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optimale Kurzwellen-Antennen

computer-designed / computer-optimiert

entwickelt von Funkamateuren für Funkamateure

optimum short-wave antennas

computer-designed / computer-optimized

developed by hams for hams

O B 2-40

2 Element Yagi 40m

!!! Quality made in Germany !!!

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1. Introduction

The OB2-40 is a high performing 2el Yagi antenna for the 40m band.

OptiBeam shortwave antennas are designed and optimised by support of modern techniques such as computerised antenna simulation and are finally adjusted by extensive tests in practice.

To reduce the rather big wing span of a 40m element high Q coils (no traps), carefully fabricated by OptiBeam, are used. Hereby achieved is an almost loss free shortening of the element lengths.
So a gain is realised which is only about 0.5 dBd less than that of a considerably larger full size Yagi.

In the following table the essential electrical and mechanical data can be seen:

Bands	40m
Gain (dBd)*	3,6
Gain (dBi)**	10,8
F/B (db)	15 - 18
SWR CW/Europe setting: **7,00 - 7,05 - 7,100** **SWR USA phone setting:** **7,15 - 7,20 - 7,30**	1,6 - 1,1 - 1,6 1,6 - 1,1 - 1,9
Impedance (Ohm)	50
Elements	2
Max. element length (m)	15
Boom length (m)	5,60
Turning radius	7,96
Weight (kg)	28
Windload at 130 km/h	500 N / 0,62 m² / 6,8 feet²

* = average gain over a dipole in free space
gain of monobanders for comparison: 2-element Yagi: 4 dbd, 3-element Yagi: 5-6 dbd
** = average gain at 20m above ground

2. Assembly

The included schematic diagram is needed for the assembly and the following information is given:

-> type of element (R=Reflector, S=Driver) and the position on the boom
-> measurements of the element sections (length and diameter)
-> lengths of the element halves
-> distances between the elements.

The lengths are given in m (meters) and the diameters are given in mm (millimeters).

2.1 Sorting the parts

The antenna to a high amount consists of already pre assembled parts.
All parts of the antenna are marked.
For faster and easier assembly it is recommended to sort the parts for reflector and driver.

2.2 Assembly of the boom

The square boom consists of three parts which have to be assembled each by two coupling pieces that are already installed at one side of the boom parts.
For each coupling piece 4 screws are needed. The screws have to be tightened finally not before the parts of the boom really **fit** to each other perfectly.
It is recommended to slide the boom to mast plate (totally pre assembled finished part, see fig. 2.9 and 2nd picture page) over the middle section before the boom sections are put together. Hereby avoided are unnecessary working steps later on.

2.3 Element-Platforms

For the element-to-boom brackets 4-cornered angle profiles in a length of 500 mm are used. The insulation and solid fixing of the elements is realised by 4 special UV stabilised tube holders, mounted on each of the platforms.
The driver and reflector middle section (d = 40mm) is already inserted into the platforms (see picture on 3rd picture page).

The elements fixed on the plates have to be mounted at the **underside** of the boom in a way that the outer edge of the platform is located 1 cm in front of the tip of the boom.
The plates are attached to the boom by 2 square brackets (already inserted into the platform by us) which embrace the boom from the top and 4 self securing nuts (see 3rd picture page). When finally tightening the square brackets pay attention that the elements are **parallel** to each other.
The square boom makes a straightening of the elements in the vertical plane unnecessary.
For the tightening procedure use the included special tool (nut driver M10/13.

In case the antenna cannot be reached easily while assembling naturally the elements can be assembled completely and then be mounted below the boom in one piece.

2.4 Screw connections of the element sections

While assembling the element sections the following segments have to be inserted into the previous segments with their side which has two drill-holes **equal in size**. The tubes have to be put in until the drill-holes of both segments overlap perfectly. The enlarged drill hole of the previous segment has to point **upwards**.
Then the corresponding ss screws have to be pushed through **from the side of the enlarged drill-hole** of the previous segment.

