# TOSSUP 98

## September's Contest

September's contest was held on 9/13. The contest had three rounds - 3, 7 and 8 minutes scored 960/40 with the option to refly one of the rounds.

The weather was mostly overcast with a deep marine layer that tried to lift during the morning. The layer was so thick that the contest start was delayed while the ceiling lifted. (Art tried launching around 9am and had his plane disappear into the clouds at the top of the launch.)

Lift was adequate for most of the morning but there was a period around 11 when there was a lot of sink causing some missed times.

(The results below include a couple of people flying 2 meter so the three sets of results are Open, 2m and Sport.) ◆

| Name | Glider | R1 | | | R2 | | | R3 | | | Total | Normal | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Don McNamee | Salza | 3:00 | 96 | 998.4 | 7:02 | 66 | 981.8 | 8:02 | 93 | 993.2 | 2973.4 | 1000.0 | 998.5 |
| Bob Swet | Cumic | 2:58 | 98 | 988.5 | 7:00 | 60 | 984.0 | 8:03 | 96 | 992.4 | 2964.9 | 997.2 | 995.6 |
| Don Northern | Gemini 'S' | 3:02 | 76 | 979.7 | 6:58 | 56 | 977.8 | 8:01 | 40 | 974.0 | 2931.6 | 985.9 | 984.4 |
| Edgar Weis-man | Emerald | 3:00 | 92 | 996.8 | 6:55 | 65 | 974.6 | 8:02 | 0 | 956.0 | 2927.4 | 984.5 | 983.0 |
| Mike Stern | Mako | 2:55 | 0 | 933.3 | 6:50 | 6 | 939.5 | 7:59 | 95 | 996.0 | 2868.9 | 964.8 | 963.4 |
| Myles Moran | ?? | 3:00 | 88 | 995.2 | 6:20 | 65 | 894.6 | 4:28 | 0 | 536.0 | 2425.8 | 815.8 | 814.6 |
| Gary Filice | Mako | 2:56 | 84 | 972.3 | 7:00 | 90 | 996.0 | 3:28 | 0 | 416.0 | 2384.3 | 801.9 | 800.6 |
| Peter Stairs | ?? | 3:04 | 96 | 977.1 | 7:04 | 0 | 950.9 | 2:30 | 76 | 330.4 | 2258.3 | 759.5 | 758.3 |
| Art McNamee | Addiction | 3:00 | 75 | 990.0 | 6:59 | 75 | 987.7 | 2:18 | 0 | 276.0 | 2253.7 | 758.0 | 756.8 |
| Bill Karp | Edge | 2:59 | 66 | 981.1 | 3:30 | 17 | 486.8 | 4:14 | 0 | 508.0 | 1975.9 | 664.5 | 663.5 |
| Art McNamee | Laser | 3:00 | 65 | 986.0 | 6:58 | 66 | 981.8 | 8:04 | 57 | 974.8 | 2942.6 | 1000.0 | 988.1 |
| Peter Stairs | ?? | 3:00 | 84 | 993.6 | 7:01 | 0 | 957.7 | 3:12 | 0 | 384.0 | 2335.3 | 793.6 | 784.2 |
| Don McNamee | Salza | 3:01 | 98 | 993.9 | 7:01 | 89 | 993.3 | 8:04 | 97 | 990.8 | 2978.0 | 1000.0 | 1000.0 |
| Don Northern | Gemini 'S' | 2:59 | 81 | 987.1 | 7:00 | 85 | 994.0 | 8:02 | 76 | 986.4 | 2967.5 | 996.5 | 996.5 |
| Bob Swet | Cumic | 2:59 | 80 | 986.7 | 7:03 | 81 | 985.5 | 7:55 | 60 | 974.0 | 2946.2 | 989.3 | 989.3 |

## Results of SWSA SC$^2$ Contest (08/30/98)

| Place | Name | Club | Class | Score | Normal | Trophy |
|---|---|---|---|---|---|---|
| 1 | Mike Smith | TPG | Master | 3961.5 | 1000.0 | M1 |
| 2 | Patrick Dioniso | TPG | Master | 3956.8 | 998.8 | M2 |
| 3 | George Joy | TPG | Master | 3954.7 | 998.3 | M3 |
| 4 | Brendan Lugo | TPG | Master | 3938.3 | 994.1 | |
| 5 | Mike Regan | TOSS | Master | 3938.2 | 994.1 | |
| 6 | Art McNamee | TOSS | Expert | 3936.8 | 993.8 | E1 |
| 7 | Don McNamee | TOSS | 3Func | 3932.9 | 992.8 | 3F1 |
| 8 | Keith Kindrick | PSS | Expert | 3932.1 | 992.6 | E2 |
| 9 | Richard Burns | PSS | Expert | 3924.5 | 990.7 | E3 |
| 10 | Fred Sage | TPG | Master | 3921.3 | 989.9 | |
| 15 | Dan Werner | SCSA | Sport | 3883.9 | 980.4 | S1 |
| 17 | Bob Swet | TOSS | Expert | 3879.2 | 979.2 | |
| 20 | Peter Olsen | SWSA | Sport | 3850.0 | 971.9 | S2 |
| 21 | Jeremy Barnes | SWSA | Sport | 3839.5 | 969.2 | S3 |
| 31 | Michael Stern | TOSS | Sport | 3553.5 | 897.0 | |
| 34 | Edgar Weisman | TOSS | Expert | 3503.7 | 884.4 | |
| 36 | Paul Trist Jr. | TOSS | Expert | 3461.9 | 873.9 | |
| 38 | Gary Filice | TOSS | Sport | 3457.6 | 872.8 | |

| Class | Entries |
|---|---|
| Master | 6 |
| Expert | 21 |
| Sportsman | 17 |
| Three Func-tion | 5 |
| | 49 |

