On the 'Wing... # 167

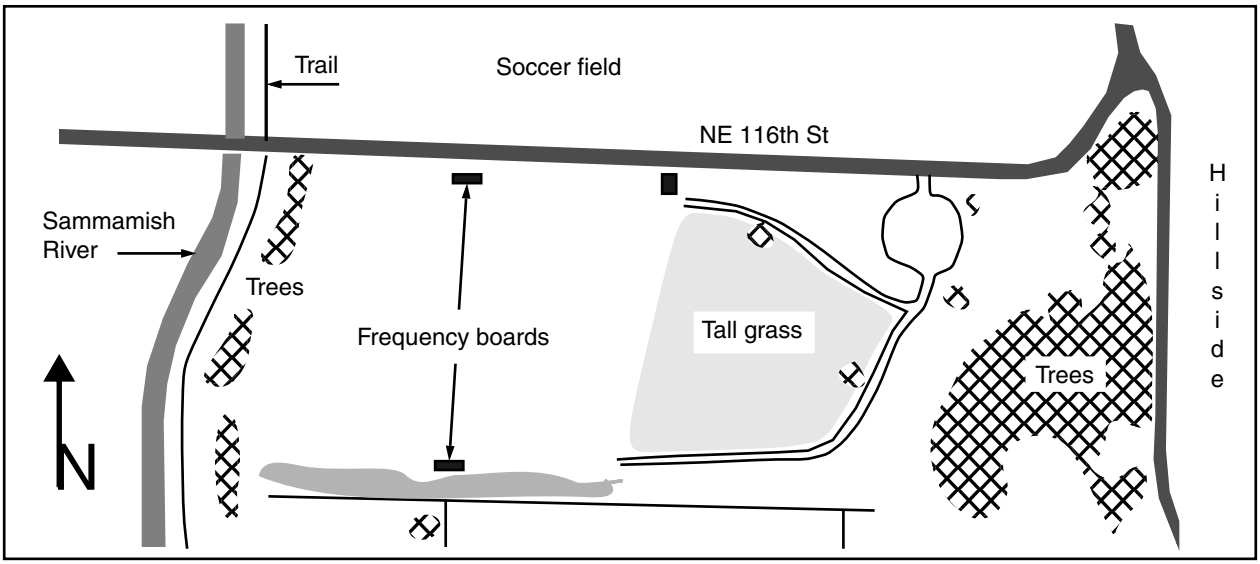
Summer 2002

Perfect weather from mid-May through much of October gave us an abundance of flying time this Summer. In addition to our experience with the hawk at the Howe Farm, described in the October issue, we identified a new visitor to 60 Acres. The additional flying time provided by the extended good weather was quite instrumental in getting our newly completed R-2 trimmed out and giving us the impetus to further modify our two meter Blackbirds.

The Seattle Area Soaring Society field is located at 60 Acres, a King County park northeast and across Lake Washington from Seattle. A road divides the field into two parcels, with the north 30 acres devoted to youth soccer and the south 30 acres set aside as a multipurpose recreational facility. RC sailplanes, quiet electrics, model rockets, dog trials, and a variety of other activities are welcome there. SASS contests are scheduled for weekends, and the club has reserved Wednesdays during daylight savings time as "open field" evenings when the club winch is put out and instructors are available for flight training. Turnout on Wednesdays is always impressive and sometimes quite astounding. Despite a long drive around Puget Sound, we managed to get out and fly at the field nearly twice each week.

The 60 Acres Harrier

Raptors are a relatively common sight at 60 Acres. The field itself is adjacent to a small river, and the valley floor in the area is populated by various types of trees and shrubs, wild Himalayan blackberry bushes, and mowed and cut grass areas. The surrounding hillside is covered with trees and homes. With populations of snakes, insects, small birds, mice and other small rodents, it's a perfect site for hawks and other predatory birds to set up housekeeping. It's not unusual for 60 Acres RC sailplane pilots to steer their aircraft toward thermals already identified by circling hawks or fluttering swallows.