There are **screws of two different diameters** (6mm and 4mm) and of different lengths.
The longer **6mm screws** are used for the 40/35mm and the 35/30mm transition, the shorter ones are used for the 30/25mm transition (please orientate by the included schematic diagram of the antenna).
The **4mm screws** have to be used as follows: 25/20mm transition = longest screw, 20/16mm transition = second longest screw, 16/12mm transition = shortest screw.
On the opposite side the washers have to be inserted and the self securing nuts have to be screwed on and **tightened solidly** (hold the screw heads with the included special screw-driver against turning, depending on the screw diameter use the thicker or thinner screw-driver, do it carefully, don't break the screws, the screw heads dive into the enlarged drill-hole, see picture page). This method results in an extremely solid mechanical connection and rattle sounds inside the segment overlaps are totally avoided.

By this way of assembling the required lengths of the sections and the element halves are achieved automatically.

While mounting the elements pay attention that all screw heads show **upwards**.
Keep in mind that the elements hang below the boom. Therefore the screw heads have to be on the same side of the elements where the element plates are located at.

2.5 Assembly of the element sections

We start with the already pre assembled middle section (d = 40mm) which is already fixed onto the element platform.
The following segment is the one with the coil (already pre assembled) with a diameter of 35mm (see picture on 3rd picture page).
The next one following has a diameter of 30mm (please orientate by the included schematic diagram of the antenna).
Before the following 25mm section is inserted into the 30mm segment (this counts for all four element halves) slide the **ring insulator** (see picture on 3rd picture page) -which represents the outer fastening of the centre element truss (see fig. 2.7)- over the 25mm tube. We have already fixed the centre truss rope to the two ring insulators by means of a special loop. Pay attention that the ring insulator is slid over the segment in a way that the truss rope which comes out of the smaller hole leads **towards the centre of the element**.
When the two ring insulators are slid over on the left and the right half of the driver and reflector the **centre element truss rope** will hang slack below the element for the moment.
Do not remove the centre insulator which is already inserted into the truss rope, but for the moment remove the truss mast from the centre insulator for this installation step!

You now have to insert the short 20mm segments into the 25mm sections. The 20mm segments have seven drill holes, one for the following 16mm element transition with an enlarged drill hole on top and six drill holes in the order of two **3-hole-rows**.
The hole rows are inscribed with ‚CW/Europe' and ‚USA phone'.
The outer hole row **‚CW/Europe'** represents the setting which mainly covers the frequency spectrum from 7.000 to 7.100 KHZ, i.e. SWR, gain and f/b are optimised in this frequency range.
This way the SWR in the frequency spectrum 7.150 to 7.300 KHZ is still manageable, but partly only by means of a tuner.
This setting mainly covers the "European 40m part" and at the same time serves the US ham who mainly wants to operate CW.
The inner hole row **‚USA phone'** represents the US SSB setting. It mainly covers the frequency spectrum between 7.150 and 7.300 KHZ regarding an optimum SWR, gain and f/b. With this setting the SWR in the „European 40m part" is considerably higher and principally not suitable for transmitting. This setting especially serves the US ham who concentrates on SSB and who can work Europe split this way, of course.
The antenna is tuned by us in a way that with each setting the centre hole of the corresponding hole row has to be chosen (regarding tuning facilities, see fig. 4)

The 20mm segments are followed by the 16mm ones and they by the 12mm tips.
Concerning the 12mm tips of the driven element the **middle one** of the three drill-holes has to be chosen (regarding tuning facilities, see fig. 4).

2.6 Installation of the termination stub

Due to the shortened elements the antenna has an impedance in the range of 29 Ohms.
Therefore the driver is terminated with a stub which transforms the impedance at the source up to the desired 50 Ohms.
The included stub is a pre assembled right angle part which consists of flat aluminium pieces.
We have pre adjusted the stub length by practical measurements so that the correct transformation to 50 Ohms takes place. This pre adjusted length is automatically achieved by screwing the horizontal parts together with the two vertical parts and by choosing the **centre hole** of the 7 holes which you find at the outsides of the horizontal parts.
This pre adjusted length can be changed, if required (in case no satisfying SWR due to influences of the surroundings).
By choosing holes which are located more to the outside the stub inductivity is enhanced, by choosing holes which are located more towards the centre the stub inductivity is reduced.
The single parts of the stub have to be screwed together solidely by the use of the screws and the self locking nuts.

