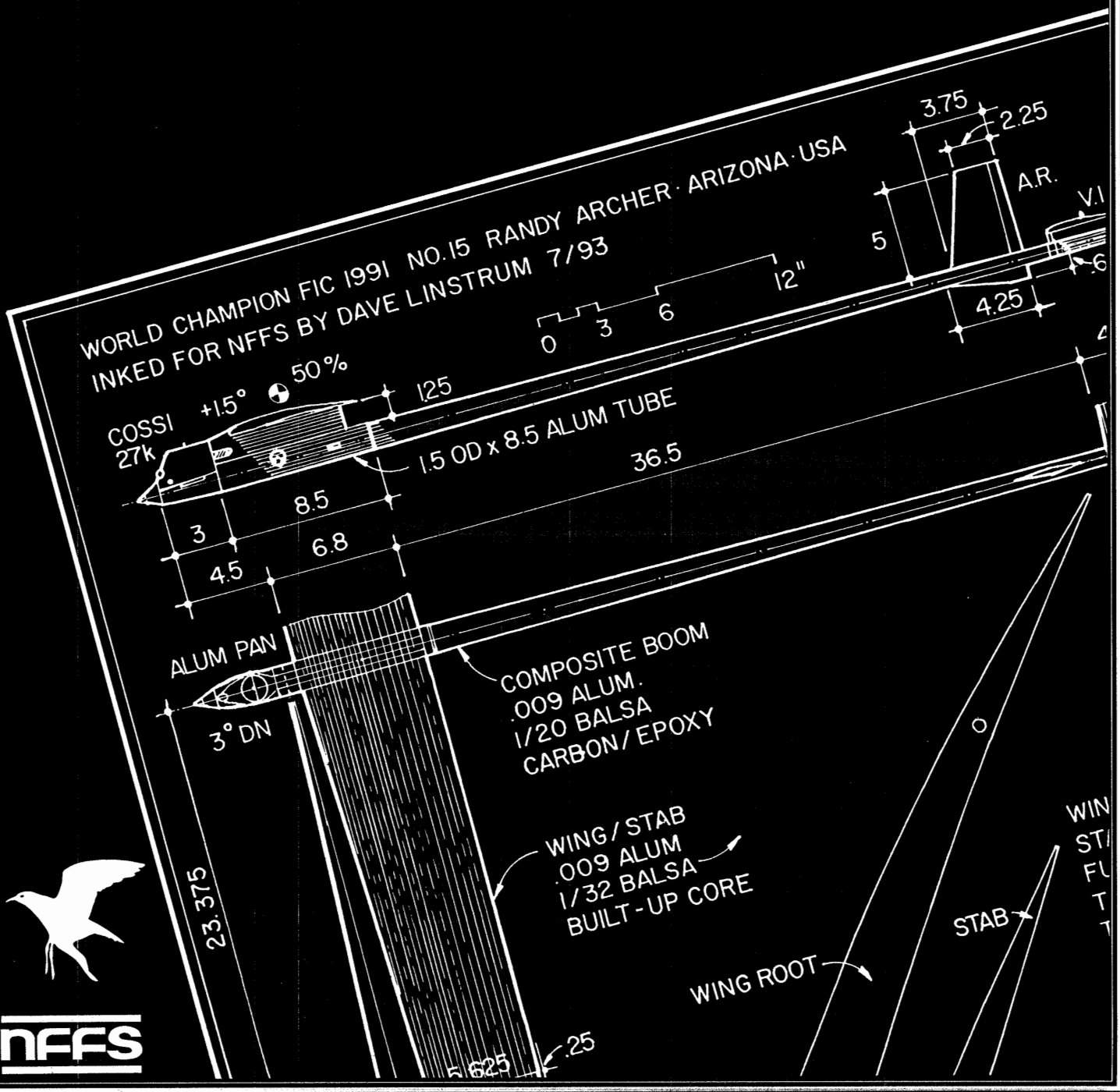
EDITED BY THE SIERRA EAGLES MAC FOR THE NATIONAL FREE FLIGHT SOCIETY

NFFS INTERNATIONAL 1993 PLANBOOK

FEATURING DRAWINGS, PHOTOS AND TECHNICAL DATA ON SELECT MODELS FLOWN AT THE 1993 FREE FLIGHT FAI WORLD CHAMPIONSHIPS--LOST HILLS, CALIFORNIA



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Published in Davis, California by
THE NATIONAL FREE FLIGHT SOCIETY,
a non-profit corporation, operating in cooperation with the Academy of Model Aeronautics, to preserve, enhance and promote the sport and hobby of Free Flight model aviation, and to serve as a unifying body for Free Flight modelers.

This publication may be purchased in soft cover for $35.00, hard cover for $42.00
(U.S orders add $4.00 postage, Foreign orders add $6.00 postage)
from:
NFFS Publications
4858 Moorpark Avenue
San Jose, California 95129

Printed by *The Printer* in Davis, California

Library of Congress Catalog Number: 95-069854


FAI FREE FLIGHT WORLD CHAMPIONSHIPS AMA
F1A ★ F1B ★ F1C
USA ★ 93
OCTOBER 4-10 ★ ★ ★ LOST HILLS, CALIFORNIA

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Dedication

This latest National Free Flight Society publication would not have happened without the concerted effort of a handful of individuals willing to gather, document and record a unique and memorable event. Yet one individual clearly stands out as the primary reason why this document exists and why the 1993 Free Flight World Championships ultimately became a success.

Bob Waterman, current President of the National Free Flight Society almost single-handedly salvaged the disrupted plans to hold the World Champs in California for the first time since 1979. Disregarding his time and personal expense Bob immediately came to the assistance of both the Academy of Model Aeronautics and the Southern California Aero Team (SCAT) in the late stages of the World Championships organizational duties. He maintained a close working relationship with all involved and continued this effort throughout the actual contest dates in early October. His exceptional and positive support is what the National Free Flight Society is all about.

Bob began building free flight models as a youth while living on a farm just outside of Taft, California in the late fifties. After receiving his MBA from the University of Oregon in 1968 and spending some time making a living, he resumed his interest in free flight in the late seventies.

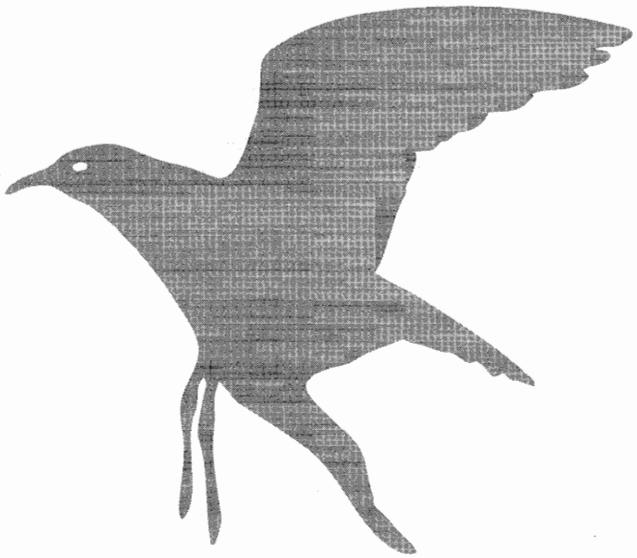
Bob has been very active in the Northwest for over a decade and has both sponsored and run various free flight contests. He has secured flying sites in the Portland, Oregon area and acted as the District Eleven FAI Team Selection representative since 1985. He has also been the FAI Team Selection Chairman for three years and is currently in charge of funding for the FAI Junior Free Flight program.

In 1982 he actively pursued the FAI program concentrating on the F1C (FAI Power) class, even developing carbon fiber tailbooms with assistance from the Loomis Fishing Rod Company. He continues to fly in all of the major FAI contests on the West Coast and can often be found between rounds relaxing next to his blue van involved in active discussions or sharing enthusiasm, technology or equipment with other participants.

We are very fortunate to have someone like Bob Waterman so actively involved in free flight.



Photo: S. Fruciano



NFFS



Robert W. Waterman, President NFFS

Once every two years, FAI free Flight experiences the culmination of their sport, the World Championships. 1993 brought us to the United States of America and, more specifically, to Lost Hills, California, one of the world's premier flying sites for this biennial event.

With the development of models to their present high degree of technology and performance, it was irresistible to bring you a Plan Book, showing off the offerings of the competitors. I hope you enjoy it.

I want to thank the Sierra Eagles M.A.C., especially Mike Achterberg, Eric Ryan and Doug Galbreath for their editorial efforts, Mr. Dave Linstrum for the cover art, Doug's shop "The Printer" for their excellent printing talent, Walt Ghio, Sal Fruciano, John Oldenkamp, Craig Cusick, Juan Livotto and Fred Terzian for their photoghaphy; Peter Alnutt, Aram Schlosberg, Tony Mathews, Martyn Cowley, Dave Lacey, Jerry Fitch and Doug Galbreath for their excellent articles. Thanks also to Bill Booth Jr., Roger Gregory, and Eric Ryan for their help on the plans. I especially want to thank all of the competitors who took the time to draw the three-views of their airplanes.

Robert W. Waterman

President, NFFS



Photo: J. Oldencamp



Photo: J. Oldencamp

THE ENDLESS OCTOBER

An Overview by Martyn Cowley

California was host not only to the 1993 Free Flight World Championships, but to a non-stop series of competitions that was to coin the phrase "The Endless October" - motto of the USA Team. The Livotto FAI Invitational held the preceding weekend and the Sierra Cup held in Sacramento the weekend after were both Open Internationals, World Cup and America Cup events. Together with the Society of Antique Modeler's SAM Champs at Taft, they produced a marathon of Free Flight indulgence which attracted visiting competitors from around the World. This combination of events helped produce the largest International participation for any model flying Championships in history, attracting 34 countries, despite the considerable expense and distances involved for most who attended.

A further combination of favorable weather, a truly World Class flying site at Lost Hills, and much hard work by members of the Southern California Aero Team (SCAT), the National Free Flight Society (NFFS) and the Academy of Model Aeronautics (AMA), produced a truly memorable World Championships.

Only 6 weeks earlier, and suffering from the added logistics workload of their recent move to Muncie, the AMA had welcomed the impetus of the NFFS, as the specialist group representing Free Flight interests in the USA. In particular, Bob Waterman volunteered to do much of the behind the scenes work on behalf of the society, including a 2 1/2 week visit to AMA's new headquarters to help sift through and organize all the paper work and entries. Together with AMA staff members, Jay Mealy, Chip Smith and Geoff Styles, they performed an excellent job and were the core group responsible for much of organizational success.

Special recognition must also be given to the many hard working ladies who assisted at these Championships, not only with the organization, paperwork and other chores but also literally on the front line as timekeepers. An event rarely if ever seen in Europe, and certainly not in Eastern Europe. Using this official charter, they also earned much respect by helping keep the pole position area clear for the competitors, including some notable occasions when they ejected additional spectators, and even unsuspecting officials from the line.

The first day, a large and imposing Team Manager was seen overshadowing one of these ladies with a critical stare, visibly wondering how she could possibly be qualified as a timekeeper. Not only did the ladies discharge their duties flawlessly but in so doing earned the friendship of visiting nations. In fact later in the week, the same manager was reported to be both relieved and appreciative to find his Team again being timed in the flyoffs by the very same lady.

Concerns by some visitors over the warnings in the official program about rattlesnakes, tarantulas and scorpions proved unfounded. In fact several tarantulas did appear at Lost Hills typically near sunset, performing their animated, "clockwork" walkabouts, to delight our visitors with truly memorable Kodak moments. Also, considering this was the Wild West, there was only one shooting, and in the words of AMA president, Don Lowe at the closing banquet, "even this was not fatal".

Of special note at these Championships, were some of the extra considerations shown to visiting foreign Teams. These included the provision of chase bikes, field equipment, unlimited free iced drinking water and hosts – both to welcome these visitors to the field and help establish and cement those International friendships that develop and flourish so well in the field of Free Flight.

Amongst the visiting Nations this year was a re-unified German Team. Two Teams formerly from Czechoslovakia, now entered separately as the Czech Republic and Slovakia (Slovenia?). The former United Soviet Socialist Republic now had 4 independent Teams in attendance, Armenia, Latvia, Russia and Ukraine, with another 4 or 5 newly independent countries, also very competitive in FAI events, apparently unable to sustain the cost of travel to the '93 Championships.

In addition, two other teams entered but did not arrive. Yugoslavia had entered full Teams in all events and, for the first time, Pakistan had entered a full Team in F1A - but neither country showed up. A late entry was however received from Bosnia Hercegovina, with two competitors flying in F1A and F1C. Holding the Championships outside Europe also encouraged more participation than usual from South America, with many competitors and supporters attending from Argentina, Brazil, Chile and Venezuela. Other regular competitors absent this year included North Korea and Cuba.

A quick calculation shows the average age of competitors this year to be just over 40 years old. The youngest competitor at 16, was France's Antoine Reverault, who would go home with a Silver Team place in F1A Glider. Other recent juniors also in attendance included Maarten van Dijk from the Netherlands and Mariusz Urban from Poland, both Junior World Champions from 1988.

At an individual level, there were many examples of last minute changes in Team personnel, even compared to names published in the official event program. Regular Canadian F1C member Frank Schlacta was unable to attend, and ex British, Croydon flyer Alan Howard made a gallant attempt to take his place, attempting to finish his models up until the last minute, in the motel room at Lost Hills. A building technique that was to produce some surprising results later in the week for others at these Championships.

Austrian National Wakefield Champion, Varena Greimel was the only lady flyer, but she was suffering a badly swollen shoulder joint that prevented her from winding her own model, as required by FAI rules. Under these circumstances special dispensation was granted, at a Team manager's meeting, for her to be allowed assistance winding. In the event, Varena did partially wind her own models with assistance from Wilhelm Kamp applying final turns to her instructions.

The Lost Hills Championships marks the first time that official "volunteer hosts" were appointed by the organizers. These hosts, one for each visiting foreign Nation, were recruited and briefed prior to the event by Bob White and Roger Morrel. Each host was requested to perform a minimum list of services which included: contacting each of the foreign Team Managers in advance to help coordinate plans using a standard format letter; provision of a sun- shade canopy, ice chest, tables, chairs and chase motor cycle at Lost Hills; and keeping the teams updated throughout the Championships. These hosts were also augmented by many other local Californian modelers who rode their own chase bikes for the Teams, and assisted in the retrieving throughout the Championships

Although provision of hosts may not warrant becoming a compulsory duty for the organizers of future Championship events, the principle would make a worthy addition to the FAI Rules Supplemental Code, and helps recognize the spirit of friendship and camaraderie that has already existed at many previous events, by ensuring no visitors are overlooked. This system also recognizes the fact that model flyers of the host Nation are typically eager to meet such foreign visitors and become

involved, if not directly in the running of the Championships, then at least by participating in the spirit of the event.

Al and Patty Ulm hosted the unified German team, which this year comprised members of what had been until recently, separate East and West Teams. In both the F1B and F1C events there was a last minute change with former World Champions, Lothar Doring (F1B '81 and '83) and Reiner Hoffsas (F1B '85) standing down.

Siegfried Limberger, a 20 year old F1A flyer, borrowed an F1B model to enable him to take Reiner's place. Unfortunately, he apparently forgot to wind the timer during the first round, with the consequence that his model dived in under VIT, forcing his retirement. On the F1C team, Karl Heinz Waechtler flew to California at the last minute to take Lothar's place, producing a respectable clean score throughout the Power day.

Other members of the German F1B team were equipped with Delayed Propeller Release (DPR) models, but ones that featured a different type of start mechanism. Instead of launching with the blades already open, with feathered pitch, the German models started with the blades folded back to minimize drag at launch - with one blade over the top of the wing, and the other hanging below the fuselage. Once the timer released these blades , immediately after launch, they rode up over two wire outriggers at the nose block which helped accelerate them out to their open position.

This year's Japanese Team included 2 former World Championship medalists, Mitsuo Kobori, who was 3rd in F1B at Wiener Neustadt in '73, and Kiichi Kibiki, 2nd to Italy's Mario Rocca in F1C at Taft in '79.

Stories of how some of the foreign teams made their way to Lost Hills are worth repeating. Apparently, Bill Hartill received a telephone call one night at midnight, from two adventurous Ukrainians, informing him they had just arrived at LAX airport complete with model boxes and tent! Bill quickly arranged for Roger Morrel to pick up F1B team member Igor Vivchar and his traveling companion to stay with him for a few days.

Igor spoke some English, Valery was reputedly a good cook, and both were eager to clean up Roger's workshop for him, so that they could get down to some serious building! A Sunday trip to the Mile Square flying site soon converted some models and accessories into necessary dollars, which first thing Monday morning were used to procure 20 lbs of Ed Dolby's latest FAI Supplies Tan 2 rubber for the Championships.

5 days later, Igor put this new rubber to good use, by winning the Livotto FAI Invitational in the 9 minute round flyoff. Igor, the youngest of the Ukrainians, would later score exactly 6 mins during the final round for 10 th place at the Championships, to help the Ukrainians take a well deserved Silver Team place

Roger learned many new techniques from his guests, including their testing the quality of Ed's rubber before purchase, using a home-made gauge to compare the extension under load of a short sample. Igor subsequently declared the batch of Tan 2 to be the best rubber he had ever seen! For running-in, they combined only a brief stretching, for several minutes, of groups of 4 to 6 motors at a time, followed by partial winding and unwinding shortly before the event.

The weather at Lost Hills the previous weekend, October 2 / 3rd, for the Livotto International was absolutely perfect, with mild warm temperatures, very little drift even by Californian standards and abundant thermals. These conditions led to record flyoffs which reached the 11 minute round for F1A and 9 minute rounds for both F1B and F1C, with American victories for Jim Parker and Ralph Cooney in F1A and F1C.

Immediately following this prize giving, the weather broke, with increasingly high winds bringing dust storms and even a little rain, due to a storm system off the Pacific centered over Northern California.

Due to the high winds at Lost Hills, the Australians were among many who instead went to Taft to practice where, as locals already know, the weather is invariably calm. Sure enough, only 30 miles away the weather was still relatively perfect. Martin Williams had a DT failure fly-away to lose one of his F1A models and was therefore without it through the Championships. Canadian Peter Alnutt, who now lives at Taft, visited the SAM Champs the week after the event, where he met up with an oilfield worker who had just found Martin's model, and knowing of the model flying field, he was trying to return it to it's rightful owner - there being no name and address label on the model!

By Wednesday, F1A Glider Day, conditions were once again back to normal, with only a little uncharacteristic high cloud for the first couple of rounds, which soon disappeared.

F1A Glider - Wednesday, October 6

The most amazing "eleventh hour" story centered around England's Mike Fantham, who had landed at LAX airport still with bits and pieces of an intended new model - his number 15, dubbed Kevin a.k.a. Kevlar-Robin. He was now behind schedule, not having realized that building was not allowed on the plane during the flight over! The first night was spent in the bathroom of Motel 6 in Sylmar with the light on, so as not to wake his sleeping Team mates, in order that Mike could work on assembling the bunting towhook installation. Emerging at dawn he was reported to have said that he felt great, and was not at all jet-lagged!.

The drive north was interrupted with multiple stops, to acquire gallons of Gatorade, prevention against every Englishman's fear of dehydration when visiting foreign parts. Continuing to attempt what fabrication was possible during the journey, in the back of a Bob Leech rental car, Mike was finally confronted by a scarcity of dope in the model shops of Bakersfield. Frantic phone calls eventually located a source at nearby Shafter Airport, where he purchased the remains if a 5 gallon drum of Spartan brand nitrated dope. Visiting his motel room in Lost Hills at near midnight the day before the Livotto, Mike was still hard at work fitting individual, axial torsion springs to each arm of the Ray Monks timer to ensure mechanical reliability.

The Livotto marked the first time Mike had ever flown a bunter. He was well pleased even though he dropped one flight by bunting out of the lift upwind - a good learning experience. Only 3 days later, at the World Championships, Mike was off to a good start in the first round until, at about 30 feet altitude, he encountered a mid air collision. Fortunately, the model was undamaged, and quickly recovered to still record 3:17 upon landing. All the hard work was beginning to pay off - Mike was on his way!

The uniformly high standard of F1A Glider flying was reflected by the first round scores, with a record 77 flyers maxing in virtually liftless, calm conditions. An example of how calm conditions were, is well illustrated by the timer failures of United Kingdom's John Bailey and American Randy Weiler in the 2nd round, with both models easily retrieved on chase bikes, Randy's after a flight of nearly an hour!

Randy's own story of preparations for the Championships closely rivaled that of Mike's, with both establishing new World standards for brinksmanship. Randy had completed his model only 3 days earlier than Mike, and had earlier telephoned his friend Victor Stamov in the Ukraine, to request his expert coaching assistance. After being collected from the airport, Victor spent most of his first night in California doing final inspection and necessary modifications to Randy's model, in preparation for first test flights early the next morning. However, all was not well, and an electronic timer malfunction resulted in the model being locked in bunt mode and diving vertically onto a concrete runway.

With the model in pieces, Randy's hopes were dashed. Victor however saw this as an opportunity to make much needed revisions to the glider. After all, they still had two whole days - and nights, remaining before the Livotto! And so began a memorable 48 hour non-stop building session, as Victor replaced much of the mechanisms with his own design hardware, while Randy rebuilt the wings, with only brief interruptions for McDonald's to sustain them. Two days later, a subsequent test flight suffered a fly-away as a result of a DT failure. The model was eventually retrieved, from a tree on a nearby golf course, before a frantic drive to Lost Hills to arrive the evening prior to Glider day at the Livotto.

With Victor's ever present support, Randy flew this new model, his first bunter, throughout the day, to place a very satisfying 14th in the 9 minute flyoff round. By all accounts, Randy was now well and truly ready for the World Championships!

Since it's first appearance at a World Championships, in 1989, the F1A towline Glider bunt launch continues to gain popularity. Despite widespread use of bunters, in Open Internationals in Europe during this period, overall standards were low. Only a mere handful of top experts present, including of course Sergei Makarov and Mikhail Kochkarev, Silver and Gold medalists from 1991, had really mastered this new launch technique. These two Russians, jointly nicknamed the Terrible Twins - M & K, clearly continued to set the standard, and demonstrate the potential of the bunt launch.

By comparison, few other competitors were really achieving much more height gain than a conventional, well executed zoom launch. Additional constraints, caused by the time taken to set up for the high speed bunt launch after having detected and verified lift during circle tow, often resulted in models bunting out through the front of the thermal. M & K's technique, during the middle of the day rounds, was to lean their launches towards the glide circle during release, producing a partially banked turn downwind, typically achieving an estimated 30 to 40 foot height gain while helping their models get around into the thermal.

Another noticeable difference at Lost Hills was the continuing effect of the removal of the builder of the model rule. Manufactured models, products of Eastern Europe, were much in evidence. These models were to a very high standard of both craftsmanship and state of the art technology It was not unusual at these Championships to see other European contestants with a model box full of these near identical, full feature, composite clones, particularly in F1A and F1B, which represented quite a financial investment in the sport.

A regular sight these days at contests throughout Europe, this was the first time for most Americans to see the incredible free enterprise Free Flight marketplace. All manner of raw materials, parts, assemblies and even complete models were on sale , primarily from the Eastern European countries. Indeed, there were even stories of flyers who had sold their own models prior to the event, and were using them for the last time, effectively on loan from their new owners.

On the Australian team, Vin Morgan, had the misfortune to have the wings fold on launch during the 4th round while towing for his 2nd attempt. This structural failure apparently resulted from earlier damage which had gone unnoticed, sustained when Vin was forced to tow-in during a line tangle on the 1st attempt and which had fractured the carbon D-box leading edge. The resulting zero spoiled Vin's otherwise perfect score.

Several flying families were in attendance, including the Nyhegns, father Henning and two sons Jes and Bo who comprised the entire Danish F1A Team. Similarly Chile's Miguel, Victor and Fernando Abarca also all flew in F1A.

F1A Glider Flyoffs

The latest, 1993 FAI Rule Book was in effect for Lost Hills, which now stipulates evening flyoff rounds, starting at 5 minutes and increasing by 2 minute increments and a tie breaker to be flown early the following day, if required, starting at 10 minutes.

Therefore, a 5 minute flyoff round started at 5:30 pm, and produced a close call for M & K. Immediately after the round was open, both had started towing. In the already very overcrowded airspace, they overlapped each others circle and line tangled. Calling out in Russian, they quickly ran around each other, as if to demonstrate their expertise with a show of formation flying. Neither of them seemed overly anxious during this exercise, and almost as quickly they both performed tremendous bunt launches into the same strong thermal to go away for a certain max. Nearby, expert Ukrainian flyer Victor Isaenko suffered a malfunction, to bunt into the ground and require a refly for his max.

At the start of the 7 minute round, Canada's Jiri Horak was still awaiting the return of his flyaway from the previous round. As the sun was already quickly sinking below the horizon, this proved to be a fatal tactic.

In the opening seconds of the 7 minute round, at the far east end of the line, 1983 World Champion Matt Gewain immediately detected lift and launched. Flying alongside from the very next pole position, Mike Fantham found the same lift and was also quick to release, breaking his 50lb towline in the process. Both flights looked good from the start, although several early stalls were to prove very costly to Matt's flight. Already in a tactical downwind position, Czech Ivan Horejsi saw both models come over and without hesitation took the same air.

Conditions were now cooling fast, and maxes would be scarce. As the round progressed, only one or two other groups of models were holding altitude at all as they drifted away downwind. When the sun finally dipped below the horizon, Randy Weiler found himself the last flyer still on tow. He moved steadily eastwards, out over the dry grass, before finally unleashing an impressive bunt in the closing minutes of the round. The model continued to hang on, slowly losing altitude, and at the 4 minute mark still looked capable of a good score, before the air quickly decayed for 5:22.

When all the scores finally came in, only Fantham and Austria's Manfred Gruneis had made 7 minutes. The F1A Team prize had been closely contested with both France and the new Czech Republic maxing all 7 rounds. The Czechs finally claiming victory, thanks in part to Ivan's eventual 3rd place, just 20 seconds short.

Kiwi Martin Gregory, at Lost Hills with the British contingent, had been quickly signed up by Team Manager Paul Lagan. Martin was to take Bill McGarvey's F1A Team place, after Bill had badly twisted his ankle while practicing before the event, a move which resulted in a Bronze medal for Martin and the other members of the New Zealand Team. Martin effectively succeeded in bypassing the traditionally lengthy Team selection process and probably also set a record for the shortest elapse time between making a Team and getting a Championship medal!

It was already too dark to fly again. There would be yet another flyoff - literally a duel at dawn the following morning. Faced with a full night to contemplate a strategy in his bid for the Gold medal Mike was heard to declare, "How are you supposed to go to sleep on that!".

10 minute F1A Glider Flyoff - Thursday, October 7th

Soon after the 7:10 am start, Manfred started towing and moved off the bare dirt launching area, out over the dry grass. Mike shadowed his flight, but it was not clear that he really dare piggyback Manfred's high aspect ratio, Isaenko designed model at this early hour. Manfred's tactics however were soon apparent, as shortly thereafter a good zoom launch was immediately followed by a contingent of Austrian flappers trying to make the most of any potential air. The resulting flight of 3:49 was not only going to be a tough time to beat, but could easily be a winning score.

Watching Mike continue to circle tow as the minutes ticked away, I couldn't help but reflect on all the other flights I'd seen him make over the years, since his first World Championships flyoff in Bulgaria in 1975. His sensational series of International victories and the dramas of the UK Team selection process. Ultimately, nothing was going to be more important than this single next flight.

In the closing minutes of the round, Mike moved to slightly higher ground and brought the model round low to the ground one last time, before sprinting all out for the bunt of a lifetime. A clean recovery brought light applause from an anxious crowd, but the model began sinking quickly overhead, becalmed in a dead spot. Finally in desperation, after about 90 seconds, the Brits ran forward to start flapping and slowly a light drift sprang up to move the model away and begin to hold altitude.

Manfred's time still seemed unbeatable, but inevitably as the stopwatches ran on and on, a possibility existed that finally became reality. Fantham was World Champion! Engulfed in a crowd of hearty congratulations, friends were already pronouncing his name Mikhail. The superb flight time of 4:23 was academic, few people even saw it land, or even noticed the significance of the competitor's number Mike had worn throughout the Championships - the magic 180.

FIC Power - Thursday, October 7

Following his 5th place in the UK Team selections, Stafford Screen was indeed fortunate to take the place of Andrew Cordes, who stepped down due to the loss of models earlier in the year, and Ken Faux his immediate replacement who did likewise. For Stafford, this was his 18th consecutive Team place, counting World and European Championships!

This year, Eugene Verbitsky was flying very high aspect ratio models, with a wingspan of 102 inches. The design used small additional tip panels to create a low, 6 panel dihedral layout. The engine also featured a small circular flap, that hinged to cover the air intake at flood-off, to keep out dirt after landing.

One month before the Championships, Eugene had described these new models to Randy Archer, during a telephone conversation with him. Since that time, Randy had built a similar, long wing model for comparison, and although he had already flown it, considered it too new to use at these Championships. During the same call, Eugene had also questioned Randy's training plan in preparation to defend his 1991 title and had sounded surprised to learn that he was only going to arrive at Lost Hills just in time for the Livotto. Increasingly curious to then understand what Eugene had in mind for his own preparation, Randy was even more surprised to learn that Eugene was already packed to leave for California, in order to spend 3 weeks practicing for the event while staying with Peter Alnutt at Taft! Upon arrival therefore, the daily schedule for Eugene and Peter was to go to field each morning and make some test flights, then return home and work on their models all afternoon.

Randy was planning to use a Ukrainian Thermic engine in his best model, with new parts which he required being supplied to him by Eugene at the Championships. Eugene told incredible stories of the excruciating lengths necessary for them to get supplies to build these engines. This included individually measuring each ball bearing, which had been purchased in bulk from Sweden, to select a small batch of only those most perfect. These were then fitted into custom machined outer rings and cages and assembled, before finally spinning them up to check the quality of each one. It was generally agreed by the US Power fliers that final result was very good, because these engines ran very strongly.

The F1C bunt transition, first introduced successfully at the '81 Champs by the Soviet Team in Spain, and for a time thought by many to be a necessity only for flyoff models, has now reached almost unanimous adoption by all Nations, for every flight throughout the day. Models were uniformly aluminum foil covered, with flood-off, brake, folding propeller and VIT all standard items. Wing wigglers, used to produce a precise, 1/2 turn roll during the climb for a tactically preferred downwind bunt into a marked thermal; and delayed, two position glide settings, used to minimize the possibility of a stall during transition from climb to glide, yet soon after to produce the flattest possible glide, were functions also widely used.

Roger Morrel also hosted the countrymen of his birth, the New Zealanders. Although the F1A glider team had acquitted themselves admirably, the F1C team was the brunt of much friendly ribbing, from their own countrymen, some of whom it was reported were too embarrassed to come out to the field on the day of the Power event. It was light heartedly pointed out, that there has never been a Championships, in the history of the Power event, at which their performance would have been competitive! Despite which, they did achieve better results the following week at the SAM Champs. Other New Zealanders were therefore noticeable, procuring much hardware from the extensive Free Flight Bazaar, in early preparation for next time!

The only reigning World Cup Champion to attend Lost Hills was Japan's Koei Tsuda, the 1992 F1C winner, who was flying for Australia where he currently resides. The Australians all looked to be very competitive in F1C, but Koei dropped the 4th round, and together with Team mates Dave Thomas and Pommy Jon Fletcher, ex-St. Albans flyer, all were out of luck this year.

The most serious setback for the event was a grass fire which started soon after lunch and caused a postponement, 13 minutes into the 5th round. The fire, probably caused by one of the many chase motor cycles, was quickly spread by the wind. Although eventually brought under control, after about one hour by the local Fire Department, valuable time had been lost that effectively eliminated the possibility of any flyoffs before dark. This in turn would push back the start of the Wakefield event the following day, with a similar reduction of flyoff rounds.

Phil Ball, one of Great Britain's top all-round competitors, had suffered an uncharacteristically eventful day, which included missing maxes by scant seconds and putting his hand through the propeller of a running engine. All this culminated in a timer failure in the 7th round, the model careening across the sky, performing aerobatics at great speed, before finally suffered the indignity of rolling inverted and diving into the ground soon after the engine finally ran out of fuel. After the dust had settled, and still in good spirits, Phil finally turned to the timekeeper and quipped, "I suppose that was an over-run then?"

Despite Phil's own misfortunes, the UK Team were to finish 5th, behind Russia, who had dropped only 1 second with Mikhailenko's 4th round flight of 179 seconds. Three other Teams still had full scores for all the rounds: USA, Ukraine and Argentina. Roger Simpson could still hardly believe his own luck, having survived a bad climb pattern in the round 3, which over-bunted almost inverted to recover at less than 100 feet, before finally thermaling out with the help of some enthusiastic flapping from the American Team.

10 minute Flyoff - Friday, October 8

Exactly half of the F1C entries maxed out, and so the remaining 27 competitors lined up the next morning in clear and calm conditions for the deciding flight. Most were out early putting up test flights to correct for the much cooler and damper conditions than they had been flying in the previous evening. During these test flights it was immediately apparent that the drift was towards the north-east, a very unfavorable direction which took gliding models towards the cars and tents.

Once the round was open, and the first one or two flights showed suitable calm stable air overhead, others followed in a seemingly endless mass launch, to join the growing cloud of circling models above. Doug Galbreath suffered a bad launch, out of the window to the right and flat, but still returned 5:29 from only half the expected height. Several other flights were already being clocked off early, out of sight behind the obstructions at 6 to 7 minutes. Although very disappointing for those competitors involved, these scores were to prove insufficient compared to other top times.

Eugene appeared satisfied that his model was timed to the ground for an excellent 9:24, but other timekeepers nearby were still timing Randy Archer's flight. Stafford Screen, with a similar high time, was overjoyed to learn that he was ahead of Eugene by just 1 second. Both of these flights were however eclipsed by China's Dehua Wang with a flight of 9:44. Randy Archer had initially been disappointed with his engine run of only 6.8 seconds, but his flight was finally timed, still gliding, out of sight at 10:11, and reported by retrievers as having landed at 10:45.

Flying at the opposite, west end of the line, Britain's other flyoff finalist, Pete Watson had already managed an absolutely perfect flight earlier in the round, with a 6. 99 second run and perfect bunt transition for a flight time of 10:02!. Two flyers had achieved the seemingly impossible - an incredible 600 second max at dawn, and now they must go for 12 minutes!

It could however so easily have been 3 in the flyoff, with Canadian Dave Sugden's perfect flight, still well up in good air when his model DT'd very early to land at 7:39. Dave admitted later that he had been unable to figure out how to tie the DT down for the flight, an oversight which cost him a certain Championship medal position.

For the 12 minute flyoff, both Pete and Randy had to fly without DT's for the same reason, despite the very real prospect at this hour of a thermal flight. Now located on adjacent pole positions, Pete Watson waited for a few minutes, before deciding he would be the first to go. Launching with his unique, left handed VTO style , Pete's launch this time produced a slightly less than perfect transition.

With memories of the similar man two-man show down at the '89 Championships in Argentina, Randy was prompted to take this opportunity to outfly Pete in the same air. Watching carefully for about 30 seconds, and with a reserve model fueled and ready to go, Randy went all out with an engine run timed at 7.01 and 7.04 seconds, the third timekeeper unable to record the engine run.

Randy's model gained a considerable climb advantage, which it continued to maintain throughout the flight as both models gradually glided down, with Pete Watson's model finally landing at 6:48. It was only a matter of time before Randy's model would surpass this score, to produce another incredible back to back flight of almost 10 minutes, to land at 9:27.

Randy's performance throughout the Championships had been perfection on every flight. He had not only successfully defended his World Championship title, but in so doing, he had achieved a consecutive Silver / Gold / Gold series equaling Lothar Doring's similar achievement in F1B in '81, '83 and '85.

Winners of the Team prize were the Ukrainians; Verbitsky, Kirilenko and Tregubenko - with the USA in 2nd place. Argentina won their first ever Championship prize in 3rd place with World class performances from veteran flyer Mauricio Zito, his son Fernando and Daniel Iele.

F1B Wakefield - Friday, October 8

The F1B event saw an unnerving start for the USA Team, as Fred Pearce's model clipped his baseball cap on launch. This collision caused the 2 piece wing to come unfastened and free to rotate on the wing rod, producing a spectacular horizontal barrel roll that was at least fortunate enough to hit the ground in under 20 seconds. It is worth noting that this is exactly the same fate that befell George Schroedter on the '83 Team in Australia, who was similarly not accustomed to wearing a cap. The moral of the story is, don't fly in a Team uniform, unless you also practice while wearing one!

Meanwhile, Britain's William Beales had a similar close call with a 19.84 second attempt in the 1st round with a malfunction on his DPR model. Team mate Russel Peers maxed, but Mick Chilton launched left to power stall, and although flapping produced a flight over 3 minutes, this effort was inadvertently stopped prematurely, leaving Mick 4 seconds short of the new increased first round max for F1B of 3:30.

Surprisingly, despite the ideal weather conditions that prevailed, almost one third of the entry failed to make this first round max. Even had the max been the normal 3 minutes it would still have eliminated a quarter of the field, on a flight that should have been a mere formality, for a modern F1B under these optimum flying conditions.

The Canadian Wakefield team were using North Korean style thermal picking tactics, employing a thermal sensing person some distance upwind who relayed windspeed information by radio to the flyer waiting at the launch pole position. In the event Gerry McGlashen performed that duty and sat out the Champs upwind in his lawn chair. His job was to detect lulls in the wind speed, noting when the thermal infill came through, in order to predict the characteristics of each passing thermal. This allowed the Canadians to verify how good each thermal was before the downwind competitor had actually launched.

George Batiuk, who chased for the Canadians, said that Tony Mathews nearly missed in round 2, while they were still perfecting this plan. He reported that Team manager Norm Beattie was saying "Don't go Tony, Gerry says it's too late" while Tony was saying "It'll be OK Norm, don't worry". Tony's score, just 1 second over 180, quickly produced Team consensus with Tony apparently conceding "OK Norm, from now on, it's what ever you say". Norm was apparently also instrumental in advising all the Canadians not to fly their latest, higher performance models, but instead to fly essentially the same ones as in '91, which have a proven contest record of flight consistency.

In round 3, defending F1B Champion, Alexander Andriukov barely scraped 180, landing just 6 secs over. Even during the climb he knew he was in trouble and pulled off his shirt to start flapping. Without his exceptionally high climb, no other model could have maxed in that air. All the rest of Alex's flights were very solid maxes. Bob Tymchek, who with wife Sue were host to 11 Ukrainians, chased for him, and said Alex likes to put on 400 to 410 turns with his 5:1 winder. Then, 10 seconds later when the prop is attached, he adds another 30 hand turns before launch, in order to keep the torque up, to maintain a strong initial climb. Most propeller runs were in the mid to high 40 seconds, but at flyoff time he was recording over 50 second propeller runs.

Australia again had a strong start, remaining all clean until round 4, when Don Blackham and Alan Edwards both dropped, followed the next round by Richard Blackham to leave them, as they say in cricket, "all out". Varena Greimel had also been making good progress, until her 5th round flight badly misjudged the air, with the model barely climbing through the sink to record only 56 seconds.

Although the new FAI supplies Tan 2 rubber was unanimously reported as being the best batch for years, many teams who had only just purchased supplies, and hence were using it for the first time, had not fully worked out how to get the most out of it. The Chinese team, like many others at the Championships, apparently later reported that they were not winding it hard enough, with other flyers confirming that they could put up to 10 or 15 % more turns than they were used to on a typical motor. The rubber was found to produce a lot more torque overall - a little higher maximum torque, but significantly more throughout the cruise phase.

The 6th round saw a prolonged wait for George Xenakis, in a particularly dead calm period. Monitoring the air temperature, and watching clouds of rising fluffies, he finally announced he was going to take it, despite some concerns expressed by fellow Teammates. The launch proved to be too early, and a tired motor produced a very weak climb that was soon back on the ground to spoil his score. Surprisingly, this year few competitors were seen to unwind tired motor, as used to be customary for after prolonged holds of 20 or 30 minutes waiting for lift.

From the adjacent pole, Russell Peers was also tempted to launch into the same air, but his wider glide circle put the model out over the dry grass, where the Brits were able to flap it back to life for a max. In an eventful round for the Americans, Chris Matsuno's model failed to DT, and Fred Pearce almost suffered the same fate as George, but for the efforts of the flappers - both however continued to remain clean. The UK and USA teams had flew similar tactics from adjacent poles throughout the event, and would end up within 7 seconds of each other's total scores.

William Beales was really getting his money's worth at Lost Hills. This time, the inertia of a fully wound motor, which broke suddenly while holding and waiting for lift, had knocked the fin off his model. Unable to successfully re-glue it, he elected to wind his reserve, only to discover a damaged propeller fold mechanism. In the remaining minutes, William was calmly attempting to repair the unit on this fully wound model until finally, in the closing seconds of the round, he was forced to launch. Not surprisingly, one propeller failed to fold, creating extra drag that produced a very tight glide circle which almost spiraled the model down several times. Fortunately, the strong lift that William had launched into appeared equally determined to defy gravity by repeatedly pulling the model back to a great height to eventually max.

It has now been 12 years since Alexander Andriukov first flew his Variable Pitch, DPR models at Burgos in '81. Since that time, these units have become commercially available and are now in widespread use. Standard composite construction methods, which include carbon or Kevlar D-box wings, carbon capped ribs and mylar covering are also now widely adopted, although some still favor Japanese tissue, to achieve what they believe to be a more suitable surface finish.

Observing Alexander, it was clear that no one else had so perfected his technique of rubber handling. After careful pre-heating, he applied his full body weight to pre-stretch each motor, to the limit of traction provided by his shoes. Alex then proceeded to apply full turns at a frantically fast rate, and then completed winding with the propeller hub in place by adding additional hand turns using his innovative, ratcheted Montreal type stop assembly.

Many more turns can be applied to currently available rubber if heated up correctly, with around 105° F being a favorite temperature. Watching Alexander earlier at the Livotto, he blew as many as 4 motors in a single round, while learning how to use this new batch of rubber. In the few days before the Champs, Alex made up his motors and improved his technique, which now included pre-stretching each motor twice. Even then, he had blown 1 motor in the 1st round, two more in the 2nd and another in round 3, plus others throughout the day. Those who saw Alexander perform will agree, no one else wound rubber as hard as he did, and even after he had broken 1 or 2 motors in a round, he did not wind noticeably any less hard on the next one!

The Ukrainian Wakefield Team maintained a clean score all day, despite the troubles of Yuri Blachevich who suffered stalling problems, and made regular test flights between every single round. In round 6, his model power stalled and looped, to dive within a few feet of the ground before climbing away to max. Just before the flyoffs Yuri took his model apart to discover a bunch of rubber, from an earlier broken motor, which had shot backwards and was now loosely trapped in the tailboom. After removing this mobile ballast, the model performed flawlessly with Yuri finally placing 7th, and helping collect a Silver Team place for Ukraine.

5 minute Flyoff - Friday, October 8

Although the sun was again fast approaching the horizon, it was apparent there would be just time for one flyoff round, which began at 6 pm. William Beales was again in trouble several minutes into the round when another motor blew while he was standing holding a fully wound model. This time the motor jammed inside the fuselage, and swapping to a backup model, he broke another motor while winding before finally completing the task.

Alexander launched halfway through the round, climbing strongly to a great height and an effortless 5 minute max. Phil Ball, current UK Senior Free Flight Champion, had watched this flight with special interest and commented with genuine admiration that in England, such a rate of climb is only associated with the Open Rubber class!

Paul Lagan as usual, had a busy time on both the F1A and F1B teams as well as being Team manager. Still recovering from a recent sickness, he made it all the way to the 10 minute flyoff in F1B, despite hooking his VIT line to the DT arm on his timer in the 5 minute flyoff round which as a consequence resulted in the model diving in under power. His timekeepers clocked him off at exactly 20 sec which permitted him to take a second attempt with his reserve model, which allowed him to max.

Al and Tina Rusch were host to Russians Anton Budov and Andrei Kirilenko. Budov launched early in the round, only to have the inertia from the operation of the DPR starting, jerk the two piece wing off their retaining wires, allowing the wings to come loose and dive into the ground like a helicopter. His reflight was successful, but the problem was to haunt him on into the following round.

Of the 3 Teams still with full scores at this stage, all three Canadians maxed comfortably early in the round and felt confident this would secure the Team prize. But the Ukrainians had matched their performance and as the end of the round approached only the Chinese still had flyers waiting to pick lift and stay in the running.

In the closing minutes, William finally launched, but like Lagan went flat on the climb and dived in at great speed. Although the flight was over 20 seconds, the wings very obligingly tore away from the fuselage just before the model hit the ground, thereby permitting William a second attempt. Mercifully, the round finally ended with William still scrambling to get a third model ready to fly. Attending this his first World Championships, at the age of 24, William will undoubtedly be back again, hopefully next time with luck on his side.

The UK team had a fantastic Championships, with 6 out of 9 reaching the flyoffs, to gain individual Gold and Silver medals. Building on many years of experience attending both World, European and Open International Championships overseas, there now exists a tightly knit

group of flyers ready to travel to any corner of the globe, open their model boxes, (or if necessary, build their models) to compete as a Team. Operating as a Team in foreign countries is something they, like many others, have developed to a fine art. A fact they were to repeat again at Sierra Cup

10 minute Flyoff - Saturday, October 9

When the scores were finally in the night before, only 4 of the 26 flights had dropped, leaving a large entry for the following morning's showdown. So it was that the final Saturday morning saw what would surely be the last flight - a 10 minute max with a Wakefield, at dawn. The weather continued to cooperate once again, providing perfect conditions for such a flyoff, with virtually no drift and little or no signs of lift, and only a thin layer of high cloud interspersed with dramatic contrails.

The round again opened at 7:10 am, and many immediately started winding, with the notable exception of Alexander who calmly waited for his rubber motor to warm up, occasionally making adjustments to the heating rate.

Anselmo Zeri, who disdains composites, priding himself in only making models the old fashioned way - from wood and paper, was preparing his model nearby. Possibly as a result of the total ban in Holland, of any model airplane that makes noise, Anselmo made a particular point of launching his model to the accompaniment of a prolonged and earsplitting cry. This being his last chance to rebel, before returning home.

Ukrainian Eugene Gorban, the reigning European F1B Champion, knew he had to go all out if he was to beat Alex, and had apparently made the decision to go for broke. Unfortunately, following an earlier test flight, he had turned the adjustment screws on his model just a little too far. This last minute trim change resulted in the model stalling, from the propeller fold all the way to the ground, during the glide and yet still recorded 241 seconds.

With just 5 minutes remaining, Alex started to wind and broke a strand. Rather than change to another cold motor, he relentlessly continued adding turns as if nothing had happened. Once wound and loaded, he stood and added the necessary extra hand turns with his usual determination, while standing nearby Eugene became noticeably more anxious with each extra hand turn.

Finally, Alex chose his moment and stood motionless to concentrate for a few seconds, taking two deep breaths and exhaling fully, before he sprang forward and hurled the model into a near vertical launch. The model leapt out of his hands into an extremely fast climb, maintaining a steep nose high attitude throughout an incredibly long 54 second run. The propeller finally folded, and with a sigh of relief, he saw the climb transition into a beautifully flat, floating glide. Already Eugene was congratulating him at this performance, but Alex remained too cautious yet to enjoy these accolades.

Meanwhile, other results were coming in. Two Canadians were clearly ahead of the field with flights over 7 minutes. Tony Mathews at 7:14, and Doug Rowsell at 7:03. Was it possible this would be an exact 1, 2, 3 repeat of the '91 results? The 3rd Canadian, Cameron Ackerly had broken several strands while winding, yet elected to stay with his hot motor. Although he power stalled badly during the climb, he was still able to produce a flight of 5:47, to help Canada capture 1st Team place over Ukraine, with China in 3rd place.

The Canadians had once again proved to be very competent in F1B, and showed the benefits of a concerted Team approach. Added to their '91 results, they proved without a doubt that their gadget-free models are truly World class. The synthesis of their ideas and experience as a group, both while building and flying, has benefited them all in the joint development of a single design. A fact further reinforced the following week by Tony Mathews, with another dawn flyoff at the Sierra Cup, to again take 3rd place with a flight of 6:16. As a further sign of their strength, the 1992 America Cup F1B winner, Jim Brookes, was not even a member of this Canadian Team!

As other results came in, Anselmo had split the Canadian scores with a 7:08, and then word spread of another big flight from the Latvian flyer, Victor Roshonok with 7:39. Victor demonstrated a very high standard of flying in F1B to claim the Silver medal at these World Championships, following his 2nd place the previous weekend at the Livotto.

Finally, the timekeepers clocked off Alex's flight. An incredible 8:54. There was no doubt about it, Alexander Andriukov had looked invincible throughout the event, and was indeed now once again World Champion. Exactly like Randy Archer's performance, this also completed not only a successful defense of his title, but achieved for Alex a similar, Silver, Gold, Gold consecutive Championship series.

Interestingly, the Ukrainians could have taken the Team prize, had Alexander been a member of the Team, instead of competing separately as an individual defending Champion.

Many flyers will already know that for the past 10 years the local Californians have run a dawn event called the "360 Club", literally attempting a 6 minute flight at 6 am . Over this period only 2 flyers, Bob Piserchio and Hank Cole, have earned this distinction. However, with the demonstration of 10 flights of 360 sec or more on a single day, this Club was rumored to be in danger of being disbanded, faced with the prospect of the seemingly unattainable "600 Club".

The following weekend at the Sierra Cup, it is worth reporting that Alex went on to win F1B again, with a similar 8 minutes plus flight, and Mike Fantham also completed the double in F1A with back to back first places. F1C was won by Eugene Verbitsky, who later referred to this victory as his first step back towards beating Randy Archer. Randy, who had earlier elected to fly his own 100 inch span model for comparison against Eugene's model, even at the expense of the contest, later said this was his first step toward preparing for the defense of his title in two years time!

Conclusion

The overall performances at these 1993 World Championships showed standards that even a few years ago would have seemed unimaginable, considering the early morning conditions under which all the final flyoffs were held.

The Chinese, who previously have stood out as spectacular performers and represented the standard that people aspired to achieve, now found that a large percentage of the entry has caught up with them. Only a few years ago, the Chinese Team performance stood out as being exceptional, when they managed 62 maxes out of 63 rounds. A seemingly unattainable standard of excellence. This year's USA team achieved 61 maxes, a performance now almost considered a prerequisite for the main event - the flyoffs, and one which barely got them into the medals this time at Lost Hills.

In the final analysis, as always it was the weather, perhaps more so than the rule book, that was the crucial factor in ensuring that this year the top models undoubtedly won the event. Under these new circumstances it is now the single ultimate flight, rather than consistent performance under pressure during the progressive flyoffs, that is required to become World Champion. The emphasis for the future in Free Flight continues to move in a new and challenging direction.

The Future

Looking to the future, much debate continues regarding whether, or how, to change the rules. There remains amongst the competitors however, an overwhelming support for the current rules, and a belief that the F1A, B and C classes should remain as the ultimate Free Flight expression of aerodynamic, mechanical and structural model engineering design, not to mention the physical sporting aspects of these FAI classes.

Rather than devalue these events, a growing opinion concedes that maybe now is the time for a specifically less technical, stick and tissue level class - both as an entry level event to Free Flight around the world and also as an event more suitable for the Junior World Championships. There is no doubt that newcomers can no longer be introduced to the sport, and be expected to reach the necessary level of technology to be competitive without phenomenal dedication or resources.

One look at the biographies of those who flew at this years event shows a mature group of flyers, with a predominance of technical or engineering backgrounds. This clearly illustrates that few new flyers have been recruited in the past 2 or 3 decades, and that the existing pool of dedicated competitors simply continues to grow. This alone is not a problem, many other sports both require and reward experience. The real problem is that no Internationally sanctioned entry level event exists, without which, no meaningful system of necessary coaching, as in other sports, can rightfully begin. Maybe such proposals as Non-Tech FAI, or the uniquely British system for Open Glider, Rubber and Power events which have led to a Slow Open Power class, merits adoption or further investigation in providing an appropriate level of popular Free Flight competition.

It appears that many new International friendships were formed during the month of October, which it appears will lead to more overseas participation by Americans, who even now seem to be planning trips to Europe next year.

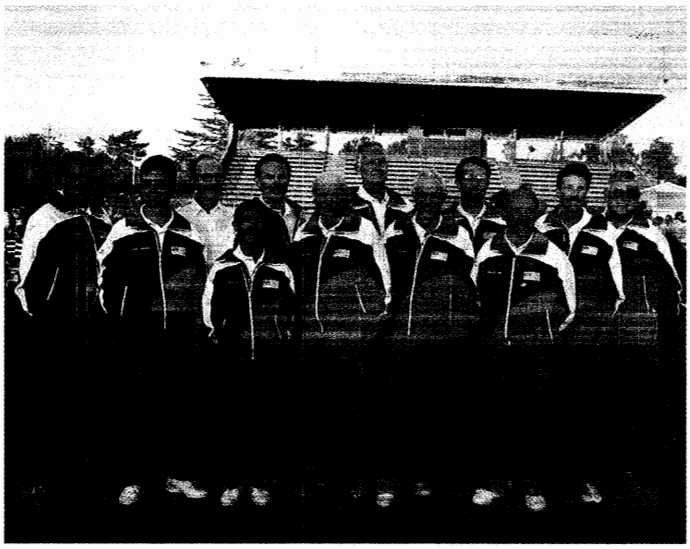
Rumor also has it that, based on the undisputed success of the 1993 World Championships, that Lost Hills will again be proposed to the FAI as host for the event in the very near future. Already, 1999 is being discussed, or perhaps 2001 - the first Free Flight World Championships of the new millennium!

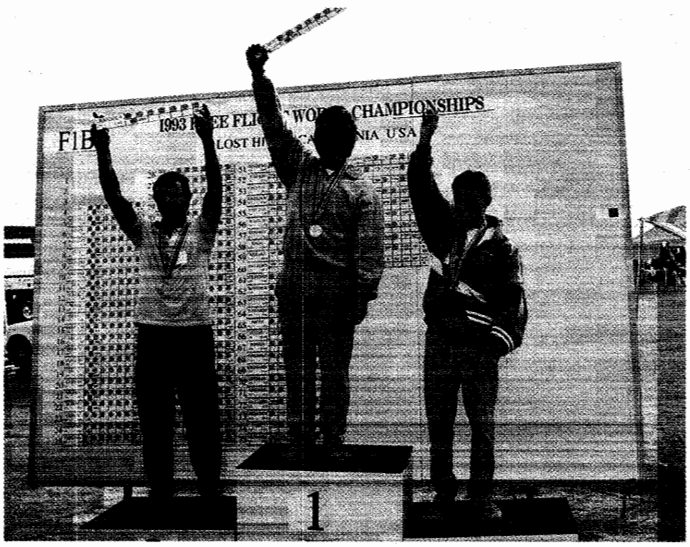
Looking back at the Endless October, the last words go to 1987 F1B World Champion, Bob White, who summed it all up best - "Bill Hartill worked hard as Contest Director; Mother Nature did her part with the weather; the field proved to be World class; the standard of flying was excellent and the best guys definitely won".



J.O.

Below: The 1993 United States Free Flight Team.
Far Below: F 1 B Awards.





J.O.



J.O.

Above: F 1 A Awards.
Below: F 1 C Awards.



Cusick



S. F.

Above: Model Bizarre International.
Below: Opening Ceremonies.
Far Below: Awards Banquette.

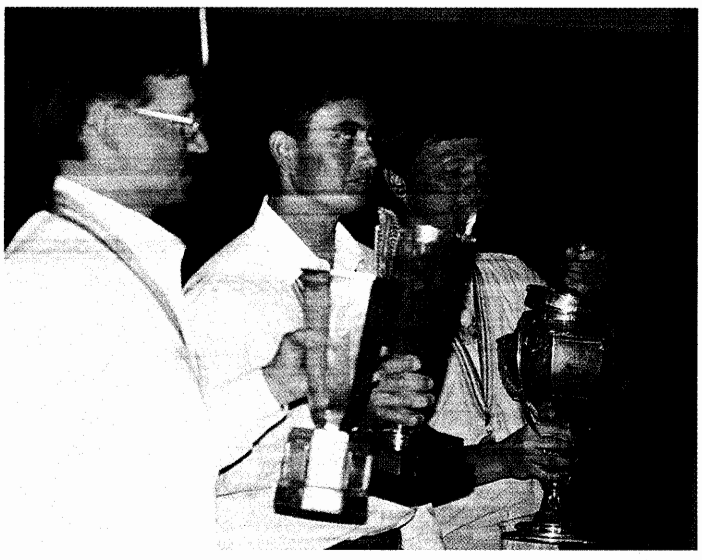


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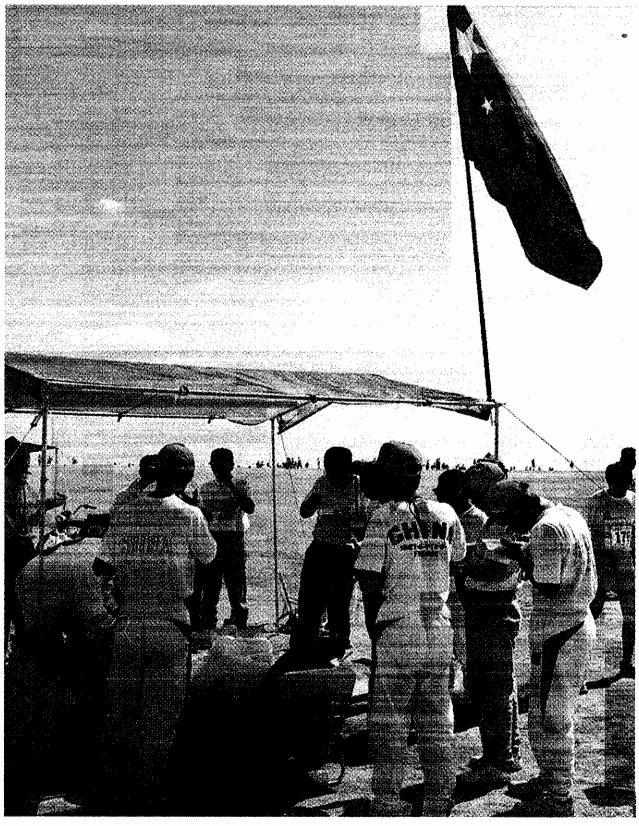
Above: Inside the Processing tent.
Below: Lunch-time for the Chinese team.



S. F.



S. F.

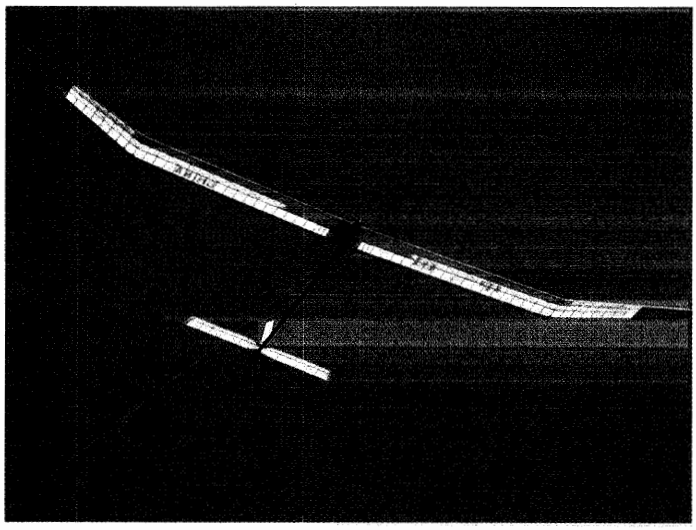


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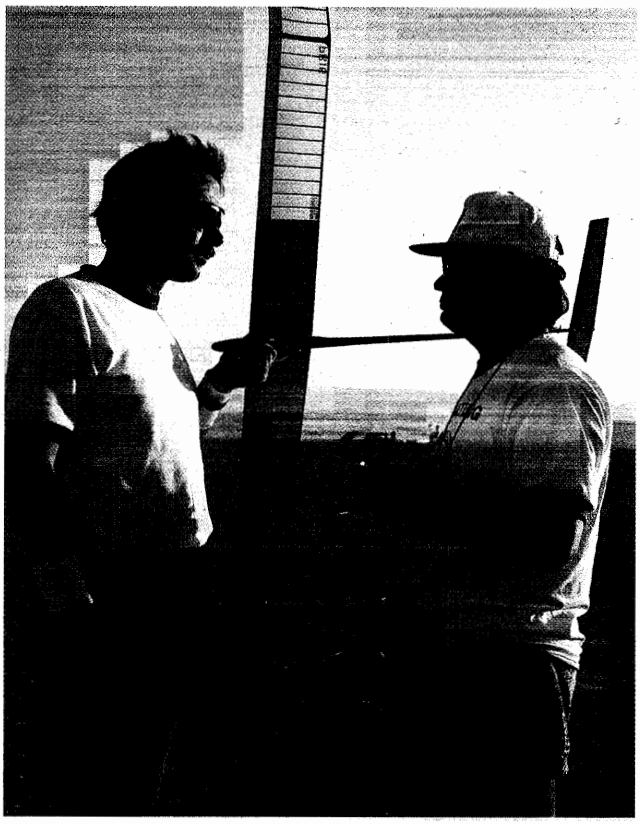
Above: F 1 C Flight Line.
Below: Chinese Nordic.
Far Below: British F 1 A.



J. O.

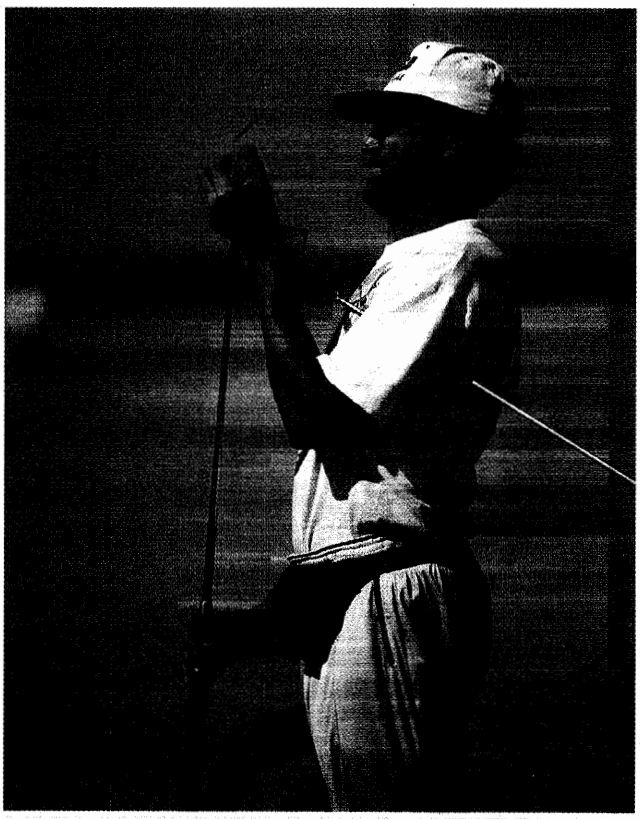


F. T.



J.O.

Above: Randy Weiler and Victor Stamov.
Below: Eugeny Gorban, F 1 B.



S. F.



J.O.

Above: Greimel, Austria.
Below: Cathy and Ryan Archer.

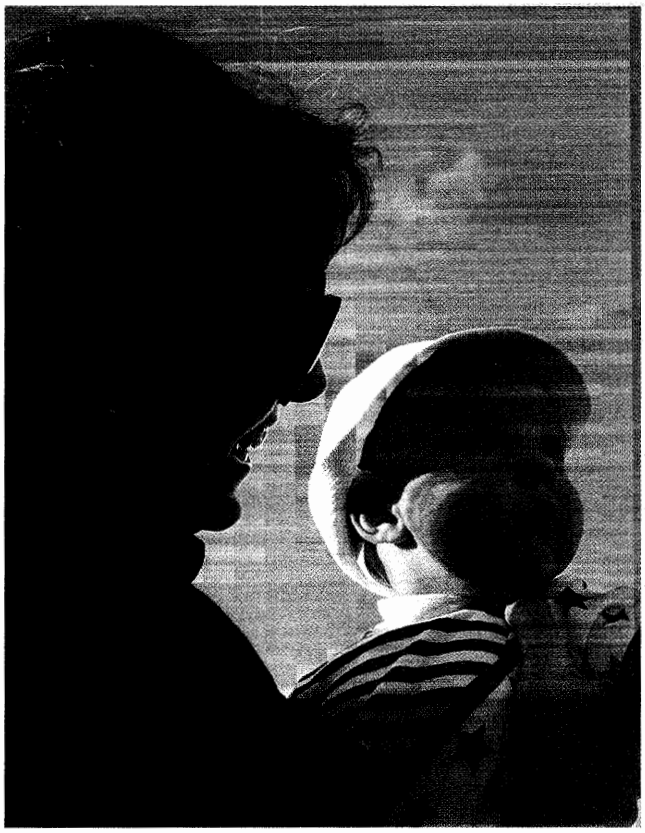


J. O.

Above: Ed Dolby and Tony Mathews.
Below: Bill Hartill.
Far Below: Alexander Andruikov and Eugeny Verbitsky.



J. O.



S. F.

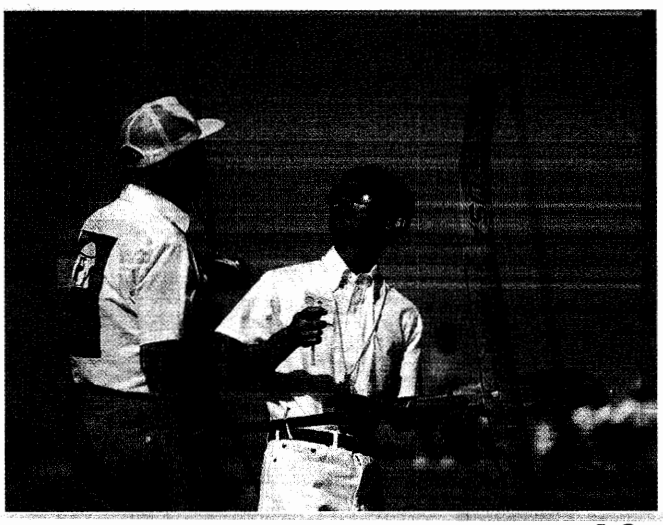


S. F.



J. O.

Above: Chinese Glider Pilot.
Below: Chinese Team Manager.



J. O.

Above: Chris Matsuno, USA.
Below: Fred Pearce, USA.



J. O.



J. O.



J. O.

Above: Igor Vivchar, Ukraine.



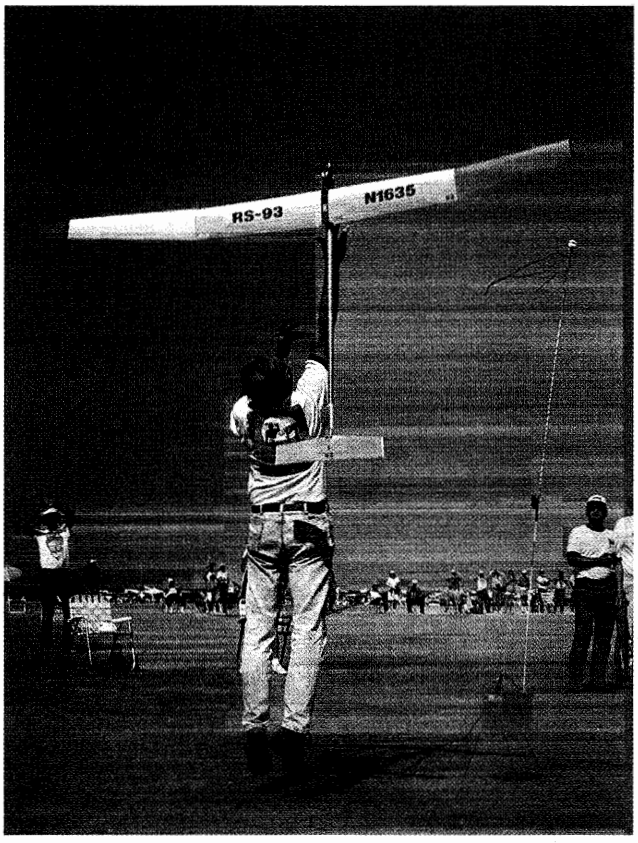
J. O.

Above: A. Kirilenko, Ukraine.
Below: Roger Simpson, USA.

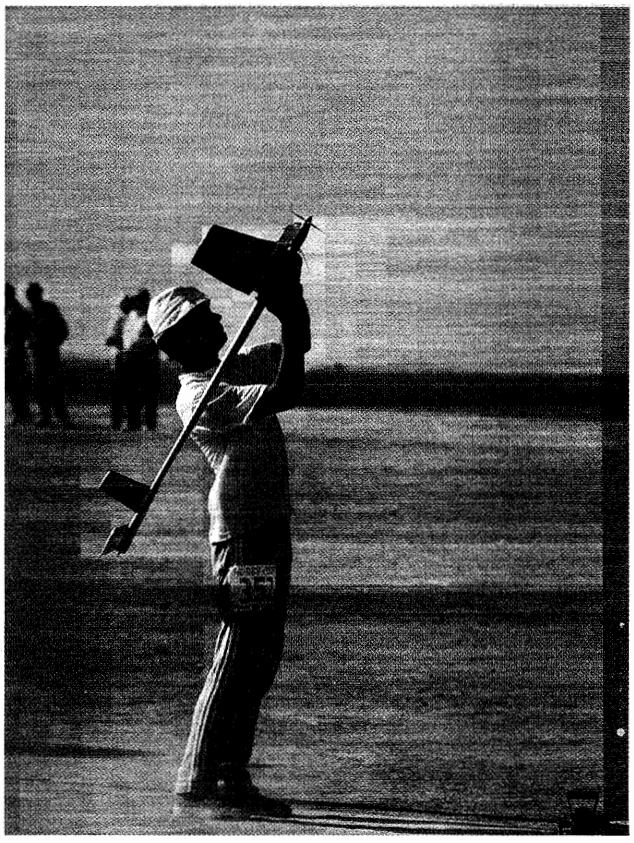


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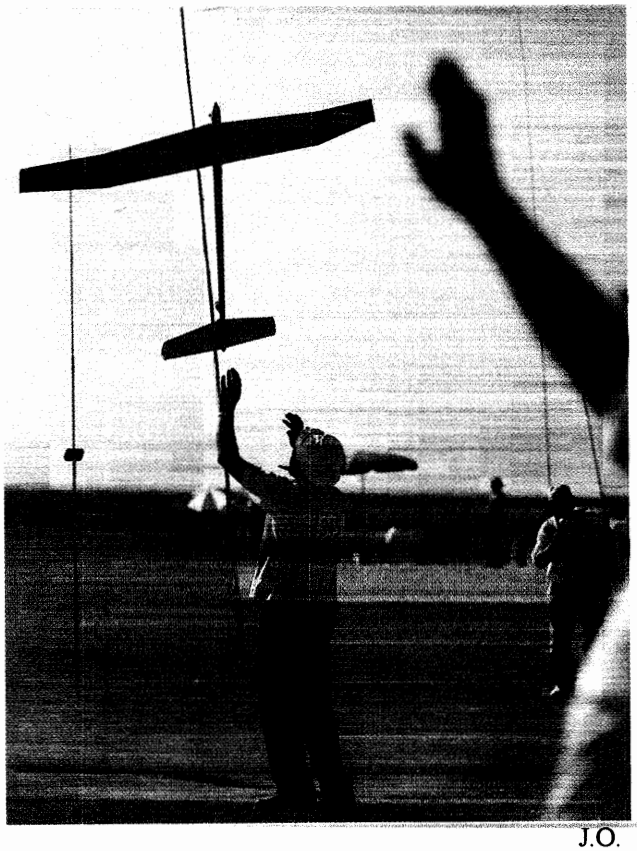
Above: F 1 C.
Below: Vladimir Tregubenko, Ukraine.



F. T.

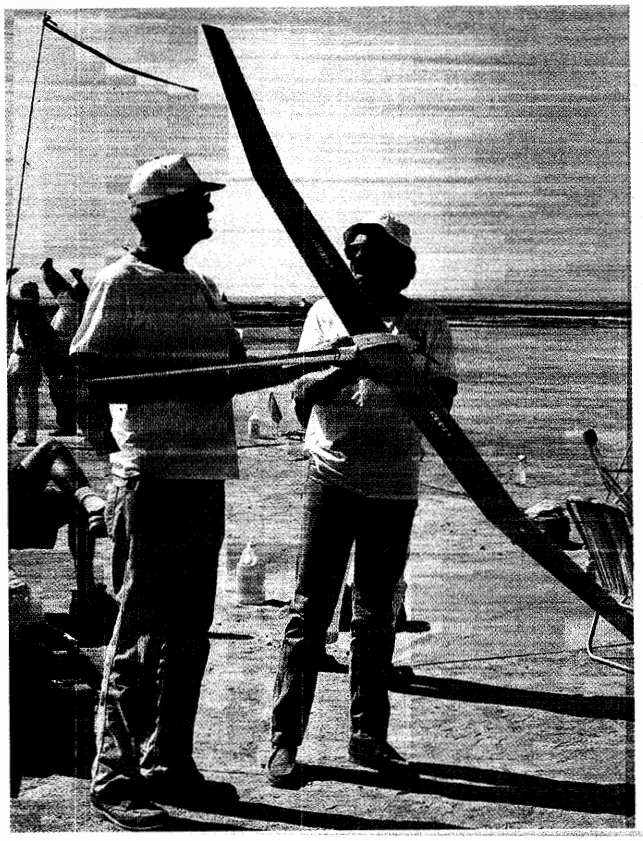


S. F.



J.O.

Above: New Zealand, F 1 C.
Below: Doug Galbreath and Mike Achterberg.

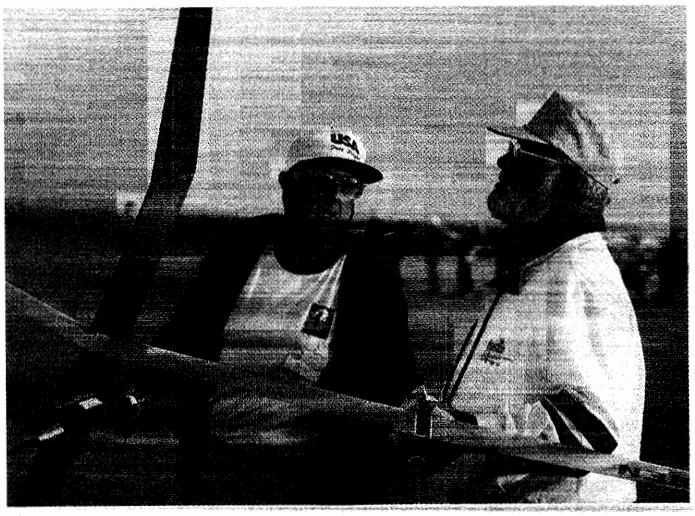


F. T.

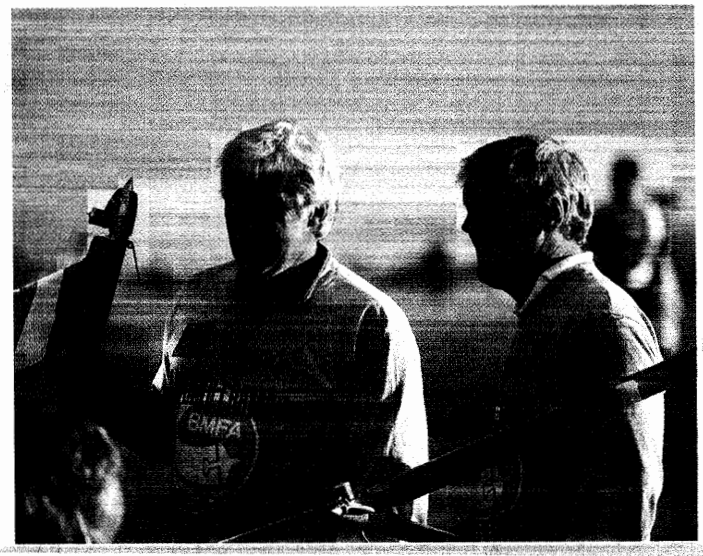


J. O.

Above: Randy Archer and Terry Kerger.
Below: Ed Keck and Bob (Santa Claus) Gutai.
Far Below: Stafford Screen and Peter Watson.



J. O.



J. O.

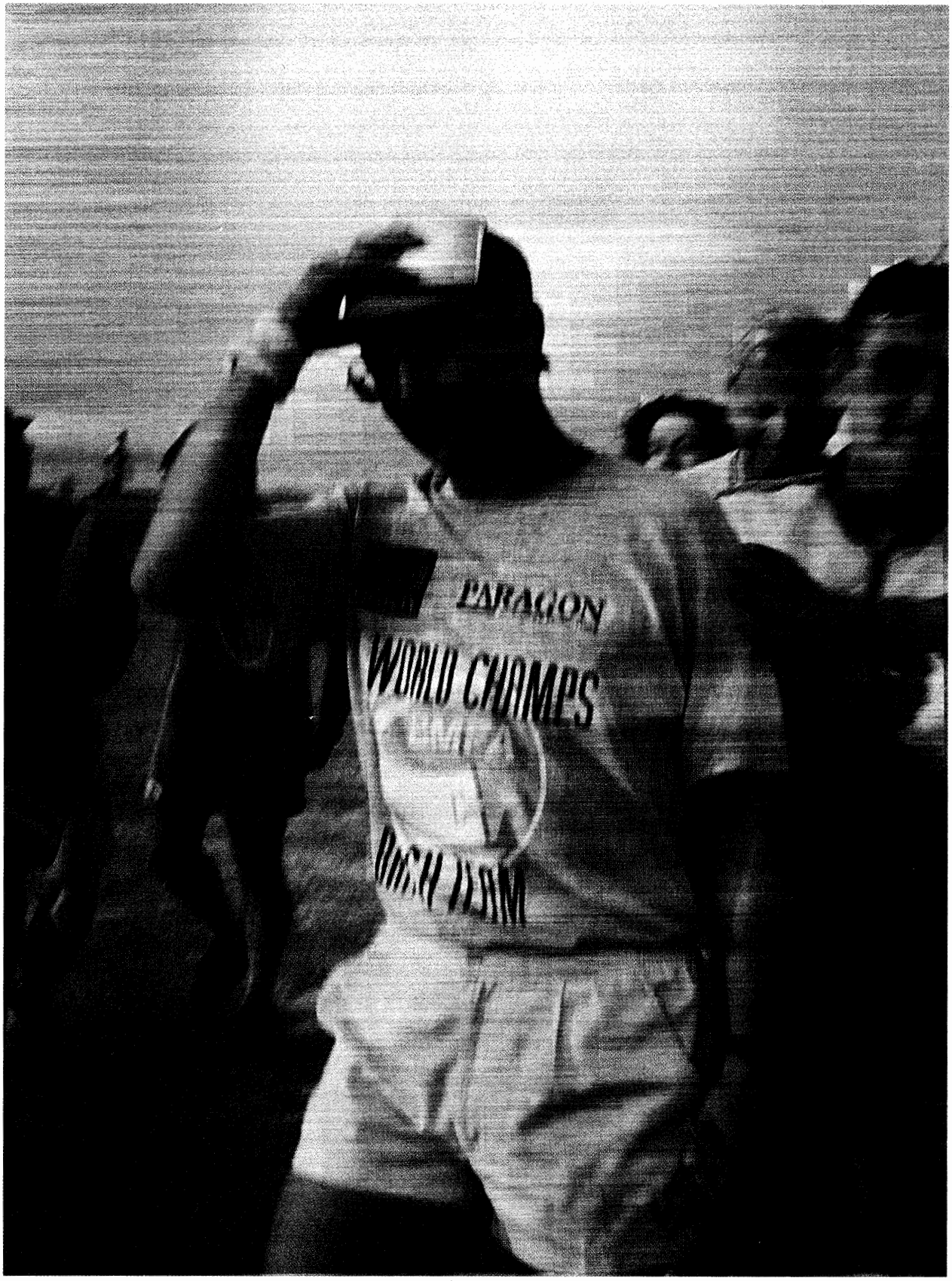


Photo: F. Terzian

Mike Fantham, F 1 A World Champion.

F1A Technical Advances Since 1979

Aram Schlosberg

In '79, Nordics were built out of balsa and hardwood, some with fiberglass tailbooms. Circle towing and zooming were common but not universal. Nordic wings were too weak to allow enough on-line acceleration for a good zoom or a bunt. During in the mid-80's modelers got access to Kevlar and carbon fiber [CF], which played a critical role in addressing the bending and torsional strength of wings.

Wing bending was tackled by CF spars, replacing hardwood spars almost completely. The most effective approach of increasing the torsional strength of wings proved to be the synthetic D-box shells ("taco shells"). Victor Stamov is credited with inventing the Kevlar D-box shell, and Victor Isaenko was the first to fly it internationally at the '85 World Championship. Later, CF D-box shells evolved. A secondary measure are CF rib cap strips, have eliminated the wing's secondary spars and diagonal rib bracing.

An alternative approach to addressing the torsional strength of wings, employs foam cores, is popular in the Western European continent. Fiberglass and later Kevlar are vacuumed at 45 degrees to foam cores.

Planforms

Nordic planforms today have a constant-chord or mildly tapered central panel, and a tapered outer panel. Double tapered wings together with the appropriate washout can approximate the optimal elliptical lift distribution along a wing rather well. My impression is that the Dutch had the shortest outer panels, while Victor Isaenko had the longest.

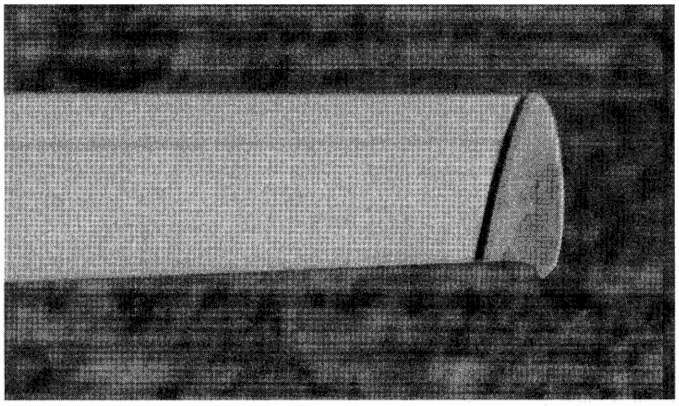
The '79 planbook has older planforms, such as the popular constant-chord elliptical wing, the rectangular wing and the tapered V wing. Fixed-chord elliptical wings try to attain an elliptical lift distribution but without washout along the wing. The absence of washout in the outer panels makes these wings more prone to wing-tip stalls. In addition, elliptical outer panels are difficult to build accurately, and they tend to be considerably heavier than tapered ones. V tapered wings pose difficulties in controlling span-wise warps. Furthermore, the absence of a dihedral break seems to make them less stable. Planforms of many models from Eastern Europe tend to be centered at 25% of the chord. This centering reduces the development of aerodynamic washout during the model's on-line acceleration. In '79 many models with tapered outer panels, either kept the leading edge perpendicular to the fuselage, or raked the outer panels backward, with the trailing edge perpendicular to the fuselage.

Since '79, higher aspect wings have evolved with better wing construction methods. In '79, two thirds of the spans fell within 195-215 cm (with a mean of 80.87"), increasing today to 212-232 cm (with a mean of 87.4"). A related change is the drop of the tapered outer panel's chord from a mean of 107 mm down to 90 mm, but not below 85 mm. (Wing tips are excluded, of course).

Wing tips

A common wing tip among Eastern European Nordics is carved out of balsa, 10 - 30 mm wide, with a rounded off (plan view) leading edge. The tip usually extends the outer section. Victor Stamov's final section is flat (the tip bends down). Jim Parker, at the Livotto contest, was flying a model with mildly raked and curled up tips. (See photo above.) Peter Allnutt used a Schuemann tip (where the leading edge sweeps back at a 45 degree rake, approximating a parabola).

Surprisingly, the raked wing tip (the wing tip is cut at an acute angle with the trailing edge extending beyond the leading edge) is still popular. But the extremity of the wing has an inbuilt washin of a few degrees above the rest of the wing. Consequently, the outer tip develops



An F1C model with curled up tips by Gradi Franco from Italy.

a lift spike, which interferes with the wing-end vortex that is rolling up from under the wing.

A wing tip with considerable potential, in my opinion, is the one used by the Canadian Wakefield team. It is a tapered and raked tip, set at a dihedral; with a thin flat section at the tip, set at minus 5 degrees to the root.

Stabs

Most stabs today are simply rectanglar, with a flat section. In '79 there were some tapered and even elliptical stabs; a few stabs had highly undercambered sections. The area of stabs has fallen: in '79 two thirds of the stabs fell within 4.27 - 4.93 sq dm, compared to 3.97 - 4.63 sq dm today (corresponding to a mean areas of 71.2 and 66.7 sq in respectively). The increase of distance between the wing and the stab by 7 cm (2.75") has more than compensated for the drop in stab's area. The tail volume has increased from a mean of .921 in '79 to .986, an increase of 7%.

Rudders

Tight circle towing requires considerable side lift by the rudder, particularly in Nordics without a wing wiggler. This may be the rationale for a number of all-flying rudders (without a fixed fin before the moving rudder) at the World Championship. These rudders require a lower deflection than the standard two-piece (flapped) rudder to turn the model.

But thin, 3.5%, sheeted all-flying rudders (2.5 mm thick and a 70 mm chord), functioning as a flat plate, stall at about 6 degrees. There is a good case for built-up thicker rudders, say 6-9%, to improve their lift and drag characteristics. Indeed, thicker rudders are common in Power and Wakefield.

Construction, Spars and Ribs

As noted, CF spars have replaced pine/spruce spars. In the most popular construction method, developed by the Russian and Ukrainians, the main spar is constructed separately. The spar core is either balsa or Rohacell, and it is faced with CF in the central panels and then wrapped with a Kevlar thread.

Because the main spar is solid, ribs have to be constructed from two parts, allowing better grain alignment. The ribs, incidentally, are balsa's remaining stronghold. The rear ribs are almost universally capped with CF strips, which also attaches them to the D-box, adding considerable warp resistance. Frequently, a minimal CF trailing edge is used, making cap strips mandatory. Cap strips have eliminated diagonal rib bracing and rear spars.

D-Box Shell Wings

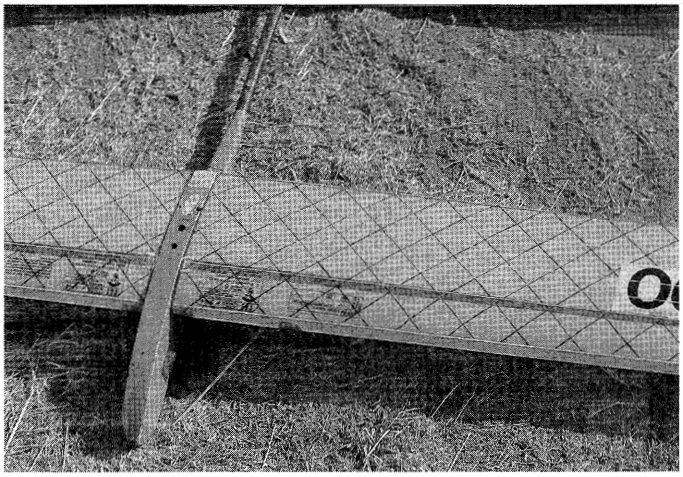
In '79, a third of the models had balsa D-boxes, 27.3-36% deep. These D-boxes, built from 1.5 mm (1/16") balsa, were not reinforced by fiberglass to increase their torsional rigidity. Today, any balsa D-box would be reinforced, usually with Fiber Glass or Kevlar at 45 degrees.

Kevlar/CF shells have replaced the balsa D-box construction. CF is considered to be stiffer and Kevlar shells are frequently re-enforced with CF strands. Synthetic D-box shells are typically 22.5-25% deep at the root, tapering to 15-20% at the extremity of the outer panels. These wings can be incredibly torsionally stiff and typically weigh 170-185 gr. Header ribs, at half the pitch of the rear ribs, and a leading edge are glued to the main spar. A Kevlar/CF shell is then glued to this structure and cured over a flat surface.

The CF and Kevlar shells are made on a male mold with one flat side and a nose radius to reasonably match that of the section. Frequently metalized Mylar is added to CF to seal CF sheets which can be porous, and to cut down on the passive heating of the black CF D-boxes. Alternatively, paper or polyester tissue cover the D-box. Kochkarev even sprays Aluminum paint on his CF tissue covered D-boxes and CF trailing edges.

Foam-Core Wings

An alternative construction method, popular in the West European continent (especially in Holland, Belgium and Denmark) are foam-core wings out of Rohacell 31 and 70, or hard Styrofoam ("Roofmate").



A close-up of one of Cenny Breeman's F1A models. Carbon Fiber tow is woven into the kevlar cloth at a 2.5cm grid and vacuumed to the Rhoacell foam-core at 45 degrees.

A layer of Kevlar at 45 degrees is vacuumed over the core. (Fiberglass is sometimes a substitute.) A smooth surface is obtained by vacuuming the wing over a female mold covered with an epoxy impregnated Kevlar/fiberglass cloth (usually the lower surface). A rough surface is obtained by vacuuming the Kevlar/fiberglass directly onto the foam-core, serving as a male mold (unusually the upper surface). Foam-core wings are also used by Italian Power fliers, as an alternative to aluminum skin construction.

The Danes (the Nyhegn family) use a variant of this method. Their wings are constructed from upper and lower molded skins, made from a sandwich of Kevlar, an .8 mm Rohacell and Fiberglass, vacuumed to upper and lower female molds. A main spar and a leading edge is glued between the skins, with no internal ribs, except at the panel's ends.

Foam-core wings allow speedy construction once the required wing-molds are made. (Accurate sanding of Rohacell is also required.) The main drawback is their weight, especially the outer panels. Typically, these wings weigh 175 to 195 grams. Foam cores are sometimes used only to construct the D-boxes, with capped ribs and a CF trailing edge behind the main spar.

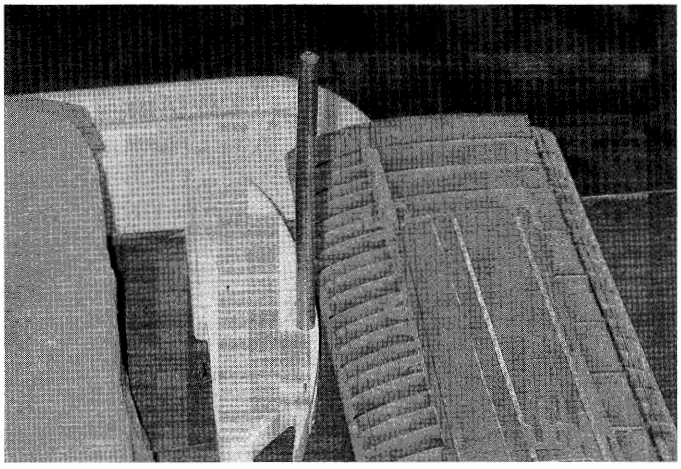


F. Kerner holding a glider with center panels made from Roofmate and a main spar tapering from 14mm to 8mm. The outer panels have ribs behind the main spar.

Main rods

In '79 Nordic wings were mounted by steel rods, typically 3 mm (1/8") and occasionally 4 mm (5/32") thick. A few models had hard aluminum tongues instead (2 mm or .078" thick).

