

# Radio JOVE

## Retrofit Antenna Assembly Manual

April 2005

### Introduction

Two versions of the Jove RJ1.1 dual dipole antenna have been sold previously. The original version (1999-2003) used a T-connector (instead of a power combiner) and did not require a phasing cable as Jupiter was high in northern hemisphere skies. In 2003, as Jupiter began to move South, a quarter wave phasing cable was included in the kit, along with a power combiner that replaced the T-connector. The antenna was mounted at a height of 10 feet using PVC mast, rope and ground stakes purchased separately by the observer.

In January 2005 the kit began shipping with a 0.375 wavelength phasing cable along with a new instruction manual that described how to erect the dual dipole antenna at heights ranging up to 20 feet (depending on the year and your latitude). This new antenna is referred to as the RJ1.2 (item #RJA on the Jove order form) and includes wire, insulators, a power combiner, coaxial cable and connectors. The RJ1.2 manual describes using PVC mast or steel tubing to reach the desired height.

All northern hemisphere observers who purchased their antennas prior to 2005 should study the RJ1.2 antenna manual [http://radiojove.gsfc.nasa.gov/elab/ant\\_manual.pdf](http://radiojove.gsfc.nasa.gov/elab/ant_manual.pdf). You may find it desirable to raise your Jove dipoles higher than the 10 ft of the original antenna kit. This is particularly important for more northerly observers.

If you have used your original Jove antenna for several years it is probably a good idea to completely replace the coax and wire portion of the antenna by ordering the RJ1.2 antenna kit (item # RJA). The reason for this is possible water intrusion into the coaxial cable and general weathering of antenna components. On the other hand if your antenna wires and coax are relatively new and in good condition there is no need to replace them. In either case you will be able to reuse your original PVC masts and hardware. This retrofit manual shows you how to raise your original Jove antenna up to as high as 20 feet with the addition of four new 10-foot PVC mast sections. It also describes how to fabricate a 0.375 wavelength phasing cable.

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### 1. Retrofit Antenna Assembly Instructions

Because Earth and Jupiter orbit the Sun on different planes, over the next 4-5 years Jupiter will be at a lower altitude in the sky for most northern hemisphere observers. For many observers the height and the phasing cable of the Radio JOVE dual dipole antenna must be altered to achieve good performance. To determine whether your antenna needs a height and phasing adjustment, refer to the New Antenna Manual on the Radio JOVE website and follow the instructions in Section 1. Approximate cost for the parts for a new phasing cable and new antenna supports is \$75.

#### 1.1 Parts List and Considerations

The antenna wire and coaxial cable parts of the Jove antenna system are the same, regardless of how high the antenna is located. If you need an additional phasing cable then it must be purchased from a store that sells coax cable, like Lowes or Home Depot (Radio Shack no longer carries coax that you can purchase by the foot). These home stores carry RG-6 and the higher grade RG-6QS (quad shield), which is also 75-ohm cable. Both of these cables have a velocity factor of 85%, so one wavelength at 20.1 MHz in RG-6 cable is 41.61 ft (12.68 m). Type F connectors for RG-6 cable can be purchased from Radio Shack (part # 278-0228).

Parts needed for Retrofit Antenna Assembly		Parts Checklist
#	Description	
1	15.60 ft. (4.75 m) RG6 Coaxial Cable (Phasing Cable)	
2	Twist-on F-connectors (for RG6 coax)	
1	Coax Cable coupler	
1	300 ft. (30.48 m) x 3/16 in. Nylon Rope	
4	10 ft. (3.048 m) x 1¼ in. Non-metallic Conduit pipes (Gray)	
4	1¼ in. Non-metallic Conduit End Caps	
4	4 in. x ¼ in. Eye Bolts	
4	4 in. x ¼ in. regular Bolts (Stop Bolts)	
8	¼ in. Nuts/Lock washers	
4	4 in. x 3/8 in. Bolts (for end caps)	
4	3/8 in. Nuts, Flat Washers, and Lock Washers (for end caps)	
10	Ground Spikes (or tent stakes)	

**Table 1.1. Parts list.**

## 1.2 Construction Time Estimates

Antenna Mast Fabrication	1 hour
Antenna site layout	0.5 hours
Field Setup (first time)	1 hour
Approximate Total Time	2.5 hrs.

**Table 1.2. Construction Time Estimates**

## 1.3 Tools Needed

Scissors	Lighter
Tape measure (at least 25 ft. is best)	Black Marker
Drill with 1/8 in., 1/4 in., and 3/8 in. drill bits	Crescent Wrench

## 2. Adding the Phasing Cable

### Building the 0.375 Wavelength Phasing Cable

1. Install the F-connectors on each end of the 15.60 ft. section ( $.375 \lambda$ ) of the coaxial phasing cable. (See Original JOVE manual Figures 7a, b, and c).
2. Connect the 0.375 wavelength phasing cable to the South antenna coaxial feed line by using the F-connector coupler (See Figure 4.1).