The stub has to be fixed at the **bottom side** of the driver (= elements hang below the boom) with the two already inserted driver screws. The opposite side of the stub is solidly hung below the boom by means of a square bolt and two screwed on insulators (see pictures at 2nd picture page).

Up to this point the antenna itself is assembled. Missing are the stabilising centre element trusses.

2.7 Installation of the centre element truss

Due to reasons regarding stability and optic the driver and reflector are trussed in the centre by means of a little truss mast and a corresponding truss rope (see picture on 3rd picture page).
The pre assembled **truss mast** is mounted on a little right angle platform. A square bolt is already inserted into this little platform. This right angle platform has to be placed straight in front of the element (counts for driver and reflector) and fixed solidly onto the boom.

The centre element truss rope already hangs slack below the element since it was already fixed to the outer element parts by means of the two ring insulators in the moment of the element assembly (see fig. 2.5).

In the centre of the rope we have already fixed an insulator by means of a special double loop. This insulator now simply has to be inserted **on top** of the truss mast.
The ends of the truss rope are fixed to the ring insulators by means of a special loop (see picture on 3rd picture page). This loop means a continuous exact fastening and simultaneously delivers the possibility for an adjustment of the truss rope at any time.
The element now can be brought into the horizontal position (no sag) by tightening the rope on both sides at the ring insulators. For convenience we recommend to first remove the insulator from the truss mast so that the rope is slack again. Now the loop can easily be pushed through the hole of the ring insulator and the rope can be pulled as much as needed. Then the loop has to be fixed again and the insulator has to be reinserted into the top of the truss mast.
Long remaining rests of the rope can either be cut off or somehow fixed at the main rope.

Important: Pay attention that the **hole in the ring insulator where the rope is fixed** points upwards when the rope is under tension.

In case the centre insulator might not be exactly in the middle the double loop can be loosened as well and a fine adjustment can be done.

2.8 Installation of the decoupling stubs

OptiBeam has designed special decoupling stubs (software aided design) which efficiently eliminate negative interaction between this Yagi and other antennas in the frequency range between 10 and 20m.
Such a decoupling stub is used on each element half of the driver and reflector (therefore all over all = four pieces).
The stubs consist of 2mm strong ss wire which runs in a short distance below the tubes of the straight outer element halves. The wire is held tight and stable in the correct distance by means of three insulators. These insulators are located at the element transitions 35/30mm, 30/25mm und 25/20mm (orientate by the schematic diagram of this antenna). The insulators have a thread on both sides. On one side there is already inserted a PVC screw which will be used to fix the wire later on. The free insulator side has to be turned onto the corresponding transition screw. Two insulators have a 6mm thread (transition 35/30mm and 30/25mm) and one insulator has a 4mm thread (transition 25/20mm).

Remove the three insulators from the wire first of all (they are slid over for transportation purposes).
The ss wire has a loop at one end. This loop has to be slid over the downpointing shaft of the screw at the 35/30mm transition.
First remove the selflocking nut and the washer at the transition screw. Now slide the loop over the screw shaft, put the washer on and turn the self locking nut on again and tighten it solidly.

Hereby the rope will be fixed as well. Pay attention that the rope will be fixed in a way that you will be able to realise a **half bow** of the rope towards the centre of the element.
One of the two insulators with the 6mm thread has to be turned onto the screw now until it **sits solidly** (= not turns any more) and the hole at the bottom part of the insulator points transverse (hole for wire lead).
Now making a little **half bow** towards the centre of the element lead the wire through the insulator transverse hole and fix it by means of the PVC screw at the bottom side of the insulator (see picture on 3rd picture page).
Then the two other insulators have to be turned onto the corresponding screws at the transitions 30/25 und 25/20mm until they sit solidly as well (not turning any more) and the hole for the wire in the bottom part of the insulator points **into the direction of the element**.
Now the ss wire can be pushed through these transverse holes, pulled tight and **fixed** by means of the PVC screw.
The remaining rest of the wire which shows out of the last insulator can now be cut off (the wire should finally show out of the transverse hole by about two to three cm).

