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e-mail: info@optibeam.de

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optimale Kurzwellen-Antennen

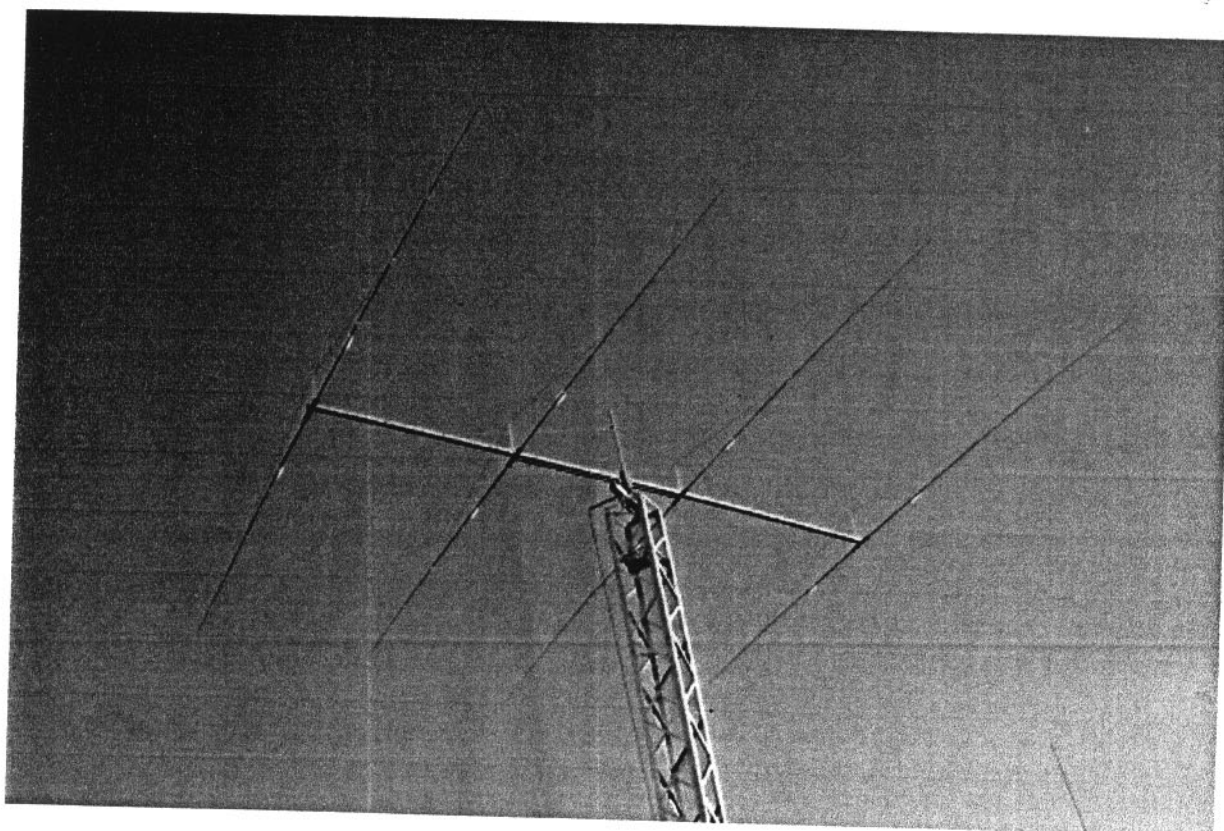
computer-designed / computer-optimiert

entwickelt von Funkamateuren für Funkamateure

optimum short-wave antennas

computer-designed / computer-optimized

developed by hams for hams



O B 4-40

4 Element Yagi 40m

!!! Quality made in Germany !!!

Thomas Schmenger, DF2BO
Rastatter Straße 37
D-75179 Pforzheim,
Tel.: / Fax +49-7231-453153

1. Introduction

The OB4-40 is an extremely high performing 4el 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.

The Yagi consists of two driven Elements (rear and front driver), which are connected by a special crossed phase line.

The use of the two driven elements and their special feeding results in a slight increase of gain.

As well, across the entire 300 khz of the 40m band, gain and pattern are kept stable and the SWR remains absolutely low.

Furthermore the Yagi consists of a reflector and a director.

By the two driven elements, their special way of feeding, the computer designed and carefully chosen lengths and positions of all four elements as well as the use of our high efficient air coils to reduce the element lengths excellent electrical values and an outstanding bandwidth are achieved which can compete and even might outperform the much bigger three element full sized Yagi on the same boom length.

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

Bands	40m
Gain (dbd)*	5,0
Gain (dbi)**	11,9
F/B (db)	25
SWR:	1,5 - 1,1 - 1,2 - 1,2 - 1,1 - 1,3
7,00 - 7,06 - 7,1 - 7,15 - 7,2 - 7,3	50
Impedance (Ohm)	4
Elements	14,74
Max. element length (m)	11,90
Boom length (m)	9,45
Turning radius	75
Weight (kg)	1.200 N / 1,49 m ² / 16,2 feet ²
Windload at 130 km/h	

* = 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, D = Director) 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).

