the optimum type for filter thanks to the indication of the terrain contrast which is changing with the filter applied.
Due to the FMC and the dynamic stabilization, a limitation of the exposure times is not necessary.

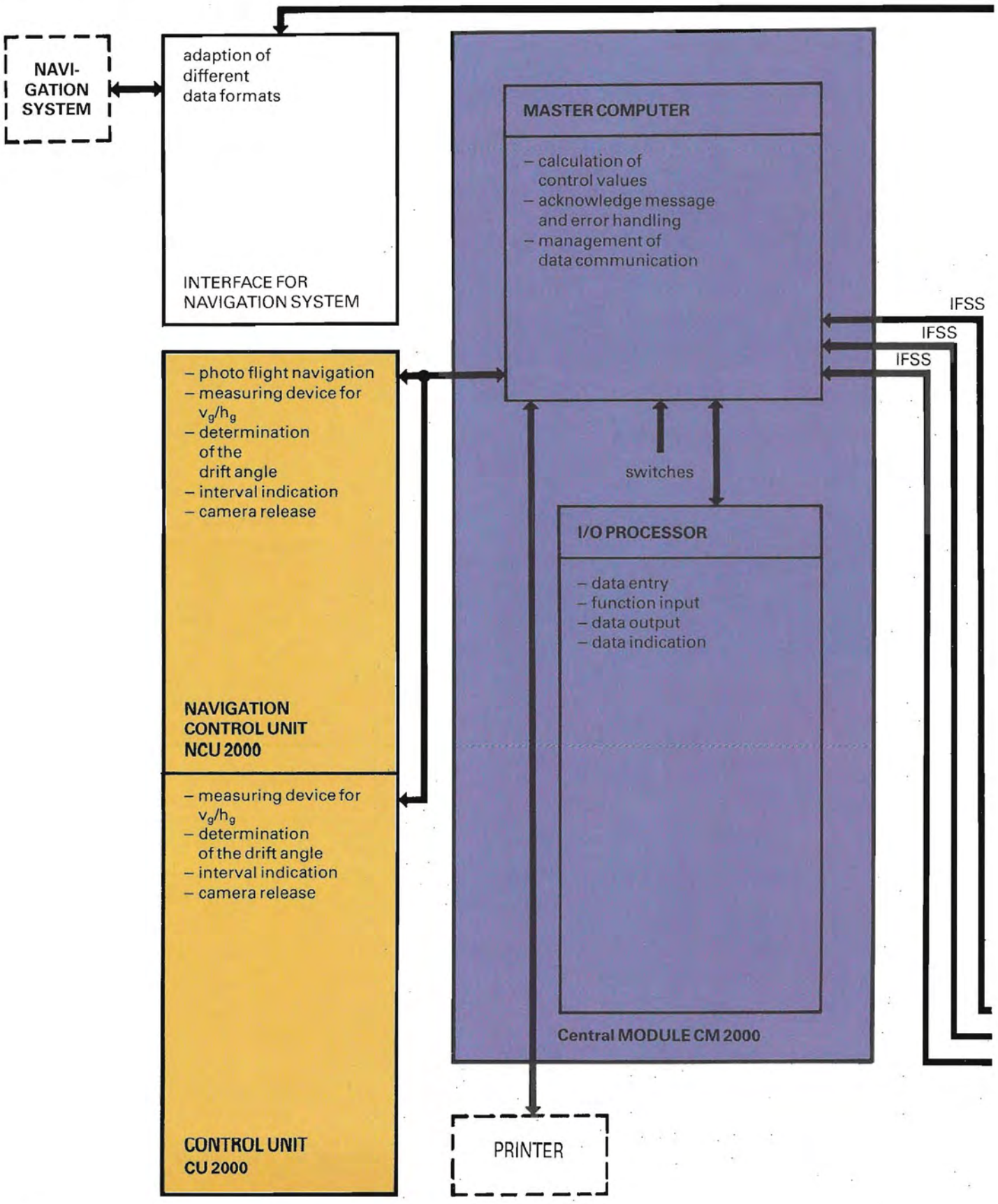
Focal plane frame

The focal plane frame plane-ground and coated with high precision is rigidly connected with the lens and protected against outer influences by the housing. Thus, permanent image sharpness and interior orientation even in case of most frequent use are ensured.

Image coordinate system and auxiliary data

The image coordinate system with the symmetry point of distortion as zero point is fixed by eight artificially illuminated fiducial marks. The recording devices (4-digit frame counter, calibrated focal length, clock, altimeter, note pad and ten-step grey wedge) accommodated in the lens cone appear on each photograph as auxiliary data.
The recording devices are easily accessible even during the flight for necessary settings and written notes.
Additionally, two projectors in the magazine image the magazine number and one line of alphanumeric data on the free edges of the film.
The following data are included in this line:
- data referred to the actual photo, such as stop/exposure time, corrected or uncorrected FMC-amount and coded error indication (functional data),
- additional alphanumeric data entered through the keyboard of the CM 2000 (e.g. date, object, weather conditions etc.) (data of the project),
- orientation data of a connected external navigation system referring to the actual photo (navigation data).