CF main spars have allowed a quantum leap in the lift a wing can generate during towing. But higher lift dramatically increases the bending moment at the root, requiring much thicker main rods. Steel rod diameters have increased to 5.0 (.197"), 5.75 mm (.227" Isaenko) and 6.35 mm (.250" Michael Fantham), weighing 44 grams when 18 cm long. The Russian Igor Slotine was using an 8 and a 10 mm steel tubes. Very thin wings sometimes use a rectangular CF main spar (without a wiggler).



A wing connection made from a 10mm tube by Igor Slotin. Note that this is one of the few wings without a D-box.

Double main rods are a recent innovation by the Russians and Ukrainians. The rods are set about 1.5 mm apart in a mold packed with carbon tow mixed with epoxy, close enough to allow the wing to wiggle. The front rod, positioned ahead of the main spar, is shorter to avoid force concentration. The rods are either 11 and 16.5 cm long (Makarov/ Kochkarev), weighing 41 grams or 14.5 and 15.5 cm long (Stamov). Both rods are usually 5 mm thick (.197"), but there was talk of increasing their diameter.

An alternative wing connection, popular with the Dutch fliers and used for many years by Peter DeBoer, are wings braced with steel cables. The wings are positioned on a pylon, while the cables span from about a third of the inner panel down to the bottom of the fuselage. Two or three small diameter rods are used to hold the wings to the pylon, as the bending moment at the root is negligible.

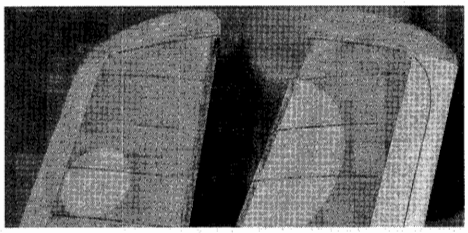
Sections and surface issues

In '79, B6356b was king of the hill, followed by Sokolov as a distant second. Today, sections tend to be variations on published ones, where the most successful ones are copied and survive in a process of elimination. Current sections range from the slim 4.42% hyper-cambered ST92 Breeman/ Somers section to the well known Makarov/ Kochkarev which closely resembles a Gard 7510 or a Ritz 7.45-5.5G, and to Isaenko's no 36, 7% thick with its gentle Phillips entry and moderate undercamber. A typical modification is to flatten the bottom of the section out to the end of the D-box to simplify its construction. Thicker front end sections accommodate narrower D-boxes. Also, thicker forward upper sections have a better ramping effect, controlling the laminar separation bubble above the wing.

Virtually all built up wings were tissue covered in '79. Over the last few years super-light Mylar and Polyester tissue have become available. Neither material has the drawback of doped tissue, which shrinks in higher temperatures, potentially creating heat induced warps.

Mylar is metallized or transparent. The latter can be sprayed with color prior to covering, making tracking and spotting easier. The Russians and Ukrainians frequently cover Mylar with tissue, to reduce its tendency to shrink and scallop, and to increase surface friction. A thinned wood lacquer is used to adhere the tissue to the Mylar, avoiding dope which can shrink and warp the wing.

Polyester tissue, weighing 20 gr/sq meter, is a popular covering material available from Austria. It is doped without wetting and actually slackens a bit in heat.



Ukrainian wing tip by Pisanoir or Remiga with a curved back turbulator.

Another development is the deployment of a second turbulator at about 21-23% of the wing, to trip laminar flow bubbles. Many Dutch models, with rough vacuumed Kevlar upper surfaces, carry a single turbulator at 28-30% of the chord. Turbulators are sometimes curved back at the wing tips, and occasionally at the dihedral break. (See photo above.)

Turbulators have also become common on stabs, at 5% of the chord. In many cases, such a turbulator improves the stability characteristics of the stab. Will invigorators and a second turbulator follow? A provoking example are Mylar covered stabs with a tissue strip from their turbulator back to about 30% of the chord.

Fuselages and Accessories

Fuselage pods carry many accessories beyond a hook and one-function DT timer in '79. Fuselages have also been impacted by synthetic materials. Many pods are made from left and right fiberglass shells instead of the traditional balsa, plywood and hardwood. Tailbooms are made out of CF or layers of CF/ Kevlar/ Aluminum, replacing the heavier and more flexible fiberglass rods. As noted above, tailbooms have extended by an average of 2.75".

By '79 the "Russian" circle tow hooks had attained the same functionality as the current hooks, including the tension driven rudder deflection. The backward motion of the hook was usually controlled by screws in the upper part of the fuselage, while today, the hook is usually controlled by screws on a panel beneath it.

Pods have become much more complex as they enclose a multi-function timer with its starting mechanism, a power supply for an electronic timer, a wing wiggler for bunters and usually a transmitter or a buzzer with their own power supply. Frequently a large removable side panel allows access to the gadgetry.

Wiring of bunters is complex and difficult. Typically three lines run through the tailboom to the stab: one to release the lever supporting the stab, another, with a spring, pull down the stab into a bunt position, and the third to DT the model. An additional fourth line attaches to the rudder. A wing wiggler requires a line to the timer in the pod. (A zoomer can get away with a line to the DT and another to the rudder.)

Timers in '79 were mechanical, with a single DT function. Presently, most timers are multi functioned. Timers on bunters activate two bunt related stab moves and a wing wiggler. A delayed rudder can be used by a bunter or zoomer, in addition to the DT. Most mechanical timers are Seeligs or camera timers faced with a flat spiral disc among the east Europeans. These timers are typically arrested by a line from the hook, which is partially retracted as the hook latch opens, and pulled away as the hook swings back after the launch. About a quarter of the fliers today use electronic timers, activated by one (single function) or two (multi-function) switches off the tow hook. The timers use solenoid (Koster), susceptible to line tension, and relay coils (Bauer and Bradley), vulnerable to a sudden impulse at launch. Recently a new generation of electronic timers is driving tiny servos (Bauer's seven-functions, VanWielen four-functions and Nyhegn.).

Airborne transmitters have become popular over the last few years. The proved invaluable even in a large open field like Lost Hills, especially in windy conditions. Doring transmitter are commonly used by European fliers, doubling up as a ground communication system. Walston transmitters are popular with American fliers.

A cottage industry

Many East bloc modelers finance their trips abroad by selling a variety of model components and even complete models. This supply stems from a tremendous wage differential, the lack of alternative employment alternatives in the East and access to sophisticated machinery and equipment. Sales and deliveries are usually made at international contests for cash, although some suppliers have bank accounts in the west. Fuselage kits include a timer, hook, wing wigglers, bunt accessories and stab mounts, in addition to the front-ends and the tailbooms. Wing kits include D-box shells, main spars (components or complete), main rod(s), trailing edges and rib caps. In most cases the workmanship is superb and the components are big time savers.

Complete models by well known fliers are also sold. For instance, Manfred Gruneis in the morning flyoff against Mike Fantham, was flying an Isaenko's older high aspect ratio zoomer. Other purchases have had less spectacular results.

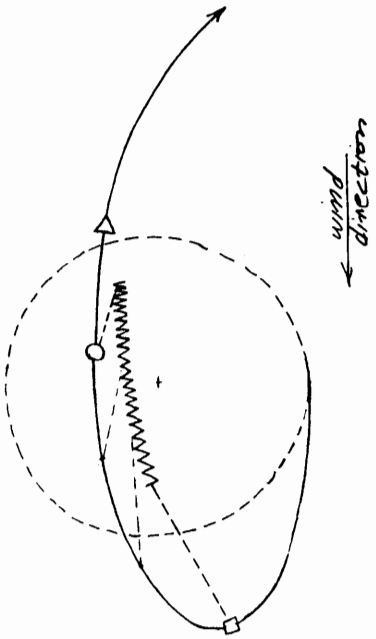


Fig 1: Kochkarev

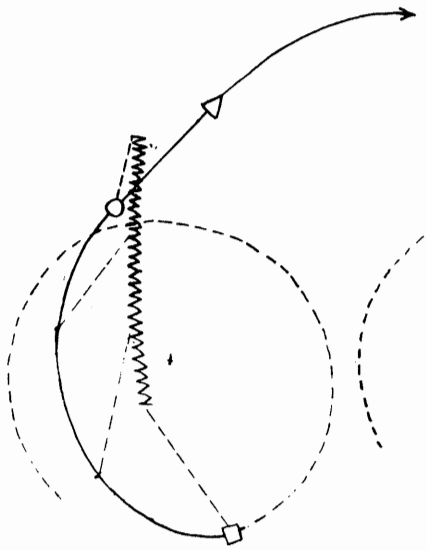


Fig 2: Makarov

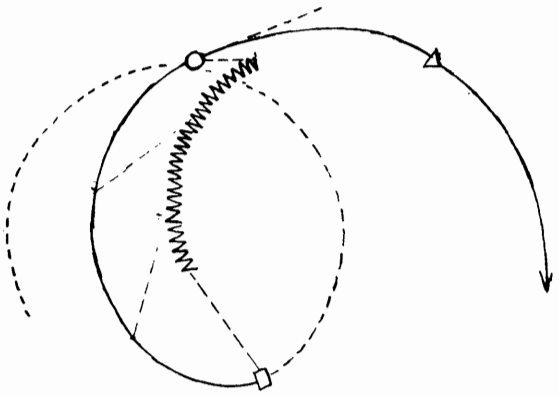


Fig 3: Stamov

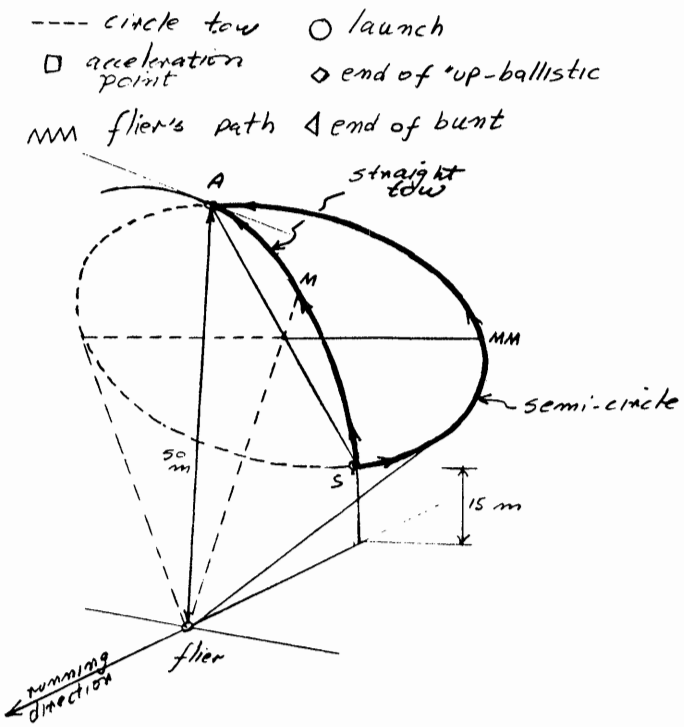


Fig 4: Straight and semi-circle geometry

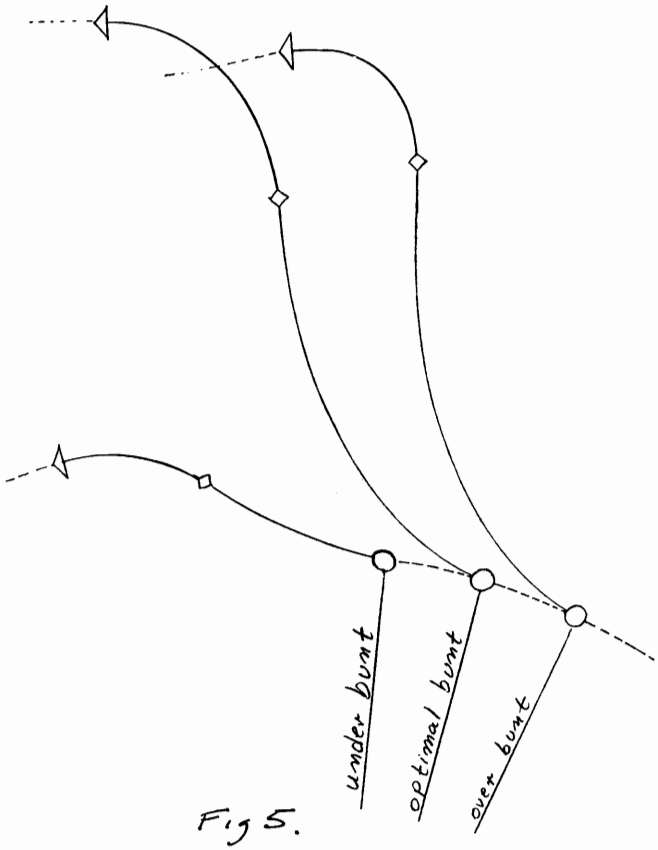


Fig 5.

FIGURES From "Nordic Bunts"

Nordic Bunts

By Aram Schlosberg

Bunts are the ideal transition from climb to glide. The term bunt in Nordics usually incorporates an "up-ballistic" phase leading to the bunt, and the bunt proper. Bunting is credited in pushing still-air performance over the four minute mark.

Bunts were widely used in Power in '79. As Nordic wings became stiffer, due to the incorporation of carbon fiber [CF] and Kevlar, higher on-line acceleration made bunts possible. Victor Tchop was the first to get "good results" for a Nordic bunt in '89, according to Sergei Makarov. Kochkarev's winning '91 bunter attests to the speed the concept was perfected. In '93, approximately a third of the fliers at the World Championship were bunting, with a higher proportion among the East Europeans.

Presently, Nordic bunts are two-phased, comprising, as noted, of an "up-ballistic" phase and a bunt proper, corresponding to two post-launch timer functions. At launch, the decalage is set to attain a large loop. The first timer function triggers the bunt, by a negative decalage, where the stab's angle of attack is higher than the wing. The second function terminates the bunt, by resetting the stab to the glide decalage. Related functions are rudder and wing-wiggler. The rudder is set at the launch, and can be reset later (by a delayed rudder); while the wing-wiggler (which increases the incidence of the inner wing to the circle) is switched off at the end of bunt, or sometimes at the end of the "up-ballistic" phase.

Bunt patterns

At Lost Hills I observed a number of distinct bunt patterns by some of the better known Eastern European modelers. The first, flown by Kochkarev, who set up his model for acceleration by towing it down over the first and second quarters to a height of 10-20 meters. The model's acceleration began just before it began turning into the wind, at about 5-6 o'clock. Kochkarev sprinted upwind, as the model traced a shallow (projected) arc. The model was launched as the line reached a pitch of 65-75 degrees, into a straight (projected) bunt upwind, beginning its glide circle head-on into the breeze (figure 1).

In contrast, Makarov and Stamov accelerated their models in a (projected) semi-circle. In both cases, the acceleration began as the model was down-wind, at about 5-6 o'clock, and at a height of 20-35 meters which is an advantage in thermal and windy conditions. Most of the acceleration is due to the model moving in a semi-circle, ascending to the full line's height, while the flier was covering a shorter distance. Both Makarov's and Stamov's models seemed to accelerate at an astonishing rate.

Makarov sprinted straight upwind, and launched his model at about 30 degrees to the wind (approximately at 10 o'clock), at about the same line pitch as Kochkarev. The (projected) trajectory of the bunt was straight (figure 2). Stamov began running up-wind, but then curved away from the model to the right, launching the model at a higher angle to the wind (at about 11 o'clock) with the line close to being vertical. The bunt's trajectory was flatter than the one by Makarov, and the model continued to turn throughout the "up-ballistic" phase and especially the bunt phase, ending almost down-wind (figure 3). The bunt resembled an extraordinary zoom!

In windy conditions, a semi-circle acceleration attempts to center the model back into a passing thermal. Launching the model at an angle to the wind also improves its recoverability. An intriguing thought is that right (left) hand fliers might be better off flying models turning to the left (right) during an arced-acceleration, keeping the model in their field of vision. In contrast, a relatively straight on-line acceleration, releases the model flying up-wind, away from the passing thermal.

On-Line Acceleration Geometry

All three models trace an arc, but with different degrees of curvature. Another common feature is that the acceleration starts just as the model begins turning into the wind, or probably even a bit earlier.

Geometry plays a critical role in the initial acceleration of the model. (At higher speeds the model's lift becomes the dominant factor.) With sufficient line tension, the model is moving on the surface of a sphere with the flier always in its center (see figure 4). In a conventional straight tow, the model simply moves on a straight (projected) line from the lower part of the sphere to towards it's top as the flyer is running into the wind. The rate of acceleration decreases as the model climbs higher on the line, reaching zero overhead (where the model has the same speed as the flier). If point S is 15 meters high, M is the mid point and A is above the flier, a one meter move upwind by the flier compels the model to travel 3.04, 1.23 and 1 meters respectively.

Makarov and Stamov accelerate their models on-line in a semi-circle. A perfect analog is a U-control performing a loop downwind, with the apex over the flier's head. Downwind, (figure 4, point S) the model is moving horizontally from left to right, while overhead (point A) the model has turned a 180 degrees and is moving right to left. At the lowest point of the circle, mid point (MM) and overhead, a one meter move upwind of the flier will force the model to travel 8.59, 1.23 and 8.59 meters respectively.

In effect, a semi-circle on-line path offers incredible acceleration as the model is moving cross-wind while the flier is moving up-wind, both at the lower and upper portions of the circle. All three fliers take advantage of the model flying cross wind to commence the acceleration. In Kochkavev's case, the model straightens into the wind as the towing proceeds (figure 1). Makarov runs upwind and seems to take advantage of the acceleration at the top of the circle (figure 2, point A in figure 4), while Stamov, who is running in the same direction of the model at the end of the tow, does not (figure 3).

Arced-acceleration requires very careful rudder settings, particularly since Nordic rudders are large due to circle towing. Attention should also be paid to the rudder deflection, beyond the unlatching point, which increased with the line tension on the standard hook. Consequently, a threshold line tension is necessary to assure that the model will turn correctly on-line. Moderate washin in the inner wing might help the turning, but excessive asymmetrical warps might, at high speeds, spin the model into a tight turn or a roll the model out of its turn. Finally, an arced acceleration requires an outstanding athletic ability, or a sufficient breeze.

Aerodynamics and Wing Distortions

Once a model has attained a certain speed on-line, its lift, or more exactly, the forward thrust component of lift, plays a critical role in accelerating the model on-line. In the absence such a forward component, a model would reach a certain pitch and hang there like a kite.

Sergei Makarov remarked to me that "shorter aspect ratio models bunt better". When asked to clarify, he alluded to wing distortions. I believe that he is referring to a wing's deflection and aerodynamic washout, issues that will be addressed next.

A wing's defection cancels out some of its lift by reducing its projected area. The lift is roughly proportional to the wing's area, which is reduced by 1 - cosine of the deflection. Considerable wing deflections

are common, as a wing is subject to forces of 15-25 G during the towing. Deflections of 10 and 25 degrees will reduce the wing's projected area by 1.52% and 9.37% respectively.

Most of a wing's deflection is concentrated in the main rod(s), just outside the fuselage, while lesser bending occurs along the wings. A thicker main rod or double main rods are an obvious prescription. Alternatively, Dutch braced wings might be used. Also, a heavily carbonized main spar and thicker sections can help.

The second phenomena is aerodynamic washout, which develops with higher speeds, causing the wing to twist (washout) along its span. This reduces the angle of attack progressively towards the tips. A fascinating example are the outer panels of some Power models, which flatten out towards the end of the climb. Torsionally "soft" wings can develop considerable aerodynamic washout, causing deceleration and loss line tension prior to the launch.

A Nordic wing's angle of attack on-line is controlled its decalage and hook's position, has been modeled mathematically by Kochkarev and Makarov as being at about 5 degrees. Consequently, built-in washout along a wing should be quite moderate, to avoid negative lift at the tips and higher induced wing drag. Indeed, Russians and Ukrainians keep the cumulative washout to about 3 mm at the end of the outer panels, corresponding roughly to 1.7 degrees built-in washout. In addition, their planforms are usually centered at 25% of the chord, as a sweepback of the outer panels would amplify the aerodynamic washout.

The rationale of building torsionally stiffer wings is to move the torsional flutter beyond the speed the model can attain. Torsional flutter is very expensive in terms of energy, and bounds a model's velocity. Single layer CF D-box shells are torsionally stiffer than Kevlar ones. Furthermore, rib caps are necessary to counter rib flattening caused by the wing's bending and twisting.

Wing distortions are cumulative. The high velocity attained while a model is being accelerated may aggravate such problems, especially when distortions become asymmetrical. Asymmetrical distortions are particularly troubling in arced-acceleration, where control of the arc's trajectory is critical. Longer aspect ratio models tend to be more prone to these problems, which is probably why Makarov prefers the lower aspect models.

Tow Lines

Tow lines vary by elasticity and thickness. Monofliament lines are relatively elastic, and convert part of the sprint, or equivalently the lift, onto line stretching. An elastic line will help maintain line tension longer by contraction.

Rigid lines are available as braided Kevlar (100-lb is .015" by .038") or thin Spectra. They are much thinner and cause considerably less line drag. In addition, these lines fare poorly in line tangles. Both lines require about 10 meters of monofliament line at the lower end for handling. Rigid lines offer no shock absorption, to protect against accidental unlatching or wing over-loading. (Another rationale for stronger wings.)

Thick lines cause more drag, but are excellent in kiting conditions. The Russians and Ukrainians tow with a 1 mm (.040") deep sea fishing line, slightly thicker than the commonly used .038" 80-lb Monofliament lines. These lines are relatively inelastic and help models accelerate on-line incredibly fast.

The "up-ballistic" phase

To analyze the bunts, we should first understand the underlying warps, wing-wiggler and rudder settings of the models flown by Kochkarev, Makarov and Stamov.

According to Mikhail Kochkarev, his and Makarov's models have flat central panels and a 2 mm washout at each tip. The wing-wiggler sets the inner wing at a 1 mm (.040") washin until the beginning of the bunt phase. Victor Stamov's model has asymmetrical warps: the inner central panel has a washin of 1 mm, while the outer central panel has a washout of 1 mm. Both outer panels had another 2 mm washout. During the bunt, the inner wing is set at a washin of 1.5 mm (.060"), and at a washin of .5 mm (.020") during glide.

The entire bunt takes up to 2.5 seconds. None of the three use delayed rudder, and all models happen to turn to the right. Since Stamov's model has a smaller glide turn, of about 25 seconds, compared to 45 and 35 seconds for Kochkarev and Makarov, he is evidently using a sharper rudder deflection during the bunt.

Directional Trim

The stated rationale for a wing-wiggler is to attain a tight on-line circle turn, especially in windy conditions. But, in the three bunt examples, the wing-wiggler is kept on during the "up-ballistic" phase of the bunt, countered with a slight deflection of the glide rudder and the models achieves a straight (projected) climb. This is a puzzle! The rudder is yawing the model into its turn, while the wing-wiggler is rolling the model out of the turn -- a case of cross controls. But the rudder/ wiggler trim happened to be the standard pre-bunt Power trim! The trim consisted of a washed-in right wing, a right rudder and an engine slightly to the left. In this trim, power models would slowly rotate counter-clockwise during the vertical climb, and then transition out into a right glide, with a delayed rudder. This is also the non-auto-surface rubber model trim.

At a low pitch, just following the launch, the outer wing's dihedral counters the roll of the wiggled (inner) wing and the model stays at a slight negative bank. At a pitch close to vertical, the model may roll counter clockwise as the gravity vector is now pointing backwards.

My conjecture is that the rudder/wiggler trim has a better directional stability than the zero-case (flat rudder and symmetrical wing warps). In the zero-case trim, first the rudder and later the wings (due to the dihedral effect), counter directional deviations. In a rudder/ wing-wiggler trim, however, the wings are already functioning at a (relative) washin/ washout offset, held in this position by the rudder. Consequently, the model's reactions to directional changes will be faster and sharper.

Bunters with no rudder deflection and a marginal washin of the inner wing, in my experience, exhibit a degree of directional randomness at the end of the bunt. Power fliers have abandoned zero-case trim, as being very sensitive the launch and as having a tendency to fall off the right. A rudder/ wing-wiggler trim, or a rudder with washin in the inner wing, attain the desired directional stability if used in moderate amounts.

Decalage and airfoils

As the model is being released, its velocity is reaches 20-25 m/ sec, with a corresponding hyper-lift of 20-25 G (balanced up to the launch by the tow line). Consequently, the model immediately goes into a large loop! The decalage during the "up-ballistic" phase should be set to maximize the height gained, ending up at a pitch and velocity which are sufficient to transition into glide. The stab trailing edge is usually set at 1-1.5 mm (.040"-.060") above its glide decalage. The higher decalage also makes keeping the model on-line much easier.

Once the model has accelerated to its maximum velocity on-line, drag and possibly lower surface separation become more critical. Wouldn't this favor airfoils with a moderate entry and a lower under-camber? Surprising as it may seem, most bunters use highly under-cambered airfoils. I could not detect a discernible difference in height

between high cambered airfoils used by Kochkarev, Makarov and Stamov and by moderately cambered airfoils used by such fliers as Isaenko.

The reason might be attributed to the fact that the minimum drag on cambered section is not at a zero (chord wise) angle of attack. Polar lift and drag coordinates indicate that cambered airfoils have their lowest drag at a positive angle of attack, which increases with the airfoil's undercamber. For instance, a high cambered Nordic airfoil might have its lowest drag at an angle of attack as high as 3-4 degrees. During the "up-ballistic" phase of the bunt, the model's decalage is slightly higher than its glide decalage, but still in the vicinity of the lowest drag of each section.

Evidently, the absolute drag differences between high and medium undercambered sections during the "up" phase, are not very significant. But, as the model's pitch increases, transitioning into the "ballistic" phase, gravity becomes the dominant factor in slowing down the climb.

The Bunt Proper

A bunt proper, has to be made with just enough speed to transform a Nordic from an almost vertical pitch at the end of the "up-ballistic" phase into its glide. Under and over bunting will entail a height loss due to stalling or diving respectively. Typically, the stab is set with a negative decalage, of 10-12.5mm (.4"-.5") relative to the glide position, for about 1-1.5 seconds.

The bunt phases by Kochkarev and Makarov had no discernible turn, attributed to small rudder and wing-wiggler reflections. Stamov's bunt phase, however, was distinguished by its turning, caused by more deflected wing-wiggler and rudder, and by having the wing-wiggler on until the end of the bunt. Evidently, the rudder's deviation dominates the effect of the wing-wiggler. This also explains the slightly curved "up-ballistic" phase of his model, as illustrated in figure 3. Turning during the bunt reduces the likelihood of the outer wing stalling first.

Zooms

The precursor to a bunt is the zoom, which is a combination of a loop and a turn. At the climb's apex, which is reached in about two seconds, the model should have turned about 90 degrees, flying parallel and banked to the ground. At this point the speed should have dropped to reduce the effect of the rudder and the latitudinal loopiness, easing the model into its glide down-wind. The model is launched with its glide decalage, and a delayed rudder is sometimes used to tighten the glide circle.

As early as '73, Tam Thompson used a wing-wiggler to tighten the circle-tow. But should the wing-wiggler be left on during the zoom? There have been attempts to do just this: Andres Lepp used a delayed aileron on the inboard panel, but it was eventually taped down. It seems that the aileron, or equivalently a wing-wiggler, increases the inner wing's washin to the point where it attains the straight trajectory of a bunter, but without the benefit of a bunt.

Jim Parker has noted an important distinction between a zoom and a bunt. Bunts are inherently self correcting when the launch speed is non-optimal. An excessively fast bunt will leave the model at a high pitch at the end of the "up-ballistic" phase, but the model will have enough speed not to under-bunt. On the other hand, a slow bunt will leave the model a much shallower pitch (and height) when the "up-ballistic" phase terminates, but the lower speed would be sufficient to perform the bunt (figure 5). A zoom, on the other hand, is portentous above its optimal launch speed. A "hard" zoom will cause the model to simply fly around in a circle. At even higher speeds the model will simply spiral in due to the dominating effect of the rudder. The tendency to spiral in can be mitigated somewhat by careful attention to the extremity of the outer wing, keeping in mind that the separation point of the air flow above the wing moves backwards at higher speeds.

Prescriptions

Very stiff wings with heavy main rod(s) or a brace are essential for attaining high on-line acceleration. Building tolerance should be below 1 mm (.040") per panel, together with a moderate amount of washout along a wing (up to 3-4 mm at the end of the outer panels).

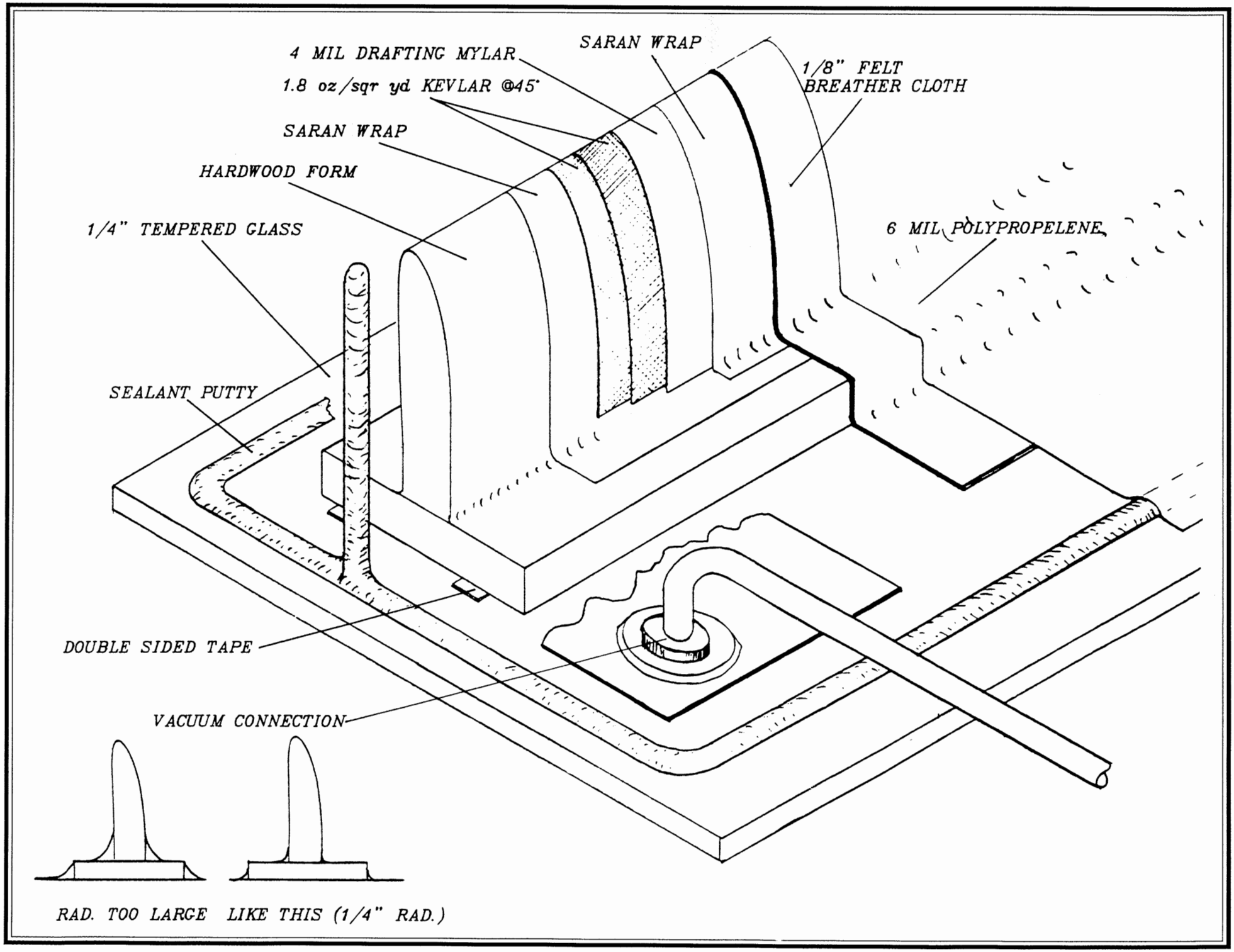
Arced-acceleration allows the critical early acceleration of models on line. A semi-circle acceleration has the potential to turn models back into a passing thermal. The acceleration might begin early in the second quarter, with the model initially diving down-wind. This is a newly developing area which holds great potential.

A wing-wiggler and an offsetting rudder trim are necessary for a stable and consistent bunt. Small rudder/wiggler deviations result in a straight up climb, followed by a straight or slightly curved bunt phase. Higher rudder/wiggler deviations induce a turn during the bunt, which might be ideal for accurately placing a model in windy conditions.

Another possible development is the three-phase bunt: a short "up" phase to point the model up, followed by a ballistic-low drag phase were the model is climbing vertically with the lowest drag-decalage, topped off by a bunt. If a true vertical (ballistic) climb can be achieved, a wing-wiggler might partially rotate the model towards it's down-wind target. Conceptually, the more control variables (modifying the decalage, wing wiggler and rudder) one has along a trajectory, the closer a model will get the ideal climb. In practice, however, it is doubted if more than a three-phase bunt will matter.

A new generation of electronic-servo driving timers might also contribute to bunts. These timers drive a servo, which can rotate backwards allowing direct line-driven functions. Backward rotation also facilitates more functions and in addition, the timing of the functions is vary accurate. The new Bauer timer also has a bail-out mode, switching the model to a glide position if the model has not been released within a prescribed time.

Finally, arced acceleration and bunts offer Nordics a tremendous performance advantage. There are many factors to experiment with, develop and perfect, and the topic offers an exciting rich subject for mathematical modeling.


4 MIL DRAFTING MYLAR
1.8 oz/sqr yd KEVLAR @45°
SARAN WRAP
SARAN WRAP
1/8" FELT
BREATHER CLOTH
HARDWOOD FORM
1/4" TEMPERED GLASS
6 MIL POLYPROPELENE
SEALANT PUTTY
DOUBLE SIDED TAPE
VACUUM CONNECTION
RAD. TOO LARGE
LIKE THIS (1/4" RAD.)

Kevlar D-Box Structures for F1A Models

By Tony Mathews and Peter Allnutt

In 1984, following a demonstration of techniques used to produce lightweight fibreglass-shell fuselages for Team-Race models, a novel method to produce molded leading edges for F1A and F1B models was produced.

The initial concept was to use glass fiber shells made in a female mold with silicone rubber pad to provide pressure. After seeing the molded Kevlar D-Box wings of Victor Isaenko at Livno in 1985, and after learning of the techniques used to fabricate them, we decided to produce a similar structure. However, it wasn't until seeing Stefan Rumpp's "S12" in Hungary (May '88) do 5 minutes at 6 a.m., that we knew we had to take the plunge! Rumpp's wing has fantastic stiffness and strength. (It has to, in order to withstand his awesome zoom launches!). The new technique would be used for the wings of PA49* "Silver Hammer" which was to be a new model for still air.

The use of Joe Maxwell's leading edge forms, jigs, machine-cut ribs, Czech carbon-fiber spars were essential to the success of the finished project. We decided on standard Vacuum-bag techniques and materials to insure success. From the first panel made, the technique has proven itself as a ideal method to produce accurate, stiff, lightweight wing structures that are also weather-proof and quick to build!

Some notes regarding the structure:

Kevlar was chosen because of its excellent stiffness-to-weight ratio and also because of its incredible resilience *(read bullet-proof).* A low-viscosity laminating type epoxy resin was essential. Shell Epon 815 with a teta hardener works very well. Because the Kevlar is vacuum-bagged onto a "male" form, the external surface finish is dependent on the surface finish and rigidity of the final layer of release film used. 4-mil drafting Mylar works very well and leaves a slight "matte" finish. This must be coated with a spray mold-release first (Freekote 700 or equivalent). Failure to do this will result in a Kevlar/drafting film composite structure! The internal release-film can be very thin PVC or Polyester (0.5 to 1 mil). Keep in mind that the internal release-coat must be a paintable grade (non silicone). The raw kevlar is very difficult to cut and high quality surgical scissors are almost essential! The final Kevlar skins can be trimmed with a sharp Olfa or X-Acto knife on glass. A note of caution: trim the cured skins as accurately as possible before bonding to the spar/rib sub-assembly. Kevlar is very difficult to sand, and merely "fuzzes" at the edges. Slow-cure Cyanoacrylate is the glue of choice for assembling the Kevlar forms to the spar/rib sub-structures. Assembly must be done on the Maxwell jigs to ensure accuracy of the airfoil and the correct warps. Be careful about the warps when final assembly is attempted. Once all of the carbon-fiber cap-strips are bonded to the ribs, you cannot alter the warps by any means! Careful checking at each stage will ensure accuracy. 0.5 mil Mylar covering over the open areas of the structure is adequate. Remember, we don't rely on the covering for stiffness!

*The name refers to it's silver mylar covering and Joe Maxwell's help.

Steps to produce Kevlar D-Box

1. Cut tracing vellum (4 mil) approximately 1" oversize all around
2. Coat vellum with 3 coats fo Freekote 700.
3. Cut 2 pieces Kevlar cloth to size (use form as template). Note: Fibers are oriented at 45 degrees.
4. Cut 1 mil mylar film to 1" oversize all around. Coat with 1 coat of Freekote 700.
5. Place Kevlar on vellum (both layers, one on top of the other).
6. Mix up Shell Epon 815 10 to 1.2 (teta hardener) approximately 20 gms. to 2.4 gms. is OK.
7. Apply epoxy with brush, wet out thoroughly.
8. Place mylar film over Kevlar (Freekoted side to Kevlar).
9. Roll out with roller so there are no air bubbles. Do this on a flat surface.
10. Add an extra 2" oversize layer of 1 mil. mylar to vellum side (to prevent epoxy bleed to felt).
11. Cut felt approximately 1" oversize.
12. Wood pattern is attached by double sided tape to the glass plate in advance.
13. Sealing putty is laid up all around pattern (approximately 3"-4" oversize.)
14. Using a helper, place mylar/vellum/kevlar/mylar assembly on form.
15. Place felt over assembly.
16. Hold assembly down over form with two hands while helper positions 6 mil. polypropylene bag over everythin (hands and all).
17. Remove one hand and replace over polypropylene, etc.
18. Finally, with 2 hands over polypropylene, felt, etc. . . . hold everything down firmly to form while helper seals bag and hooks up vacuum hose.
19. Helper plugs in vacuum pump while you hold down everything tightly to form.
20. Try to avoid wrinkles, release vacuum and re-do if necessary.
21. Ensure that vacuum is at least 21" to 25" Hg then place heat lamps over unit.
22. Allow to cure overnight.

The models used in the World Championship were:-

#15 for rounds 1,9,10.
#14 for rounds 2-8 .. The thermal rounds.

Model #14 is the same as #13. Robin II, model #13, was in FFn 200 and I have supplied a copy of that drawing here. The planform of #15 is the same as models #13 and #14.
I have also supplied a page of full size sections for #15, showing structure layout. These were plotted using Ian Kaynes' KPS Plotting Software, which I have found most useful -Ian is selling this package, see Free Flight News June 1993 for details.
I have supplied copies of the full size lay-outs of the wing and tail and the profiles of the nose and fin. All the wing and fin curves are quarter ellipses.
Model #15 uses the same wing section as #13 and 14. The #15 tail is the Wöbbeking section with minor modifications. The lower surface of the tail is mounted 12 mm above the top of the fuselage - for the bunt. The fuselage ends 18 mm in front of the tail trailing edge so that the tail trailing edge can drop 15 mm for the bunt. Bunt timings are approximately 0.75 secs-down, 2.0 secs - back up. The tail trailing edge is jacked up 1.25 mm for the tow. The bunt system is the M and K style and all the bits are home-made.
Towhook - own design, one step zoom on unlatch.
Timers. #13 and #14 have 2x KSB DT (up to 10/11 minutes). #15 has one KSB and a modified Monks for bunt and 3 minute back-up DT. Monks is ex F1J, speeded up to get faster disk speed (reduce waggler mass), new faceplate and self made release arms.

Turbulators

#13 has a turbulator at 5% and trips at 14% and 25% - see drawing for sizes.
#14 has a turbulator at 6.5% and one trip at 22% - except the right tip which has a second at 14%.
#15 has a turbulator at 5% and a trip at 14.5%
#14 also has a trip on the tail at 3%.

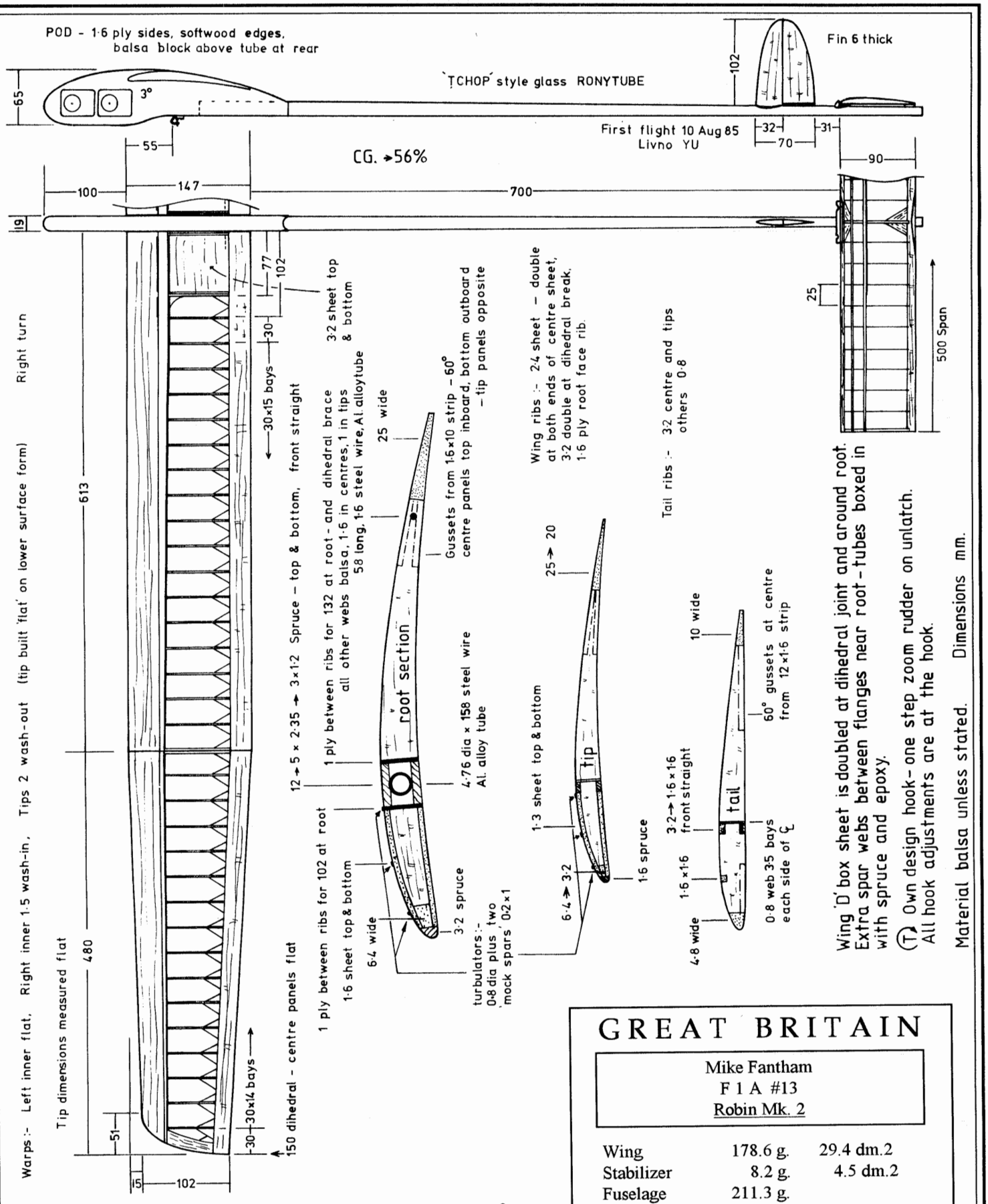
#15 details

Wing
No leading edge member
Spars
Centre panels 7.2x1.27 → 3x1.27 carbon/epoxy top and bottom.
Tip panels 3x0.8 →.2.5x0.6→2x0.4 carbon/epoxy top and bottom- thickness stepped.
Balsa web vertical grain between flanges. +/- 45° Carbon/epoxy webs front and back of spar - 0.2 in centres, 0.1 in tips. Webs thickened to 0.5 at joiners and 0.3 at dihedral joint. Kevlar thread binding round spar. 3 thick Carbon/epoxy dihedral brace inside spar and at trailing edge. Kevlar/cyano strap on D box joint.

GREAT BRITAIN

Mike Fantham
F 1 A #13
Robin Mk. 2+

Notes for Drawing.



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Mike Fantham
F 1 A #13
Robin Mk. 2

Wing	178.6 g.	29.4 dm.2
Stabilizer	8.2 g.	4.5 dm.2
Fuselage	211.3 g.	
Joiners	22.9 g.	
Total	421.0 g.	33.9 dm.2

Aspect Ratio: 15.8 to 1

Trailing Edge 2.5x1.27 → 2.5x1.27 → 1.5x1.0 carbon/epoxy

Centre panel D box two layers +/- 45° 63 gm/m^2 Kevlar/epoxy on Maxwell male leading edge mould.
Tip panels two layers +/- 45° 35 gm/m^2 Kevlar/epoxy on Maxwell male leading edge moulds.

17 gm/m^2 aluminised mylar laminated on outside of D box skins.

Ribs 30 pitch 1.6 balsa 0.12 carbon caps. Root ribs 1.6 ply. Dihedral ribs are 3x2.4 balsa in each panel. Centre ribs are 2x2.4 balsa at each end of 2.4 sheet balsa in-fill skins.
5 wide caps at root and full width of dihedral joint ribs.

Joiners - 6.35 diameter x 164 and two 1.6 diameter x 34 at 65.5 from main (left) and 75.5 from main (right). Right wing incidence is adjustable but fixed at zero. (no time to fiddle with it yet)

Tips laminated block balsa 11 wide with 0.2 carbon/epoxy strips inboard and outboard.

Covering Saltzer polyester tissue, nitrate dope.

Warps.
The wing is built on a single Maxwell undersurface form. This has a twist of 0.25 degrees per 750 mm. The tip profile leads to equal wash-out being superimposed on the overall tip-to-tip twist.
The resulting warps are approximately:-

left tip	2 mm wash-out
left centre	0.5 mm wash-out
right centre	0.5 mm wash-in
right tip	1 mm wash out

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F 1 A #13
Robin Mk. 2+

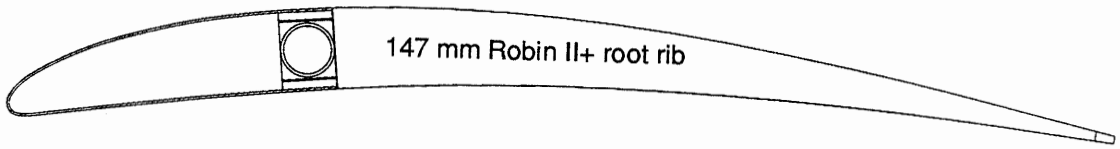
Notes for Drawing.
(Continued)

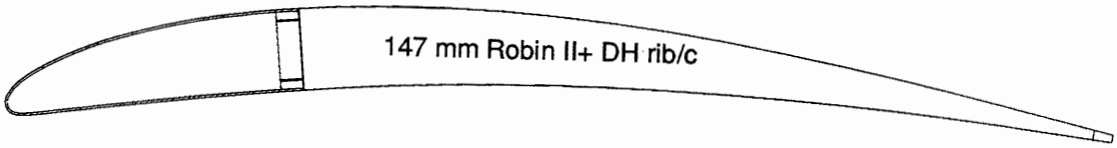
Tail
Spars 1.6x0.2 carbon/epoxy flanges on balsa web vertical grain. Top flange doubled over centre third. 1.6x1.6 balsa turbulator spar.
Leading edge from 4.8 thick balsa. Trailing edge 1.5x1 carbon/epoxy.
Ribs 0.8 balsa 0.08 carbon/epoxy caps. Tip rib 1+3 balsa.

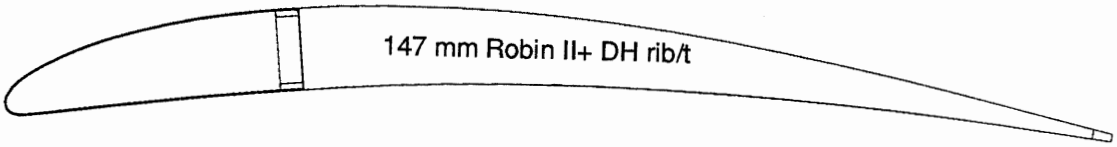
Covering 7 gm/m^2 transparent mylar.

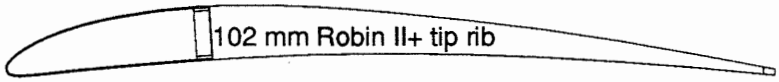
Fin 6 solid balsa.

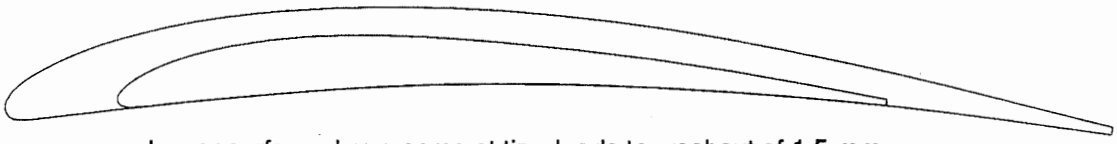
Fuselage carbon/epoxy tube 16.4 → 10 x 832 (John Carter). 1.6 ply sides softwood strip edges.
The pod is 20 mm thick - 13,14 were 19 mm. (But the wing panels are the same length so 15 has 1 mm more span in theory!)



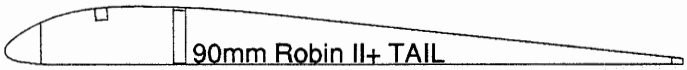








Lower surface shape same at tip - leads to washout of 1.5 mm.





GREAT BRITAIN

Mike Fantham
F 1 A #13
Robin Mk. 2+

Airfoils.

Model data

	Model #13 (now)	Model #14	Model #15
Wing	182 gm	174 gm	191
Tail	8.6 gm	7.6 gm	9.6
Fuselage	229 gm	229 gm	209.8
Joiners	23 gm	22.6 gm	41.6
Total	442.6 gm	433.2 gm	452 gm
CG	55.5%	53%	53.5%
Hook - mm in front of CG	26	19	18.5
Un-latch	2.7 kg	3.2 kg	4.1 kg

Robin II+ wing section
nose radius 1.2%

Station	top	lower
0.00	1.07	1.07
0.65	2.42	0.03
1.25	3.01	-0.10
2.50	3.90	-0.05
3.75	4.62	0.11
5.00	5.24	.27
6.25	5.80	.44
7.50	6.32	.59
8.75	6.78	.76
10.00	7.19	0.93
12.50	7.90	1.23
15.00	8.51	1.54
17.50	9.02	1.84
20.00	9.42	2.10
25.00	10.02	2.61
30.00	10.38	3.06
35.00	10.54	3.42
40.00	10.54	3.66
45.00	10.36	3.77
50.00	10.00	3.81
60.00	8.88	3.58
70.00	7.26	3.08
80.00	5.29	2.30
90.00	3.06	1.25
100.00	0.70	0.00

Robin II+ tip rib
Nose radius 1%

Station	top	lower
0.000	0.98	0.98
1.250	2.70	-0.11
2.500	3.58	-0.11
5.000	4.90	0.09
7.500	5.88	0.36
10.00	6.65	0.62
15.00	7.78	1.07
20.00	8.55	1.50
25.00	9.00	1.90
30.00	9.15	2.25
40.00	8.96	2.72
50.00	8.24	2.84
60.00	7.22	2.72
70.00	5.97	2.32
80.00	4.46	1.74
90.00	2.71	0.97
100.0	0.80	0.00

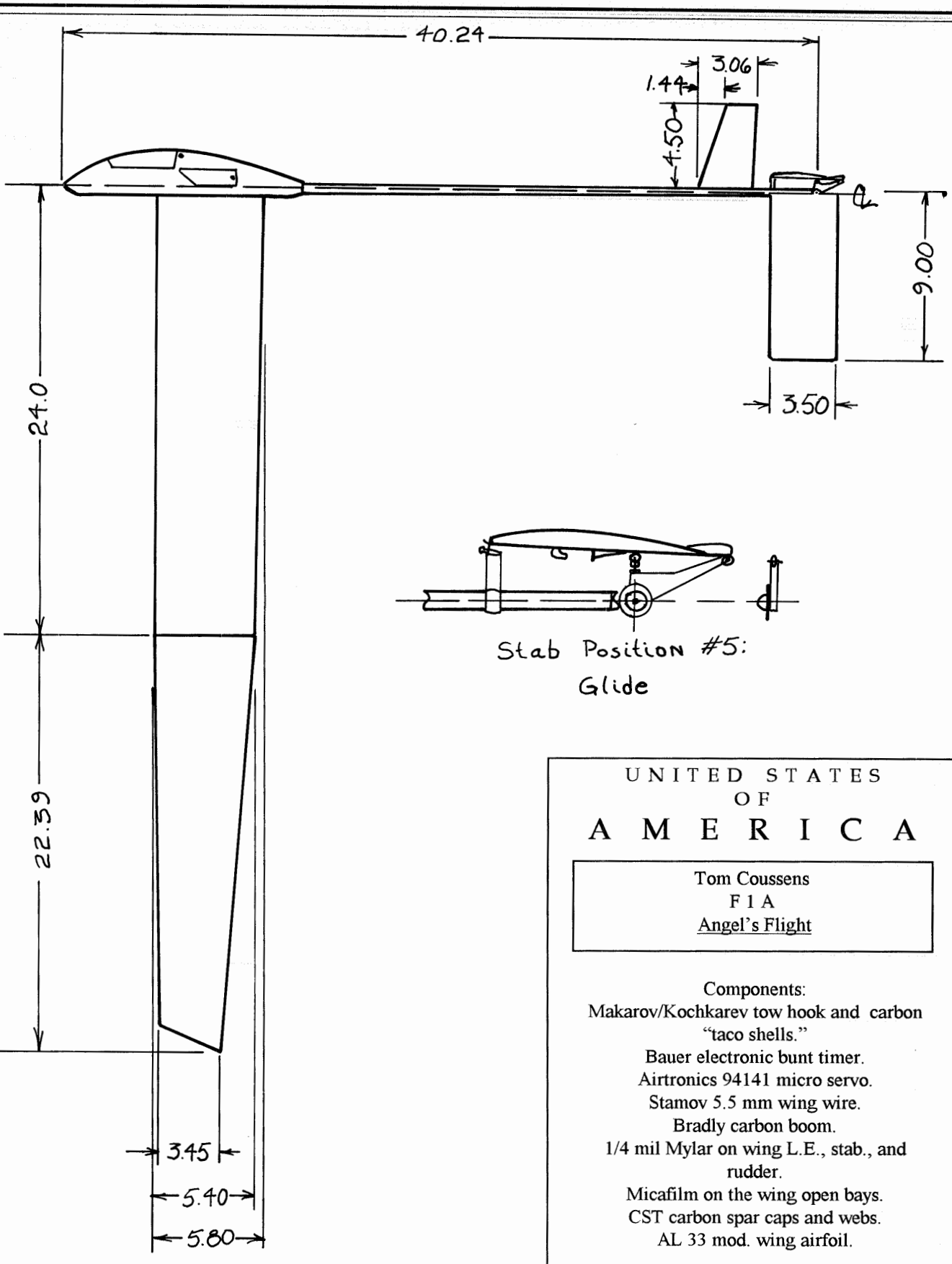
Robin II+ TAIL
Nose radius 1.2%

Station	top	lower
0.000	2.090	2.090
1.250	3.780	.710
2.500	4.690	.410
5.000	6.060	.100
7.500	7.060	.020
10.000	7.720	.000
15.000	8.420	.000
20.000	8.554	.000
25.000	8.473	.000
30.000	8.220	.000
40.000	7.310	.000
50.000	6.240	.000
60.000	5.170	.000
70.000	4.100	.000
80.000	3.020	.000
90.000	1.950	.000
95.000	1.420	.000
100.00	.880	.000

GREAT BRITAIN

Mike Fantham
F 1 A #13
Robin Mk. 2+

Airfoil numbers and model data..



Stab Position #5:
Glide

UNITED STATES
OF
A M E R I C A

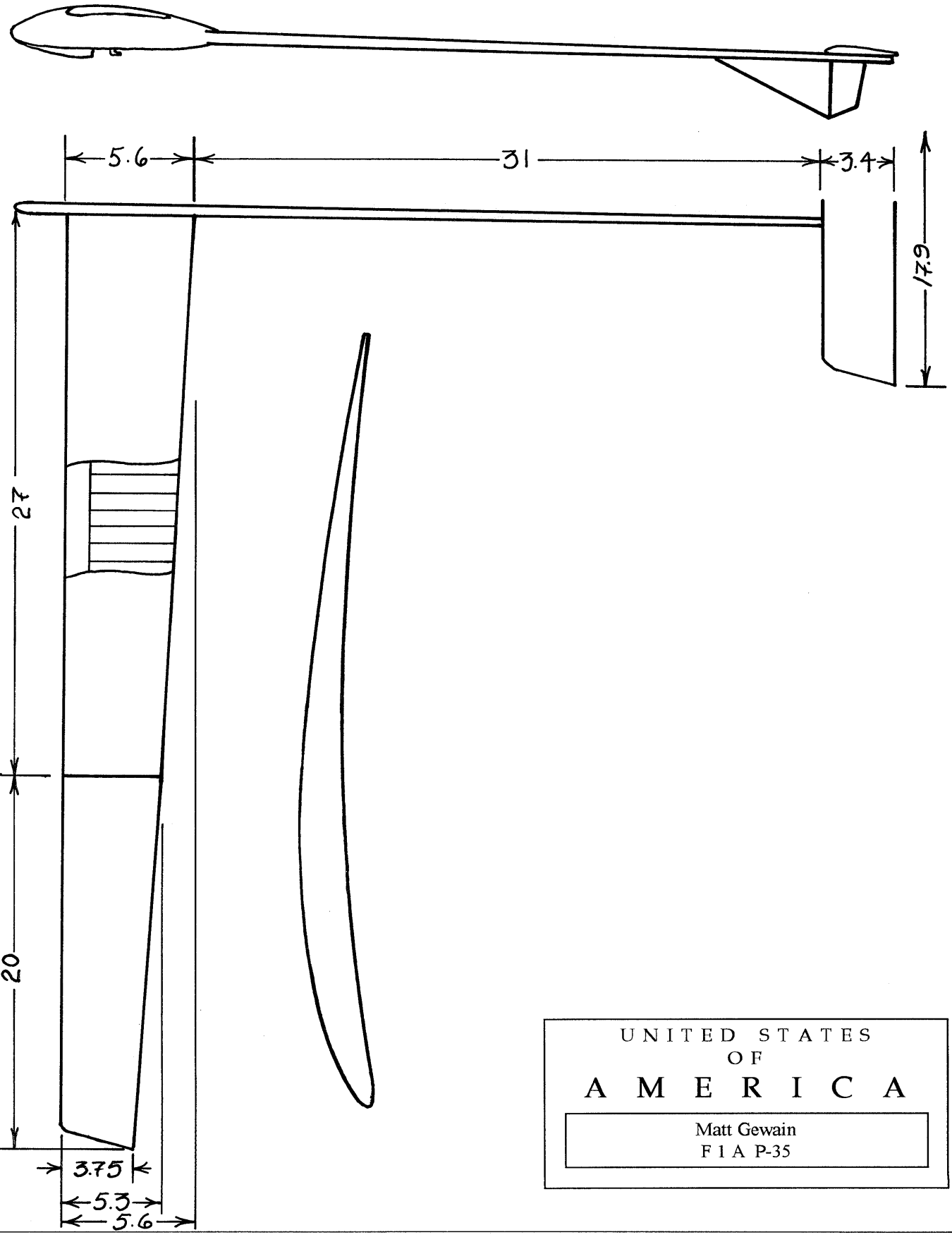
Tom Coussens
F1A
Angel's Flight

Components:
Makarov/Kochkarev tow hook and carbon "taco shells."
Bauer electronic bunt timer.
Airtronics 94141 micro servo.
Stamov 5.5 mm wing wire.
Bradly carbon boom.
1/4 mil Mylar on wing L.E., stab., and rudder.
Micafilm on the wing open bays.
CST carbon spar caps and webs.
AL 33 mod. wing airfoil.

Wing	462.5 sq in	173 gr
Stabilizer	62.7 sq in	8.8 gr

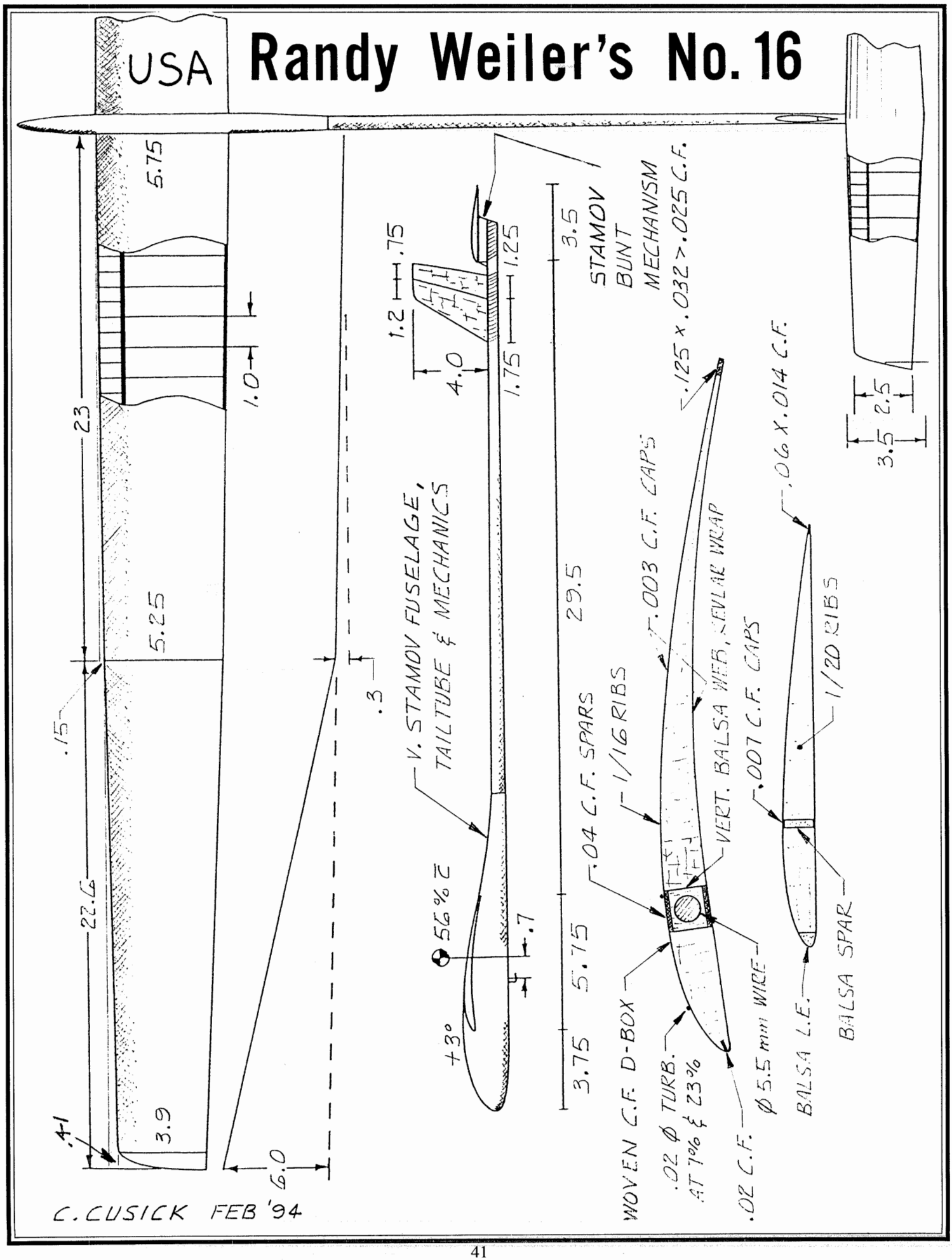
DIMENSIONS IN INCHES

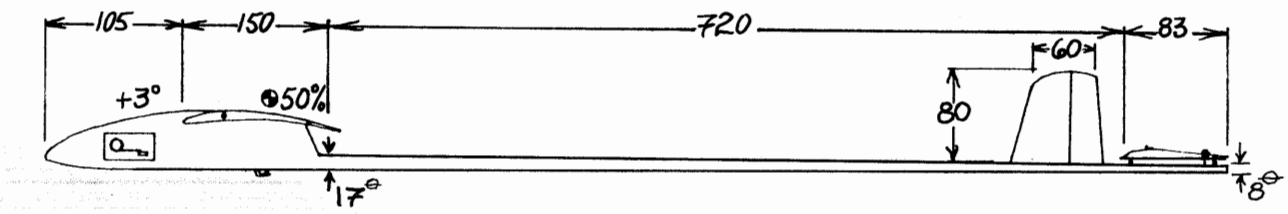
DIMENSIONS IN INCHES

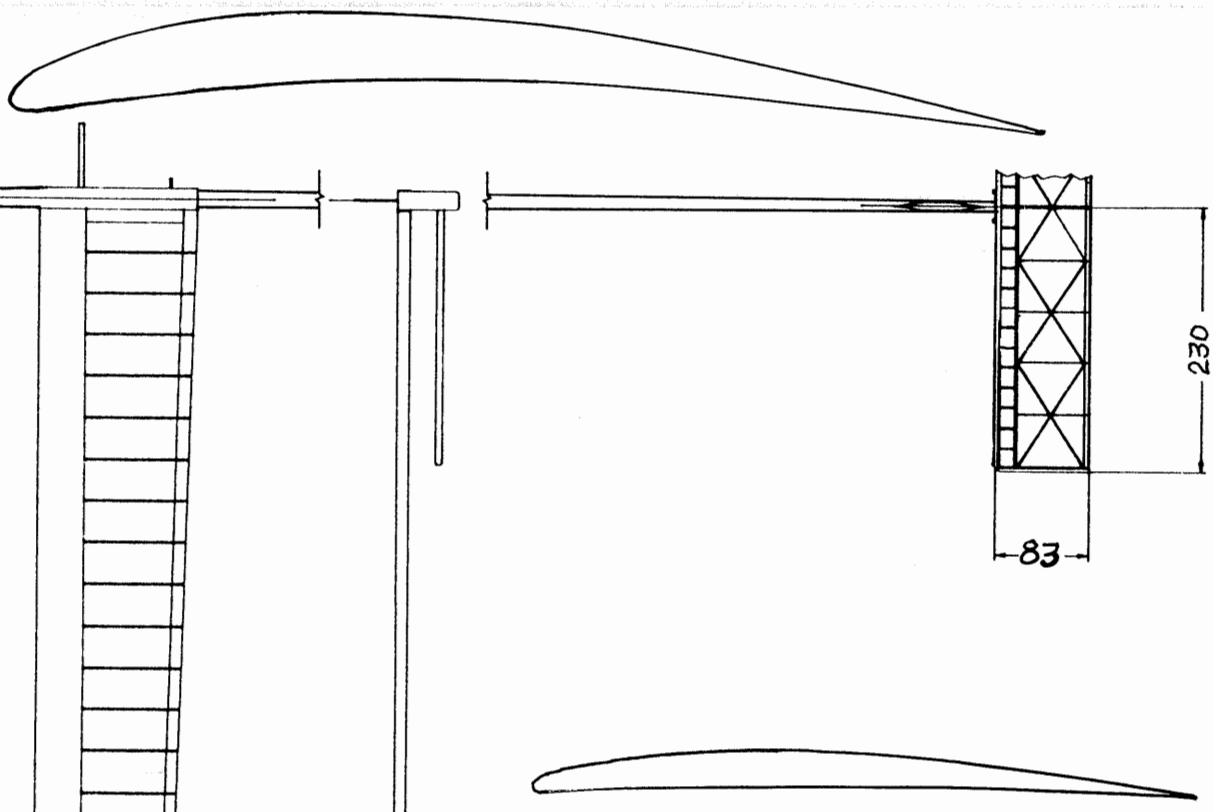


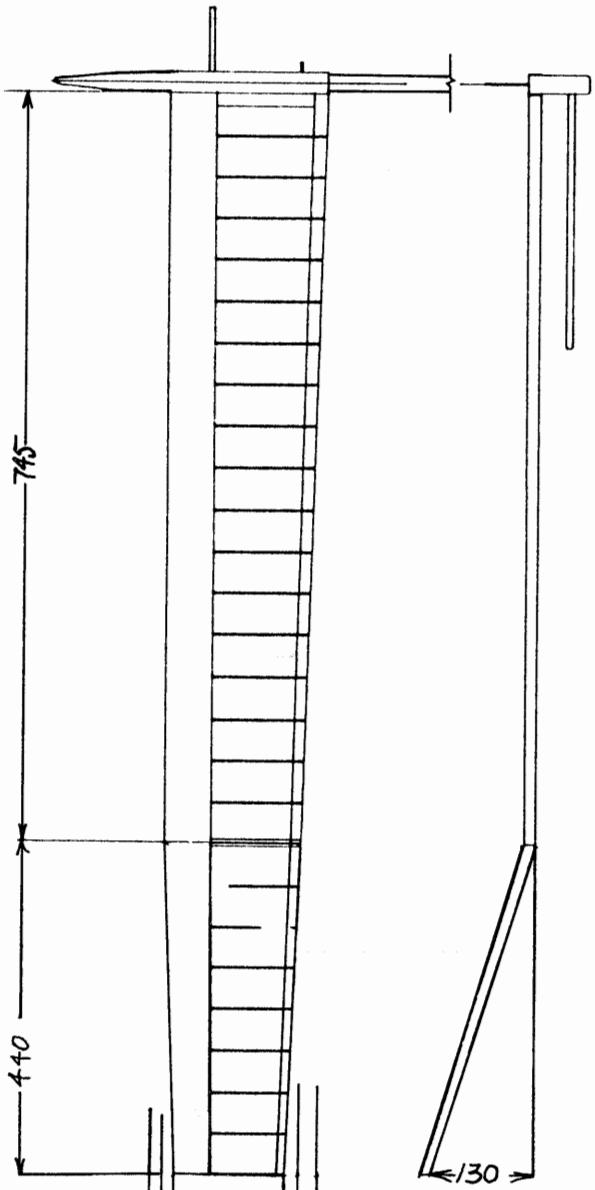
UNITED STATES
OF
AMERICA

Matt Gewain
F1A P-35


USA
Randy Weiler's No. 16
5.75
5.25
3.9
23
22.6
.41
.15
1.0
.3
6.0
1.2
.75
4.0
1.25
1.75
3.5
29.5
5.75
3.75
+3°
56% ℄
.7
V. STAMOV FUSELAGE, TAILTUBE & MECHANICS
STAMOV BUNT MECHANISM
.125 x .032 > .025 C.F.
.003 C.F. CAPS
.04 C.F. SPARS
1/16 RIBS
VERT. BALSA WEB, KEVLAR WRAP
.007 C.F. CAPS
.06 X .014 C.F.
1/20 RIBS
WOVEN C.F. D-BOX
.02 Ø TURB. AT 7% & 23%
.02 C.F.
Ø 5.5 mm WIRE
BALSA L.E.
BALSA SPAR
3.5
2.5
C. CUSICK FEB '94





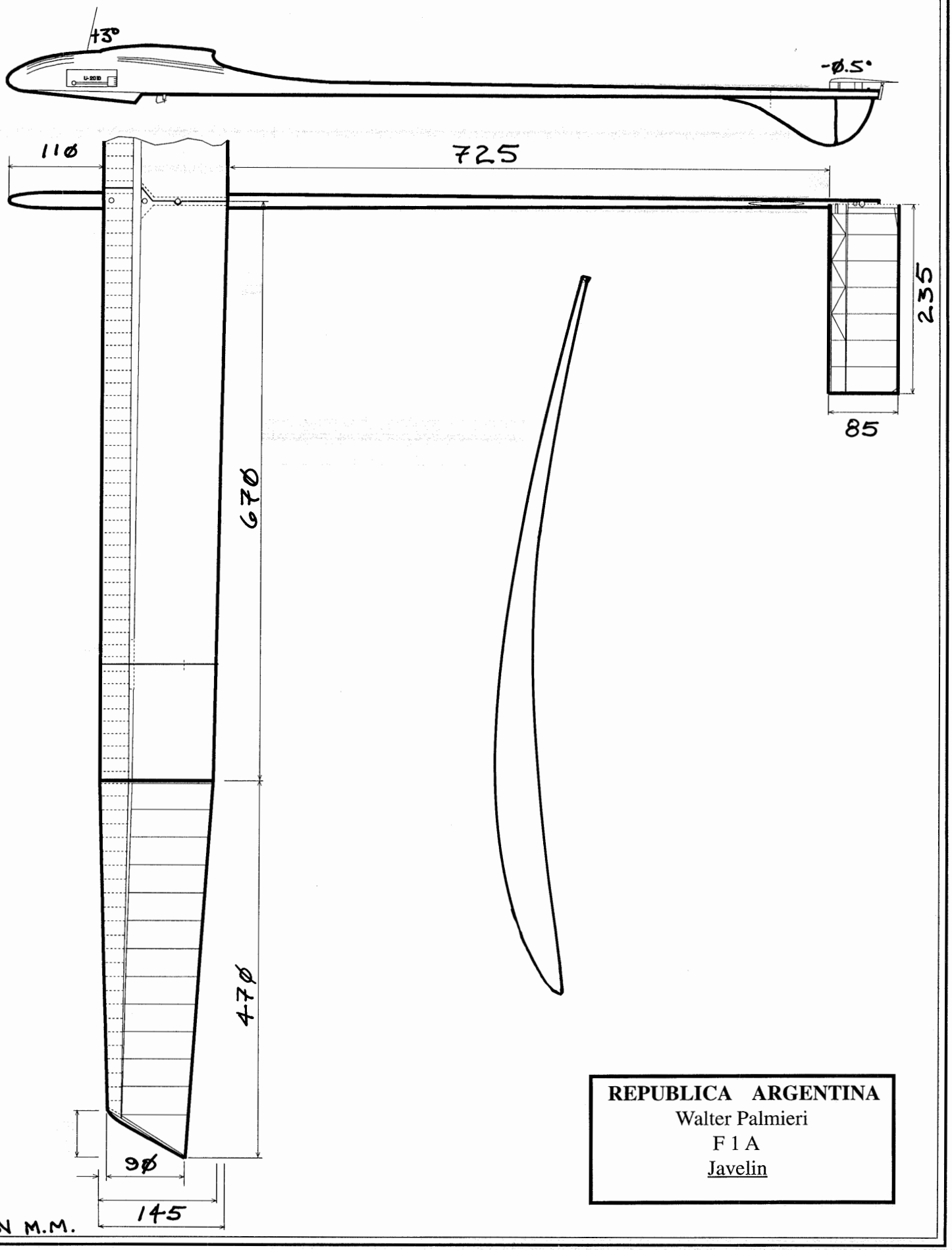


REPUBLICA ARGENTINA

Jorge R. Bovio
Av. Buenos Aires 815
2400 San Francisco Cba.

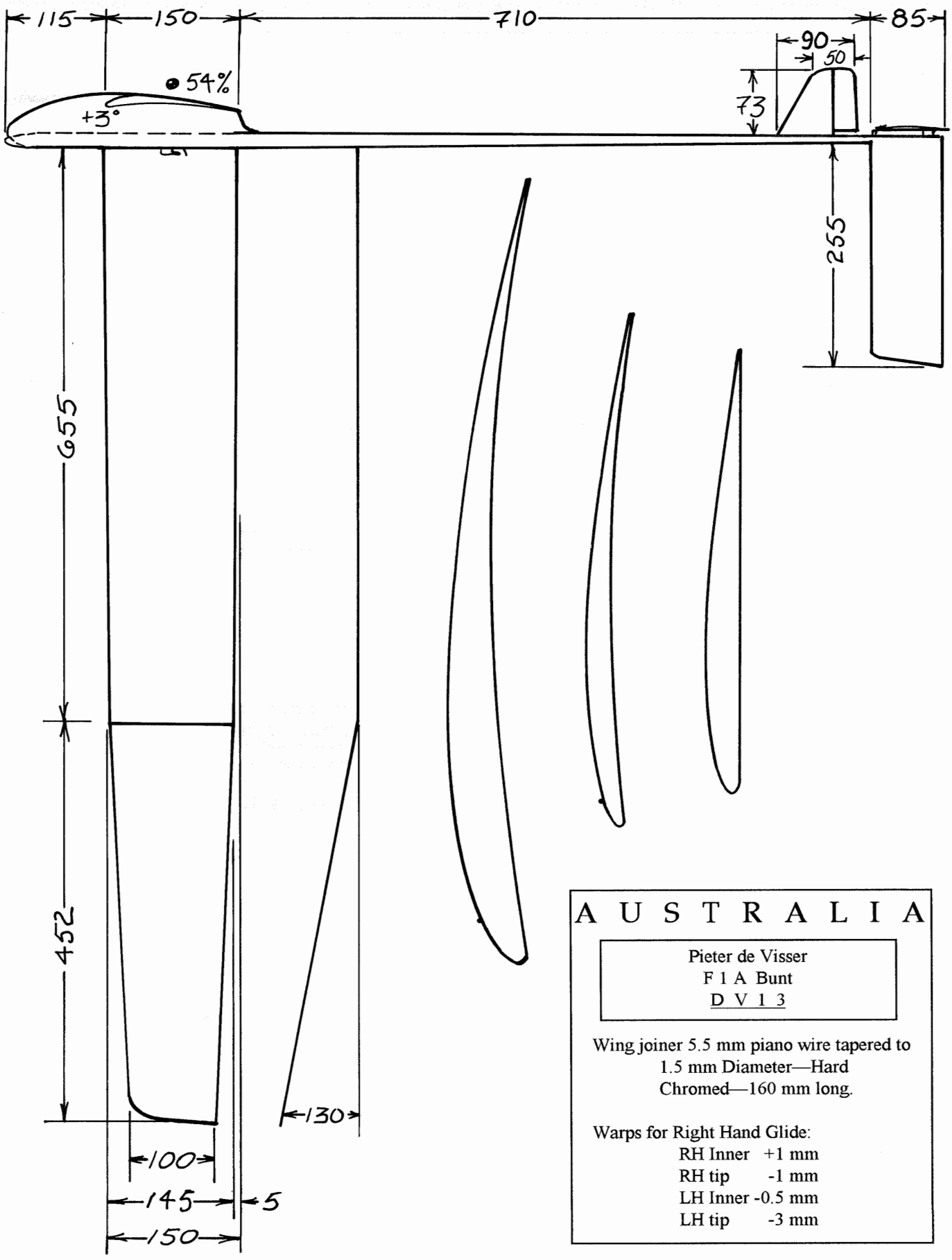
	Peso	Areas
Alas	175	30,10
Estabilizador	7	3,81
Fuselage	233	
Totales	415g.	33,91 dm.2

DIMENSIONS IN MILLIMETERS



REPUBLICA ARGENTINA
Walter Palmieri
F 1 A
Javelin

DIMENSIONS IN MILLIMETERS



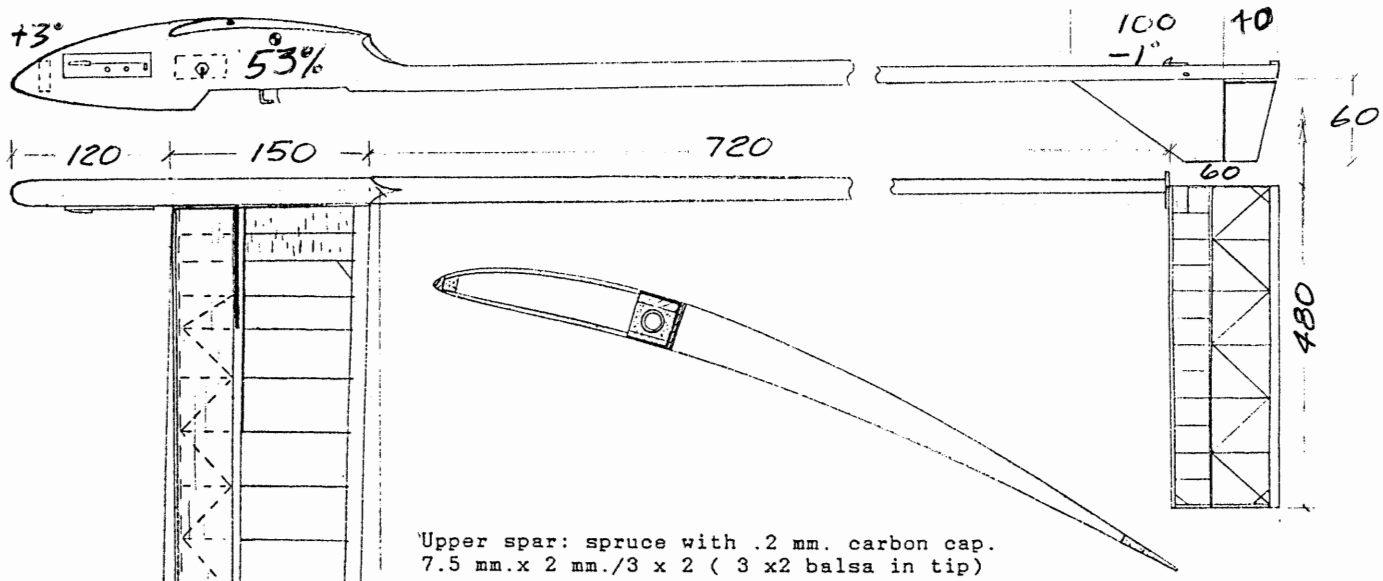
A U S T R A L I A

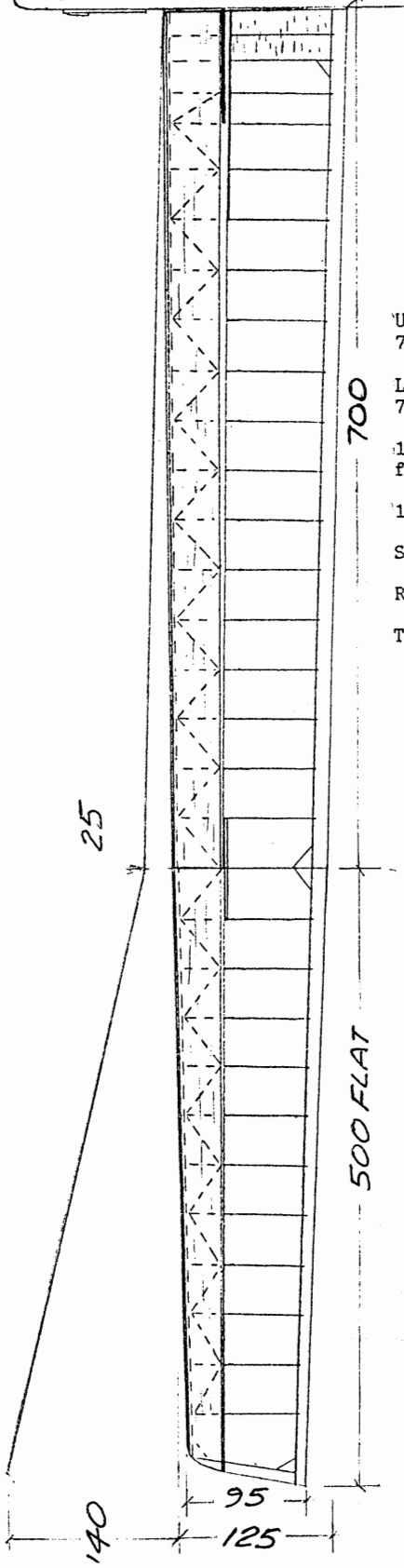
Pieter de Visser
F 1 A Bunt
D V 1 3

Wing joiner 5.5 mm piano wire tapered to 1.5 mm Diameter—Hard Chromed—160 mm long.

Warps for Right Hand Glide:

RH Inner	+1 mm
RH tip	-1 mm
LH Inner	-0.5 mm
LH tip	-3 mm





Upper spar: spruce with .2 mm. carbon cap.
7.5 mm.x 2 mm./3 x 2 (3 x2 balsa in tip)

Lower spar: spruce with .2 mm. carbon cap.
7.5 x 1.5 /3 x 1.5 / 2 x 1.

1 mm. balsa, .13 gm/cm3. 35 gm/m3 Kevlar covering; two layers for first 300 mm.

1.5 mm. ply reinforcement for first 170 mm.

Single 4 mm. wing wire.

Ribs: 2.5 mm. balsa, .25 gm/cm3.

Trailing edge: 3/1 x 12 mm. balsa, .35 gm/cm3, reinforced with boron.

AREAS AND WEIGHTS.

	AREA DM2.	WEIGHT GM.
Wing:	29.8	156
Tail:	4.0	9
Fuselage:	--	252
TOTAL:	33.8	417

EQUIPMENT.

Towhook:	Bradley (U.S.A.)
Timer:	Koster (DK.)
Transmitter:	Morgan (Aus.)
Boom:	Lewis (N.Z.)

WARPS.

Left tip: 4 mm. washout

Left inner: flat

Right inner: flat

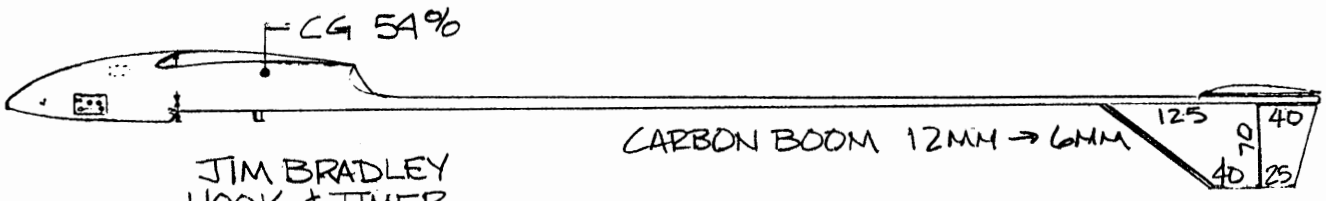
Right tip: 2 mm. washout

Glide right, 45 second circles.

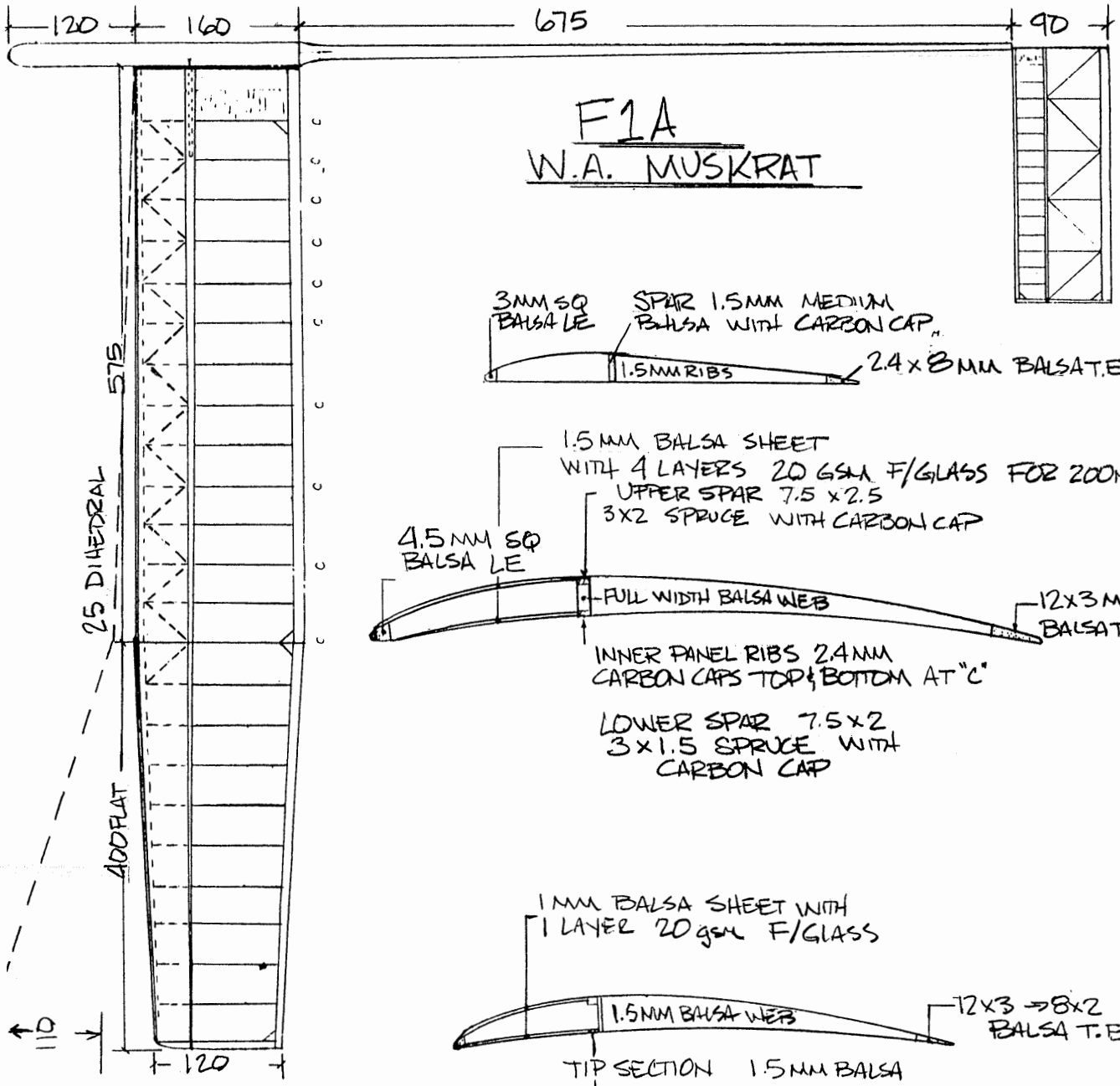
THE INELUCTABLE SNIKWAD.