When assembling the following **order** is recommended:

- 1) coupling of the boom sections, simultaneously mounting of the boom to mast plate (see fig. 2.2) and of the boom truss (see fig. 2.10)
- 2) installation of the element middle sections, which are mounted on the element platforms, at the marked positions on the boom (see fig. 2.3)
- 3) connection of the two driven elements by means of the phase line and installing of the balun (see fig. 2.4)
- 4) adjustment of all mounted middle sections on the boom and final fastening
- 5) mounting of this „skeleton“ to the mast or temporarily to a separate pipe
- 6) completing of all four elements (see fig. 2.6 - 2.8)
- 7) installation of the boom truss (see fig. 2.10)

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 the drivers, the reflector and the director.

2.2 Assembly of the boom

The square boom consists of four parts which have to be connected by 12 coupling pieces in total.

For each coupling piece 4 screws are needed.

Pay attention that there will be 4 big M12 washers on each of the two top coupling pieces at the second screw of the outer boom segment (here the outer ends of the boom truss have to be fixed, see further down).

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 second section (seen from the rear) before connecting the boom sections and to prefix it **close to the coupler screws**. Hereby avoided are unnecessary working steps later on.

Furthermore the boom truss should be installed at this moment as well.

The **shorter** steel rope has to lead towards the **rear** (reflector side), the **longer** one to the **front** (director side). Each of the two unused 6mm loops have to be slid over the **second screw** of the upper coupler of the outer boom segment. Three of the four big 12mm washers have to be below the loop, one has to be above (see fig. 2.10 and the photo on the picture page).

The screws have to be tightened finally not before the parts of the boom really **fit** to each other perfectly. They have to be tightened very solidly.

The OB4-40 is a heavy antenna which means a lot of load on the boom as well.

Therefore the installation of the mast to the boom and the mounting of the boom truss to the mast to stabilise the boom should be done before lifting the antenna up, if possible.

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, reflector and director middle sections (d = 40mm) are 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 at the marked positions.

The connecting screws of the boom have to remain horizontal.

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 Installation of the phase line and the balun

The two driven elements (S20a = rear driven element, S20b = front driven element) are connected by two parallel 20mm square tubes (= phase line) which are broken in the centre by a **crossing** that consists of two pieces of flat aluminium.

The square tubes have to be in **direct contact** to the elements (put the washers only below the screw heads). Therefore first remove the element screws and washers. Then insert the predrilled square tubes (move the elements slightly if needed) by means of the element screws in a way that the additional holes for the phase line hanger system lead towards the centre (= towards the crossing).

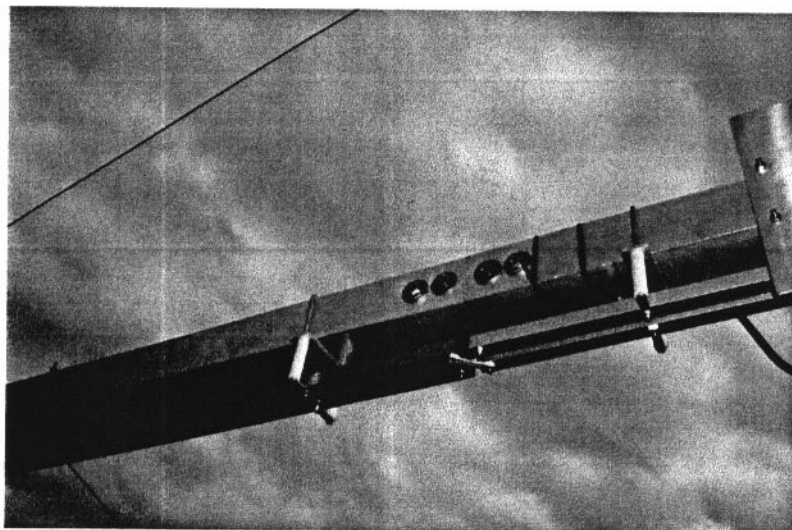
For mechanical stabilisation the four phase line tubes are hung below the boom by about 12 cm left and right of the crossing by means of a special hanger system.

Before the installing the crossing the **phase line hanger system** has to be fixed.

Each phase line half (S40a until crossing and S40b until crossing) is stabilised below the boom by the use of a special hanger system.

The hanger system consists of a square U-bolt which is fixed to the boom by a flat aluminium transverse strap and two insulators which are screwed onto the shanks of the square U-bolt.

The phase line tubes have to be fixed at the bottom side of the insulators by two little flat aluminium straps (see picture on picture page and the picture below). The hanger system should not be tightened finally in this moment.



