Chapter 33

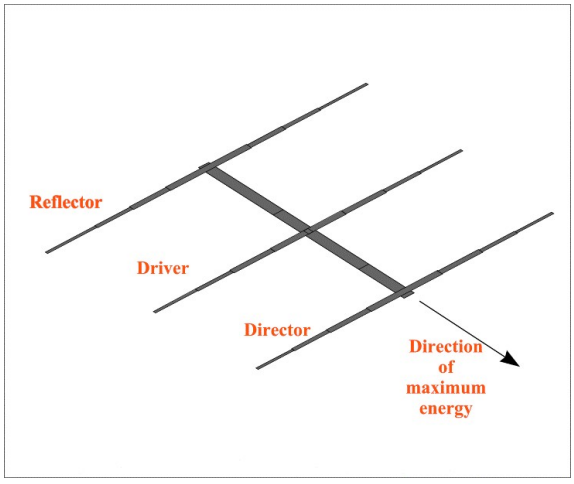
Yagi Review
using Information from several of my PowerPoint Presentations

yahhh' gi
yag' ee

The Yagi-Uda antenna utilizes
a driven element (dipole) and
parasitic elements to focus the pattern,
such as……...

W6RJ
Left: stack of C-49XR's
Right: 3el 40 meter "N" type, stacked over 6el 20 meter (50 ohm feed)

Below is a typical 3-element Yagi:



There is lots of literature about Yagi antennas and here are a few excerpts:

A Yagi-Uda Antenna, commonly known simply as a Yagi antenna or Yagi, is a directional antenna system consisting of an array of a dipole and additional closely coupled parasitic elements (usually a reflector and one or more directors).

The dipole in the array is driven, and another element, 5% longer, operates as a reflector.
Other shorter parasitic elements are typically added in front of the dipole as directors (5% shorter). This arrangement gives the antenna directionality that a single dipole lacks.

Yagis are directional along the axis perpendicular to the dipole in the plane of the elements, from the reflector through the driven element and out via the director(s). If one holds out one's arms to form a dipole and has the reflector behind oneself, one would receive signals with maximum gain from in front of oneself.

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Question: Referring to the 3-element Yagi drawing above, what is the purpose of the driver element?

→ To excite the array.

Question: What is the purpose of the reflector and director elements?

→ To redistribute the energy.

Question: How many elements in a Yagi?

→ A minimum of two (driver and either a reflector or director).

Question: What is the maximum number of elements in a Yagi?

→ Some practical limit to be sure. The most I've built it 49 at 5.8GHz.

Question: What is the "best bang for the buck" in terms of Yagi antennas?

→ A 2 element, driver/reflector will get to 4-4.5dBd with a minimal amount of aluminum and boom torque in the air. This is a large percentage of much larger models. The second element getting 4-4.5dB over a dipole is a good deal.

Adding another element to make a 3-element, improves the forward gain about .75-1dB. This is a 20% increase in gain for a 50% increase in aluminum in the air.

Question: How much more to increase the 2-element by 2dB to achieve 6-6.5dBd?

→ Make the boom 2.5-3 times longer and double the elements.

The practical Yagi designs that follow will provide the gains noted and can be verified in real life – not only on paper. You might notice that the gain figures are much lower than a lot of advertised figures that have been around for decades.

Making a stack of 2-element Yagis is a great way to increase gain, as well as afford coverage in another direction for chasing DX or contesting. The models usually show the "stacking gain" of 2.5-3dB over a single. I've found in the real world that it is more on the order of 5-6dB improvement, with less QSB.

Gain	Full Size	20 meters
0dBd	Dipole	Boom length
4.5	2 element	10'
5.5	3	20'
6.5	4	30'
7,5	5/6	42'
8,5	7	60'
9.5	8	80'
10.5	9	105'
12.5	12	175'
14.5	20	330'

Things to keep in mind:

1) Just because an antenna has a pattern, does not mean it has any forward gain at all;
2) Claims and naming antennas like "killer tribander", for example, do not mean the antenna is very effective at all.
3) Stacking inefficient Yagis greatly increases the performance of the system.

Item 3) is especially important. The gain from a stack is an increase over a single antenna. If it is an excellent Yagi, the gain of the stack is an increase over the gain of the single. If the Yagis are poor, the stack improvement is still an improvement over the gain of a single.

General Rules:

- If you increase your antenna efficiency, you will expand your performance envelope, be able to hear AND work more stations, providing more enjoyment from radio.
- If you increase only your transmit power, you will expand your "transmit envelope", working stations you could not work before, and, sometimes, able to work people you can't hear!

When comparing signals:

- Select signals that are at the "margin"
- Terrain has a lot to do with performance, so if comparing with a large station, keep in mind that its location was probably selected carefully and the antennas placed exactly where they should be for optimum performance on the property.