2.9 Installation of the boom to mast plate

The boom to mast plate is a completely pre assembled part (see picture page) with four horizontal square-bolts which embrace the boom and four vertical U-bolts (depending on the corresponding installation 54mm, 65mm or 75mm) which embrace the mast.
The boom to mast plate should have already been slid onto the boom middle section in the moment of the boom assembly (see fig. 2.2).
It now can be fixed at the **balance point** of the antenna (about the centre of the boom).

3. Connection of coax cable

The feeding of the antenna is done by 50 Ohm coax cable.
For connection a PL-259 connector is required. The connector should be sealed against water entry.

Close to the feed point the cable should be winded to a choke coil with 5 to 6 turns of about 20 cm of diameter. Hereby the antenna is electrically balanced and unwanted radiation of the cable itself is prevented.
Instead of the choke coil a 1:1 balun can be used as well.

4. Adjustment of the antenna

An adjustment of the antenna is not necessary if the given dimensions are exactly observed.

By some influences of the direct surroundings it may happen that the resonance of the antenna (= point of best SWR) shifts slightly.

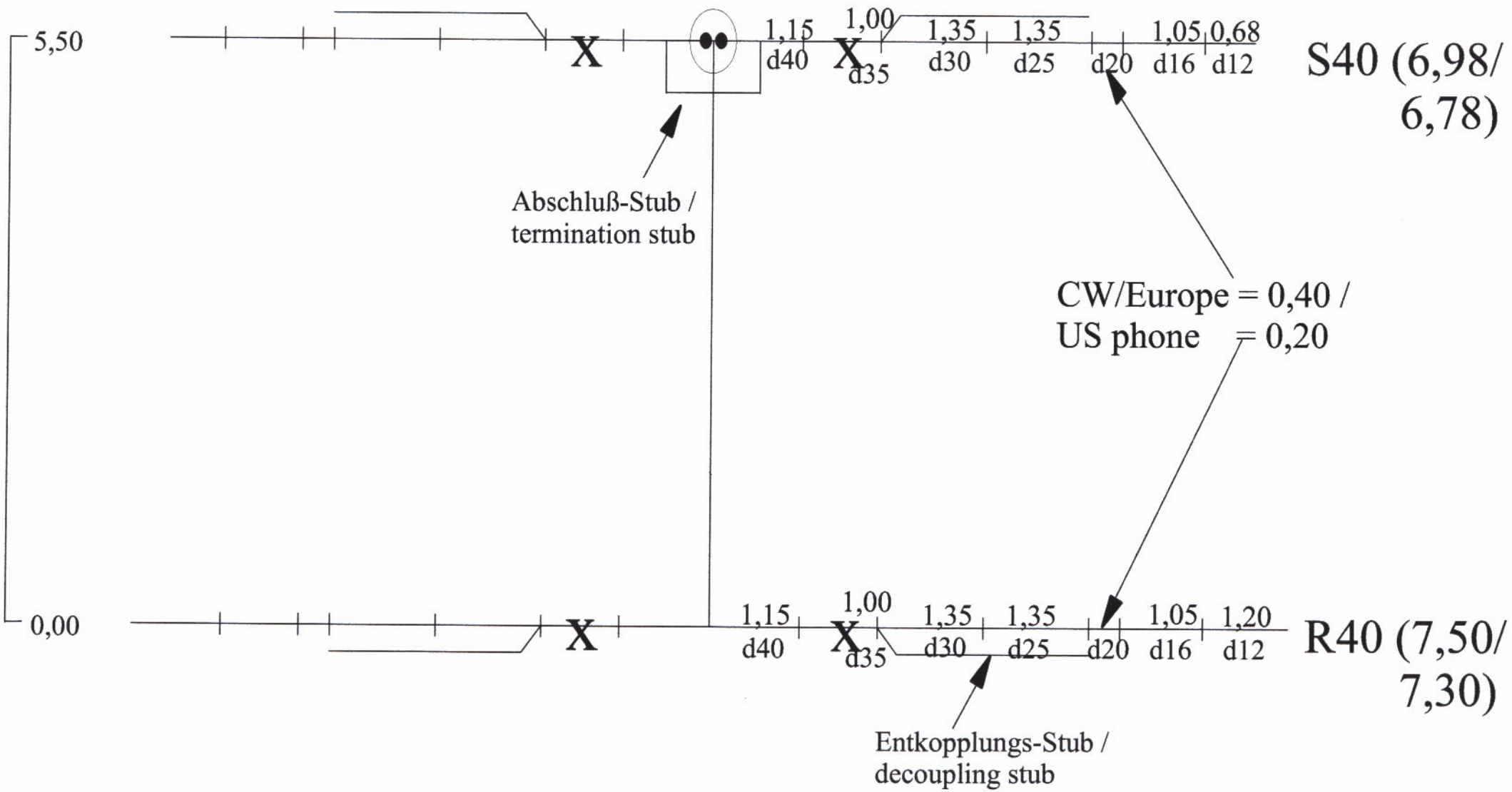
By minimum changes of the driver length (=shortening or lengthening of the outer 12mm sections) the resonant frequency can be shifted to the desired point.
By a slight decrease of the lengths of both element halves (put outer section in to the last drill-hole) the resonant frequency will be shifted upwards, by an increase (pull final section out to the first drill-hole) it will be shifted downwards.