After pre mounting the hanger system now the phase line crossing has to be installed.

One flat aluminium piece has to be fixed at the **top** and the other at the **bottom** of the phase line. Use the corresponding screws, washers and nuts (see picture on picture page).

If necessary move one of the drivers slightly until the crossing fits correctly.

The cross straps now have to be **fixed solidly** to the phase line tubes.

Afterwards **well tighten** the entire phase line hanger system.

Now attach the included balun at S40b. For the balun installation please study the extra picture page with the detailed description.

In addition the included plastic distance piece (shape of a half circle, to be found in the balun installation bag) has to be inserted in between the legs of the phase line, just above the half tube holder piece which holds the balun.

Hereby avoided is that the phase line square tubes will be pressed to close to each when tightening the three ty wraps.

The plastic distance piece will be solidly pressed in between the phase line tubes when the ty wraps are fastened and likewise cannot fall through due to the half tube holder piece below.

Finally the phase line square tubes have to be **tightened really solidly** (though carefully) together with the driven elements (= important electrical contact).

The entire construction can be seen on the picture page.

2.5 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.

2.6 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 are followed by the 16mm ones and they by the 12mm tips.

Concerning the 12mm tips of the two driven elements the **middle one** of the three drill-holes has to be chosen (regarding tuning facilities, see fig. 4).

2.7 Installation of the centre element truss

Due to reasons regarding stability and optic all four elements 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 elements 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. 2.6).

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 all four elements (in total = eight 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 **into the direction of the element** (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 2nd picture page) with four horizontal square-bolts which embrace the boom and four vertical U-bolts which embrace the mast.

The boom to mast plate should have already been slid onto the second boom section (counted from the rear) in the moment of the boom assembly (see fig. 2.2). It should have been pre fixed **close to the coupler screws**.

It now should be fixed solidly, if not already done before.

2.10 Installation of the boom truss

The boom of the antenna mounted to the mast has to be trussed by two included stainless steel ropes of 4mm in diameter. The **shorter** rope leads to the **rear** (reflector side), the **longer** one to the **front** (director side).

A turn buckle is inserted into each steel rope at one side and a steel loop for the fixation to the boom at the other side.

Each of these loops should have already been fixed to the **second screw** of the top coupler piece of the outer boom segment, with **three** big washers below and one above (see picture page).

The two turn buckles, turned out by about 2/3 of their lengths, are already connected by us to the centre piece of the boom truss. Fasten this centre piece by means of the corresponding U-bolt to the mast and push it up to about one meter until the truss ropes are pre tensioned and then fix it solidly.

Finally the steel ropes have to be tightened by means of the turn buckles until the boom is stable in the horizontal **without any sag**.

The entire installation can be seen on the picture pages.

3. Connection of coax cable

The feeding of the antenna is done by 50 Ohm coax cable.

The coax cable has to be connected to the balun at the feed point. For the connection a PL-259 connector is required. The connector should be **sealed** against water entry.

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 both driver lengths (=shortening or lengthening of the outer 12mm sections) the resonant frequency can be shifted to the desired point.