MARTIN WILLIAMS

AUSTRALIA



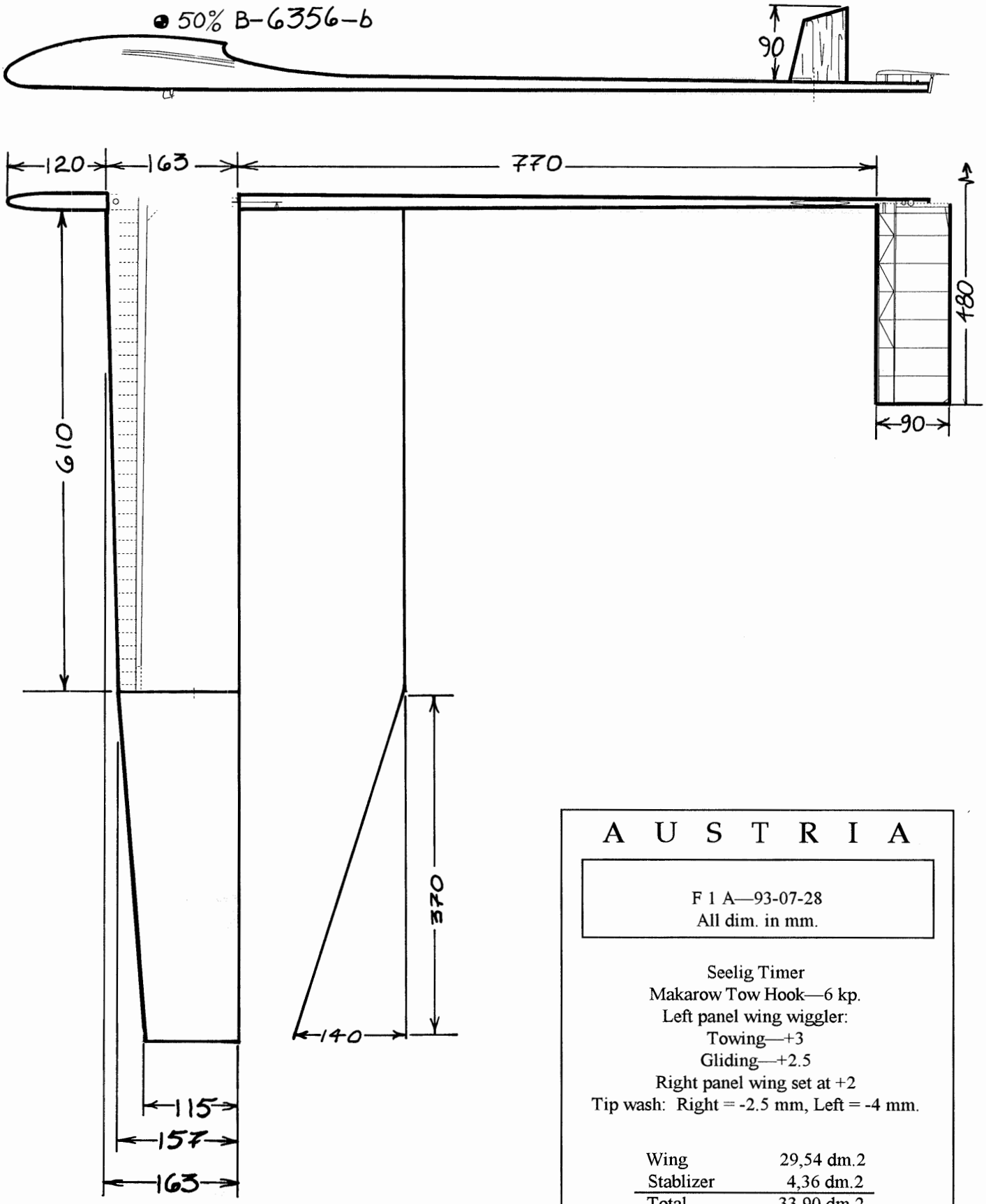
JIM BRADLEY
HOOK & TIMER
MORGAN TRANSMITTER



F1A
W.A. MUSKRAT

TIP SECTION 1.5MM BALSA
3 x 1.5 → 2 x 1 SPRUCE

WING & AREA	29.4 dm^2	WEIGHT	174 g
TAIL: AREA	4.5 dm^2	WEIGHT	9.5g
TOTAL	33.9 dm^2		41/6g



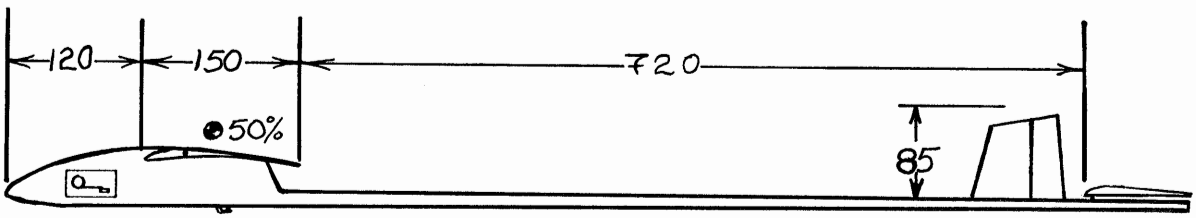
A U S T R I A

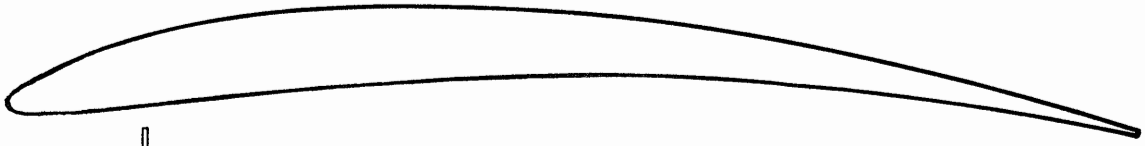
F 1 A—93-07-28
All dim. in mm.

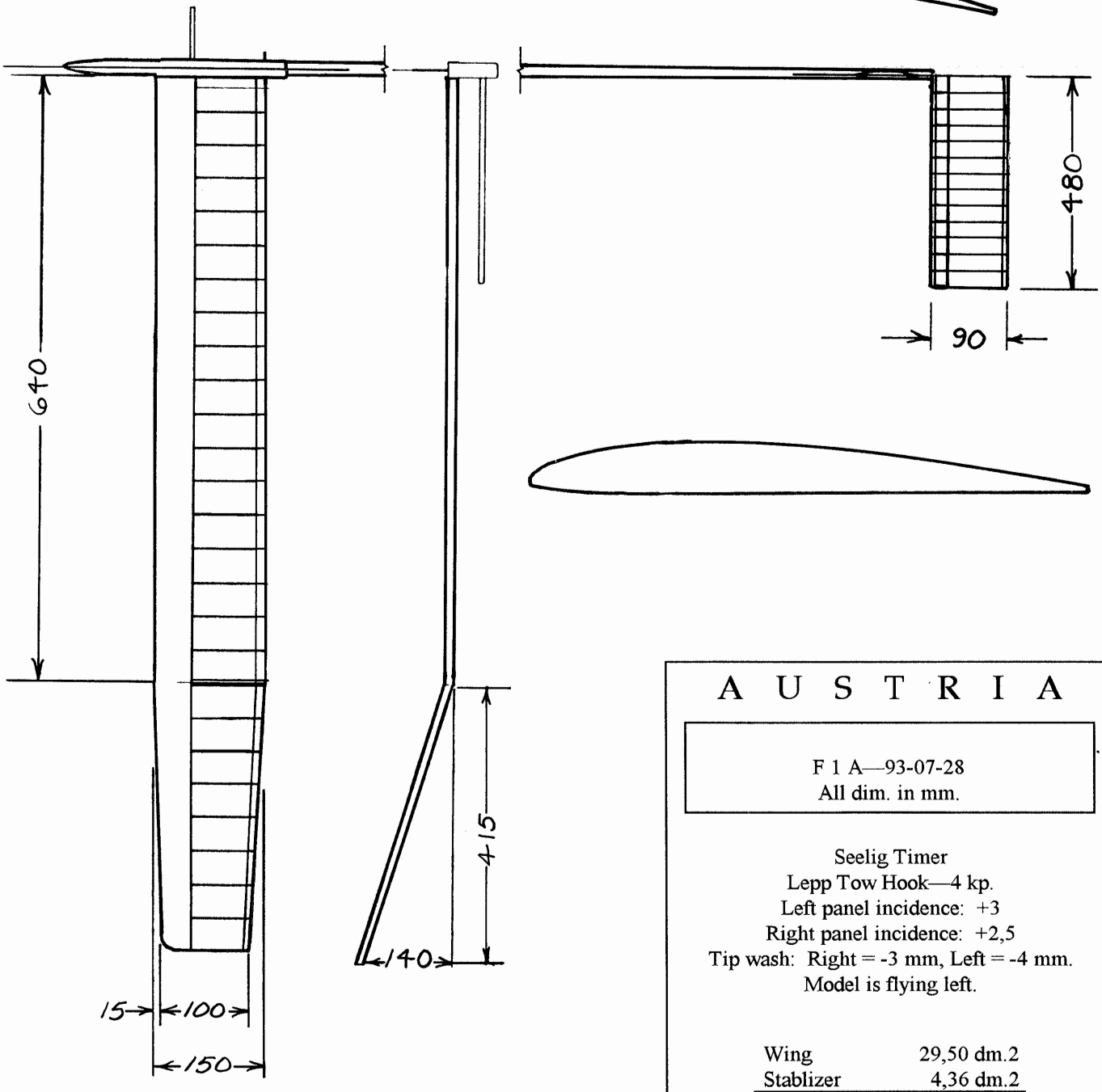
Seelig Timer
Makarow Tow Hook—6 kp.
Left panel wing wiggler:
Towing—+3
Gliding—+2.5
Right panel wing set at +2
Tip wash: Right = -2.5 mm, Left = -4 mm.

Wing	29,54 dm.2
Stablizer	4,36 dm.2
Total	33,90 dm.2

DIMENSIONS IN MILLIMETERS







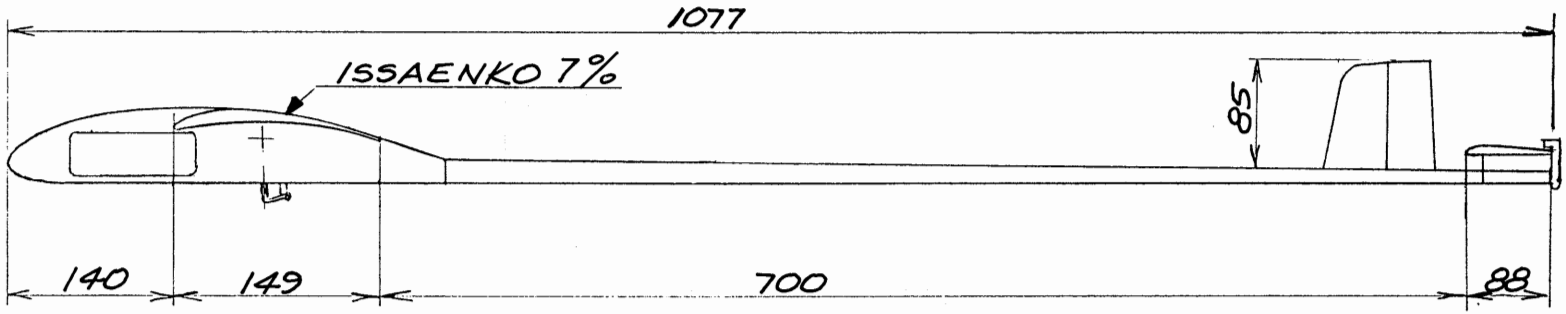
A U S T R I A

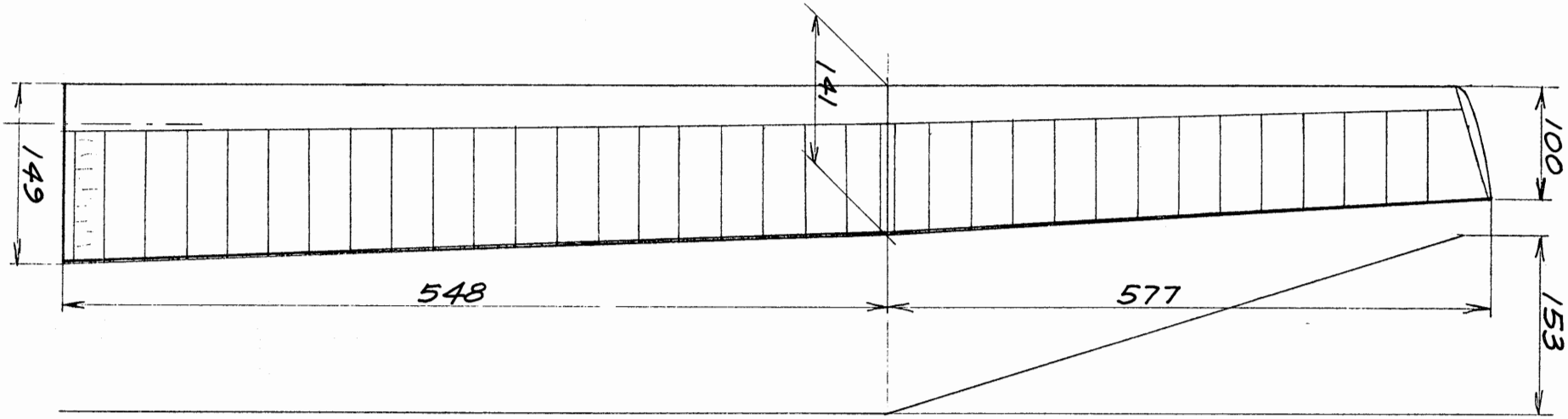
F 1 A—93-07-28
All dim. in mm.

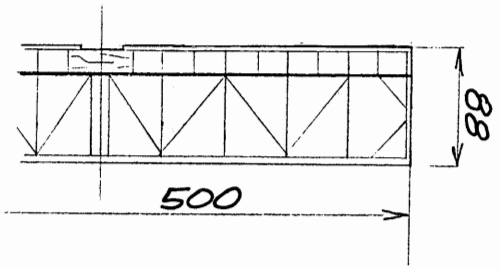
Seelig Timer
Lepp Tow Hook—4 kp.
Left panel incidence: +3
Right panel incidence: +2,5
Tip wash: Right = -3 mm, Left = -4 mm.
Model is flying left.

Wing	29,50 dm.2
Stablizer	4,36 dm.2
Total	33,86 dm.2

DIMENSIONS IN MILLIMETERS







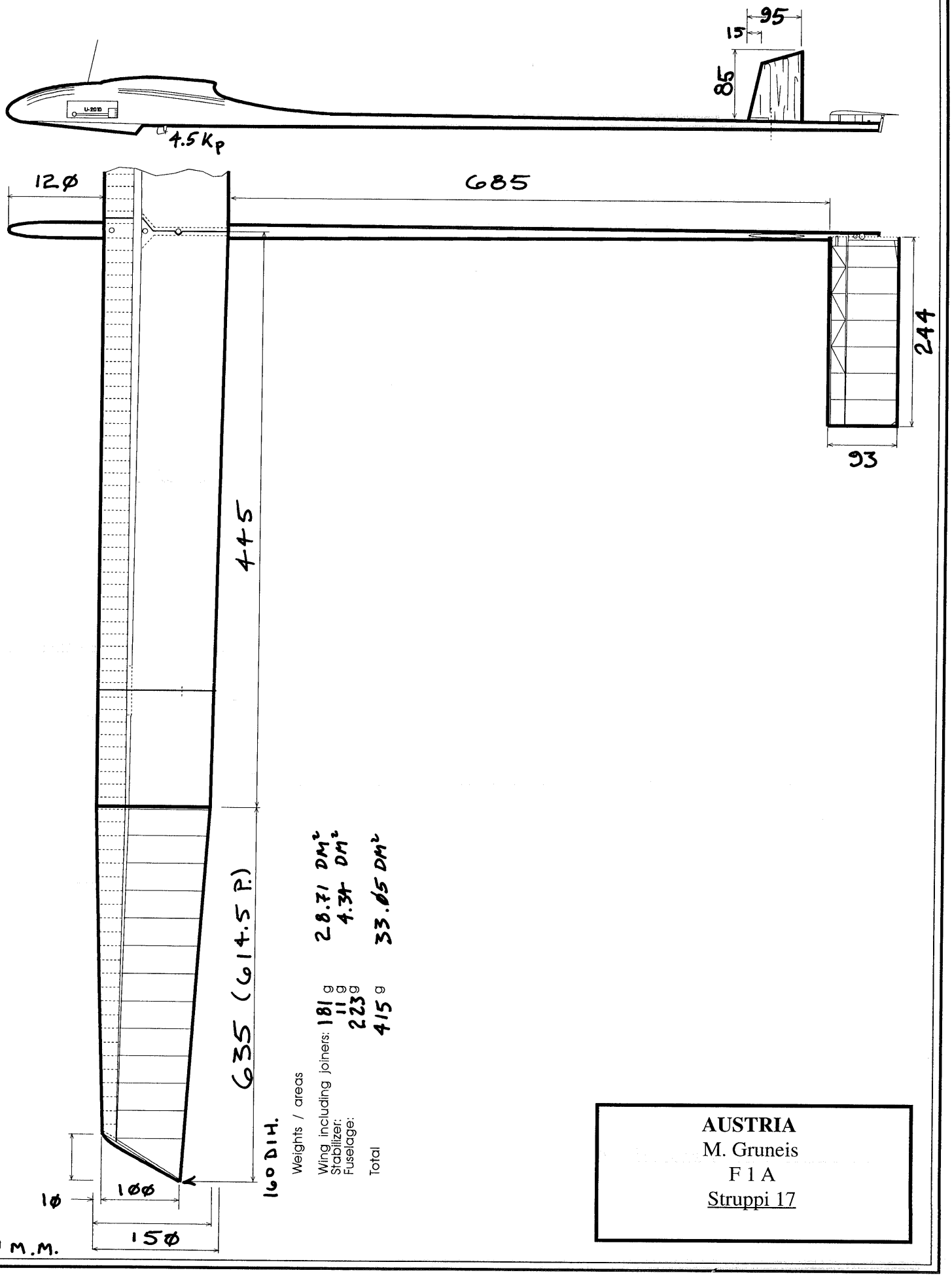
BUNT SYSTEM - ISSAENKO

AREAS: WING - 29.30 dm²
STAB - 4.40dm²

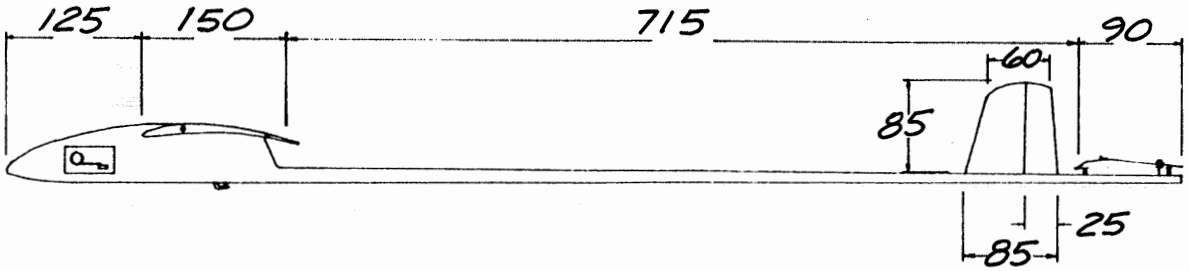
WEIGHTS: WING - 188 g
FUSE - 222g
STAB - 12 g

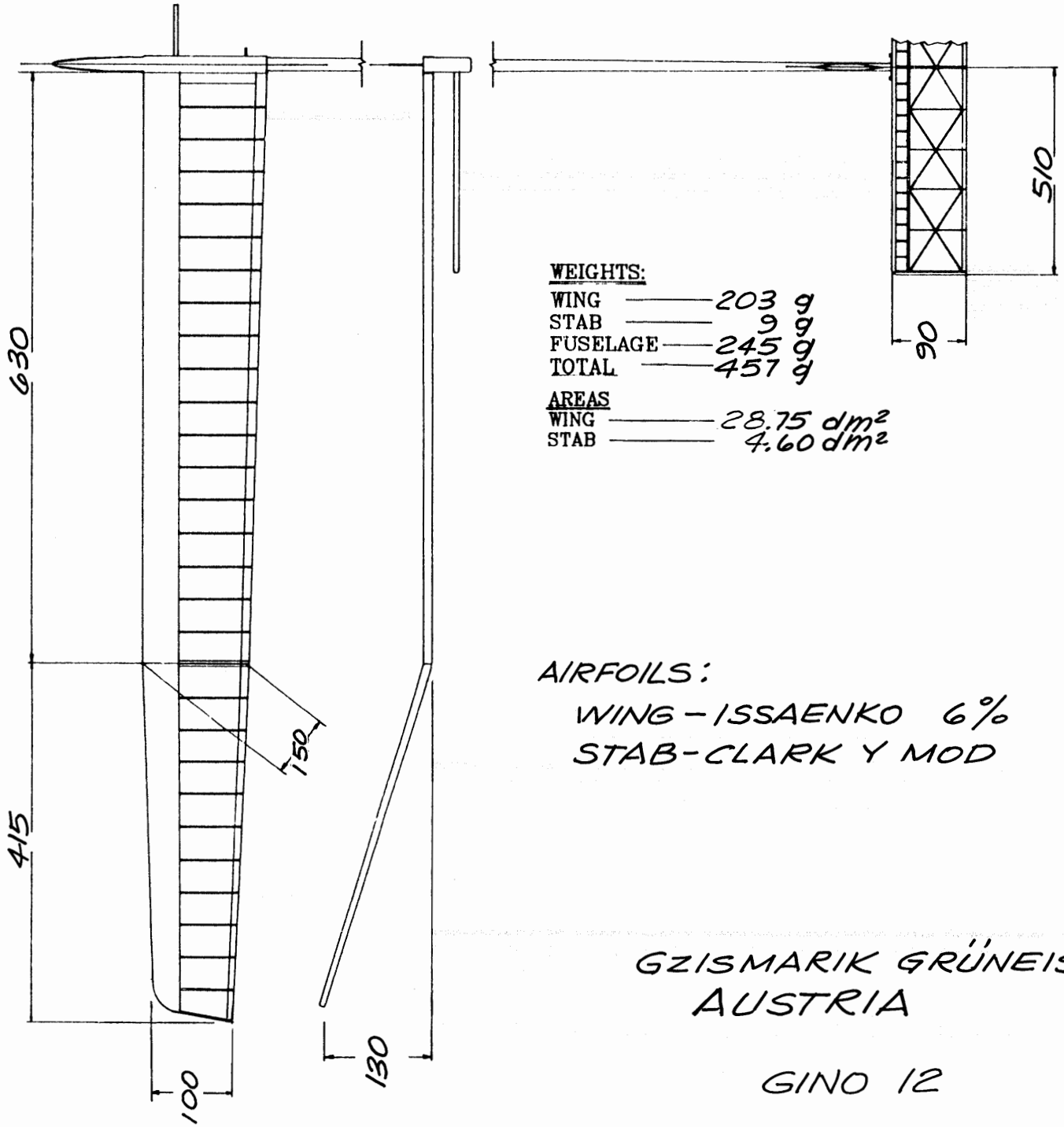
M. GRÜNEIS
AUSTRIA

DIMENSIONS IN MILLIMETERS



AUSTRIA
M. Gruneis
F 1 A
Struppi 17





WEIGHTS:

WING	203 g
STAB	9 g
FUSELAGE	245 g
TOTAL	457 g

AREAS

WING	28.75 dm²
STAB	4.60 dm²

AIRFOILS:

WING – ISSAENKO 6%

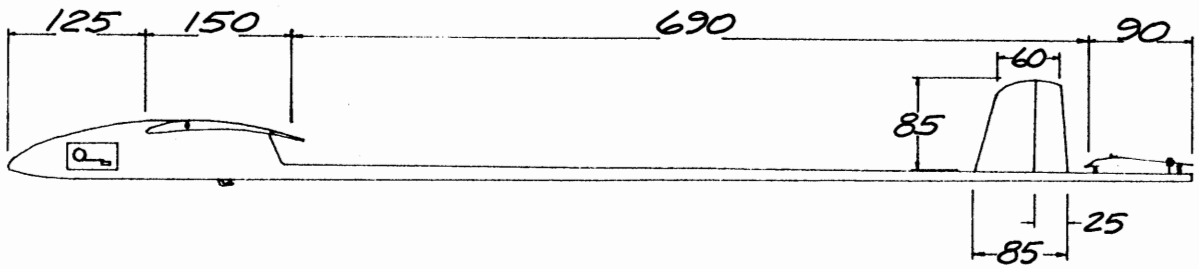
STAB – CLARK Y MOD

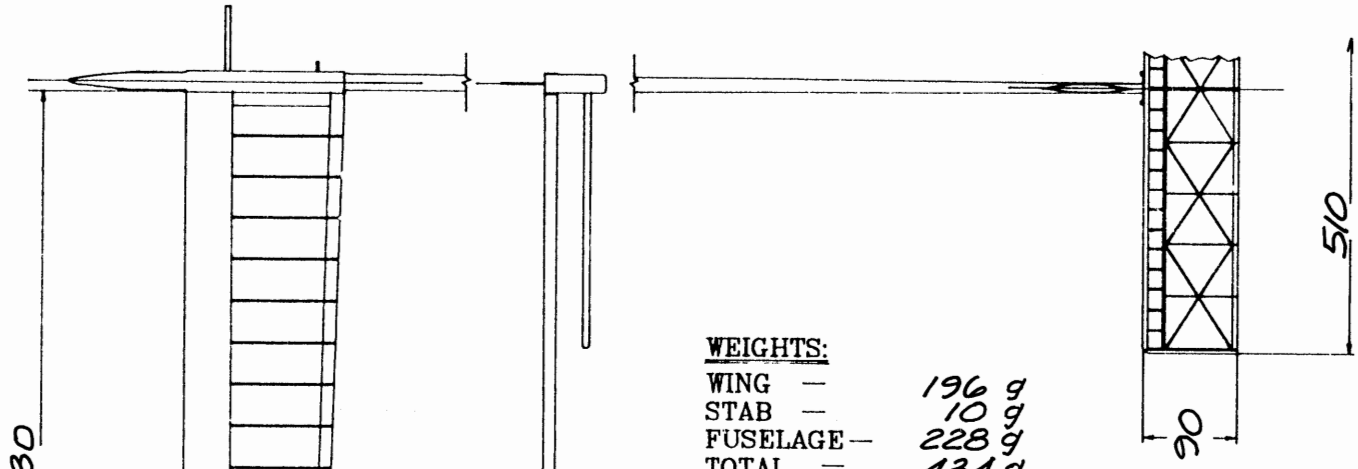
GZISMARIK GRÜNEIS

AUSTRIA

GINO 12

DIMENSIONS IN MILLIMETERS



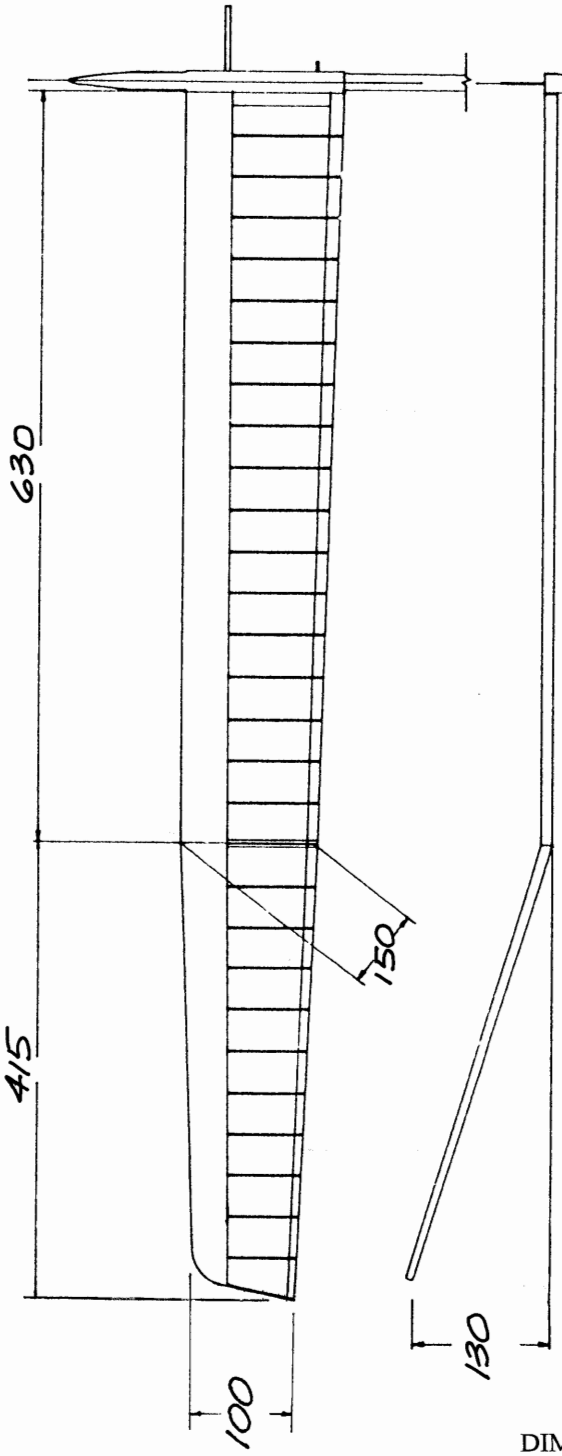


WEIGHTS:

WING —	196 g
STAB —	10 g
FUSELAGE —	228 g
TOTAL —	434 g

AREAS

WING —	28.75 dm²
STAB —	4.60 dm²

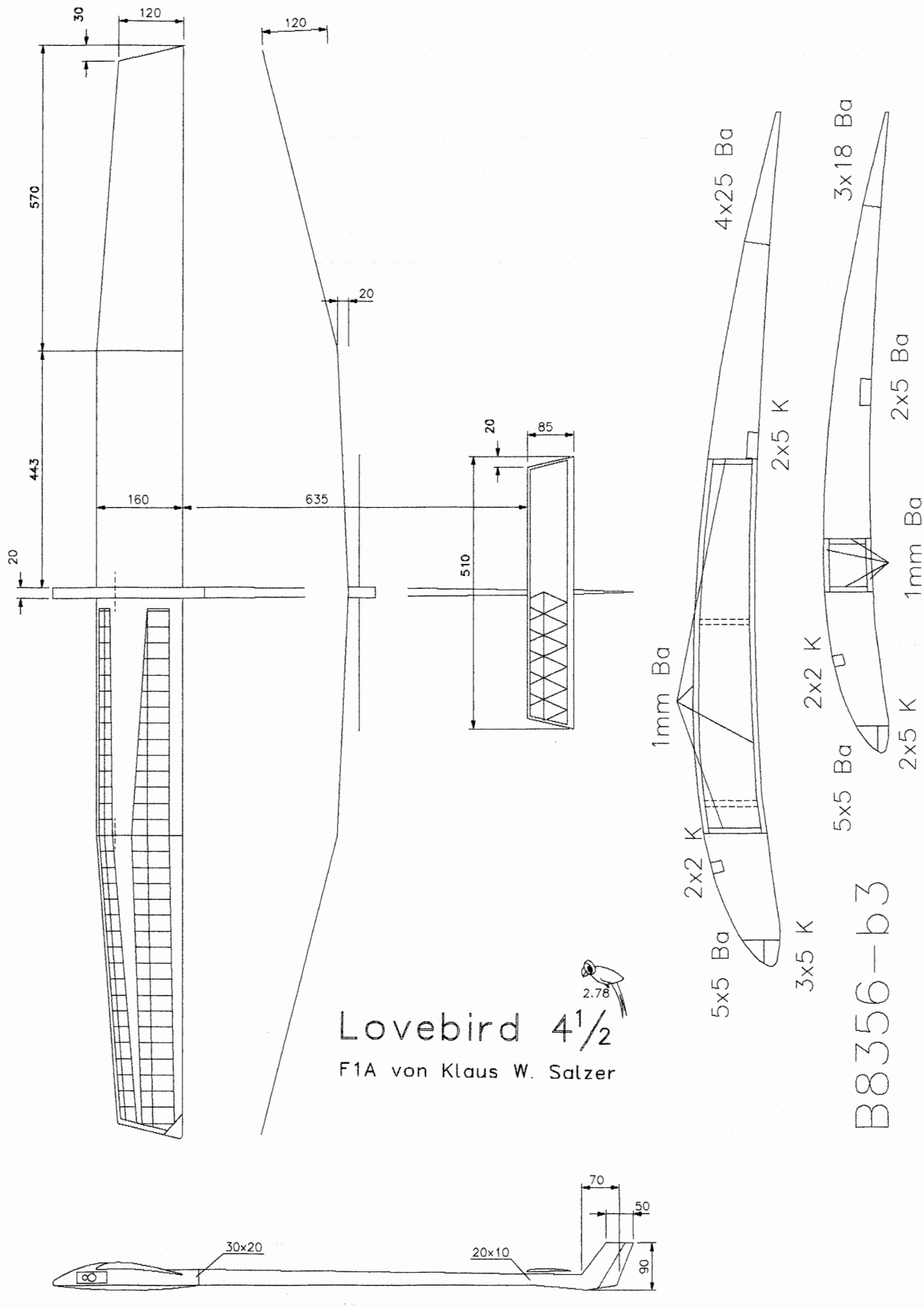


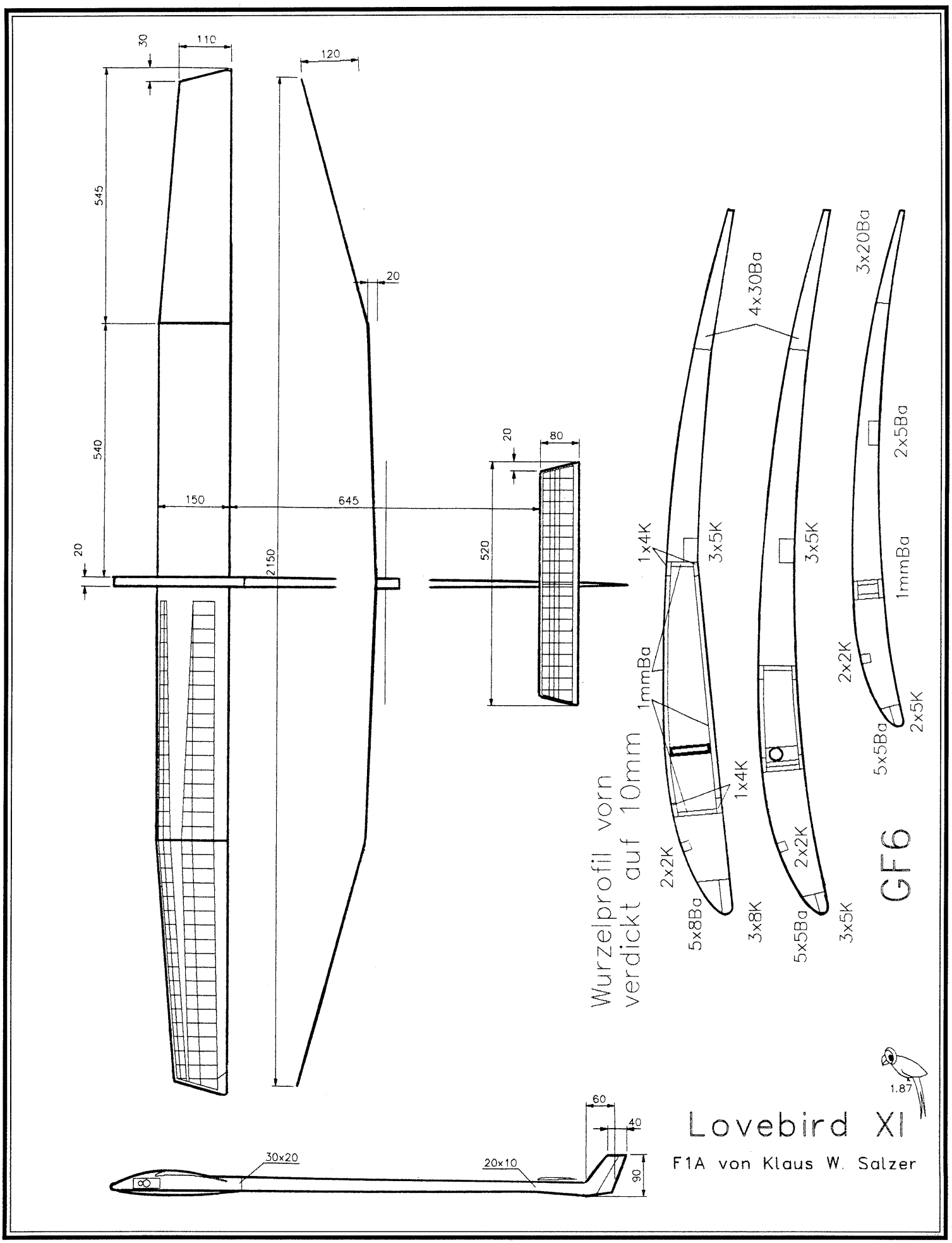
AIRFOILS:
WING – ISSAENKO 6%
STAB – CLARK Y

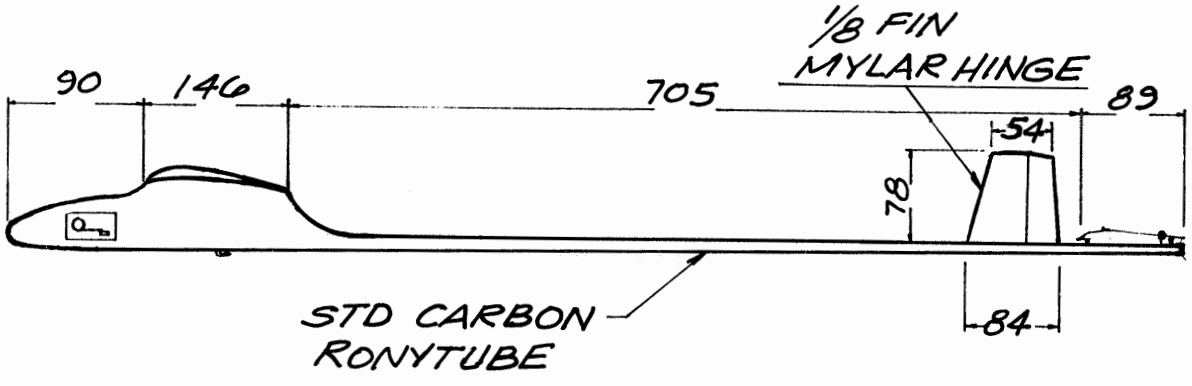
CZISMARIK GRÜNEIS
AUSTRIA

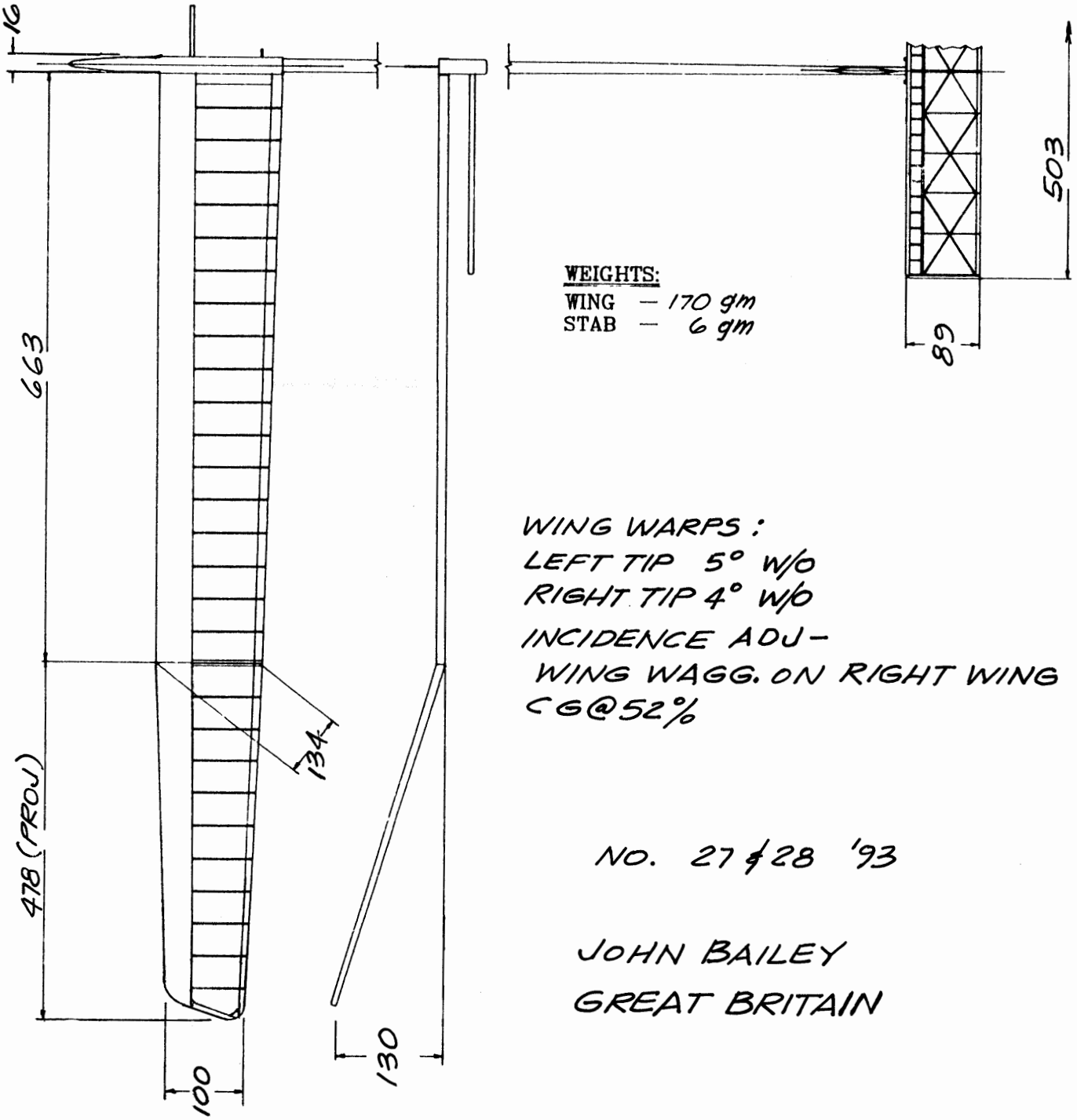
GINO 13

DIMENSIONS IN MILLIMETERS


30
120
120
570
20
443
160
635
20
85
20
510
4x25 Ba
2x5 K
1mm Ba
2x2 K
5x5 Ba
3x5 K
3x18 Ba
2x5 Ba
1mm Ba
2x2 K
2x5 K
5x5 Ba
2.78
Lovebird 4½
F1A von Klaus W. Salzer
B8356-b3
70
50
30x20
20x10
90


30
110
120
545
20
540
150
645
20
2150
20
80
520
Wurzelprofil vorn
verdickt auf 10mm
1x4K
3x5K
1mmBa
2x2K
5x8Ba
1x4K
4x30Ba
3x5K
2x2K
3x8K
5x5Ba
3x5K
3x20Ba
2x5Ba
1mmBa
2x2K
5x5Ba
2x5K
GF6
60
40
30x20
20x10
90
1.87
Lovebird XI
F1A von Klaus W. Salzer





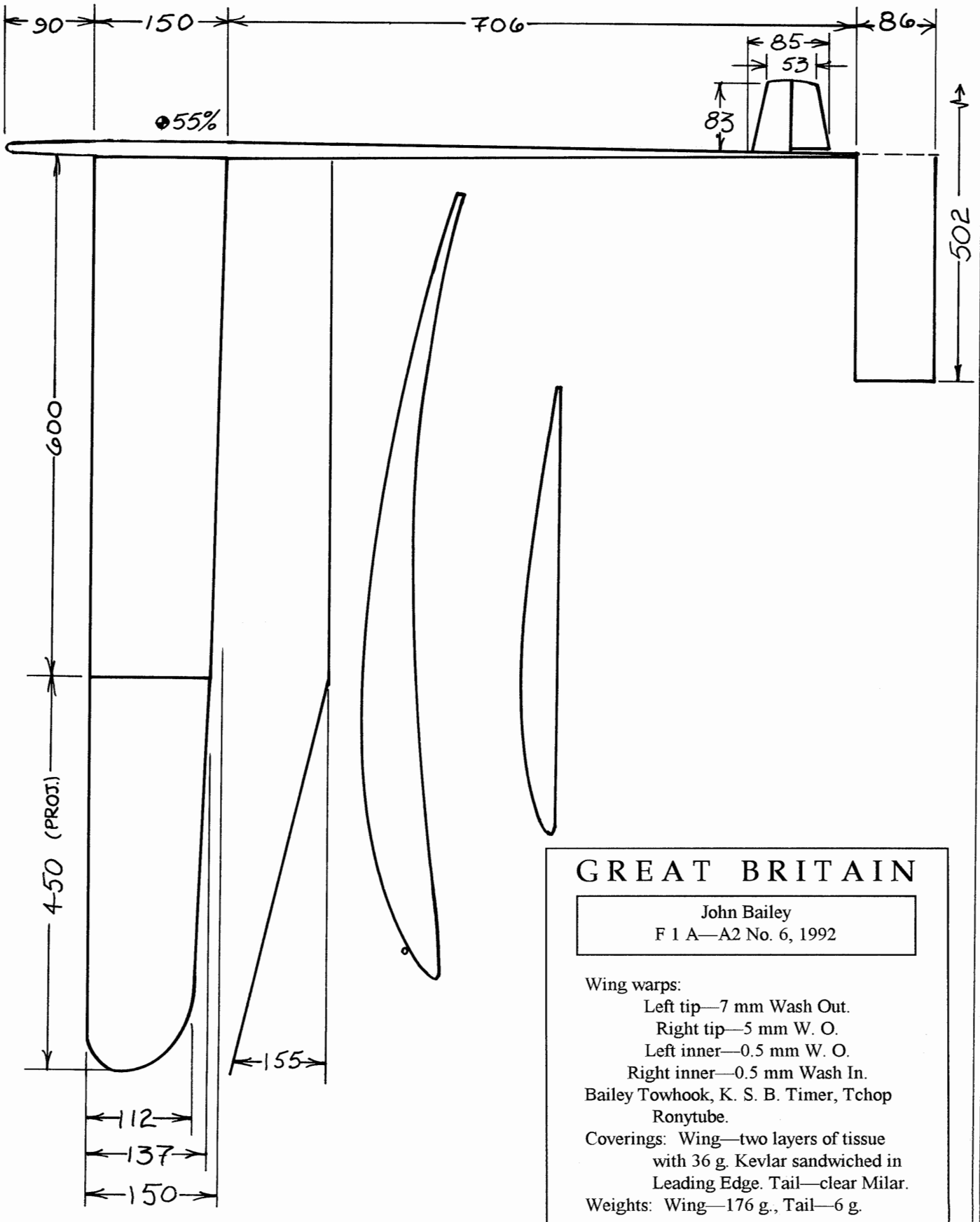
WEIGHTS:
WING — 170 gm
STAB — 6 gm

WING WARPS:
LEFT TIP 5° W/O
RIGHT TIP 4° W/O
INCIDENCE ADJ-
WING WAGG. ON RIGHT WING
CG@52%

NO. 27 & 28 '93

JOHN BAILEY
GREAT BRITAIN

DIMENSIONS IN MILLIMETERS

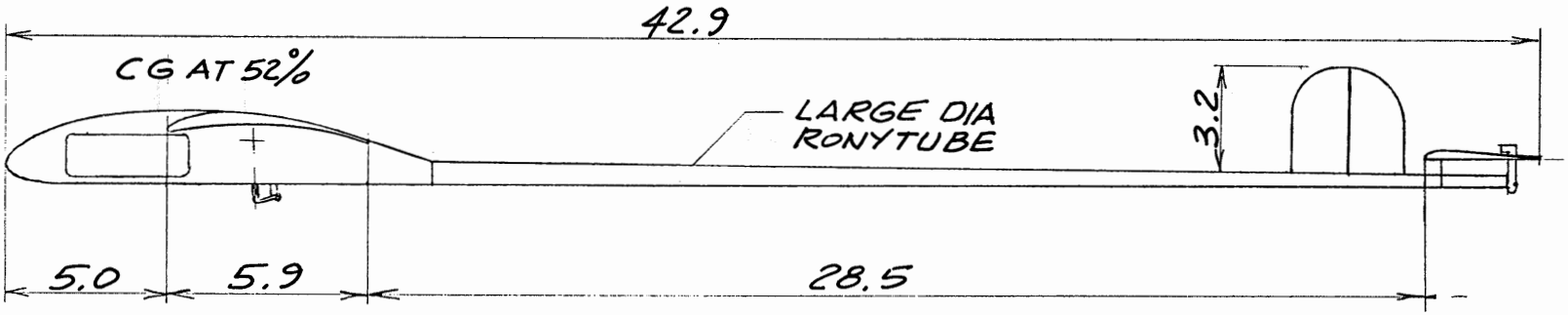


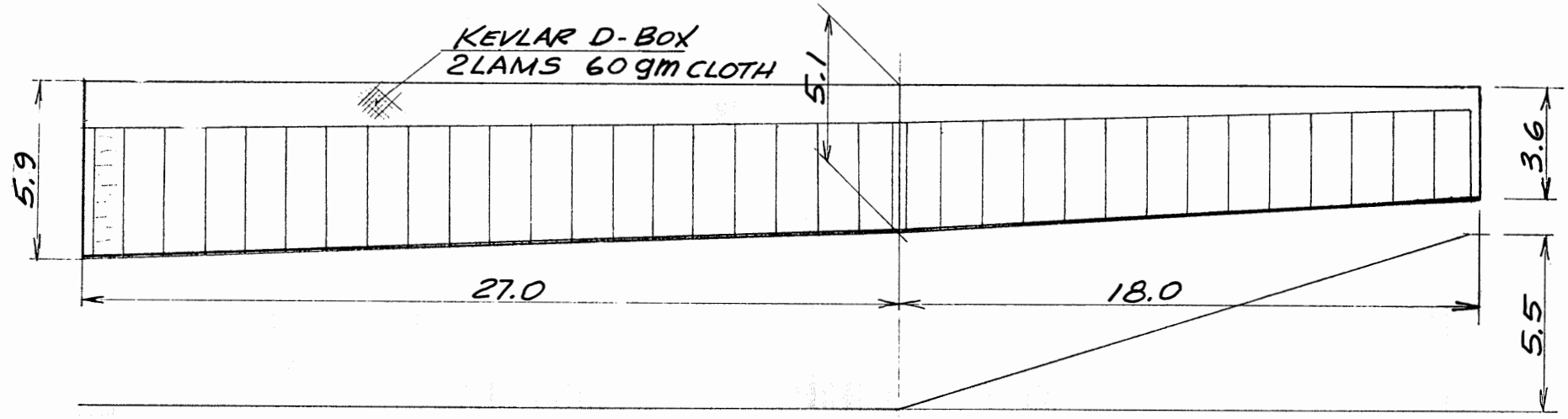
DIMENSIONS IN MILLIMETERS

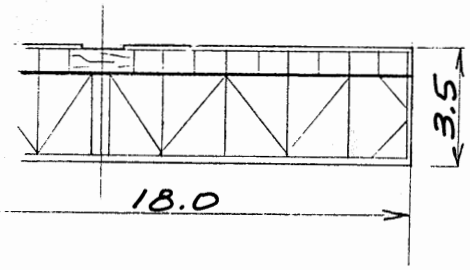
GREAT BRITAIN

John Bailey
F 1 A—A2 No. 6, 1992

Wing warps:
Left tip—7 mm Wash Out.
Right tip—5 mm W. O.
Left inner—0.5 mm W. O.
Right inner—0.5 mm Wash In.
Bailey Towhook, K. S. B. Timer, Tchop Ronytube.
Coverings: Wing—two layers of tissue with 36 g. Kevlar sandwiched in Leading Edge. Tail—clear Milar.
Weights: Wing—176 g., Tail—6 g.



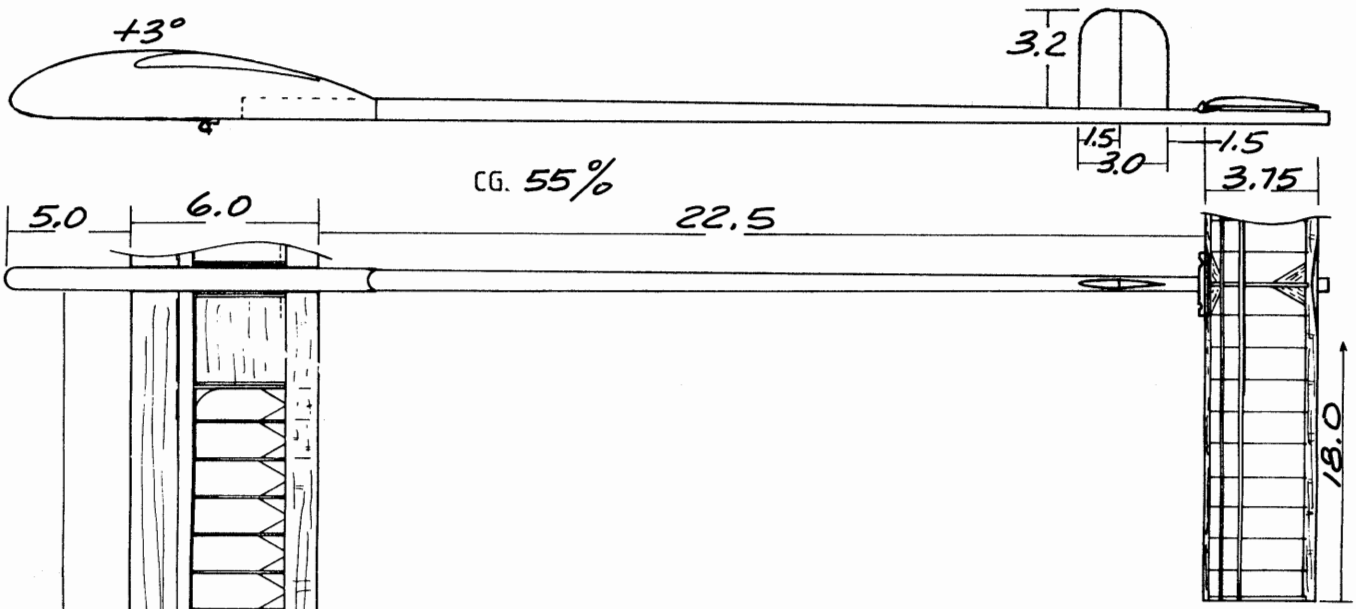


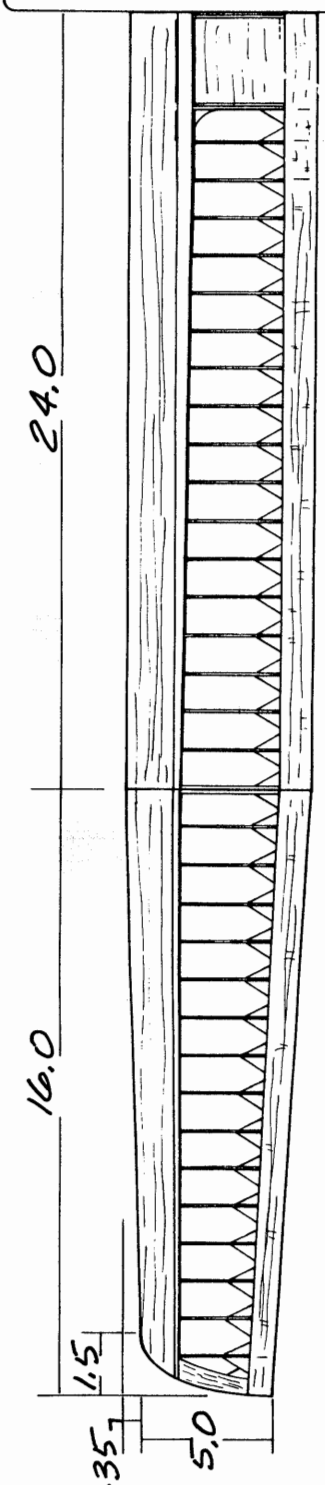


WEIGHTS:
WING- 200
TAIL- 9
JOINER- 26
FUSE- 190
TOTAL 425

JOHN COOPER
GREAT BRITAIN
MODEL NO 35

DIMENSIONS IN INCHES





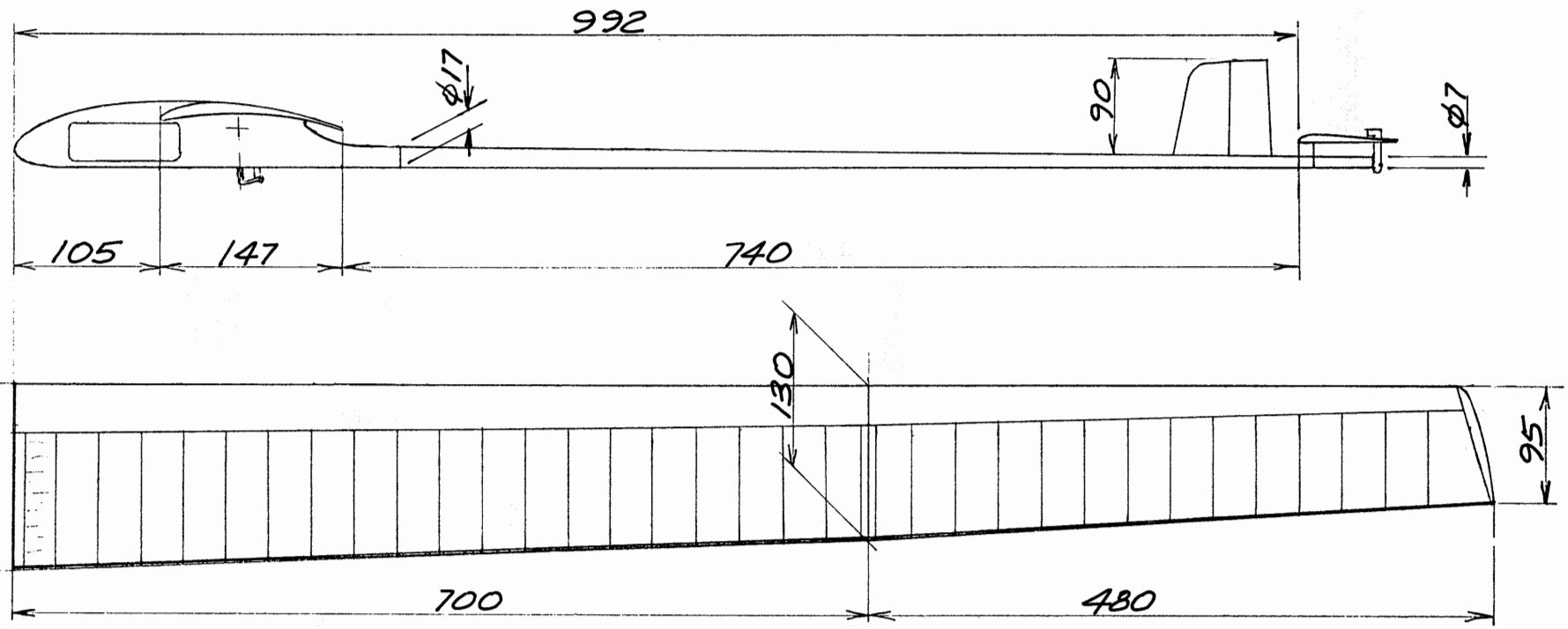
WEIGHTS:

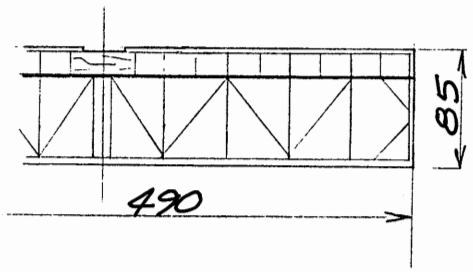
WING	202
TAIL	10
JOINER	17
FUSELAGE	195
TOTAL	424

DIHEDRAL:
TIP 5.75
C/P FLAT

JOHN COOPER
GREAT BRITAIN
MODEL NO. 30

DIMENSIONS IN INCHES

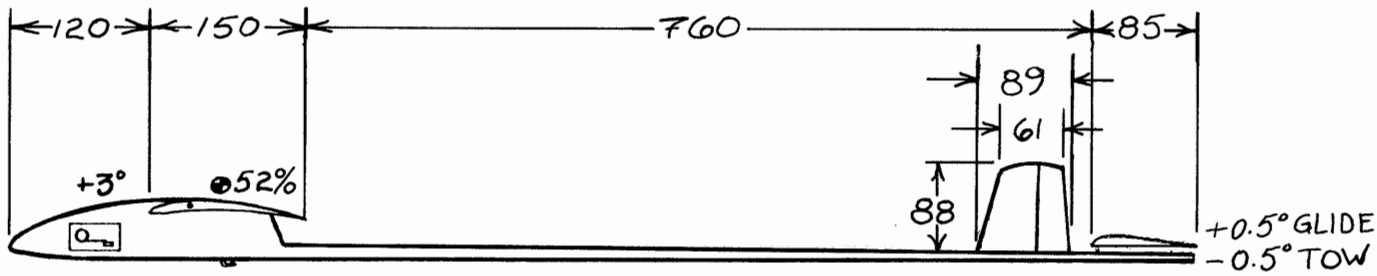


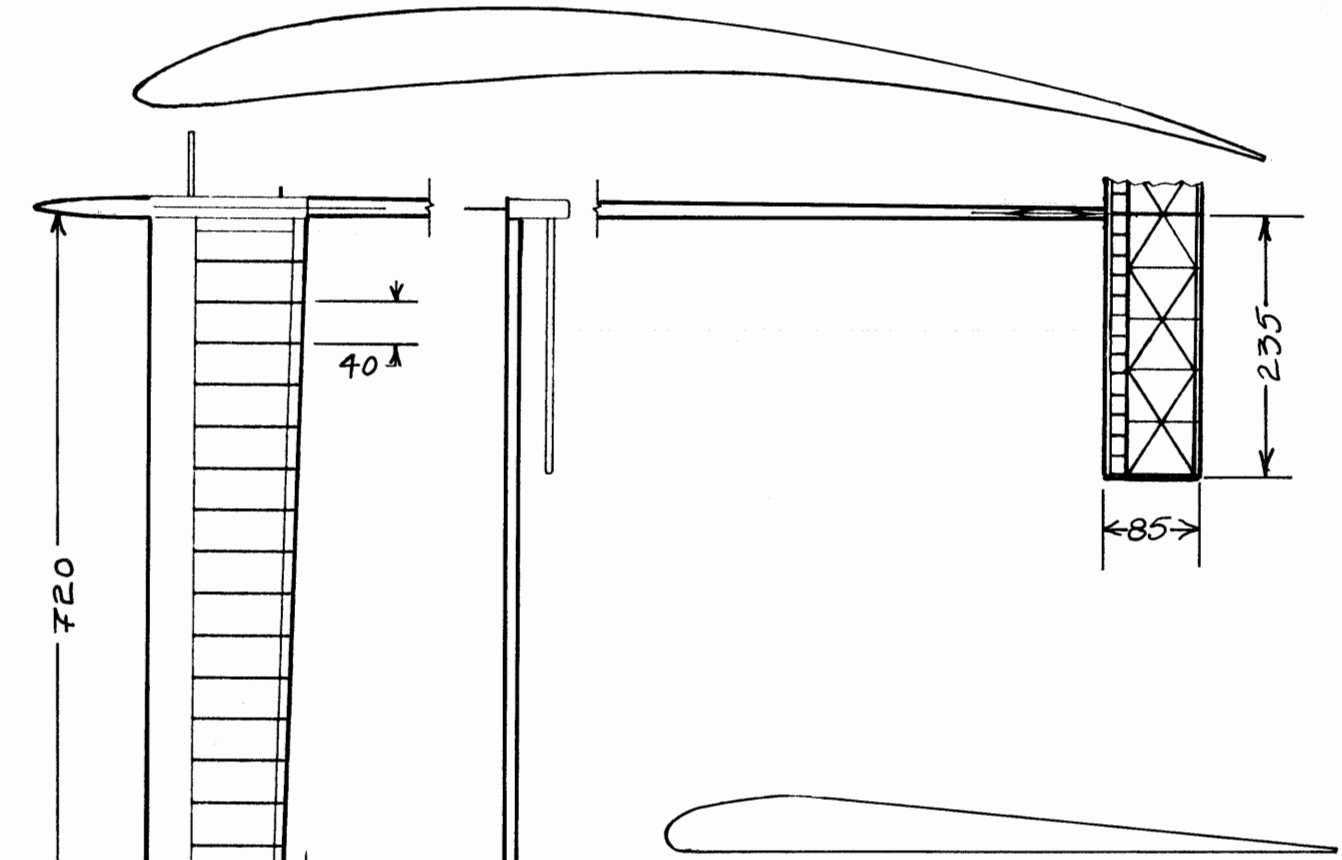


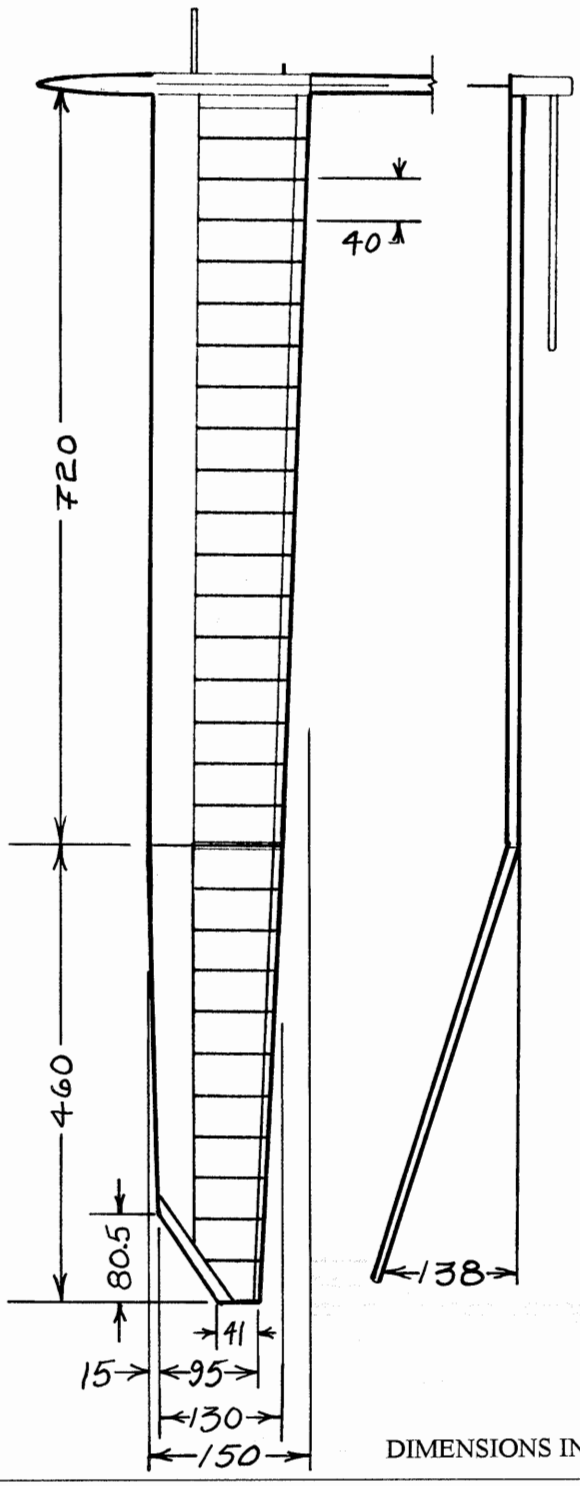
WING AREA - 29.84 dm²
STAB AREA - 4.16 dm²
WEIGHT - 415 g

THE BULGARIAN TEAM

DIMENSIONS IN MILLIMETERS





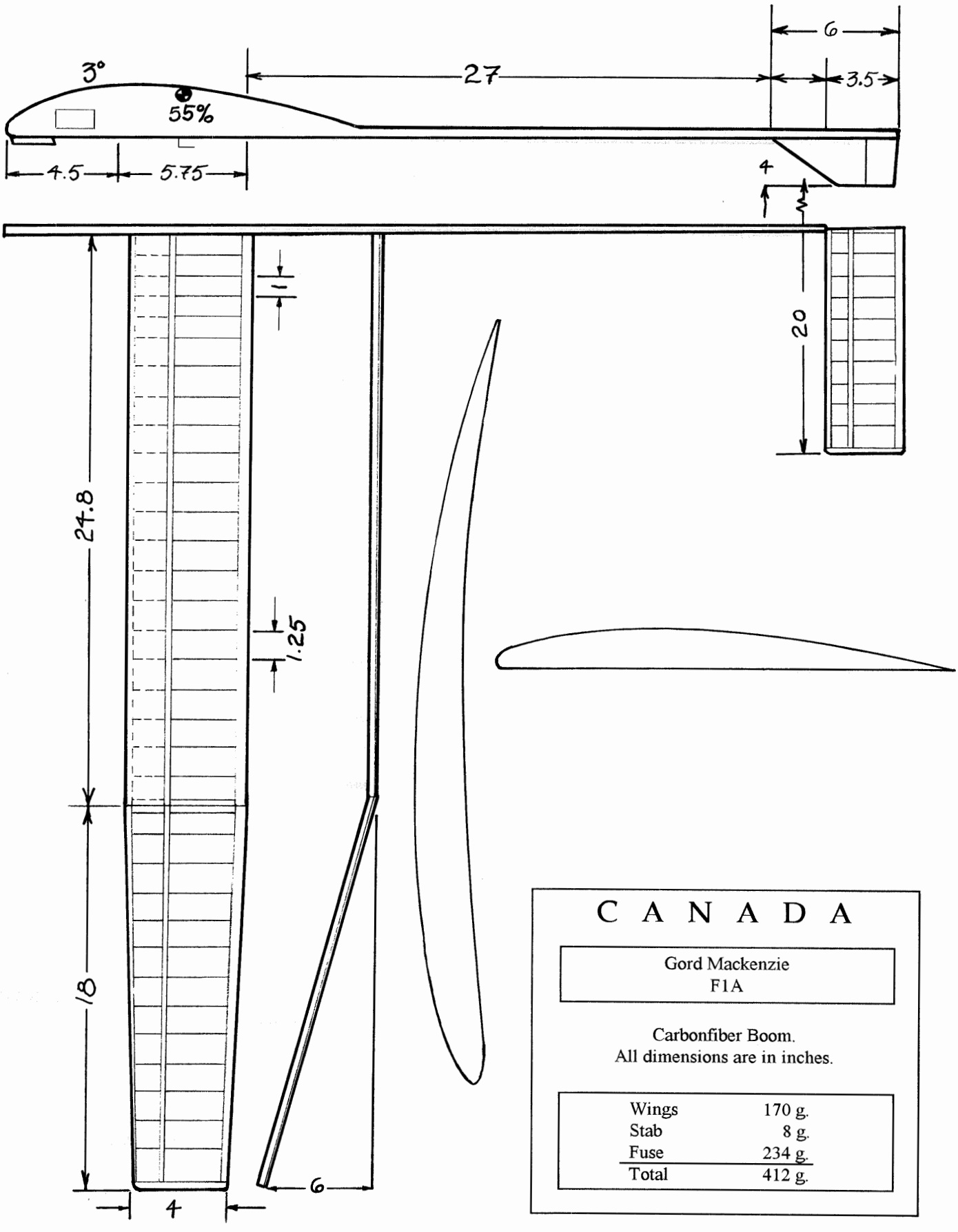


C A N A D A

Peter Allnutt
F 1 A PA—49
Silver Hammer Mk II

Wing	155 g.	29.32 dm.2
Stabilizer	7 g.	4.00 dm.2
Fuselage	253 g.	
Total	415 g.	33.32 dm.2

DIMENSIONS IN MILLIMETERS



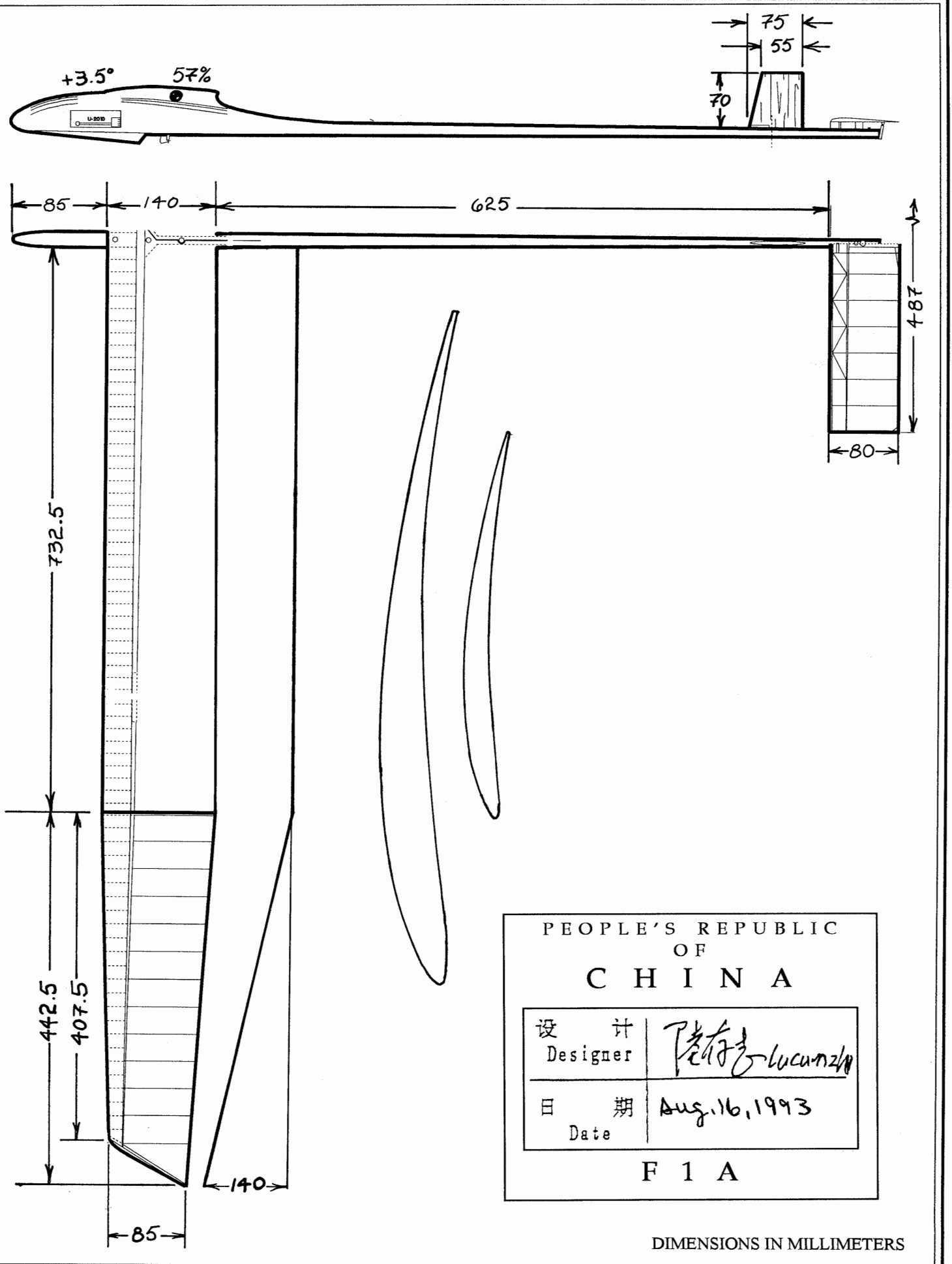
C A N A D A

Gord Mackenzie
F1A

Carbonfiber Boom.
All dimensions are in inches.

Wings	170 g.
Stab	8 g.
Fuse	234 g.
Total	412 g.

DIMENSIONS IN INCHES

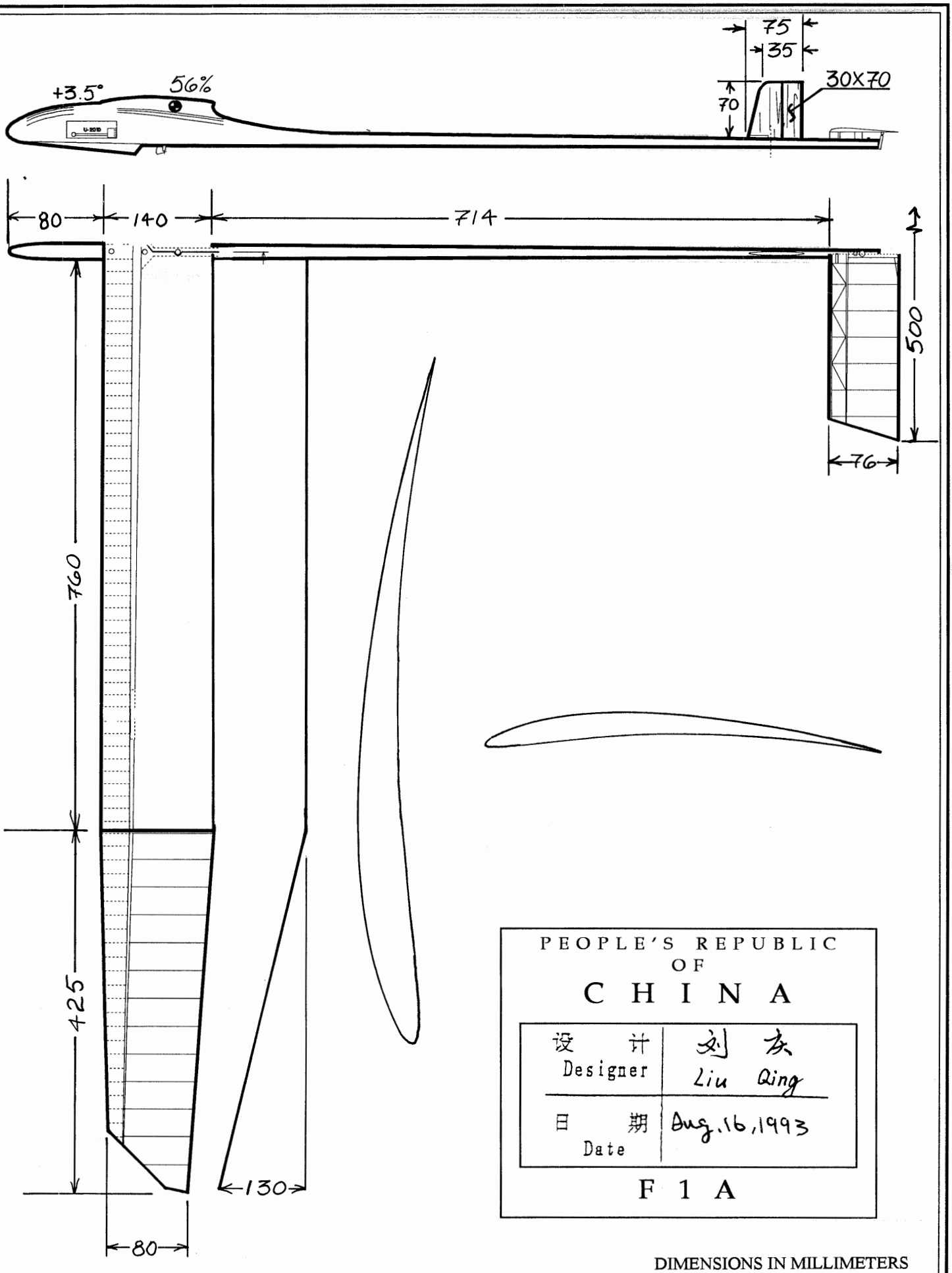


PEOPLE'S REPUBLIC
OF
C H I N A

设　计 Designer	陆存忠 Lucunzhong
日　期 Date	Aug. 16, 1993

F 1 A

DIMENSIONS IN MILLIMETERS

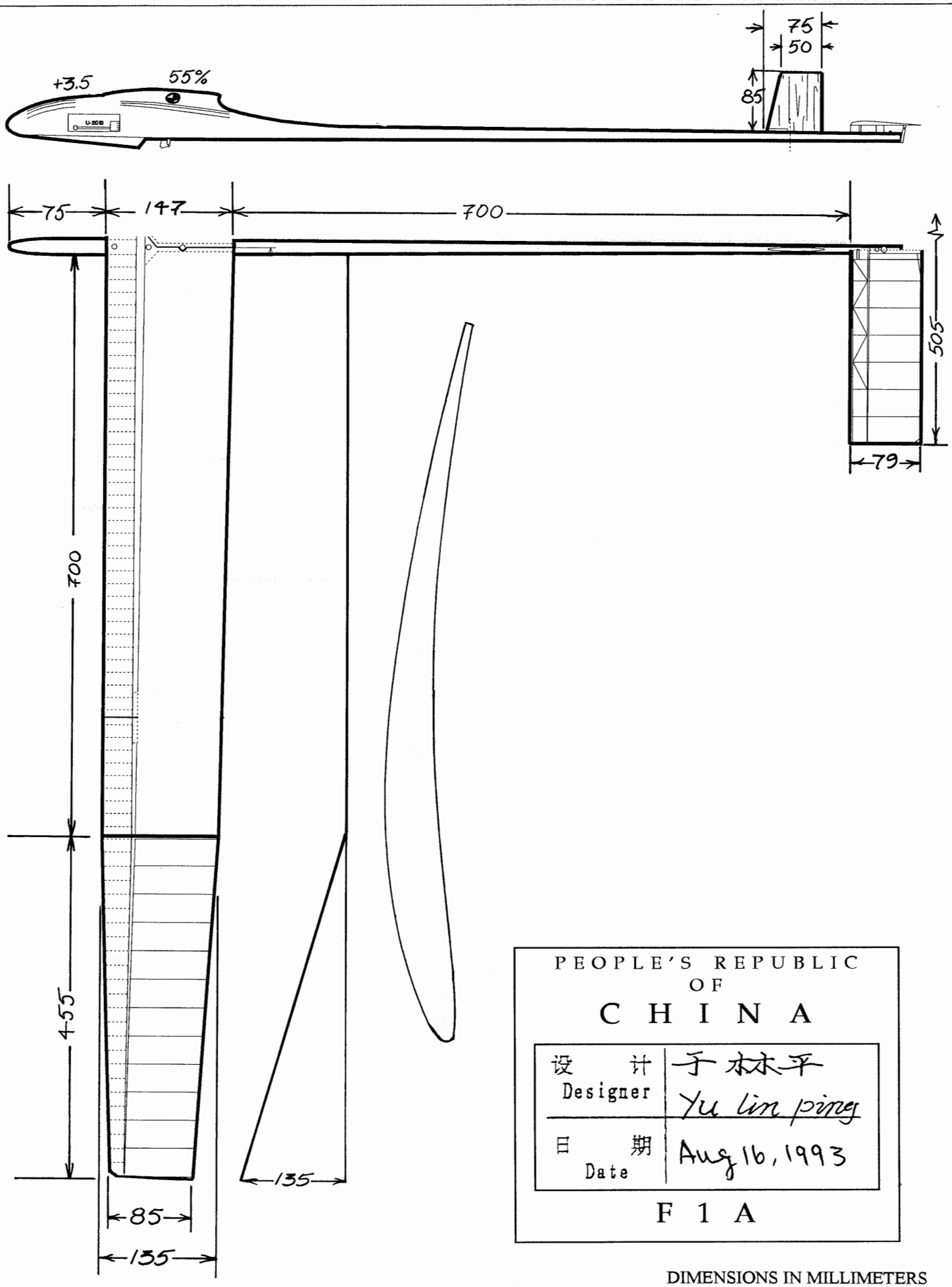


PEOPLE'S REPUBLIC
OF
CHINA

设 计 Designer	刘 庆 Liu Qing
日 期 Date	Aug.16,1993

F 1 A

DIMENSIONS IN MILLIMETERS

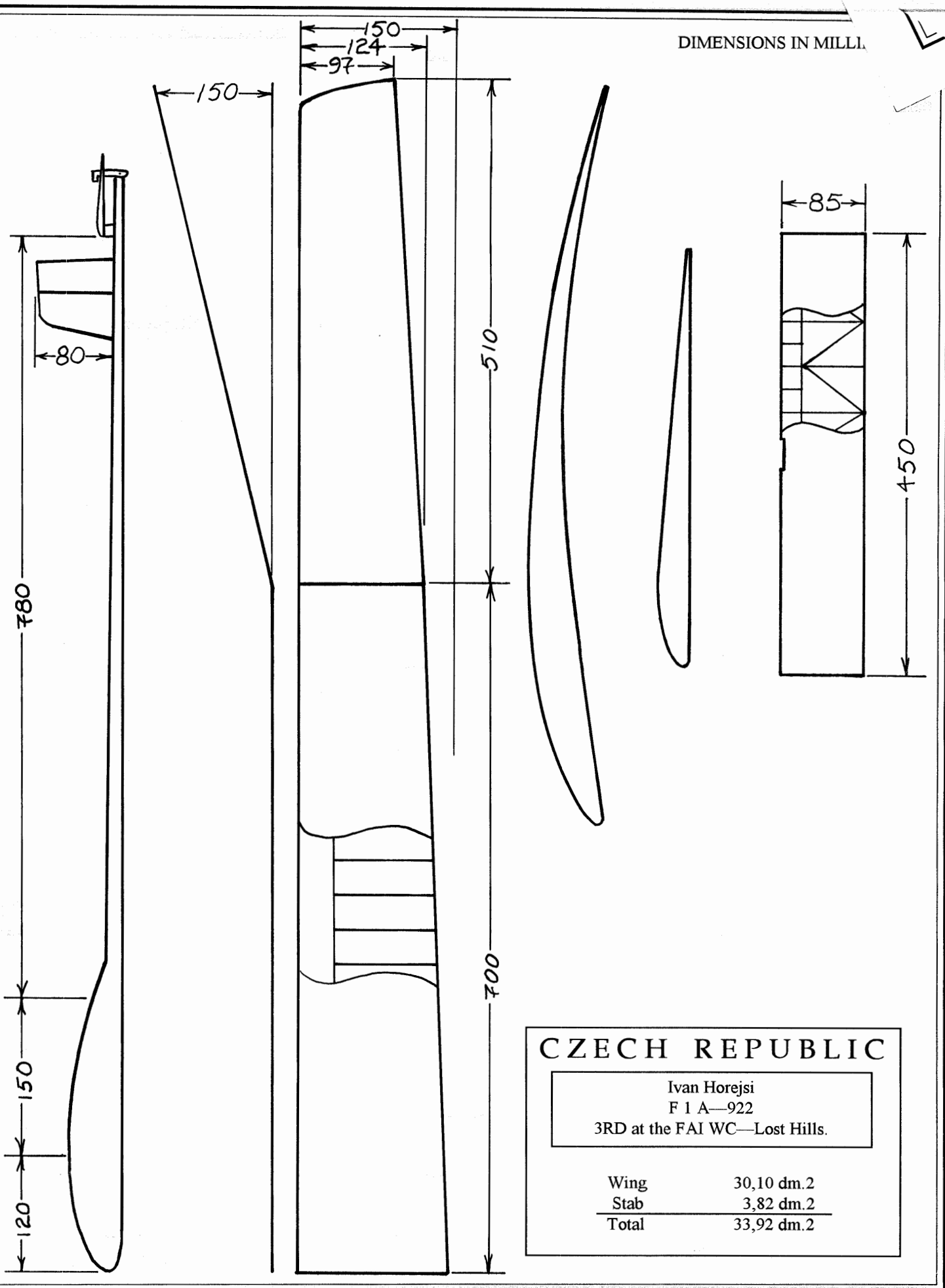


PEOPLE'S REPUBLIC
OF
CHINA

设　计 Designer	于林平 Yu lin ping
日　期 Date	Aug 16, 1993

F 1 A

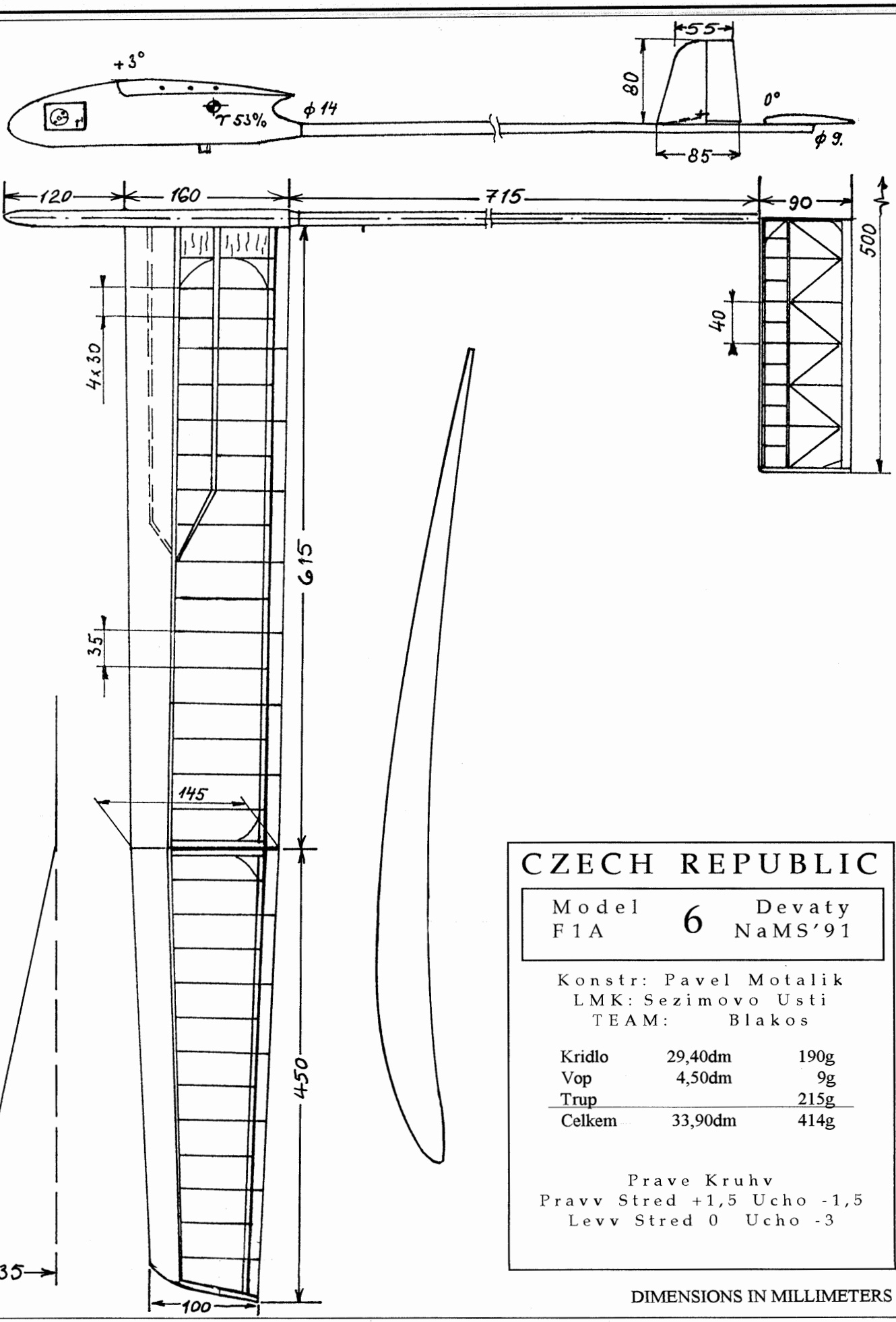
DIMENSIONS IN MILLIMETERS



CZECH REPUBLIC

Ivan Horejsi
F 1 A—922
3RD at the FAI WC—Lost Hills.