In case of unexpected big discrepancies to the desired resonance frequency or thinking in terms of changes in the official band plans in addition there is the possibility of realising even bigger changes by adjustments through the 3-hole rows of the 20mm segments.
It counts as well: By pushing the 20mm segment in to the last drill-hole of the corresponding 3-hole row the resonant frequency will be shifted upwards, by pulling the 20m segment out to the first drill-hole of the corresponding 3-hole-row it will be shifted downwards.

5. Position of the antenna at strong winds

At strong winds the antenna should be placed in a way that the tips of the elements **show straight into the wind** which means that the boom stands broadside to it.
Hereby physical stress to the elements is avoided and their duration is enlarged.

OptiBeam OB2-40



X = Spule / Coil

alle Längenmaße in m ; alle Durchmesser in mm

Balun-Installation OB2-40 / OB2-40M

Insert the termination stub first and then the two aluminium straps of the balun onto the driver screws and fix all solidly.

The rear of the balun (where the coax will be connected) can be supported additionally by means of the included ty wrap.

Now it is a solid construction and the coax cable can be connected to the rear SO239 connector of the balun.

The entire construction can be seen on the above picture (it shows the bottom of the boom).

In the manuals you will find many more colour pictures of the entire antenna parts.

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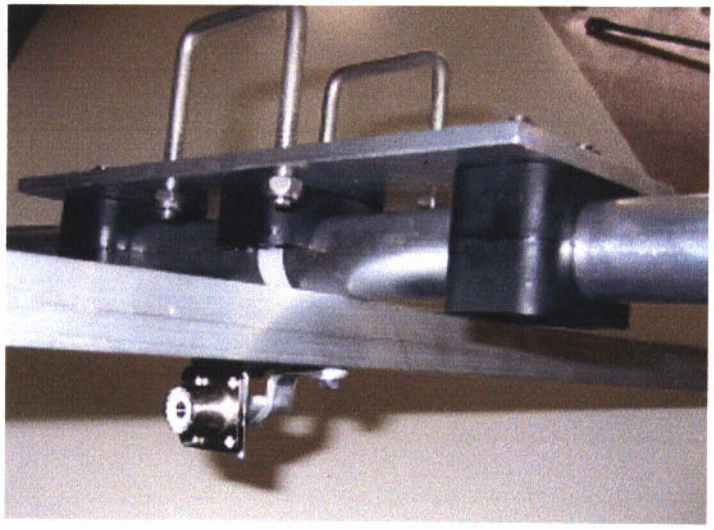
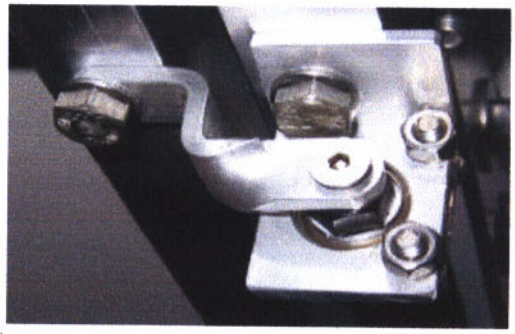
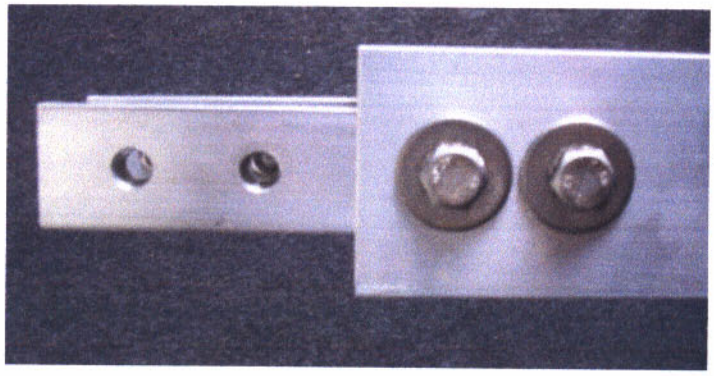