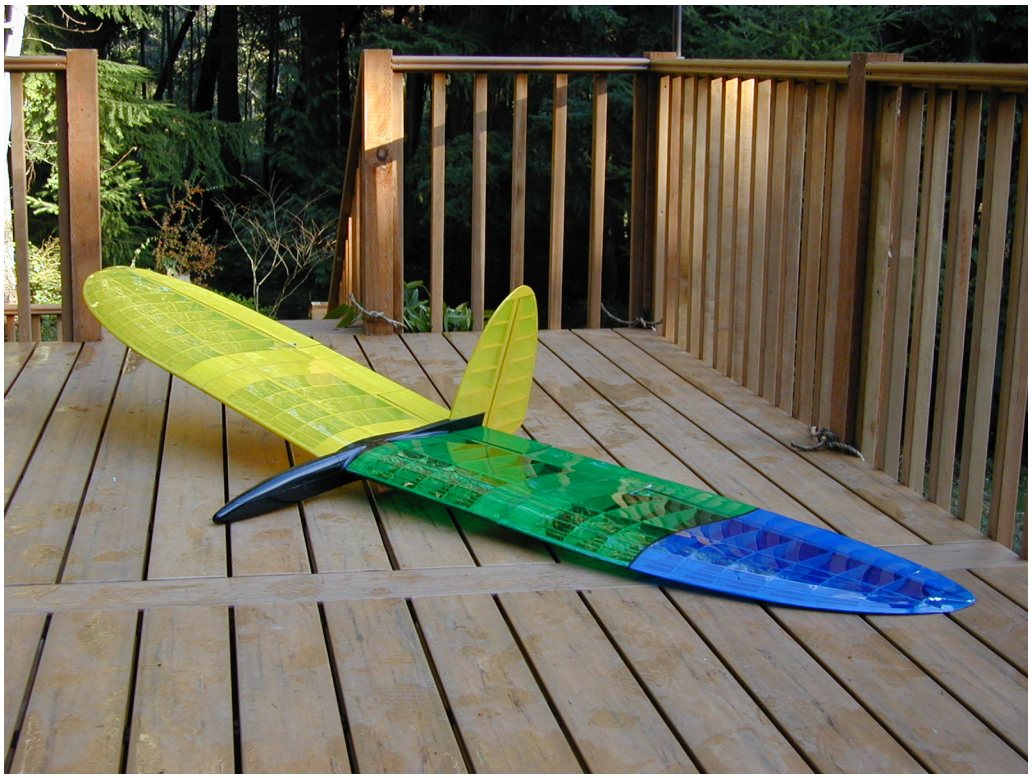
60 Acres South, Redmond, Washington

One Wednesday evening toward the end of Summer, a new arrival appeared. Rather than flying over the trees and circling in thermals, this raptor stayed very low to the ground and concentrated on the grassy area just east of the middle of the field. Instead of flying in a straight line, the bird seemed to follow a meandering course, frequently doubling back and at times hovering into the wind perhaps 25 or 30 feet above the ground. Every so often he would fold his wings upward and dash toward the ground talons first. Although we never saw him actually catch anything, it was obvious that he was searching out the visible members of the resident rodent population.

Once back home, the Audubon book in our library confirmed our initial Northern Harrier field identification. The Northern Harrier is a small falconiforme which uses a different hunting method than other members of the family. In contrast to the others, it uses its hearing more than its sight when hunting, and is known to travel up to 100 miles per day in search of food. It's one of the most agile of the raptors as well. Little wonder the McDonnell Douglas AV8-B/BAe GR3 and GR5 received the "Harrier" name.

The R-2

Our R-2 was completed earlier in the year, and was ready for flight testing as soon as 60 Acres dried out enough from our seasonal rains to allow cars on the field. Bill Henley, experienced RC flyer, helped us get the initial CG location and control surface throws established. The control throws were then adjusted over many test flights until we had what we considered to be the best feel. The aileron throws, for example, were set up so full deflection roll rate was as rapid as



possible without producing excessive drag. The aileron to rudder mix was adjusted so nearly perfect coordinated turns could be made using the right stick only.

We had originally thought the R-2 was a floater, but that notion was dispelled as we got more experience flying in wind. It proved itself fully capable of flying upwind in stiff breezes and getting back home after going downwind in pursuit of thermals.

After final tweaking, we offered the transmitter to Sherman Knight, SASS test pilot and computer radio guru. He was ecstatic over its performance, and once on the ground talked David Beardsley, another resident expert pilot, into taking a turn at the sticks. David took over the controls immediately after launch and headed toward the southwest corner of the field where a couple of composite ships were scratching for height in a light lift thermal. Dave flew into the thermal 50 to 100 feet below the two gliders already circling and in four turns was above them by the same difference. He was more than impressed! Giving a bit of down elevator, he came across the field diagonally and found another thermal near the hillside. Tight circles, figure eights, stall turns... Dave did it all while actually gaining height. Aside from desiring some method of glide control for landing, all of Dave's comments about the flight were overtly positive.

A number of other SASS members and visitors to the field flew the R-2 over the course of the Summer. Word quickly spread that the R-2 was deceptively easy to fly and offered excellent performance for a balsa, spruce and plywood sailplane with open bay construction.

The included Table provides the final end of Summer CG and control throw schedule for the R-2.

R-2 Control Surface Deflections

Control Surface	Deflection
Ailerons	
up	1.0 inch at root (3.25 inch chord)
down	1.0 inch at root (")
Elevator	
up	1.25 inches
down	1.25 inches
Rudder	
direct from Tx stick	2.0 inches each side
mixed from ailerons	1.75 inches each side

CG at 4.5 inches behind leading edge at wing root.