Coupling of functional units



Lenses

A precondition for a high image quality and heart of the lens cones are the top-performance lenses:

Lamegor PI 5.6/300 B
Lamegoron PI 5.6/210 A
Lamegon PI 4/150 D
Superlamegon PI 5.6/90 C

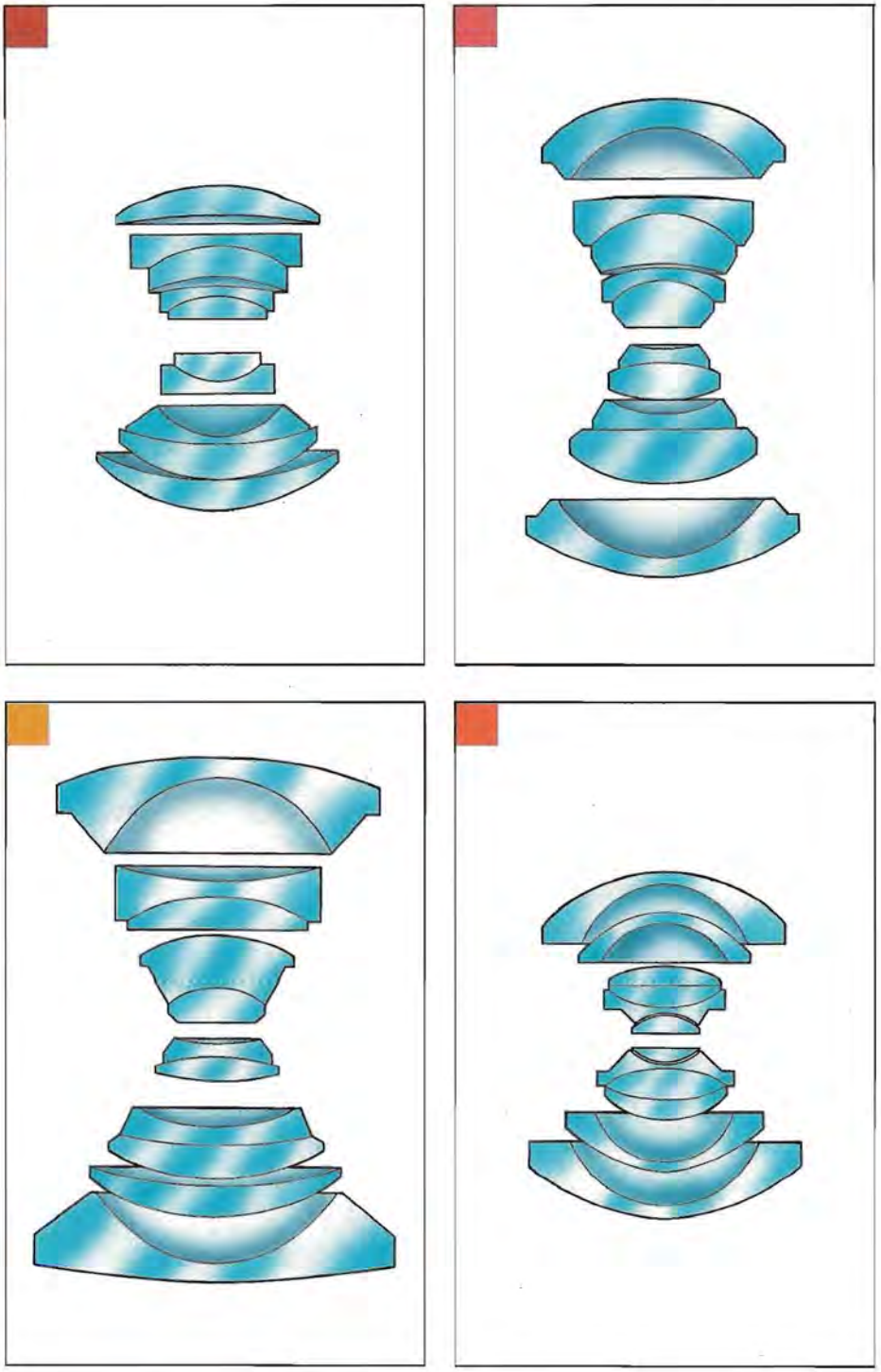
All the lenses have been corrected for use in visible and near infrared spectral range (λ = 400 nm up to 900 nm; PI = Pan/Infra). When using the appropriate filters aerial photos can be taken, without any restriction, on
– black-and-white film
– coloured film
– infrared film
– coloured infrared film.
Across the entire correction range and field of view, the lenses have a high resolution with optimum contrast reproduction and colour fidelity.