## 3. Antenna Mast Assembly (Figures 3.1, 3.2 and 3.3)

There are 3 choices of antenna height: 10, 15, and 20 ft.

1.  The dipole mast assembly consists of a 10 ft bottom section (1.25 inch gray electrical conduit, schedule 40, PVC) and a 10ft top section (two 5ft x 1 inch white schedule 40 PVC coupled together). The 10, 15, and 20 ft antenna heights are achieved by telescoping the top mast up or down inside the bottom mast. Overall antenna heights may vary a few inches (or cm); this is perfectly acceptable.
2.  **Drill all holes through the masts at 1/4 inch diameter.** The hole through the end-cap for the spike is 3/8-inch diameter. All holes in the masts should be in the same plane (i.e. not rotated around the mast pipe). A hammer and punch (or nail) can be used to make a starting point for drilling. A pilot hole using a 1/8 in drill bit is recommended. Eyebolts and regular bolts should be secured using a flat washer, lock washer and a nut.
3.  Draw a guide line the length of the top mast to insure that all holes line up.



**Figures 3.1a and 3.1b. Drill the PVC piping (1/4 in. drill bit) and end cap (3/8 in. bit).**

4.  Draw a guide line from the top to the midpoint of the bottom mast (Refer to Figure 3.2). Using the guideline for orientation, drill holes (E and F) through the bottom mast. Secure the stop bolt in hole (F).
5.  With the guide lines on the two mast sections aligned, insert the top mast 6 inches into the bottom mast section. Using hole (E) as a guide, match-drill a hole through the top mast section – this becomes hole (D). The best way to match-drill the holes is to drill the mast from each side – using hole E as a guide. Then without moving the two masts relative to each other, run the drill all the way through both masts.
6.  With the guide lines on the two mast sections aligned, push the top mast section into the bottom mast section until it hits the PVC coupler or the stop bolt at (F). Using hole (E) as a guide, match-drill a hole through the top mast section – this becomes hole (C).
7.  Assemble and attach the bottom cap and spike. (Glue optional)
8.  Repeat assembly steps above for the remaining masts.
- 9a.  For the 20 foot antenna assembly, insert the top mast 6 inches into the bottom mast and secure with a 4 inch eyebolt thru holes E/D.
- 9b.  For the 15 foot assembly insert the top mast until it hits the PVC coupler or the stop bolt and secure with an eyebolt through holes E/C
- 9c.  For the 10-foot assembly remove PVC coupler and the lower 5 ft. section on the top mast. Insert the top mast until eyebolt (B) hits the top of the bottom support mast. The inner guy rope is not used. The total antenna height will be closer to 11 feet; this is perfectly acceptable.