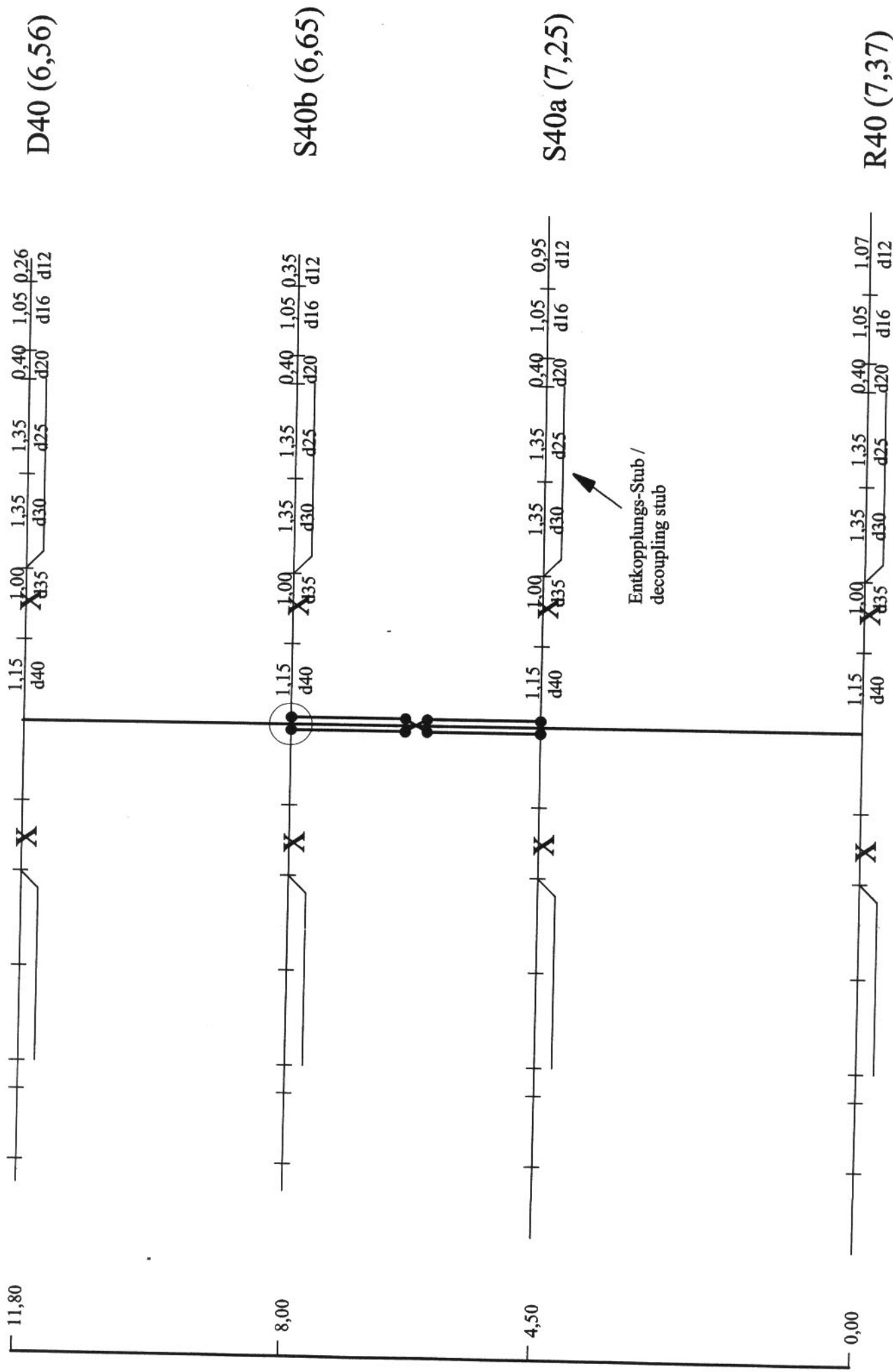
By a slight decrease of the lengths of both element halves (put outer section in to the last drill-hole) on both elements the resonant frequency will be shifted upwards, by an increase (pull final section out to the first drill-hole) it will be shifted downwards.

5. Position of the antenna at strong winds

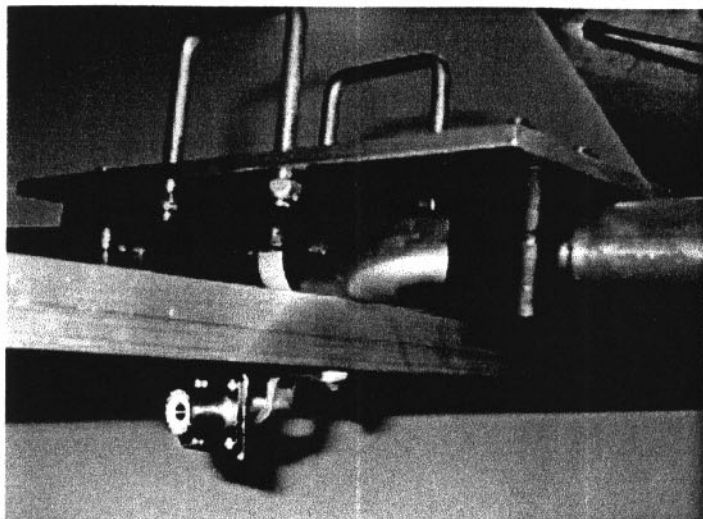
At strong winds the antenna should be placed in a way that the tips of the elements **show straight into the wind** which means that the boom stands broadside to it.

Hereby physical stress to the elements is avoided and their duration is enlarged.

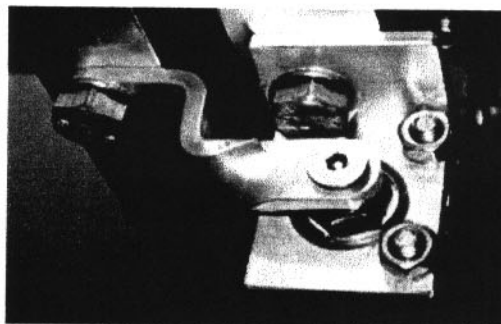
OptiBeam OB4-40



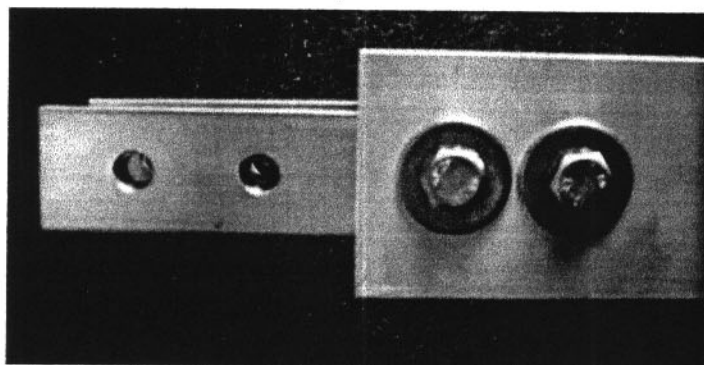
X = Spule / Coil
alle Längenmaße in m ; alle Durchmesser in mm