Lamegor PI 5.6/300 B
for normal-angle lens cone LC 2030

Lamegoron PI 5.6/210 A
for semi-wide-angle lens cone LC 2021

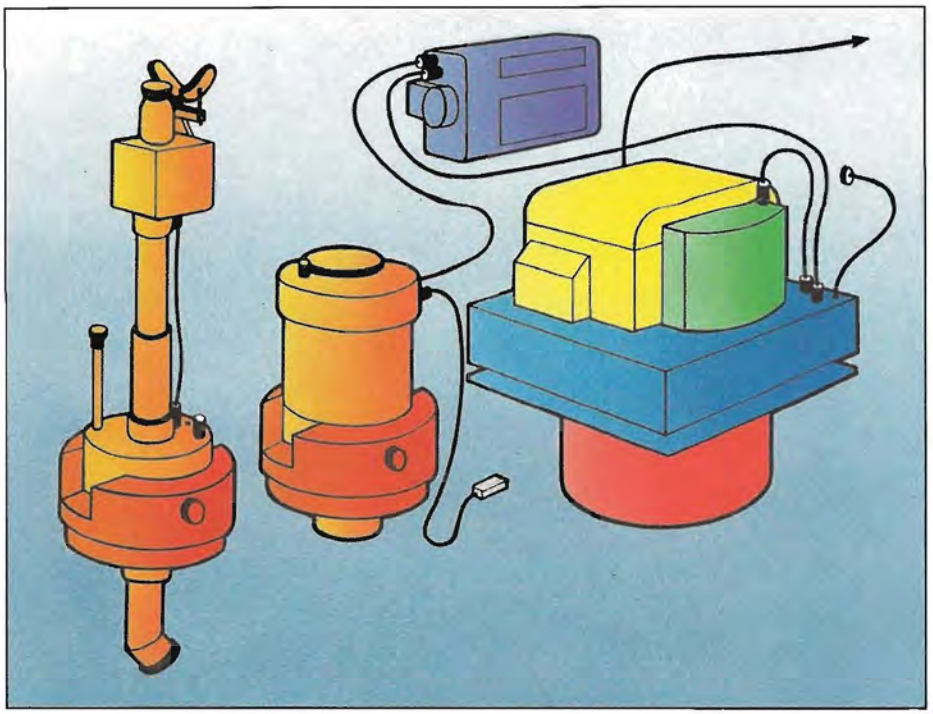
Lamegon PI 4/150 D
for wide-angle lens cone LC 2015

Superlamegon PI 5.6/90 C
for superwide-angle lens cone LC 2009

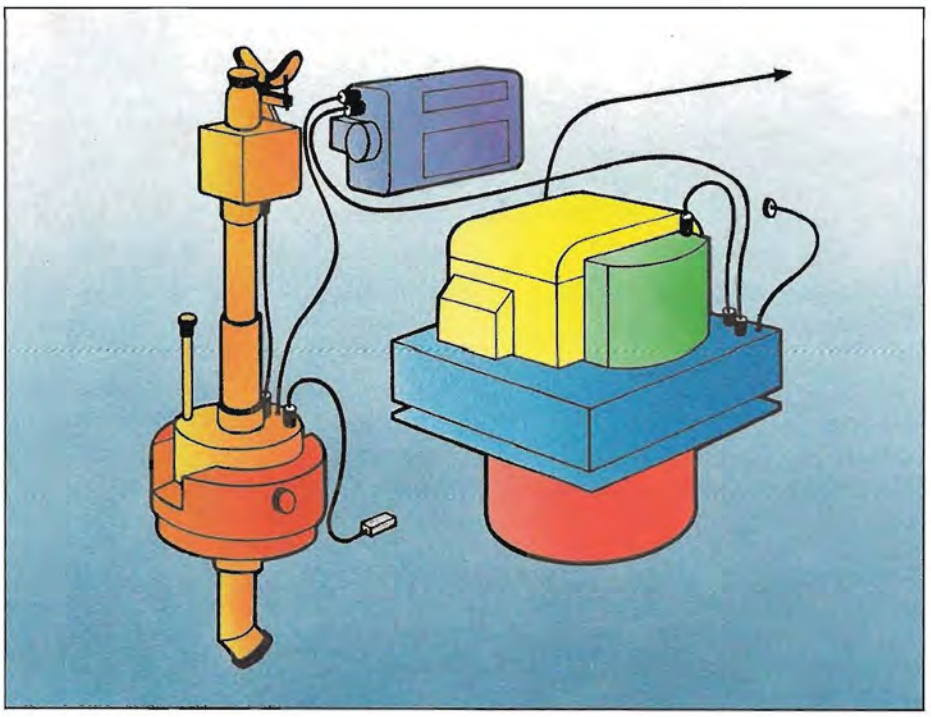


Equipment versions

Equipment for three-men flight
(pilot/navigator/operator)
Navigation:
NCU 2000 without using the camera control
Photographing:
Camera with CU 2000 and CM 2000
Image sequence indication for the pilot



