

## **Avimo prototype binocular 7x42 roof prism and military model - by Anna and Terry Vacani**

### **Acknowledgments**

We would like to express gratitude to Thomas Antoniades for his kind help.

### **Contest**

#### Introduction

#### I. Technical issue of the Avimo prototype

#### II. The design of the Avimo prototype

##### 1. Optical information

##### 2. Mechanical Information

#### III. The military Avimo

#### IV. The comparison of the prototype and military models

#### V. The civilian model

#### VI. Avimo - Monocular

#### VII. Summary

### **Introduction**

In the end of 1960s, Ministry of Defence has intended to design a universal pattern service binocular in the minority variations. The binoculars should be design for Naval Service, Land Service and Air Force.

According to William Reid the issue of the binoculars' new design was problematical<sup>1</sup>.

### **I. The technical issue of the Avimo prototype**

This binocular was bought at a military boot-fair.

The information about Avimo prototype binocular is difficult to find. The experiments with the Avimo were taken under the English Government protection. The result of the experiments was never published for the public.

Some of the prototypes were made by Royal Armaments Research and Development Establishment Sevenoaks, Kent (RARDE) and some work was done by - Avimo a division of the Company named United Scientific Instruments.

RARDE made 5 different types to try built up the best. It is thought it has been made 5 to 10 pieces of each deferent prototype. Each model received a number.

One of them is numbered - A2/4213/43 ↑ pictured below.

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<sup>1</sup> William Reid – ‘We’re certainly not afraid of Zeiss’ Barr & Stroud Binoculars And The Royal Navy, *National Museum of Scotland Publishing Limited, 2001*



Pict.1. 7x42 Avimo prototype from Anna and Terry Vacani collection; Copyrights Anna Vacani

One of the prototypes was presented to the Queen of England. It was painted silver and gold. The Queen was photographed being presented with one.

The work was discontinued on this design; it was thought it was not suitable for military application. Looking closely at the binocular, it is noticeable that it was made by hand, not as a serial production.

## II. The design of the Avimo prototype

### 1. Optical information

The scientists of the prototype say the magnification of the prototype is - 7x40. After a close examination of the exit pupil of our model, it appears the magnification is only - x 6, 5. Furthermore, the measure of the glass objective (inside the ring) is 42mm. However, according to the scientist statement, the effective measure is only 40mm.

The apache of the front objective is 45mm, but it is another element of the objective set back in the body effectively making it 42mm. This type of objective is named as telephoto objective.

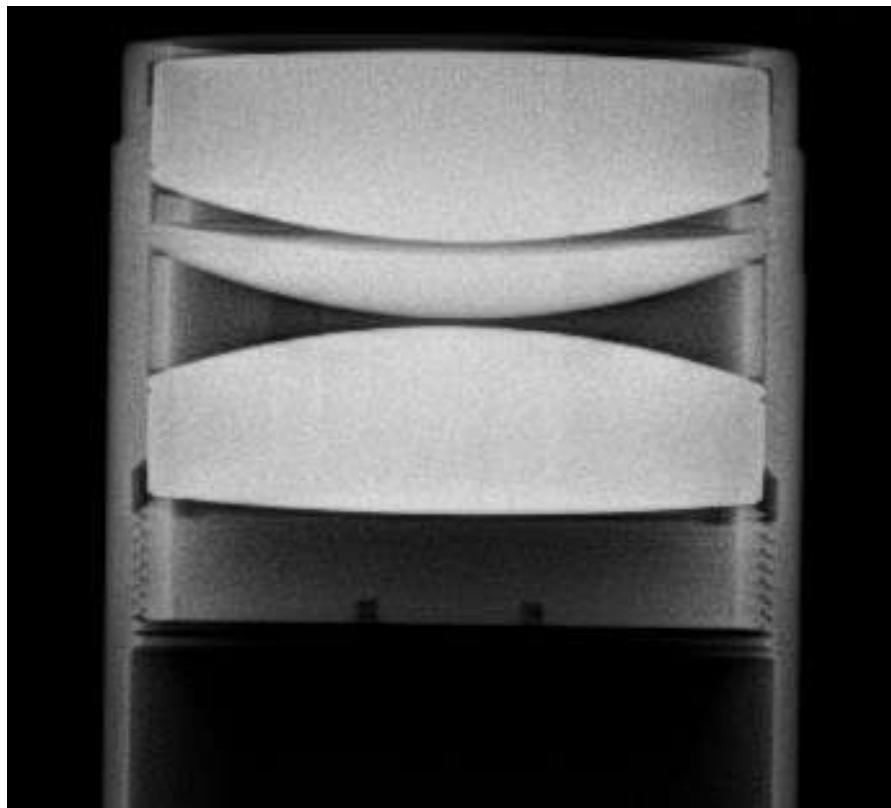
The model - A2/4213/43 colour cast is very slightly warm. It is not dead white coloration. The edge definition is slightly positive, but it is fully usable up to the edge of the picture.