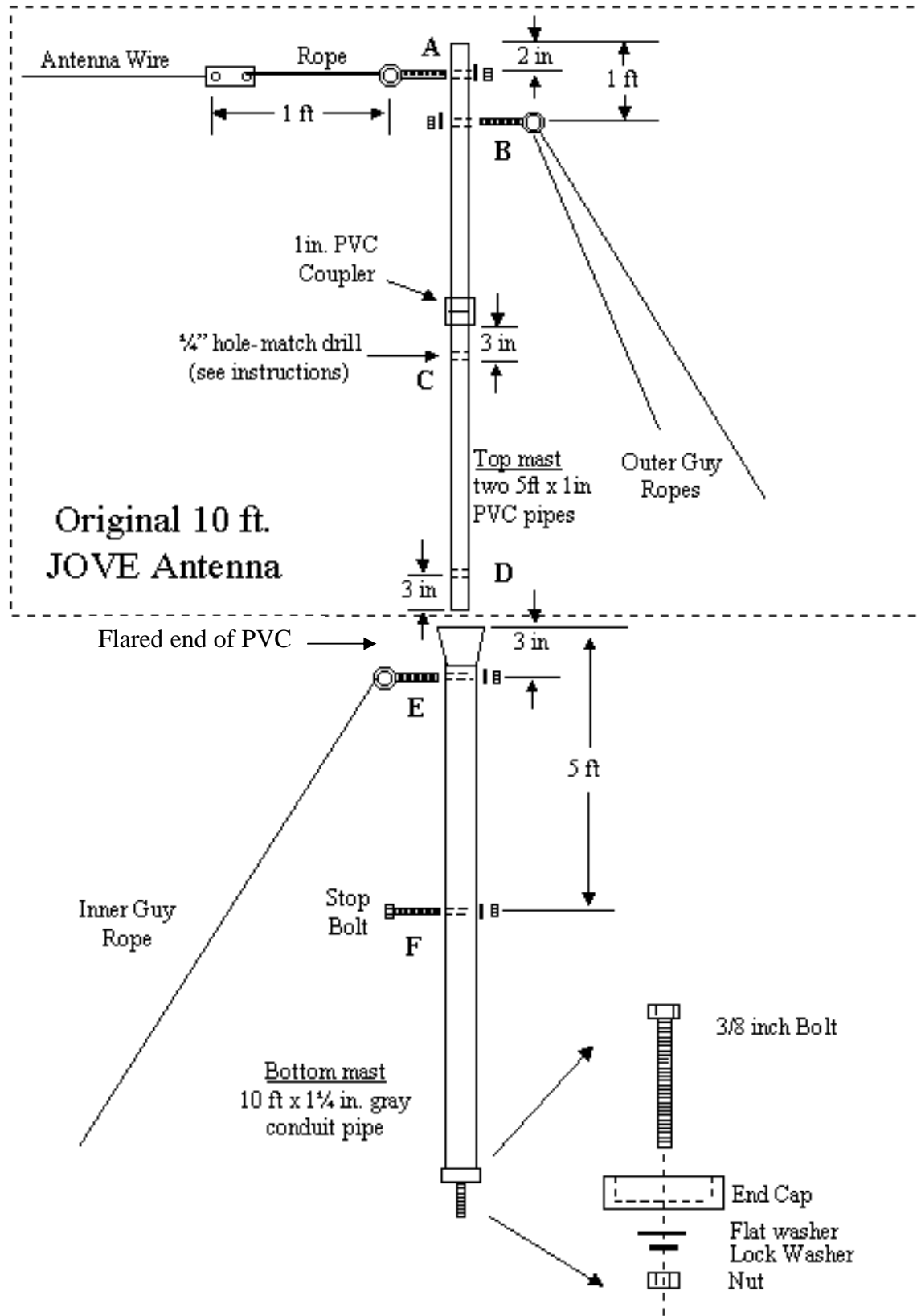


Figure 3.2. Retrofit PVC Mast Assembly Diagram.

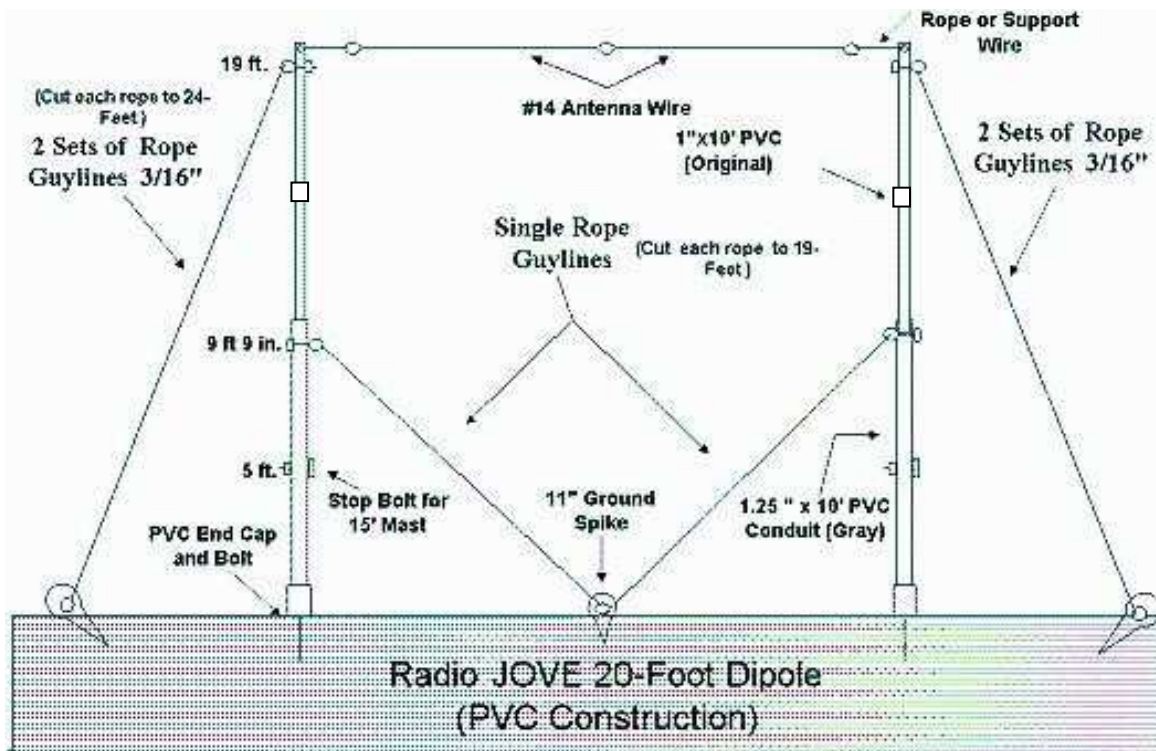


Figure 3.3. Side-view schematic of PVC dipole.