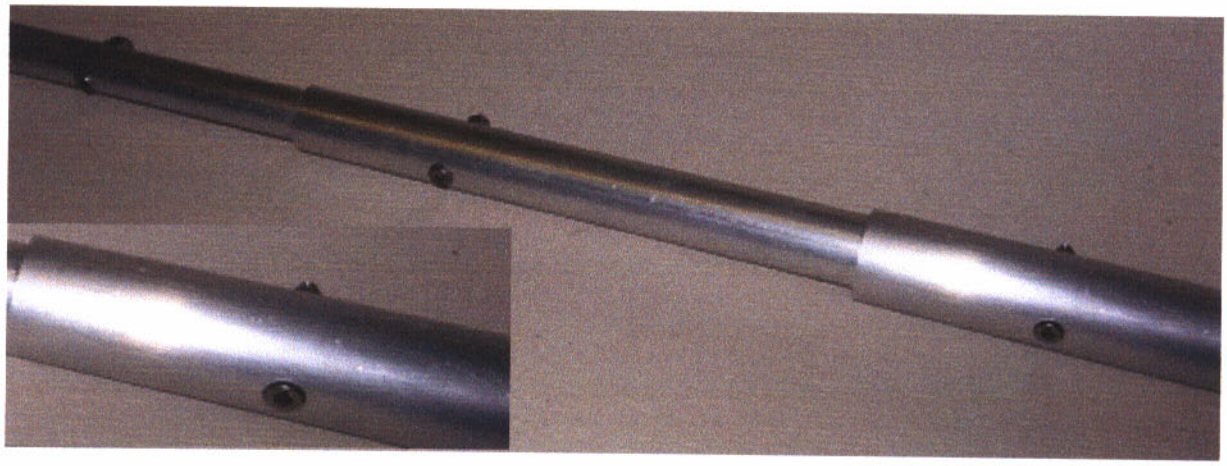
Ansicht Element-Plattform Strahlerelement mit Phasenleitung und Mittenunterstützung / view element platform driven element with phaseline and centre support



Ansicht Koax-Anschlußbuchse SO239 mit Strahlerelement und Phasenleitung /
view coax connector SO239 with driven element and phaseline