The binocular eye lenses are very big – 28 mm diameter.



*Pict.4. the Avimo prototype oculars; Copyrights Anna Vacani*

The ocular of the binocular has got five lenses. It is visible on the x-ray picture below.



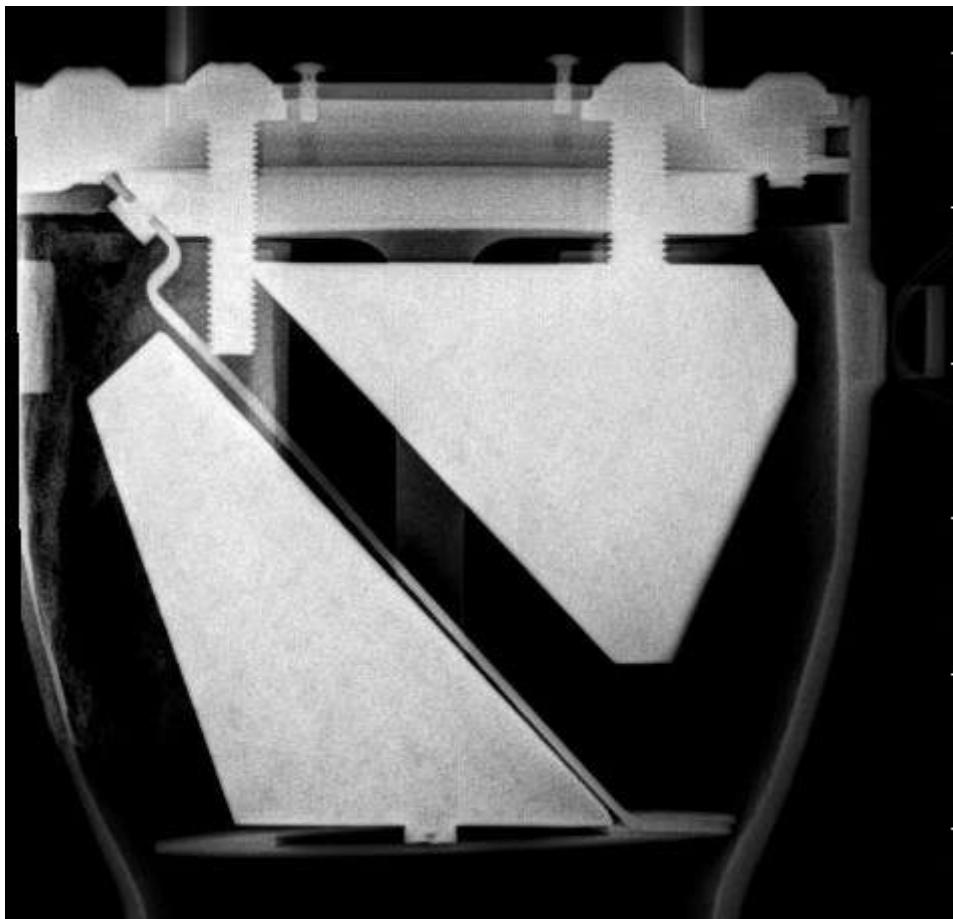
*Pict.2 x-ray of the eye lenses<sup>2</sup>*

As the optics is fully coated inside and outside, it gives very good light transmission. It is standard coating not multicoated.