## 4. Field Setup

### Step 1. (Refer to Figures 3.2 – 4.2)

Mark the ground positions of each antenna mast and stakes. Lay out the 4 masts on the ground, with the base of each mast near its mark. **Be sure that the dipoles are oriented in phase – that is, be sure that the side (or arm) of the dipole soldered to the center conductor is on the same side on both dipoles.**

*Refer to Figures 3.2 and 3.3.* Cut 8 ropes to 24-feet. Attach 2 ropes to each of the eyebolts at the 19 ft level (hole B). Cut 4 ropes to 19-feet and attach each to an eyebolt at the 9-foot 9-inch level (holes D/E).

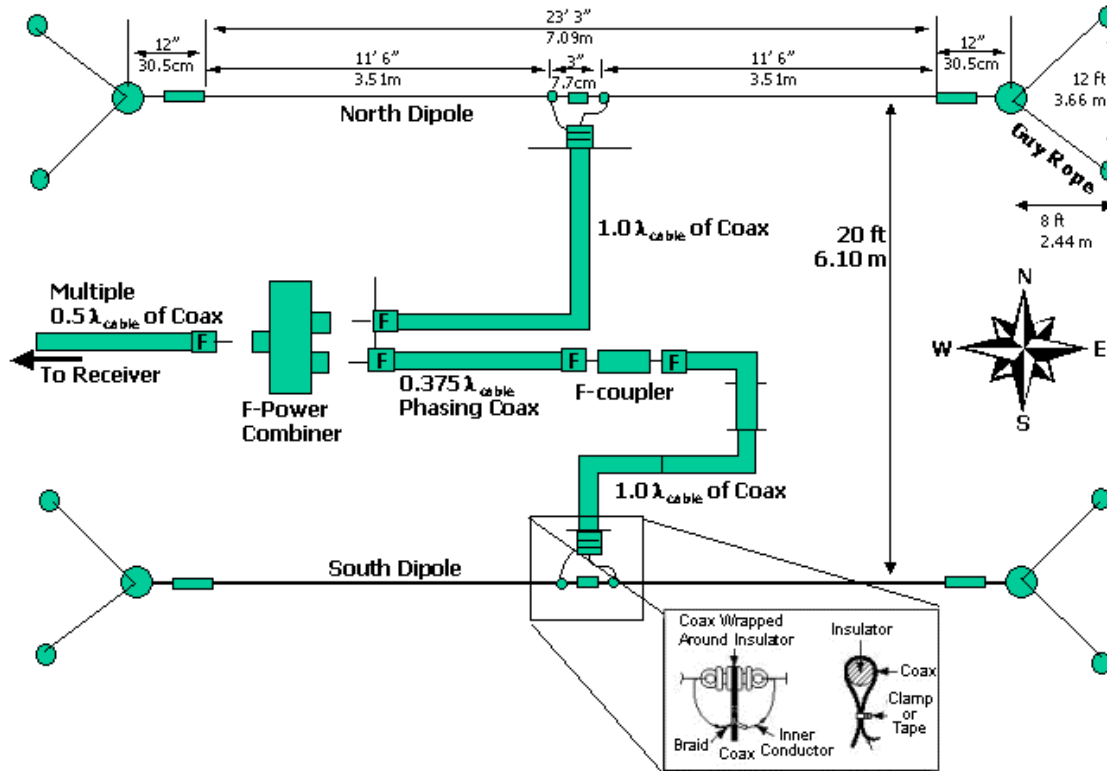
### Step 2.

Insert the mast with the dipole wire attached into its hole in the ground and erect it to the vertical position. Tie guy ropes to their stakes so that the mast is approximately vertical.

### Step 3.

Erect the second mast and secure the guy ropes so that the mast is approximately vertical. The antenna should be fairly taut with both masts near vertical. If it is not, move one mast as needed along the E-W line, reinsert in ground, and retie the guy ropes. You may have to adjust all guy ropes to make the antenna masts vertical. Do not expect perfectly straight PVC masts, as the PVC pipes will flex one direction or another.

**Step 4.** Connect the coaxial cable to the power combiner. **Do not let the power combiner hang in the air, as this will strain the antenna solder joints.** Support the power combiner with a bucket on the ground or an attached rope tied between two masts.



**Figure 4.1.** Top-view schematic of Radio JOVE dual dipole with phasing cable.



**Figure 4.2.** Sample picture of the 20-foot mast.