Equipment for two-men flight
(pilot/navigator=operator)
Navigation:
NCU 2000 with simultaneous camera control
Photographing:
Camera with NCU 2000 and CM 2000
Image sequence indication for the pilot



- Lens cones
- Drive unit
- Film magazine MA 2000
- Stabilized mount SM 2000
- Control unit CU 2000
- Central Module CM 2000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Fields of application

	LMK 2030	LMK 2021	LMK 2015	LMK 2009
Production of aerial photos for:				
the setting-up of data banks and the production of topographic line maps at				
– small scales			○	●
– medium scales	○	○	●	●
– large scales	●	●	●	○
the production of controlled mosaics and photomaps by means of rectification or differential rectification of				
– slightly or non-built-up terrain		○	●	●
– city areas with densely-built up and high structures, industrial plants	○	○	○	
– mountaineous regions	○	●	●	○
the national mapping and large-area monitoring of the environment (flying heights of 10,000 m)	○	●	●	
the setting-up of large-scale data banks and the production of large-scale line maps for civil engineering projects, such as				
– open areas (e.g. for melioration, road building, railway engineering etc.)	○	○	●	●
– city areas with densely-built up and high structures, industrial plants etc.	●	●	○	
the updating of digital data banks, maps and mosaics	○	○	●	○
the production of cadastral maps	●	●	●	○
large-area first mappings			●	●
the control extension by aerotriangulation	○	○	●	●
mapping tasks with very high vertical accuracy	○	●	●	●
tasks with restriction of photographic flying altitude by insufficient ceiling altitude of the photographic aircraft or for special photographs under a continuous cloud cover			○	●
the tasks of environmental protection especially in using coloured infrared film)	○	○	●	○
the ocean floor mapping in neritic zones (continental shelf)			●	
the tasks in forestry and agriculture	○	●	●	○
the tasks in geography, geology, geoohysics and geo-ecology	○	○	●	○
the setting-up of national information systems for				
– municipal planning	●	●	○	
– regional planning		○	●	○
– country planning			●	●

○ well suited
● very well suited

Characteristic features and advantages

1

2

1 Without stabilization of camera position

2 With stabilization of camera position

Reasonable and extendable series of easy-to-change lens cones of the standard image format 23 cm × 23 cm (9″ × 9″)

Neglectably small distortion of the high-performance lenses

High stability of the interior orientation of the lens cone

Optimum contrast reproduction and colour fidelity at the highest resolution possible

Optimum exposure due to exposure automatics on the base of a differential measuring unit

Unlimited application possibilities for black-and-white and coloured films as well as black-and-white and coloured infrared films

Compensation of forward image motion up to speeds of 64 mm/s

Elimination of image motion caused by low-frequency torsional vibrations due to the dynamic gyro-supported stabilization of the camera position about all three axis of the space

Stabilization of the spatial portion of the optical axis

Reduction of high-frequency vibration influences by center-of-gravity mounting of the camera and reasonably matched damping elements

Indication of a recommended gradation with automatic determination of the effective sensitiveness of the emulsion

High stability of the longitudinal overlap by a new frequency balancing

Digital indication of film supply

Further development of the modular principle by concentrating the setting and the control elements on the central module; combination facilities of various modular components via standard interfaces in order to set up camera systems for one-man, two-men or three-men flights

Multi-camera operation

High functional reliability thanks to the use of most modern electronic components and computer-controlled camera functions

Extensive self-test of the computer system and permanent check of the functions

Easy change of magazines, lens cones or filters due to small weight of these functional units which is without competition

High flexibility for installation in small aircraft because of minimized weight and dimensions

Image quality – reaching the limits of the physical possibilities

Aerial Survey Camera System

LMK 2000

The LMK 2000 is a logical further development of the LMK and LMK 1000 camera systems. These systems were international trend-setters due to realizing, for the first time, the compensation of the linear image motion, which is caused by the forward motion of the aircraft. Thus, they are setting higher standards with respect to using the modern aerial photoemulsions better and more reliable due to the differential exposure measurements.

So far, it has not been possible yet to fully use the imaging quality of this kind of top-performance systems because of image-quality-reducing influences resulting from low-frequency torsional vibrations of the camera.

But with the LMK 2000 we succeeded in solving this problem as well, without achieving unreasonable dimensions in weight, size or price.

With regard to operational comfort, automation and modular principle, the new system also offers all advantages of a microprocessor-controlled equipment for taking vertical aerial photos.

The first aerial survey camera system with integrated, dynamic stabilization of the camera position