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<sup>2</sup> The top and bottom lenses are double. The x-ray pictures from Anna and Terry Vacani files.

It is only roof prism binocular ever made in Britain in modern time.

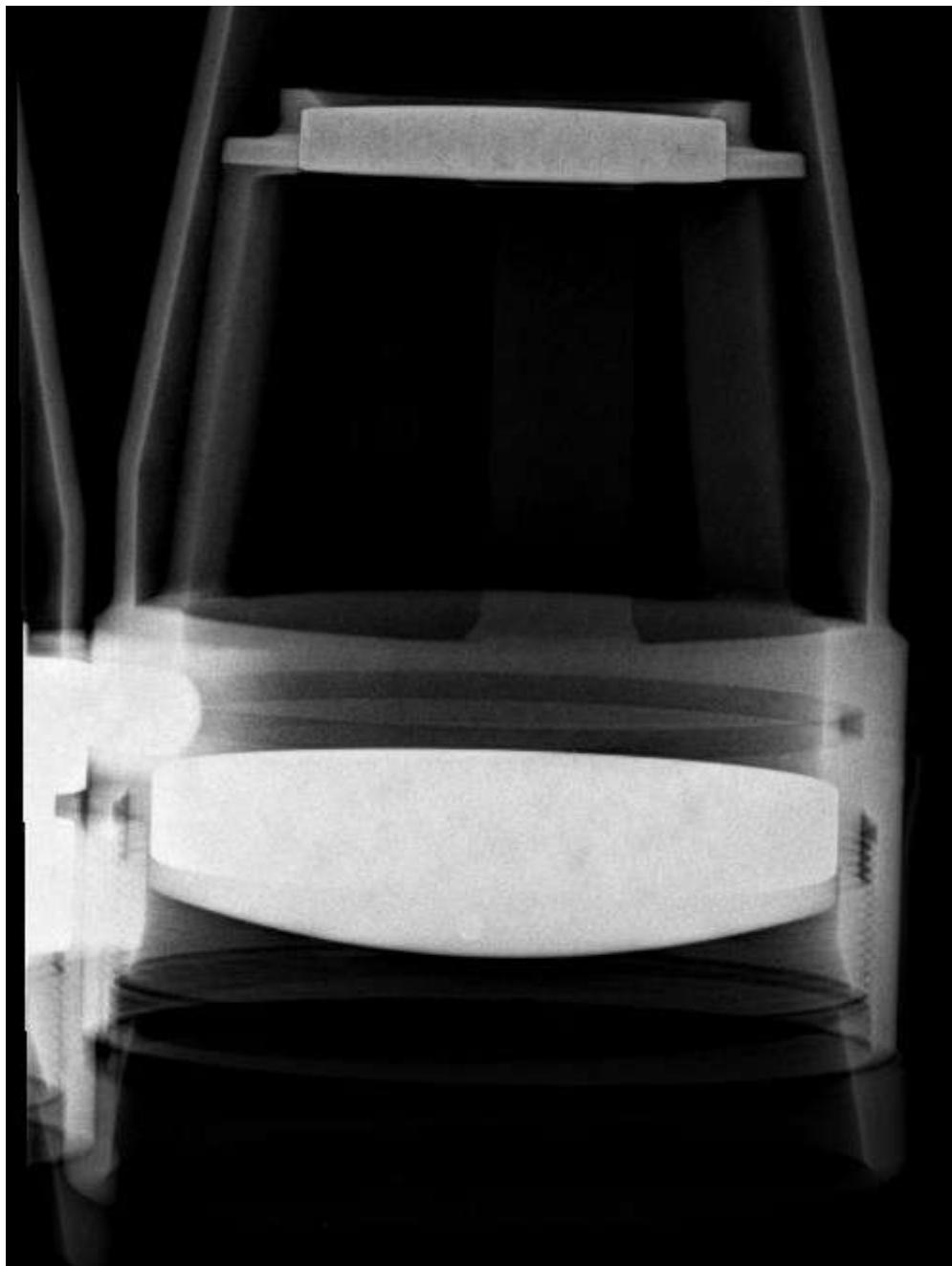


*Pict.3 x-ray of the Avimo prototype's prism*

The binocular has got a peculiar objective, it is named telephoto objective. It contains three elements.



