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CRASHMASTER

When this trainer comes to a 'sudden' stop, just straighten out the wings and tail, and fly again! Plans show two sizes—.15 to .30 and .35 to .40. ■ **John Hunton**

The proof of the pudding is in the eating. In this unfaked picture, the small Crashmaster has just dived inelegantly into the ground—and only broke the prop. After straightening out the wings and replacing the prop it was back into the air in jigtime.

THE Crashmaster is designed to be able to survive a crash. The key to its resilience is the use of a two-piece wing and a stabilizer attached to the main structure by the use of pressure plates. With the onset of a "sudden stoppage" usually all you have to do is straighten out the wings and tail and fly it again.

An airplane that will survive a crash presents a new approach to control-line training. Whether you are learning to fly, to loop, or to fly inverted, the Crashmaster concept allows you to just go ahead and try it. With a conventional plane a mistake usually results in a lengthy rebuilding process. With the Crashmaster you can learn from your mistakes and progress rapidly.

The Crashmaster is presented in two sizes, .15 to .30 and .35 to .40. The smaller model will probably be more popular, but the larger version is intended to fill the void of larger control-line trainers.

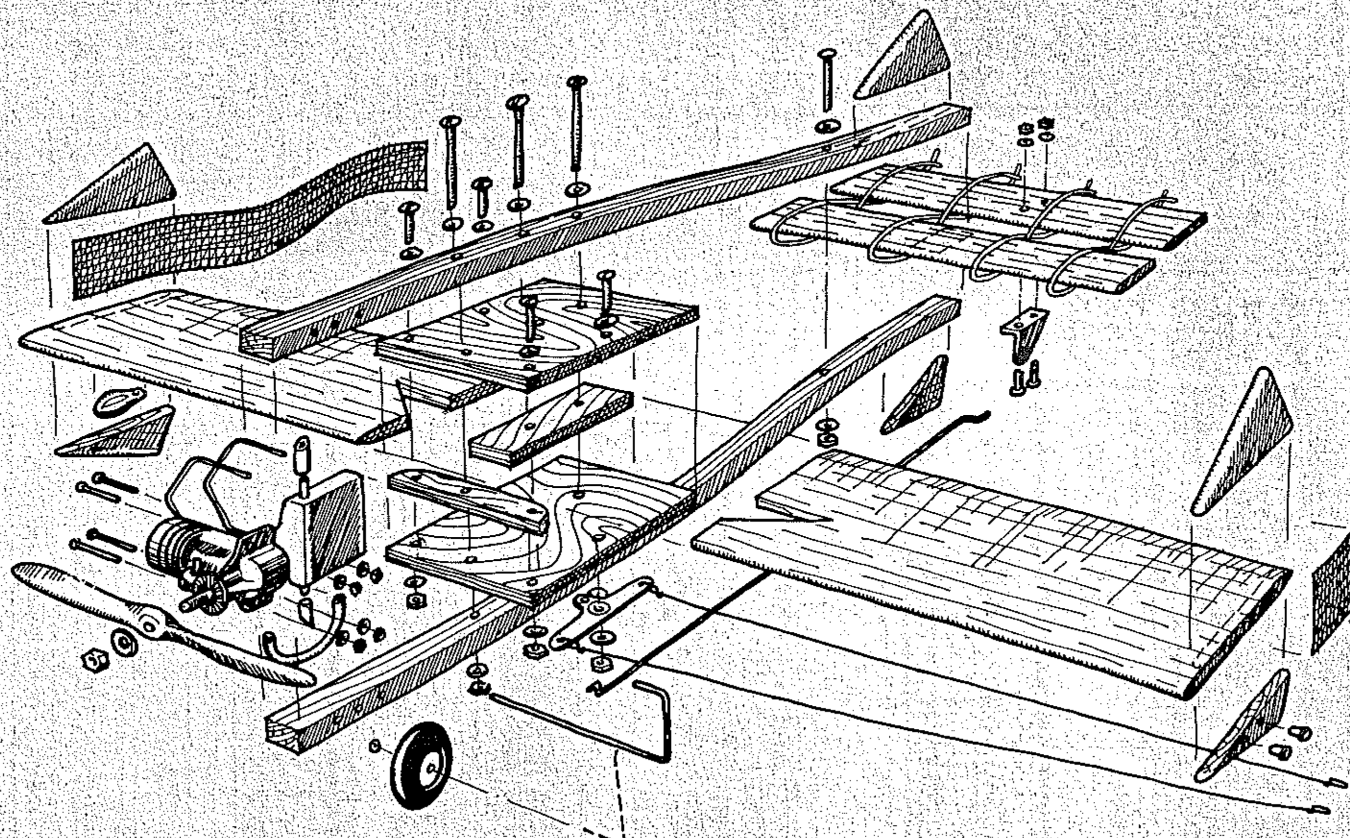
Hand launching the 15/20. The streamer on the wing tip is a simple way to add drag at the outer wing tip to help maintain line tension.