The two meter Blackbirds, “Galah” and “Cebu”

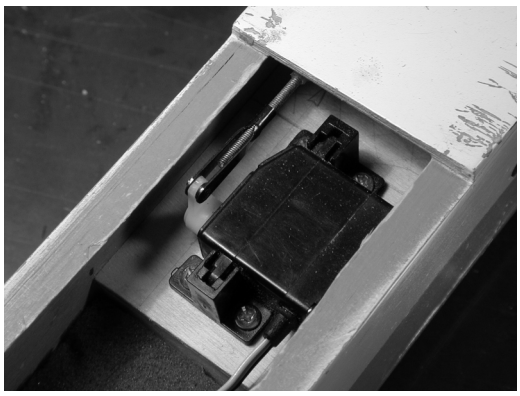
In addition to consistently flying the R-2, we and a large number of others put a lot of flight time on our two Blackbirds — the one built for our trip to Australia in 1993 (“Galah”) and #7 (“Cebu”), completed last year and subject of a series of articles here in *RCSD*. The Blackbird was originally designed with both of the servos located within the fuselage. Long sleeved push-pull cables linked the servos to the control surfaces. The hinge line for the elevons is set back so that a contoured leading edge of the control surface is inserted downward into the air flow as the surface is deflected upward. This was done in an effort to reduce adverse yaw, as there is no rudder.

Moving the servos out into the wing eliminated the slop in the control system, but the Frise-type elevon seemed to create a large amount of unnecessary drag while thermalling with up trim, and grass and other debris always had a way of getting into the gap between the wing and the control surface. As a result, the Blackbird version taken to Australia had simple top mounted fabric hinges. Until recently we felt that adverse yaw was not much in evidence. The latest, Cebu, has bottom mounted fabric hinges, but adverse yaw was not a big problem if the control surface movements were coordinated properly. But by the middle of Summer we had established that the flight characteristics of both aircraft would be dramatically improved with the addition of a moveable rudder.

We cut into the fin area so that the rudder hinge would be at about 50% of the local chord, the sub fin would retain enough structure to be able to withstand landing abuse, and the top of the rudder would be set back from the tip of the fin. The addition of some sheet balsa and scrap plywood sealed off the open edges of the control surfaces and formed the hinge line, and standard Goldberg

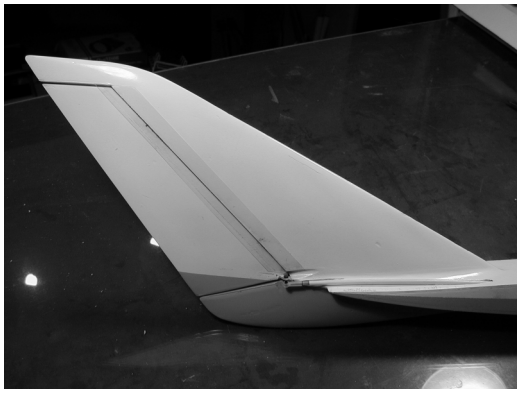
hinges were then mounted on the centerline to allow 45 degrees of deflection in both directions. The rudder planform and pushrod linkage can be seen in the included photos.

Although the hinge line is severely swept back, there is no discernible effect on pitch when the rudder is fully deflected. Rudder function is slaved to the aileron channel in addition to being freely controlled by the transmitter rudder stick. Once in a tight turn, rudder deflection alone can straighten out the flight path within about one and a half turns. The aircraft cannot be flown by rudder alone as there is not enough dihedral, but the rudder deflection does eliminate any remnants of adverse yaw and helps maintain heading during approach. The latter is particularly evident while making our now standard cross-wind landings. In a contest where there is a two servo limit, the rudder can be taped in its neutral position. For fun flying or AMA two meter competitions the moveable rudder makes flying a pleasure.



On the ’boards

Our experience with the two meter Blackbirds has been so successful we are currently performing surgery on our old XC Blackbird. Additionally, another XC ’bird which is currently under construction will have its fin contour modified to eliminate the swept hinge line of the rudder so a pull-pull cable setup can be more easily installed. This new XC ’bird, the eighth Blackbird we’ll have built, will also be the first to have flaps installed. Watch for a series of articles to be printed in future issues of *RC Soaring Digest*. And now that we have all of the templates and molds necessary, it also looks like a new flapped R-2 may be in the future as well.



In all, it was an exceptionally exciting Summer. We got to see a Northern Harrier in action.There was a lot of time for flying and testing, sufficient time for some airframe modifications to be accomplished in the workshop, and enough ideas for construction projects to last the winter. The highlight of the Summer, however, was to witness so many people taking the opportunity to fly a tailless airplane for the first time and having so much fun doing it!