# So - What About the Rest of the Radio?

*(This month I thought I'd add to the note about servos with something about the rest of the radio system - how the stick input gets to the servo connector on the receiver, that sort of thing. Again, this draws heavily on Signetics data sheets and associated Applications Notes. - Ed.)*

Last months note about servos described how a servo turned a periodic variable width pulse into a shaft position. (Well, it more or less did - it skipped the tricky bits.) In order to go a bit deeper into how the rest of the radio system works we should be very clear what we mean by the terms *pulse, pulse train, pulse width, pulse rate* and *period.* A *pulse* is a momentary change in something - it could be a light flashing, a brief change in color or a change in a voltage level. It has three characteristics - when it starts, how long it lasts - its *pulse* width - and how long a pause between it and the next one - its *pulse rate* (in pulses per second) or *period* (in seconds per pulse). (It also has a characteristic called *amplitude*, or how big it is, but in a digital system that's not important - all that matters is that its two states are easy to distinguish.) When we describe a set of pulses we refer to them as a *pulse train*, and a set is a group of pulses that occur periodically. Pulses in a radio control system are usually of the order of thousandths of a second *(milliseconds)* in length.

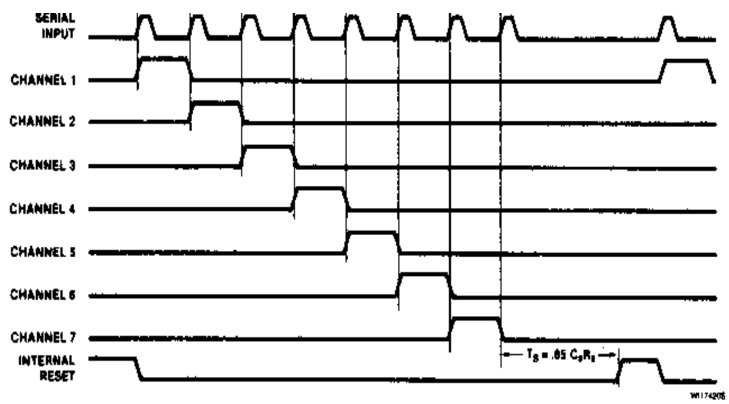


**Figure 1. NE5045 Decoder Timing Diagram**

Servo information is coded as a varying width pulse that occurs at a rate of about 50 per second. If the pulse is a half a millisecond long the shaft turns full counterclockwise (at least my Futaba servos did) and if it is one and a half milliseconds long the shaft turns fully clockwise. The radio system electronics has to put - or *multiplex* - the information for a number of servos into one train of pulses, and it does this by putting the pulses one behind the other. Since the transmitter only needs to mark the start of a servo pulse (the end is going to be the start of the next pulse) it does this by marking the start with a short pulse, one that's about a third of a millisecond long. It also needs to mark the beginning of the pulse train to the receiver so that the receiver can *demultiplex* the pulses to the correct channel, and it does this by pausing for a fairly long time, of the order of 5 milliseconds or more, before sending a set of pulses. So a typical pulse train sent from a seven channel transmitter to its receiver has a group of eight third millisecond pulses with the interval between each pulse being the servo command for the corresponding channel followed by a pause of 10 to 15 milliseconds to *frame* the next set of data. (As you can imagine the first interval commands channel 1, the second channel 2 and so on).

This encoding by pulse width is somewhat traditional in radio control and is unlikely to change any time soon. The reason for this is to do with the radio system that we use to carry the pulse train between the encoder in the transmitter and the decoder in the receiver. Pulses are put onto the radio system by momentarily switching the radio carrier off to indicate a pulse ("Amplitude Modulation") or by momentarily shifting the frequency of the transmitter slightly ("Frequency Modulation"). AM is equivalent to flashing a light, FM to changing its color (which is easy to turn into a flash by just passing it through a filter - as the color changes the new color can't get through it so the amplitude changes). Unfortunately every time you change the amplitude or frequency of a radio signal you generate small amounts of off frequency radio energy, the amount and spread increasing with how often and how suddenly you change the signal. Since we are restricted to only a very narrow part of the spectrum to transmit on we can't put much more information on the radio signal than we are doing at the moment. (The 20KHz channel spacing is tied to this characteristic - its about as narrow as you can get and still send this signal.)

A typical encoder / decoder chip set is the NE5044 / NE5045 parts from Signetics. The NE5044 encoder is used in my Futaba Conquest 4 channel where it connects directly between the stick potentiometers and the handful of components that is the transmitter proper. (In a computer radio the encoder is usually just a small piece of the program code.) The receiver uses something like a NE5045 to decode the pulse train from the radio part, driving the servo command wire directly from the decoder chip. The radio receiver - the part that builds the pulse train from the radio signal - is probably the most complex part of the radio chain because it has to accurately decode that pulse train from what could be a comparatively weak signal accompanied by a lot of electrical noise. Or rather - its really easy to do if your foamie is wafting back and forwards in front of your nose on a slope but its a lot more tricky if the plane is half a mile away or more near some source of noise like some power lines or a pager transmitter. That's the reason why a good receiver is the most critical part of the R/C system - if that pulse train gets distorted then the servo information will get screwed up, the servos will do weird things - and so will your plane.◆