Whereas the Crashmasters are not high performance models, they will perform the basic maneuvers. Transition to stunt-trainer types will be natural.

Some of the construction materials for these models come from a hardware store or lumberyard. Parting bead is used for the fuselages and there are some plywood parts. These parts will require unusual effort to obtain and form, but they will be almost indestructable. It may be difficult to get 6–32 screws over 2" long. Just get the next largest size that the desired length is available in.

Assembly instructions

1. Cut out all parts. (Send for full-size templates.)
2. Round indicated edges with sandpaper and taper trailing edge of wing to a point. Sand all parts smooth.



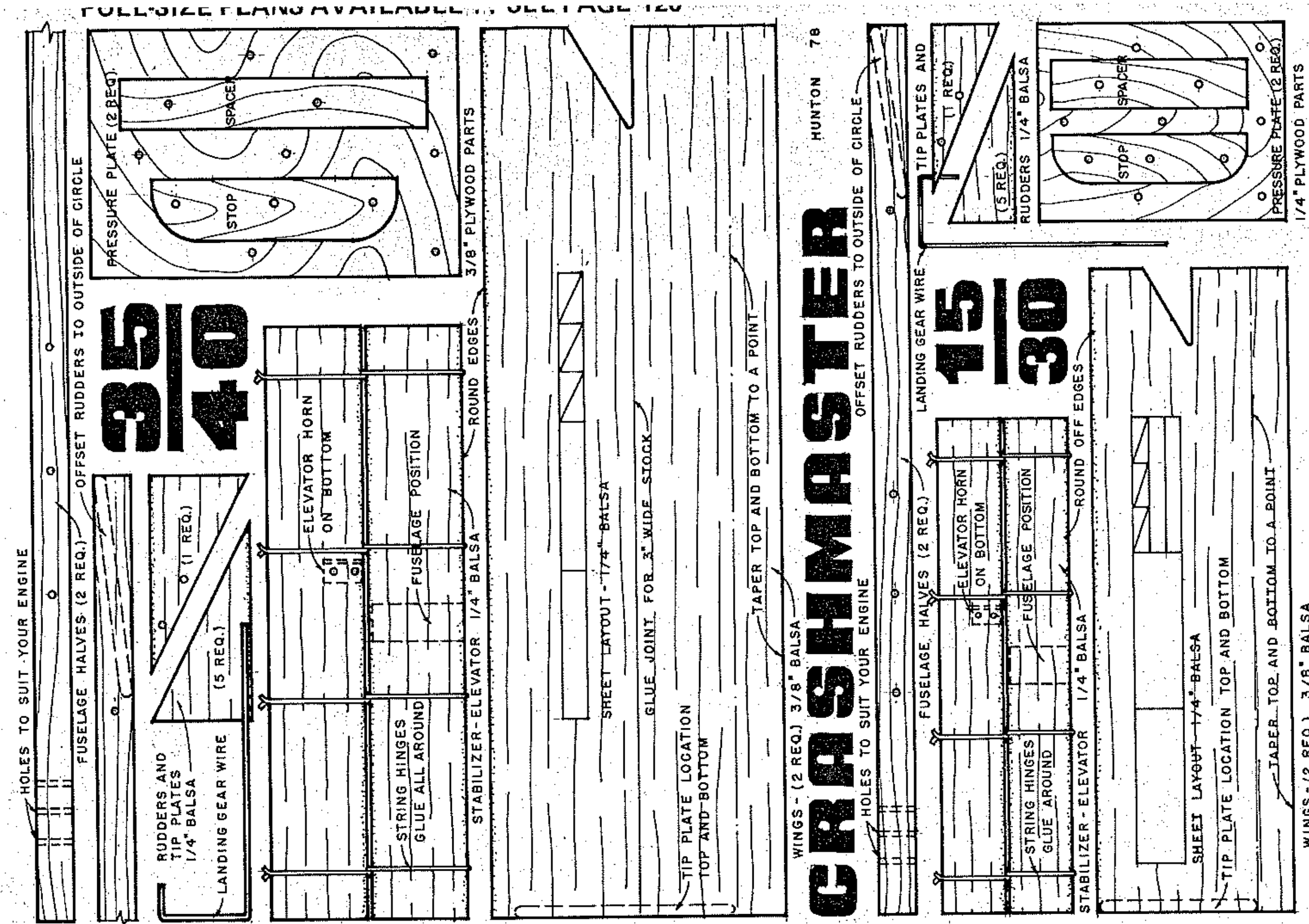
MATERIALS FOR EACH SIZE MODEL

	15 to 30	30 to 40
Parting bead (½" x ¾" pine)	2 — 18" long	2 — 27" long
Plywood	2 — ¼ x 4 x 5"	2 — 3/8 x 5 x 7"
	2 — ¼ x 1 x 4"	1 — 3/8 x 1 x 6"
		1 — 3/8 x 1¼ x 5"
Balsa wood	1 sheet ¼ x 4 x 36"	1 sheet ¼ x 2 x 36"
		2 sheets 3/8 x 3 x 36"
Bolts, with washers & locknuts	7 — No. 6 x 1"	4 — No. 6 x 1"
	5 — No. 6 x 2"	4 — No. 6 x 1-5/8"
		4 — No. 6 x 2¾" (or larger)
Pushrod wire	1 — 1/16 x 36"	1 — 3/32 x 36"
Leadout wire	1 — .030 x 36"	1 — .040 x 36"
Wheels	1 — 2"	1 — 3"