Wing	30,10 dm.2
Stab	3,82 dm.2
Total	33,92 dm.2



CZECH REPUBLIC

Model 6 Devaty
F1A NaMS'91

Konstr: Pavel Motalik
LMK: Sezimovo Usti
TEAM: Blakos

Kridlo	29,40dm	190g
Vop	4,50dm	9g
Trup		215g
Celkem	33,90dm	414g

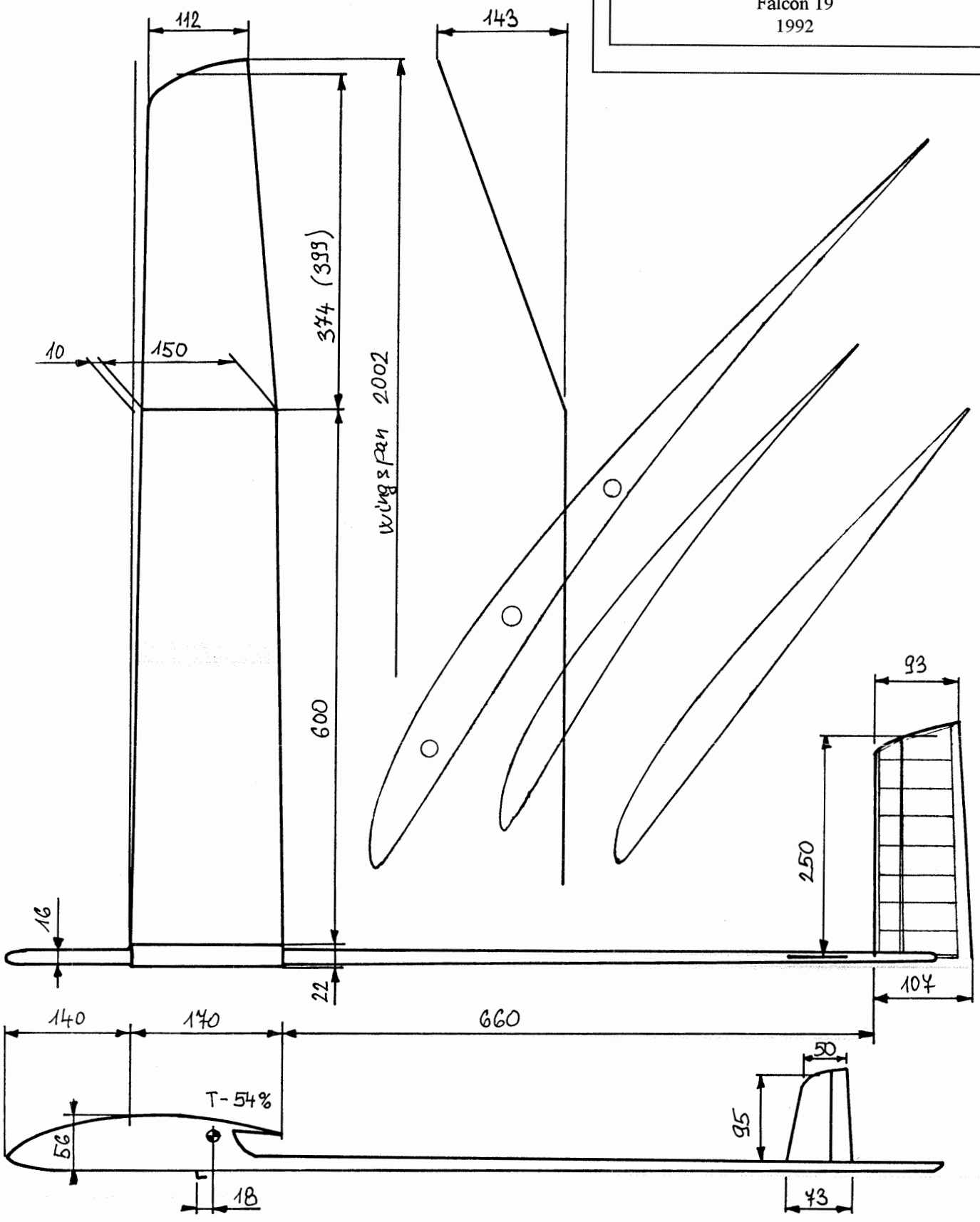
Prave Kruhv
Pravv Stred +1,5 Ucho -1,5
Levv Stred 0 Ucho -3

DIMENSIONS IN MILLIMETERS

DIMENSIONS IN MILLIMETERS

CZECH REPUBLIC

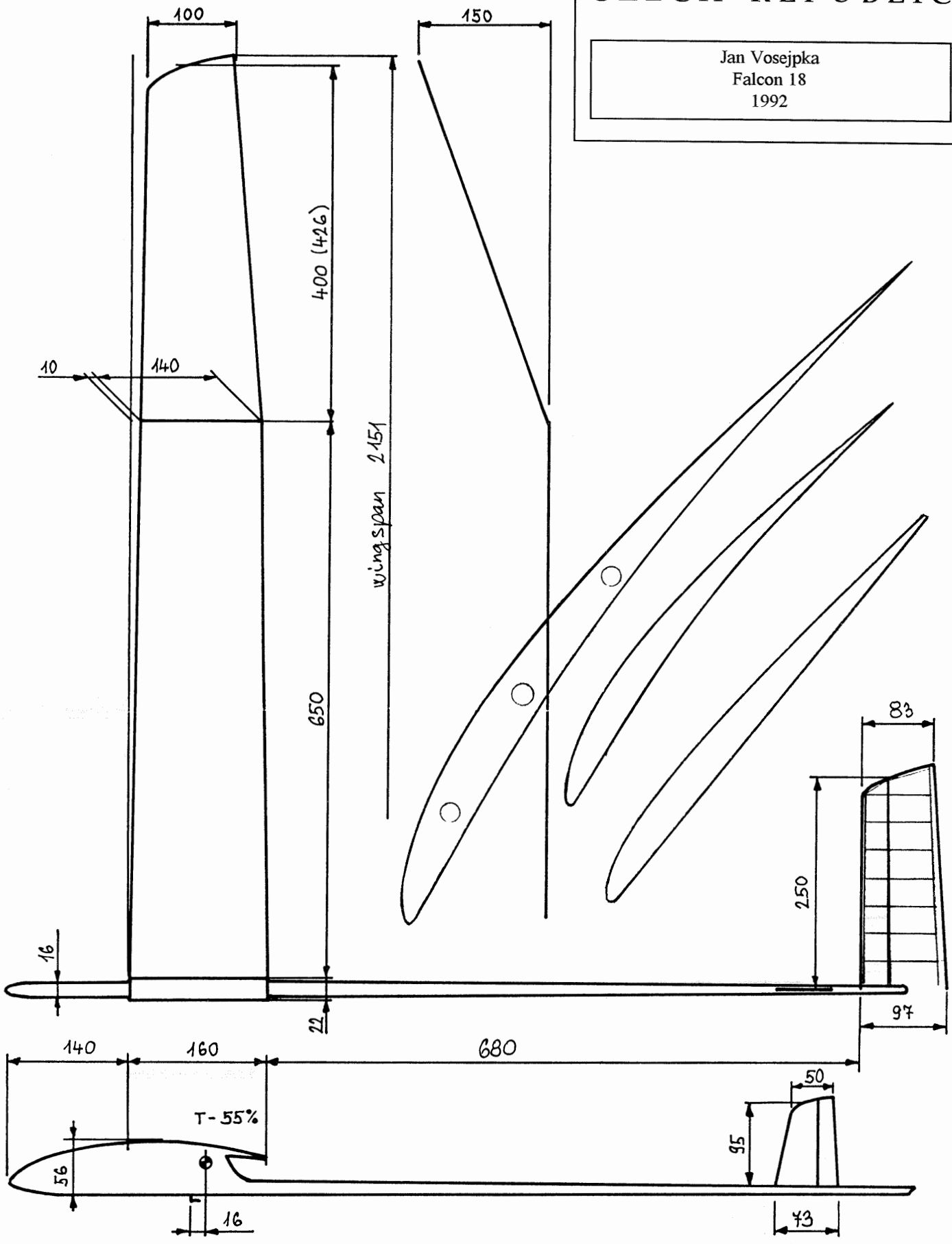
Jan Vosejpka
Falcon 19
1992

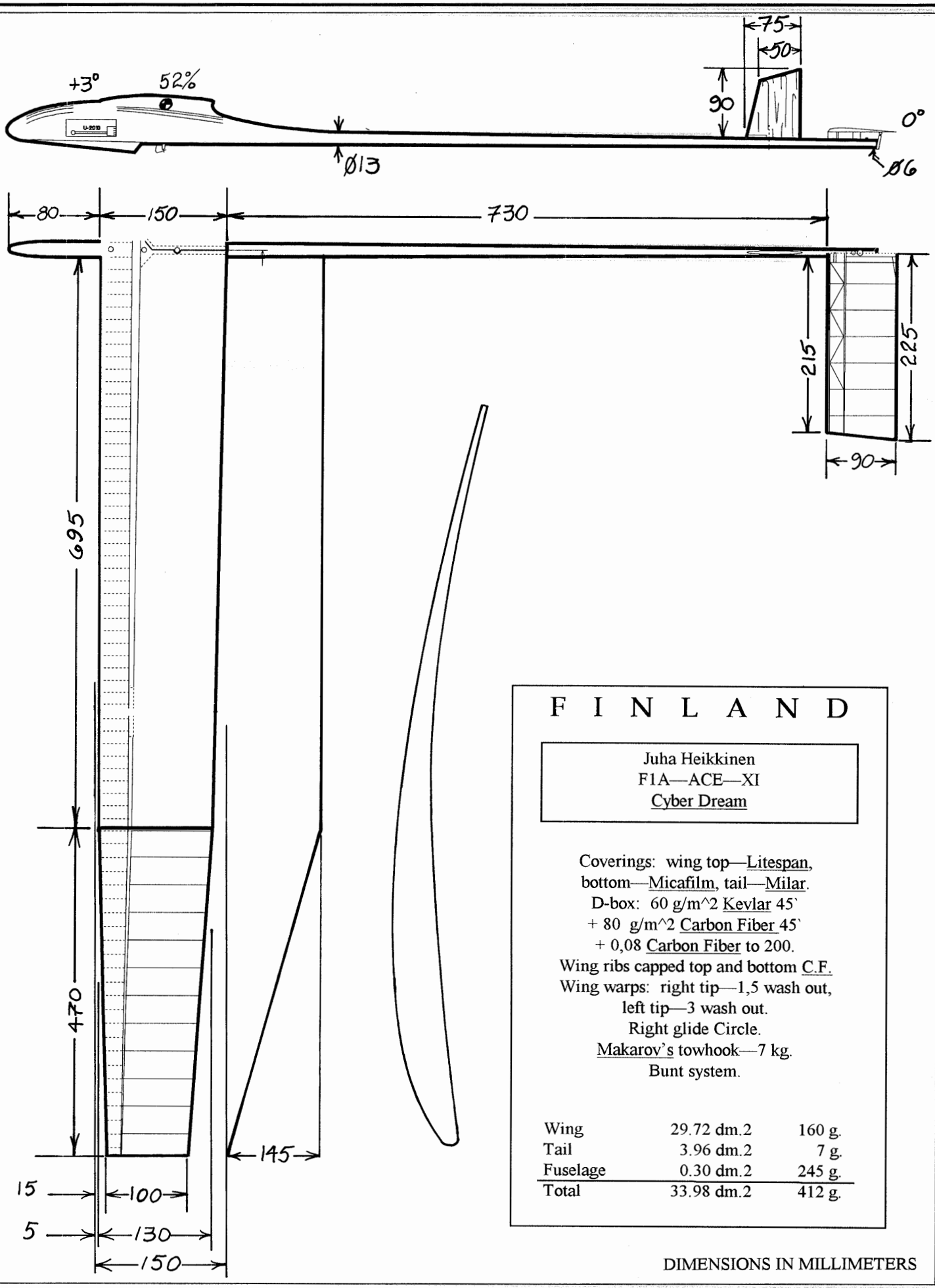


DIMENSIONS IN MILLIMETERS

CZECH REPUBLIC

Jan Vosejpka
Falcon 18
1992





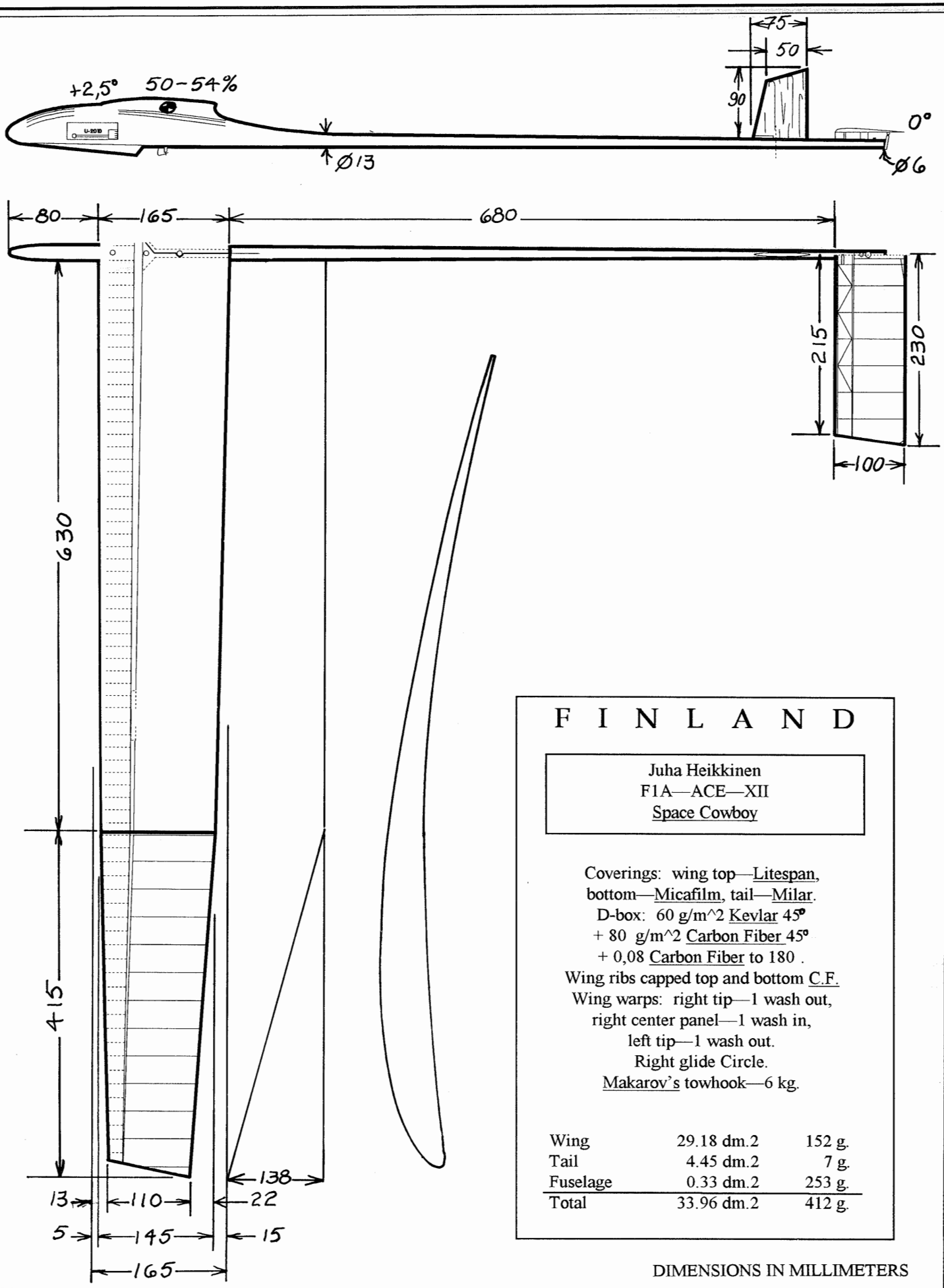
F I N L A N D

Juha Heikkinen
F1A—ACE—XI
Cyber Dream

Coverings: wing top—Litespan, bottom—Micafilm, tail—Milar.
D-box: 60 g/m^2 Kevlar 45`
+ 80 g/m^2 Carbon Fiber 45`
+ 0,08 Carbon Fiber to 200.
Wing ribs capped top and bottom C.F.
Wing warps: right tip—1,5 wash out, left tip—3 wash out.
Right glide Circle.
Makarov's towhook—7 kg.
Bunt system.

Wing	29.72 dm.2	160 g.
Tail	3.96 dm.2	7 g.
Fuselage	0.30 dm.2	245 g.
Total	33.98 dm.2	412 g.

DIMENSIONS IN MILLIMETERS



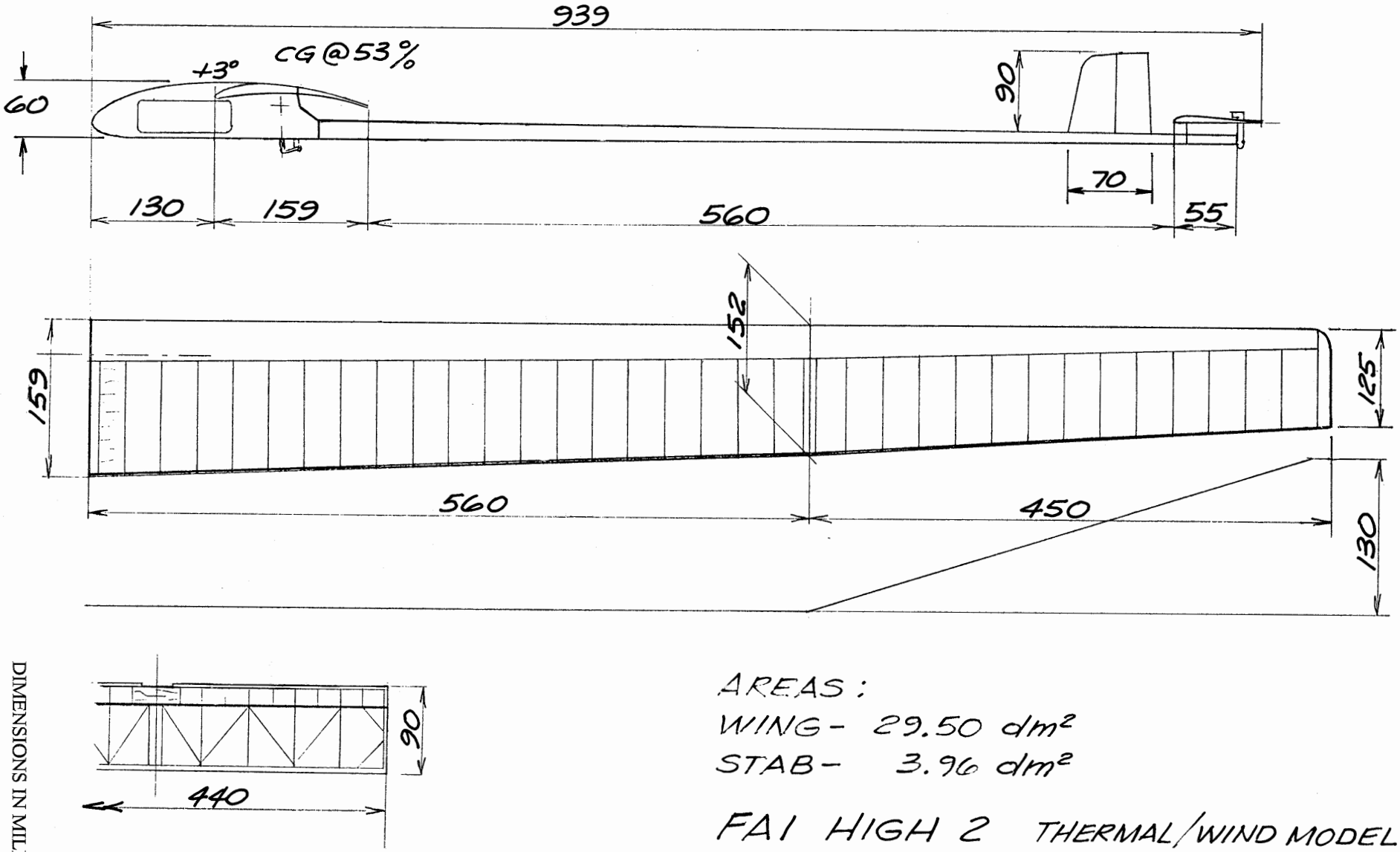
F I N L A N D

Juha Heikkinen
F1A—ACE—XII
Space Cowboy

Coverings: wing top—Litespan,
bottom—Micafilm, tail—Milar.
D-box: 60 g/m^2 Kevlar 45°
+ 80 g/m^2 Carbon Fiber 45°
+ 0,08 Carbon Fiber to 180 .
Wing ribs capped top and bottom C.F.
Wing warps: right tip—1 wash out,
right center panel—1 wash in,
left tip—1 wash out.
Right glide Circle.
Makarov's towhook—6 kg.

Wing	29.18 dm.2	152 g.
Tail	4.45 dm.2	7 g.
Fuselage	0.33 dm.2	253 g.
Total	33.96 dm.2	412 g.

DIMENSIONS IN MILLIMETERS

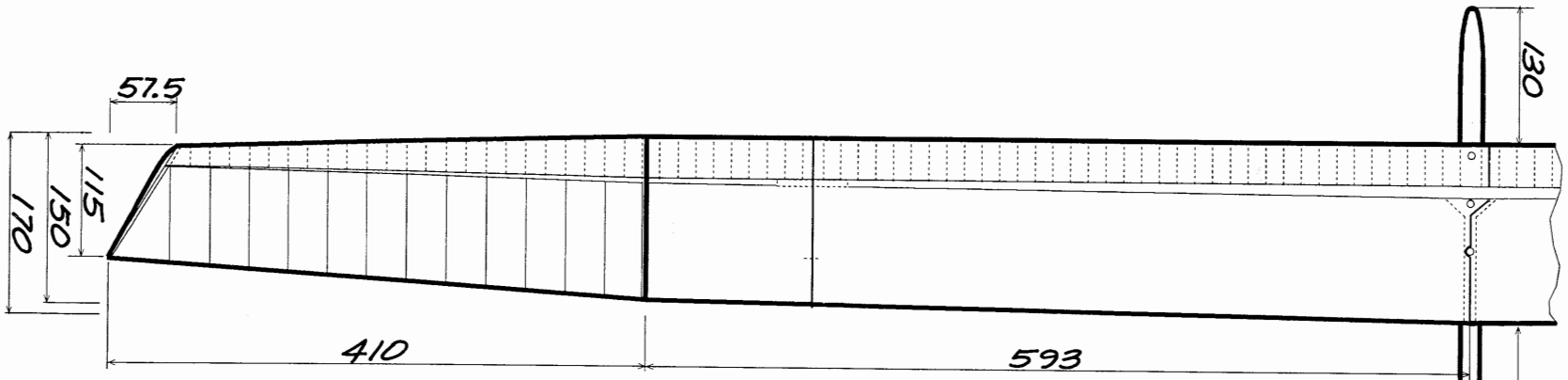


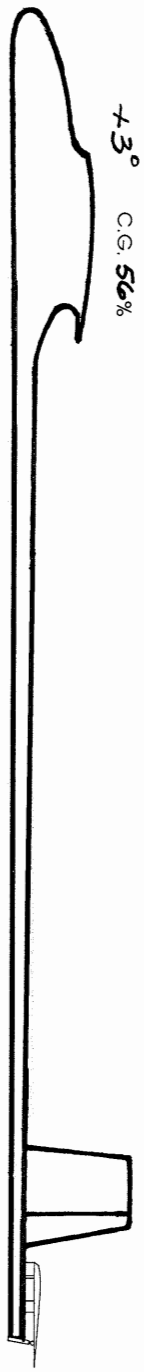
AREAS:
WING - 29.50 dm²
STAB - 3.96 dm²

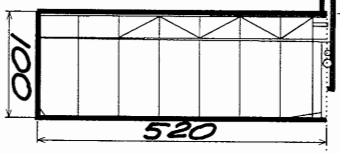
FAI HIGH 2 THERMAL/WIND MODEL

PEKKA RAHKALA
FINLAND

DIMENSIONS IN MILLIMETERS





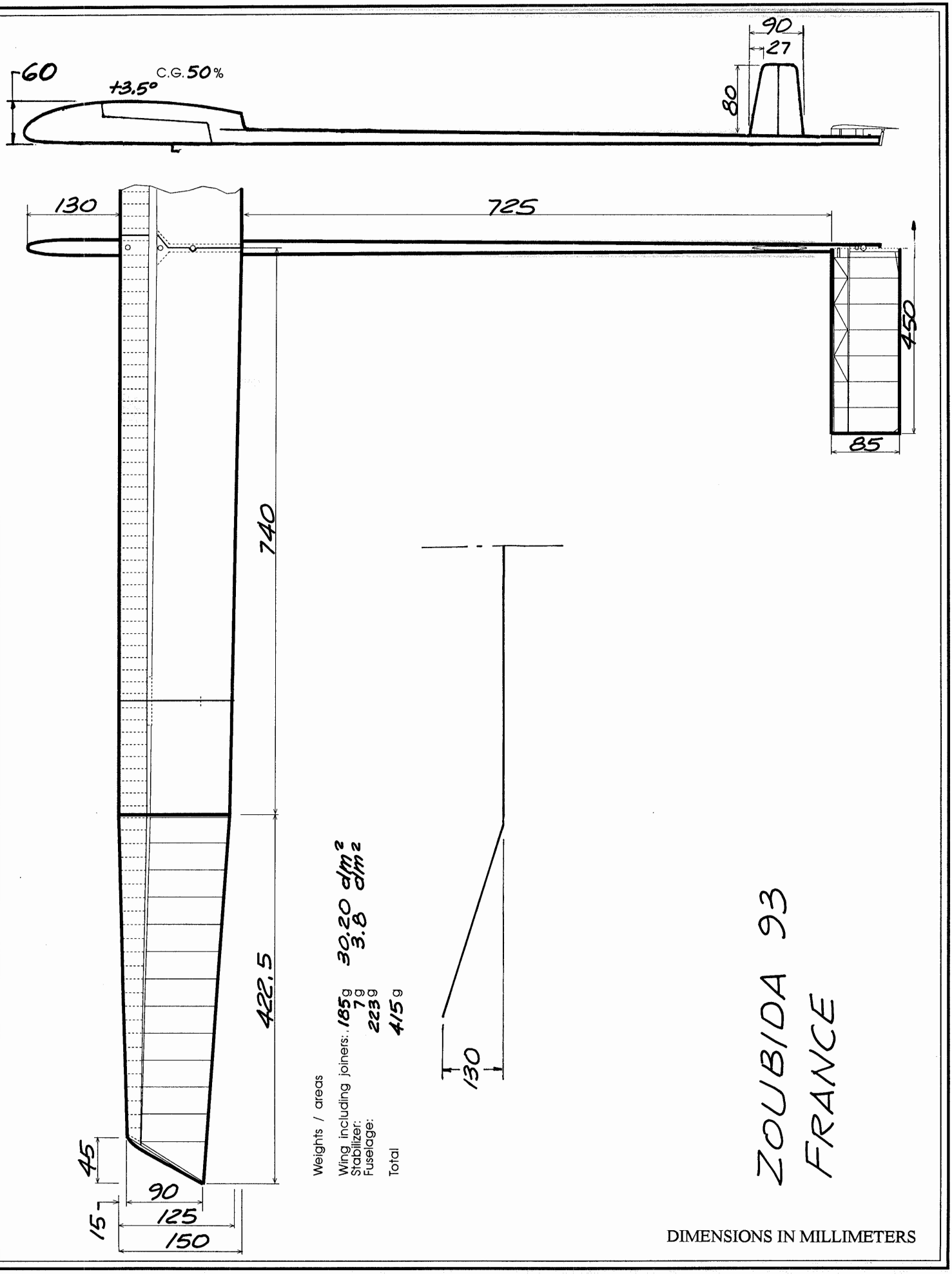


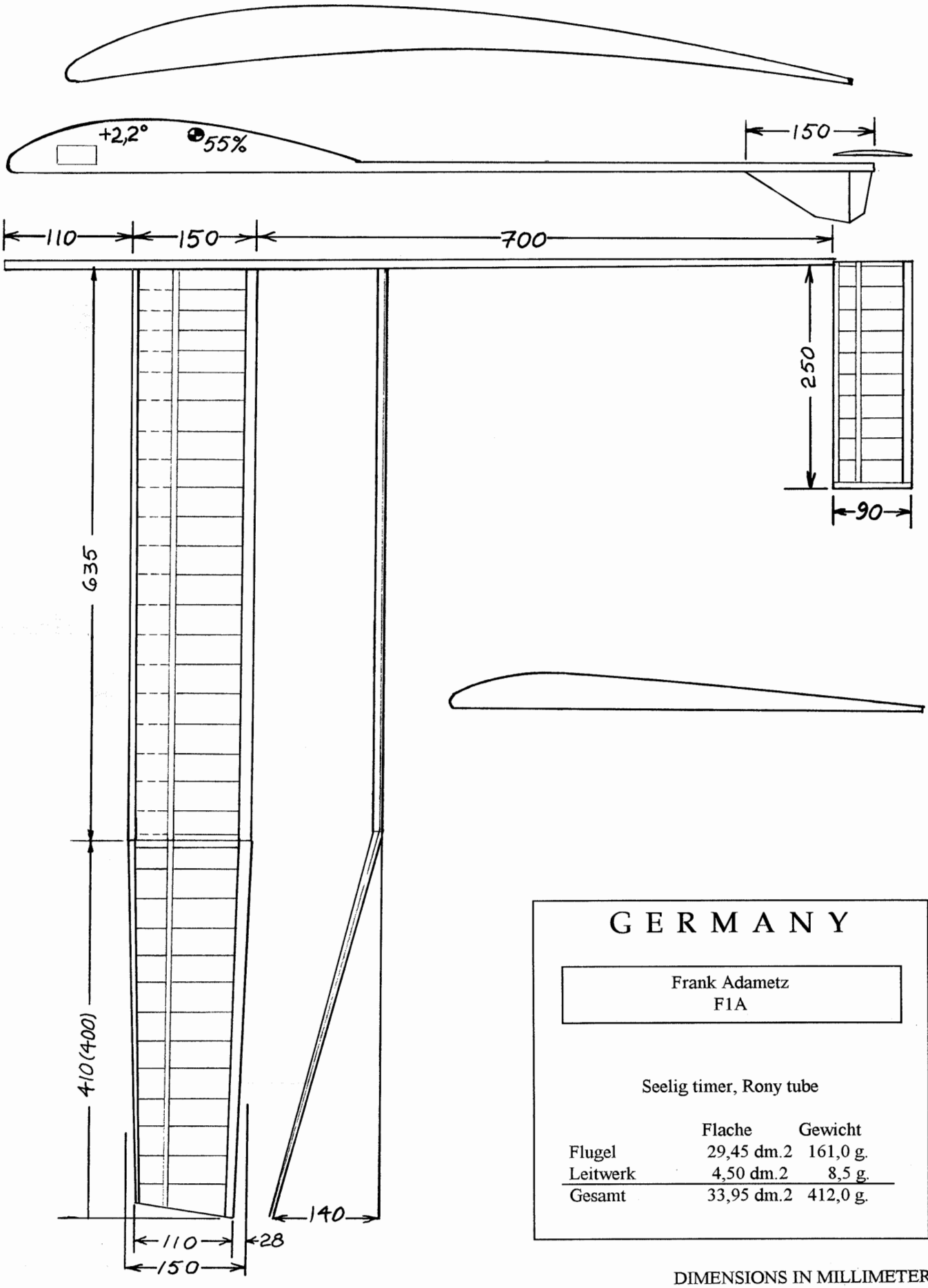
AREAS: WING - 28.6 dm^2
STAB - 5.2 dm^2

WEIGHTS: WING - 185 g
STAB - 11 g
FUSE. - 216 g

DIMENSIONS IN MILLIMETERS

JAN SOMERS
CENNY BREEMAN
FRANCE


60
C.G. 50%
+3,5°
90
27
80
130
725
450
85
740
422,5
45
90
125
150
15
130
Weights / areas
Wing including joiners: 185g
Stabilizer: 7g
Fuselage: 223g
Total 415g
30,20 dm²
3.8 dm²
ZOUBIDA 93
FRANCE
DIMENSIONS IN MILLIMETERS



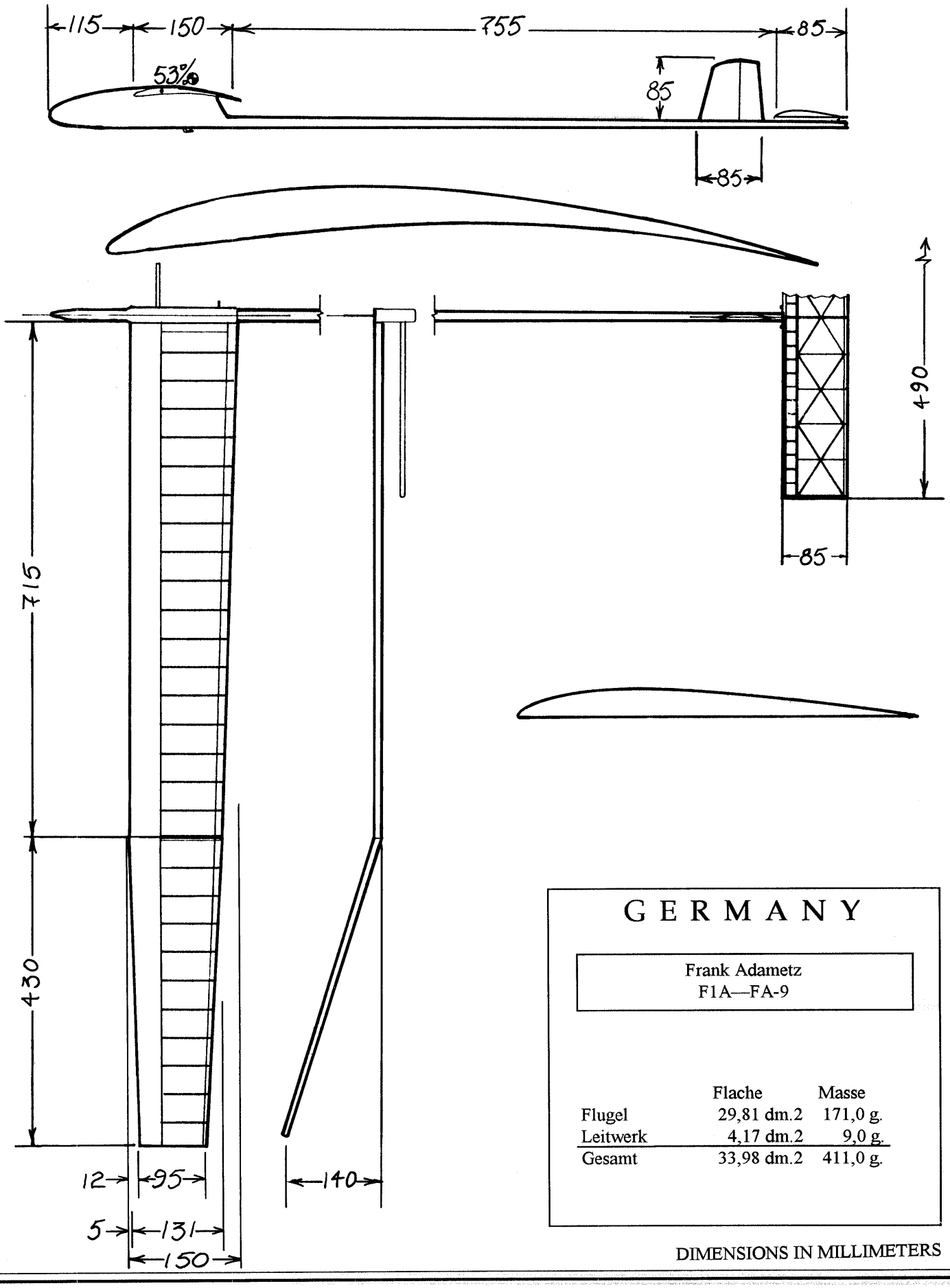
GERMANY

Frank Adametz
F1A

Seelig timer, Rony tube

	Flache	Gewicht
Flugel	29,45 dm.2	161,0 g.
Leitwerk	4,50 dm.2	8,5 g.
Gesamt	33,95 dm.2	412,0 g.

DIMENSIONS IN MILLIMETERS

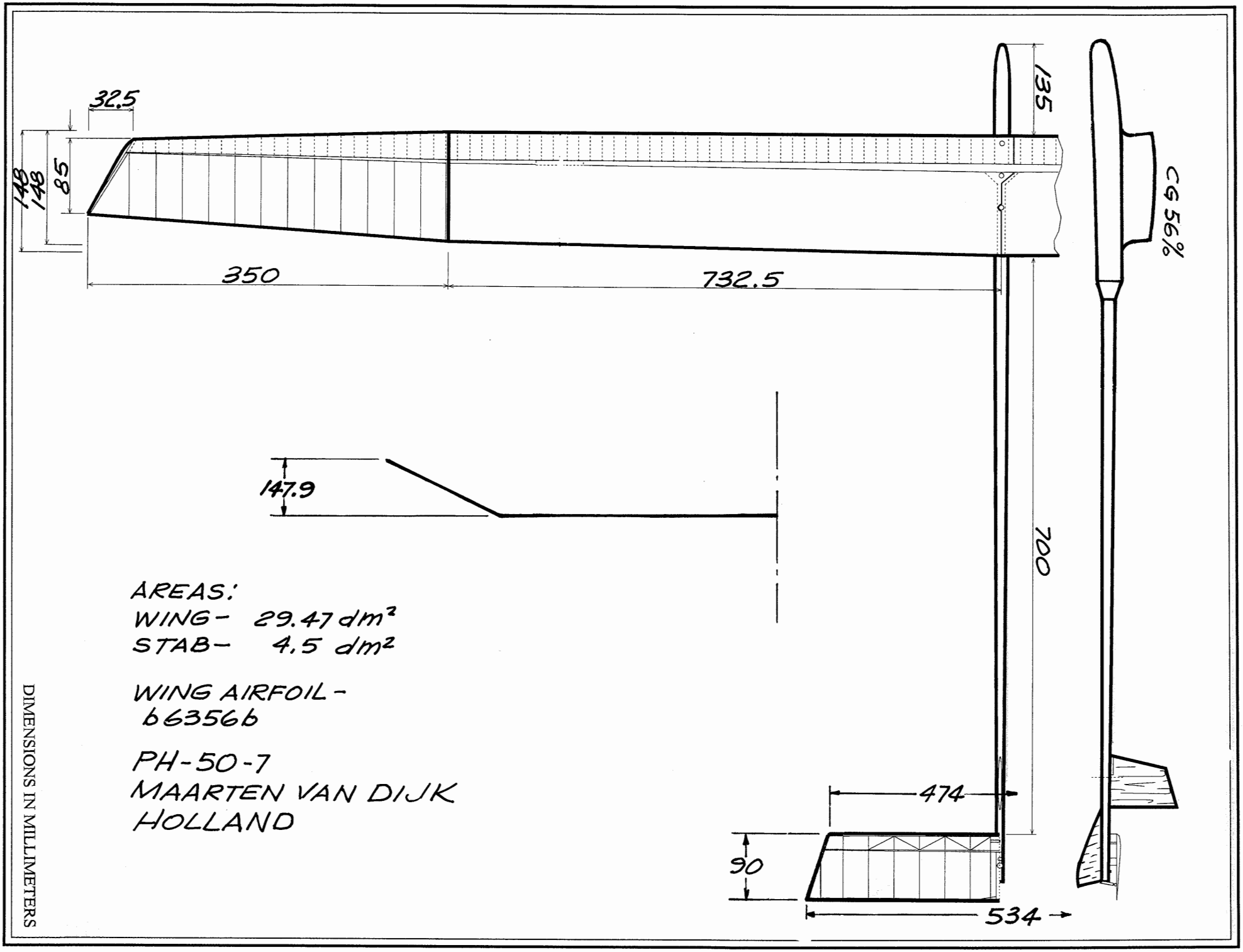


GERMANY

Frank Adametz
F1A—FA-9

	Flache	Masse
Flugel	29,81 dm.2	171,0 g.
Leitwerk	4,17 dm.2	9,0 g.
Gesamt	33,98 dm.2	411,0 g.

DIMENSIONS IN MILLIMETERS

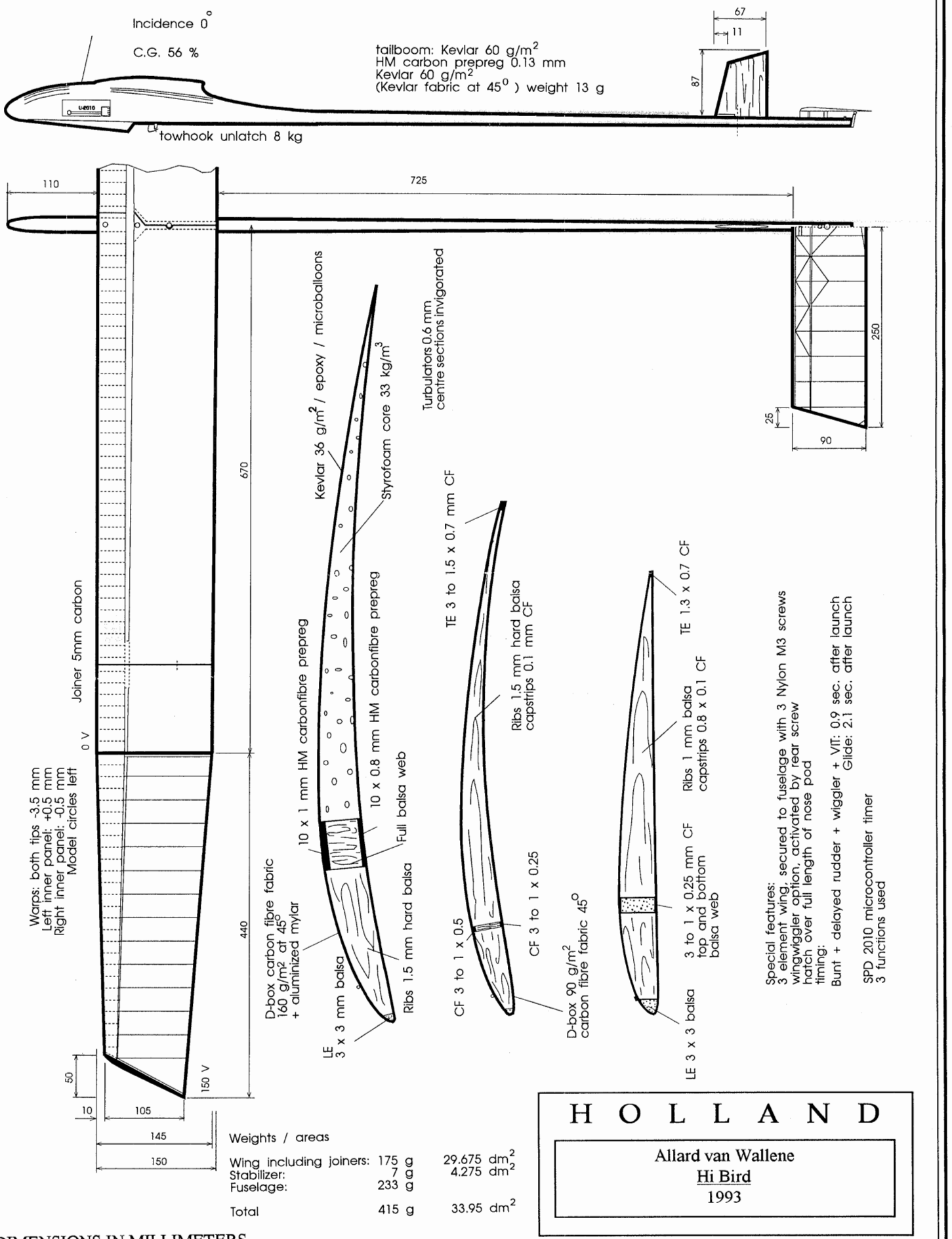


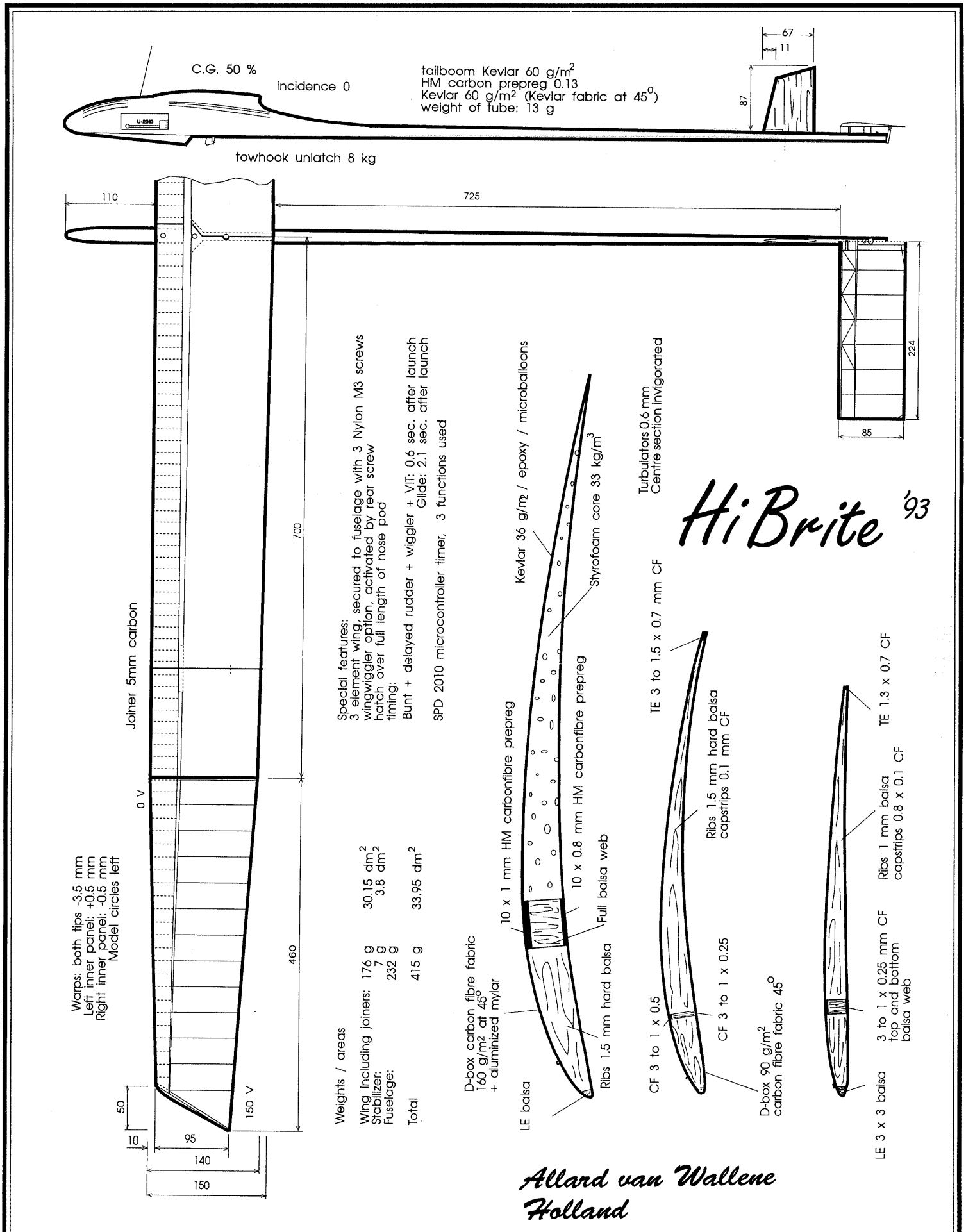
AREAS:
WING- 29.47 dm²
STAB- 4.5 dm²

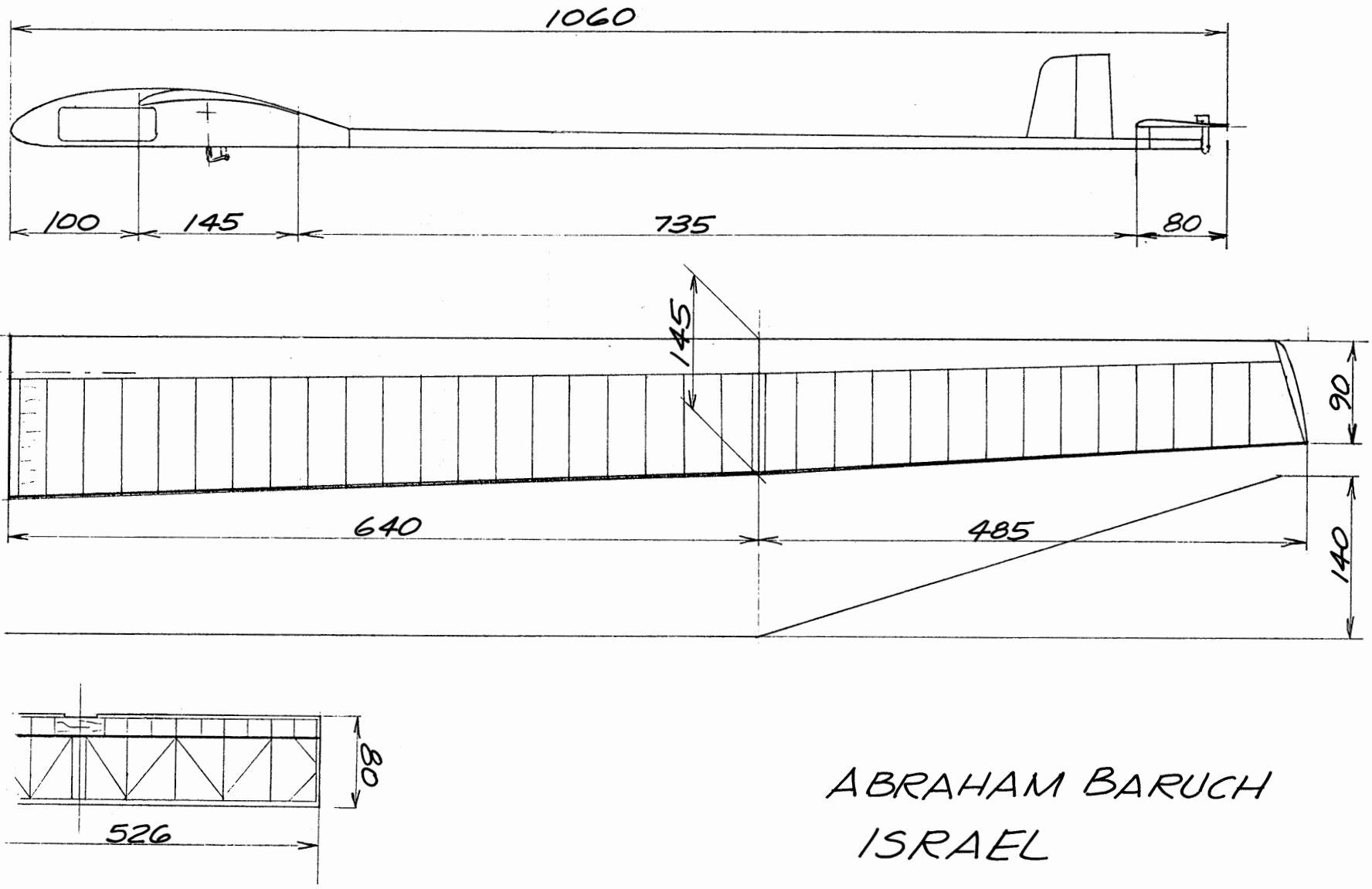
WING AIRFOIL -
663566

PH-50-7
MAARTEN VAN DIJK
HOLLAND

DIMENSIONS IN MILLIMETERS

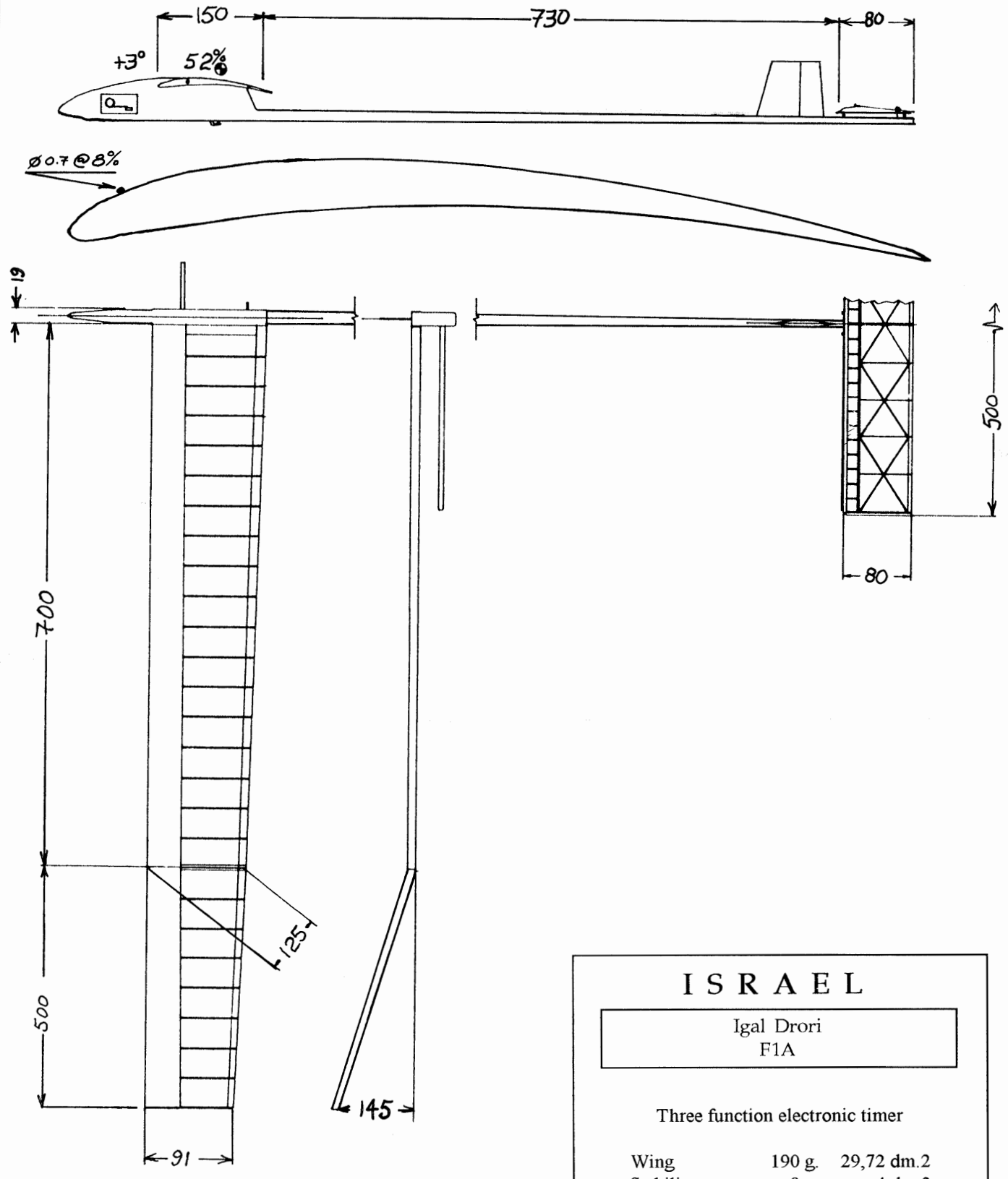

Incidence 0°
C.G. 56 %
tailboom: Kevlar 60 g/m²
HM carbon prepreg 0.13 mm
Kevlar 60 g/m²
(Kevlar fabric at 45°) weight 13 g
67
11
87
towhook unlatch 8 kg
110
725
250
25
90
670
440
50
10
105
145
150
0 V
150 V
Joiner 5mm carbon
Warps: both tips -3.5 mm
Left inner panel: +0.5 mm
Right inner panel: -0.5 mm
Model circles left
Kevlar 36 g/m² / epoxy / microballoons
Styrofoam core 33 kg/m³
Turbulators 0.6 mm
centre sections invigorated
10 x 1 mm HM carbonfibre prepreg
10 x 0.8 mm HM carbonfibre prepreg
Full balsa web
D-box carbon fibre fabric
160 g/m² at 45°
+ aluminized mylar
LE
3 x 3 mm balsa
Ribs 1.5 mm hard balsa
TE 3 to 1.5 x 0.7 mm CF
Ribs 1.5 mm hard balsa
capstrips 0.1 mm CF
CF 3 to 1 x 0.5
CF 3 to 1 x 0.25
D-box 90 g/m²
carbon fibre fabric 45°
TE 1.3 x 0.7 CF
Ribs 1 mm balsa
capstrips 0.8 x 0.1 CF
3 to 1 x 0.25 mm CF
top and bottom
balsa web
LE 3 x 3 balsa
Special features:
3 element wing, secured to fuselage with 3 Nylon M3 screws
wingwiggler option, activated by rear screw
hatch over full length of nose pod
timing:
Bunt + delayed rudder + wiggler + VIT: 0.9 sec. after launch
Glide: 2.1 sec. after launch
SPD 2010 microcontroller timer
3 functions used
Weights / areas
Wing including joiners: 175 g 29.675 dm²
Stabilizer: 7 g 4.275 dm²
Fuselage: 233 g
Total 415 g 33.95 dm²
H O L L A N D
Allard van Wallene
Hi Bird
1993
DIMENSIONS IN MILLIMETERS


C.G. 50 %
Incidence 0
tailboom Kevlar 60 g/m²
HM carbon prepreg 0.13
Kevlar 60 g/m² (Kevlar fabric at 45°)
weight of tube: 13 g
towhook unlatch 8 kg
67
11
87
110
725
700
460
224
85
50
10
95
140
150
0 V
150 V
Joiner 5mm carbon
Warps: both tips -3.5 mm
Left inner panel: +0.5 mm
Right inner panel: -0.5 mm
Model circles left
Special features:
3 element wing, secured to fuselage with 3 Nylon M3 screws
wingwiggler option, activated by rear screw
hatch over full length of nose pod
timing:
Bunt + delayed rudder + wiggler + VIT: 0.6 sec. after launch
Glide: 2.1 sec. after launch
SPD 2010 microcontroller timer, 3 functions used
Weights / areas
Wing including joiners: 176 g 30.15 dm²
Stabilizer: 7 g 3.8 dm²
Fuselage: 232 g
Total 415 g 33.95 dm²
D-box carbon fibre fabric
160 g/m² at 45°
+ aluminized mylar
10 x 1 mm HM carbonfibre prepreg
LE balsa
Kevlar 36 g/m² / epoxy / microballoons
Styrofoam core 33 kg/m³
10 x 0.8 mm HM carbonfibre prepreg
Full balsa web
Ribs 1.5 mm hard balsa
Turbulators 0.6 mm
Centre section invigorated
TE 3 to 1.5 x 0.7 mm CF
Ribs 1.5 mm hard balsa
capstrips 0.1 mm CF
CF 3 to 1 x 0.5
CF 3 to 1 x 0.25
D-box 90 g/m²
carbon fibre fabric 45°
TE 1.3 x 0.7 CF
Ribs 1 mm balsa
capstrips 0.8 x 0.1 CF
LE 3 x 3 balsa
3 to 1 x 0.25 mm CF
top and bottom
balsa web
HiBrite '93
Allard van Wallene
Holland



ABRAHAM BARUCH
ISRAEL

DIMENSIONS IN MILLIMETERS



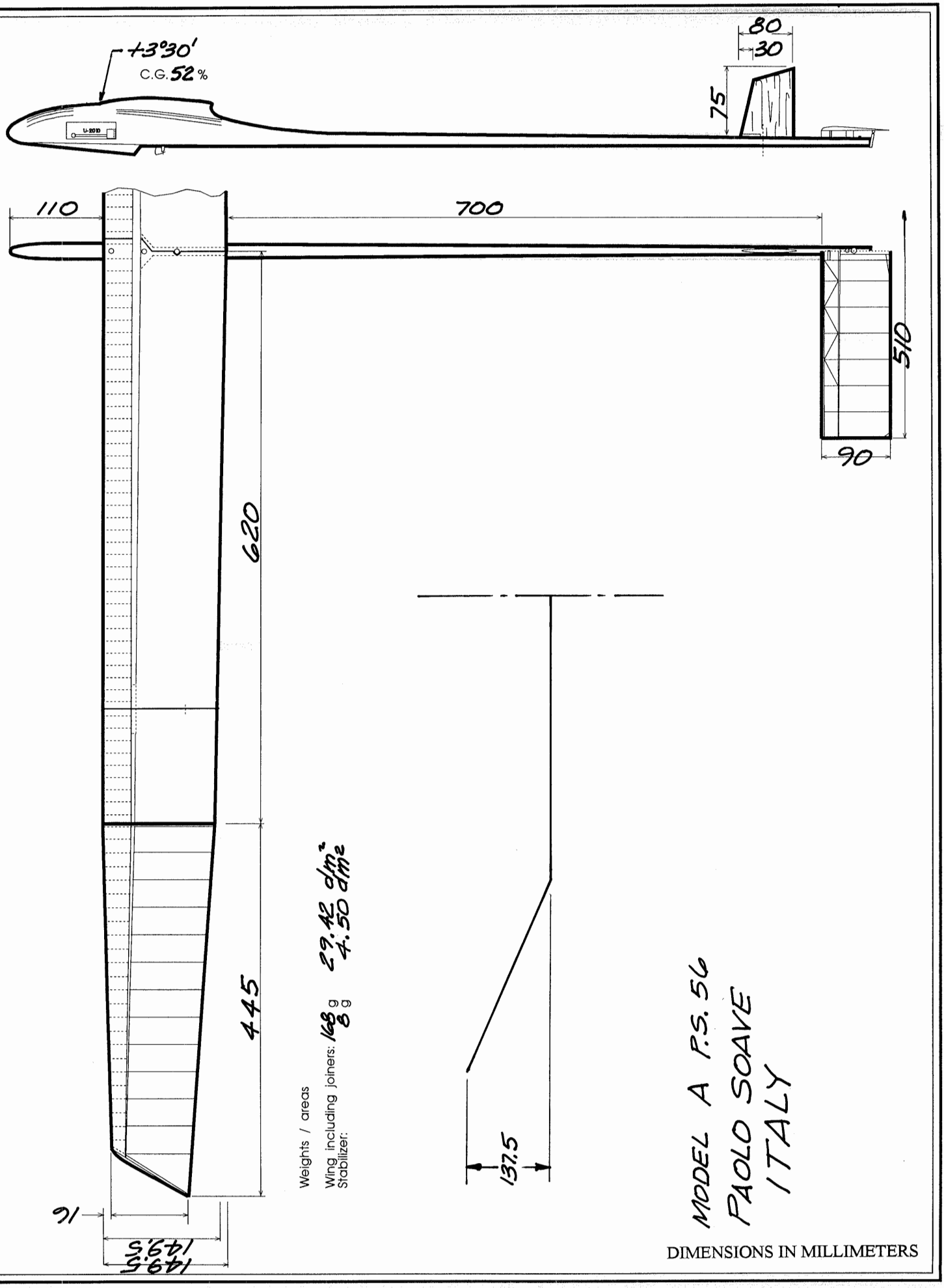
I S R A E L

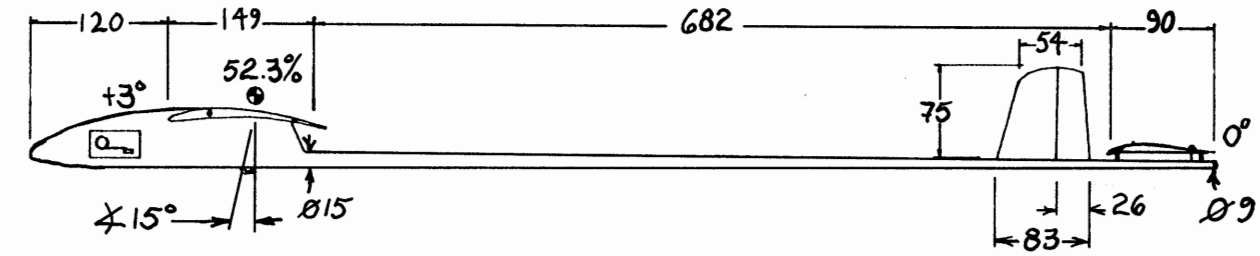
Igal Drori
F1A

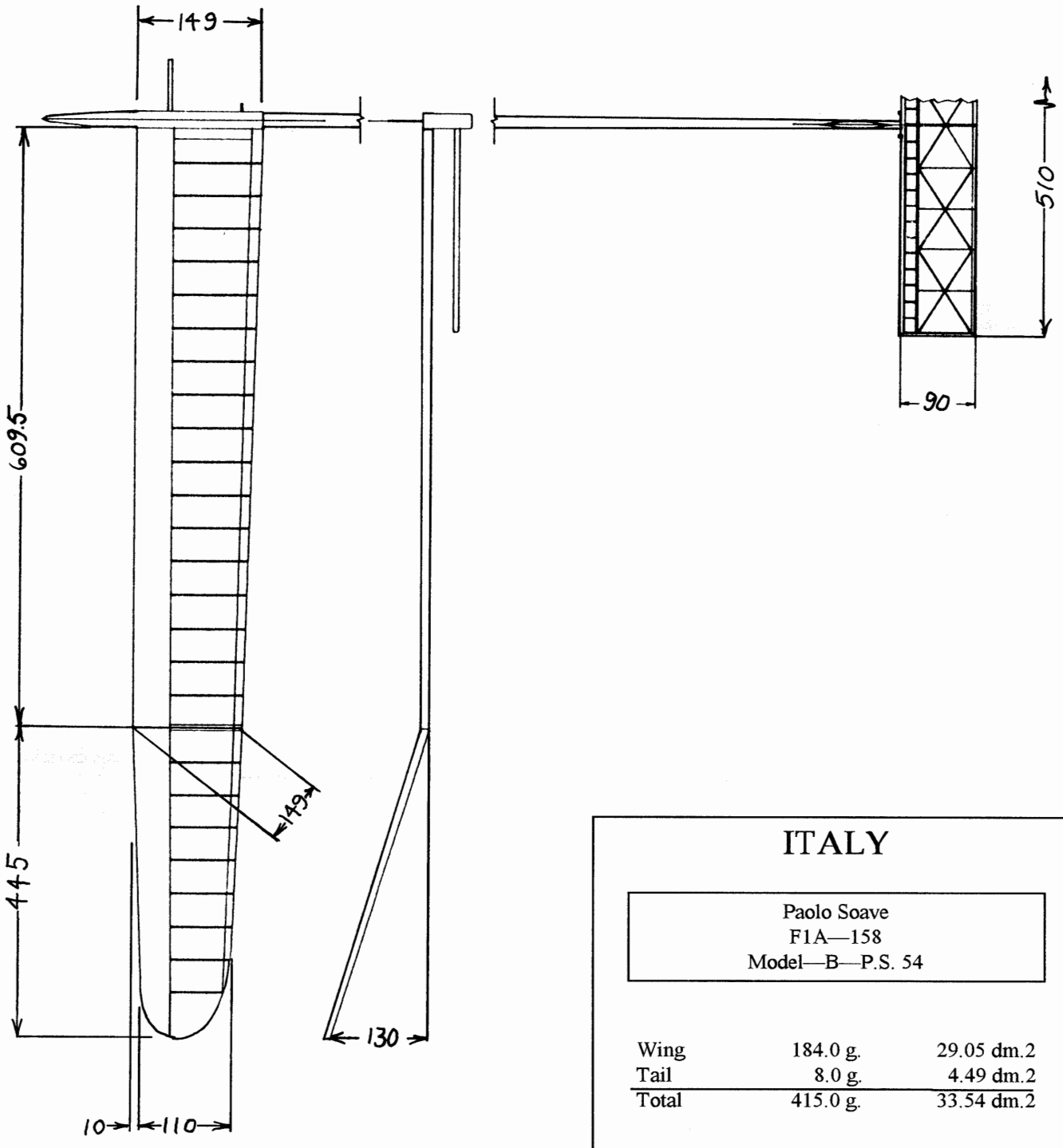
Three function electronic timer

Wing	190 g.	29,72 dm.2
Stabilizer	9 g.	4 dm.2

DIMENSIONS IN MILLIMETERS


+3°30'
C.G. 52 %
80
30
75
110
700
510
90
620
445
91
149.5
149.5
137.5
Weights / areas
Wing including joiners: 168 g 29.42 dm²
Stabilizer: 8 g 4.50 dm²
MODEL A P.S. 56
PAOLO SOAVE
ITALY
DIMENSIONS IN MILLIMETERS



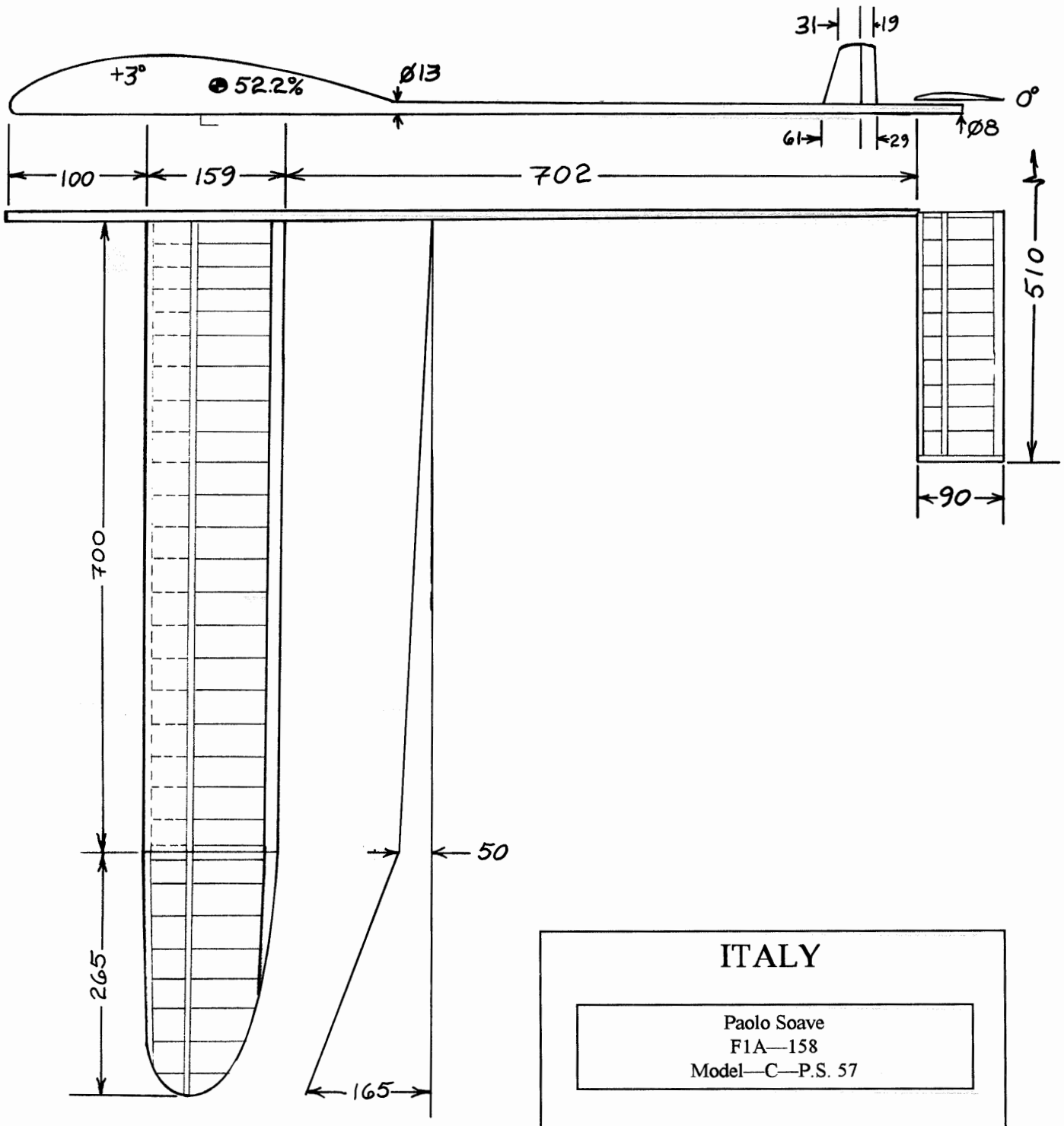


ITALY

Paolo Soave
F1A—158
Model—B—P.S. 54

Wing	184.0 g.	29.05 dm.2
Tail	8.0 g.	4.49 dm.2
Total	415.0 g.	33.54 dm.2

DIMENSIONS IN MILLIMETERS



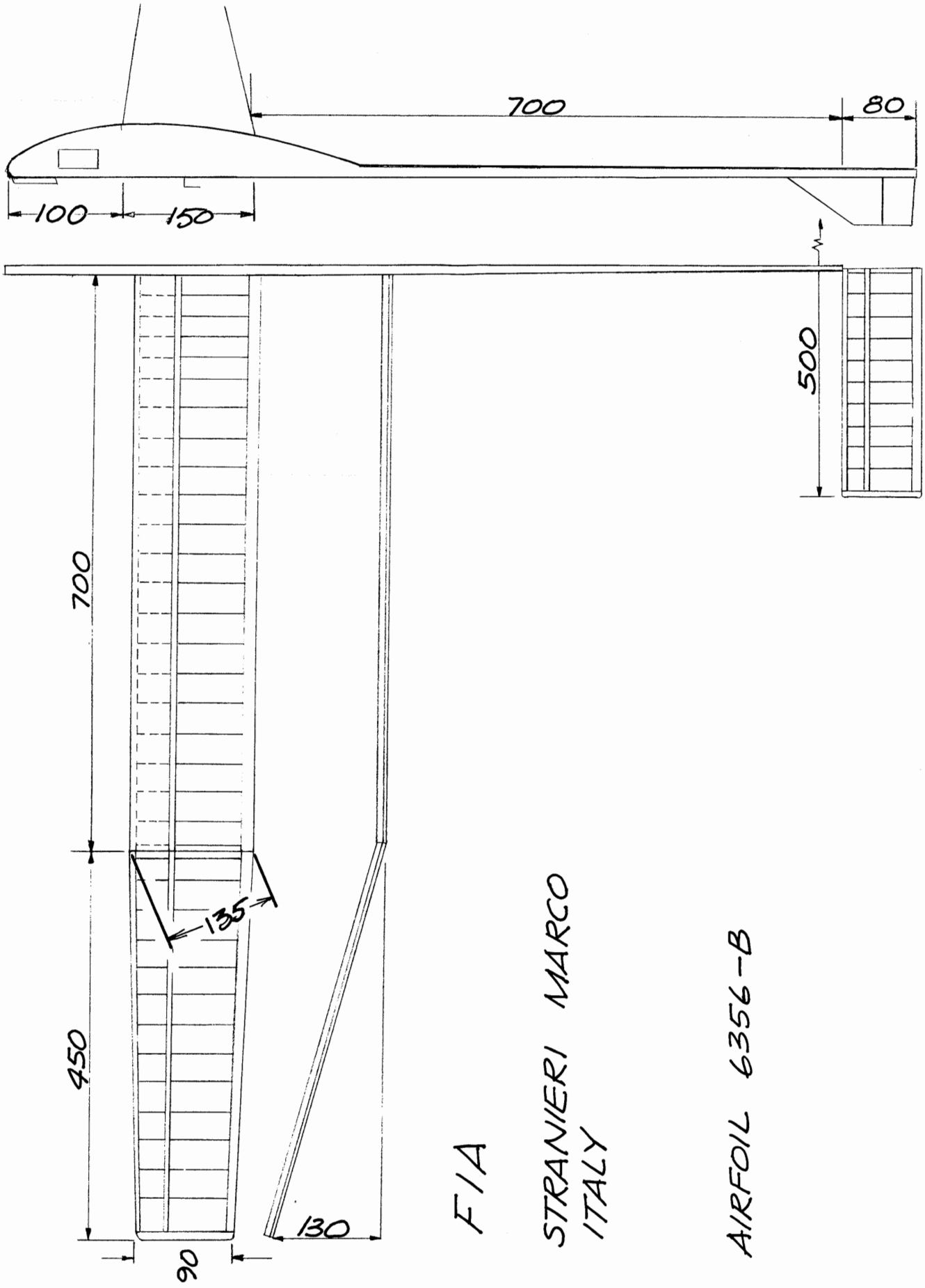
ITALY

Paolo Soave
F1A—158
Model—C—P.S. 57

Wing	179.5 g.	28.45 dm.2
Tail	10.0 g.	4.50 dm.2
Total	426.0 g.	32.95 dm.2

DIMENSIONS IN MILLIMETERS

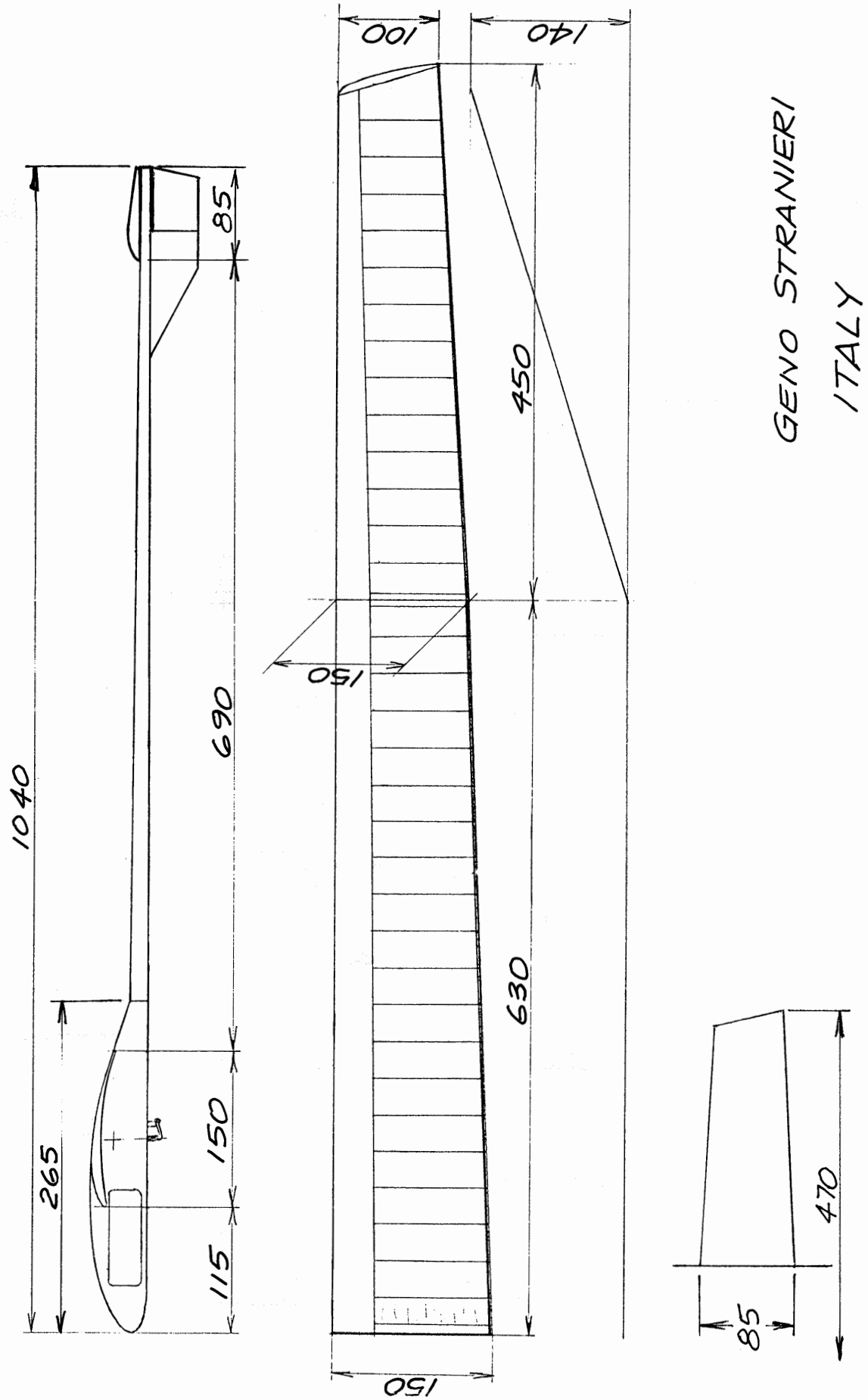
DIMENSIONS IN MILLIMETERS



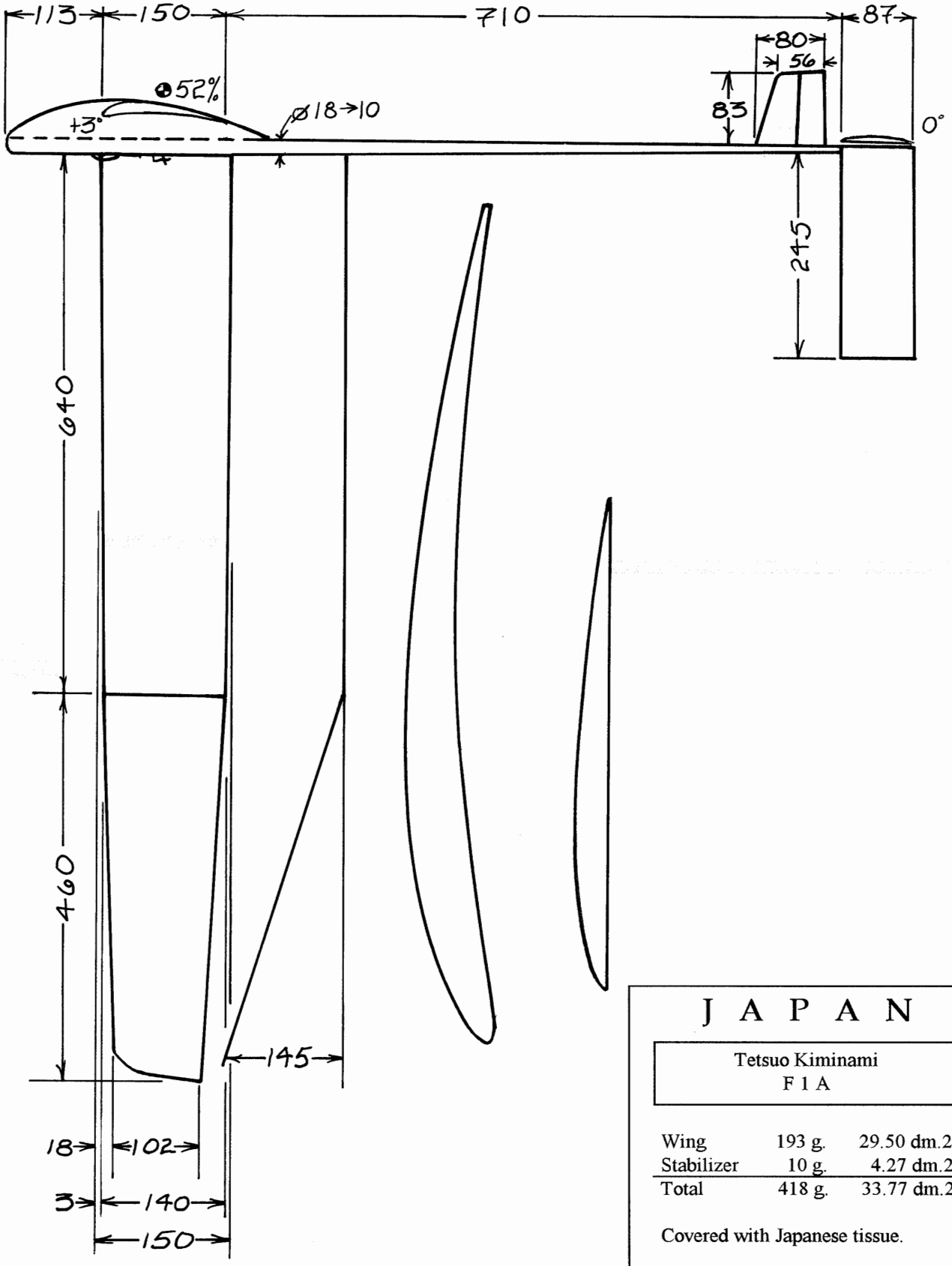
F1A

STRANIERI MARCO
ITALY

AIRFOIL 6356-B



DIMENSIONS IN MILLIMETERS



J A P A N

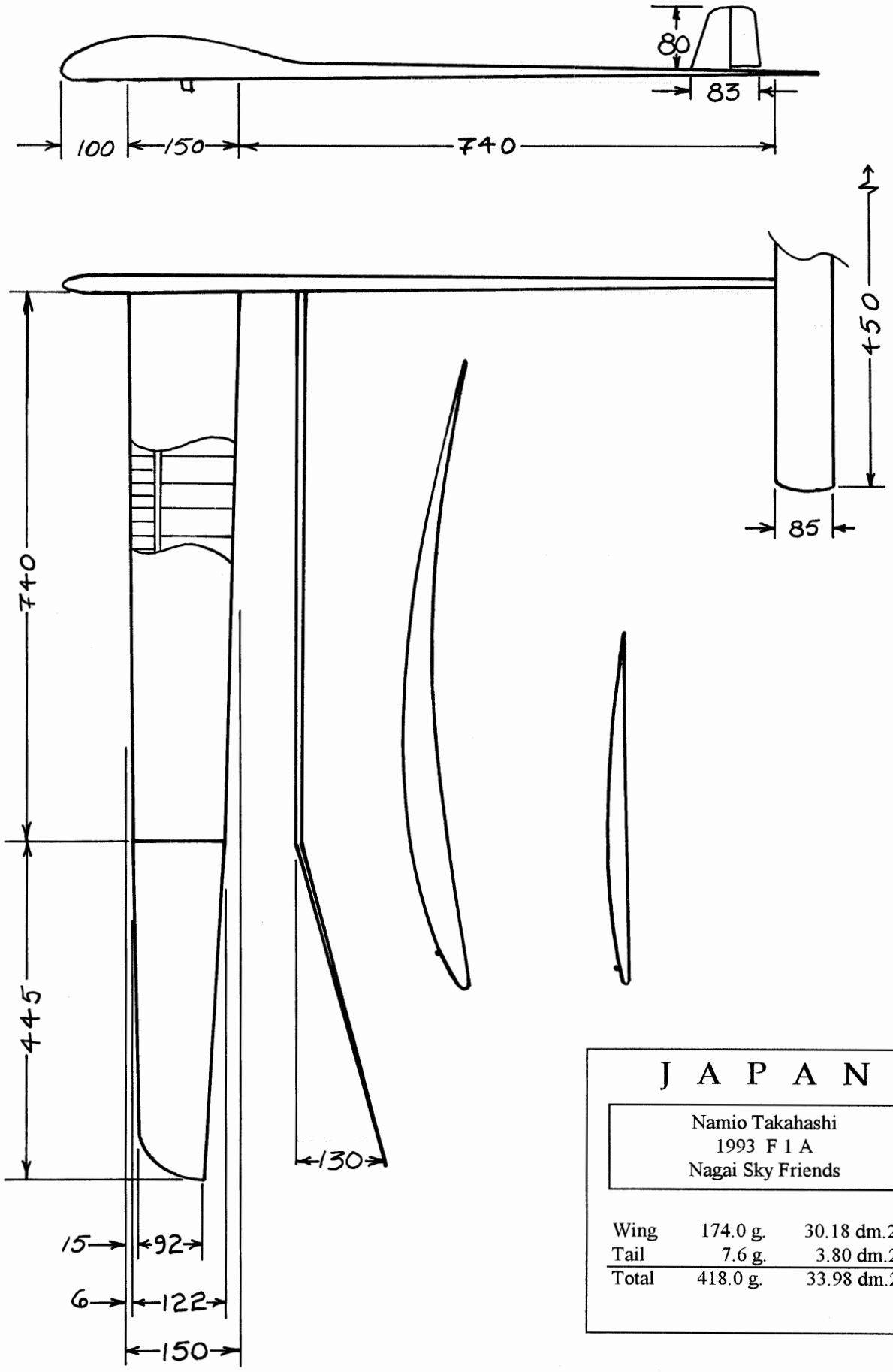
Tetsuo Kiminami
F 1 A

Wing	193 g.	29.50 dm.2
Stabilizer	10 g.	4.27 dm.2
Total	418 g.	33.77 dm.2

Covered with Japanese tissue.

DIMENSIONS IN MILLIMETERS

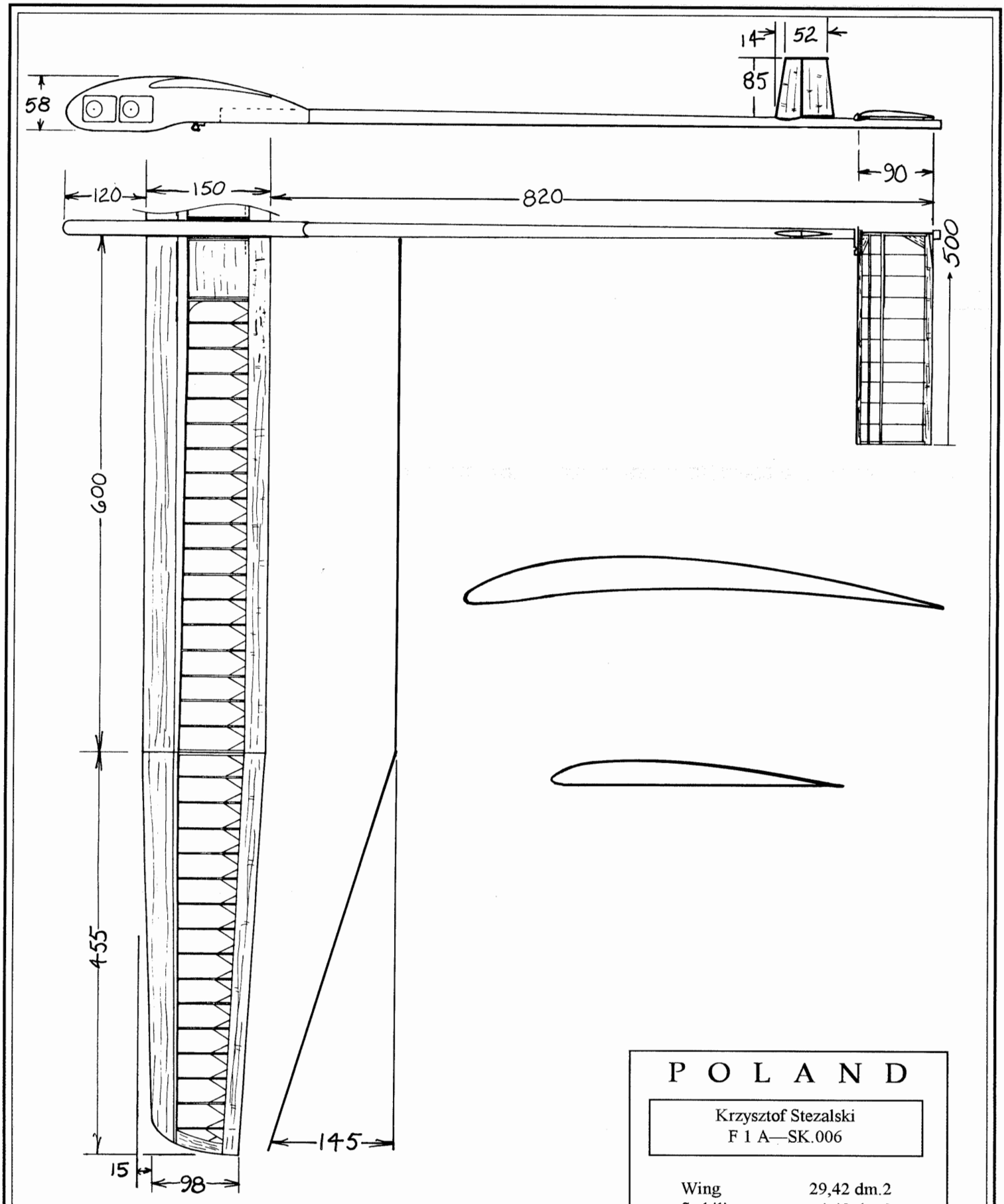
DIMENSIONS IN MILLIMETERS



J A P A N

Namio Takahashi
1993 F 1 A
Nagai Sky Friends

Wing	174.0 g.	30.18 dm.2
Tail	7.6 g.	3.80 dm.2
Total	418.0 g.	33.98 dm.2

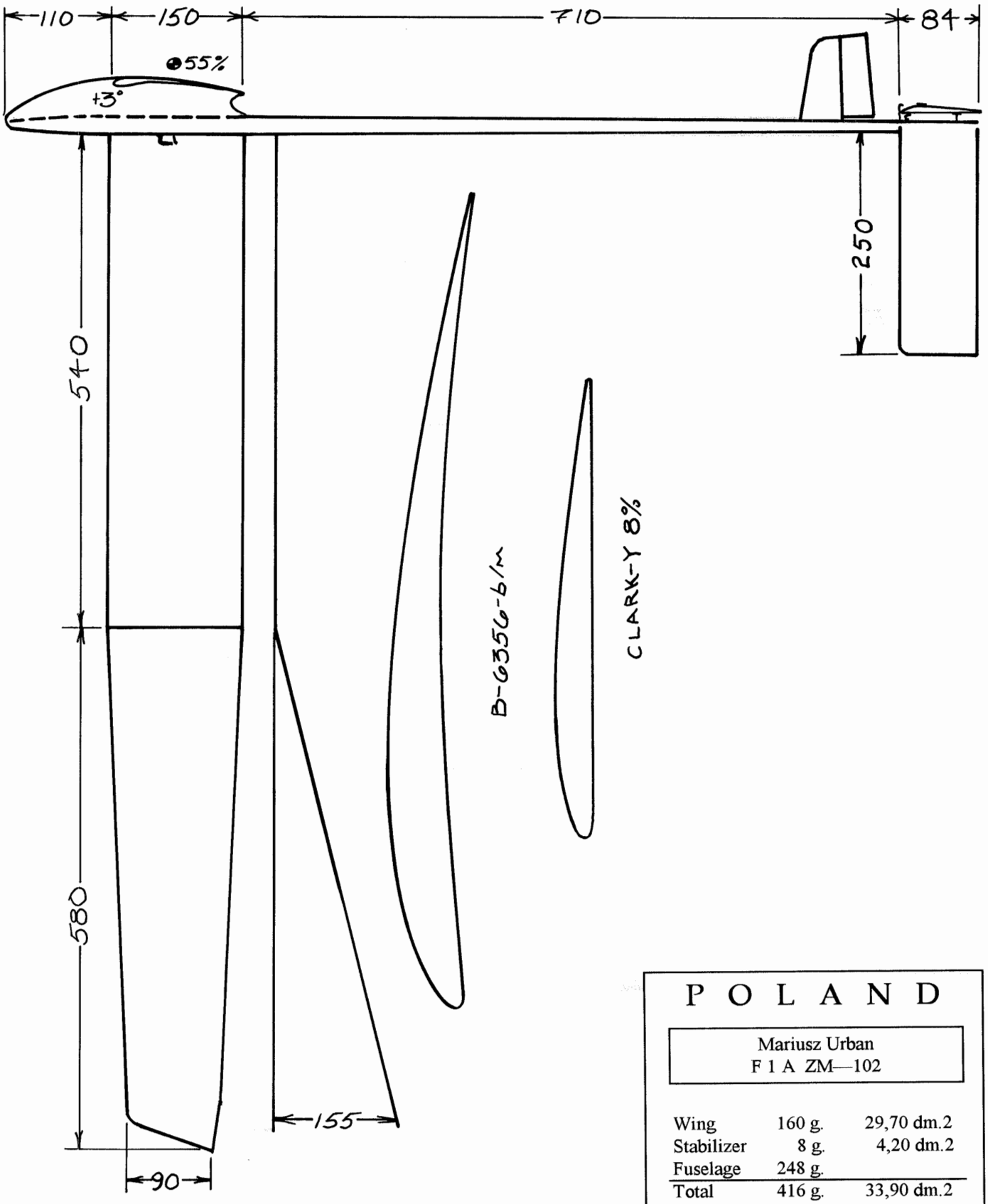


POLAND

Krzysztof Stezalski
F 1 A—SK.006

Wing	29,42 dm.2
Stabilizer	4.48 dm.2
Total mass	421 g.