*Pict.4. the Avimo prototype objectives; Copyrights Anna Vacani*



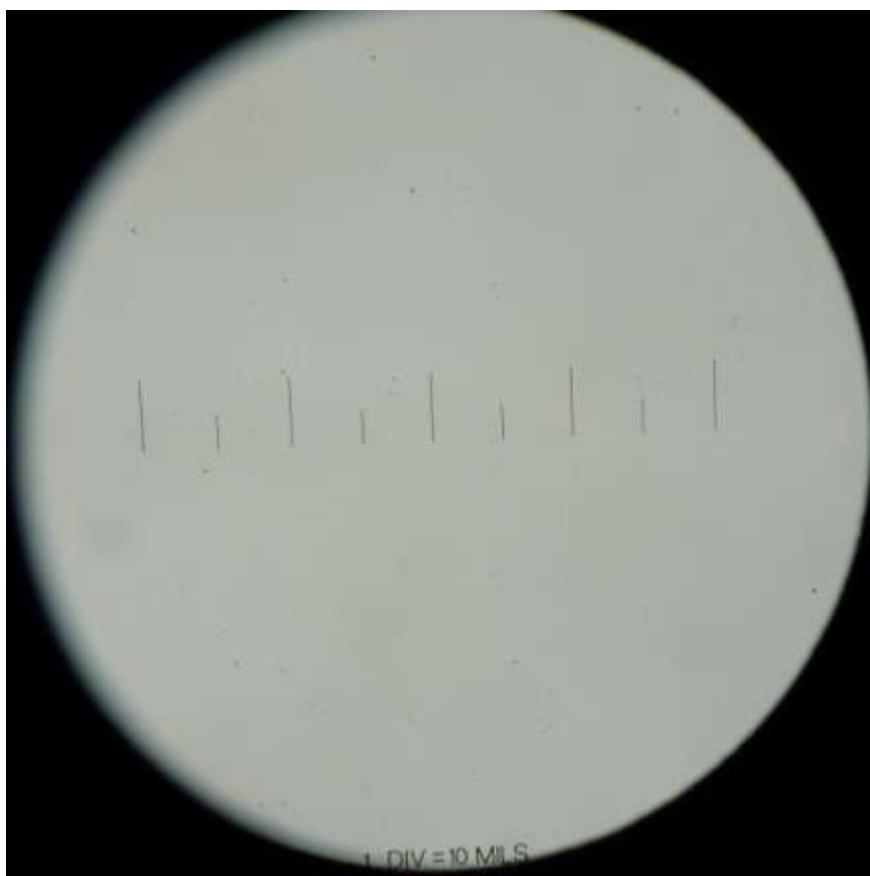
*Pict.5. X-ray of the Avimo prototype telephoto objective with three elements*

On the x-ray picture are visible whole assemble of the glasses in the binoculars' tube.



Pict.6. x-ray of the glasses inside of the Avimo prototype

The military reticule is fitted into right tube of the binoculars.



*Pict. The reticule in the Avimo Prototype from our collection; Copyrights Anna Vacani*

The reticule pattern is the standard British Army military miles reticule; every interval is of 10 mils. The collimation adjustment is done by cams operating on the bending bar as in the later porro Avimo military binocular.

The focus is fixed, non adjustable, on the binocular.

The binocular is fitted with rubber long eyecups and rubber objective glass protecting rings.

## **2. Mechanical information**

The internal body finished is rather matt and it does not give a reflection.