Fuel Tank	1 — 2 oz.	1 — 3 oz.
Fuel line, medium	6"	6"
Elevator horn	¾" minimum height	1" minimum height
Bellcrank	2 to 3"	3"
Control lines	50 to 60', .012 min.	60 to 70', .018 min.
Control handle	4"	4"
Propeller, nylon (boil before using)	8 x 6 to 9 x 6	9 x 6 to 10 x 6
Glue	White, or model airplane type	
Lead sinker	1 oz.	2 oz.
Eyelets	2 — 1/8"	2 — 1/8"
Strong cord	Small roll	Small roll
Ribbon	1 x 12"	1 x 18"
Finishing material	Fuel-proof finish system per the quality of your choice, two coats of phenolic resin used for the prototypes.	

3. Drill all holes (9/64" for 6–32 screws).
4. Finish all wood parts.
5. Mount the fuselage halves to your motor. Use washers between heads of screws and under nuts when in contact with wood. Use locknuts or lockwashers.
6. Assemble the plywood plates and slip them into the fuselage, engine to the right, and the bellcrank to the left (looking as the pilot sits).
7. Tighten the fuselage halves down onto

The pilot always walks away from these crashes. Unposed shot of an air disaster reveals a bent prop and scattered dirt. Crashmasters perform basic maneuvers, are natural transition to stunt.

FULL-SIZE PLANS AVAILABLE ... SEE PAGE 120



the stabilizer so that the stabilizer is contacted evenly, front and back.