DIMENSIONS IN MILLIMETERS

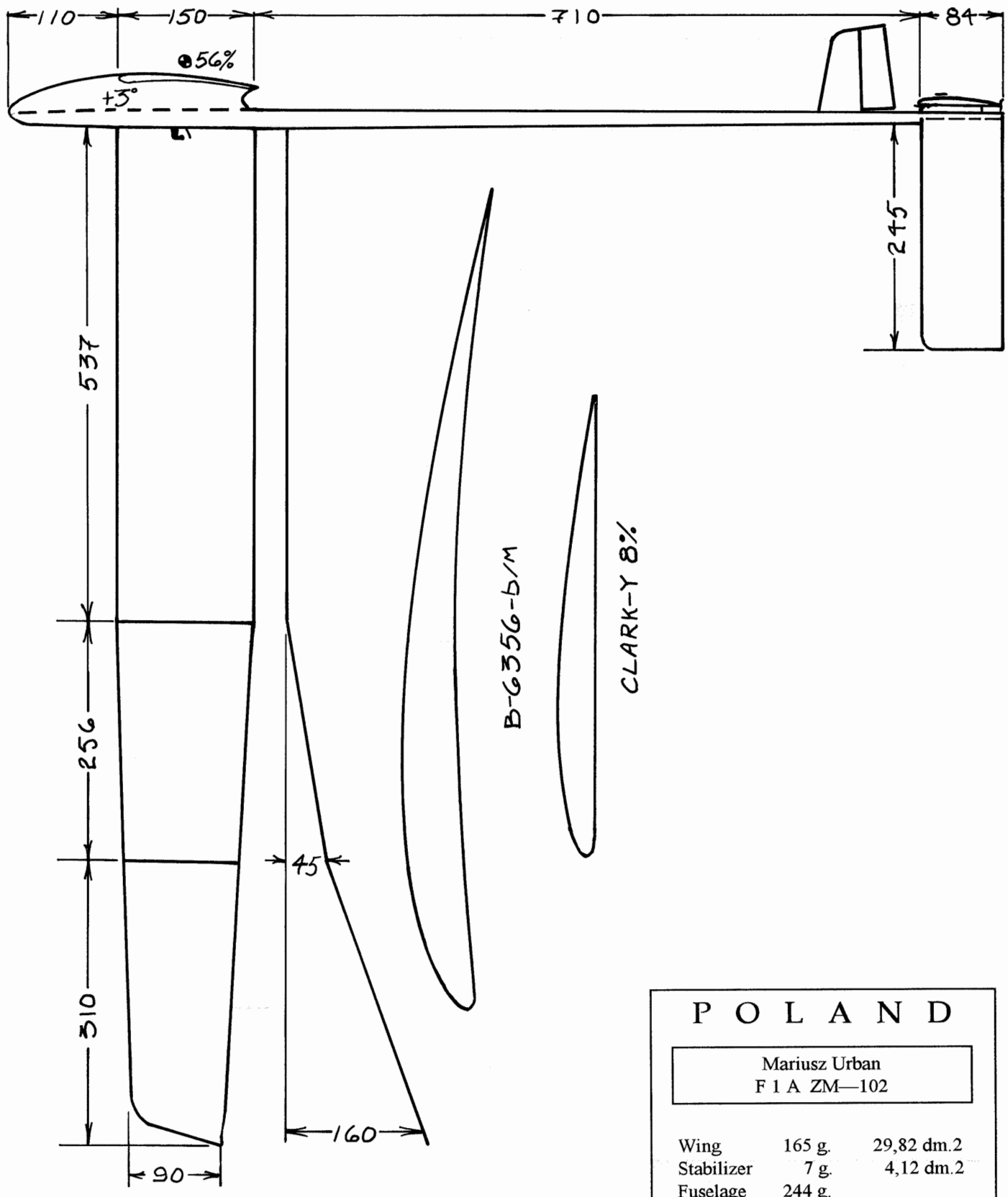


POLAND

Mariusz Urban
F 1 A ZM—102

Wing	160 g.	29,70 dm.2
Stabilizer	8 g.	4,20 dm.2
Fuselage	248 g.	
Total	416 g.	33,90 dm.2

DIMENSIONS IN MILLIMETERS



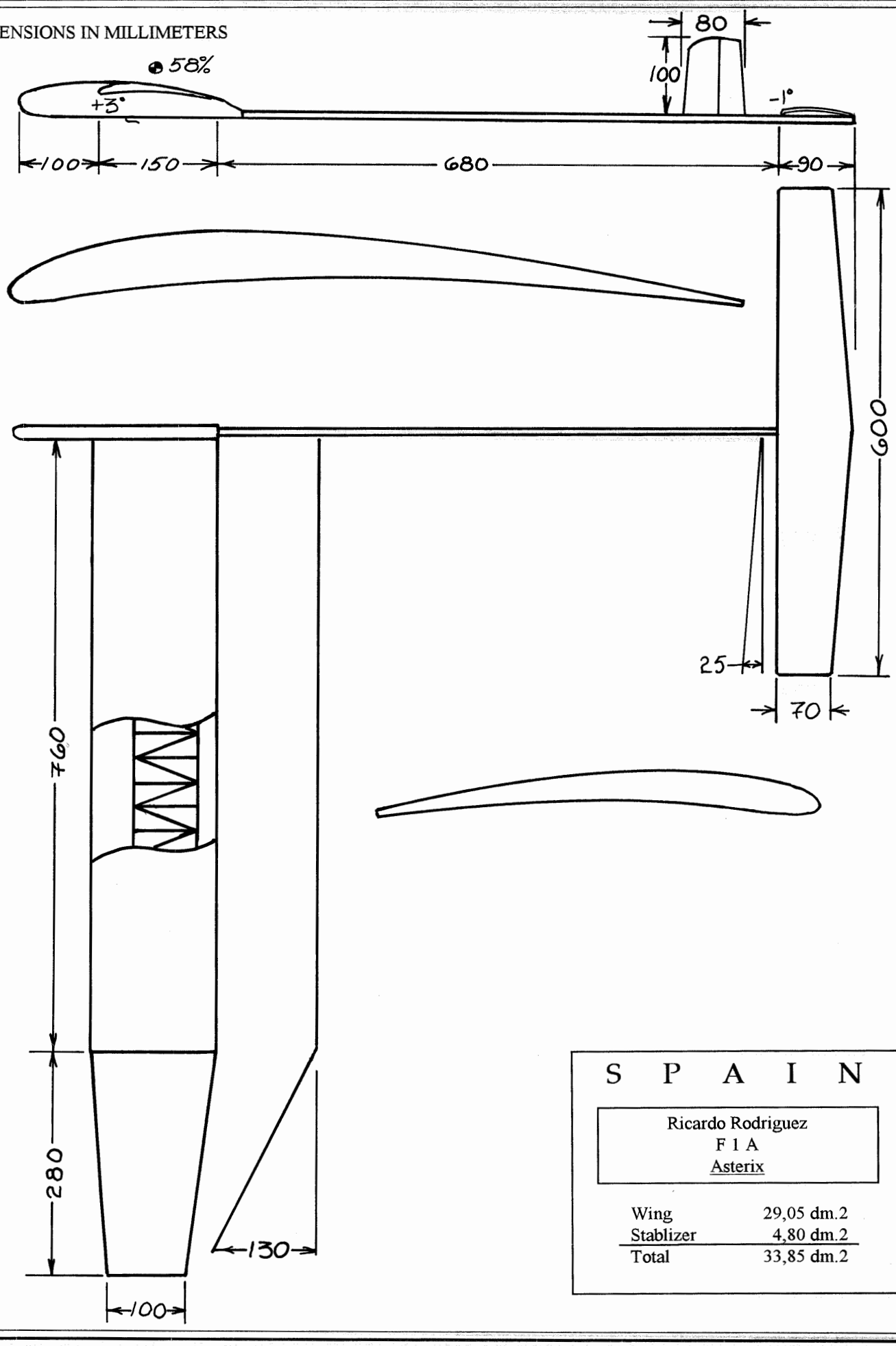
POLAND

Mariusz Urban
F 1 A ZM—102

Wing	165 g.	29,82 dm.2
Stabilizer	7 g.	4,12 dm.2
Fuselage	244 g.	
Total	416 g.	33,94 dm.2

DIMENSIONS IN MILLIMETERS

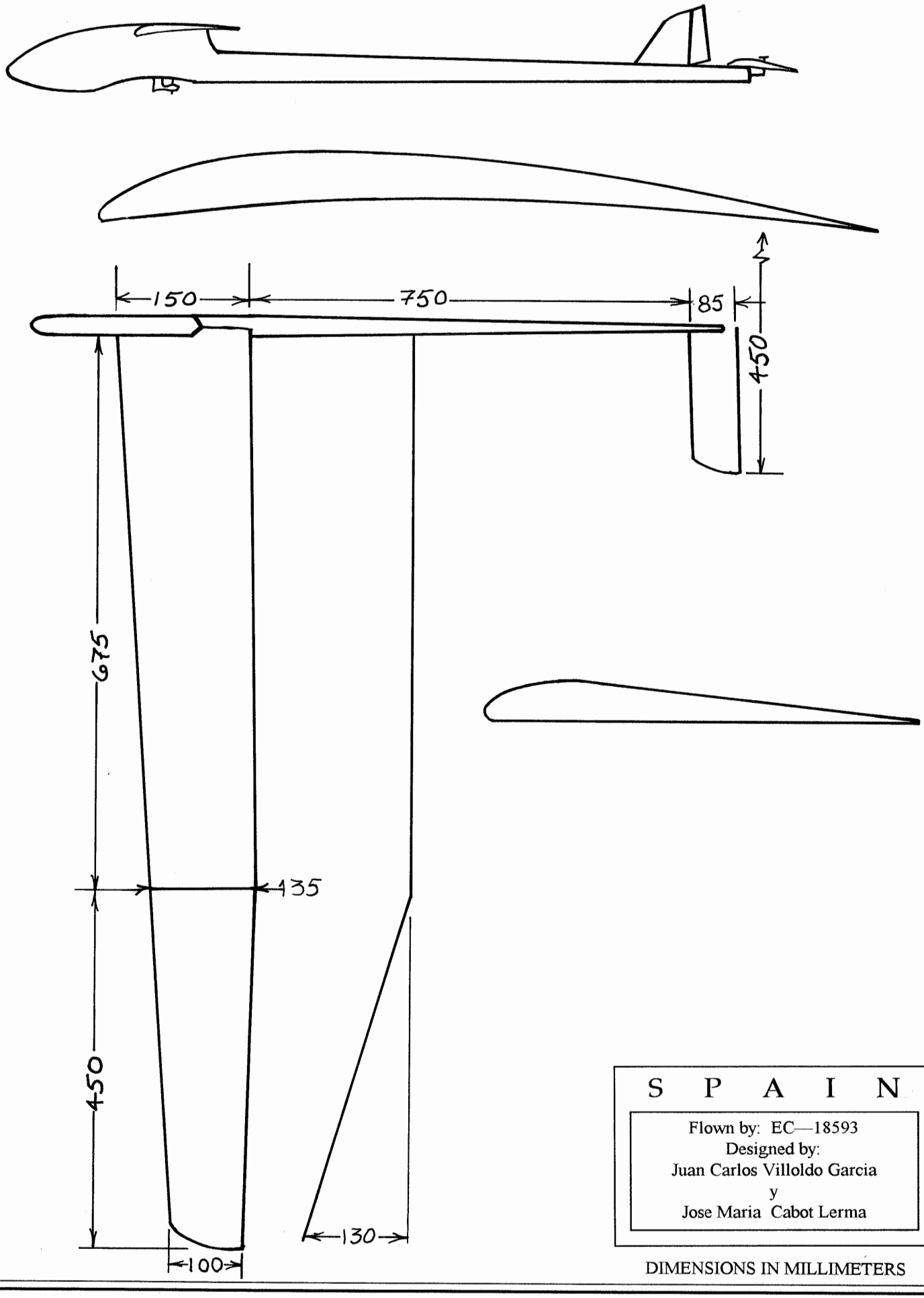
DIMENSIONS IN MILLIMETERS



S P A I N

Ricardo Rodriguez
F 1 A
Asterix

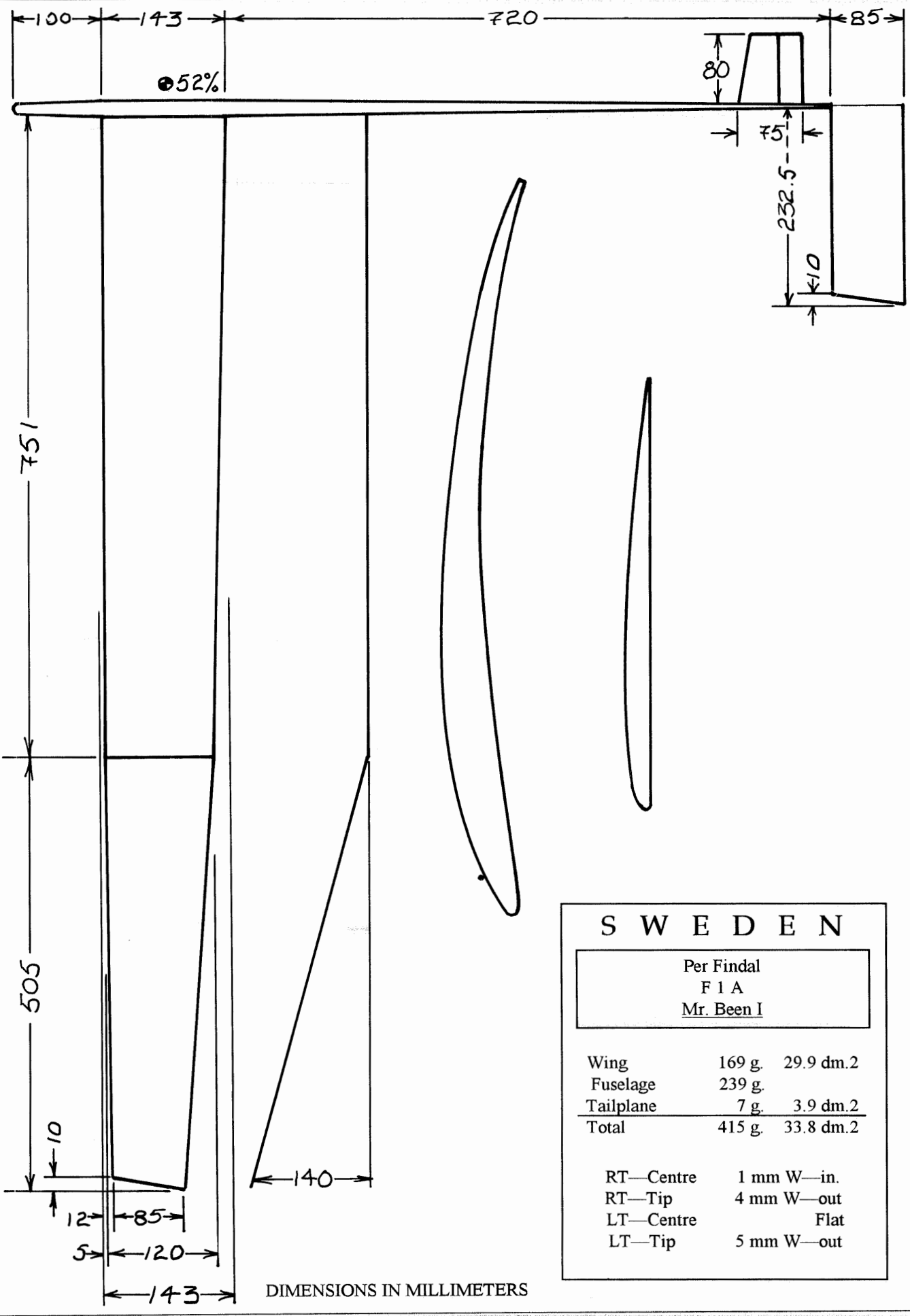
Wing	29,05 dm.2
Stablizer	4,80 dm.2
Total	33,85 dm.2



S P A I N

Flown by: EC—18593
Designed by:
Juan Carlos Villoldo Garcia
y
Jose Maria Cabot Lerma

DIMENSIONS IN MILLIMETERS



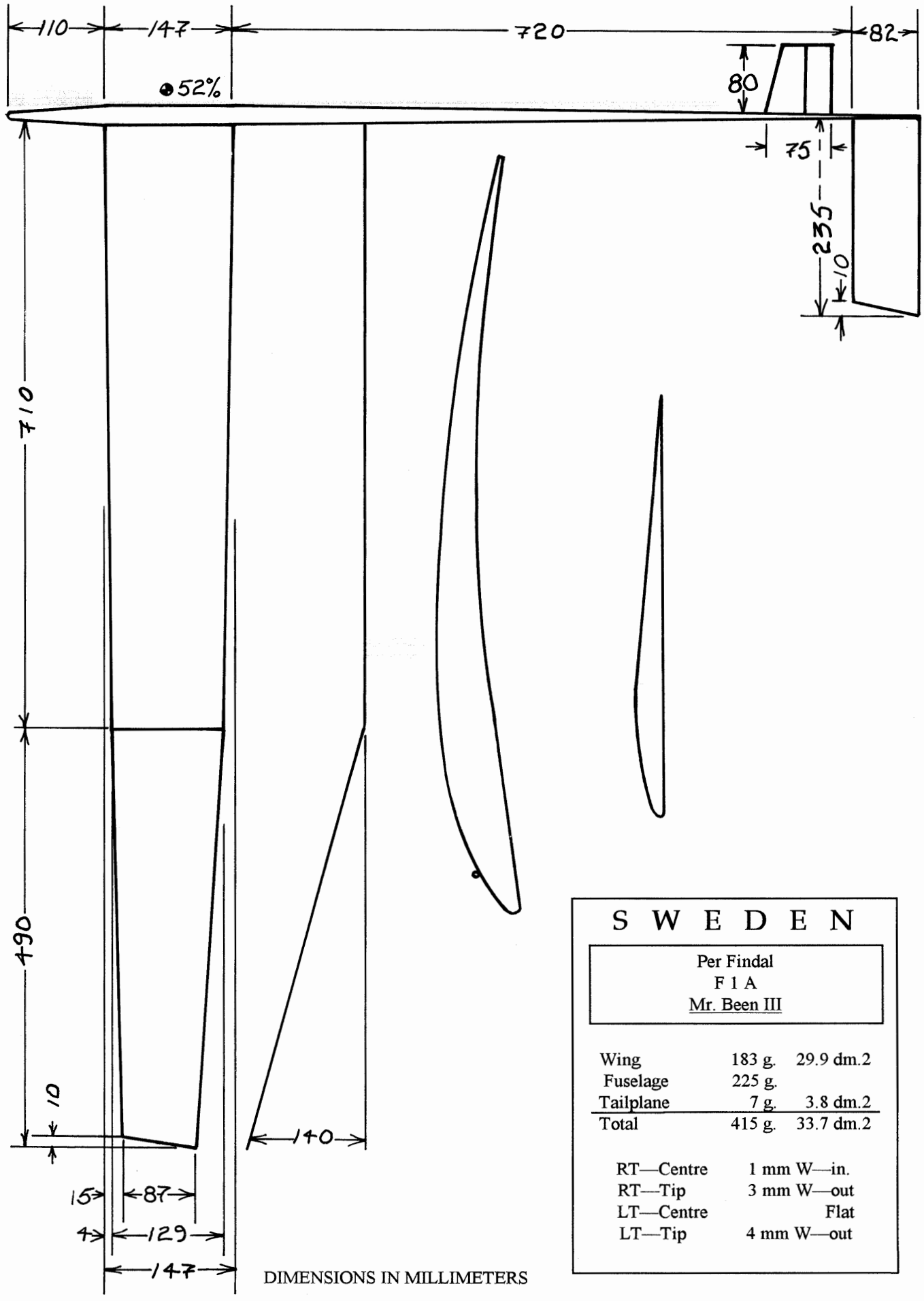
S W E D E N

Per Findal
F 1 A
Mr. Been I

Wing	169 g.	29.9 dm.2
Fuselage	239 g.	
Tailplane	7 g.	3.9 dm.2
Total	415 g.	33.8 dm.2

RT—Centre	1 mm W—in.
RT—Tip	4 mm W—out
LT—Centre	Flat
LT—Tip	5 mm W—out

DIMENSIONS IN MILLIMETERS



S W E D E N

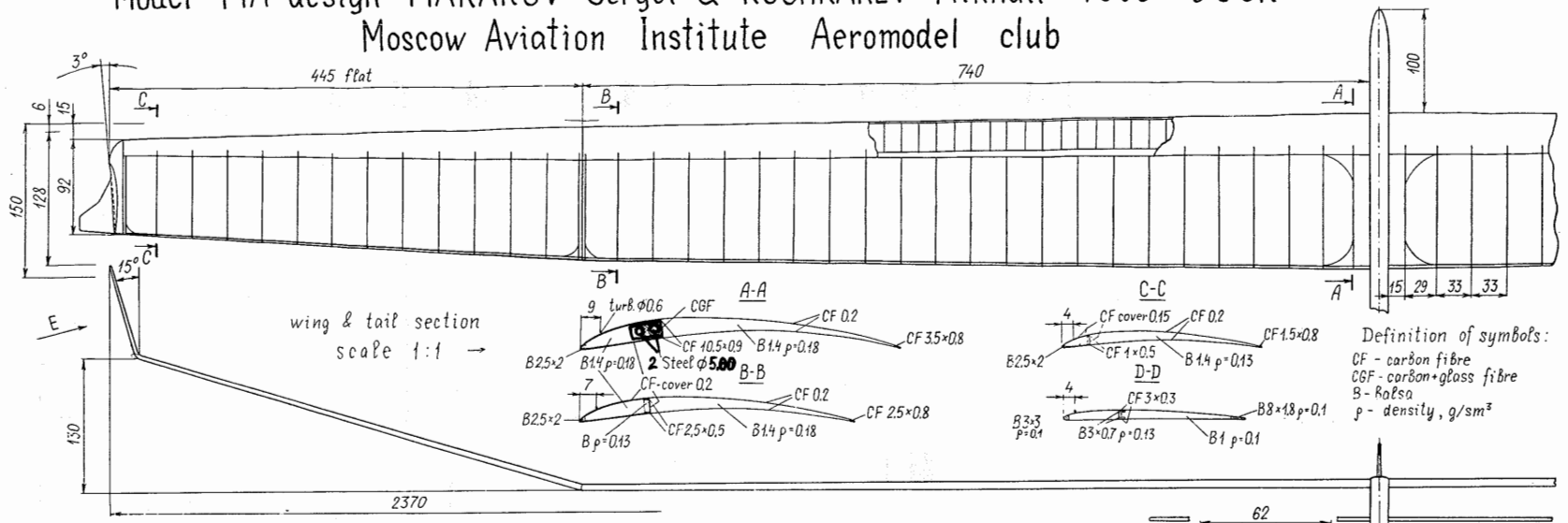
Per Findal
F 1 A
Mr. Been III

Wing	183 g.	29.9 dm.2
Fuselage	225 g.	
Tailplane	7 g.	3.8 dm.2
Total	415 g.	33.7 dm.2

RT—Centre	1 mm W—in.
RT—Tip	3 mm W—out
LT—Centre	Flat
LT—Tip	4 mm W—out

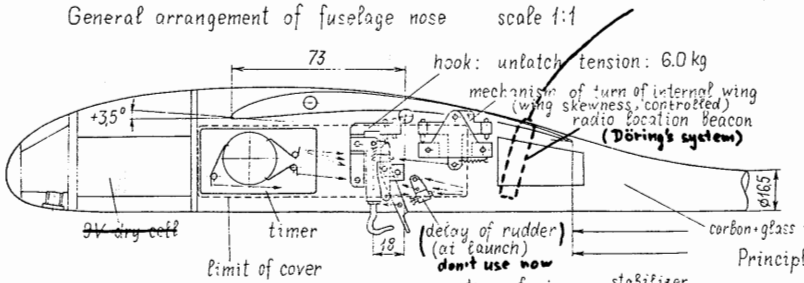
DIMENSIONS IN MILLIMETERS

Model F1A design MAKAROV Sergei & KOCHKAREV Mikhail 1990 USSR
Moscow Aviation Institute Aeromodel club

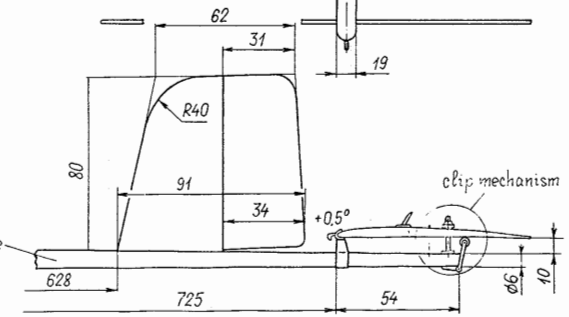


Definition of symbols:
CF - carbon fibre
CGF - carbon+glass fibre
B - Balsa
p - density, g/sm³

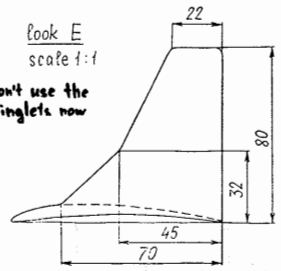
General arrangement of fuselage nose scale 1:1



Wing weight	~~170~~ g
Stabilizer weight	6.5 g
Flying weight	412 g
Wing area	30.18 dm²
Stabilizer area	3.8 dm²

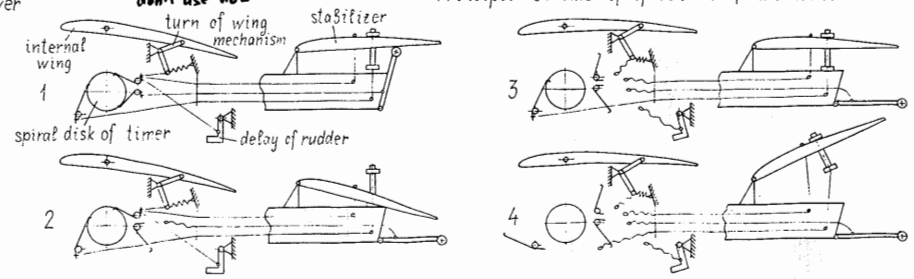


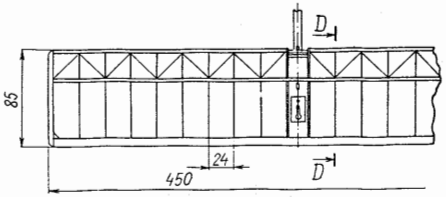
look E
scale 1:1



Don't use the winglets now

Principle scheme of operation of mechanism



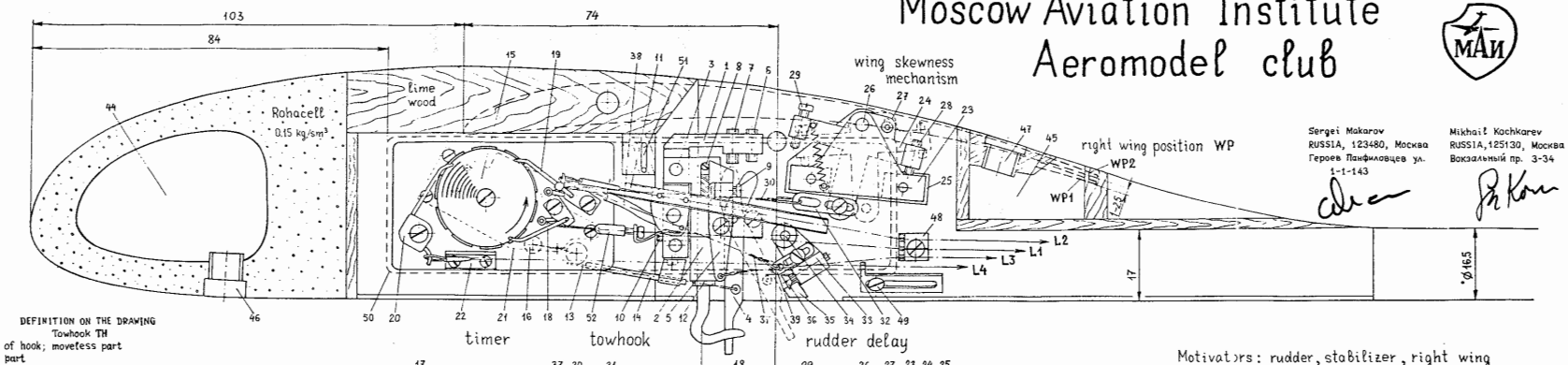


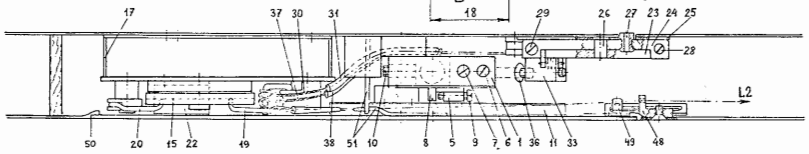
F1A "bunt" model fuselage design by MAKAROV & KOCHKAREV 1991

Moscow Aviation Institute Aeromodel club

Sergei Makarov
RUSSIA, 123480, Москва
Героев Панфиловцев ул.
1-1-143

Mikhail Kochkarev
RUSSIA, 125130, Москва
Вокзальный пр. 3-34





DEFINITION ON THE DRAWING

Towhook **TH**

1 - holder of hook; moveless part
2 - moving part
3 - axle of moving part turning
4 - latch
5 - rocker
6 - adjusting screw of rudder position on circles **RP2**
7 - adjusting screw of rudder position in free flight **RP5**
8 - screw of **TH** piston
9 - adjusting screw of rudder position in the time of start **RP3**
10 - adjusting screw of front position of **TH** moving part
11 - channel for second "bunt" line protection; the channel mount on hook holder
12 - adjusting screw of hook unlatch effort
13 - line from latch to pendulum of timer; the line provides starting of timer
14 - guide tube for line 13; the tube mount on hook holder

Mechanical timer 3 functions

15 - spiral disk
16 - pendulum of timer
17 - box of timer
18 - rocker of first "bunt" command
19 - rocker of second "bunt", wing skewness mechanism and rudder delay commands
20 - rocker of **DT** command
21 - plate of timer machine
22 - angle piece for **DT** line protection

Wing skewness mechanism **WSM**

23 - **WSM** body; moveless part
24 - rocker; moving part
25 - **WSM** plate; the plate was glued on carbon cover of fuselage nose
26 - axle of rocker turning
27 - hole for pin of right wing
28 - adjusting screw of right wing position **WP1** on circles and in the time of start tilt second "bunt" command
29 - adjusting screw of right wing position in free flight **WP2**
30 - stiff line from timer to **WSM**; steel cable ø 0.5 mm
31 - tube for line 30
32 - adjusting component of length of line 30

Rudder delay **RD**

33 - **RD** body; moving part
34 - axle of turning
35 - a stop on a fuselage; **RD** body rests to the stop
36 - adjusting screw rudder position **RP4** during some seconds after start; **TH** latch rests on the screw
37 - stiff line from timer to **RD**; steel cable ø 0.5 mm
38 - tube for line 37
39 - adjusting component of length of line 37

Clip mechanism

40 - holder of stabilizer
41 - post with knurled nut; stabilizer rests on the nut in free flight, by the nut changes stabilizer position **SP3**
42 - roller; stabilizer rests on the roller before first "bunt" command, by the screw of roller changes stabilizer position **SP1**
43 - tubes for lines **L2** and **L4**

44,45 - front and back places for charge; permit to change center of mass position without change flying weight
46,47 - screw plugs of front and back places for charge
48 - angle piece with holes for lines **L1, L2, L3**
49 - adjusting component of stabilizer position **SP4** after **DT**
50 - limit of window cover
51 - lock of window cover
52 - adjusting component of line **L1** length
53 - adjusting component of line **L3** length

ORDER OF MECHANISMS OPERATIONS

model on a towline

I. towline is tensed (projection of line tension force on longitudinal fuselage axis is not less 150-200 g); moving part of hook rests in screw 10; model flights straight; timer is not work; position of motivators: **RP1, WP1, SP1**

II. towline is slackened; moving part of hook rests in screw 6; model makes circle; timer is not work; position of motivators: **RP2, WP1, SP1**

III. speeding up; latch 4 is released when projection of line tension force on normal fuselage axis achieves 5.8-6.0 kg; adjusting screw 9 of rocker 5 rests on the piston screw 8; position of motivators: **RP3, WP1, SP1**

free flight

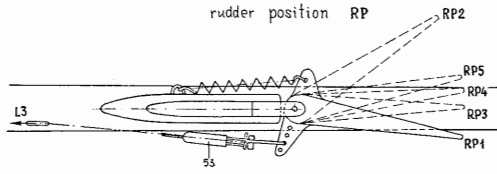
IV. towline is release; timer begins to work; moving part of hook rests in screw 36 of rudder delay; position of motivators: **RP4, WP1, SP1**

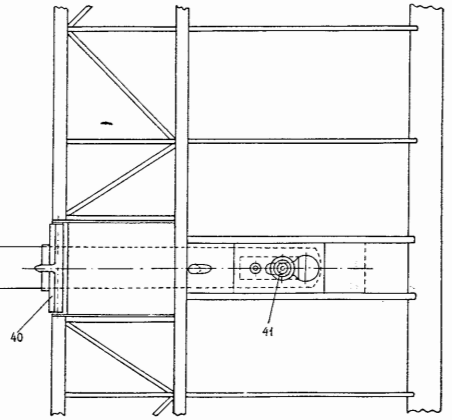
V. 0.7-1.0 sec after line release; first "bunt" command releases line **L1**; stabilizer aft edge moves down because of elastic line **L2**; position of motivators: **RP4, WP1, SP2**

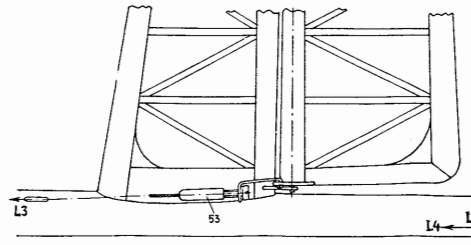
VI. 1.3-1.7 sec after first "bunt"; second "bunt" command releases line **L2**; stabilizer aft edge moves up because of rubber of stabilizer mounting; at the same time are released **WSM** line 30 and **RD** line 37; position of motivators: **RP5, WP2, SP3**

VII. after necessary flight time; **DT** command releases line **L4**; stabilizer aft edge moves up because of rubber of stabilizer mounting; position of motivators: **RP5, WP2, SP4**

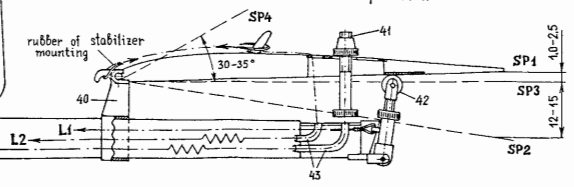
Motivators: rudder, stabilizer, right wing







stabilizer position SP



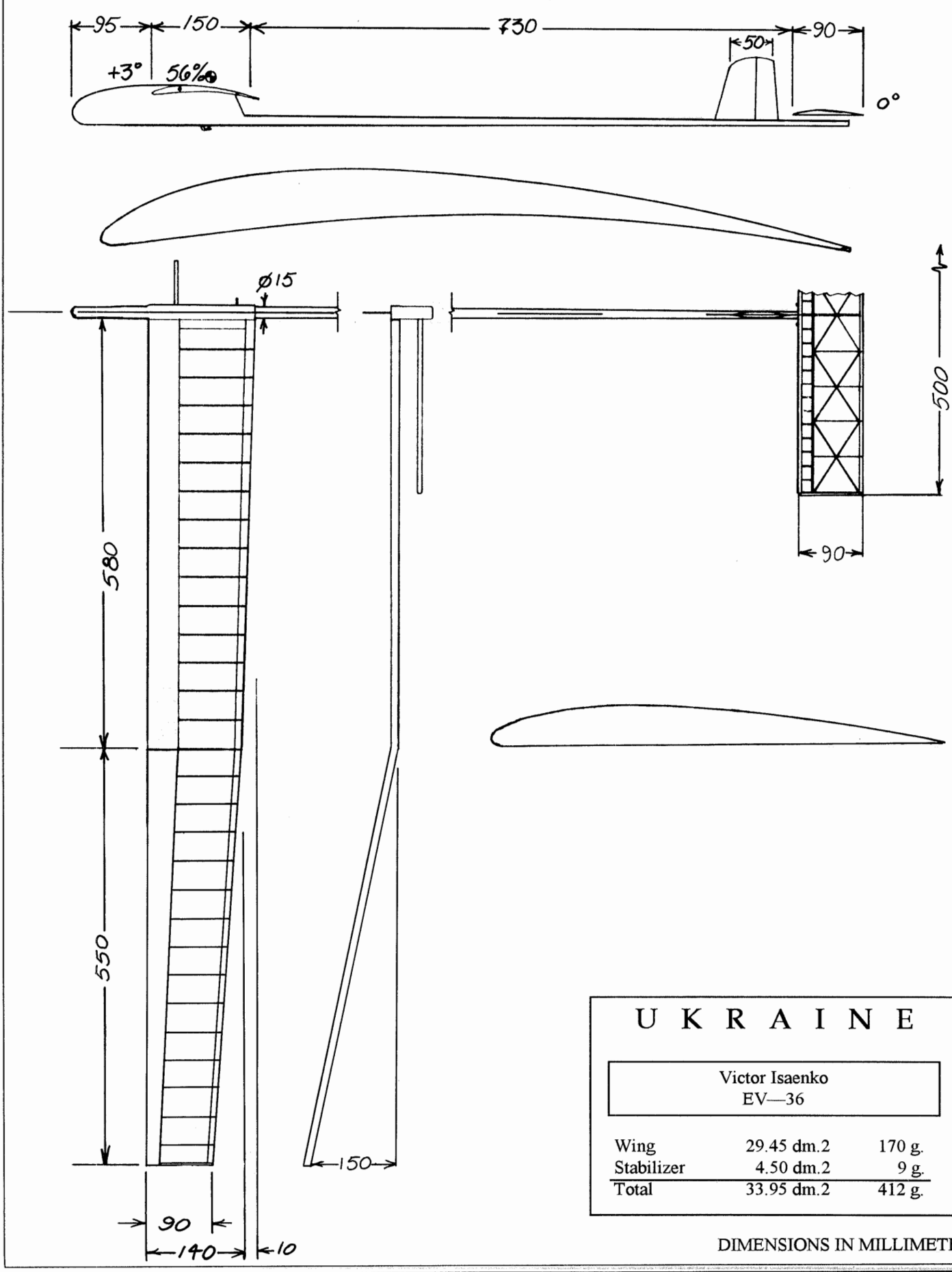
clip mechanism

LINES DEFINITION

L1 - stiff line (steel cable ø 0.3 mm) first "bunt"
L2 - elastic line (capron thread ø 0.4 mm) second "bunt"
L3 - stiff line (steel cable ø 0.3 mm) from towhook to rudder
L4 - elastic line (capron thread ø 0.4 mm) **DT**

scale 2:1

All dimensions mm



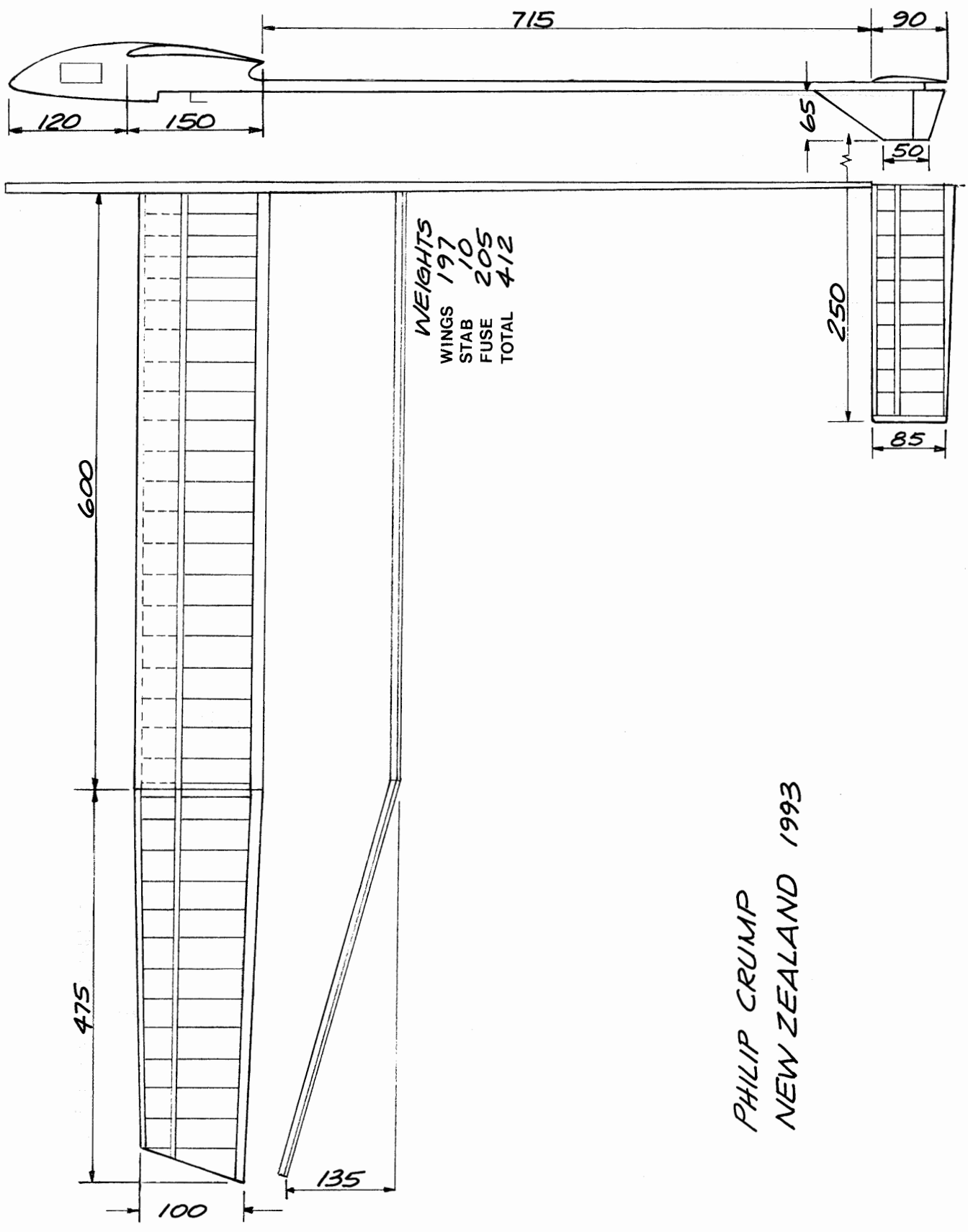
U K R A I N E

Victor Isaenko
EV—36

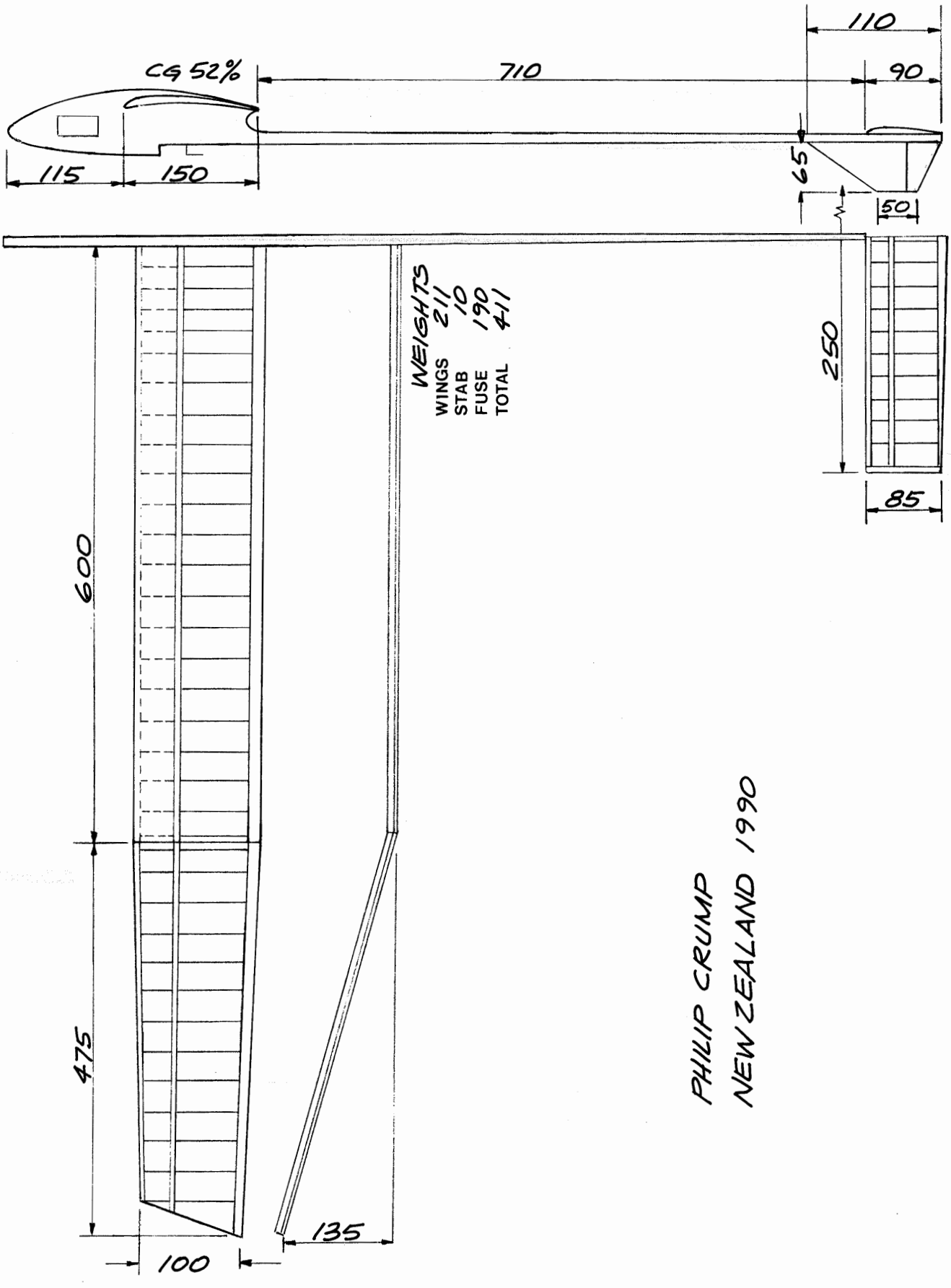
Wing	29.45 dm.2	170 g.
Stabilizer	4.50 dm.2	9 g.
Total	33.95 dm.2	412 g.

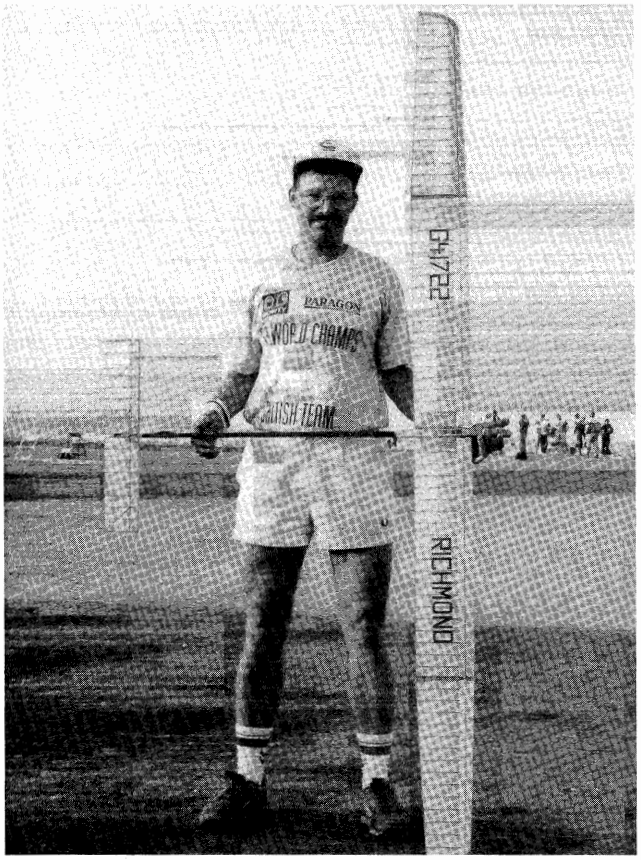
DIMENSIONS IN MILLIMETERS

DIMENSIONS IN MILLIMETERS



DIMENSIONS IN MILLIMETERS



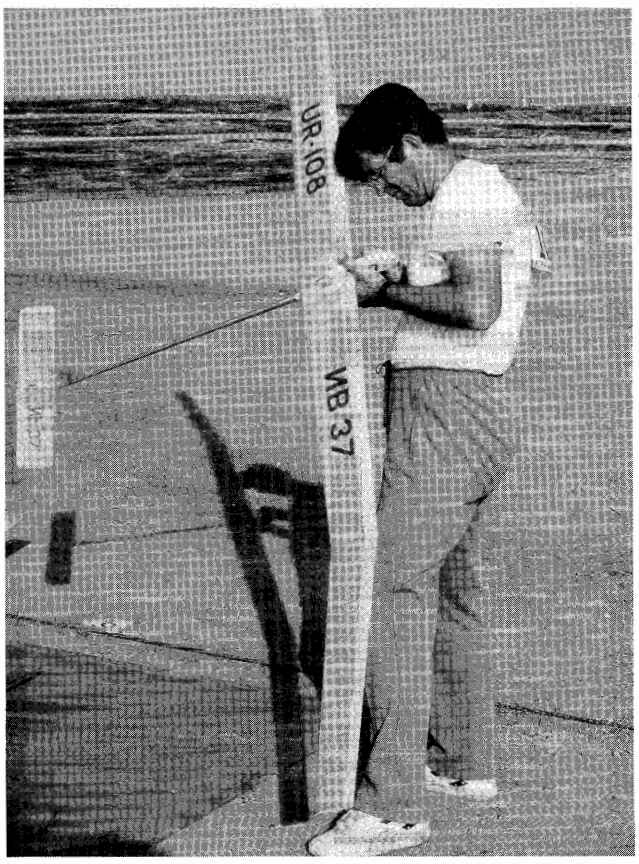


Above: Mike Fantham, Great Britain.
Below: Vic Morgan, Australia



Above: Russian Team Manager.
Below: Victor Isaenko, Ukraine.



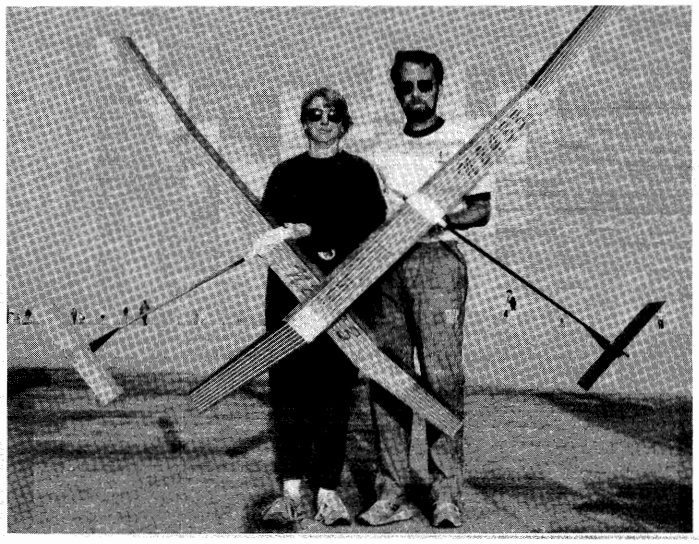






Above: Manfred Gruneis, Austria.
Below: Matt and Gail Gewain, USA.
Far Below: No Caption.

Above: Lisa with Peter Allnutt's model.
Below: Janos Bodo, Hungary.









Above: L. Fouseev with M. Kochkarov's model, Russia.
Below: Polish Manager with K. Stezalski's model.



Above: Japanese F 1 A.
Below: Canadian Manager with G. MacKenzie's model.

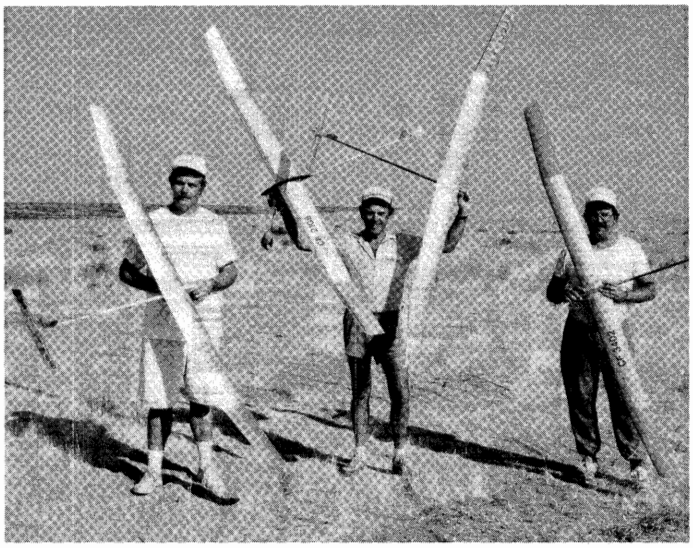






Above: Liv, China.
Below: Alan van Wallene and Pym Ruyter, Holland.
Far Below: Horak, Allnutt, and MacKenzie; Canada.

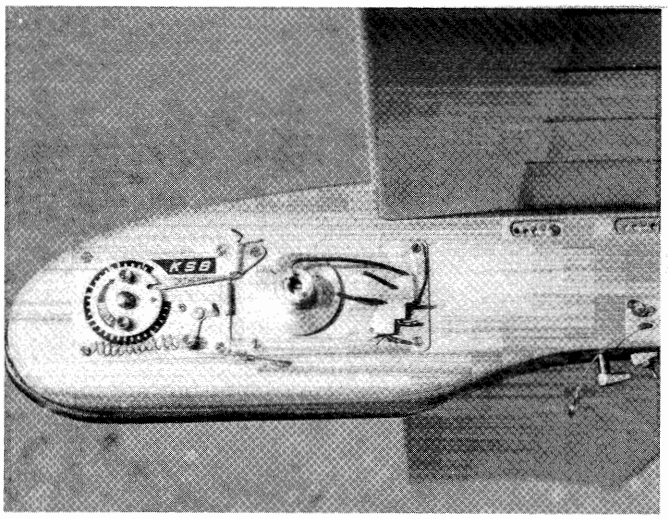


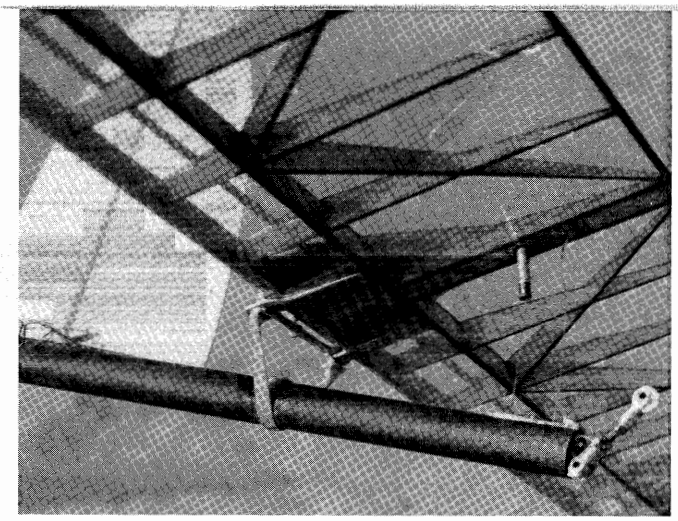


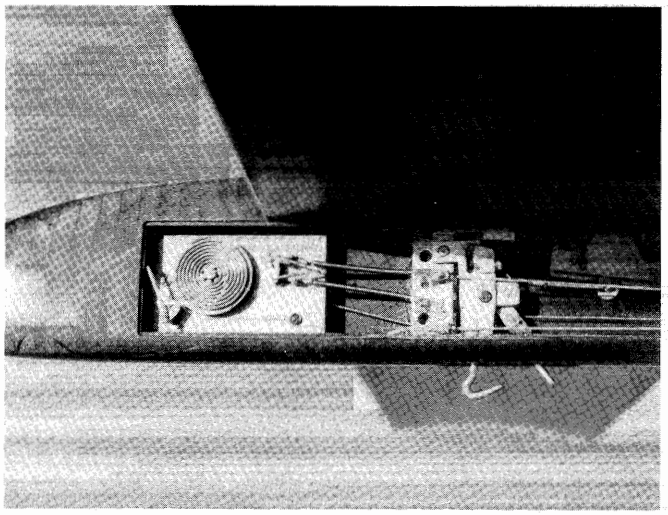


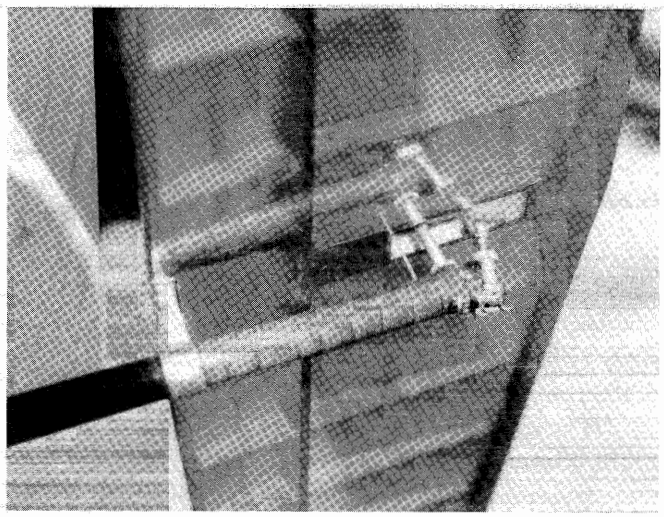
Above and Below: Pisani, Ukraine.

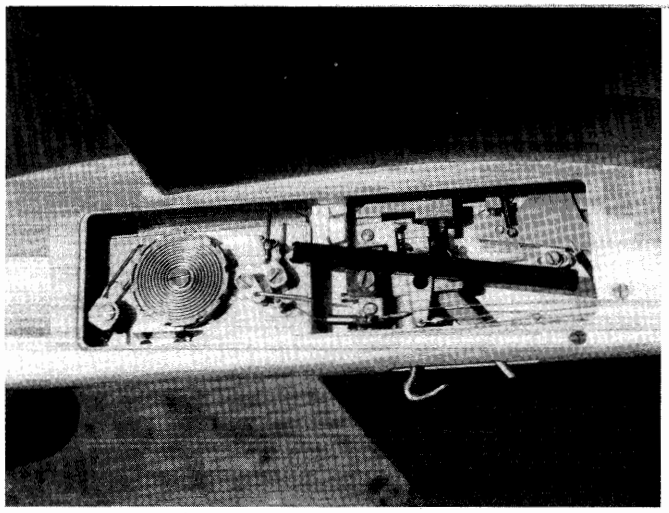








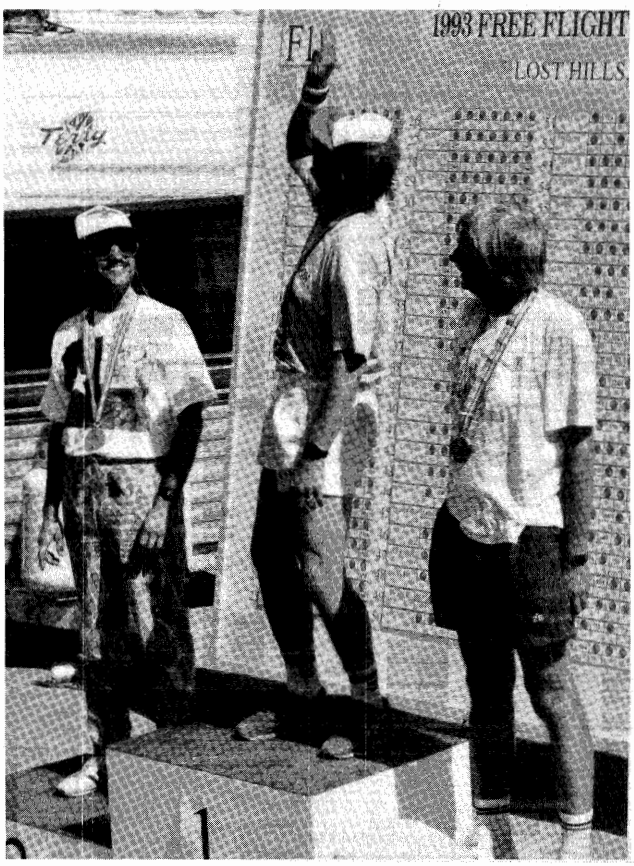




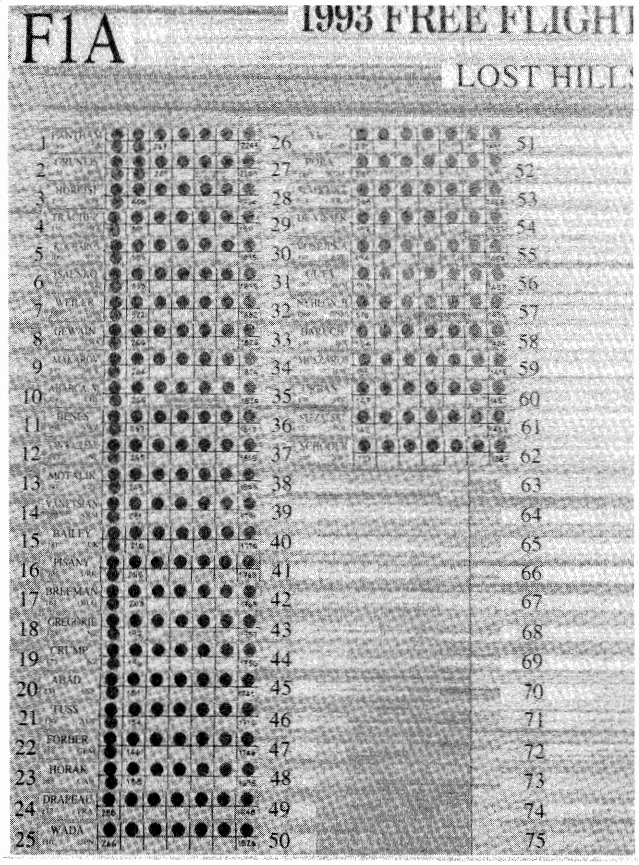
Top: Mike Fantham, Great Britain.

Middle: Randy Weiler, USA.

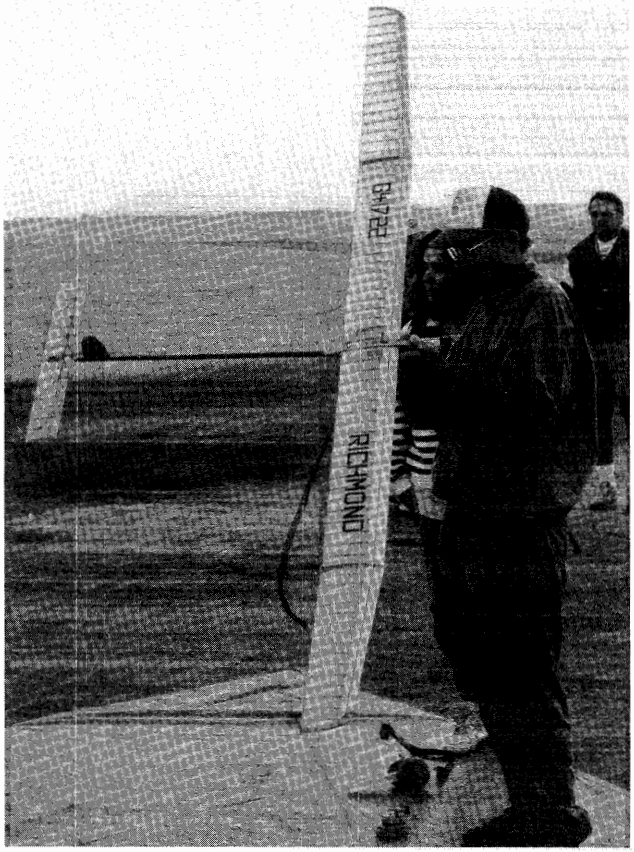
Left: Sergiej Makarov, Russia.

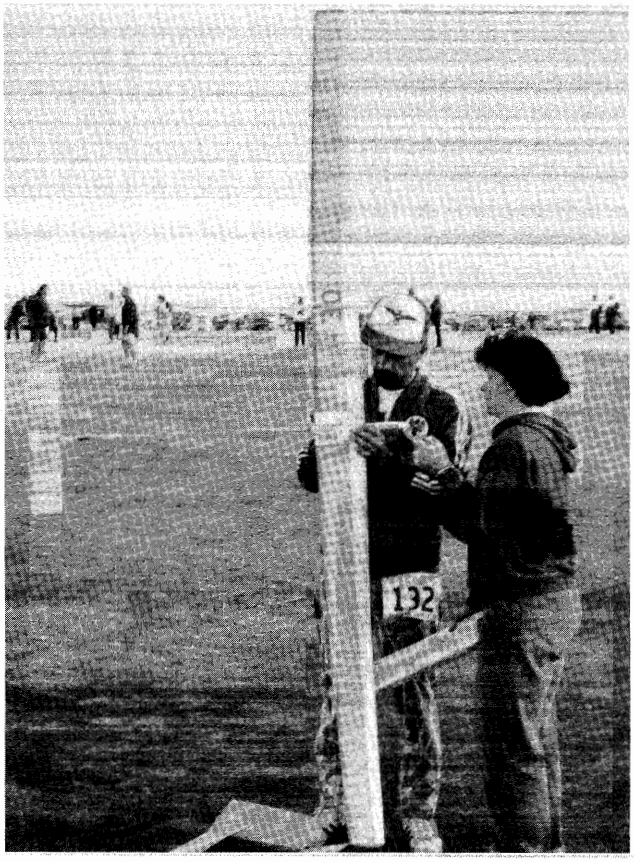


Above: F 1 A Awards.
Below: Mike Fantham, Great Britain.



Above: Flyoff board.
Below: Manfred Gruneis, Austria.





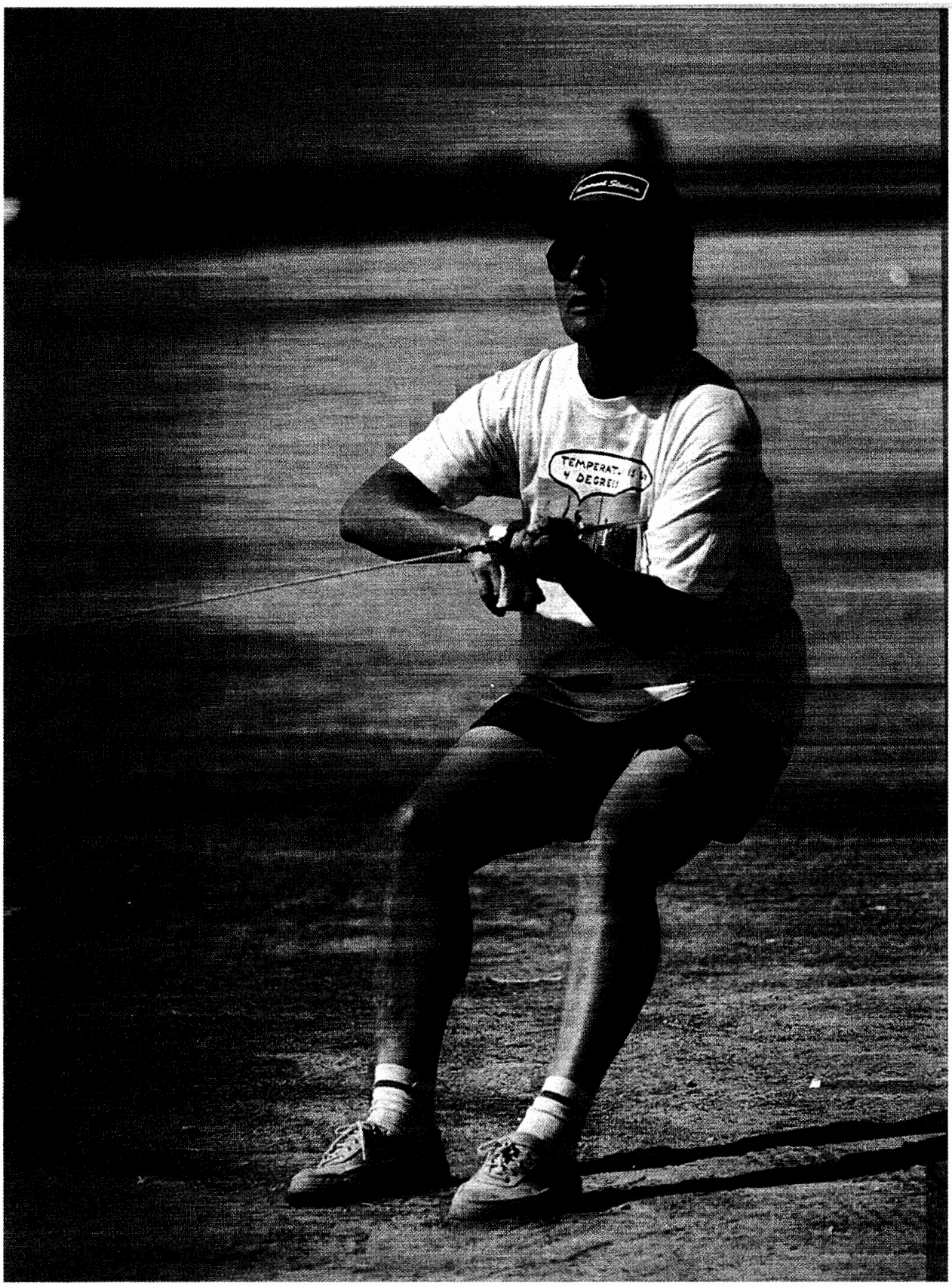


Photo: S. Fruciano

Alexander Andruikov, F 1 B World Champion.

F1B Development since the 1979 W/C

Tony Mathews

F1B model performance has increased dramatically since 1979. In 1979 the maximum sunrise performance for a World class F1B in calm air was 4 to 5.5 minutes. By 1993 the sunrise calm air time has risen to over six minutes with the best models capable of over 7 minutes! Flyoffs are now the norm rather than the exception with a larger number of flyers making the flyoffs than ever before.

What are the developments responsible for these improvements in F1B performance?

The improvements can be detailed in the following categories:

1. Structures
2. Wing Aerodynamics
3. Rubber Handling
4. Thermal Detection Equipment
5. Trim

1. STRUCTURES

The composite revolution was a little slower to be adopted by the average F1B flyer, but composites are now here in full force! In 1979 the majority of F1B models flown at the Championships were of balsa and spruce construction with tissue covering. New materials have entered into every component in the modern F1B:

FUSELAGE

Motor Tubes:

In 1979 motor tubes were constructed from either thin aluminum tubing, rolled balsa with fiberglass tubing, fiberglass tubing, or balsa and spruce rectangular boxes. Winding tubes were very common to protect the motor tubes from damage in the event of a blown motor. By 1993, the most common motor tube material is molded kevlar. Some variant include carbon fiber of carbon/kevlar, but kevlar is by far the material of choice for a motor tube. Many Eastern Europeans have abandoned the winding tube and have chosen to reinforce the motor tube to withstand a blown motor. This way the motor tube becomes the winding tube. This allows an advantage in flying strategy.

Motor tube weights are now at 1.1 to 1.5 gram/inch with diameters reducing to a typical range of 28 to 32 mm.

Tailbooms:

In 1979 most tailbooms were produced from rolled balsa with a light Japanese tissue covering or in some cases light fiberglass cloth. In 1993, tailbooms are now produced in carbon fiber, carbon fiber/aluminum, or aluminum/carbon fiber aluminum. Diameters have decreased steadily with the Russians using tailbooms with a maximum diameter if 12mm and a small end of 4.5mm! The weight savings have been dramatic. A rolled balsa tailboom of 500 to 600mm would typically weigh 10 to 12 gm. However, these booms were fragile and were also prone to warping when exposed to variations in temperature and humidity. The new composite tailbooms are typically 600 to 700mm long and can weigh as little as 6 gm! They are also extremely stiff and strong and are not affected by changes in temperature and humidity. Tailbooms complete with rear joiner, fin, auto stab mechanisms, lines etc. can now weigh as little as 12 gm. all up ! In 1979 20-25 gm. all up weight was not uncommon. This is a weight reduction of 40%.

WINGS

The wing was nearly the last component to be transformed by the new composites. I believe that the reason was that a wing could still be produced for a reasonable weight and stiffness using traditional materials, and composites were perceived as being difficult to work with. Three changes began when F1B flyers began experimenting with kevlar D-boxes similar to the types used in Soviet F1A models. Others began experimenting with aluminum and balsa D-boxes like miniature F1C models. The results were very light and stiff structures that were also temperature and humidity stable. Many were unconvinced and continued with traditional structures. Indeed, although several prominent F1B flyers were working with composites in the early 1980's, the composite F1B wing did not become a common sight at contests until 1990. Certainly the availability of pre-made eastern European and domestic D-box sets (Kevlar) helped a great deal. As the techniques became more widely known, and as materials became easier to obtain, composite wings were becoming more and more common. By now the structure is well defined.

The wing can be defined as comprising three main parts by their primary function.

1) The D-box in composite cloth (Kevlar or Carbon Fiber) @45 degrees, which carries virtually all of the torsion loads.

2) The spar, in unidirectional carbon fiber, carries virtually all of the bending loads.

3) The rear portion, ribs and trailing edge, which are essentially only an aerodynamic fairing , but must be warp resistant.

1. Torsional rigidity

The D-box is now ubiquitous. Constructed from three main materials or hybrids. Kevlar, typically in the form of woven fabric @ 45 degrees with either a single layer of 70 gm/sq. meter, or 2 layers of 37 gm/sq. meter with an epoxy matrix formed over a male form. Carbon fiber, usually a single layer of 80 to 90 gm/sq. meter woven fabric at 45 degrees with an epoxy matrix, or aluminum foil 0.03mm thick formed against a sheet of glass ala F1C technique and then wrapped around ribs to achieve an airfoil shape.

D-box widths have decreased dramatically with the advent of the new composites. Typically a composite D-box will have a width that can vary from 25% of chord at the root to as little as 15% of the chord at the tip. Ribs are spaced inside the D-boxes with a close pitch to preserve the airfoil shape. Typical pitches are 12 to 20 mm.

Many of the D-boxes seen on sale at the '93 W/C had a layer of metallized mylar bonded to the outside. The outer layer of mylar is apparently used to prevent excess heat buildup which would occur when the sun heated a normally black carbon fiber D-box. The mylar also seals any porosity making the D-box impervious to moisture and air. Another benefit is that a good (glossy) finish can be obtained with less epoxy than usual, as the epoxy has only to connect the fibers and not fill out a surface finish, with resultant weight savings.

2. Bending Strength

Carbon fiber spars are now almost universally adopted. One point should be made that the new D-box materials contribute little to the bending strength of the wing as the fibers are usually arranged at 45 degrees, therefore the stiffness of the spar becomes more important than with a wooden D-box, which did contribute somewhat to the wing bending strength. Fortunately a little carbon fiber goes a long way! Spars are arranged with carbon fiber flanges 4 to 6mm wide at the root, tapering to 1.5-3mm at the dihedral break. Typical flange thicknesses are .35 to .5mm for the top flange and .17 to .35mm for the lower flange. Webbing is typically horizontal or vertically grained balsa.

Spars are sometimes wrapped with very fine Kevlar thread or reinforced with carbon sheet applies at 45 degrees to the rear of the web. The Kevlar thread helps to prevent delamination due to compressive buckling while the carbon sheet adds additional stiffness in shear. Tip spars are usually of a smaller cross section with widths of 1.5 to 3mm and thickness of .17 to .35mm with a balsa web.

3. Rear Fairing

The rear portion of the wing consists of ribs arranged at a pitch of 25 to 40mm capped with carbon fiber sheet typically .075 to .125mm in thickness and 1 to 1.5mm in width. The carbon caps are applied in such a manner as to overlap the D-box by 1.5 to 3mm and also the trailing edge. This way all the torsion loads are transferred from the D-box to the ribs by means of these carbon caps.

The trailing edges are now fabricated from strips of carbon fiber sheet with thicknesses of .6 to .8mm and widths of 2 to 3mm. These trailing edges are now easily available as pre-made pieces and make the chore of trailing edge construction extremely easy. The added advantage is a tremendous weight savings. The resultant structure is extremely stiff and very warp resistant.

Typical wing weights in 1979 for a balsa wing of D-box construction was 60 to 70 grams. The new composite wings can weigh as little as 45 to 55 grams. While the weight savings are a useful result of switching to composites, the main advantage is the tremendous increase in stiffness.

4. Covering

Tissue was the only real option for covering in 1979. Today the choices are more varied. Mylar, either clear or metallized, Micafilm, or other commercially available fiber-re-inforced plastic coverings and now from Germany, Polyester tissue (as used by Andriukov) are all available for covering an F1B wing.

Some of the Eastern Europeans use an interesting hybrid for covering. The wing is first covered with 1/4 mil clear mylar and then is covered in very light Japanese tissue as per traditional practice, but with the twist that dope is not used for adhesive. The tissue is covered with non shrink lacquer as a adhesive and is not water shrunk. This reduces the chance of warps due to shrinking that are prevalent with dope.

The Polyester tissue that Andriukov used appears to be an interesting material. It is very tough and puncture resistant with a finish similar to Japanese tissue. The material is applied with dope as per tissue, but is heat shrunk like a plastic covering and then sealed with a few thin coats of non-shrink lacquer.

1/2 mil mylar has also become a popular material for F1B models. A current area of controversy surrounds the Aerodynamic influence that the covering material may possess related to surface finish. Some modelers claim that the minute surface roughness of tissue offers an aerodynamic benefit producing a favorable turbulence useful at the Reynolds number of an F1B.

Others including this author have found that the smooth surface finish inherent in a mylar covering can have similar performance as a tissue covered wing as long as a surface turbulator is chosen to produce the required degree of turbulence. At the moment no serious scientific testing has been done to refute or support either of these claims and it seems that good performance has been achieved with either method.

In a discussion with current F1A expert Victor Stamov in 1990, I heard a remarkable story regarding the tissue vs. Mylar debate. Victor believes that the tissue covered wings fly better. He feels that since his profile (mod. Ritz 75-555g) was developed for balsa/tissue wings, a tissue covered composite wing can simulate the surface roughness (at the boundary layer) of a balsa/tissue wing. Victor originally tried this wing with the Mylar covering only. While it flew well, he claims that the addition of a top layer of Japanese tissue improved the flying characteristics. Then he added the under surface layer and found a further increase in performance!

This is completely opposite to what I have found with my Mylar covered Composite F1B wings. In my experience, the smoother the wing surface, the better. (I do use "invigorators" though). Victor suggested that a different profile would react in a different manner to surface roughness variations, and I agree wholeheartedly.

One of the advantages of using a Composite structure is the warp resistance obtained. It is crucial, for maintaining warp resistance, that all materials be both temperature and moisture stable. A World class F1B model will have a very fine trim which may take many flying sessions to optimize. It is imperative then, that this trim be maintained from session to session. It is my opinion that this often overlooked fact is one of the less obvious reasons for the very high performance of the new models.

Another possible reason for the increased performance of the new generation of F1B models is the tremendous increase in stiffness of the wings in both bending and torsion. In a conversation with Bob White, he felt certain that the little un-notices distortions in an F1B wing during the climb from both aerodynamic loads and possibly from vibration induced from the rubber motor unwinding (!) rob the model of some efficiency by an increase in drag and possibly from a loss in lift. It may be coincidence, but 3 of the top 5 models in the fly-off at the World Championships in Lost Hills, used carbon-fiber D-boxes and not Kevlar*. The other two used Aluminum/balsa. (*Carbon D-boxes are stiffer for a given weight.)

2. WING AERODYNAMICS

F1B wings have followed the trends observed in F1C and F1A with wings that are stretching in span (increasing in Aspect ratio) and decreasing in thickness. It would seem obvious that the new composite structures would allow the possibility to produce some very extreme models with very high aspect ratios and/or very thin airfoil sections.

Such models were observed at this World Championships. Alexander Andriukov was testing a model in practice with very nearly a 2 meter wing span! (24:1 aspect ratio). However, he chose to use his less extreme AA-30 for the rounds and fly-off which had a much more conservative 1.6m span. Eugeny Gorban was using a relatively long model (1.7m) throughout the entire contest. Victor Roshonoks' (Latvia) 2nd place in the morning fly-off was using a very long model with what must have been a 1.8m wing.

This writer believes that the very high aspect ratios being attempted on some new wakefields are not the answer for high performance. Martyn Presnell's article in the '92 Symposuim (NFFS) on the wind tunnel tests of the Benedek 6356b, showed that an optimum aspect ratio was quite clearly defined for a given Reynolds number. In fact, the optimum aspect ratio varied considerably with the performance of the sections chosen at the lower Reynolds numbers seen in high aspect

ratio wings. The use of invigorators could also increase the optimum aspect ratio by as much as 15 to 20%! Martyn recommended a maximum aspect ratio for an F1B using the Benedek 6356b of 18:1 (using invigorators

Certainly, if very long wings are to be contemplated, the sections used at the dihedral break and tip must be chosen with great care to minimize the performance loss due to Reynolds number effect. Victor Roshonok's long model had a section that must have been only 2.5mm thick and virtually flat bottomed!

This brings up an interesting point: if very thin low cambered wing sections are used to optimize the wing an a high aspect ratio model, what influence does this have on the all-important climb?

Many wings in 1979 were of either constant chord or had constant chord center panels with moderately tapered tips. Newer models use fully tapered wings arranged in either a double taper (Eastern European) or a multiple taper swept leading edge planform ala Schuemann (Canadian). Each layout appears to be an attempt to produce a favorable near elliptical lift distribution for optimum performance.

Many models are now produced with extra care in the selection and accuracy of the wing sections used (perhaps an artifact of the composite wing construction method?) with extra attention paid to the varied Reynolds number inherent in a tapered wing.

A word should be included about the undercamber jig used. The Ukrainian F1B flyers use a jig that is of constant chord approx. 500mm long and utilizes a curve which matches the *underside* of the wing *root* profile. This curve is the same at both ends--i.e. the root undercamber id maintained throughout the entire wing! This causes a reduction in *effective* mean camber of the profiles from root to tip.

They also reduce the tip camber progressively towards the tip, causing a reduction in profile thickness from approx. 7% at the root to 6% at the dih. break and 4% at the tip. I believe that aerodynamically, this is the correct approach to wing profile distribution for tapered wings that fly at our Reynolds numbers. My latest F1B models follow this approach exactly. Incidentally, both Andriukov and Verbitsky (F1C) use this technique for making wings.

Wing Sections

A sample of some of the most successful current F1B wing sections are included with co-ordinates. Wing sections are usually chosen to be optimum for the chords used and are highly dependent on the Aspect Ratio. Typically, an F1B wing section is as thin as an F1A section but with less mean camber. Maximum top cambers are rarely over 4.5%. Leading edge radii have varied for years with some modelers preferring very sharp leading edges and some preferring more blunt leading edges. The new composite molded D-boxes cannot replicate an extremely sharp leading edge as the D-box fabric is laid-up onto a male form.

One trend that has been noted has been the shifting of the maximum thickness towards the leading edge. Some new profiles have the maximum thickness located at as far forward as 15%! It is difficult to say whether this trend is due to possible aerodynamic theory, or due to structural developments i.e.: since it is now possible to thin the rear section of the airfoil without loss of structural integrity (remember past structures used thicker wooden trailing edges to ensure stiffness) perhaps many modelers are trying this, believing that there may be an aerodynamic benefit.

Some divergence in airfoil development has been noted due to varying structural technologies. The modelers experimenting with solid foam cored (Rohacell or Polystyrene) Kevlar skinned wings (notably Stebenmann, Rupert et al) have been trying very thin (4%) profiles. This no doubt an attempt at a reduction in profile drag, and an attempt to minimize the volume of the foam core thereby reducing weight.

The most successful profile using the Composite D-box (Andriukov) is actually on the thick side of current profiles (nearly 7% at the root).

3.) RUBBER HANDLING

Fred Pearces' article in the NFFS Symposium, 1990, has shown that a rubber motor heater is an essential piece of support equipment for the modern F1B flyer. The Russians (Andriukov) first demonstrated the effectiveness of heaters at the 1989 World Championships.

If the temperature is below 30° C then you must use a rubber heater to be competitive. In a morning or evening fly-off the advantage is very great. Estimated benefits are 20% if the ambient temperature is 5 to 10 degrees Celsius and is the heater is set to 35 to 45 degrees Celsius.

4.) THERMAL DETECTION EQUIPMENT

At the 1979 World Championships, Itzhak Ben Itzhak (Israel) used a recording sensor located upwind of the launch position. This began a trend which has continued to this day. Lothar Doring and Reiner Hoffsass (West Germany) combined for three consecutive World Championships (81, 83, 85) with a twin recording system (upwind and flight line recording devices). The West Germans demonstrated the effectiveness of a combined Thermistor and Anemometer recording system that allowed the development and passing of thermals to be tracked and recorded. The Chinese F1B team have used upwind sensors throughout the 80's and Andriukov has an upwind and flightline recording sensor used to good effect in the 1989 and 1991 World Championships. The Swiss team of Roger Rupert and Dieter Siebenmann have also been very successful with such a system. The writing is on the wall. Anyone contemplating a successful run at a World Championships medal must invest in similar equipment to be competitive.

It is suggested a temperature and wind speed recording device located at least 100 to 200 meters upwind and a similar device (could be temperature only) to be located at the flight line. There are two ways that this can work.

a) A man can be stationed upwind to monitor the device. When he feels that any change in the local conditions has occurred, he can radio the flight line his impressions. The team manager and the flyer can compare the conditions locally on the flight line with the conditions being described by the upwind man and determine if a thermal is moving towards the flight line.

b) The upwind sensor can be automated and radio the information to the flight line to a recording device located where the team manager and the flyer can view it. The local recording device must be located immediately next to the upwind device so that the results can be compared.

Canada used the first method (although we do have a transmitting device) and we put our National Champion (not on the World Championships team) on the device to give us his expert opinion on the conditions. This was how we could determine when to begin winding our models, and when to prepare for launching. When the upwind sensor showed a drop in wind speed and an increase in temperature (steady, not short term) I would wait until the conditions had moved to the flight line. When the same conditions occurred on the flight line, I would begin to wind my model. When the upwind manager said that the temperature had dropped and the wind has increased, and he felt that this

indicated a thermal was coming directly *toward* us (important, because some thermals moved sideway and did not reach us) then I would ready myself to launch. When the local temperature began to drop and the wind to increase, I would watch other models being launched to confirm the decision, then if all looked OK, I would launch.

This technique meant that at no time during the World Championships did any of our team members stand around with a wound model waiting for a thermal to develop. Of course you know, that when you wait like this the rubber is losing energy very fast. I estimate that in 5 minutes, 10 percent of the energy is lost!

5.) TRIM

Current F1B practice is to use Autosurfaces grouped into several categories.

Now if you scanned the plans in this planbook and compared timings and systems, it would be easy to get confused. However, I think that if we look at the problem logically, we can come up with a consensus on what to do to achieve a near optimal flight path for the trim of a wakefield model.

Let's start by listing the most common F1B trim devices along with approximate angular movements and trimmings.

Basic F1b Auto-surface--2 position rudder and stabilizer:

Assume a prop run of 40 seconds (nominal) and a CG of 65% with a glide decalage of 4°, with the wing set on the fuselage at 0° and with 1.5° of side thrust and 1.5° to 2° of downthrust. (I just chose these numbers arbitrarily, they are not the optimum).

Surface	Angular setting	Timing
Wing	0°	0 to 180 sec.
Stab 1	-0.5°	0 to 4.5 sec.
Stab 2	-4.0	4.5 to 180 sec.
Fin 1	0°	0 to 35 sec.
Fin 2	2° right	35 to 180 sec.

Now this is the "standard" auto-surface trim that has been used for many years, and is still used by many people today. However, it is not without its flaws.