As on other Avimo binoculars each individual body is turning around spindle, it does mean, it is fully rotatable.

The prototype, it is possible to use it upside down and still get an adjustment to both eyes.

Using the reticule is not obligatory to turn the binocular, to adjust the graphic design of the reticule.

The reticule does not have any number on the scale. In this way, it is possible to use binocular at both ways up.

The paint on the binoculars' body is reminiscent of the type of paint used by Ross Company. This paint was named – deco rock.

The binocular is fitted with the Avimo neck strap.

It is a heavy binocular - weight 923 g (2lb 4 Oz). Overall length of the binocular is 210mm.

Gallery pictures of the Avimo prototype:



Pict.8. 7x42 Avimo prototype – both sides of the binoculars, from Anna and Terry Vacani collection; Copyrights Anna Vacani



Pict.9. 7x42 Avimo prototype from Anna and Terry Vacani collection; Copyrights Anna Vacani



Pict.9. 7x42 Avimo prototype; objective and eyepieces from Anna and Terry Vacani collection;  
Copyrights Anna Vacani

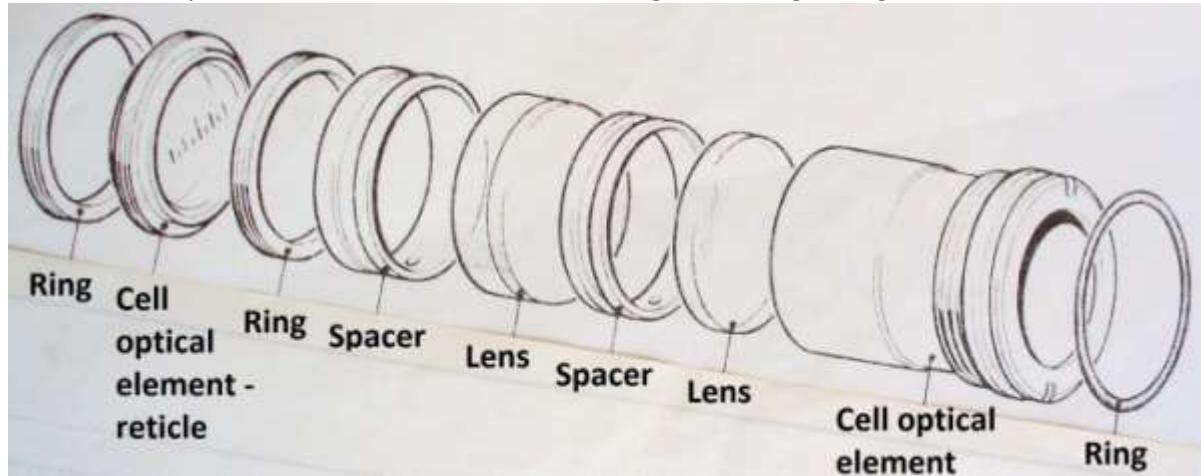
### III. The military Avimo

The military Avimo – porro, model was issued for the English Military on 1979 just before Falklands War (1982).

This binocular was produced by Avimo Ltd. The Avimo Ltd was a division of the large Company named United Scientific Instruments. The main registry office was in Singapore, where was an

optical manufacturing plant. The optical elements to military model were made most probably in Singapore.

The lenses and prisms are anti-reflection coated throughout for highest light transmission.



*The presumably design of the optical elements in the military model. The graphic design by Margaret Kisielewicz; Copyrights Margaret Kisielewicz*

The eyepiece focus is fixed to minus 1 dioptre. The exit pupil diameter is 6 mm. That large diameter supplied maximum light improving vision under low-light conditions.

The body is rubber armouring. The rubber covers the main bodies and objective lenses.

Blinker type rubber eye guards, which exclude light, are fitted and provide a good location for the eye.

The binocular is fitted with eye lens protectors and filters. The eye lens protectors can be snapped on the neck strap if the binocular is in use.