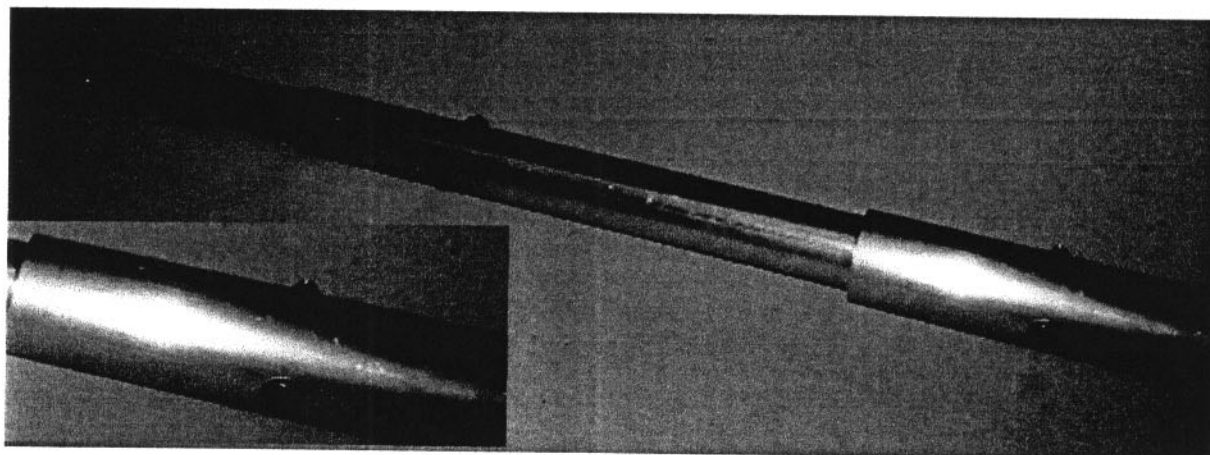
Ansicht Element-Plattform Strahlerelement
mit Phasenleitung und Mittenunterstützung /
view element platform driven element with
phaseline and centre support



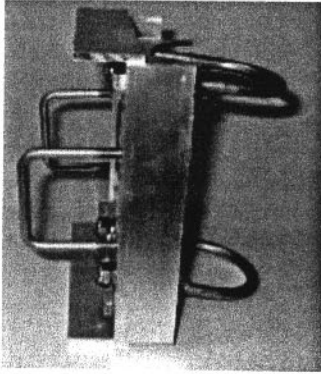
Ansicht Koax-Anschlußbuchse SO239 mit Strahler-
element und Phasenleitung /
view coax connector SO239 with driven element
and phaseline



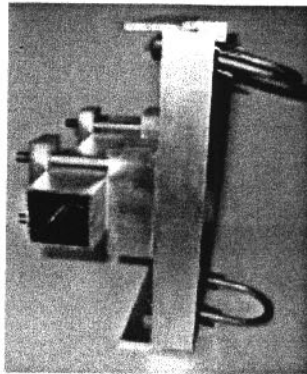
Ansicht Boomkopplung bei Vierkantboom /
view boom coupler at square boom



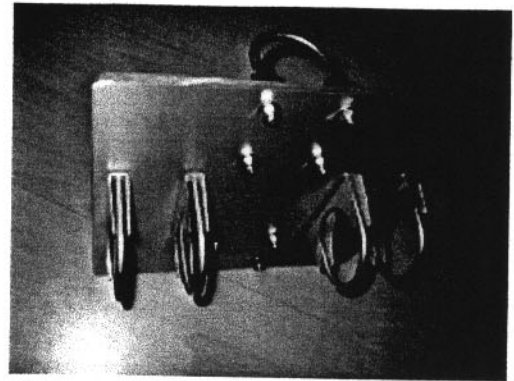
Detailansicht Elementübergänge / close up view element transitions



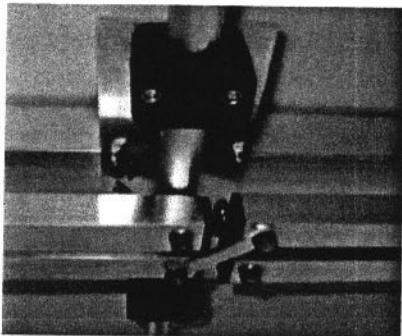
Boom-Masthalterung für kleinere Modelle /
 boom to mast mounting for smaller models