8. Slip the wings in and tighten the wing bolts.

9. Hinge the elevator to the stabilizer using the heavy cord. The cord will help prevent spanwise splitting.

10. Bolt the elevator horn on the bottom left of the elevator.

11. Scrape away the finish at contact points and glue on the tip plates and rudders. Align the rudders so that they will tend to turn the plane out of the circle. Install eyelets in the lower left tip plate.

12. Bend the landing gear wire to preliminary shape and slip it into the fuselage holes. Install the wheel. Solder on a washer to retain the wheel.

13. Install the pushrod and leadouts.

14. Install the fuel tank on the right side with the cord. Slip on the fuel line and vent extentions.

15. Install the tip weight on the right wing tip.

Here is a good launch form and pilot posture with arm straight out. Girls make fine pilots—one of them once won the Combat event at the Nationals. Huntons are a fly-together family.

Flying

The Crashmaster should be flown over soft earth, preferably over grass. Because of the super strong construction, any crash on asphalt or concrete will probably result in engine damage. As it is, a flexible needle valve is recommended and you had better bring along some engine cleaning fluid when you fly.

There is a logical sequence from which to build your flight experience. If you want to learn to loop or fly inverted you may want to skip to that section.

For beginners: Most information on learning to fly indicates that the takeoff should begin on the downwind side of the circle. More accurately, the takeoff should be begun with the wind to the tail of the airplane so that when it leaves the ground the wind will be helping to keep the lines tight. Also, there will be more time for the plane to gain healthy flying speed before heading into the wind, the most critical phase of the takeoff, when the plane will tend to climb and you must keep it down.

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Bob's design allows the flaps to blow up to a streamlined position if they should deploy during high-speed flight.

Although flap systems like Bob's are a joy to behold, they are not necessary for good low-speed performance. In fact, many people prefer to use no flaps at all. I think that flaps do offer a slight advantage in low-speed performance, particularly if a model is flown without stalling or prop-hanging.

In profile Carrier, two-minute low speeds (15 mph) are quite possible using flaps, and the model can be in a near-level attitude. The simplest flap, and the type used almost universally in Carrier, is the plain flap. The plain flap is the type of flap used on Stunt ships in which the flap is simply hinged to the rear of the airfoil section. The Top Flite Flite Streak and Sterling Mustang kits have fixed sheet-balsa flaps which can easily be hinged to form plain flaps.

The most common method of operating flaps is to use a conventional horn and a pushrod which is attached to another horn on the tailhook. When the tailhook deploys, the flaps are deployed also. The use of a spring clevis at one end of the pushrod allows adjustment of the amount of flap deflection. Thus flap travel can be adjusted to suit existing wind conditions.

Flaps are most effective if their chord is at least 10% of the wing chord, but not more than 20%. Flaps work best on thicker wings (at least 15% thickness ratio), but they are effective on thinner wings as well. The key to effective flap operation is a blunt, well-rounded leading edge.

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Crashmaster/Hunton

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But let us talk through it.

Begin with the wind at the tail. Start the engine and be certain it is developing good power, slightly on the rich side. Make it a habit to perform two pre-takeoff checks; check that the handle is right side up by visually checking that when you pull up, the elevator goes up. Also, have the mechanic wait for your clear visual signal before releasing the plane.

Assuming that the mechanic has gotten the release signal from the pilot, he should let the plane pull from his hands, outboard wing last, to insure the plane is pointed out from the circle, without pushing the plane.

The instant the plane is released it is not an airplane, but a ground vehicle, and not a very good one. As the plane is released the velocity is slow and it has little centrifugal force to keep the lines tight, a necessity for control. The pilot can increase line tension at this critical time by stepping back slightly.

For your first flights, hold the controls neutral and let the plane take itself off. By using that method you will have sufficient airspeed and line tension for good control. If the plane comes off the ground too quickly you will have poor speed, poor line tension, and be near a stall. Get the nose down. In short, on takeoff let the plane stay low and build up speed, for you will be coming around into the wind, a critical area.