1. It is almost impossible to achieve a straight away (ie: vertical) burst *and* a nice tight spiral cruise with only 2 rudder positions. If the rudder is deflected left sufficiently to produce a straight burst, then the cruise will inevitably be too straight. If the rudder is set for a good cruise, the burst will veer to the right. Of course both adjustments are made in concert with the side thrust, but we know that too much side thrust will act like right rudder etc.

2. When the stab comes in at 4.5 sec. the sudden increase in decalage could cause the model to either dip to the right, mush, possibly prop stall or even loop if the airspeed is too high. If you delay the stab then the model will make a large diameter bunt (if trimmed near zero zero) and *may* be in a better attitude for the cruise, however this trim is not forgiving of bad launches.

So, recognizing these ailments, several Wakefield flyers sought ways to improve the situation. The 3-position rudder was one of the first ideas.

Improved F1B Auto-surface-3 position rudder and 2 position stabilizer:

Surface	Angular setting	Timing
Wing	0°	0 to 180 sec.
Stab 1	-0.5°	0 to 4.5 sec.
Stab 2	-4.0°	4.5 to 180 sec.
Fin 1	1° left	0 to 4.5 sec.
Fin 2	0°	4.5 to 35 sec.
Fin 3	2° right	35 to 180 sec.

Now we can set the rudder at whatever angle is required to get us a nice straight burst and then we can give the model a little kick at the 4.5 sec. mark into the cruise position. We still haven't addressed the stab decalage problem but we have improved our power pattern noticeably. Now into the picture comes wing wigglers (and here we will discuss an often misunderstood aspect of "wing wigglers"). The classic wing wiggler device as popularized by Andriukov and other Soviet F1B flyers was developed for two reasons:

1. To *replace* the 3-position Auto-rudder with a device that was less sensitive to timing and movement.

2. To allow the model to climb in a spiral with the wings twisted. See Andrew Bauers' NFFS Sympo, 1986 article for an explanation of the benefits of this feature. It can also allow you to set the glide for warps at any position independent of the climb to fine tune your thermal centering trim (don't underestimate this feature!)

Note that I said that the wing wiggler will *replace* the 3-position auto-rudder. Most people miss this point.

Improved F1B Auto-surface: 2-position wing, 2-position rudder and 2-position stabilizer

Assume a prop run of 40 seconds (nominal) and a CG of 65% with a glide decalage of 4°, with the wing set on the fuselage at 0°, and with 1.5° of side thrust and 1.5° to 2° of down thrust.

Surface	Angular setting	Timing
Wing 1	-1.5° left panel	0 to 10 sec.
	0°right panel	0 to 180 sec.
Wing 2	0° left panel	10 to 180 sec.
Stab 1	-0.5	0 to 4.5 sec.
Stab 2	-4.0°	4.5 to 180 sec.
Fin 1	0°	0 to 35 sec.
Fin 2	2° right	35 to 180 sec.

Now we have improved our climb pattern a little bit more but we still have the problem of the large stab movement at the 4.5 second mark. Perhaps a wing wiggler could come to the rescue here.

Well, to tell you the truth, I don't think so. The wing wiggler movement of about 1.5° on the left panel is what is typically used. You could use more but I think that you would lose efficiency. Note that 1.5° is equivalent to 1/8" at the trailing edge of a 4.5" chord wing! This movement is equivalent to 0.75° decalage reduction when averaged. This decalage reduction is insufficient to solve problem #2, and if you try to use it as a fix, you will cause some other problems. But, to be fair, let's go through the motions and show how it could be attempted:

Improved F1B Auto-surface: 2-position wing, 3-position rudder and 2-position stabilizer

Assume a prop run of 40 seconds (nominal) and a CG of 65% with a glide decalage of 4°, with the wing set on the fuselage at 0°, and with 1.5° of side thrust and 2° of down thrust.

Surface	Angular setting	Timing
Wing 1	-1.5° left panel	0 to 10 sec.
	0° right panel	0 to 180 sec.
Wing 2	0° left panel	10 to 180 sec.
Stab 1	-0.5°	0 to 4.5 sec.
Stab 2	-4.0°	0 to 4.5 sec.
Fin 1	0°	0 to 4.5 sec.
Fin 2	1° right	4.5 to 35 sec.
Fin 3	2° right	35 to 180 sec.

Now the problem that we have here is that the wing wiggler is being used as a temporary decalage reduction device to reduce the overall decalage from the period 4.5 sec, to 10 sec. As I have explained above, I don't think that a reduction of 0.75° reduction in decalage will solve the problem. Also look what happened to our rudder settings. The wing wiggler has caused us to set the rudder straight for the burst, which will be OK, but we can only move the rudder a small amount at the 4.5 second mark, because at 10 seconds the wing is moving back and we would have too much right rudder if we moved the rudder the normal 2°. As it stands, you would have to remove *all* side thrust to pull this trim off and fly the plane on the rudder in the cruise.

You may ask "Why not keep the wing in for the entire climb qnd let the entire climb have a reduced decalage?" Good question. Well, that is what we did with the previous trim and notice that we didn't need a 3-position rudder to do it. However, let me reiterate: I don't think that a 0.75° reduction in decalage will solve your problem. So, what do we do? (I thought you would never ask!) You need to reduce the decalage from the 4.5 sec. to 10 sec. interval by 2° (approx.). The way to do this is *with the stab* because it doesn't screw up your rudder settings (or side thrust).

Improved F1B Auto-surface: 3 position rudder and 3-position stabilizer

Assume a prop run of 40 seconds (nominal) and a CG of 65% with a glide decalage of 4°, with the wing set on the fuselage at 0°, and with 1.5° of side thrust and 1.5 to 2° down thrust.

Surface	Angular setting	Timing
Wing	0°	0 to 180 sec.
Stab 1	-0.5	0 to 4.5 sec.
Stab 2	-2.5°	4.5 to 10 sec
Stab 3	-4.0°	10 to 180 sec.
Fin 1	1° left	0 to 4.5 sec.
Fin 2	0°	4.5 to 35 sec.
Fin 3	2° right	35 to 180 sec.

Ah, now we are getting somewhere! Now we can set our rudder and stab for the best burst; we can set our rudder for the best cruise; and we can set our stab for a reduced decalage during the 4.5 to 10 sec. interval to prevent mushing or stalling. Now we have really improved the trim of our wakefield, and we have made it safer to fly too!

But...can we make it better? Yes, I think so. We can get the wing in on the act to replace the 3-position rudder and to take advantages of the wing wiggler as discussed above.

Improved F1B Auto-surface: 2-position wing, 2-position rudder and 3-position stabilizer

Assume a prop run of 40 seconds (nominal) and a CG of 65% with a glide decalage of 4°, with the wing set on the fuselage at 0°, and with 1.5° of side thrust and 1.5 to 2° of down thrust.

Surface	Angular setting	Timing
Wing 1	-1.5° left panel	0 to 35 sec.
	0° right panel	0 to 180 sec.
Wing 2	0° left panel	35 to 180 sec.
Stab 1	-0.5°	0 to 4.5 sec.
Stab 2	-2.5	4.5 to 10 sec.
Stab 3	-4.0°	10 to 180 sec.
Fin 1	0°	0 to 4.5 sec.
Fin 2	2° right	4.5 to 180 sec.

Now we can trim our plane to be very near optimum in the climb and truly optimum in the glide. Of course there are a lot of mechanisms involved here! If you include DT, the above set up includes 8 separate surface movements! If you add DPR, then you have 9 functions! F1C, eat your heart out!

The above trim set up is the system now favored by the Swiss (Roger Ruppert) and by the Dutch (Arno Haacken and Anselmo Zeri). I am also told that the Russians are going to this system (Fedorov, etc.). Several planes at the 93 World Champs were using this system and I think that it will allow you to climb very high *safely*.

Note that the wing wiggler requires no more additional functions on the timer. You connect the burst rudder and stab together as before, and you connect your wing wiggler to your current mid-rudder position arm. You need only add an extra function (arm) to your timer for the 2nd stab position and of course an extra hammer at the rear of the fuselage.The other auto function to be mentioned is the Delayed Prop Release of DPR.

DPR was introduced at the 1971 World Championships by Reiner Hoffsaess (West Germany). The only other modeler to take up the challenge for many years was Mike Thomas of Canada. Certainly many people understood the potential benefits (or the presumed benefits) but there were two technical problems to overcome:

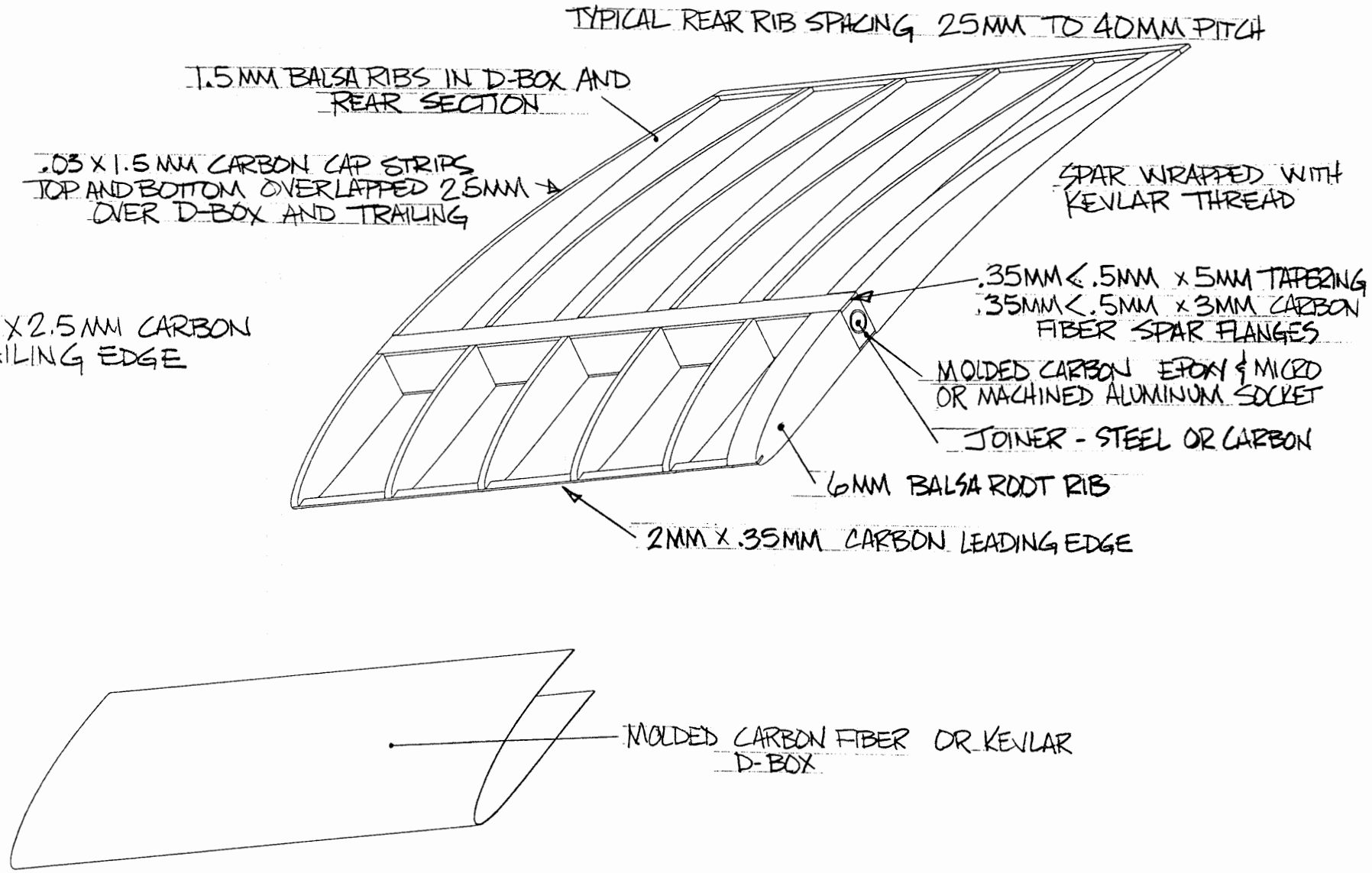
1) Reliability. The mechanical systems developed by Hoffsaess and Thomas were less than completely reliable and both suffered some spectacular failures. Clearly some more advanced engineering was required.

2) Blade position at launch. Both Hoffsaess and Thomas used folded blades at launch that opened by centrifugal force when released. This caused two problems. One, the blades were subject to very high loads when opening and often jammed, and two, this system put an effective limit on the length of the nose as it was not possible to have blades fold under the wing.

At the 1981 World Championships, a young Alexander Andriukov showed that the Soviets and been hard at work on this problem and they demonstrated a completely new engineering approach. The blades were held out and rotated into a feathered position on launch. On prop release (timer activated) the blades rotated to design pitch and began turning for flight. The holding and latching mechanism was also very well engineered and quite robust in design. The new system removed virtually all of the strain of the motor torque from being seen at the timer.

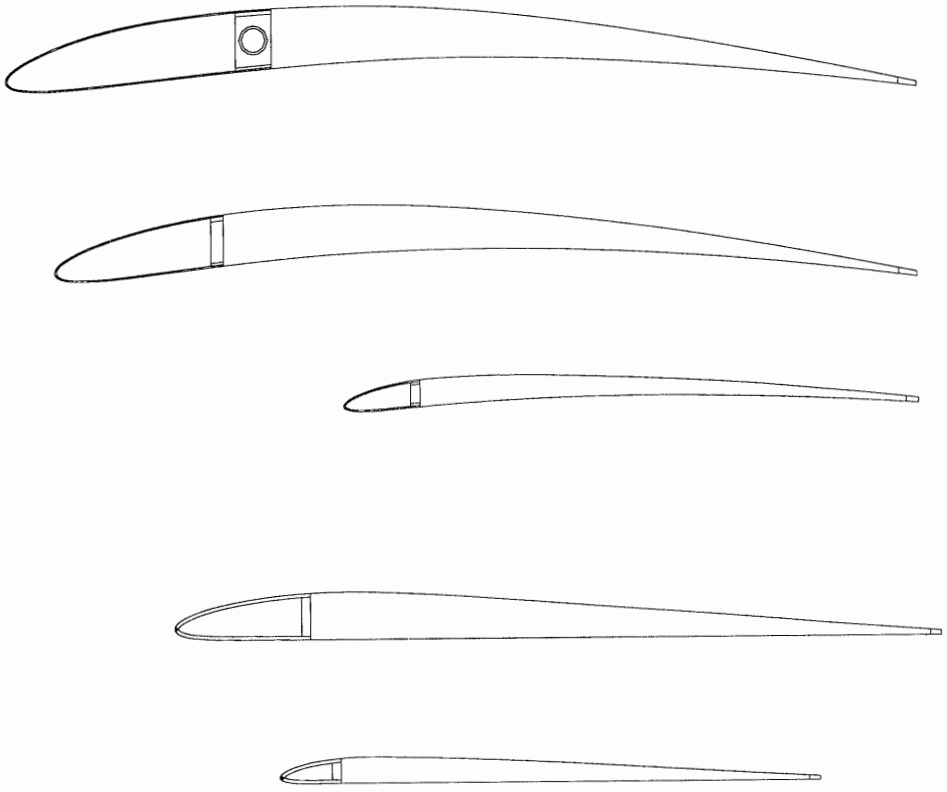
By now, the Soviet system is considered ubiquitous and virtually all modern systems use some sort or all of the techniques pioneered by Andriukov.

TYPICAL MODERN F1B WING



Canadian F1B Wing and Stab sections 92/93

Shown full-sized



LOWER SURFACE

X AXIS	Y AXIS	X % CHORD	Y % CHORD
POINT 0.0000000000,	0.0000000000,	0.00	0.00000
POINT 0.0475096316,	-0.0420979210,	1.00	-0.88627
POINT 0.0950096316,	-0.0498488378,	2.00	-1.04944
POINT 0.1425096316,	-0.0528518056,	3.00	-1.11266
POINT 0.2375096316,	-0.0514243733,	5.00	-1.08261
POINT 0.4750096316,	-0.0294505365,	10.00	-0.62001
POINT 0.7125096316,	-0.0103091062,	15.00	-0.21703
POINT 0.9500096316,	0.0273765282,	20.00	0.57634
POINT 1.4250096316,	0.0787162570,	30.00	1.65718
POINT 1.9000096316,	0.1178305879,	40.00	2.48064
POINT 2.3750096316,	0.1376433591,	50.00	2.89754
POINT 2.8500096316,	0.1363674005,	60.00	2.87089
POINT 3.3250096316,	0.1200967281,	70.00	2.52835
POINT 3.8000096316,	0.0909756841,	80.00	1.91527
POINT 4.2750096316,	0.0505394944,	90.00	1.06398
POINT 4.7500000000,	0.0000000000,	100.00	0.00000

ROOT CO-ORDINATES **MATHEWS SECTION APR/92**

UPPER SURFACE

X AXIS	Y AXIS	X % CHORD	Y % CHORD
POINT 4.7500000000,	0.0250455348,	100.00	0.52736
POINT 4.2750096316,	0.1177296916,	90.00	3.73256
POINT 3.8000096316,	0.2028403090,	80.00	4.27032
POINT 3.3250096316,	0.2779381614,	70.00	5.85132
POINT 2.8500096316,	0.3405439613,	60.00	7.16934
POINT 2.3750096316,	0.3848085616,	50.00	8.10123
POINT 1.9000096316,	0.4014019843,	40.00	8.45056
POINT 1.4250096316,	0.3886441765,	30.00	8.18198
POINT 0.9500096316,	0.3449445728,	20.00	7.26198
POINT 0.7125096316,	0.3072032813,	15.00	6.46743
POINT 0.4750096316,	0.2519401111,	10.00	5.30400
POINT 0.2375096316,	0.1681639960,	5.00	3.54029
POINT 0.1425096316,	0.1234212199,	3.00	2.59835
POINT 0.0950096316,	0.0975461514,	2.00	2.05360
POINT 0.0475096316,	0.0656466637,	1.00	1.38203
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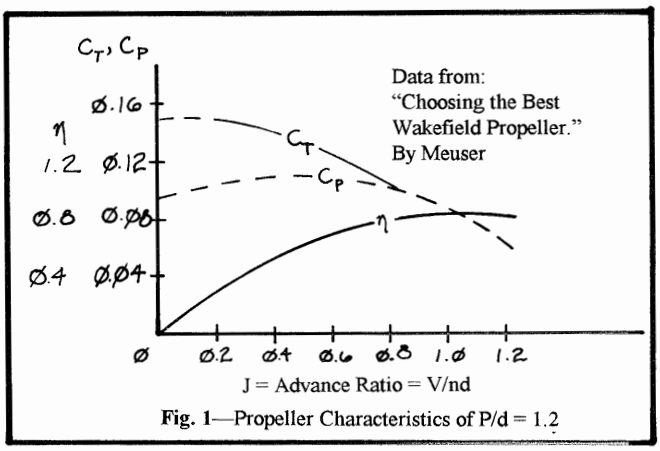


Fig. 1—Propeller Characteristics of P/d = 1.2

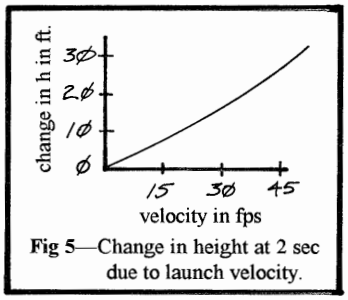


Fig 5—Change in height at 2 sec due to launch velocity.

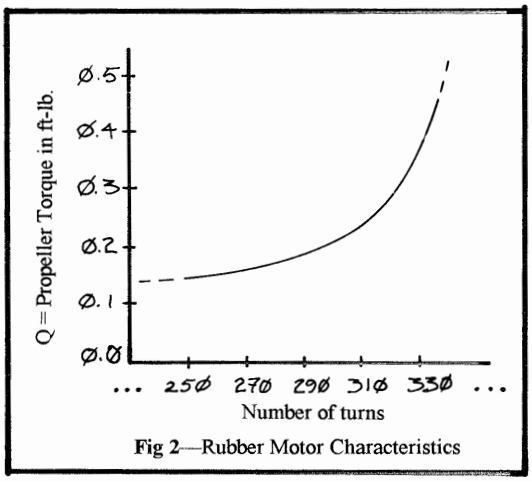


Fig 2—Rubber Motor Characteristics

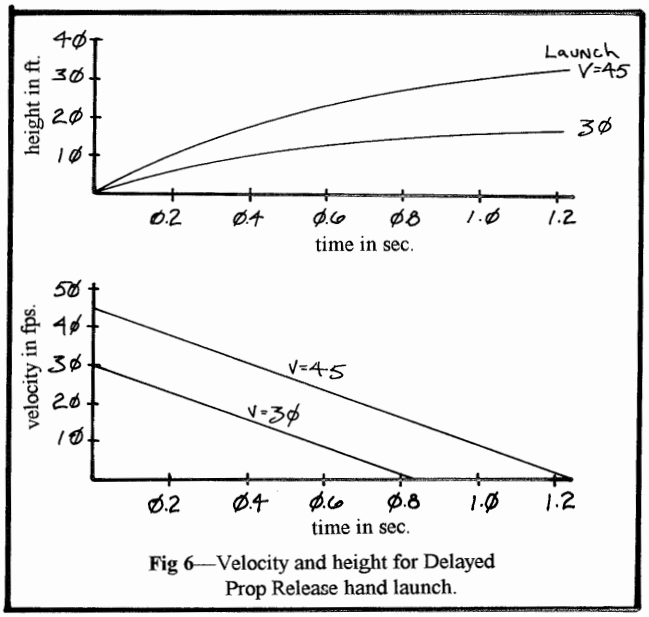


Fig 6—Velocity and height for Delayed Prop Release hand launch.

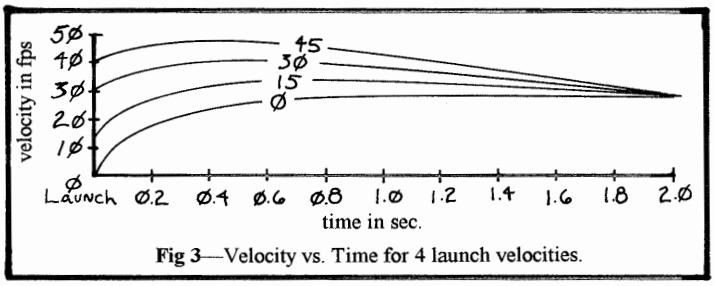


Fig 3—Velocity vs. Time for 4 launch velocities.

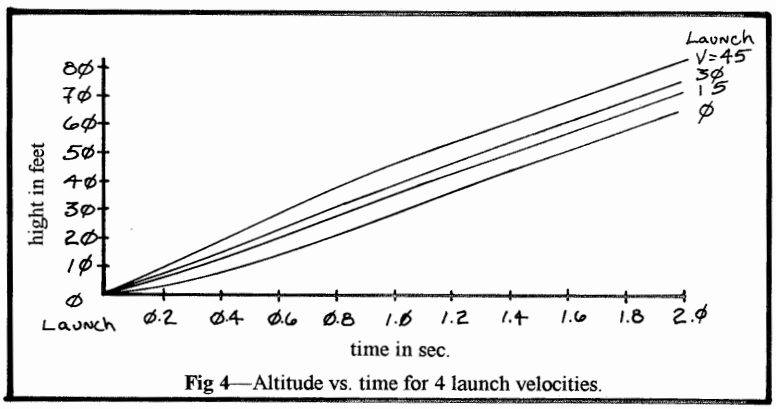


Fig 4—Altitude vs. time for 4 launch velocities.

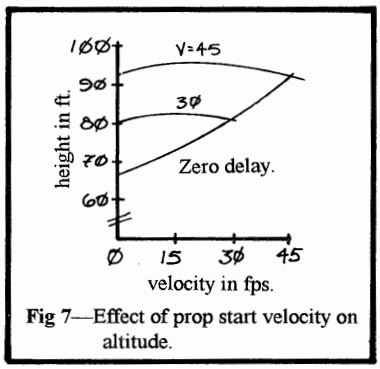


Fig 7—Effect of prop start velocity on altitude.

Effects of Launch Velocity and DPR In F1B

By Dave Lacey, CAMMA

Delayed Prop Release (DPR) is impressive to watch when done by masters of the art. But, is it worth it? Spurred on by previous articles in Flyoff 16 and 18, I decided to do a simulation of the first 2 seconds of a Wakefield's flight. The simulation uses previously published characteristics of the prop, motor, and airframe. The equations are;

$mv=T-D-W\sin\gamma = T-(D+W)$

$T=h*n*Q*2\pi/v = h*Q*2\pi/J*d$ or $C_T pn^2d^4$

$n2=Q*2\pi/C_p d^5 p$ $J=v/n*d$ $D=.5*C_D*p*v^2*S$

Meuser published in an early NFFS Symposium report the prop and rubber characteistics in Fig. 1 and 2. The prop is 24" diameter and 28.8" pitch (P/D ratio of 1:1.2).

The simulation used finite difference methods to integrate for velocity (v) and altitude(h). Flight path angle (g) was assumed vertical ($g = 90^\circ$).

The dynamics of the hand launch for DPR were simulated by: $mv=-(D+W)$.

Velocity and altitude are obtained by:

$$v_{h+1} = v_h + v_h+\Delta t$$

$$h_{b+1}=h_h = .5(v_h = v_{h+1})*\Delta t$$

Cp and g were matched by an iterative scheme described as follows:

Assume $C_{p\phi}$

Calculate $n = Q*2\pi/C_{p\phi} *pd^5$, $J_{new} = v/n*d$

Look up C_{Pnew} at J_{new}

If $(C_{Pnew} - C_{p\phi}) =$, Stop

If $(C_{Pnew} - C_{P\phi}) \neq 0$, Try again until match.

Integration was done at a time increment of 0.1 sec. (Δt=0.10 sec.)

Results of initial launch velocities of 0, 15, 30, and 45 f.p.s. are presented in Fig 3 and 4. Velocity variation with time is presented in Fig. 3 and, as can be seen, velocity is the same in all cases about 2 sec. into the flight. The same is not true, however, for altitude (Fig. 4). Letting the model out of your hand versus a hard launch can lose as much as 23 feet in altitude for the case of V=45 f.p.s. Altitude difference at 2 sec. is shown in Fig. 5.

These results assume no delayed prop release: only that the flyer can impart these velocities to the model at the instant the model leaves his hand and releases the prop.

What about delayed prop release? The velocity and altitude profile of a hard vertical hand launch at 30 and 45 f.p.s. are shown in Fig. 6.

Adding the altitude gained by the hand launch to the altitude gained by the zero delay altitude presented in Fig. 4 will thus provide the total altitude obtained. For example, assume that the model is thrown at 30 f.p.s. and the prop is delayed until the model has decelerated to 15 f.p.s., total altitude will be 9.5 + 72.7 or 82.2 feet.

The variation of altitude with propeller start velocity is shown in Fig. 7 for cases of no prop delay and delay launches of 30 and 45 f.p.s., which correspond approximately to 4g and 9g respectively. It can be seen that there are slight gains to be obtained if the model can be thrown very hard (i.e. 45 f.p.s.). These gains amount to approximately 3 feet if the prop is released at the apogee of the hand launch (v=0) to a maximum of 6 feet at a prop release of 15 f.p.s.

Throwing the model at lower velocities results in negligible gains over that obtained with no delayed prop release (1 ft. at 15 f.p.s. prop start for a 30 f.p.s. launch).

In conclusion, it appears that, for simplicity, the instantaneous prop release may be the easiest way to go. However, if you can really heave the model, small gains in altitude can be obtained if the prop is released at the optimum velocity.

Nomenclature, constants and assumptions

m=Mass (slugs)=W/g

v=Velocity (ft. per sec.)

v=Acceleration (ft./sec^2)

T=Thrust (lb.)

t=Time (sec.)

D=Drag (lb.)

W=Weight (0.507lb., or 230 grams)

g=Flight-path angle (degrees)

p=Air density (0.002378 slug/ft^3)

n=Prop rotational speed (rps)

Q=Prop torque (lb.-ft.)

d=Prop diameter (ft.)

J=Advance ratio (v/nd)

C_T=Propeller thrust coefficient

C_p=Propeller power coefficient

h=Propeller efficiency

S=Wing area (1.67 ft.^{2}, or 240 in^2)

C_D=Coefficient of drag (0.5)

Figure 1—Propeller Characteristics of P/d=1.2 Prop

Figure 2—Rubber motor Characteristics

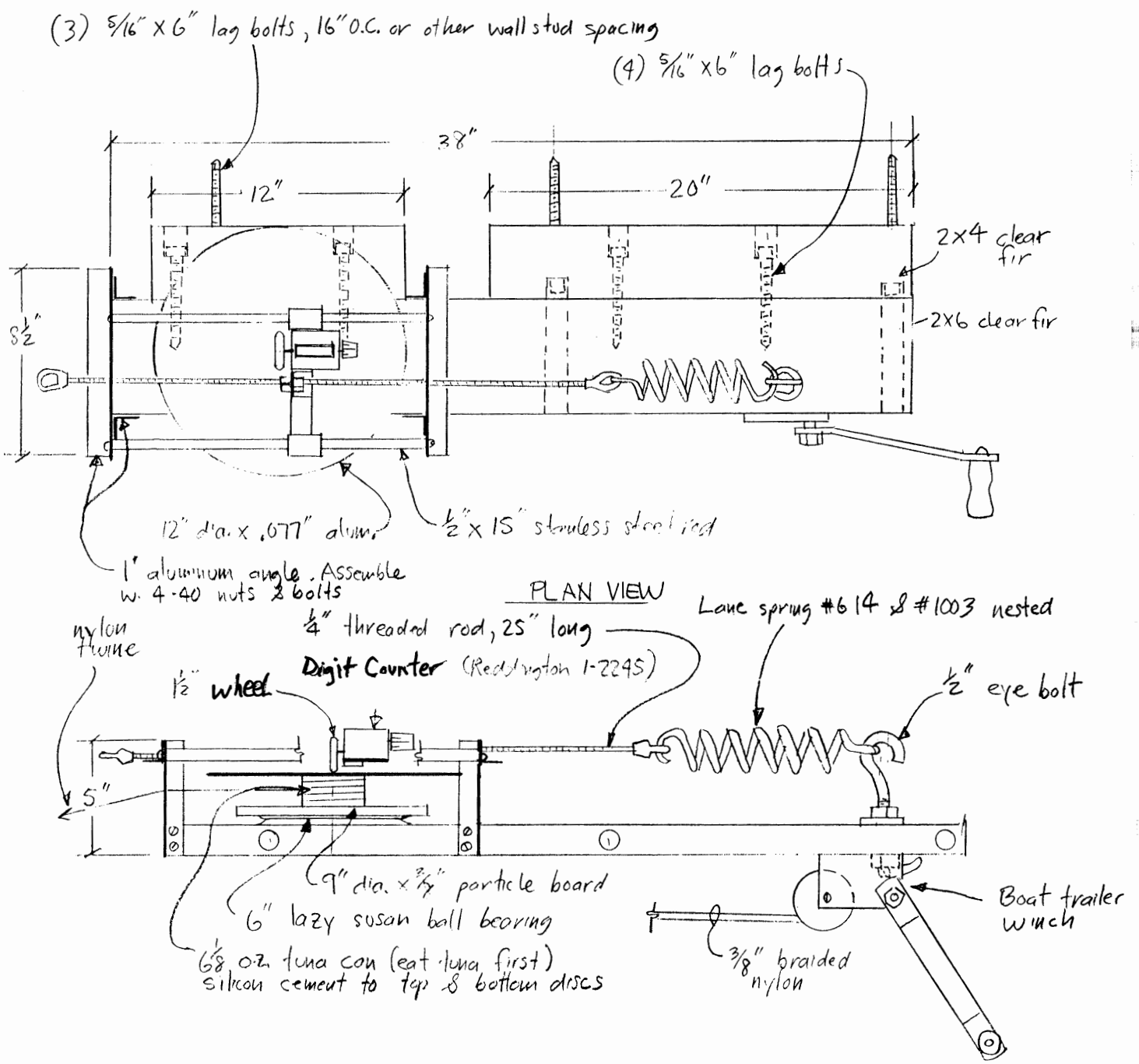
Figure 3—Velocity vs. Time for 4 launch velocities

Figure 4—Altitude vs. Time for 4 launch velocities

Figure 5—Change in height at 2 sec., due to launch velocity

Figure 6—V and h for DPR Hand Launch

Figure 7—Effect of prop start velocity on altitude



Mechanical Integrator	
Designed: JWF	
Drawn: JWF	
Inspired: G. Xenakis	3/24/93

Mechanical Integrator

by Jeremy Fitch

Integrator: a device or computer that totalizes variable quantities in a manner comparable to mathematical integration (Websters Ninth Collegiate).

The device shown here was built for the purpose of testing the energy-releasing ability of 40-gram F1B rubber motors, while breaking them in at the same time. The machine is conceptually identical to one built by George Xenakis and described in the 1971 NFFS Symposium.

The energy release of a rubber sample can be measured by plotting a force vs. elongation plot, or a torque vs. turns plot, and then measuring (integrating) the area under the curve. This area is equal to the energy released by the sample. If the plot can be described mathematically, the area can be evaluated explicitly using integral calculus. Since there is no such mathematical formula to describe the shape of the force/elongation curve, the area must be measured by numerical methods. Basically this means dividing the irregular area under the curve into rectangles or trapezoids and adding their areas together. (Don Hughes cuts out the area and weighs the paper. Should work if your paper is of constant area weight.)

All this plotting, dividing, and adding is tedious. Also, it is difficult to test a full motor, since the forces involved become large. A smaller sample can be tested, but there remains the question of how representative the smaller sample is. The mechanical integrator addresses these problems by testing a full motor, and by mechanically, automatically generating a number on the counter (see drawing) that is proportional to the energy release of the motor. A side benefit is that the motor is broken in during the testing.

The machine is used by stretching the motor to a selected length or force, holding for a selected time, taking up slack in the messenger string, zeroing the counter, and then releasing the motor at a controlled rate, using the boat winch. The main problem has been standardizing on a stretch distance or force, and on holding time. This is a subject for another article.

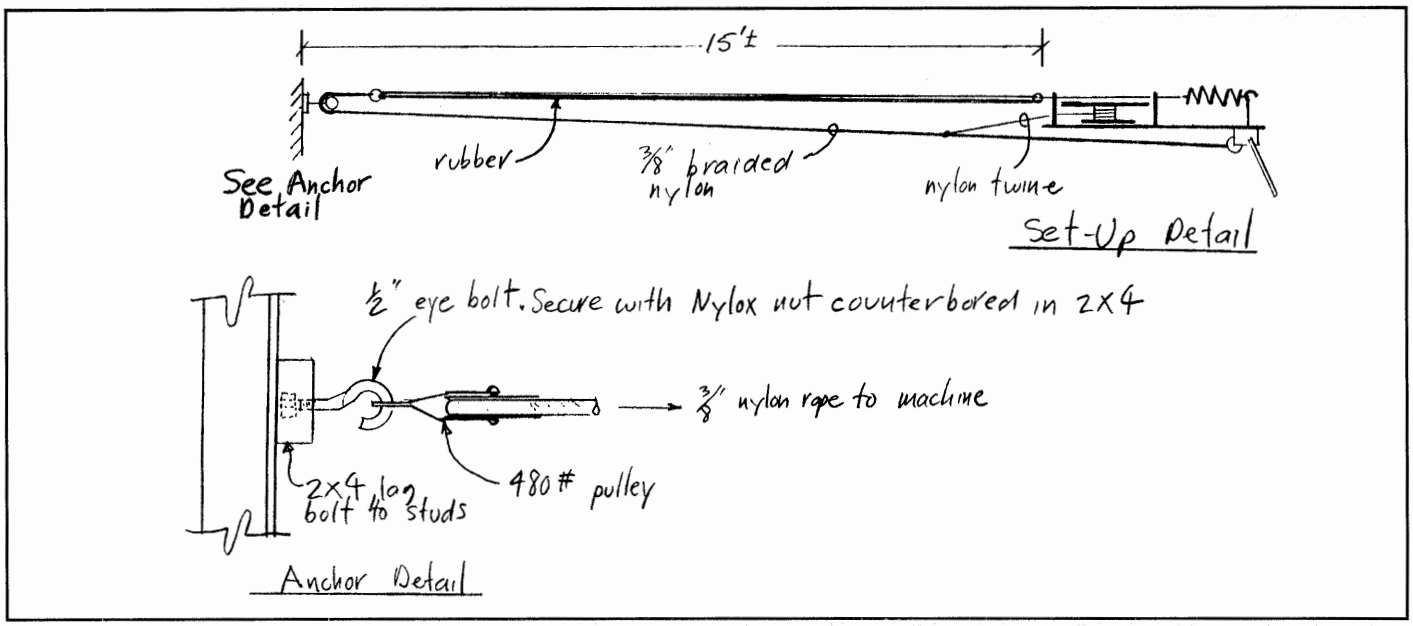
Here are some miscellaneous notes regarding construction and operation of the machine:

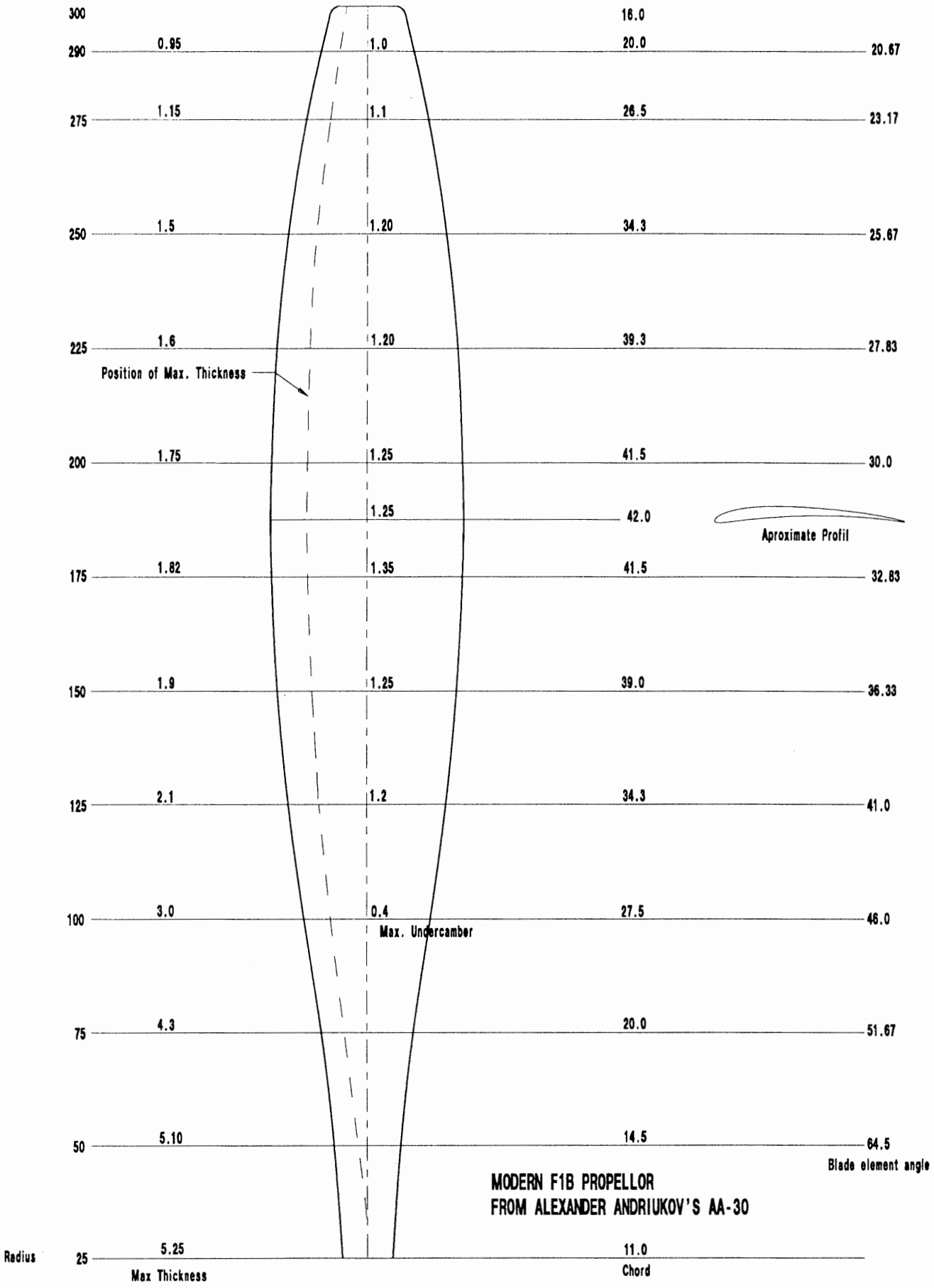
Astute readers will notice that the integrator is measuring not only the stored energy of the rubber, but of the cable and other flexible components as well. As long as these components have a high elastic modulus compared to the rubber, the resulting inaccuracies should be small and proportional to the rubber energy.

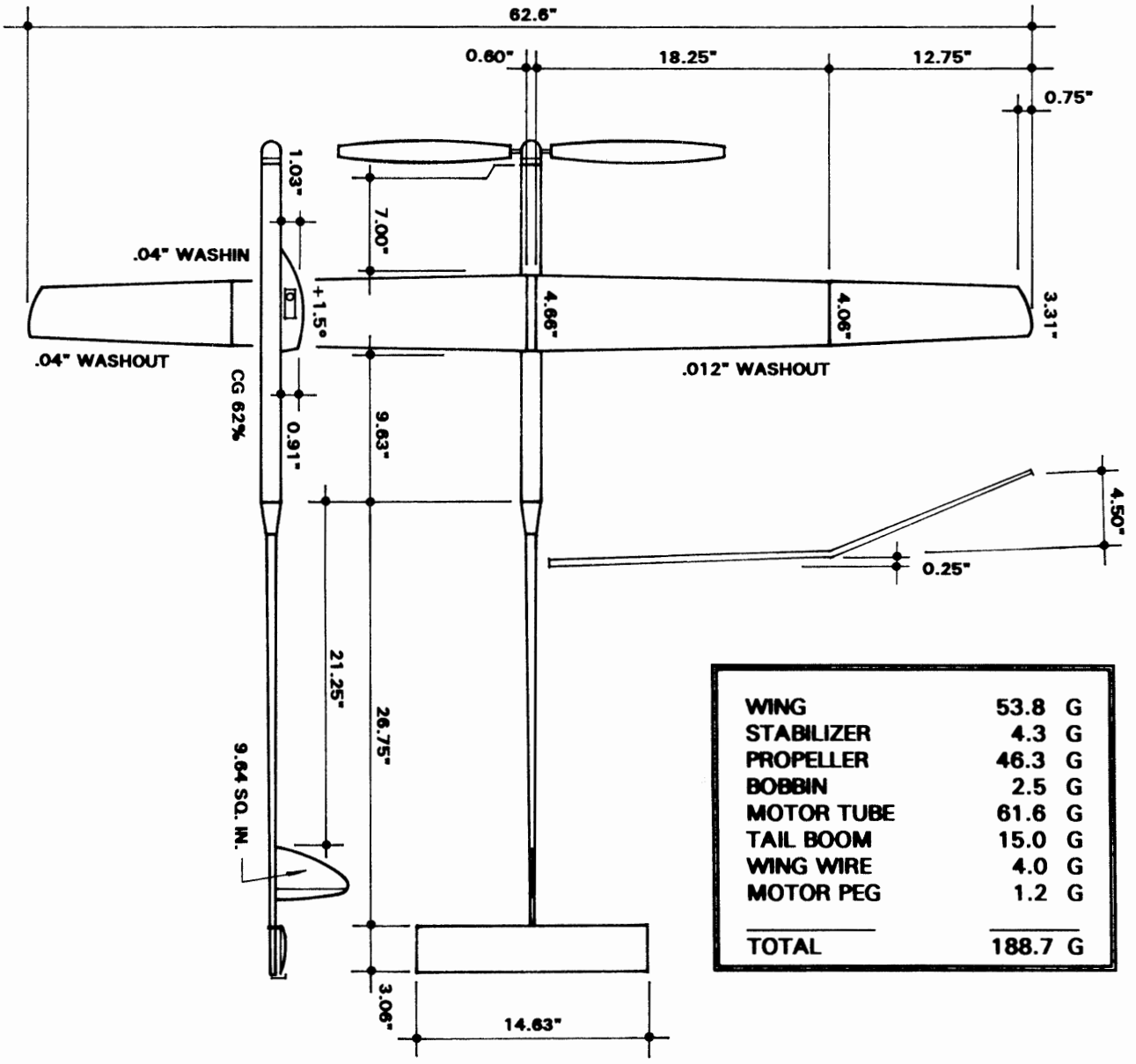
The forces generated are quite high; around 200 to 250 pounds tension in the cable (which means 400 to 500 pounds on the pulley). Together with the amount of stored energy, this means that a failure could result in a serious injury to the machine and the operator. I'm using eighth inch steel braided aircraft control cable. The pulley anchor is through-bolted to the 2 x 4 anchor, which is triple lag bolted to the garage wall. The point is, safety is a definite concern here.

I've tried various ways of making the turntable turn. One was to route the messenger string through pulleys to a falling weight. I considered a spring under the turntable that winds the up as the rubber is stretched out, then automatically winds the string back up as the rubber is let in. I tried leading the string through the cable pulley and attaching it to the cable near the rubber, to eliminate including the cable energy (as described above). None of these worked very well, and I'm now back to tying the messenger to the rope with a rolling hitch. After stretching out the rubber, the string must be wound up on the spool (tuna fish can) by hand. It's not convenient, but it does work.

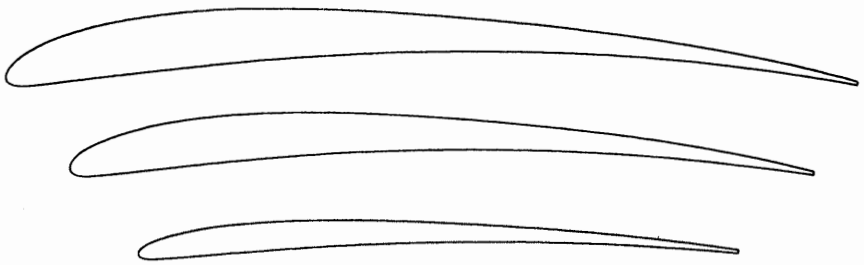
The uses of the machine have been well worth the effort expended in putting it together. There are many aspects of rubber behavior that could be investigated with this machine, such as the relationships between hold time and torque loss, hold time and energy loss, temperature and energy storage, energy storage and re-use of motors at various time intervals, etc. I'd be happy to correspond with anyone who has one or is contemplating building one.




300
290
275
250
225
200
175
150
125
100
75
50
25
Radius
0.95
1.15
1.5
1.6
1.75
1.82
1.9
2.1
3.0
4.3
5.10
5.25
Max Thickness
1.0
1.1
1.20
1.20
1.25
1.25
1.35
1.25
1.2
0.4
Max. Undercamber
16.0
20.0
26.5
34.3
39.3
41.5
42.0
41.5
39.0
34.3
27.5
20.0
14.5
11.0
Chord
20.67
23.17
25.67
27.83
30.0
32.83
36.33
41.0
46.0
51.67
64.5
Blade element angle
Position of Max. Thickness
Aproximate Profil
MODERN F1B PROPELLOR
FROM ALEXANDER ANDRIUKOV'S AA-30



WING	53.8 G
STABILIZER	4.3 G
PROPELLER	46.3 G
BOBBIN	2.5 G
MOTOR TUBE	61.6 G
TAIL BOOM	15.0 G
WING WIRE	4.0 G
MOTOR PEG	1.2 G
TOTAL	188.7 G

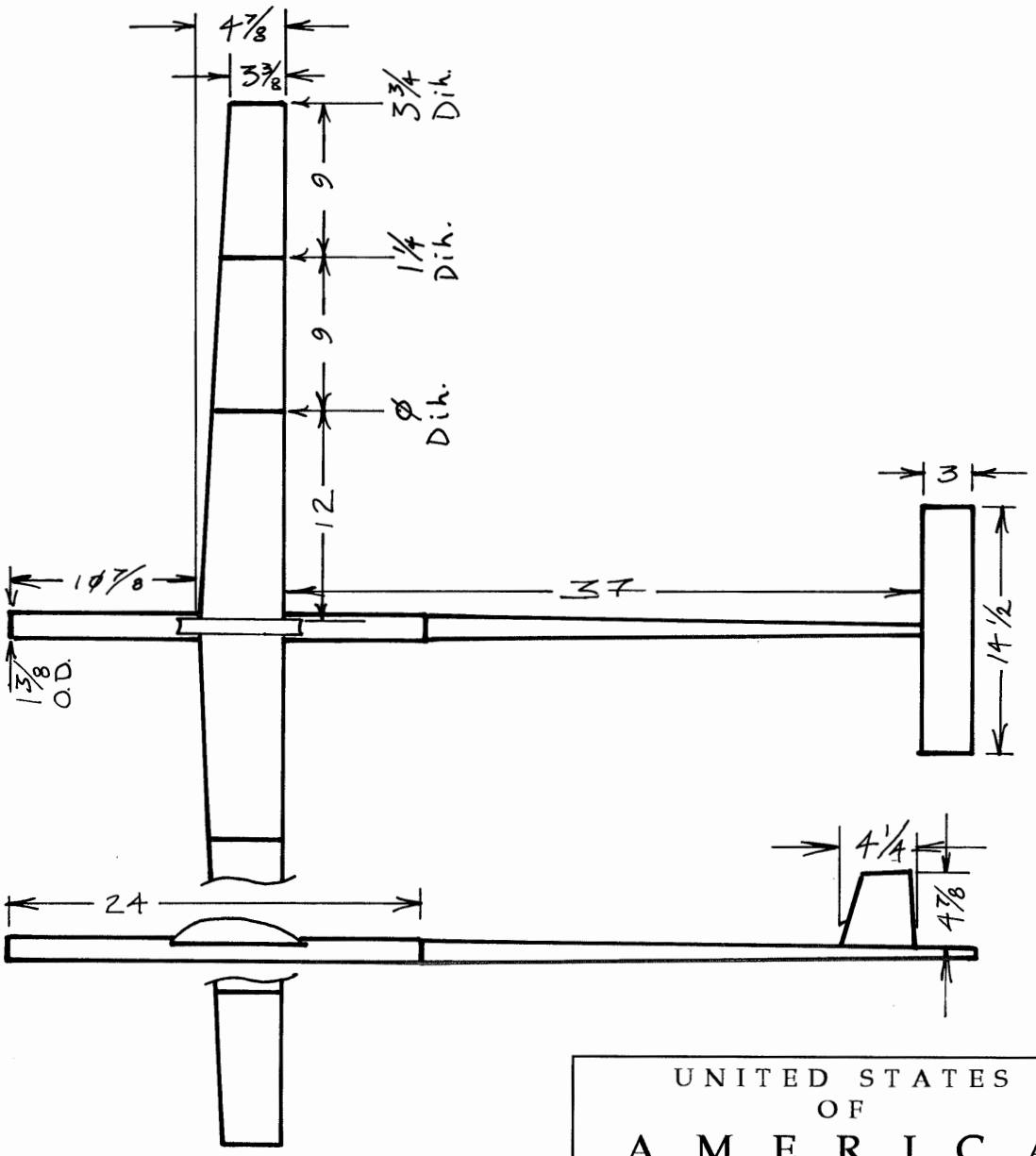


WING	254.0 SQ. IN.
STABILIZER	45.0 SQ. IN.
TOTAL AREA	299.0 SQ. IN.

ALEKSANDAR

ANDRIUKOV ★ UKR

DRAWN BY: BILL BOOTH, JR.



UNITED STATES
OF
A M E R I C A

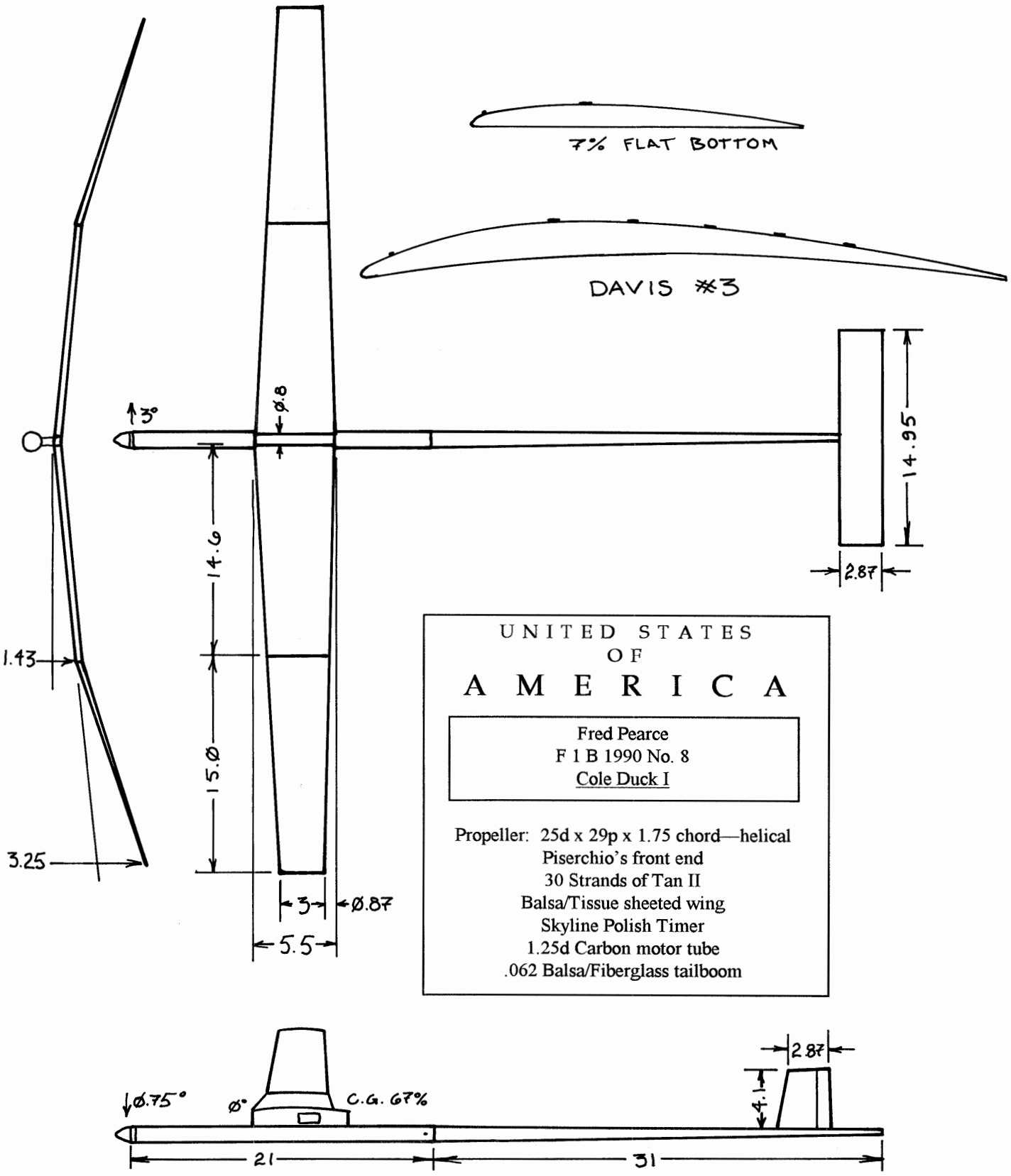
Chris Matsuno
F 1 B
The Viceroy

Motor tube and Pylon	57 g.
Tail boom and fin	16 g.
Wing	65 g.
Stab	5 g.
Prop and bobbins	43 g.
Balast	4 g.
Total	190 g.

Airfoil—Gard 7510 (wing and stab),
C. G. 65%
Trim—wing LE 1/2" higher than TE,
Stab shimmed as necessary,
Right-right patern,
Down thrust: very little,
Right thrust: about 3*,
Propeller: 24" d X 32" p,
Double bobbin Front, single bobbin rear,
Warps: 1/16" WI Right main pannel,
1/8" WO both tips.

DIMENSIONS IN INCHES

DIMENSIONS IN INCHES



UNITED STATES
OF
A M E R I C A

Fred Pearce
F 1 B 1990 No. 8
Cole Duck I

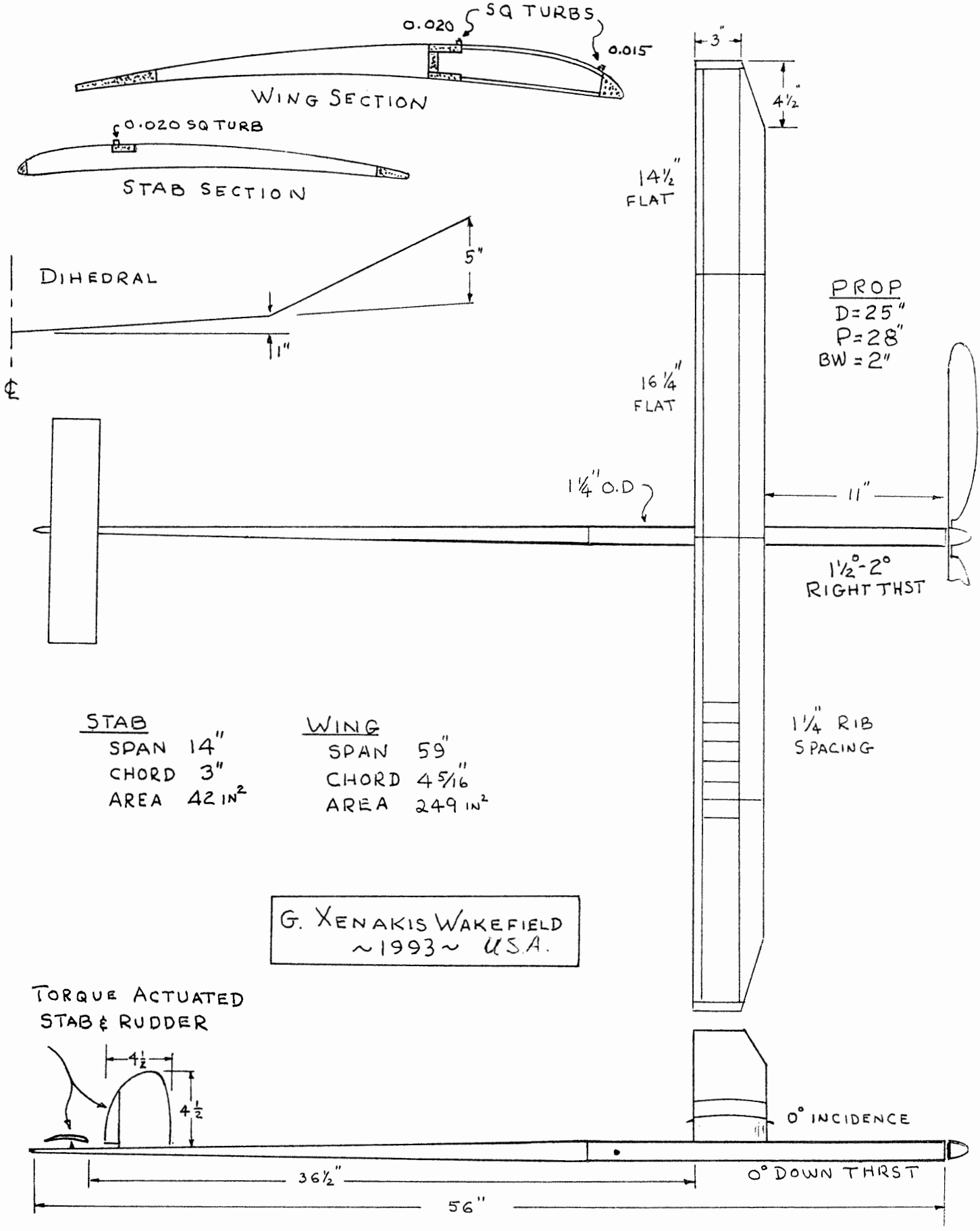
Propeller: 25d x 29p x 1.75 chord—helical
Piserchio's front end
30 Strands of Tan II
Balsa/Tissue sheeted wing
Skyline Polish Timer
1.25d Carbon motor tube
.062 Balsa/Fiberglass tailboom

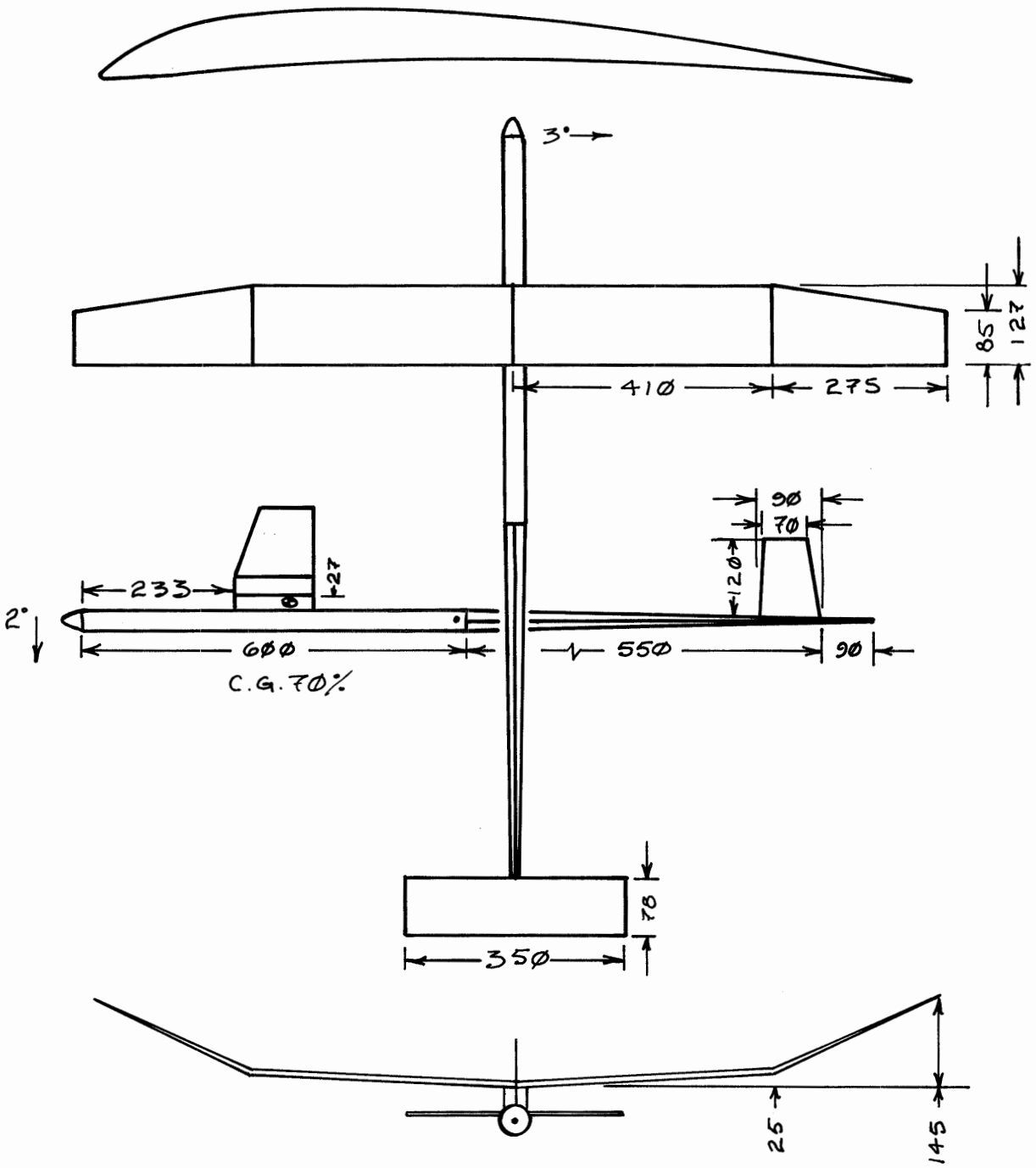
Timer Program:

0-4 sec	Stab -2*
0-7.5 sec	Left Rudder
7.5-35 sec	Neutral Rudder
35-DT sec	Right Rudder

Weights

Wing	60g.
Stab	5g.
Fuse	83g.
Prop	45g.


0.020
SQ TURBS
0.015
WING SECTION
0.020 SQ TURB
STAB SECTION
DIHEDRAL
5"
1"
℄
3"
4½"
14½"
FLAT
16¼"
FLAT
PROP
D=25"
P=28"
BW=2"
1¼" O.D
11"
1½°-2°
RIGHT THST
STAB
SPAN 14"
CHORD 3"
AREA 42 IN²
WING
SPAN 59"
CHORD 4 5/16"
AREA 249 IN²
1¼" RIB
SPACING
G. XENAKIS WAKEFIELD
~1993~ U.S.A.
TORQUE ACTUATED
STAB & RUDDER
4½
4½
0° INCIDENCE
36½"
0° DOWN THRST
56"



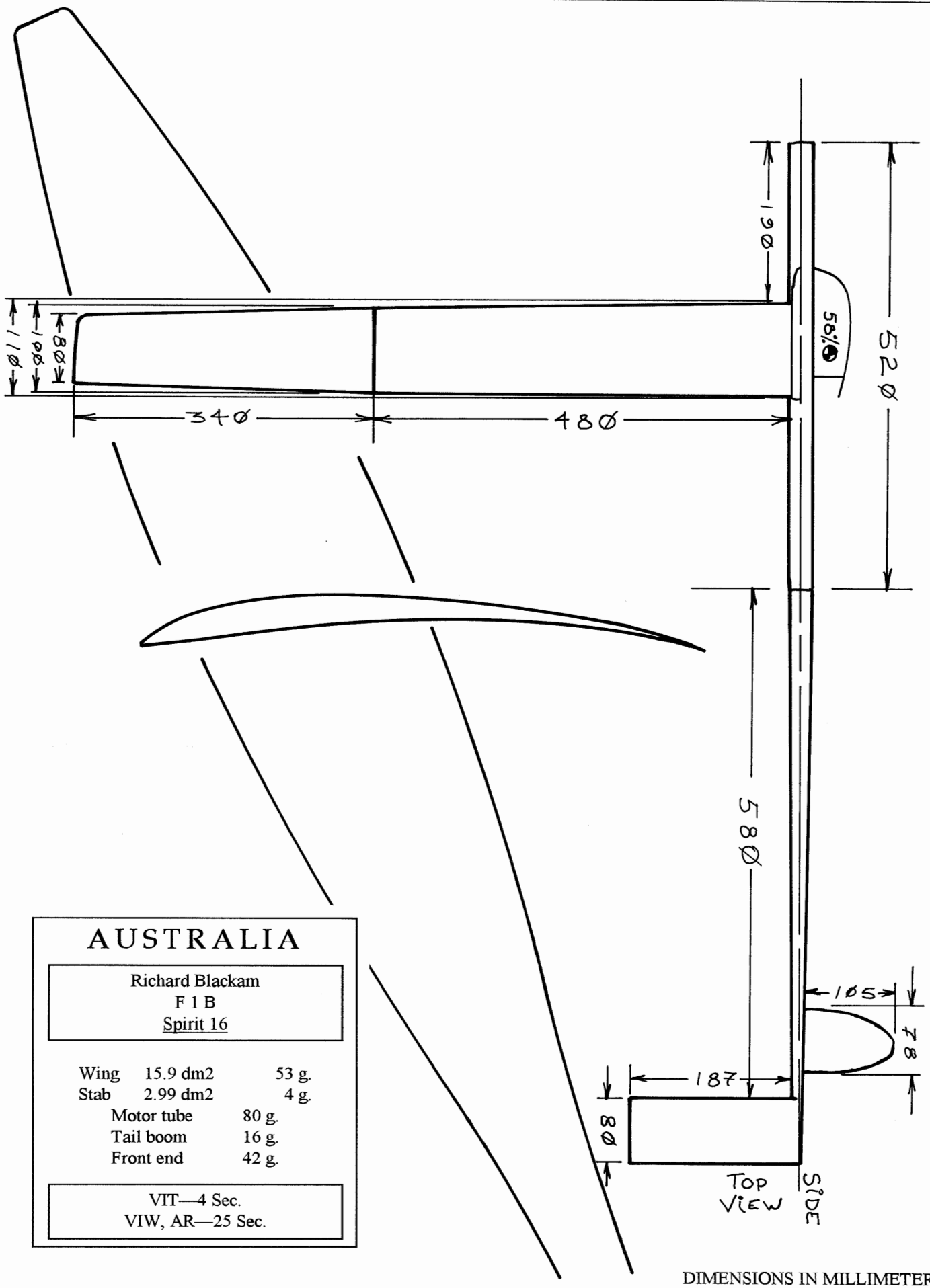
REPUBLICA ARGENTINA

Adolfo A. Principe
F 1 B Team member 1993

Wing	15.66 dm2	50 g.
Stab	2.73 dm2	4 g.
Fuse		88 g.
Prop		48 g.

Airfoils—Wing: Koster 66, Stab: 7%.
Propeller—600d X 680p.

DIMENSIONS IN MILLIMETERS



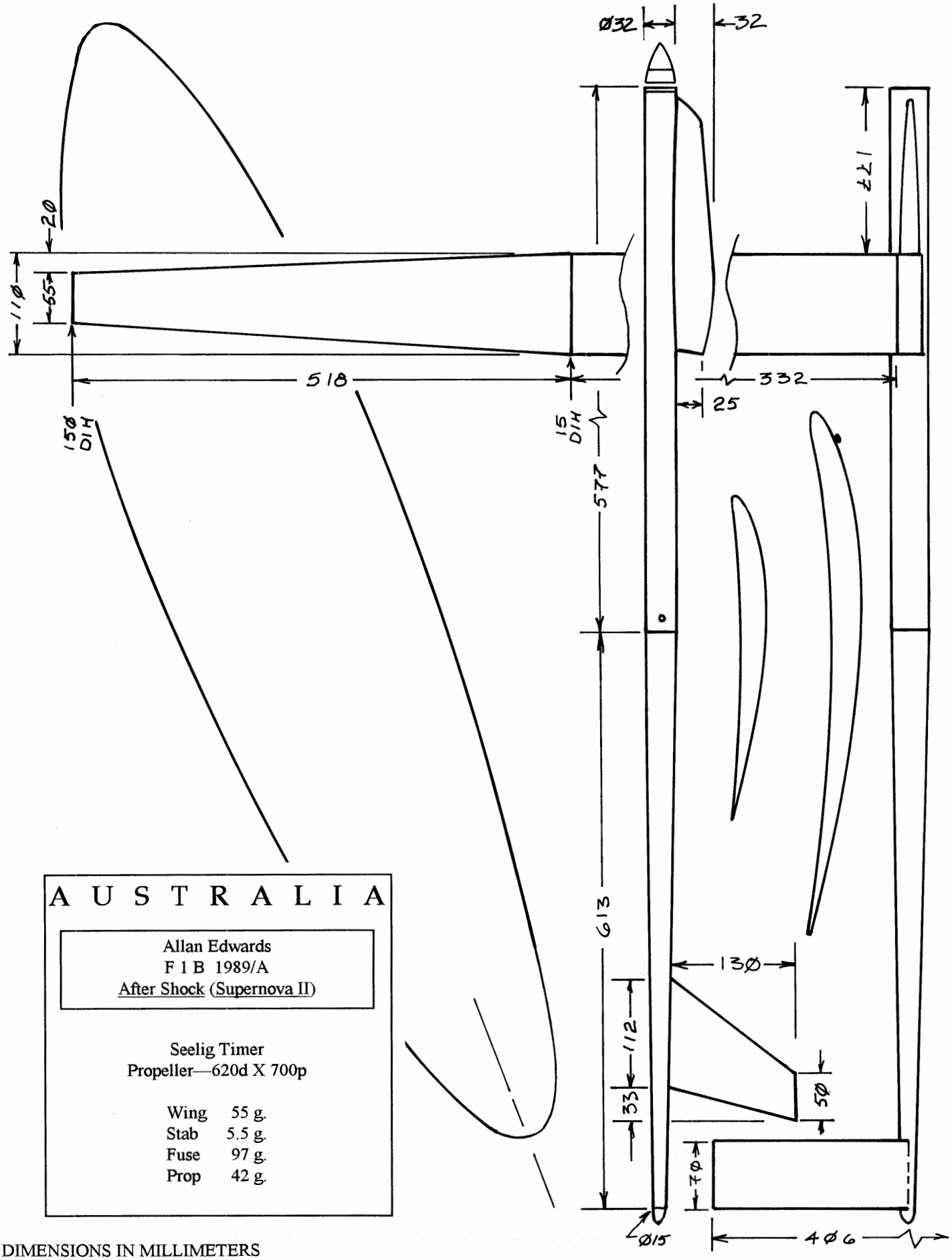
AUSTRALIA

Richard Blackam
F 1 B
Spirit 16

Wing	15.9 dm2	53 g.
Stab	2.99 dm2	4 g.
Motor tube		80 g.
Tail boom		16 g.
Front end		42 g.

VIT—4 Sec.
VIW, AR—25 Sec.

DIMENSIONS IN MILLIMETERS



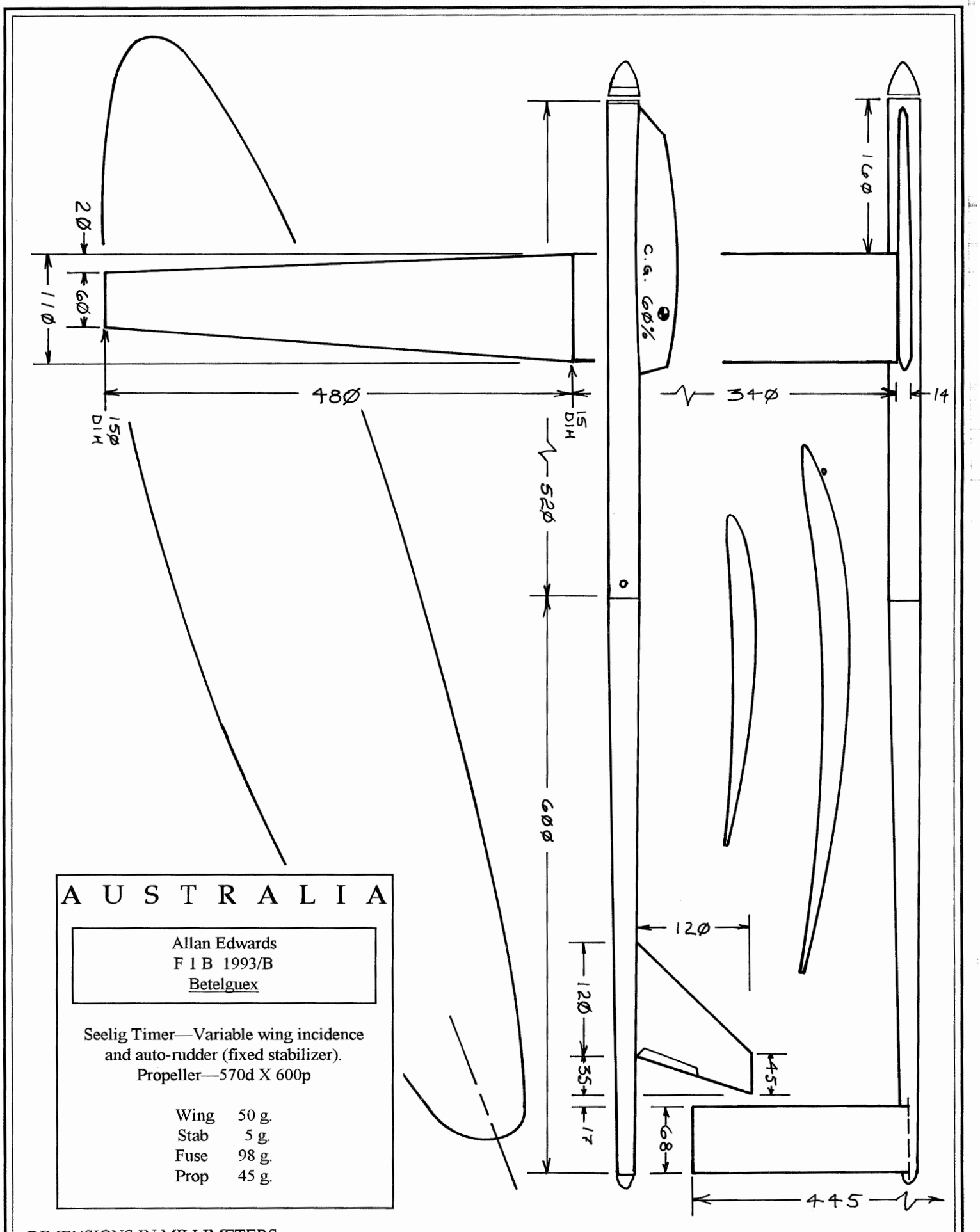
AUSTRALIA

Allan Edwards
F 1 B 1989/A
After Shock (Supernova II)

Seelig Timer
Propeller—620d X 700p

Wing	55 g.
Stab	5.5 g.
Fuse	97 g.
Prop	42 g.

DIMENSIONS IN MILLIMETERS



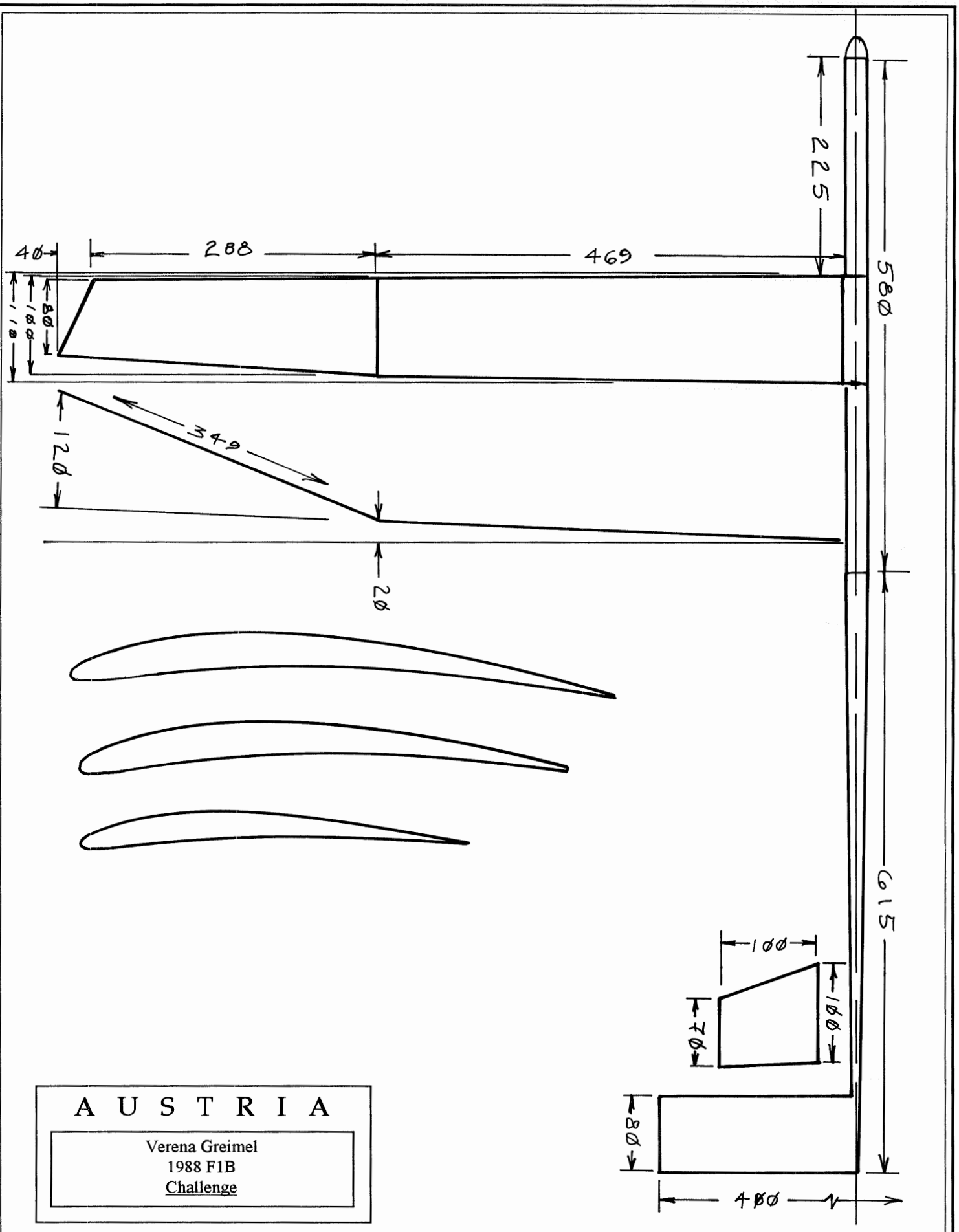
A U S T R A L I A

Allan Edwards
F 1 B 1993/B
Betelguex

Seelig Timer—Variable wing incidence and auto-rudder (fixed stabilizer).
Propeller—570d X 600p

Wing	50 g.
Stab	5 g.
Fuse	98 g.
Prop	45 g.

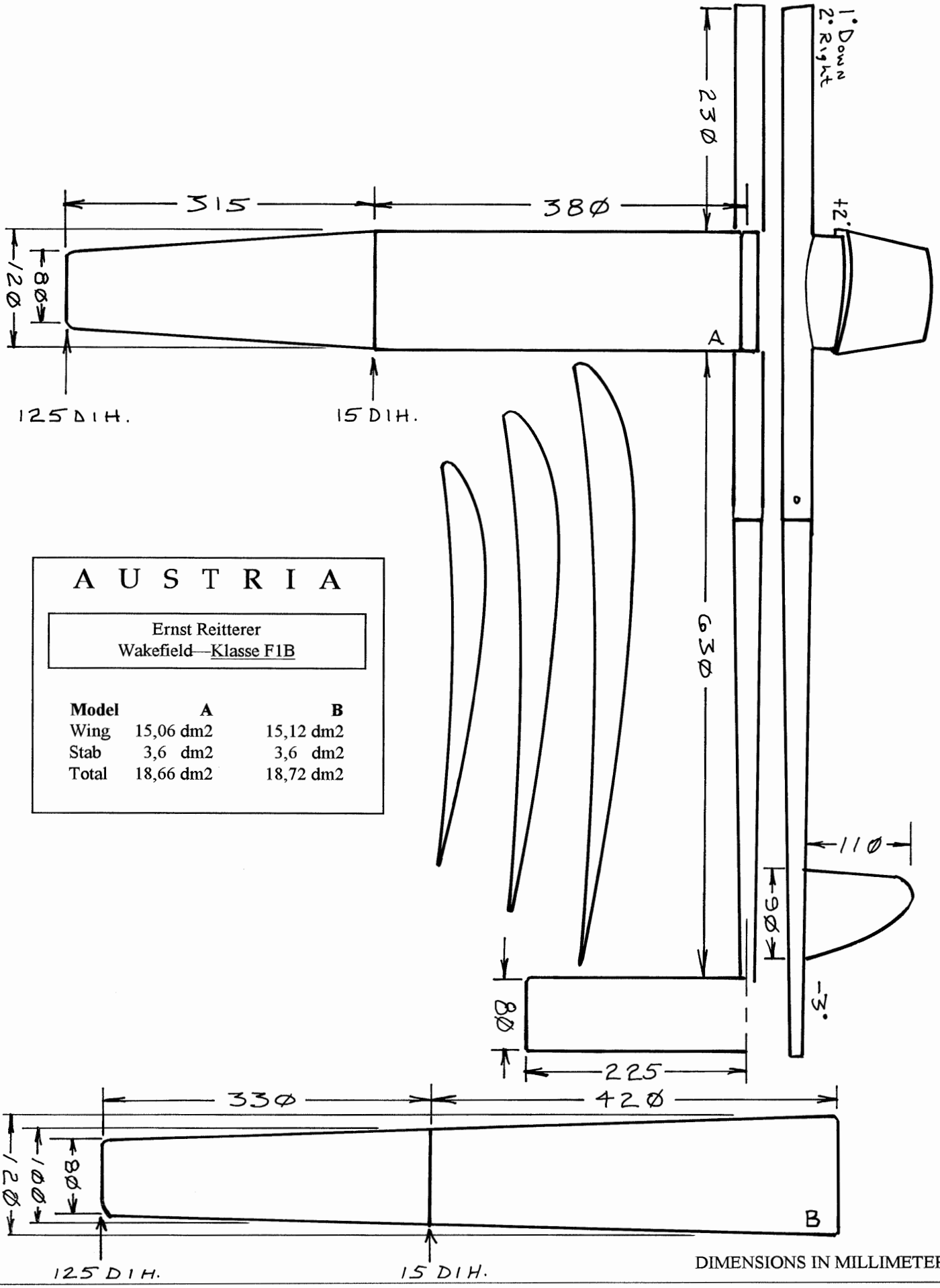
DIMENSIONS IN MILLIMETERS



AUSTRIA

Verena Greimel
1988 F1B
Challenge

DIMENSIONS IN MILLIMETERS

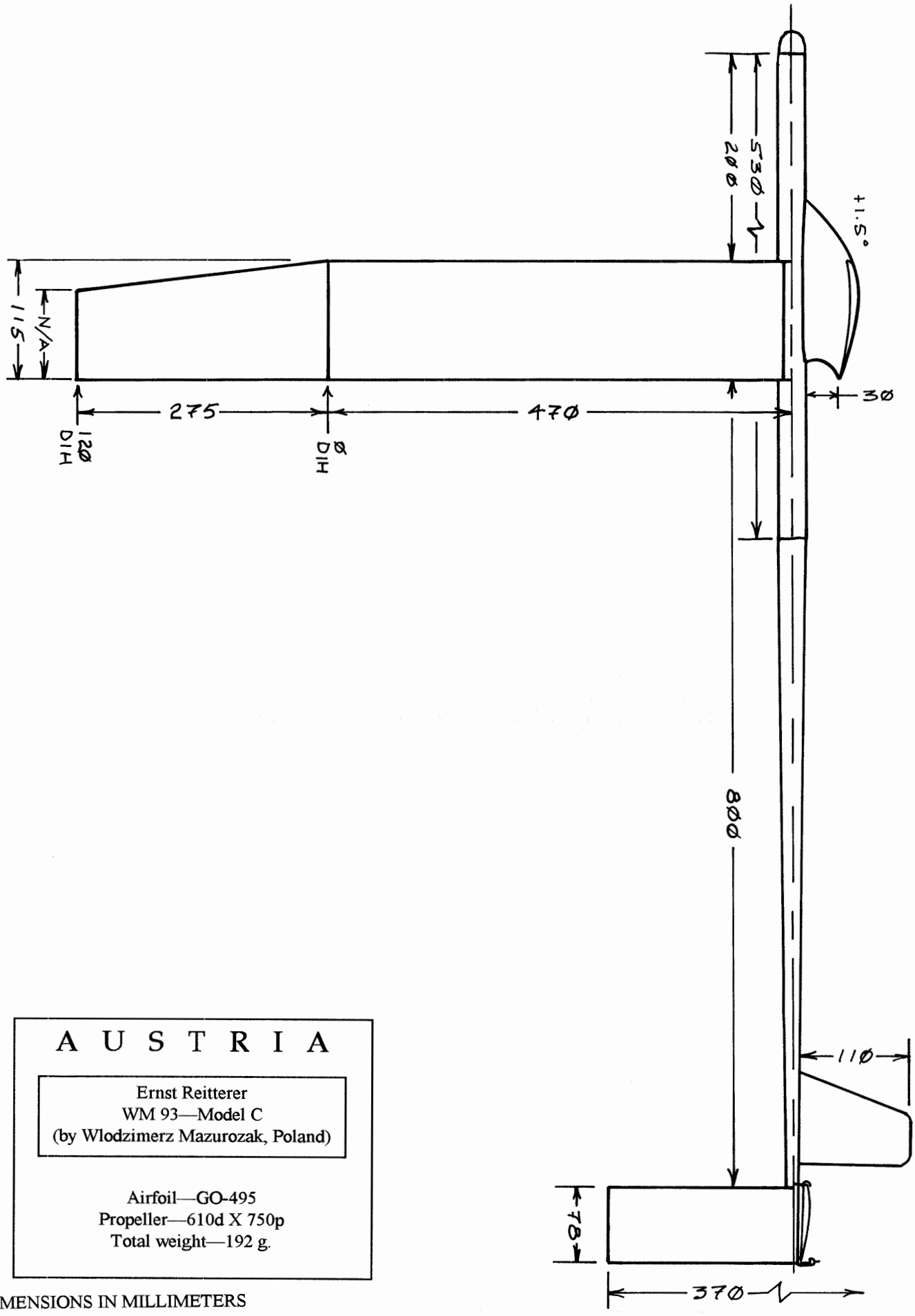


A U S T R I A

Ernst Reitterer
Wakefield—Klasse F1B

Model	A	B
Wing	15,06 dm2	15,12 dm2
Stab	3,6 dm2	3,6 dm2
Total	18,66 dm2	18,72 dm2

DIMENSIONS IN MILLIMETERS

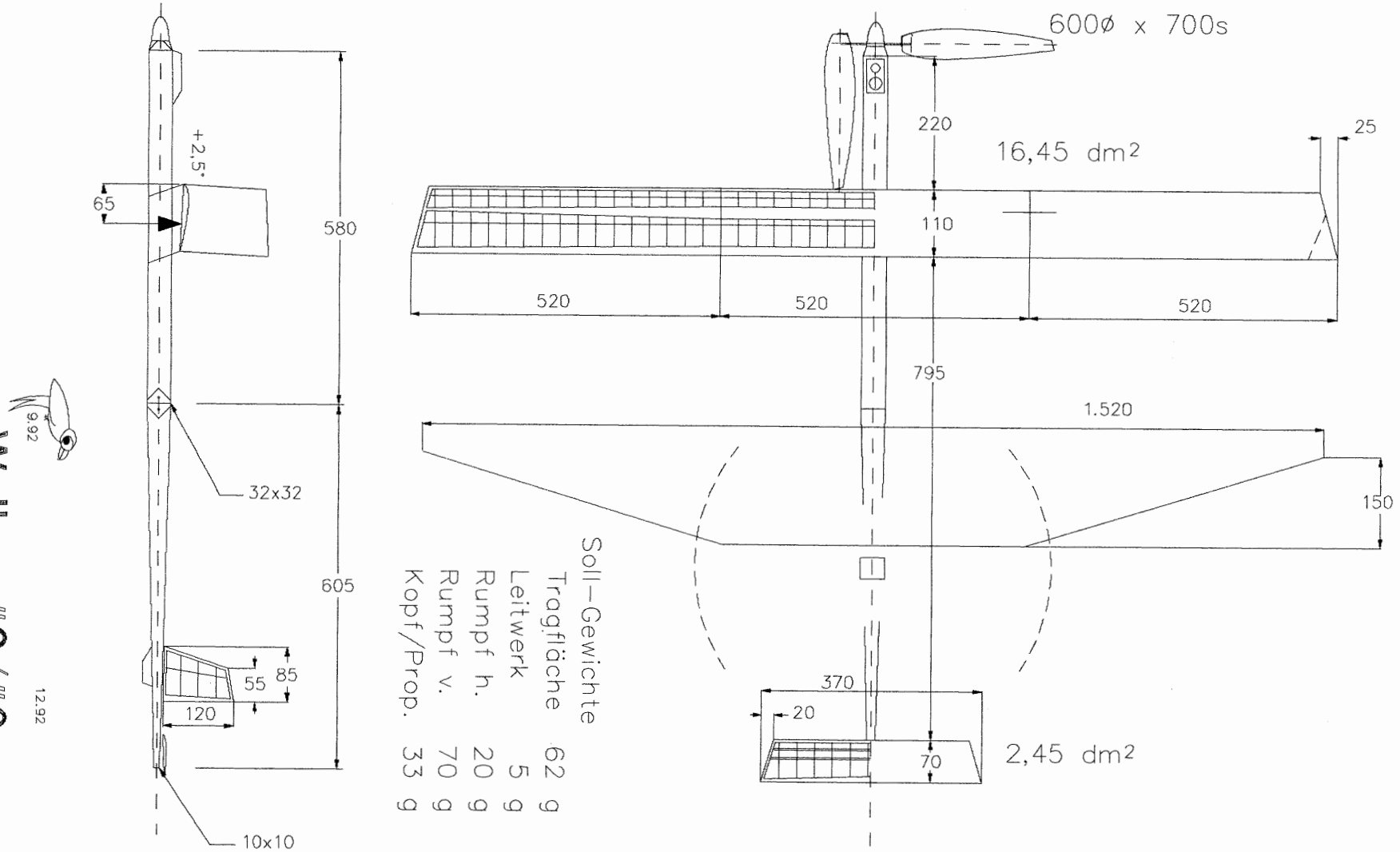


A U S T R I A

Ernst Reitterer
WM 93—Model C
(by Wlodzimerz Mazurozak, Poland)

Airfoil—GO-495
Propeller—610d X 750p
Total weight—192 g.