Ansicht Boomkopplung bei Vierkantboom /
view boom coupler at square boom



Detailansicht Elementübergänge / close up view element transitions

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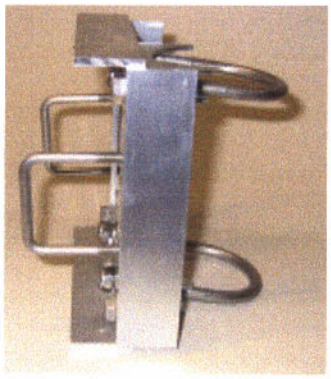
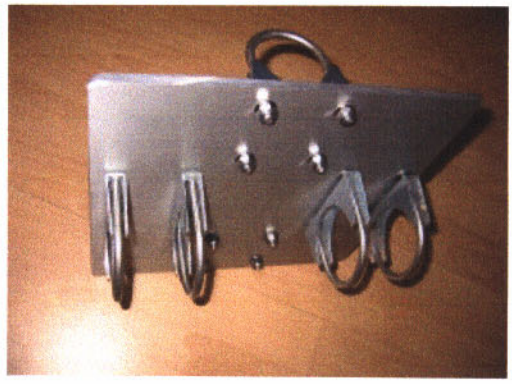
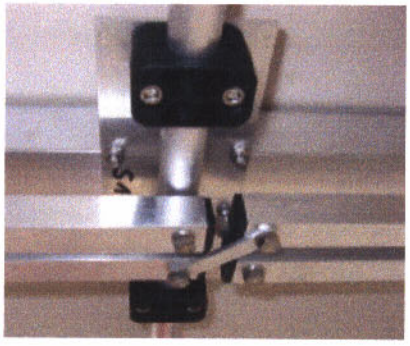


Boom-Masthalterung für kleinere Modelle /
boom to mast mounting for smaller models

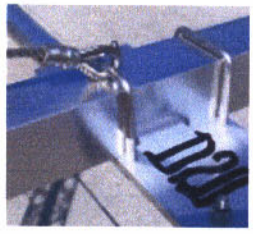
Boom-Masthalterung für mittlere Modelle /
boom to mast mounting for medium size models



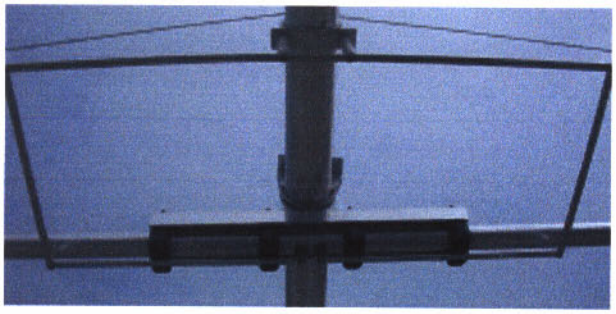
Boom-Masthalterung für große Modelle /
boom to mast mounting for big models



Seitenansicht Überkreuzung Phasenleitung bei Modell 9-5 u. 4-40 /
side view crossing of phase line at model 9-5 and 4-40

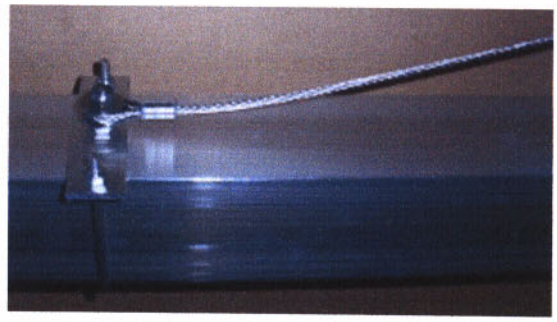


Ansicht zentrale und äußere Boomabspannung für OB11-3 /
view centre and outer boom truss for OB11-3



Gesamtansicht Abschlußstub mit Isolatoraufhängung an Boom bei diversen Modellen /
total view termination stub with insulated fixing to the boom at diverse models

Ansicht variable äußere Boomabspannung div. Modelle /
view variable outer boom truss diverse models



Zentrale Seilabspannung für Modelle über 6 Meter Boomlänge /
centre boom truss for models over 6 meter boom length

Äußere Seilabspannung für große Modelle, Rundboom dto. /
outer boom truss for big models, round boom equivalent

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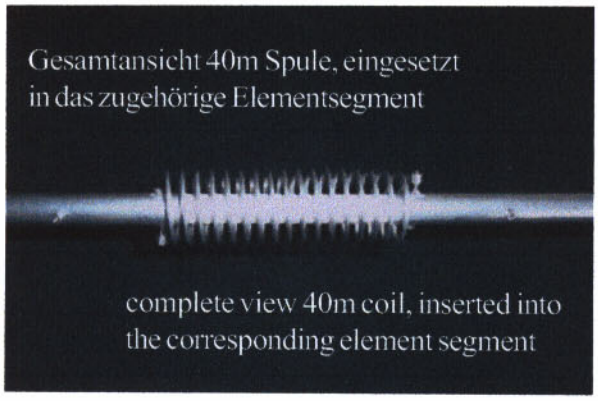