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



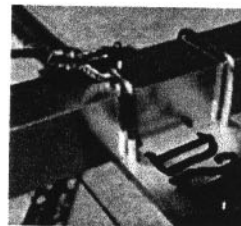
Boom-Masthalterung für große Modelle /
 boom to mast mounting for big models



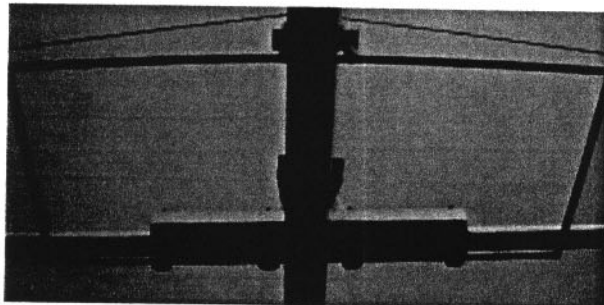
Seitenansicht Überkreuzung Phasenleitung bei Modell 9-5 u. 4-40 /
 side view crossing of phase line at model 9-5 and 4-40



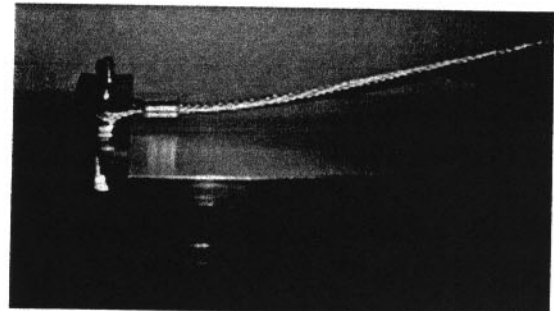
Ansicht zentrale und äußere Boomabspannung für OB11-3 /
 view centre and outer boom truss for OB11-3



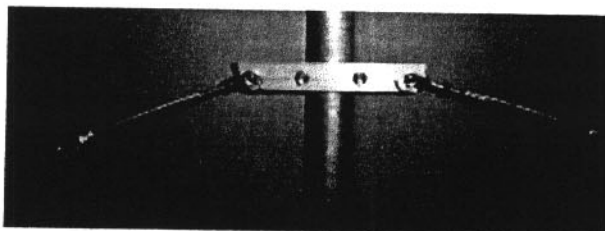
Ansicht variable äußere Boomabspannung div. Modelle /
 view variable outer boom truss diverse models



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

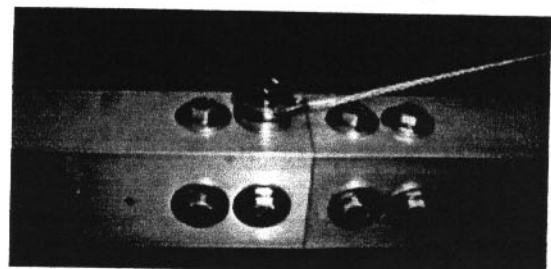


Äußere Seilabspannung für große Modelle, Rundboom dto. /
 outer boom truss for big models, round boom equivalent

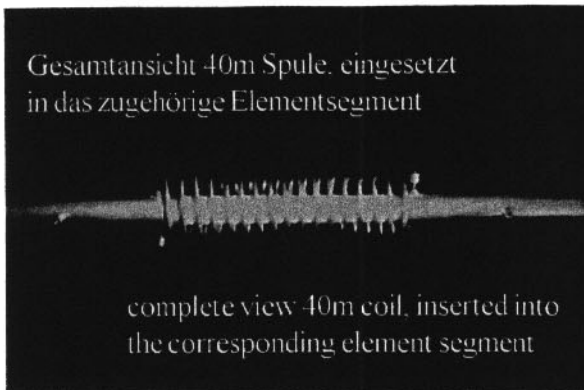


Zentrale Seilabspannung für Modelle über 6 Meter Boomlänge /
 centre boom truss for models over 6 meter boom length

Thomas Schmenger, DF2BO
Rastatter Straße 37
D-75179 Pforzheim,
Tel.: / Fax +49-7231-453153