DIMENSIONS IN MILLIMETERS



Welles #2/#3

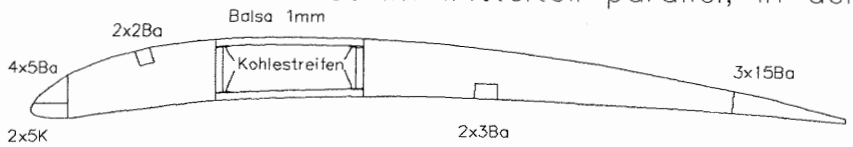
9.92

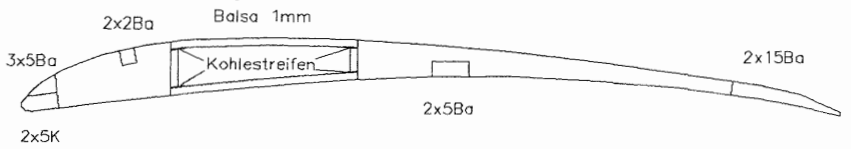
12.92

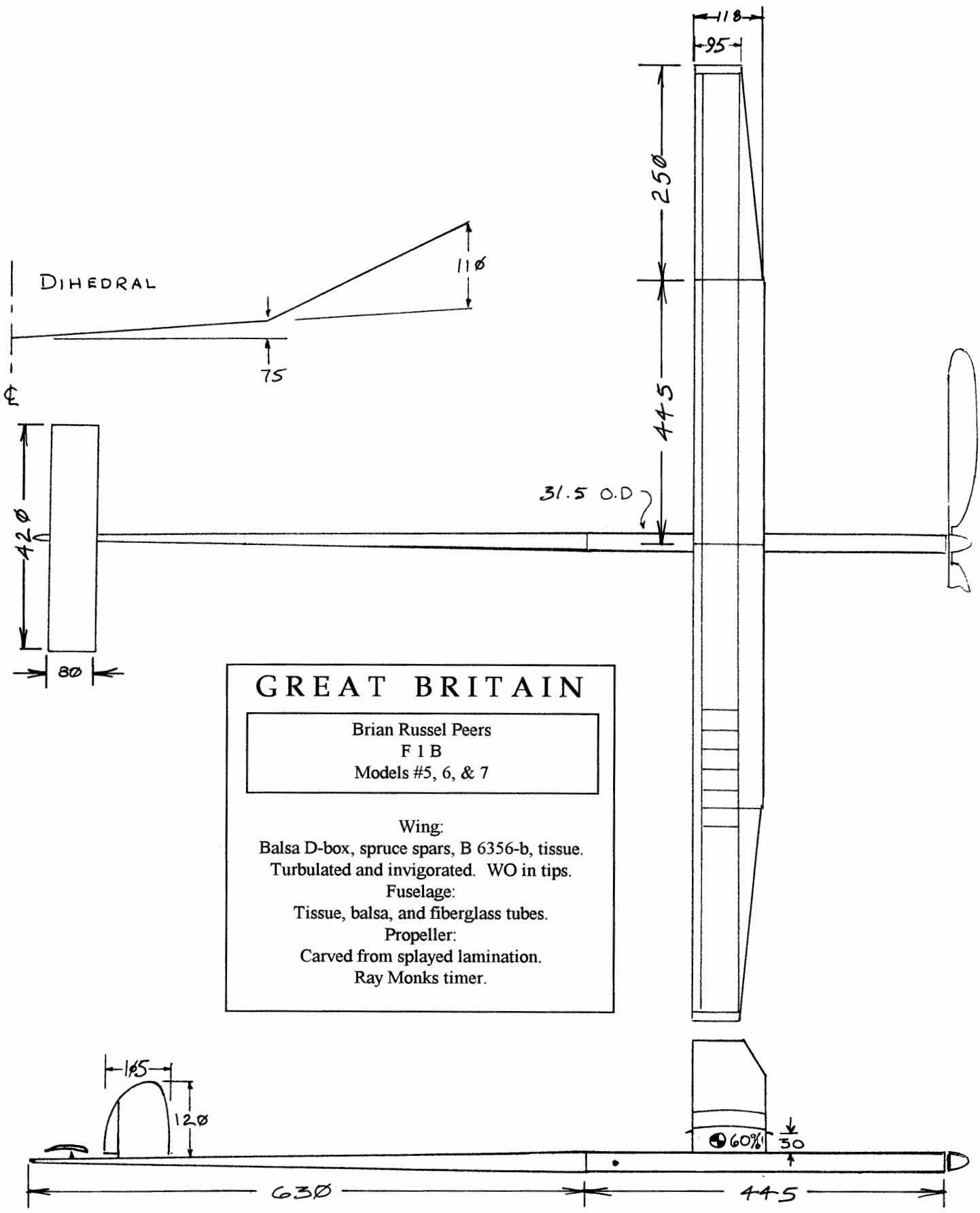
F1B-Modell von Klaus W. Salzer

B8356-b3 (Welles #2) B6456f (Welles #3)

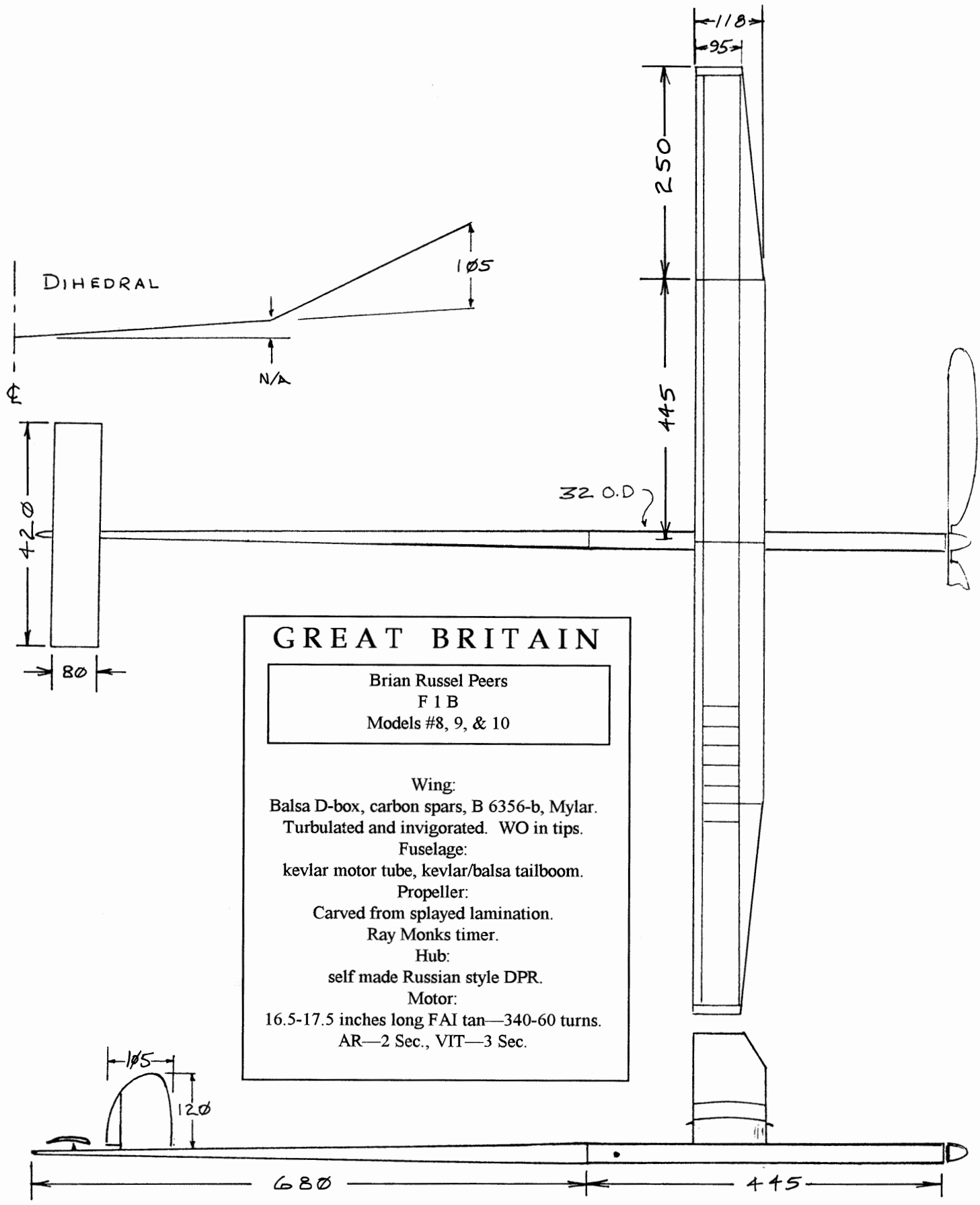
Der Kastenholm ist im Mittelteil parallel, in den Ohren verjuengt er sich bis auf 5mm Breite







DIMENSIONS IN MILLIMETERS

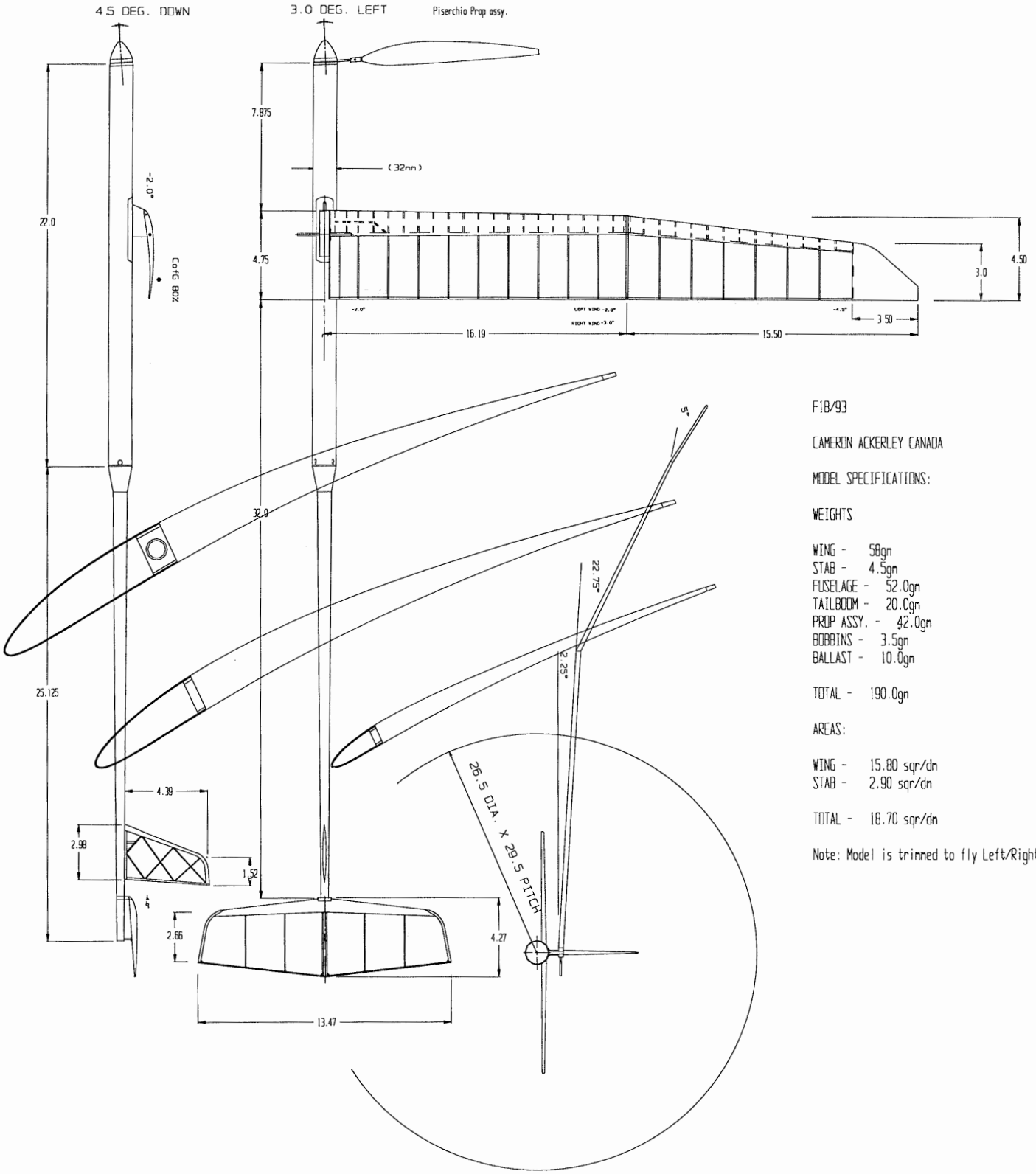


GREAT BRITAIN

Brian Russel Peers
F 1 B
Models #8, 9, & 10

Wing:
Balsa D-box, carbon spars, B 6356-b, Mylar.
Turbulated and invigorated. WO in tips.
Fuselage:
kevlar motor tube, kevlar/balsa tailboom.
Propeller:
Carved from splayed lamination.
Ray Monks timer.
Hub:
self made Russian style DPR.
Motor:
16.5-17.5 inches long FAI tan—340-60 turns.
AR—2 Sec., VIT—3 Sec.

DIMENSIONS IN MILLIMETERS



F1B/93

CAMERON ACKERLEY CANADA

MODEL SPECIFICATIONS:

WEIGHTS:

WING - 58gn
STAB - 4.5gn
FUSELAGE - 52.0gn
TAILBOOM - 20.0gn
PROP ASSY. - 42.0gn
BOBBINS - 3.5gn
BALLAST - 10.0gn

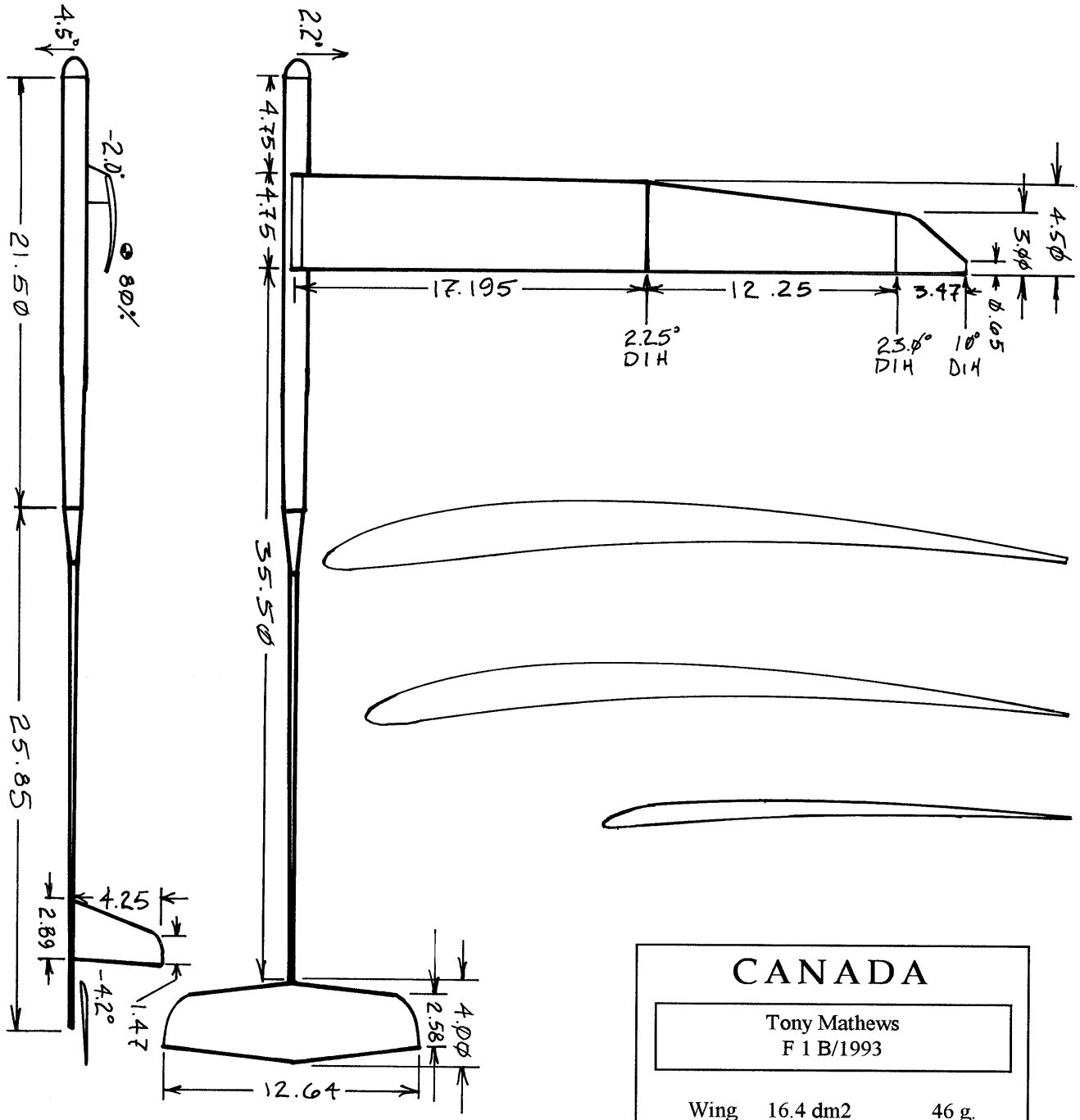
TOTAL - 190.0gn

AREAS:

WING - 15.80 sqr/dn
STAB - 2.90 sqr/dn

TOTAL - 18.70 sqr/dn

Note: Model is trimmed to fly Left/Right!



CANADA

Tony Mathews
F 1 B/1993

Wing	16.4 dm2	46 g.
Stab	2.56 dm2	3.6 g.
Fuse		58.0 g.
Tailboom		14.0 g.
Prop assy.		52.0 g.
Bobbins		3.5 g.
Transmitter		5.0 g.
Ballast		7.9 g.
Total		190.0 g.

Andruikov DPR/VP front end
Prop: 22.5d X 26p (high), 20p (low)
Coverings:
Wing—1/2 mil. metalised Mylar,
Stab—1/4 mil. metalised Mylar.
Model is trimmed to fly Right/Left.

DIMENSIONS IN INCHES

'93 F1B Wing Weights

Tony Mathews

Center Spar

0.014" Carbon spar 17" lg x 0.187 to 0.070	0.47 gm
0.021" carbon spar 17"lg x 0.187 to 0.070	0.70 gm
bottom spar +balsa webb 6lb/cu/ft	1.40 gm
spar complete minus web and binding (web=D-box matl. x 3" lg both sides)	2.30 gm
spar complete + web (carbon) and kevlar binding, 0.162" wide to 0.60"	2.50 gm

L. E.

0.16" carbon x 17"lg x 0.070" wide	0.40 gm

Ribs L.E.

10 lb. cu/ft balsa	1.00 gm
glue	0.10 gm
Subtotal center spar assembly	4.00 gm

Tip Spar

0.014 carbon x 12.25" lg + balsa web 6 lb cu/ft (size – 0.075" wide to 0.060")	0.75 gm

L.E.

0.016" carbon x 12.25" lg x 0.070" wide	0.29 gm

Ribs L.E.

10 lb. cu/ft balsa	0.40 gm
glue	0.06 gm
Subtotal Tip spar/rib assy.	1.50 gm

Carbon/Kevlar D-boxes (Achterberg)

Weight per square inch (sanded)	0.14657 gm
Area center panel D-box	36.97 sq. in.
Area Tip panel D-box	15.61 sq. in.

Weights (D-boxes)

Center	5.42 gm
Tip	2.29 gm

Glue–Epoxy Ciba Geigy (araldite)

Center	0.50 gm
Tip	0.30 gm

Sub Total D-box + spar/rib assy. + glue

Center	9.92 gm
Tip	4.09 gm

T.E. Weights

Center (0.26" x 0.093 x 17" lg carbon fiber)	0.87 gm
Tip (0.026" x 0.093 x 17" lg carbon fiber)	0.63 gm

Rear Ribs

Center	1.00 gm
Tip	0.60 gm

Glue (Hot Stuff) for tacking ribs to T.E. and spar

Center	0.10 gm
Tip	0.06 gm

Carbon Caps 0.003" x 0.060"

Center	0.30 gm
Tip	0.15 gm

Glue Ciba Geigy Araldite

Center	0.20 gm
Tip	0.15 gm

Subtotal D-box + rear ribs + carbon caps + glue

Center	12.40 gm
Tip	5.65 gm

Dural insert 1.00 gm

Epoxy

Araldite + micro balloons to attach insert	0.20 gm

Plywood root rib

0.60" thk. (6 layers Ply)	0.80 gm

Fiberglass cloth at root

0.5" balsa rib	0.25 gm

Balsa spacer ribs

0.187" x 10 lb cu/ft	0.10 gm

Dihedral Brace

(D-box material) + glue	0.10 gm

Mylar (0.0005 aluminized)

Weight per square inch	0.009876 gm

Area

Center (top and bottom)	123.25 in/sqr
Tip	79.63 in/sqr

Weight Mylar Subtotal

Center	1.22 gm
Tip	0.79 gm

Glue (Lepages contact cement Gel Form. 3 coats thinned)

Center	0.20 gm
Tip	0.10 gm

Wing Tip

(4.5 lb/cu/ft balsa + sanding sealer = floures. orange)	1.00 gm

Total Weight

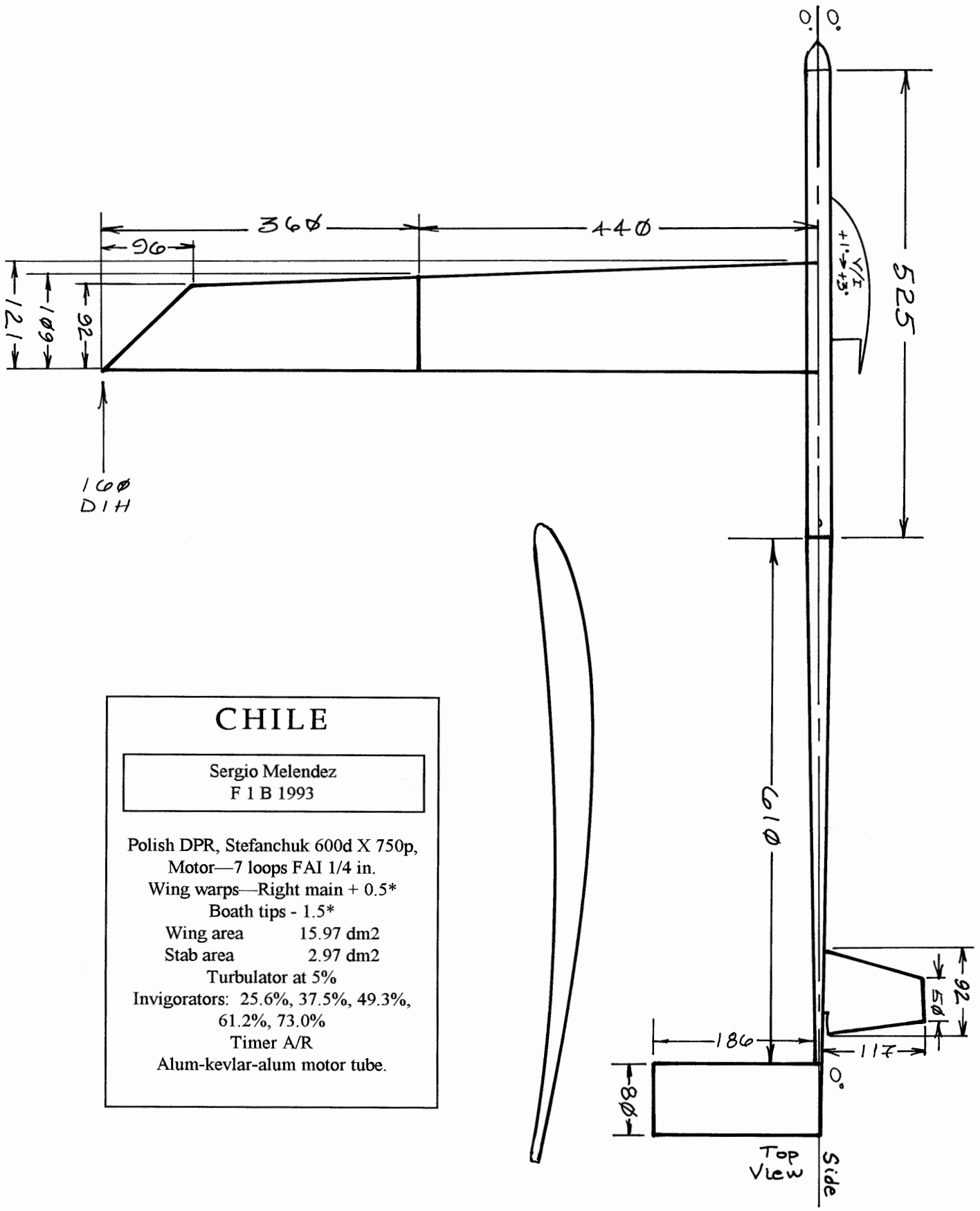
(per wing half)	23.80 gm

Total Weight

(both wing halves)	47.59 gm

Additional weights

Black Baron clear (1 coat on D-boxes only)	0.25 gm
Turbulators	0.20 gm
Decals (Numbers, etc.)	0.20 gm

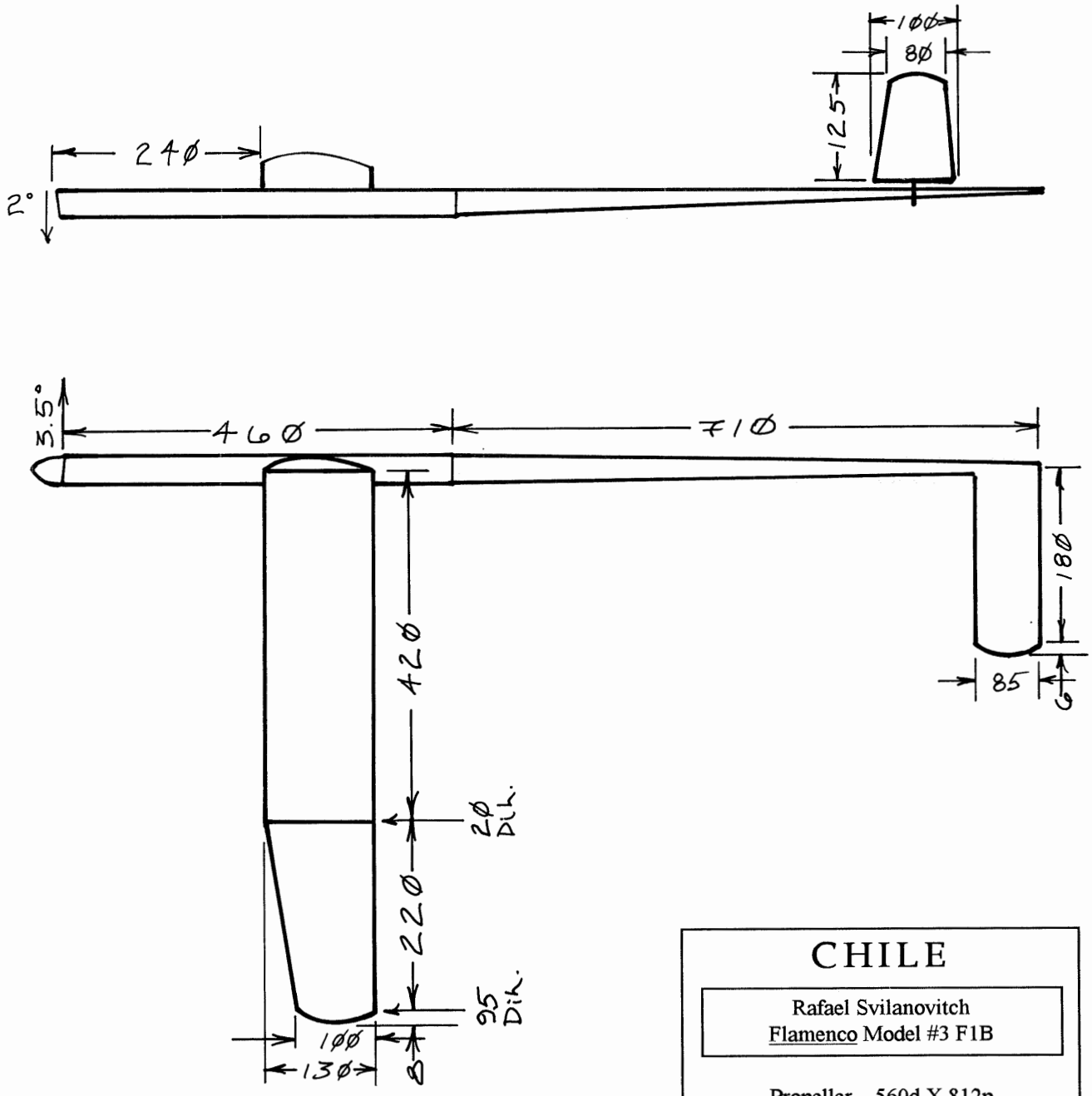


CHILE

Sergio Melendez
F 1 B 1993

Polish DPR, Stefanchuk 600d X 750p,
Motor—7 loops FAI 1/4 in.
Wing warps—Right main + 0.5*
Boath tips - 1.5*
Wing area 15.97 dm2
Stab area 2.97 dm2
Turbulator at 5%
Invigorators: 25.6%, 37.5%, 49.3%,
61.2%, 73.0%
Timer A/R
Alum-kevlar-alum motor tube.

DIMENSIONS IN MILLIMETERS



CHILE

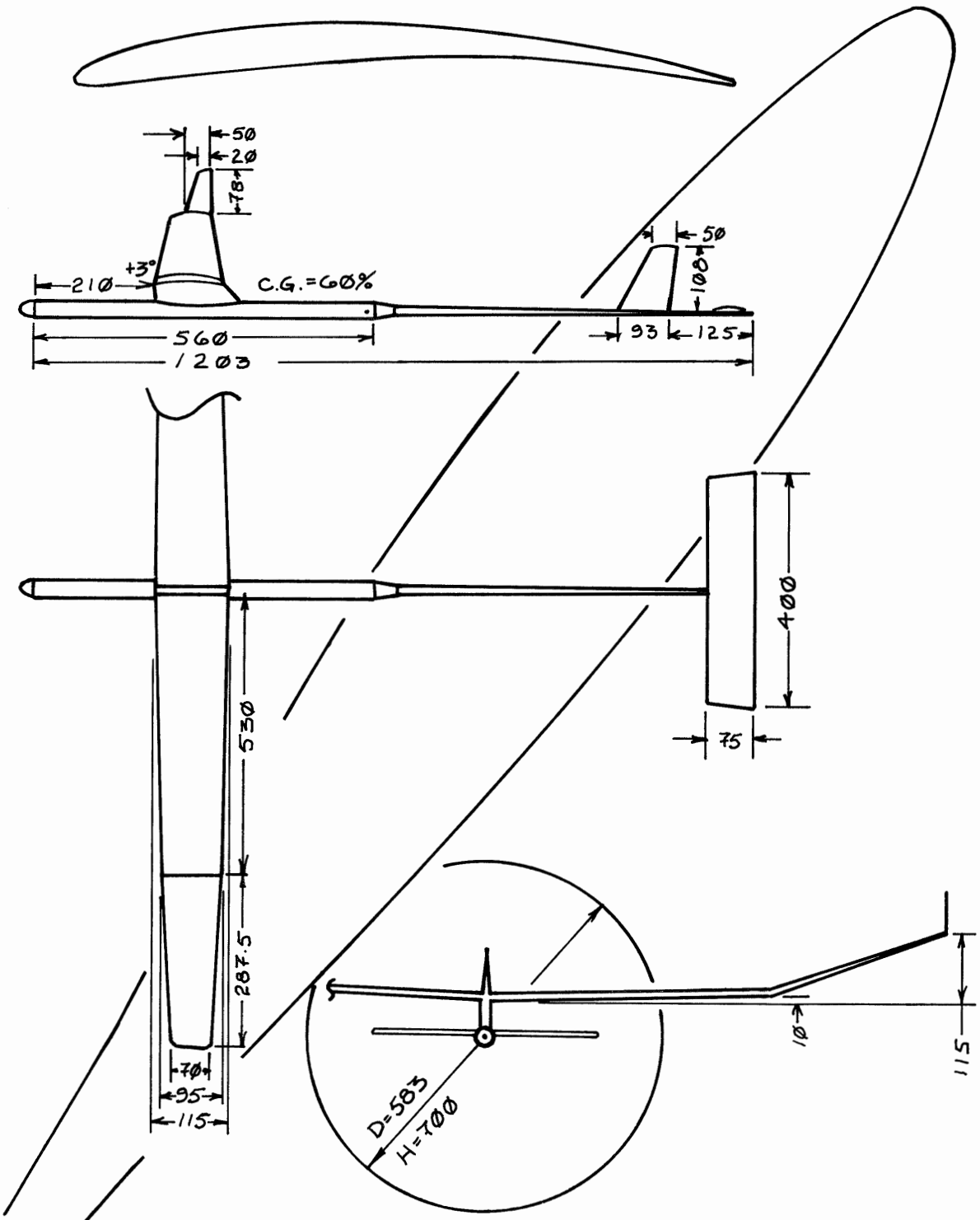
Rafael Svilanovitch
Flamenco Model #3 F1B

Propeller—560d X 812p
Motor—16 loops 3 X 1 tan, 320 turns, 35 sec. motor run.

Wing	15.63 dm2	58 g.
Stab	3.13 dm2	7 g.
Fuse		49 g.
Tail boom		35 g.
Front end		44 g.
Total		193 g.

DIMENSIONS IN MILLIMETERS

DIMENSIONS IN MILLIMETERS

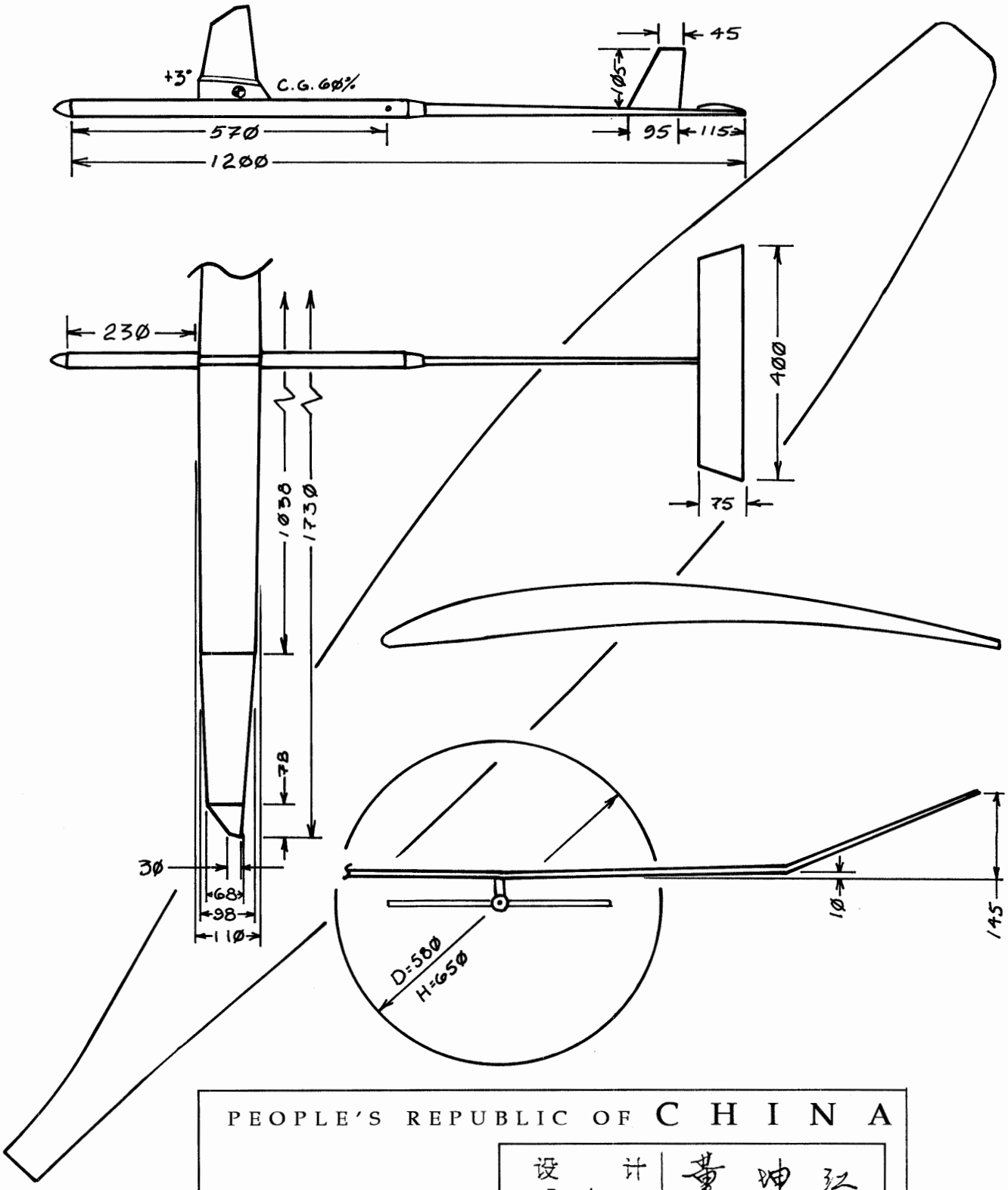


PEOPLE'S REPUBLIC OF CHINA

F 1 B

设 计 Designer	吕济发 Lü Jifa
日 期 Date	~~23-8-93~~ Aug. 16, 1993

DIMENSIONS IN MILLIMETERS

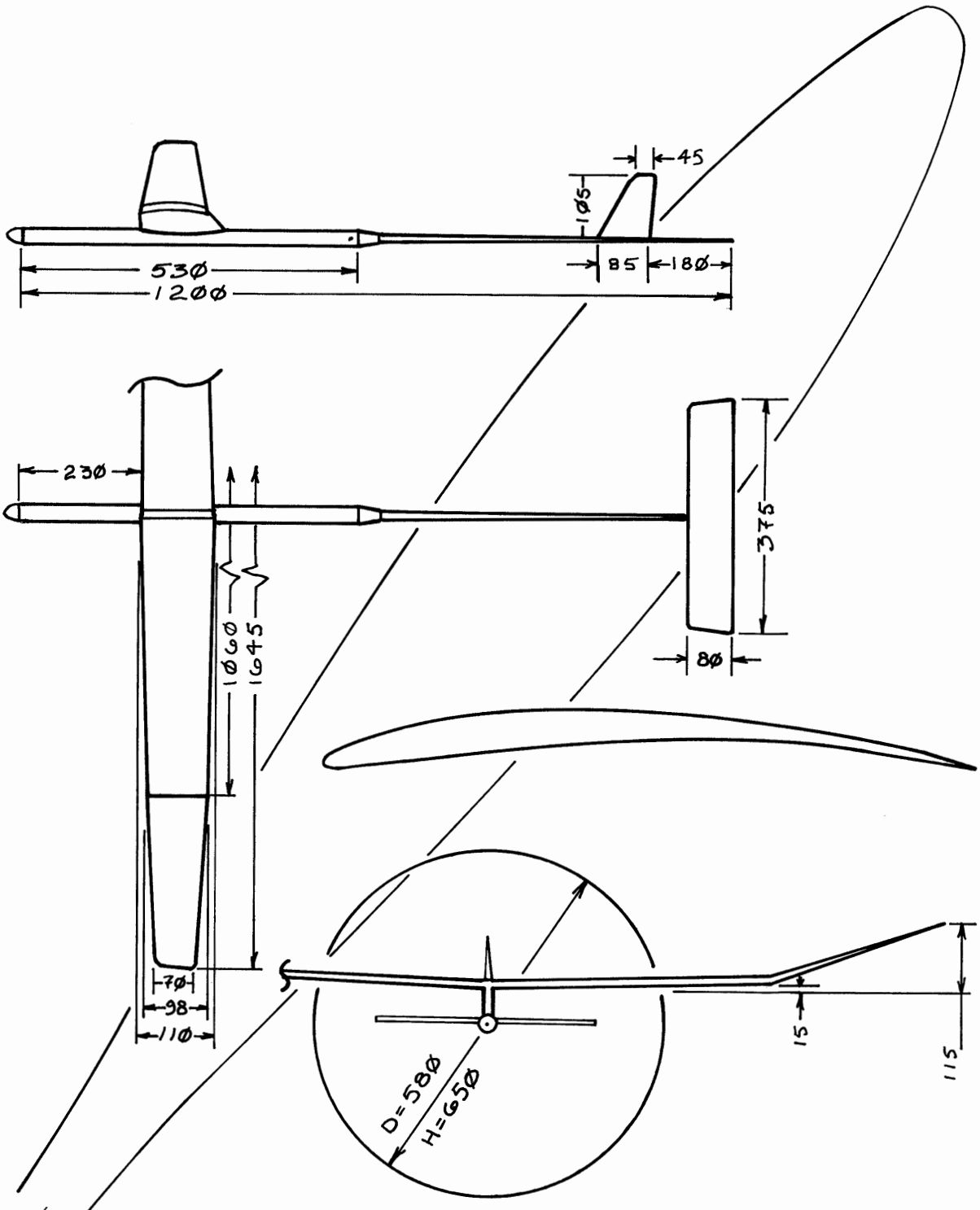


PEOPLE'S REPUBLIC OF CHINA

F 1 B

设 计 Designer	董坤江 Dong Kunjiang
日 期 Date	Aug. 16, 1993

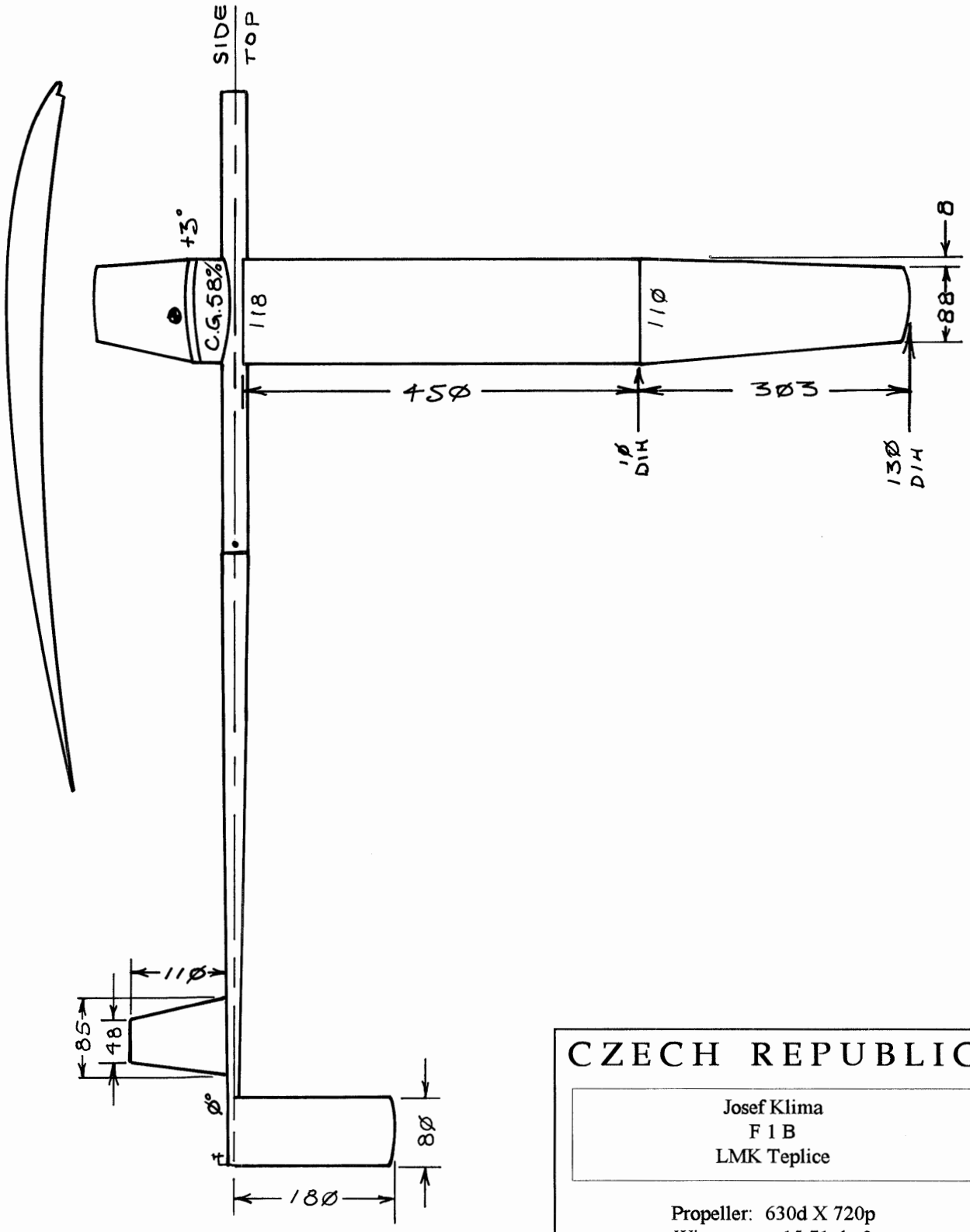
DIMENSIONS IN MILLIMETERS



PEOPLE'S REPUBLIC OF CHINA

F 1 B

设 计 Designer	陆悦忠 Lu Yuezhong
日 期 Date	Aug. 16, 1993

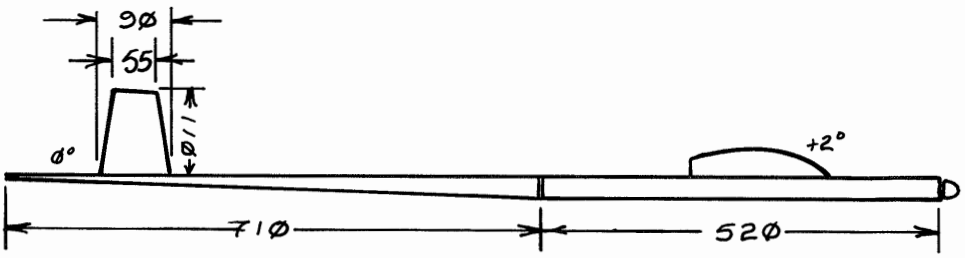


CZECH REPUBLIC

Josef Klima
F 1 B
LMK Teplice

Propeller: 630d X 720p
Wing area—15,71 dm2
Stabilizer area—2,88 dm2
FAI Tan 380 obratek.

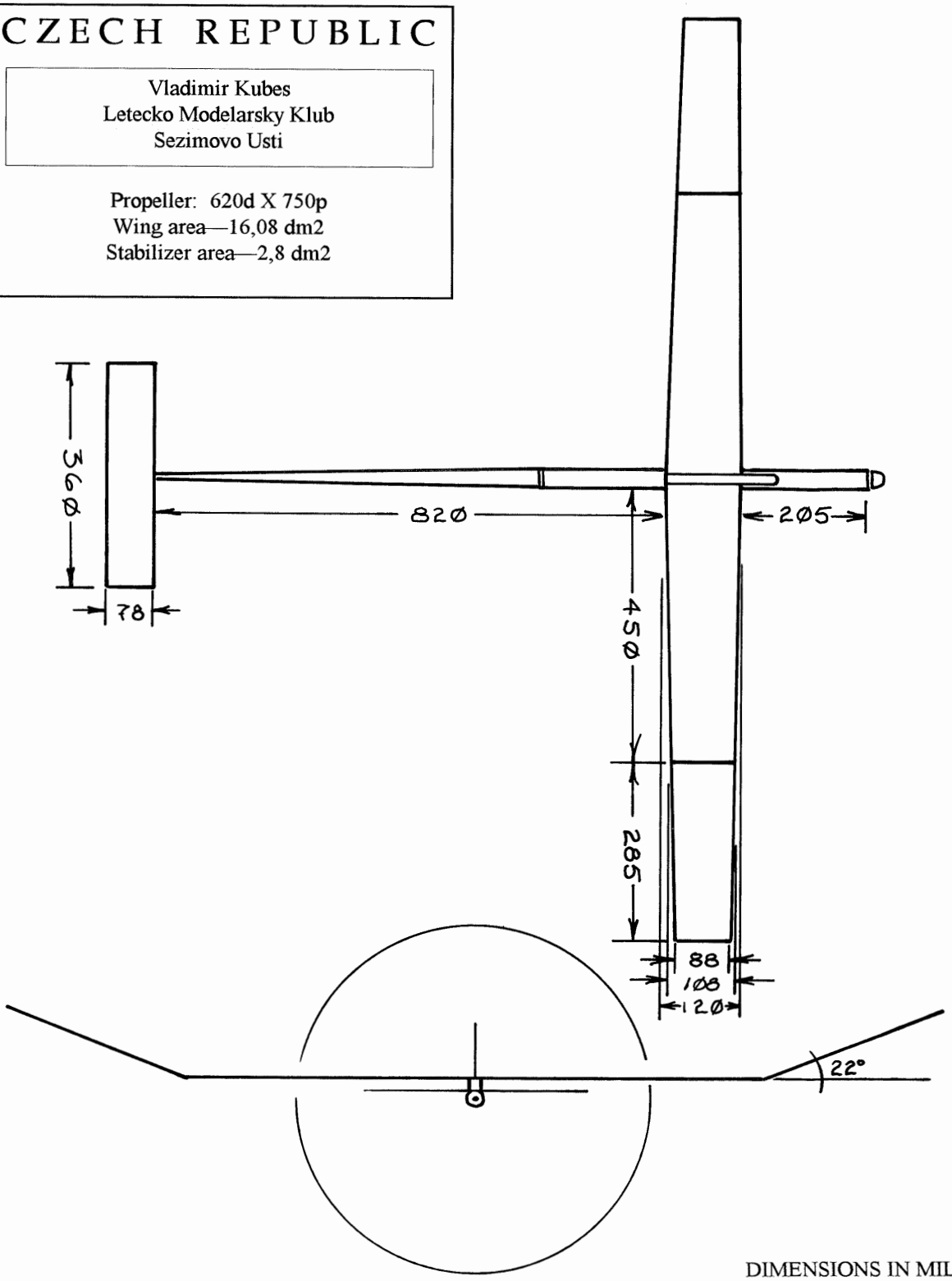
DIMENSIONS IN MILLIMETERS



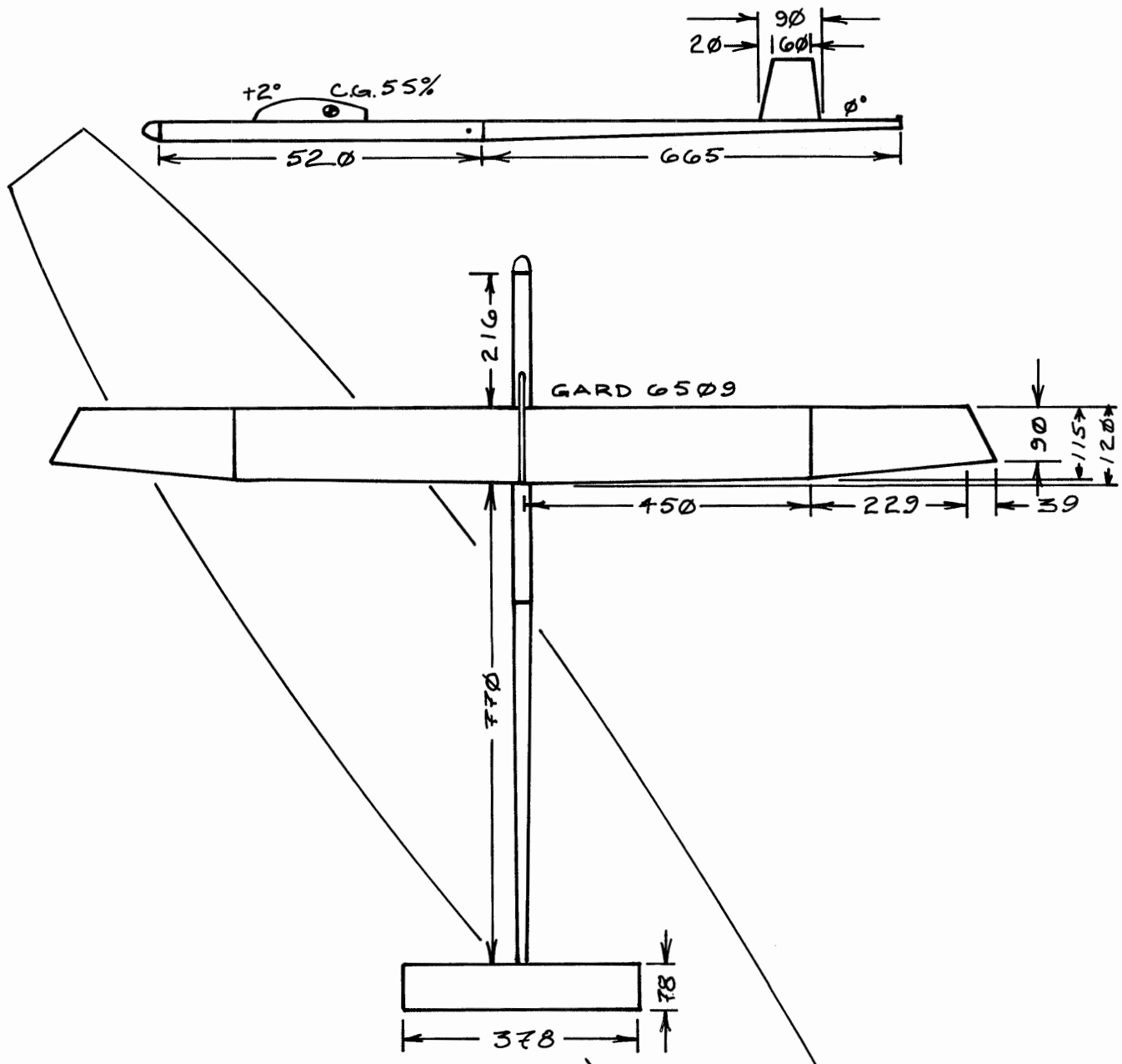
CZECH REPUBLIC

Vladimir Kubes
Letecko Modelarsky Klub
Sezimovo Usti

Propeller: 620d X 750p
Wing area—16,08 dm2
Stabilizer area—2,8 dm2



DIMENSIONS IN MILLIMETERS

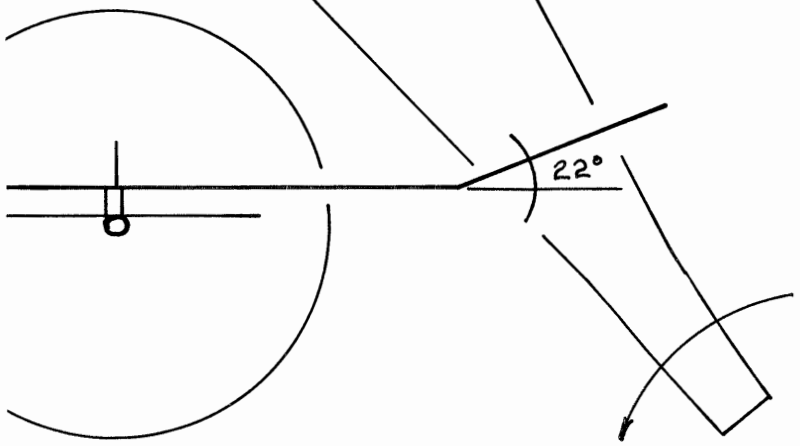


CZECH REPUBLIC

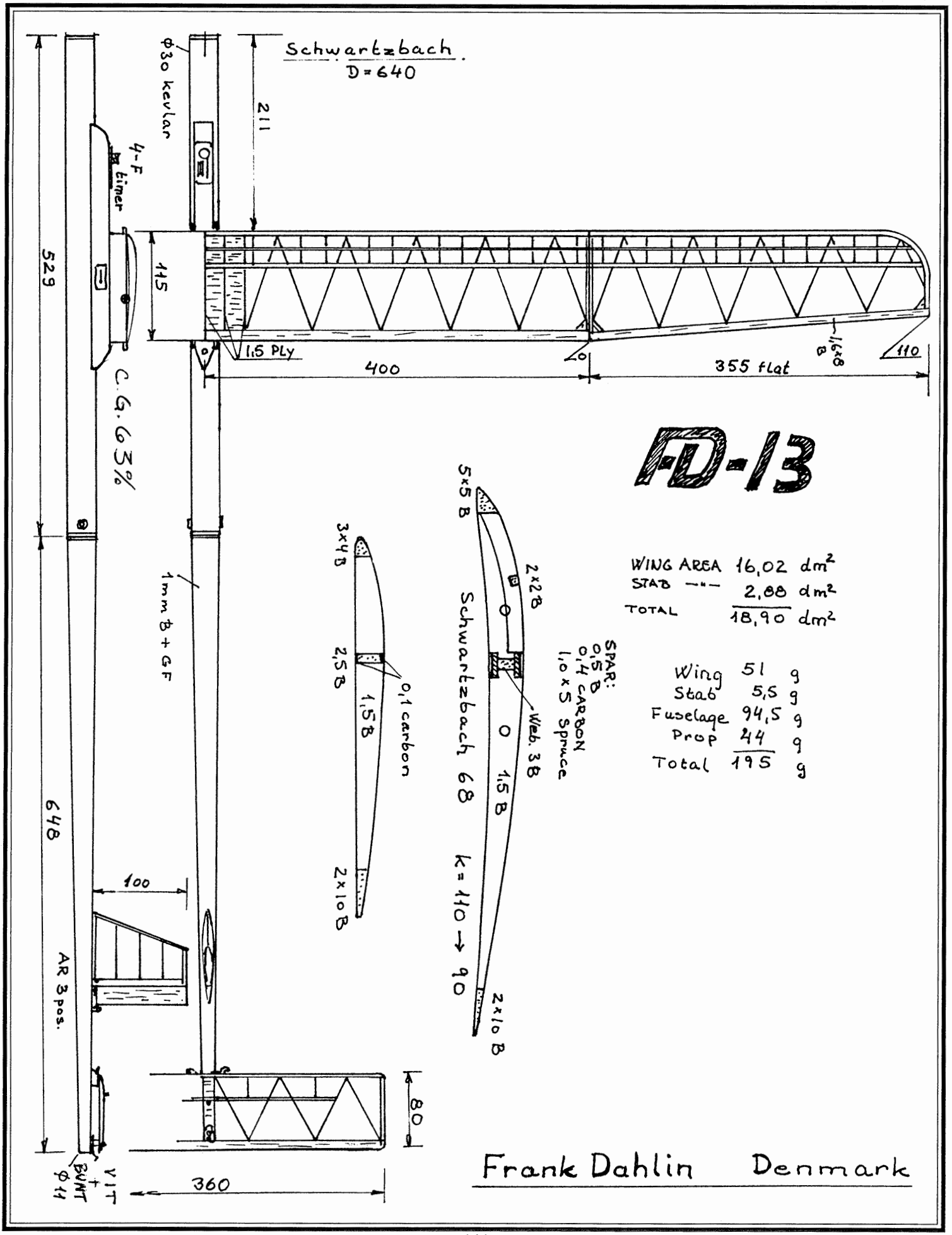
Vladimir Kubes Jr.
LMK Sez. Usti
CSR

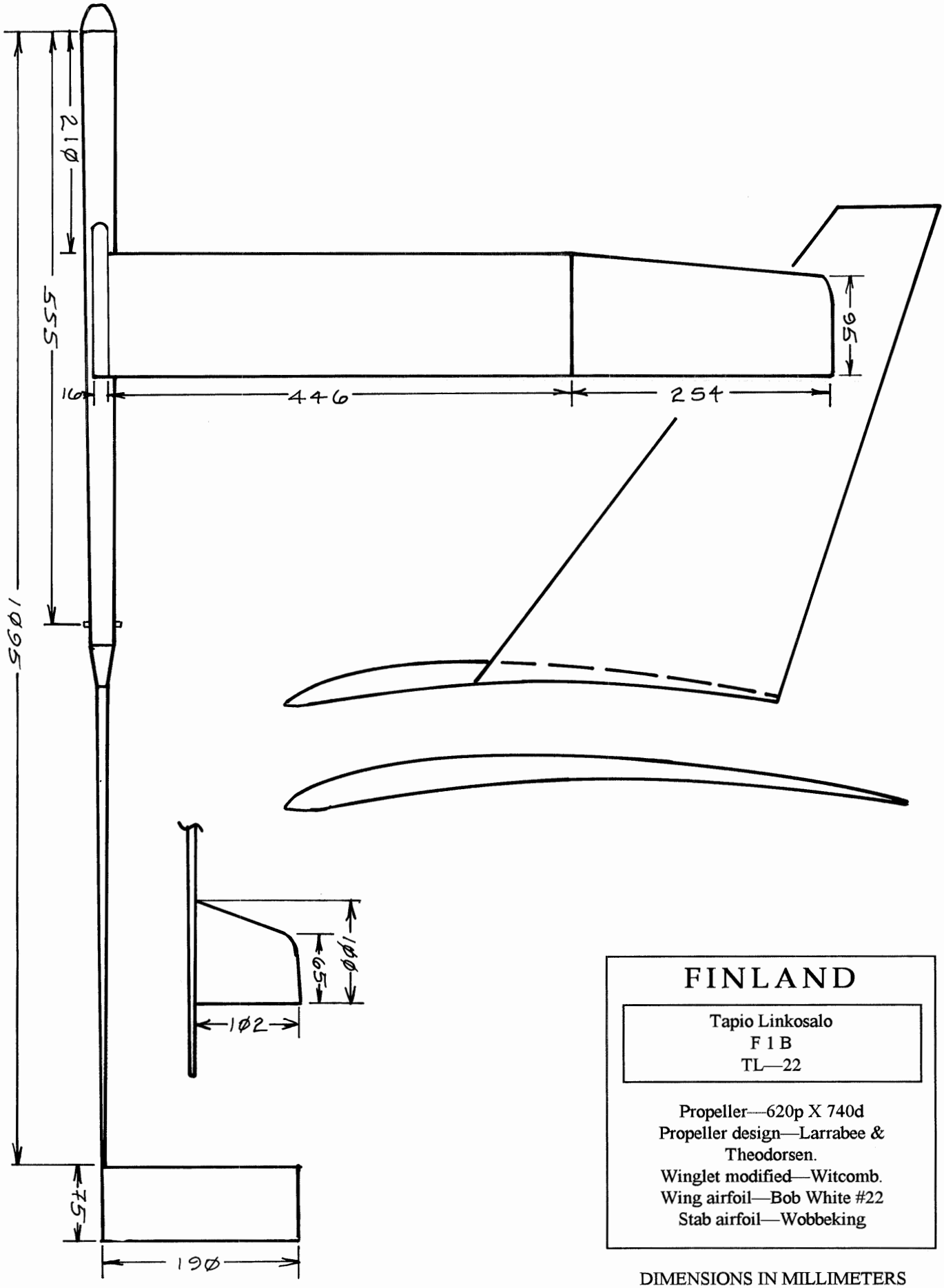
Propeller: 620d X 750p
Wing area—15,94 dm2
Stabilizer area—2,96 dm2
Weights:

Trup	92g.
Kridlo	56g.
VOP	5g.
hlavice	40g.
celkem	193g.



DIMENSIONS IN MILLIMETERS


Schwartzbach
D=640
Ø30 kevlar
211
4-F timer
529
115
1,5 PLY
400
355 flat
1,6x8 B
110
C.G. 63%
1mm B + GF
648
100
AR 3 pos.
360
80
VIT + BUNT Ø11
3x4 B
2,5 B
1,5 B
0,1 carbon
2x10 B
5x5 B
2x2 B
Schwartzbach 68 k=110→90
Web. 3 B
1,5 B
2x10 B
SPAR:
0,5 B
0,4 CARBON
1,0 x 5 Spruce
FD-13
WING AREA 16,02 dm²
STAB —"— 2,88 dm²
TOTAL 18,90 dm²
Wing 51 g
Stab 5,5 g
Fuselage 94,5 g
Prop 44 g
Total 195 g
Frank Dahlin Denmark

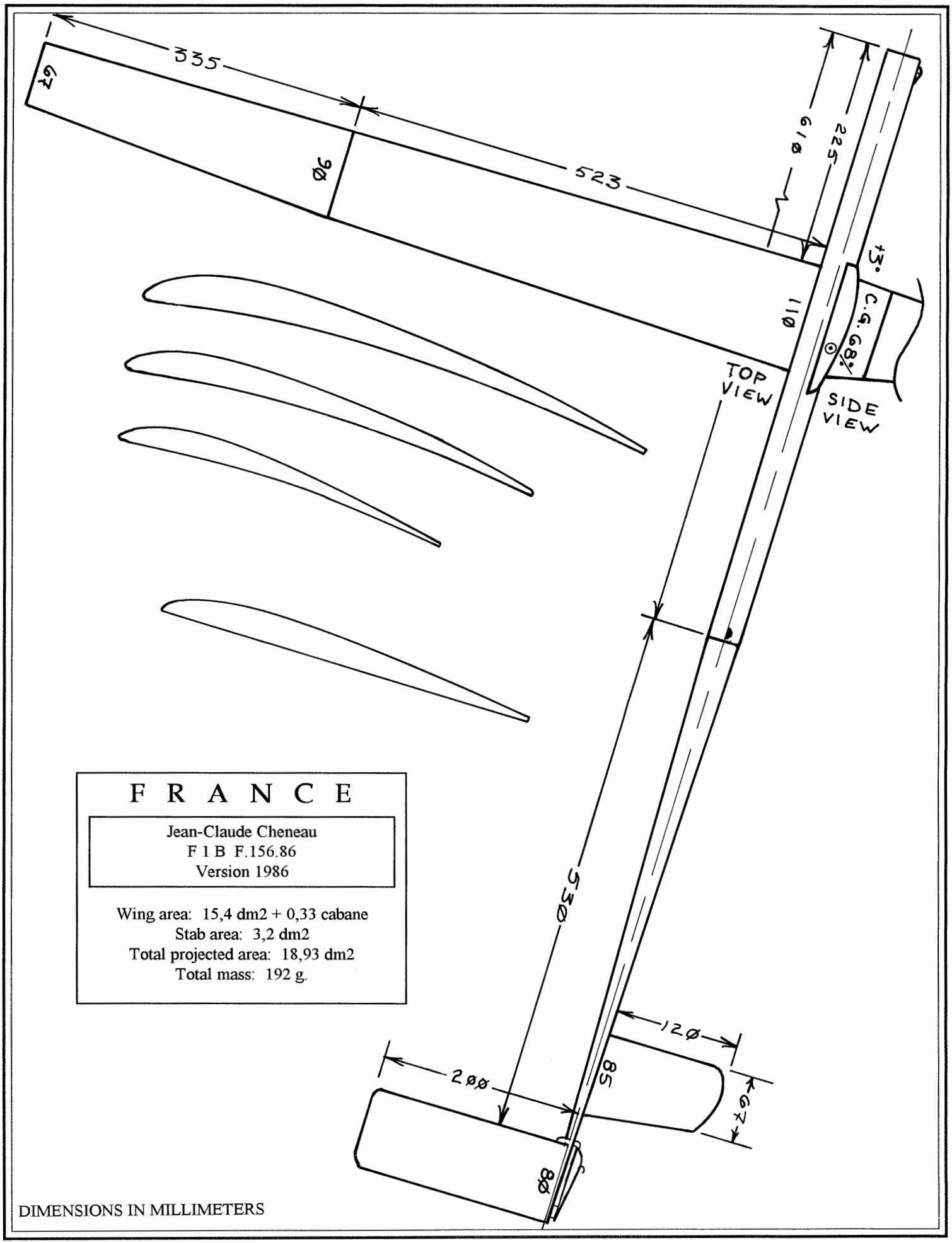


FINLAND

Tapio Linkosalo
F 1 B
TL—22

Propeller—620p X 740d
Propeller design—Larrabee & Theodorsen.
Winglet modified—Witcomb.
Wing airfoil—Bob White #22
Stab airfoil—Wobbeking

DIMENSIONS IN MILLIMETERS

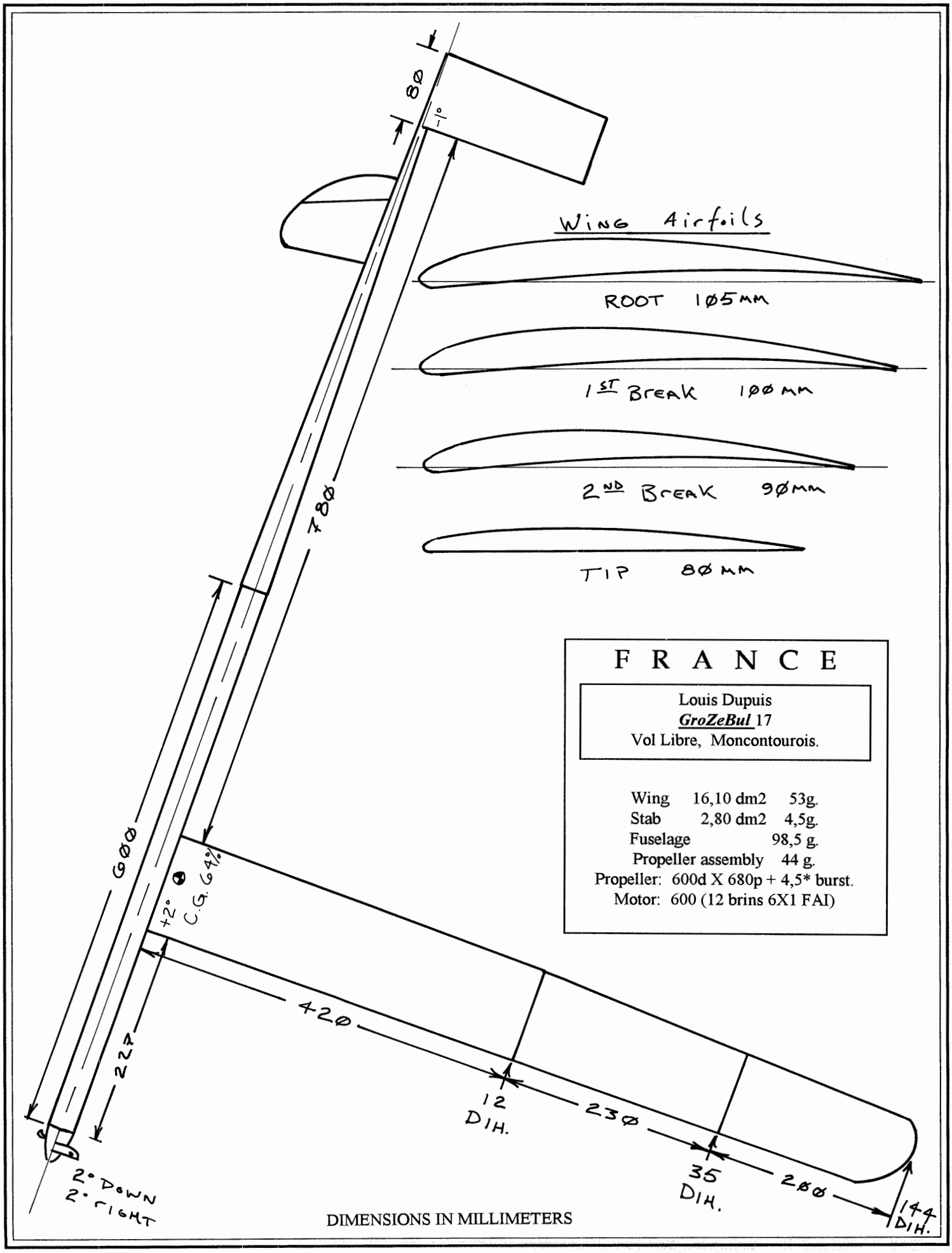


F R A N C E

Jean-Claude Cheneau
F 1 B F.156.86
Version 1986

Wing area: 15,4 dm2 + 0,33 cabane
Stab area: 3,2 dm2
Total projected area: 18,93 dm2
Total mass: 192 g.

DIMENSIONS IN MILLIMETERS



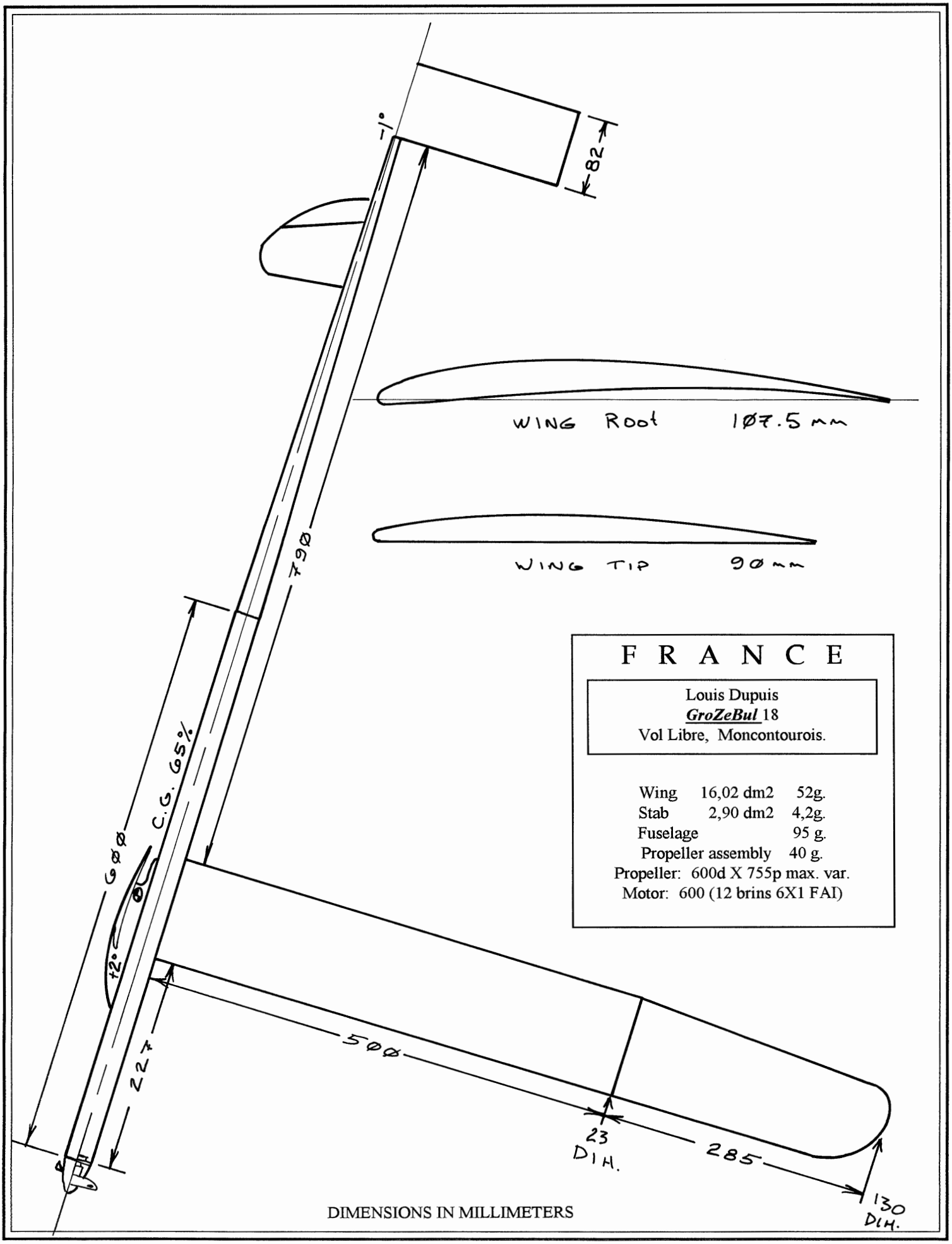
F R A N C E

Louis Dupuis
GroZeBul 17
Vol Libre, Moncontourois.

Wing	16,10 dm2	53g.
Stab	2,80 dm2	4,5g.
Fuselage		98,5 g.
Propeller assembly		44 g.

Propeller: 600d X 680p + 4,5* burst.
Motor: 600 (12 brins 6X1 FAI)

DIMENSIONS IN MILLIMETERS



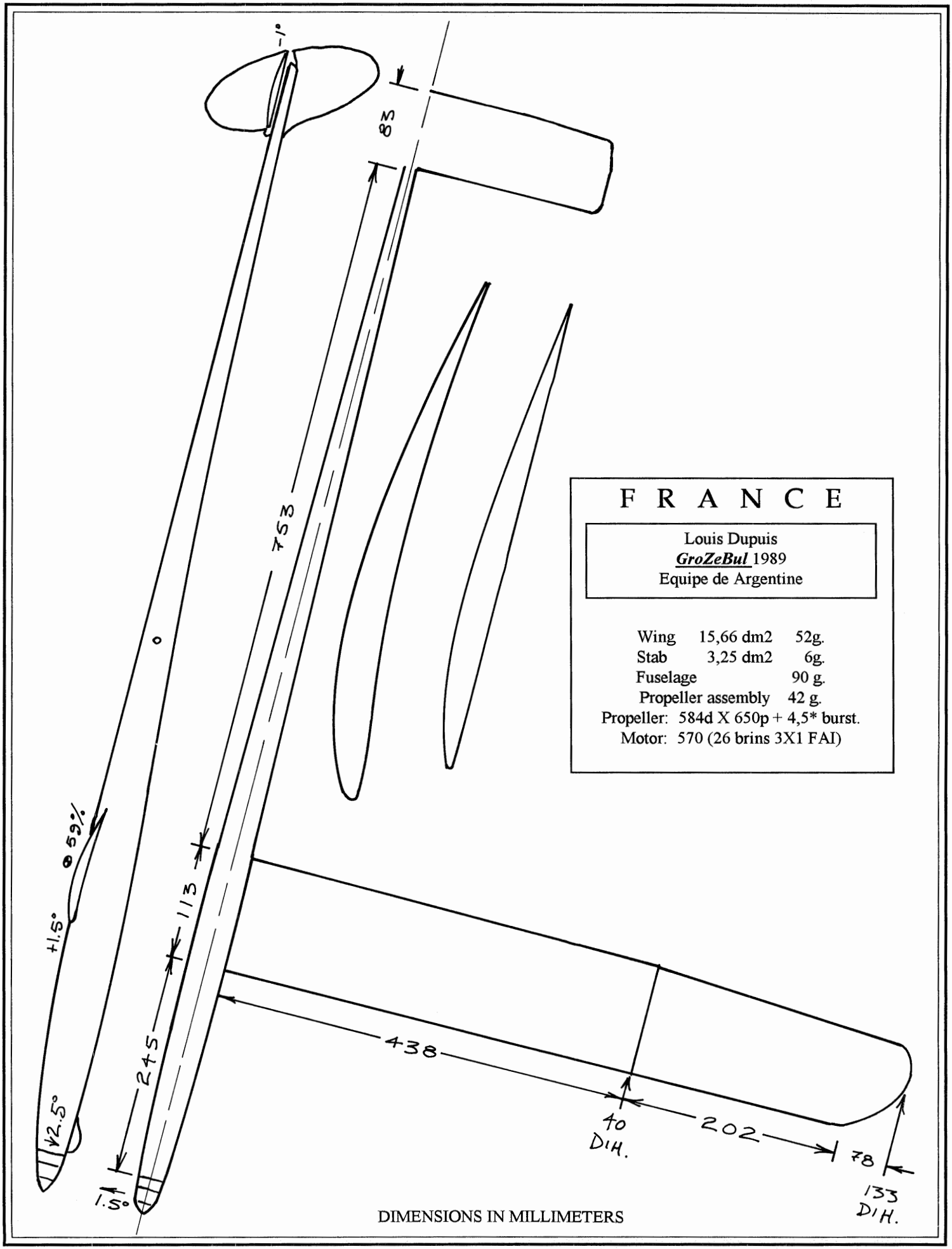
F R A N C E

Louis Dupuis
GroZeBul 18
Vol Libre, Moncontourois.

Wing	16,02 dm2	52g.
Stab	2,90 dm2	4,2g.
Fuselage		95 g.
Propeller assembly		40 g.

Propeller: 600d X 755p max. var.
Motor: 600 (12 brins 6X1 FAI)

DIMENSIONS IN MILLIMETERS



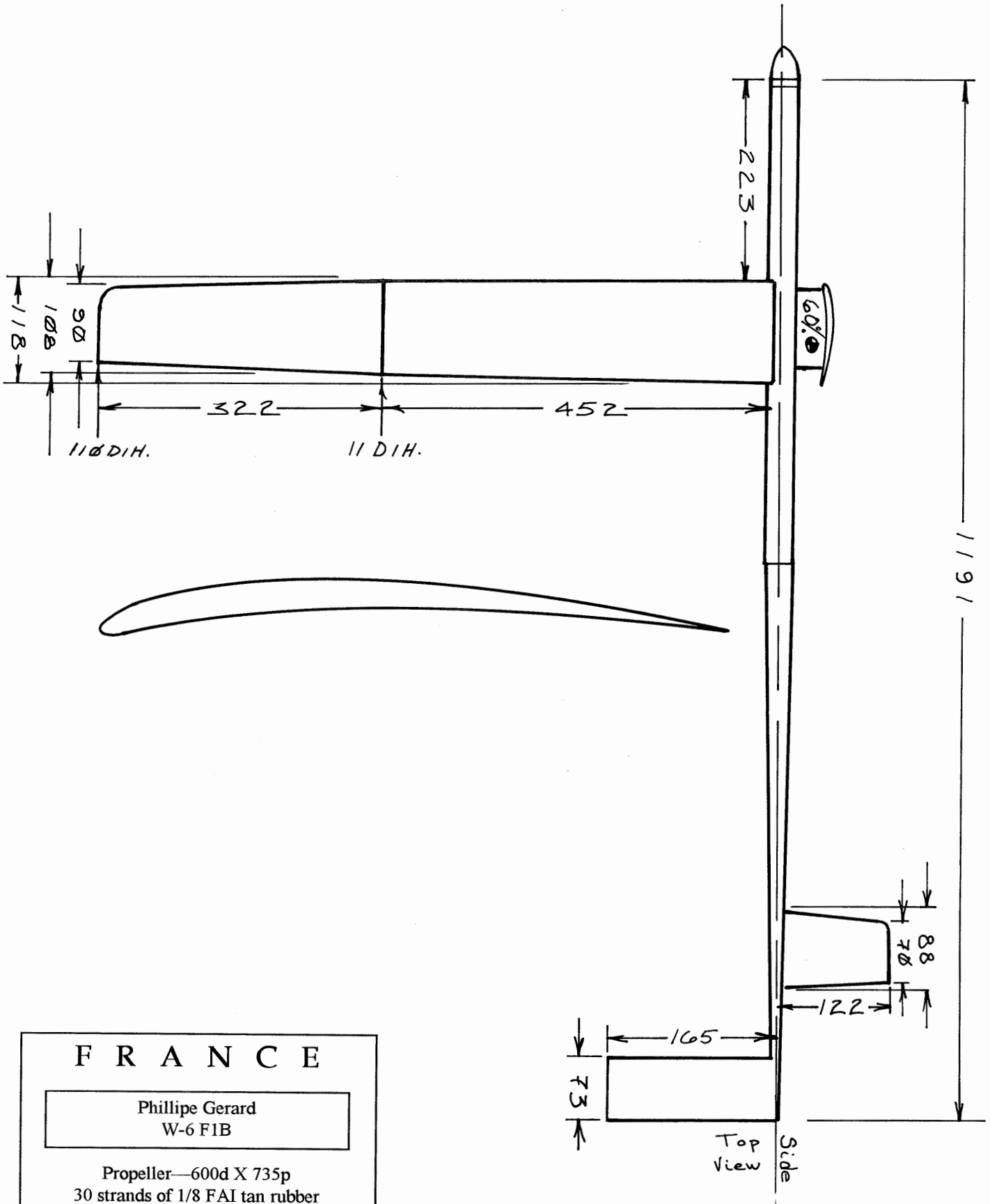
F R A N C E

Louis Dupuis
GroZeBul 1989
Equipe de Argentine

Wing	15,66 dm2	52g.
Stab	3,25 dm2	6g.
Fuselage		90 g.
Propeller assembly		42 g.

Propeller: 584d X 650p + 4,5* burst.
Motor: 570 (26 brins 3X1 FAI)

DIMENSIONS IN MILLIMETERS

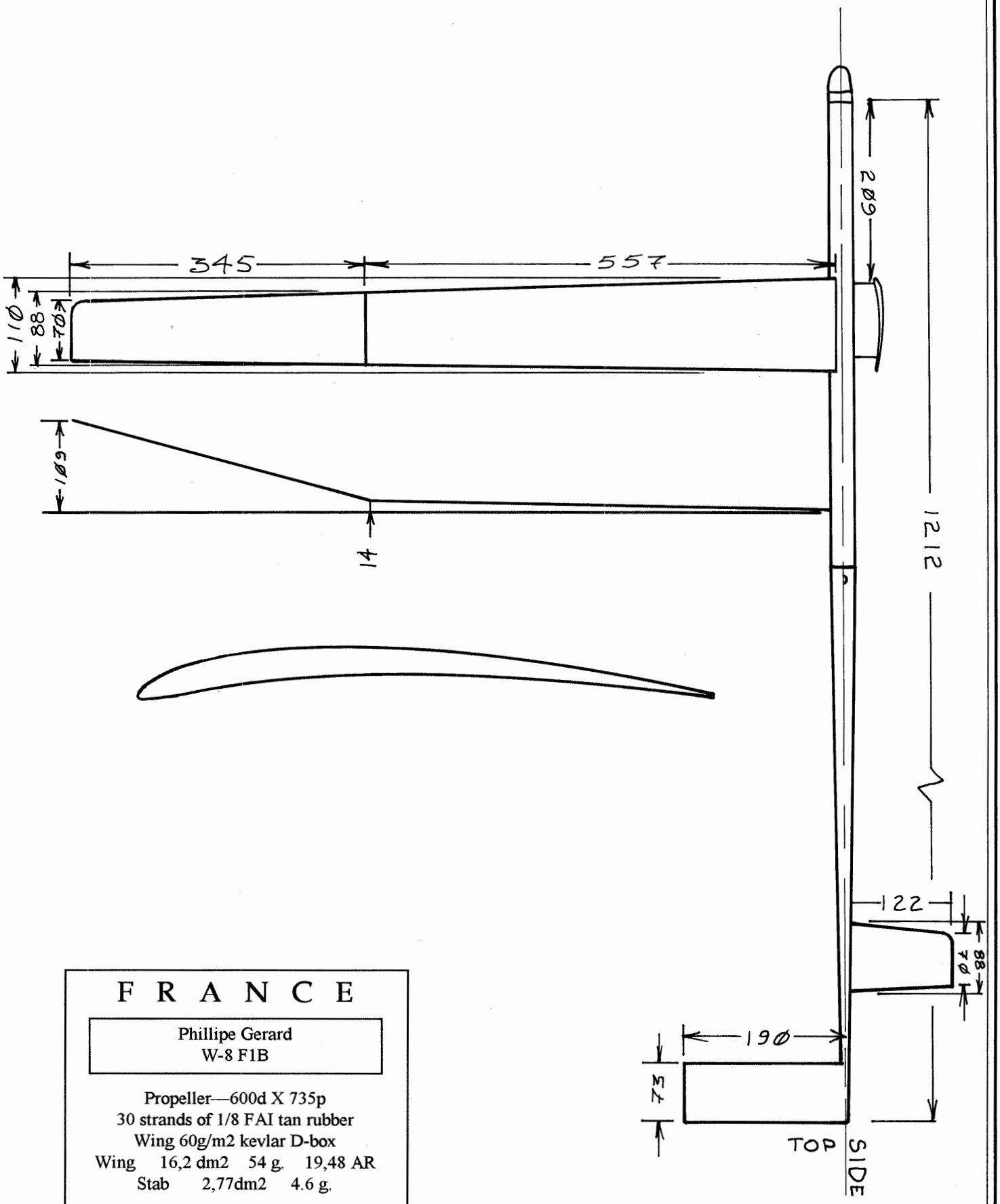


F R A N C E

Phillipe Gerard
W-6 F1B

Propeller—600d X 735p
30 strands of 1/8 FAI tan rubber
Wing 60g/m2 kevlar D-box
Wing 16,2 dm2 54 g. 14,18 AR
Stab 2,77dm2 4.6 g.

DIMENSIONS IN MILLIMETERS

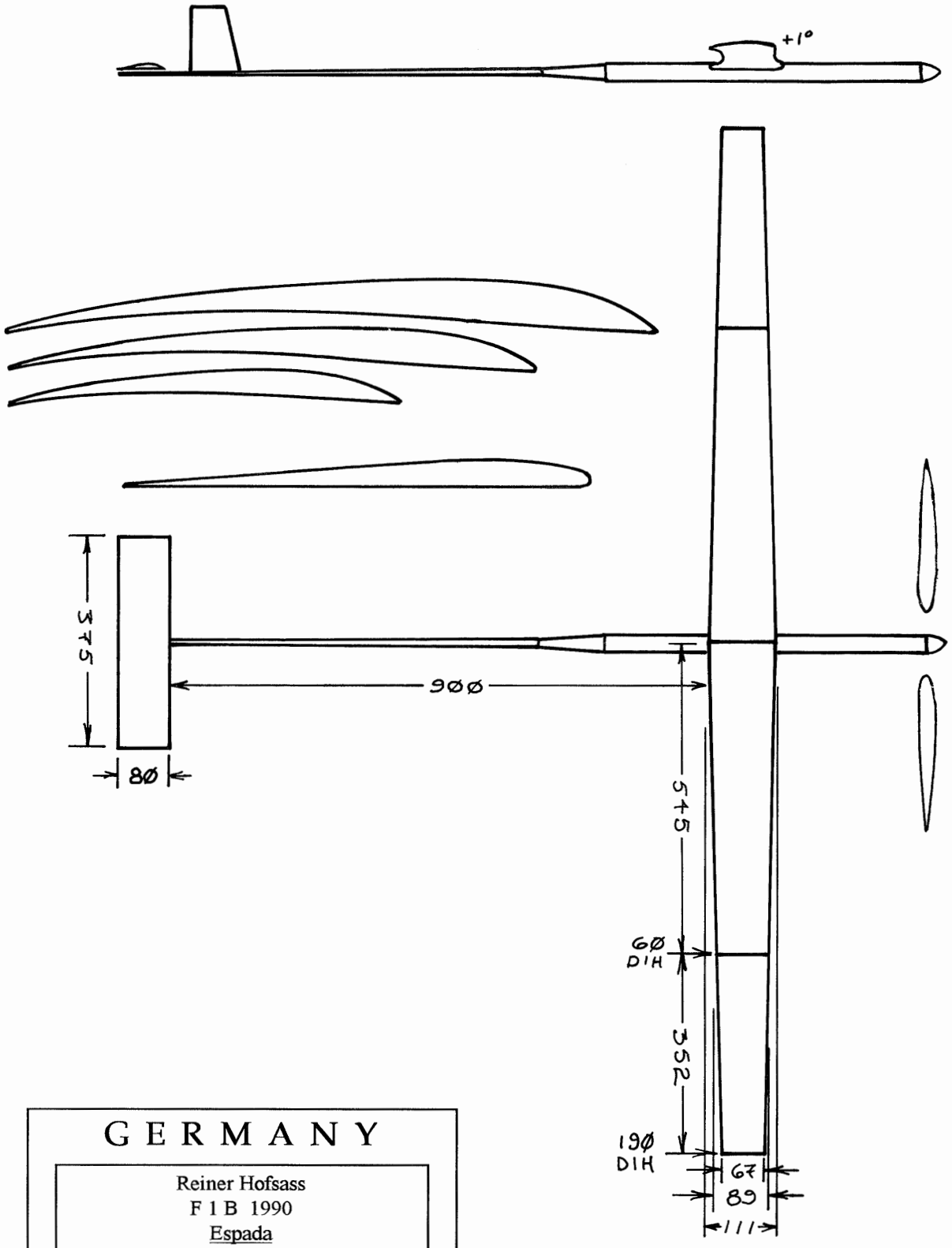


F R A N C E

Phillipe Gerard
W-8 F1B

Propeller—600d X 735p
30 strands of 1/8 FAI tan rubber
Wing 60g/m2 kevlar D-box
Wing 16,2 dm2 54 g. 19,48 AR
Stab 2,77dm2 4.6 g.