*Pict.10. 7x42 Avimo military model with eye lens protectors, from Thomas Antoniades collection; Copyrights Thomas Antoniades*

The filters; neutral density – 15-20%, light grey, are stored in the pouch fitted to the binoculars' strap.

The binocular's neck strap is coated with PVC.



Pict.11. 7x42 Avimo military model from Thomas Antoniades collection – with the pouch;  
Copyrights Thomas Antoniades

The weight of the binoculars is 1.2kg (42oz), the length 173mm and the height 80mm. The prototype is much heavier and highest: weight 923 g (2lb 4 Oz) and overall length of the binocular is 210mm. The military reticule is fitted into right tube of the binoculars.

Some of the military Avimo models do not have fitted the military reticule. The pictured binocular with a description as: 7-42 L11A1 is without the reticule. The models built up for Land and Air forces services are supplied with the standard military miles reticule.

The military model contains some features from the experimental model. It lets us to drove a conclusion that all experiment's work on the roof prism binocular was taken place about 1973-1975. The Avimo military model is a combination between a Ross binocular prototype and Avimo prototype described in the chapter one.

The soldiers at Falkland war had problems with the military model.

The scientist, who had written and published an article about porro Avimo, claiming that by setting collimation of the binocular by closed distance; I believe less than four meters, and not collimated on infinity, made the binocular superior and gave mathematical reason for this. Unfortunately no other binoculars' manufactures have ever come to the same conclusion.

The porro Avimo model was designed for the British Military, and analyzing that statement, it could be drawn a conclusion, that the soldiers will be fighting only in four meters distance.

The construction of the military model has caused many problems to soldiers.

The first, it was dangerous to use them under military fighting.

As Dr Hans Seeger mentioned in his book<sup>3</sup>, the specific shape of the binoculars' body caused risk of killing, as a soldier had to move his head up, above an observation point, higher than with usual construction of military binoculars.

Next problem, as we heard, was with collimation of the binocular. The soldiers fighting in the Falkland war they found in the battle it was often going out of collimation in use. They had stricken the binoculars on the leg into two pieces and used them as a monocular.

The 7x42 Avimo binoculars were still in use during the war in Iraq by the British Military. Furthermore they are used in Afghanistan, as it is noticeable on the TV reports.

The design was licensed to German Company Rollei. Later on Russia copied the binocular and started producing by BELOMO in Minsk.

**BELOMO** or Belorusskoe Optiko-Mechanicheskoye Obyedinenie (Belarus Optical & Mechanical Enterprise) was founded in 1971 in Minsk in Byelorussian SSR, Soviet Union. Belarus is now an independent country.

Belmo 7x42 is offered for selling, on the internet for over \$1,600.

In the same way, it is a very peculiar binocular.

#### IV. The comparison of the prototype and military models

The professor of the Institute of Theoretical Physics and Astrophysics at Xiamen University, Holger Merlitz, as an enthusiast of the binoculars, made a scientific research of the technical construction and the optical performance of some military binoculars 7x40. Among them is the Avimo military model.<sup>4</sup>

The professor pointed out that Avimo; "binocular is of fixed-focus type and has to be used with eyeglasses by anybody with visual defects. Its eye-relief is long enough, however, and the telescopic eye-cups are effectively shielding any side-stray light".

And in further opinion of Holger Merlitz is:

"Apart from that, I dislike the fixed-focus feature of this binocular. I believe that every optical instrument has to be focused in order to deliver maximum performance. The argument, such a binocular should be used with glasses only, is of little impact. How many people are wearing glasses which are perfectly tuned to 100% compensate their visual defects? I have often experienced that my eyes perform somewhat differently from day to day, and I always turn the focus wheel to find the optimum position during my observations. I don't want to miss this opportunity to get the best out of the instrument I am using".

While testing the Avimo prototype, it is noticeable identical impression.

And in the chapter - 'Mechanical Construction' says:

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<sup>3</sup> Dr. Hans T. Seeger – Military Binoculars and Telescopes for Land, Air and Sea Service, Hamburg, 1995

<sup>4</sup> <http://www.holgermerlitz.de/six7x40.html>

"The Avimo has got no focuser, and I think this handicap leads to serious limitations of its application range. Most people will need to use eye-glasses in order to exploit the full optical performance of this device, and the observation with spectacles is always a potential source of trouble".