Assuming you have made the takeoff and the plane is coming into the wind, the relative speed will increase, increasing lift. The plane will tend to rise, but you must keep it down, for if it balloons up it will slow down, then as it flies crosswind, the wind will reduce line tension even more. If you get past the wind-crash syndrome, you will have mastered the most difficult part of learning to fly next to landing.

Let us talk about an area of apparent contradiction in flying nomenclature. Most airplanes are "neutrally stable" with regard to controls. You apply control to point the nose in the desired direction, returning the controls to neutral, and the plane keeps going in that direction until directed otherwise. The point is that pulling up does not necessarily mean the plane will climb.

Visualise the plane on the surface of the sphere it is limited to by the lines. If the plane is climbing on one side of the circle, it will cross over the top and be diving on the other side with no change in control input. To climb the plane, pull up to point the nose up, then neutralize to let it climb, then pull down to level the plane out and go back to neutral again. Reverse the process to go down.

Rapid control inputs of large deflection make your airplane fly less efficiently by increasing drag. Drag makes the plane fly slower, decreasing line tension. Make control inputs gentle and smooth.

If you have a tendency to get dizzy, concentrate on the airplane, the background will become a blur. It takes time to get in shape so you can fly without getting dizzy. Use a partial tank of fuel for your first flights so that you will have all of your faculties when you land. You will need them

There is a tendency for people to think that, when the engine quits the plane will fall from the sky, and they pull full up to keep it up, with disastrous results—again a stall, reducing airspeed and line tension. When the engine quits, keep on flying the plane. It is a fair glider. Bring the plane down, keep the airspeed up, and fly it right into the ground at a gentle angle. Full stall landings are unnecessary and dangerous at first. When the plane contacts the ground, keep it there.

Don't hesitate to land your plane under power. If you become dizzy, or if the engine has begun to run sour fly it onto the ground at a gentle angle. If the engine does not quit, have your mechanic throw a rag into the propeller. That will stop it.

That covers the dynamics of a typical flight and most of the problems you will encounter, if you are going to go out there and do it yourself. To get help from an experienced pilot will reduce the chances of a problem, but remember, you have to learn to respond to your visual perception, not the shouted instructions that will come too late.

Be aware of the wind. Check everything thoroughly. Learn from your failures; that is one of the lessons of life. Once you become confident with your takeoff, level flight, and landing, you will want to expand the scope of your capabilities.

Precise level flight is one of the most difficult maneuvers. Establish a height above the ground that you want to fly, say six feet. Fly the plane at six feet and keep it there. To fly level is not just a matter of holding the handle at neutral; you must continually adjust for wind. Practice fighting turbulence; it will make you a better pilot. Practice changing altitude. Fly at six feet, change to ten feet, etc. When you can climb and dive to different altitudes, you are ready for some stunts.

To learn to loop: Do not fly around, say this is it, hold your breath, close your eyes, pull full up, and hope. You will learn nothing. To learn the loop properly, first learn the wingover.

To perform a wingover, wait until the wind is at the tail of the plane (to let the wind help maintain line tension during the maneuver), then pull up into a climb. Neutralize, and let the plane continue to fly across the circle until it dives across the other side, then pull out (up). Work with the wingover until you can get it right over your head and make your pull-out at the same height as you entered the maneuver.

Now you are ready to loop. Do another wingover, but this time do not turn with the airplane. That was a loop. Now wasn't that easy? Now just tighten up the loops a little. The joy of looping is immense, but do not overdo it. Each time you loop you put a turn of twist into the lines. After six or eight loops, the controls will become stiff. Always unwind these loops after each flight. To perform consecutive loops, just relax up control each time the plane is climbing vertically. Gravity tends to pull each loop lower and you must adjust for this.

So now you can fly at precise altitudes, do crisp wingovers and consecutive loops. You are already an accomplished pilot. Many people are satisfied with that. However, if you want to get into stunt flying, combat, or just know that you can master control-line flying and perform any stunt your plane is capable of, you will want to rise to the greatest challenge of control-line flying, learning to fly inverted.