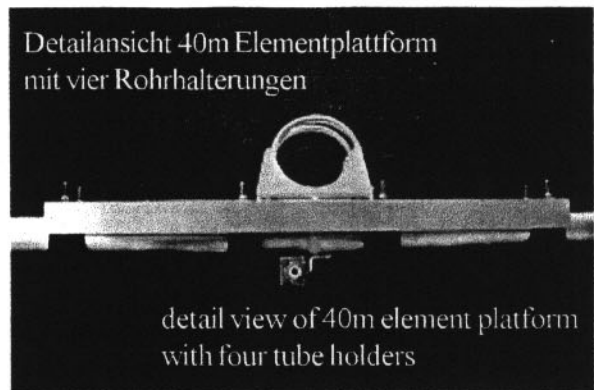


Gesamtansicht 40m Spule, eingesetzt
 in das zugehörige Elementsegment



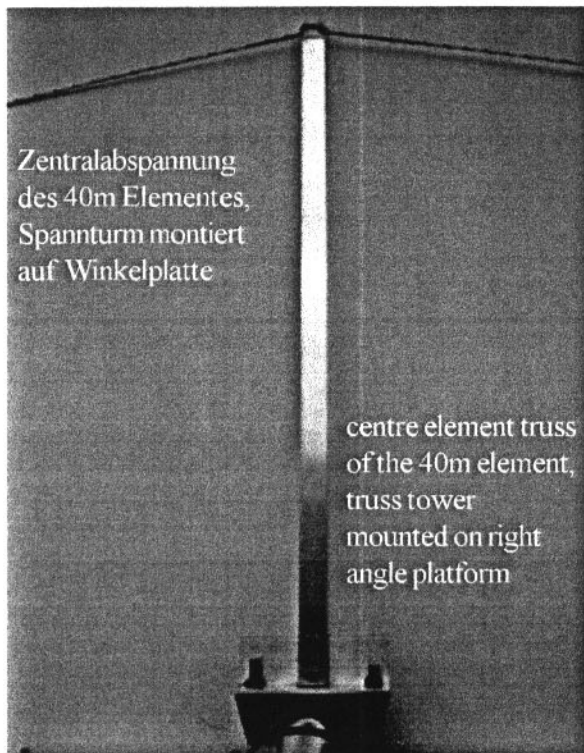
complete view 40m coil, inserted into
 the corresponding element segment

Detailansicht 40m Elementplattform
 mit vier Rohralterungen



detail view of 40m element platform
 with four tube holders

Zentralabspannung
 des 40m Elementes,
 Spannturm montiert
 auf Winkelplatte



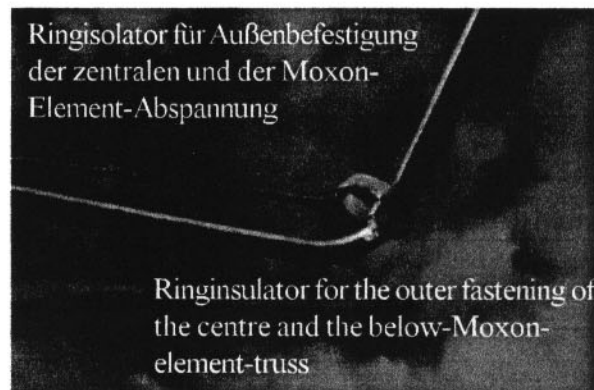
centre element truss
 of the 40m element,
 truss tower
 mounted on right
 angle platform

mechanische isolierte Verbindung des
 Moxon-Elementteiles mit Moxon-
 Element-Travers-Abspannung



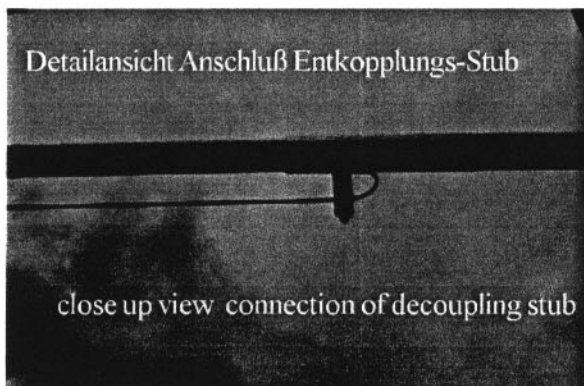
mechanical insulated connection of the
 Moxon element part with the below-
 Moxon-element-truss

Ringisolator für Außenbefestigung
 der zentralen und der Moxon-
 Element-Abspannung



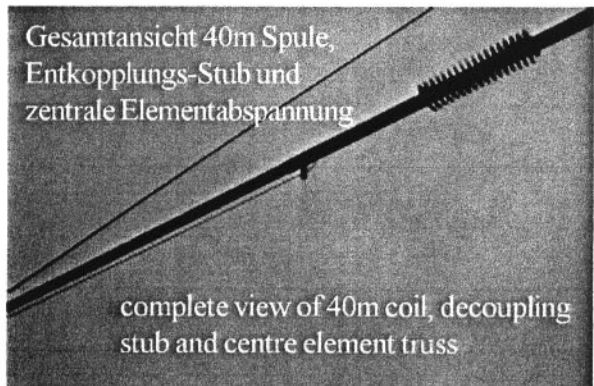
Ringinsulator for the outer fastening of
 the centre and the below-Moxon-
 element-truss