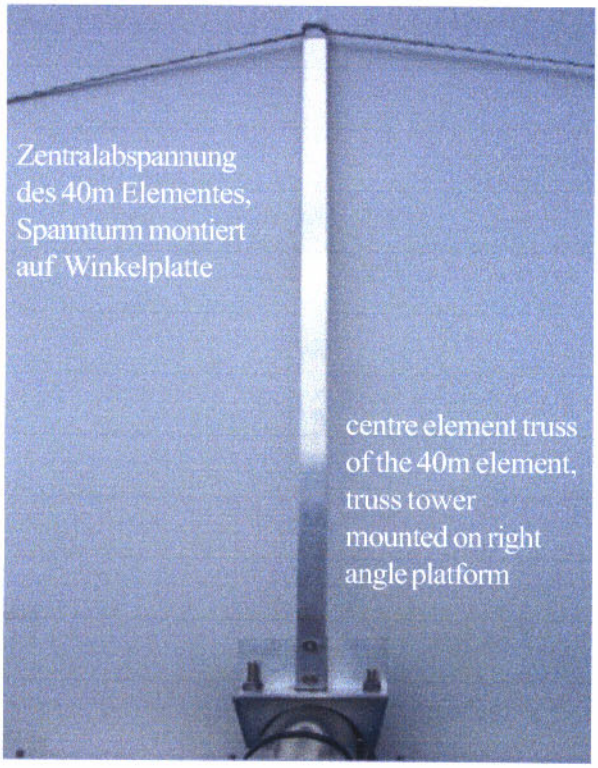

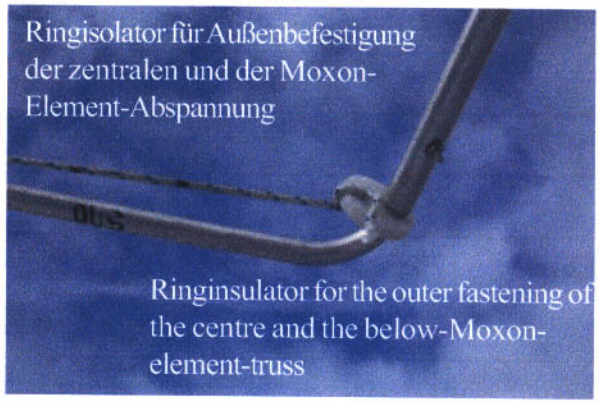

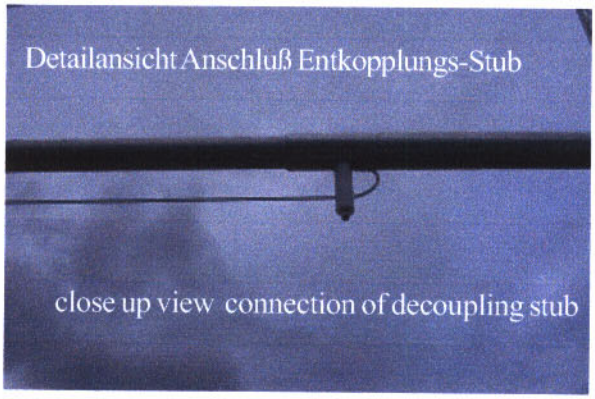

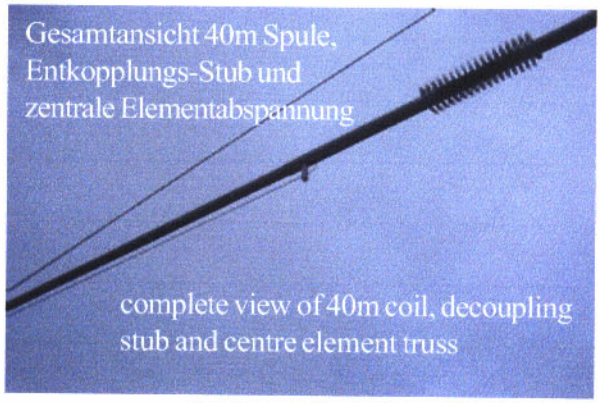

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