The challenge of learning to fly inverted has proven too much for many fliers. The catch is, of course, that the controls are reversed when you are inverted. Down is up and up is down.

The traditional method of learning to fly inverted is to do a half loop, then fly on inverted. The problem with this method is that your first exposure to inverted flight has begun with the plane flying slow and with poor line tension. No wonder there are so many failures and people give up.

There is a better way. Impress into your brain the words "If I get into trouble, pull full down." When you have that phrase memorized you are ready to try to fly inverted.

Flying inverted should begin with a wingover. When the plane is overhead, pull down. You will come out flying inverted and fast and healthy. Of course you will panic immediately and full down, but you will come back out flying right side up. Keep stretching out the length of your inverted flight. I won't be long until you can fly many laps inverted, and then you can work on holding precise altitudes.

Once you have mastered inverted flight the freedom of the entire control-line hemisphere is yours. The AMA rule book lists stunts used in competition which presents good challenges to be mastered. But once you have learned to fly inverted everything else is easy.

Many happy crashes.

FF Indoor/Tenny

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sheet is as straight as possible. Otherwise, the spar you cut will be tapered in a way you didn't intend! After one spar is cut, the edge is no longer parallel to the grain, so cut another tapered piece (Fig. 1) to even up the sheet before cutting the next spar.

Double taper is harder. The double-tapered spar mentioned above is achieved in two steps. First, the sheet of balsa is painstakingly sanded to the proper taper along its entire length, and then the second taper is created by cutting a tapered piece from the tapered sheet just as with the simpler spars. Don't forget to "even-up" the sheet between spar cuts to keep the grain parallel to the length of the spar.

Many present-day fliers have decided that the double-tapered spar is not really necessary any place except for prop spars. Their approach is to assume that up- and down-loads on the wing and stabilizer represent the maximum conditions of stress, so that the spar thickness (front to back) and spar weight can be minimized. This seems to be true except for conditions such as collisions and steering. Another factor enters into spar sizes. Before indoor models were braced, the wing spars supported the entire flight stress, and the point of maximum stress (needs to be stronger) was at the junction between the wing post and wing spar. Spar loading then was progressively lower nearer the wing tips, with spars tapering from a maximum at the wing post to a minimum at the tip.

What about braced wings? Fig. 2 shows the front view of a simple wing bracing scheme. Since the cabane and bracing wires transfer much of the flight loads directly to the wing post, the wing spar is supported at three points. Only the flight loads between these points (A and B in Fig. 2) can now cause spar stress. Consequently, we can see that the strongest points on the wing should be at the dihedral joint (or at the bracing point if simple dihedral is used as in Fig. 3). Therefore, the spar needs to be tapered smaller in both directions from the support points. A common compromise is to make the spar the same depth between wing post and support point, and tapered toward the tips. It is obviously easier to make each such wing spar in four pieces—two pieces between wing post and dihedral joint, and one piece for each tip. The proper kind of splice to use is shown in Fig. 4. This is sometimes referred to as a scarf splice (anyone know why?), and is shown for both straight spars and for a dihedral joint.

Measuring Balsa: Once the spars are cut, they can be measured just like any other structural member of similar size—use a machinist's micrometer caliper or a dial indicator caliper. Just use a delicate touch to avoid crushing the spar. One method of getting the right touch is to slowly close the calipers while moving the wood back and forth between the jaws. As soon as some drag is felt on the wood, take a reading. A little practice will enable you to make very repeatable measurements.

Another photo shows one way to cut ribs, using a curved template. Once again, a sharp knife is very important. It is also important for the blade to be tangent to the curve (Fig. 5). If this is not observed, the pressure of the cutting will often stress the rib and change the curvature. Just as with the spars, ribs can be tapered. In this case, it is easy to imagine the maximum stress is in the center of the rib, so logically the rib should be wider in the center. This can be accomplished by using two templates (Fig. 6) with different degree of curvature in each. The major place for such extremes to