However, using the Avimo prototype, it is a trouble to make out a very good optical performance wearing glasses with minuses or pluses dioptres.

In image sharpness of Avimo binocular, professor underlines, that in the star test - the deficiency of fixed-focus of the Avimo is noticeable:

"The stars are fine at the centre, but already less than 50% off they start deforming. This poor performance is of course a consequence of its fix-focus feature. It is not possible for me to find the optimized focus for my eyes, so that the full performance of this binocular remains inaccessible".

Let's say a few words about prisms in the prototype and the military model of Avimo binoculars. The Avimo prototype has got the roof prism. The roof prism system gives no stereo effect in a handheld binocular, as against porro one binocular, which in a majority of them have a good stereo effect. However, some theatre binoculars porro one are designed not to give stereo effects. The distance between the centre of the ocular lenses are the same, or less, as the objective lenses.

Additionally, in opinion of the binoculars designers, the definition of the picture with the roof prism is not good, as porro one prism system.

Looking at the eyepieces of both models:



Pict.13. 7x42 Avimo prototype from Anna and Terry Vacani collection; Copyrights Anna Vacani



Pict.14. 7x42 Avimo military model from Thomas Antoniades collection; Copyrights Thomas Antoniades

It is visible differences of the eyepieces measurement. The prototype has got very large eyepieces – 28 mm diameter, when the military model has got only 22 mm. It is easy to look through and restful for the observer's eyes. The shape of the prism tube is absolutely different.

The Avimo body has got a very peculiar shape.



Pict.15.Anna and Terry Vacani's collection



Pict.16.Thomas Antoniades' collection

Although, professor Merlitz has observed a very interesting phenomenon, caused by the producer of the Avimo military model:

"It has got a quality coating, excellent low light performance, and high resistance against ghosting. Unfortunately, this impression is spoiled by a glossy finish of the inner tube walls, causing a stray light which could easily be avoided. Confronted with examples like that, I sometimes ask myself whether such an obvious defect could be left unnoticed during those field tests which are mandatory for defence projects".

## V. The civilian model

The 7x42 Avimo binoculars were made as a civilian model as well. The design is similar to military model.

The eyepieces, in the civilian model, are 22 mm diameter, as the military model.

The Avimo Optical Imaging Company has sold the construction design, of the military Avimo model, to German Company Rollei<sup>5</sup>.

As a civilian model, the body of the binocular is without rubber armouring and silver finished body. On the prism left side is printed: 7 x 42 Made in Germany. On the lower left hand body tube is painted 'Rollei'.

The binoculars' strap is different from the military model. It has a textile neck-strap with embroidered name 'Rollei', on it. The strap is fitted with a snap on connectors for the eye lens protectors, when the binocular is in use. In the same way as it is designed on the military model.

The glasses are a fully coated on all surfaces.

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<sup>5</sup> [http://www.sl66.com/pg/rollei\\_history.shtml](http://www.sl66.com/pg/rollei_history.shtml)

The binocular was priced 900€ - the information from the internet forum. In England in Kent the new Rollei binocular was retailing about 700 pounds.



Pict.17. 7x42 Avimo civilian model from Thomas Antoniades collection; Copyrights Thomas Antoniades

The differences between military and civilian model we can spotted in the picture below.



Pict.18. 7x42 Avimo the military and the civilian model from Thomas Antoniades collection;  
Copyrights Thomas Antoniades



Pict.18. 7x42 Avimo the military and the civilian model from Thomas Antoniades collection;  
Copyrights Thomas Antoniades



Pict.18. 7x42 Avimo the military and the civilian model from Thomas Antoniades collection;  
Copyrights Thomas Antoniades

As we heard, the Rollei model was produced for a short time. It is difficult to say how many binoculars were produced.