Detailansicht Anschluß Entkopplungs-Stub



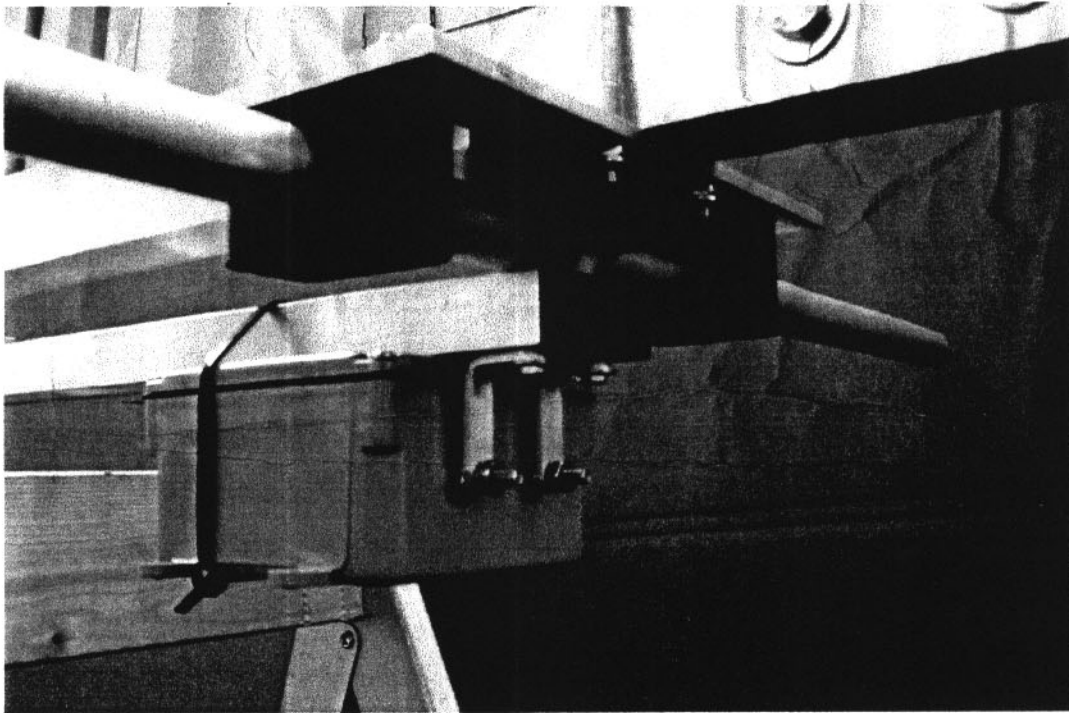
close up view connection of decoupling stub

Gesamtansicht 40m Spule,
 Entkopplungs-Stub und
 zentrale Elementabspannung



complete view of 40m coil, decoupling
 stub and centre element truss

Installation des 5 KW Baluns / Installing the 5 KW balun



Durch die Verwendung des beigefügten 50 Ohm 1:1 5 KW Baluns (Design nach WX0B) am Speisepunkt wird die Antenne elektrisch symmetriert und Eigenstrahlung des Koaxkabels wird unterbunden.

Installation

1. Zuerst sind die zwei Schrauben des Strahlerelementes zu entfernen, an dem die Antenne gespeist wird und die auch die Phasenleitungsrohre halten.
2. Der Balun läßt sich aufgrund seiner Flachstruktur gut unter den beiden Phasenleitungsrohren befestigen. Er ist mit seinen beiden Aluminium-Anschlußbügeln und den vorher entfernten Strahlerschrauben am Strahler zu befestigen.
3. Das Einschmieren der Balun-Anschlüsse mit einer Konduktionspaste kann den einwandfreien Kontakt zwischen Balun und Element dauerhaft fördern.
4. Der Balun ist mittels des beiliegenden Kabelbinders an der Unterseite der Phasenleitungsrohre abschließend zu fixieren.
Die Details gehen aus obigem Photo hervor.
5. Das Koaxkabel ist am SO239 Anschluß des Baluns zu befestigen und sollte hier gegen Wassereindringen geschützt werden (z.B. mit selbstverschweißendem Klebeband oder Silikon).

The antenna is electrically balanced and unwanted radiation of the coax cable itself is prevented by the use of the attached high quality 50 Ohm 1:1 5 KW balun (design by WX0B) at the feed point.

Installation

1. Un-screw the two bolts of the driven element where the source is located at and which hold the two square tube transmission lines.
2. Due to the flat structure the balun can easily be mounted below the two square phase line tubes. It has to be connected to the driver by means of the two aluminium straps and the driver screws.
3. You may want to put some anti-oxidant paste such as No-Alox, or Penetrox on the terminal connection before you tighten the bolts.
4. Use the included plastic ty-wrap to finally secure the balun to the transmission line.
The entire installation can be seen on the above added picture.
5. Attach your feedline jumper to the balun's SO239 connector and weather proof this connection to protect it from water.