#### VI. Avimo - monocular

We could assume it is only 7x42 Avimo binocular prototypes made for a military purpose, and designed by Royal Armaments Research and Development Establishment Sevenoaks, Kent (RARDE). Astonishingly, we bought another prototype; monocular Avimo model. It looks as it has got the same technical and optical elements as the binoculars model. The magnification is x7 and objective is 42 mm, only objective ring is a little different. It does not have a protective rubber ring on the objective, as on the binoculars or it was lost. It is finished with a metal ring only.

The body texture and the finish is the same.



*7x42 Avimo monocular prototype from our collection; Copyrights Anna Vacani*

The monocular has got the final description on the prism shoulder, when the binocular prototype has got only a prototype number.



*7x42 Avimo monocular prototype from our collection; Copyrights Anna Vacani*

The part of the number written on the monocular; 525-8305 MONO XLIEI PPE 044/73 indicates, that the producer of the monocular is Pilkington Precision Equipment, and the letter 'X' specifies it was a prototype.



7x42 Avimo monocular prototype from our collection –the objective ring ; Copyrights Anna Vacani

The monocular was produced on a design made by a military Office, presumably by Royal Armaments Research and Development Establishment Sevenoaks, Kent (RARDE), as was designed 7x42 Avimo binocular prototypes.

The monocular has an additional description on the objective ring; DON 12/76. Presumably, it is a description of Donnington British Army Storage Depot, dated Dec 1976 – the date of the Depot inspection.

The monocular is fitted with a rubber long eyecup, the same as on the binocular model.

The monocular is fixed with a military linear reticule, the same in design as in the prototype binocular.

Additionally, it is fitted with two lugs for the strap. It does mean the designer intention was to produce, in the future, the monocular model as well. It is appeared, the strap is a regular military kind applied to the other British military binoculars.

The monocular had a problem with internal optics. When the item was acquired, making an examination it was possible to hear a noise of racking inside. It appears one of the two prism elements had come unbounded from its mounting.

When our monocular was opened, it becomes visible a very poor quality construction of the all optical system.



*7 x 42 Avimo monocular prototype from our collection – the prisms; Copyrights Anna Vacani*



*7 x 42 Avimo monocular prototype from our collection – the prisms; Copyrights Anna Vacani*

On the prism mounting plate, was a thin layer of the rubber sheet and on the top of it was glued the elements of prism.



*7x42 Avimo monocular prototype from our collection; Copyrights Anna Vacani*

On the picture is visible the layer of the rubber on the right side of the vertical wall. Furthermore, the line is noticeable on the wall, where the prism was glued.

We can observe the deteriorated process of the glue, on the next picture.



*7x42 Avimo monocular prototype from our collection – the prism system; Copyrights Anna Vacani*



7x42 Avimo monocular prototype from our collection – the prism system; Copyrights Anna Vacani

On the prism wall the pieces of the glue are visible. The glue, on the right wall, is very well observable on the picture taken with a flash:



7x42 Avimo monocular prototype from our collection – the prism system; Copyrights Anna Vacani

**The binocular was completely and professionally serviced and assembled by Terry Vacani.**

## **VII. Summary**

Analyzing all information about the prototype and military models of Avimo, it seems to appear that the prototype has got some well-designed elements.

The body of the binocular is very well designed. It is easy to use it without any rotation and adjustment. Besides, it is nice to keep in hands; the centre of gravity (mass) is well calculated.

It seems only optics design is rather week. It is very poor prism mounting using glue to retain each prism. It would not be strong and long lasted using the binocular in the military service.

Looking closely at the 7x42 military models, we can observe a few positive parts of the whole construction.

Unfortunately, the model has got two parts not well design: the collimation and the body shape. The collimation adjustment is made by using eccentric cams, which will need replacing with new ones every time when it needs re-collimating.

The second problem is the unsafe shape of the body.

Next problem is focus set at minus one dioptre.

Avimo produce a monocular military model. The pictures of that model are presented on the web site:

<http://www.monocular.info/scope7x43.htm>

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