DIMENSIONS IN MILLIMETERS

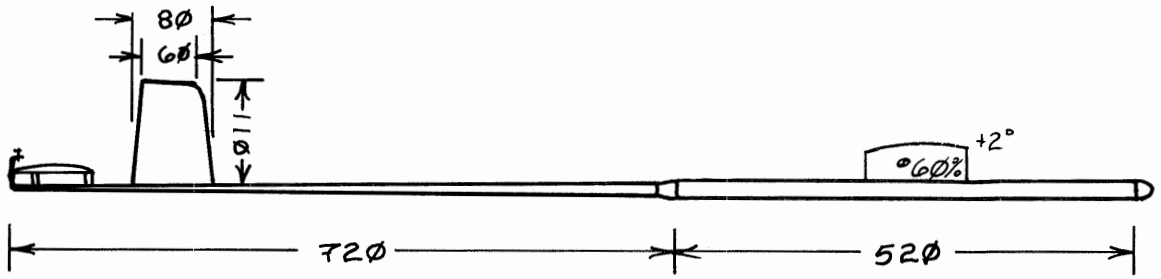


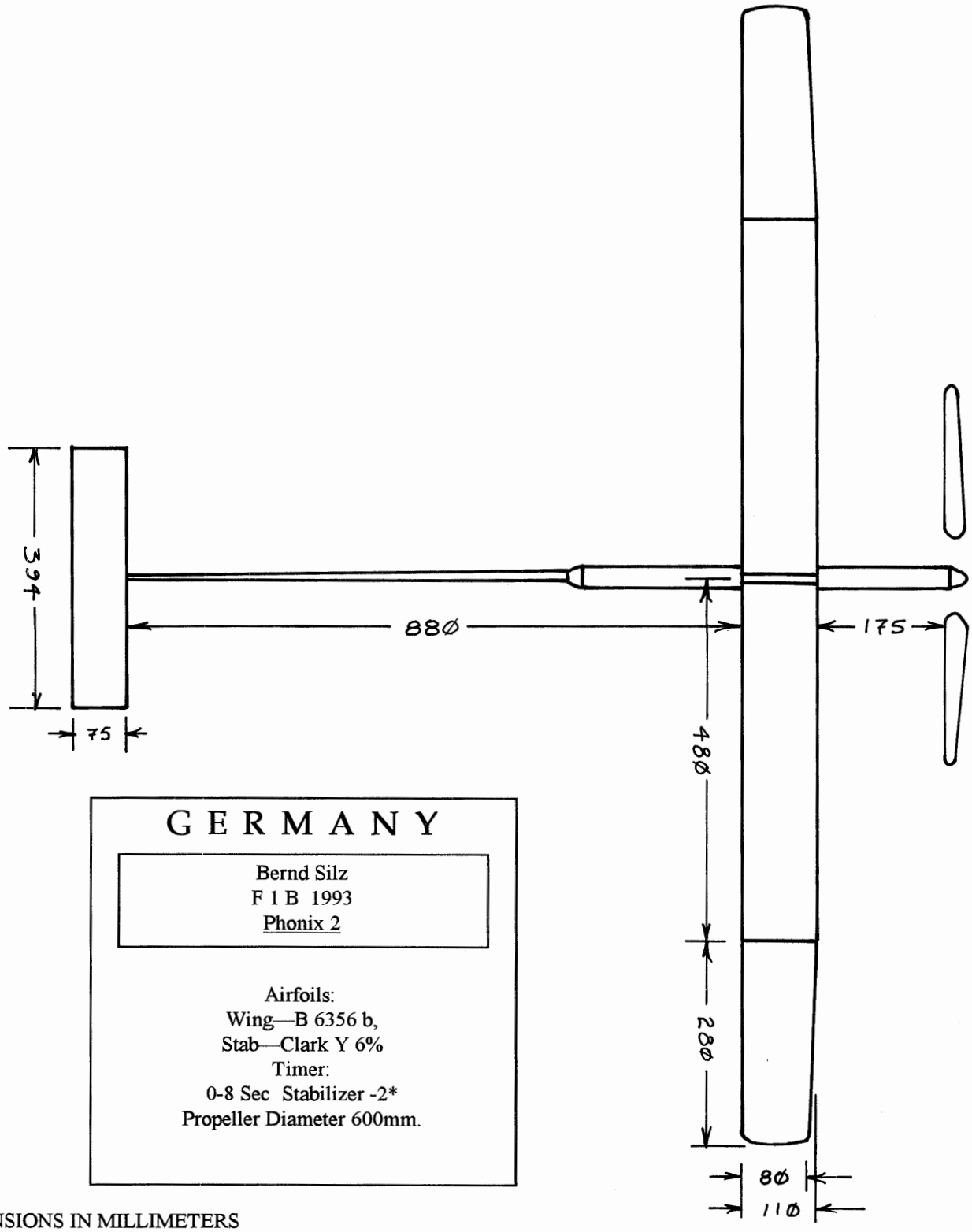
GERMANY

Reiner Hofsass
F 1 B 1990
Espada

Rohacell/Kevlar Wing
Carbon-tube (Swiss made)

DIMENSIONS IN MILLIMETERS



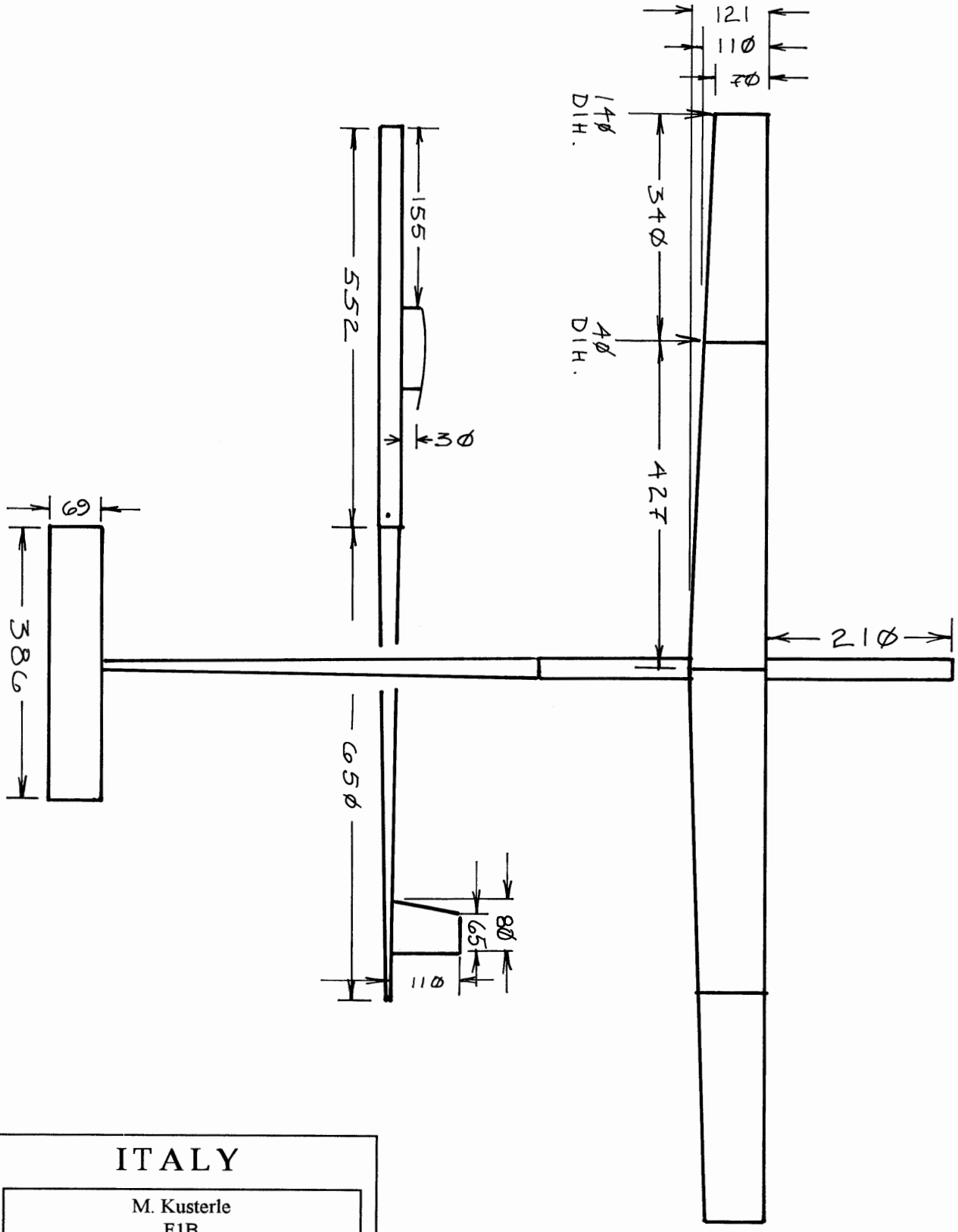


GERMANY

Bernd Silz
F 1 B 1993
Phonix 2

Airfoils:
Wing—B 6356 b,
Stab—Clark Y 6%
Timer:
0-8 Sec Stabilizer -2*
Propeller Diameter 600mm.

DIMENSIONS IN MILLIMETERS

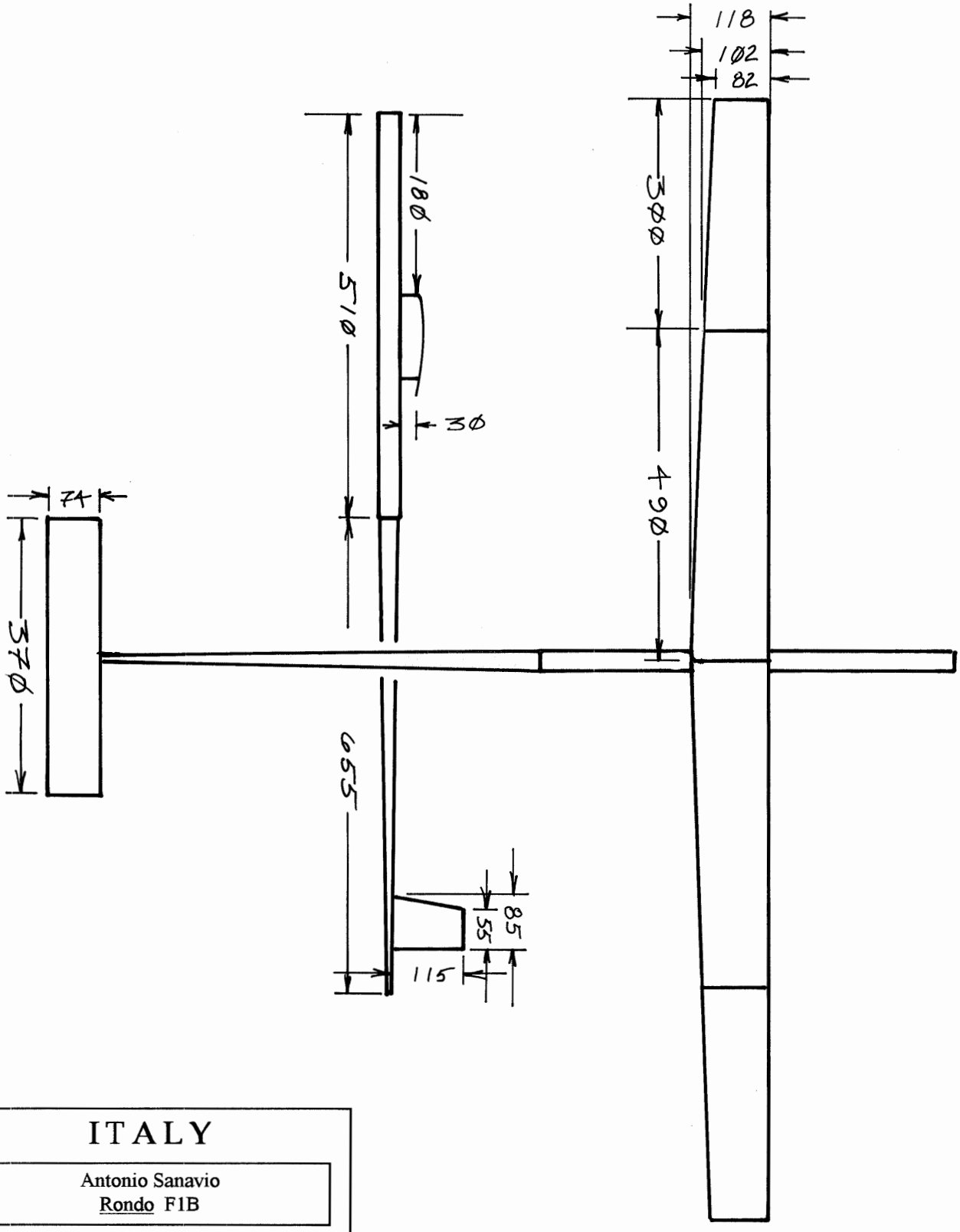


ITALY

M. Kusterle
F1B

Airfoil—NACA 6306
Wings—foam + fiber glass—52 g.

DIMENSIONS IN MILLIMETERS

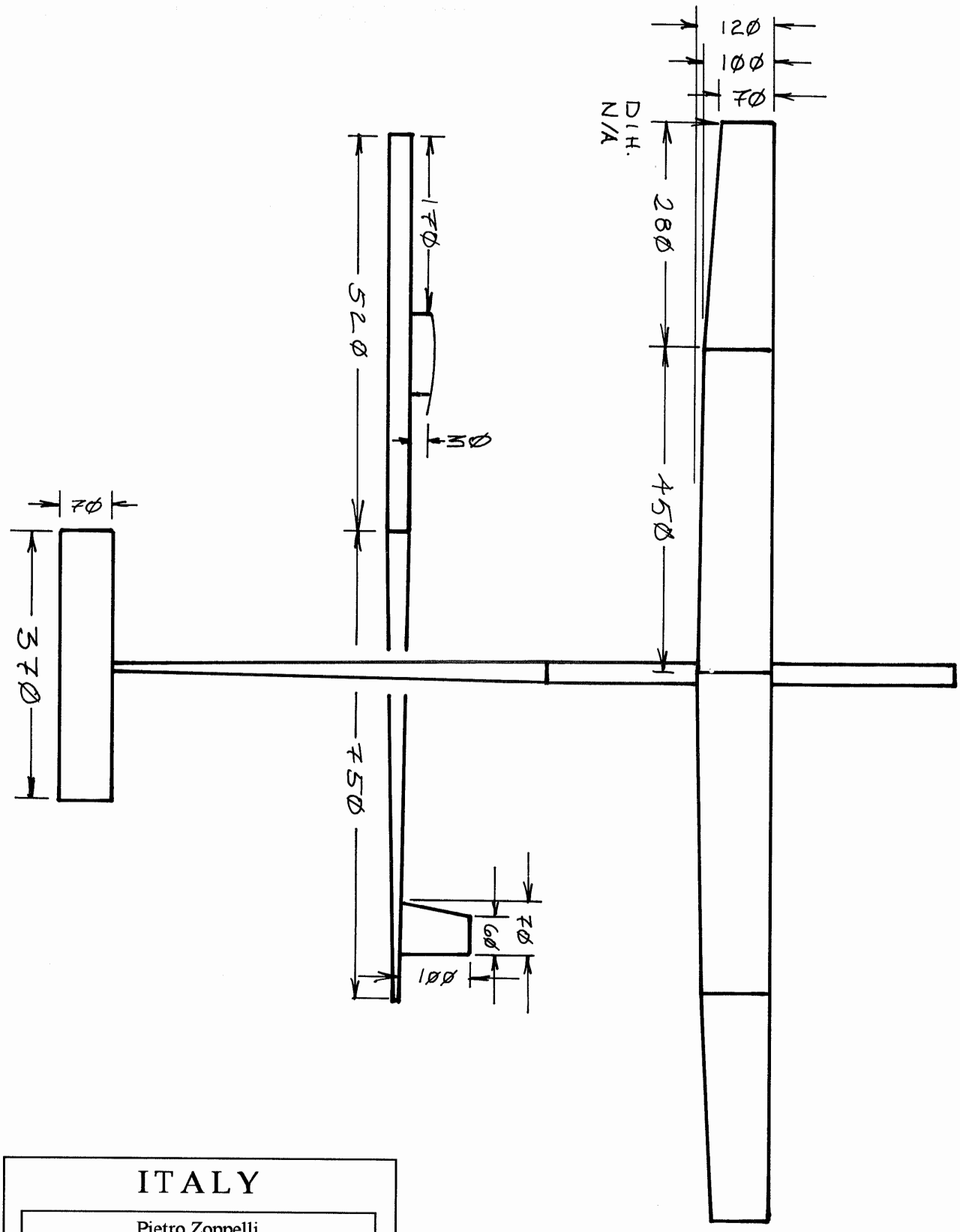


ITALY

Antonio Sanavio
Rondo F1B

Wings—foam + kevlar—36 g.
Motor tube—kevlar
Tail boom—carbon and aluminum
Airfoil—personal.

DIMENSIONS IN MILLIMETERS

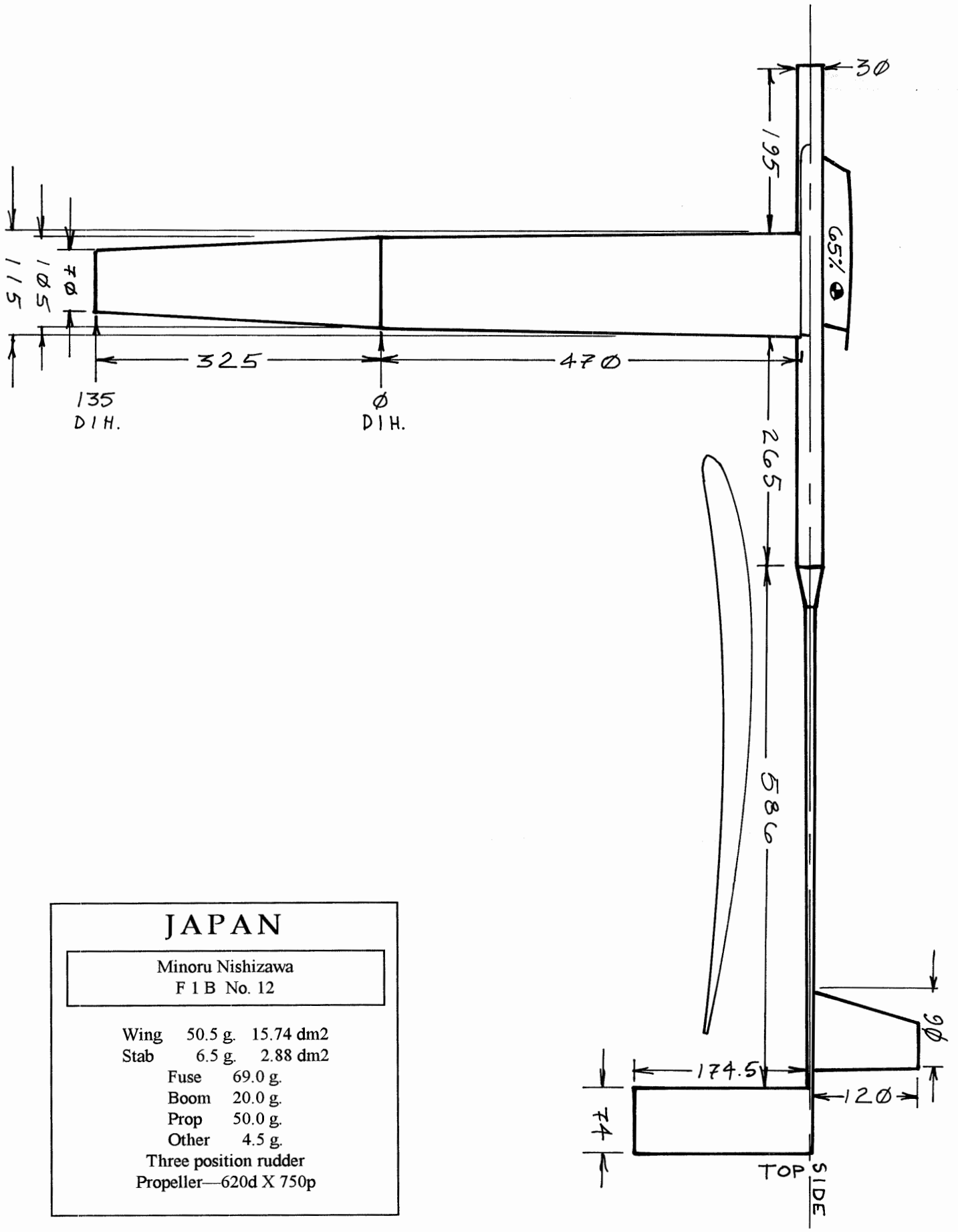


ITALY

Pietro Zoppelli
F1B

Airfoil—Italia.

DIMENSIONS IN MILLIMETERS



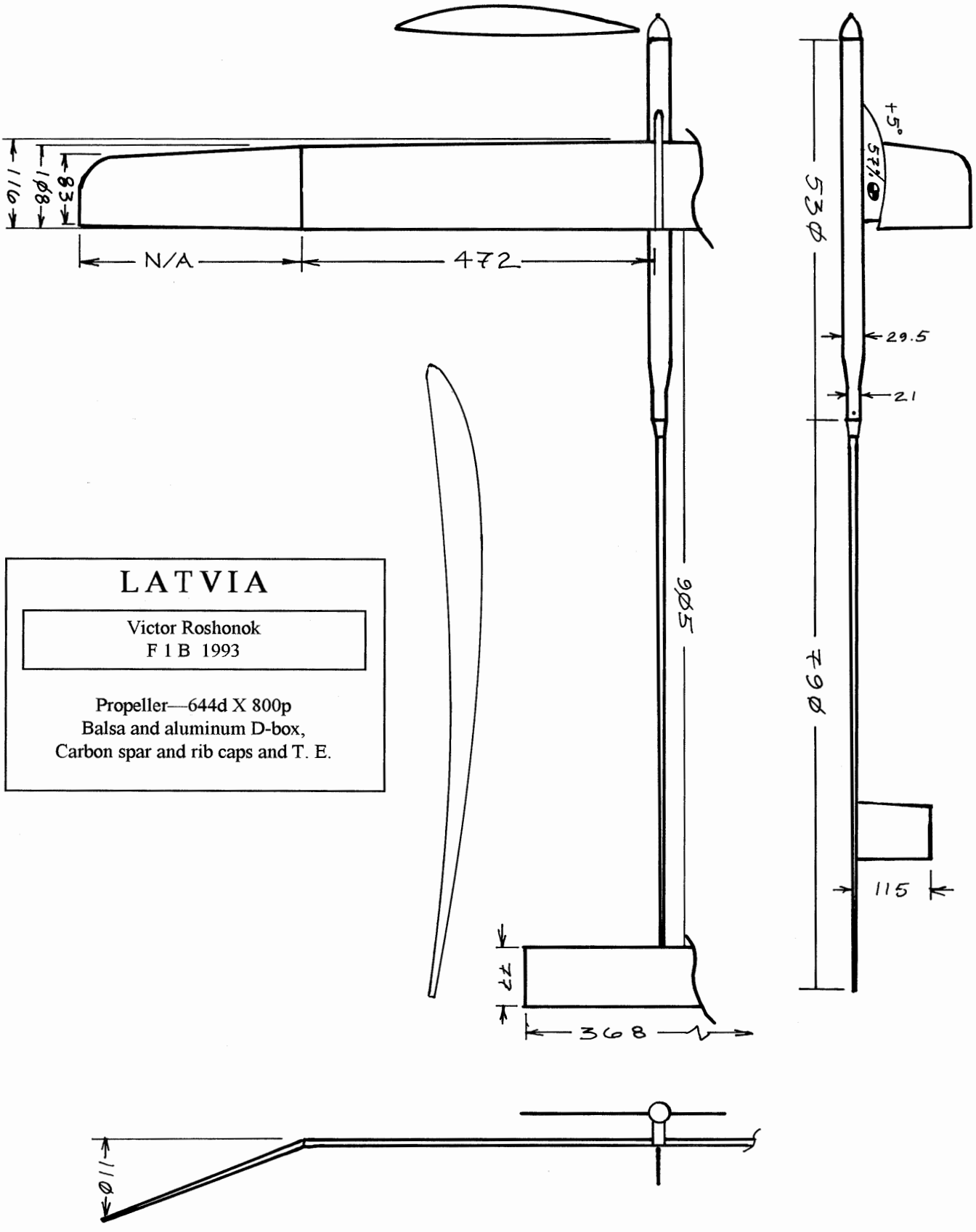
JAPAN

Minoru Nishizawa
F 1 B No. 12

Wing	50.5 g.	15.74 dm2
Stab	6.5 g.	2.88 dm2
Fuse	69.0 g.	
Boom	20.0 g.	
Prop	50.0 g.	
Other	4.5 g.	

Three position rudder
Propeller—620d X 750p

DIMENSIONS IN MILLIMETERS

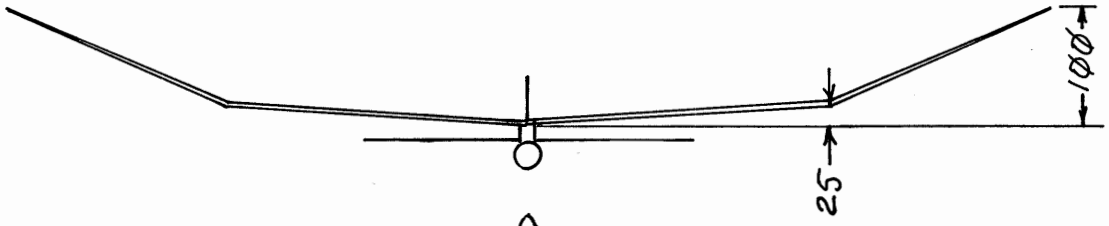


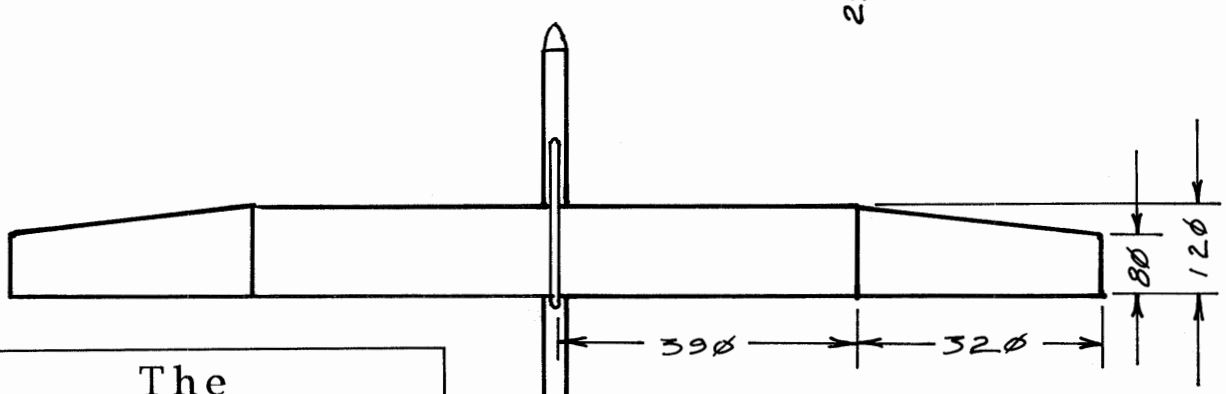
LATVIA

Victor Roshonok
F 1 B 1993

Propeller—644d X 800p
Balsa and aluminum D-box,
Carbon spar and rib caps and T. E.

DIMENSIONS IN MILLIMETERS

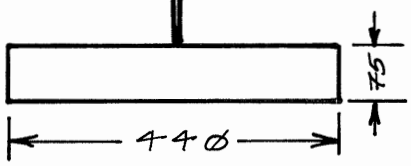


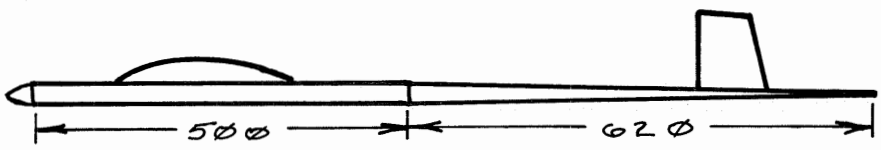


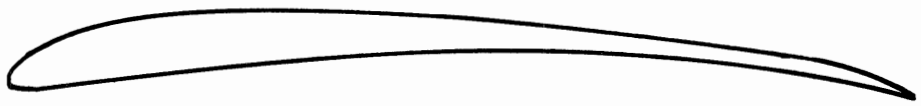
The NETHERLANDS

Peiter Van Merkestijn
F 1 B

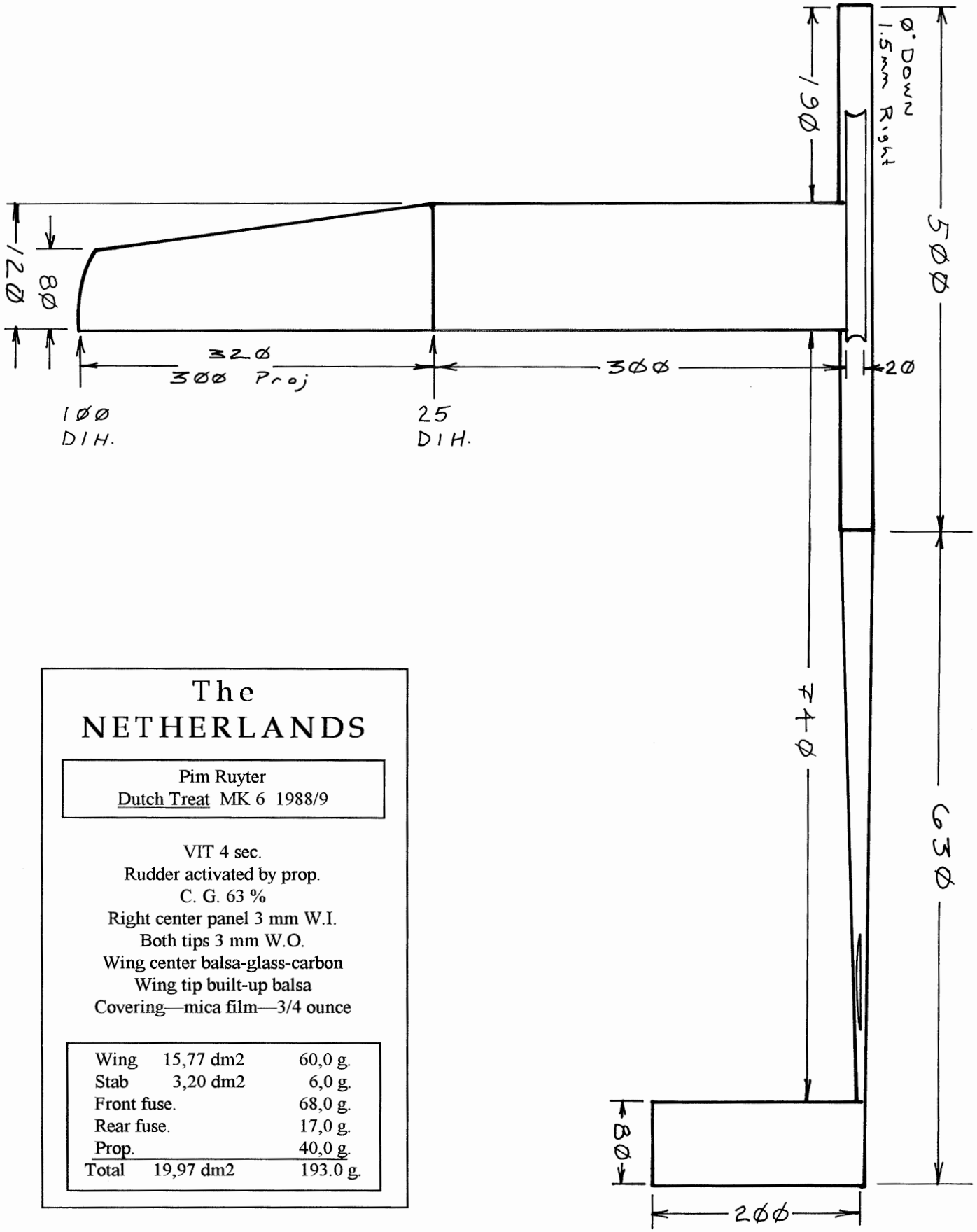
Wing	15.46 dm2	52.0 g.
Stab	3.30 dm2	4.5 g.
Boom & Fin		22.0 g.
Fuse & Timer		73.0 g.
Prop		42.0 g.







DIMENSIONS IN MILLIMETERS



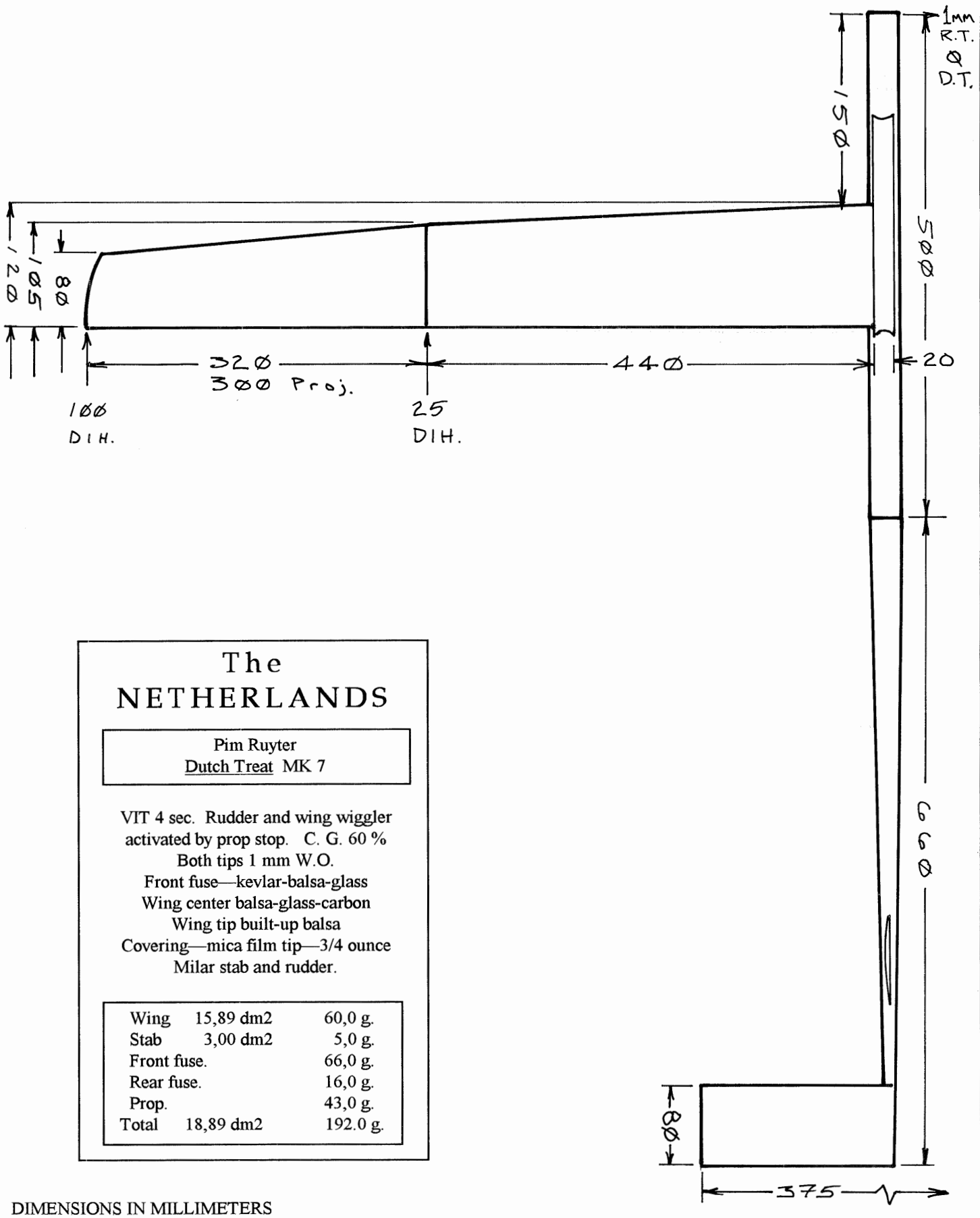
The NETHERLANDS

Pim Ruyter
Dutch Treat MK 6 1988/9

VIT 4 sec.
Rudder activated by prop.
C. G. 63 %
Right center panel 3 mm W.I.
Both tips 3 mm W.O.
Wing center balsa-glass-carbon
Wing tip built-up balsa
Covering—mica film—3/4 ounce

Wing	15,77 dm2	60,0 g.
Stab	3,20 dm2	6,0 g.
Front fuse.		68,0 g.
Rear fuse.		17,0 g.
Prop.		40,0 g.
Total	19,97 dm2	193.0 g.

DIMENSIONS IN MILLIMETERS



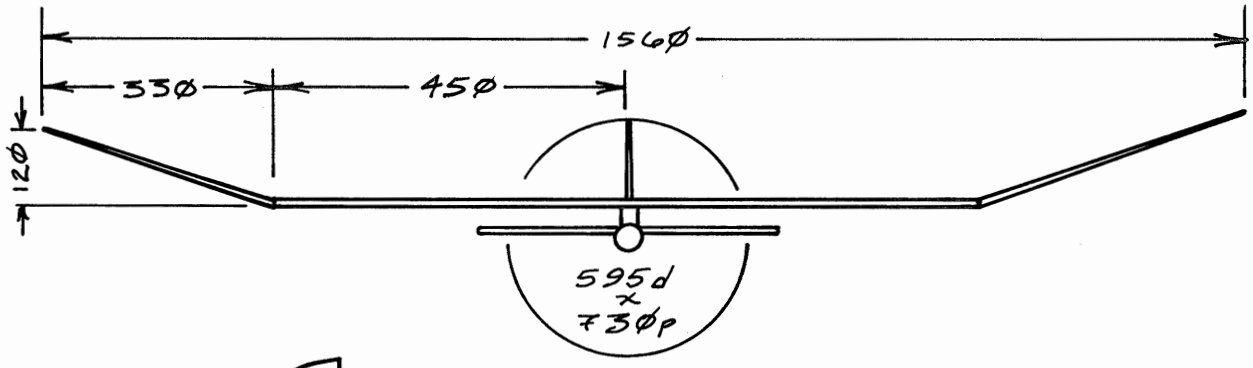
The NETHERLANDS

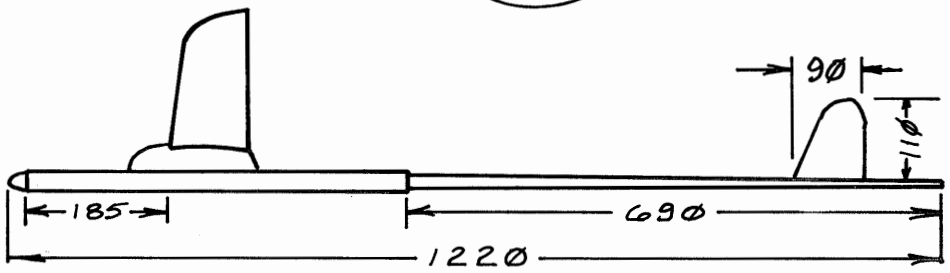
Pim Ruyter
Dutch Treat MK 7

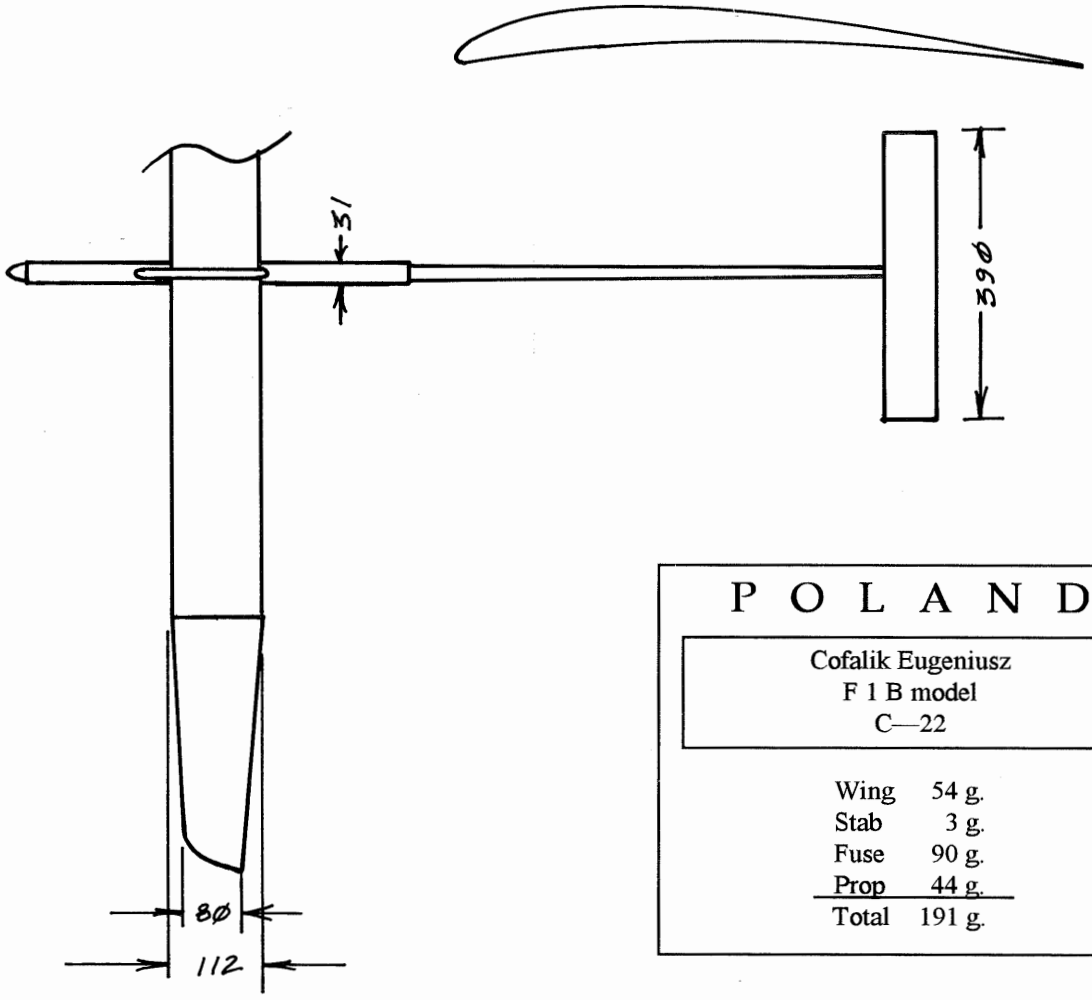
VIT 4 sec. Rudder and wing wiggler activated by prop stop. C. G. 60 %
Both tips 1 mm W.O.
Front fuse—kevlar-balsa-glass
Wing center balsa-glass-carbon
Wing tip built-up balsa
Covering—mica film tip—3/4 ounce
Milar stab and rudder.

Wing	15,89 dm2	60,0 g.
Stab	3,00 dm2	5,0 g.
Front fuse.		66,0 g.
Rear fuse.		16,0 g.
Prop.		43,0 g.
Total	18,89 dm2	192.0 g.

DIMENSIONS IN MILLIMETERS





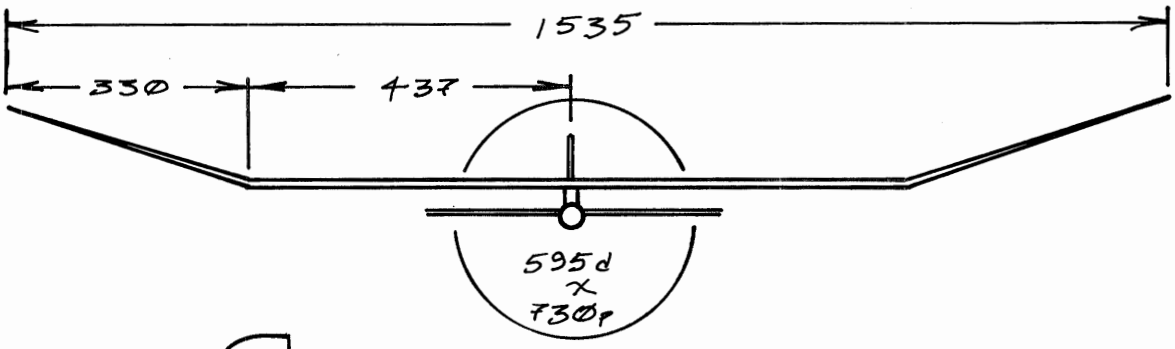


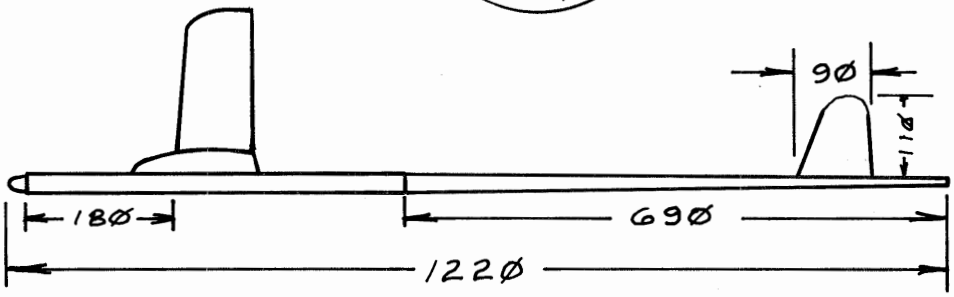
P O L A N D

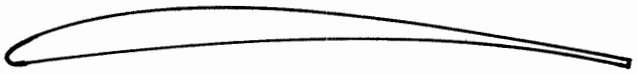
Cofalik Eugeniusz
F 1 B model
C—22

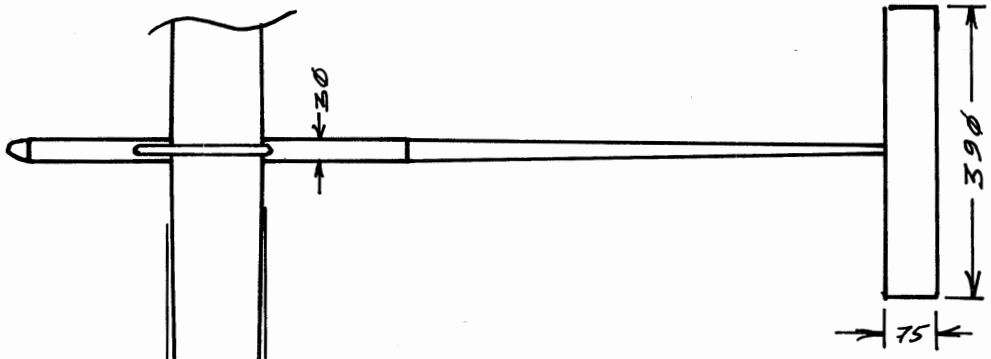
Wing	54 g.
Stab	3 g.
Fuse	90 g.
Prop	44 g.
Total	191 g.

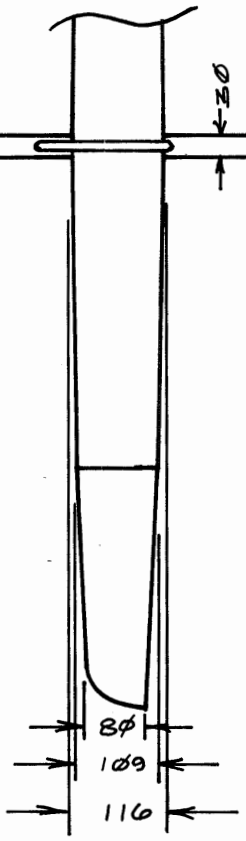
DIMENSIONS IN MILLIMETERS









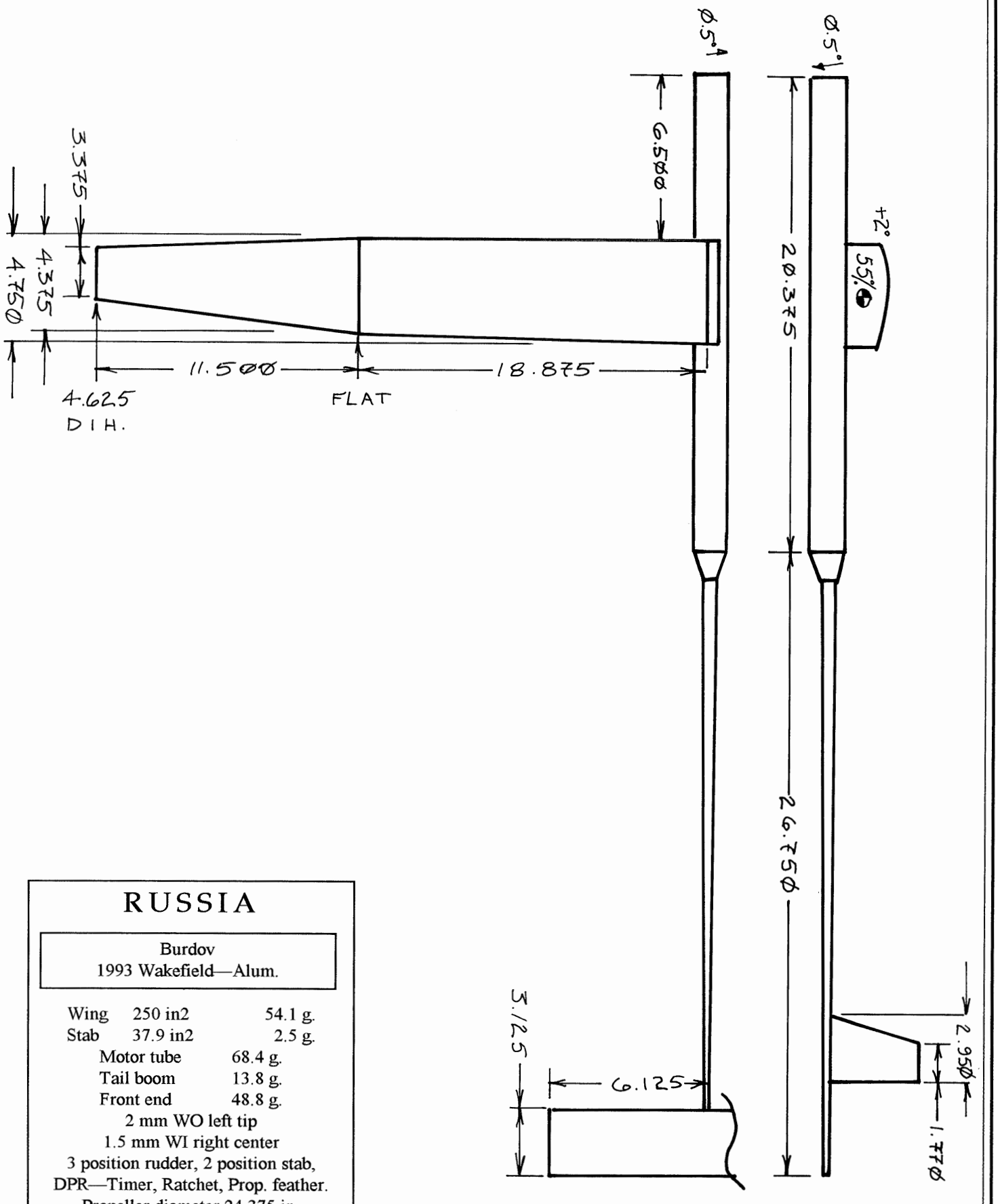


P O L A N D

Cofalik Eugeniusz
F 1 B model
C—23

Wing	57 g.
Stab	3 g.
Fuse	91 g.
Prop	43 g.
Total	194 g.

DIMENSIONS IN MILLIMETERS



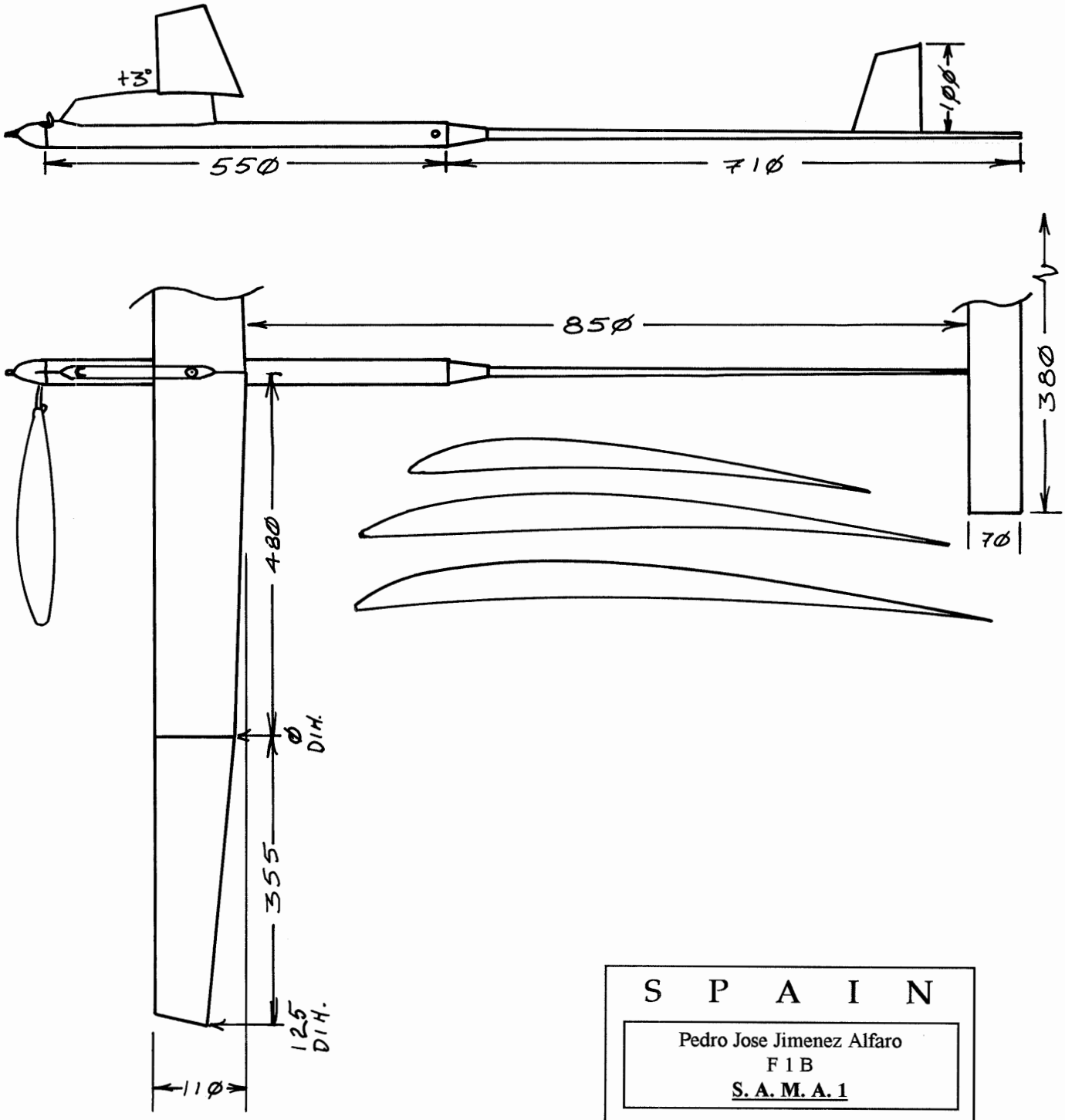
RUSSIA

Burdov
1993 Wakefield—Alum.

Wing	250 in2	54.1 g.
Stab	37.9 in2	2.5 g.
	Motor tube	68.4 g.
	Tail boom	13.8 g.
	Front end	48.8 g.

2 mm WO left tip
1.5 mm WI right center
3 position rudder, 2 position stab,
DPR—Timer, Ratchet, Prop. feather.
Propeller diameter 24.375 in.

DIMENSIONS IN INCHES

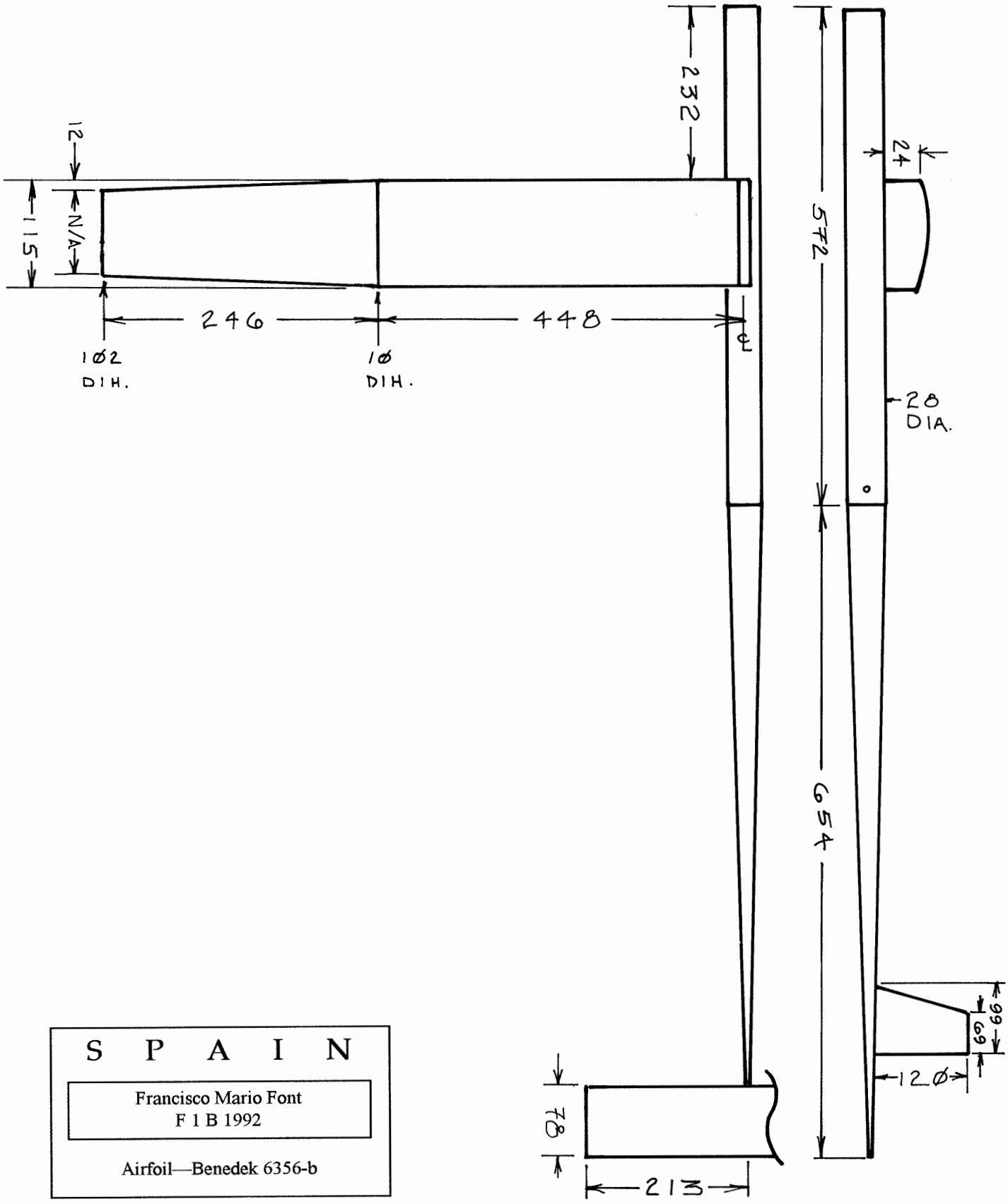


S P A I N

Pedro Jose Jimenez Alfaro
F 1 B
S. A. M. A. 1

Propeller and fuselage type:
Vladimir Feodorov

DIMENSIONS IN MILLIMETERS

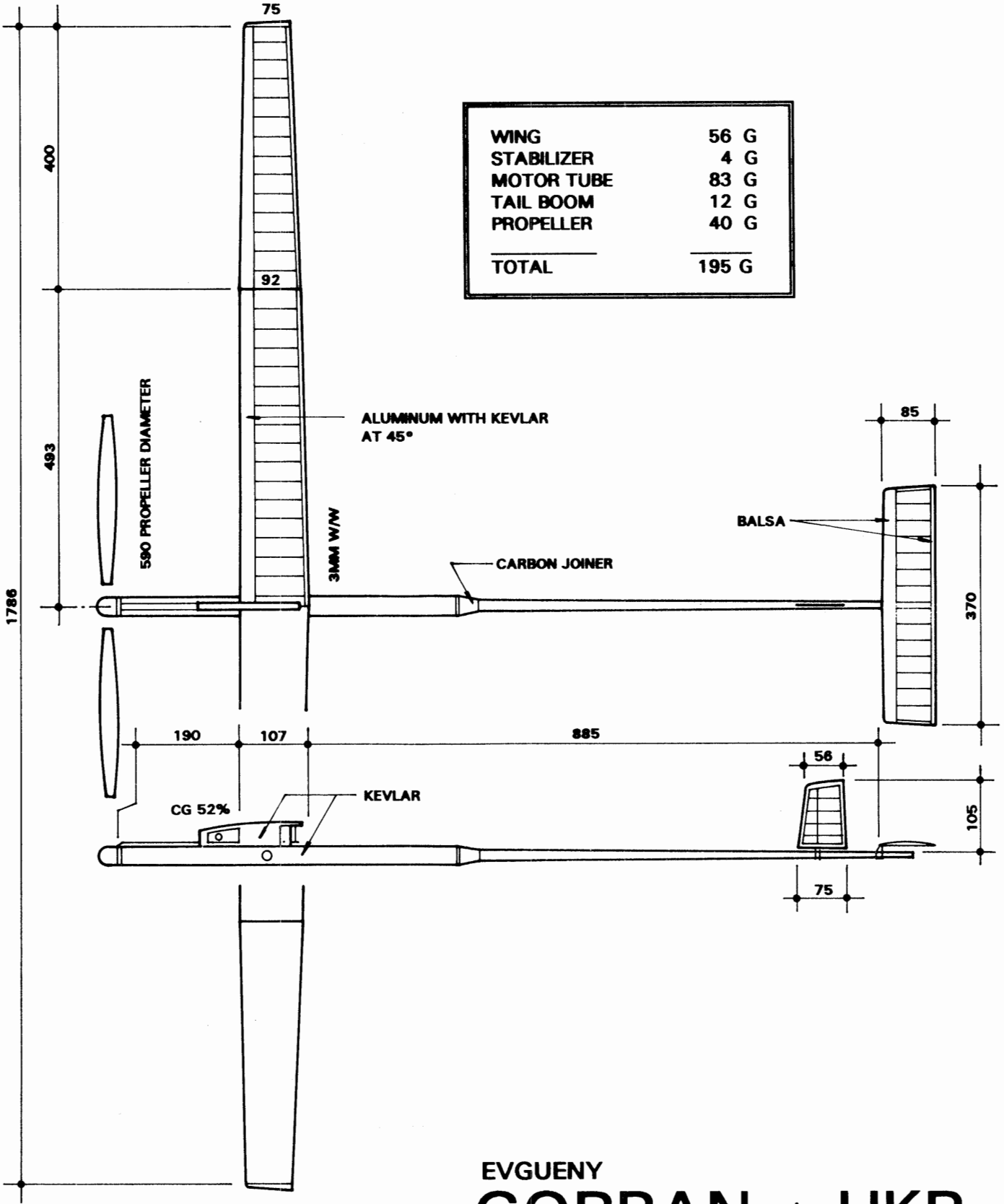


S P A I N

Francisco Mario Font
F 1 B 1992

Airfoil—Benedek 6356-b

DIMENSIONS IN MILLIMETERS

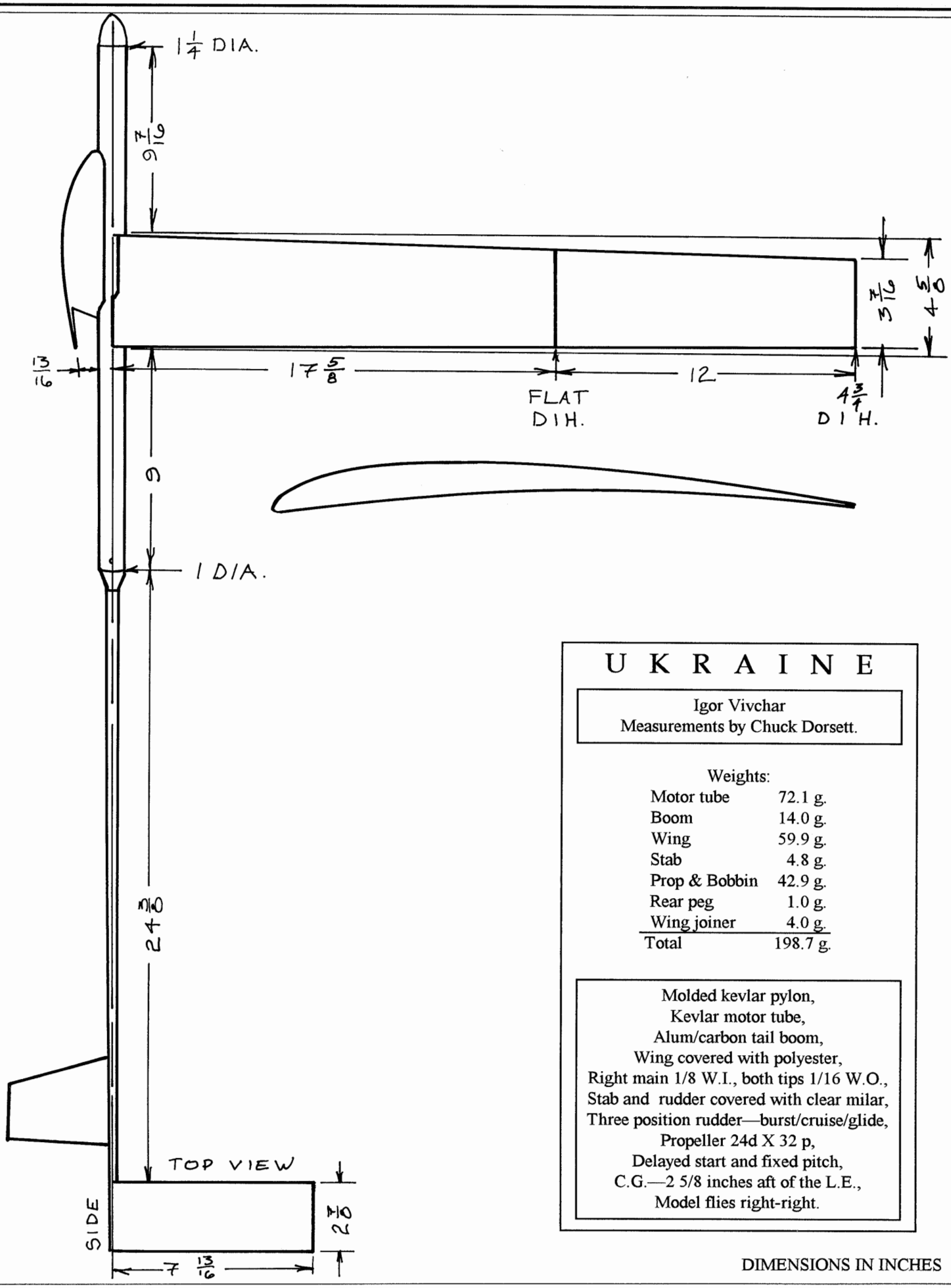


WING	56 G
STABILIZER	4 G
MOTOR TUBE	83 G
TAIL BOOM	12 G
PROPELLER	40 G
TOTAL	195 G

EVGUENY

GORBAN ★ UKR

DRAWN BY: BILL BOOTH, JR.



U K R A I N E

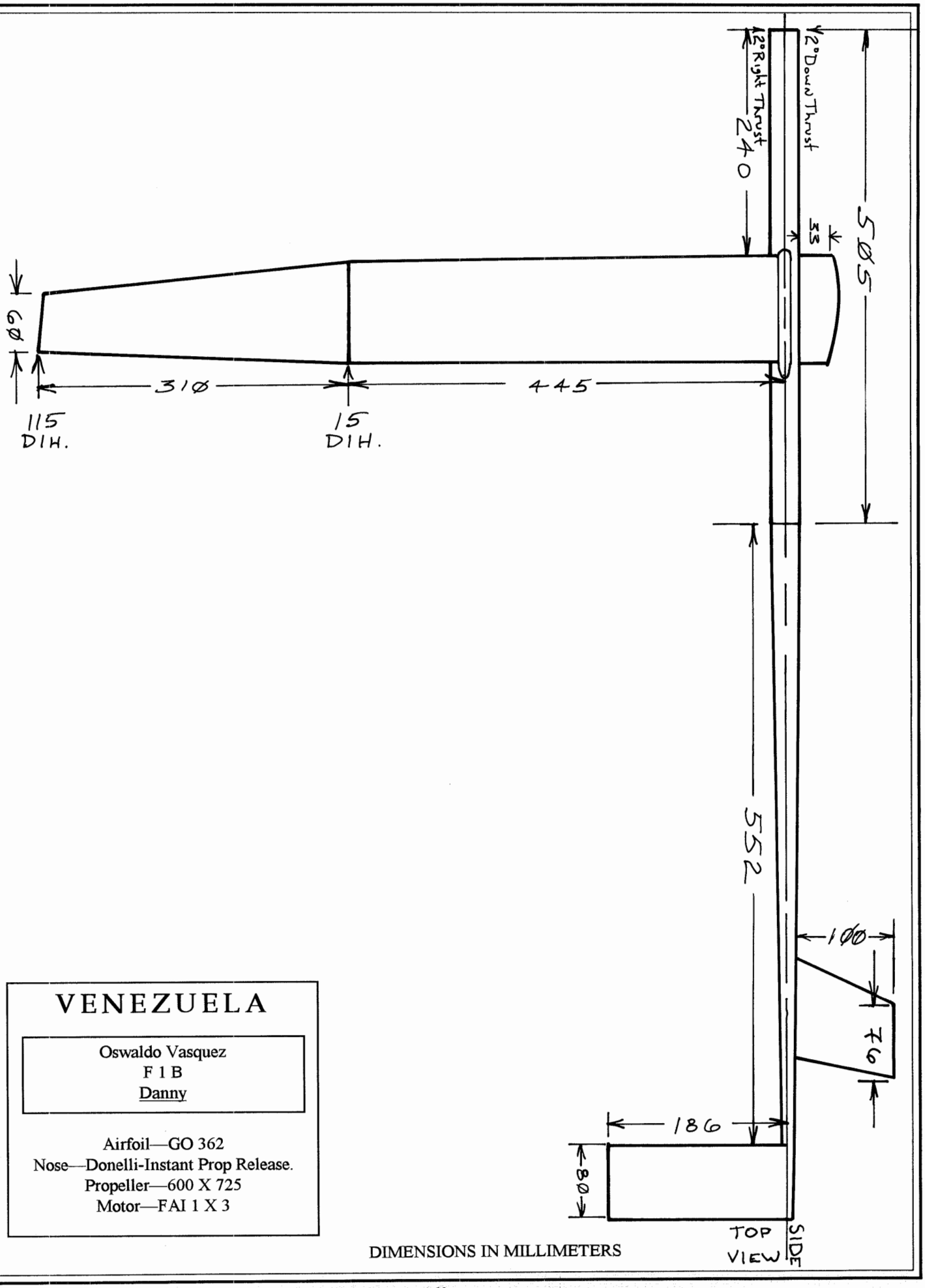
Igor Vivchar
Measurements by Chuck Dorsett.

Weights:

Motor tube	72.1 g.
Boom	14.0 g.
Wing	59.9 g.
Stab	4.8 g.
Prop & Bobbin	42.9 g.
Rear peg	1.0 g.
Wing joiner	4.0 g.
Total	198.7 g.

Molded kevlar pylon,
Kevlar motor tube,
Alum/carbon tail boom,
Wing covered with polyester,
Right main 1/8 W.I., both tips 1/16 W.O.,
Stab and rudder covered with clear milar,
Three position rudder—burst/cruise/glide,
Propeller 24d X 32 p,
Delayed start and fixed pitch,
C.G.—2 5/8 inches aft of the L.E.,
Model flies right-right.

DIMENSIONS IN INCHES

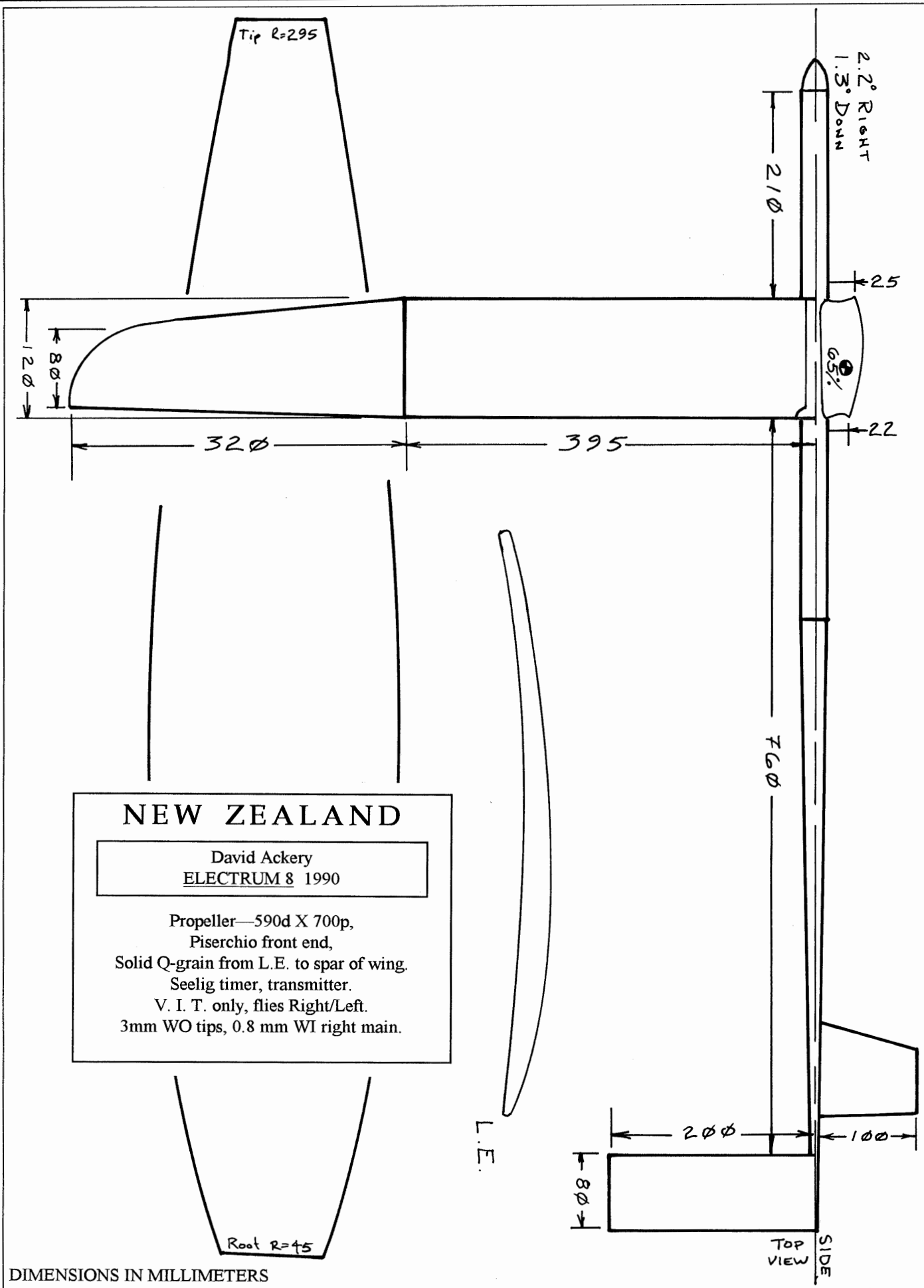


VENEZUELA

Oswaldo Vasquez
F 1 B
Danny

Airfoil—GO 362
Nose—Donelli-Instant Prop Release.
Propeller—600 X 725
Motor—FAI 1 X 3

DIMENSIONS IN MILLIMETERS

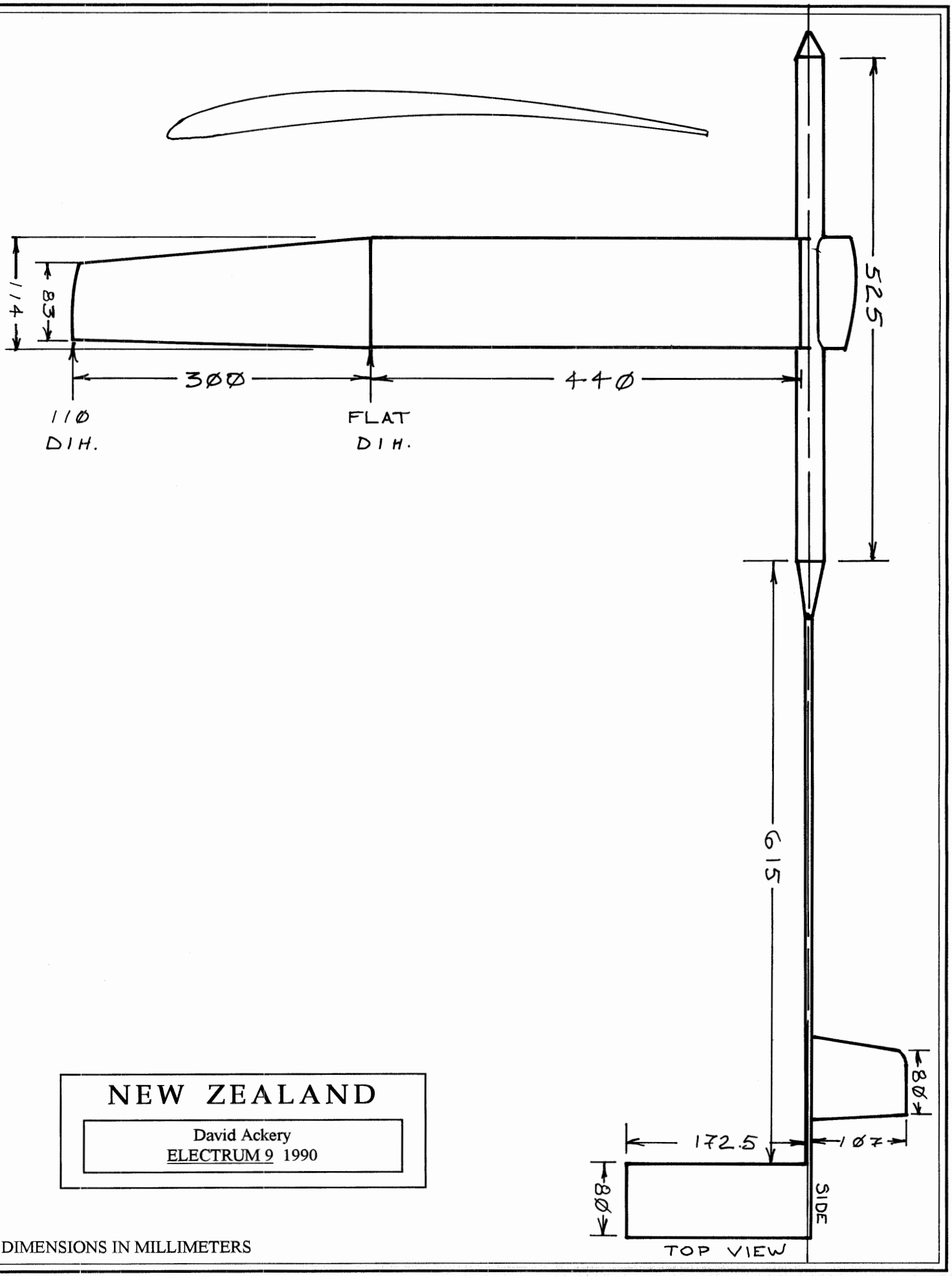


NEW ZEALAND

David Ackery
ELECTRUM 8 1990

Propeller—590d X 700p,
Piserchio front end,
Solid Q-grain from L.E. to spar of wing.
Seelig timer, transmitter.
V. I. T. only, flies Right/Left.
3mm WO tips, 0.8 mm WI right main.

DIMENSIONS IN MILLIMETERS

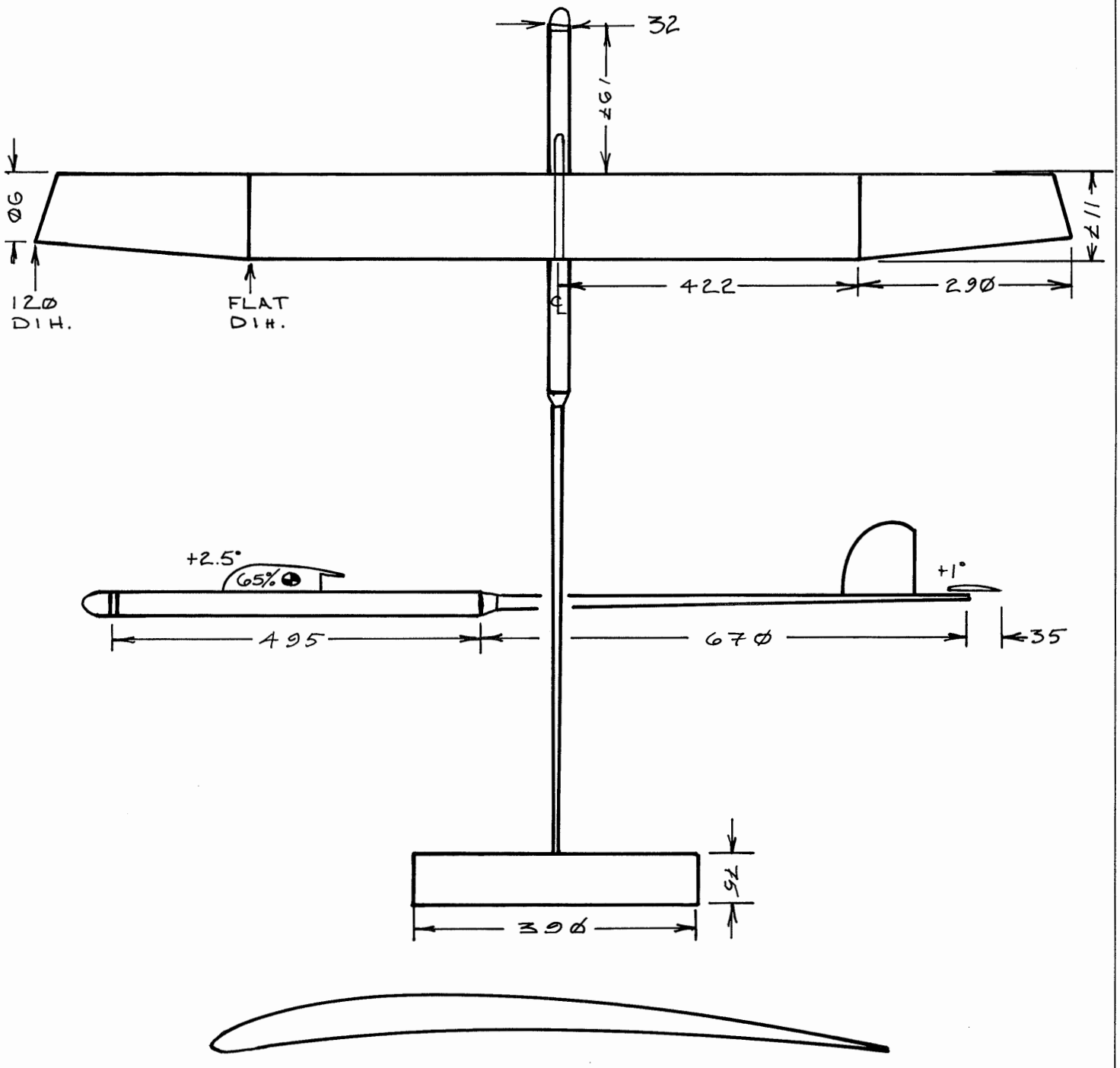


NEW ZEALAND

David Ackery
ELECTRUM 9 1990

DIMENSIONS IN MILLIMETERS

DIMENSIONS IN MILLIMETERS



NEW ZEALAND

John Malkin
F 1 B

Propeller—600d X 31* @ 200mm, E. F. R. Front end,
28 strands 3 X 1 Tan, 32-34 strands 3 X 1 Grey,
D. P. R., V. I. T./R., V. I. Wing (Left only).
D-box—carbon-balsa-carbon, carbon main spar,caps, and T. E.



Above: Jean-Claude Cheneau, France.
Below: Fibish, Israel.
Far Below: Greimel, Austria.

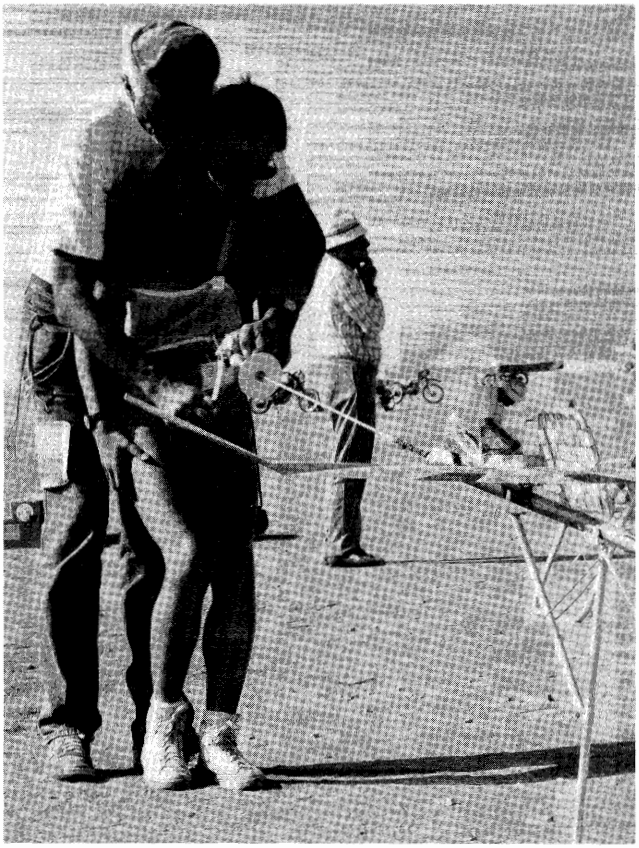






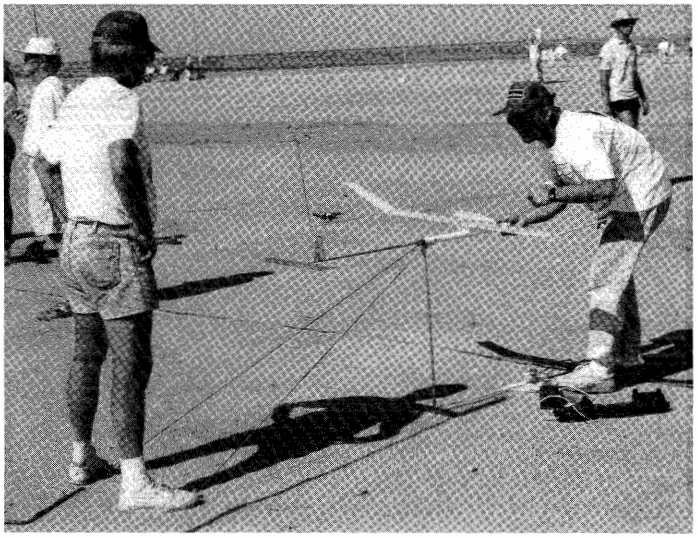
Above: Mihaly Varadi, Hungary.
Below: Anselmo Zeri, Netherlands.





Above: Greimel gets help after dislocating sholder.
Below: Vladimir Feodorov, Russia.





Above: Alexander Andruikov, Ukraine.
Below: Linkosalo, Finland.
Far Below: V. Feodorov.



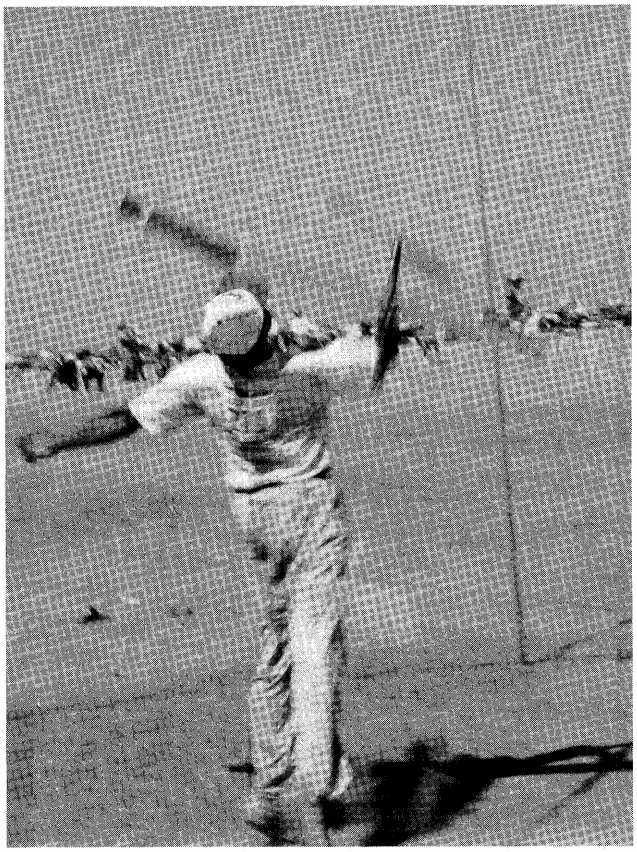




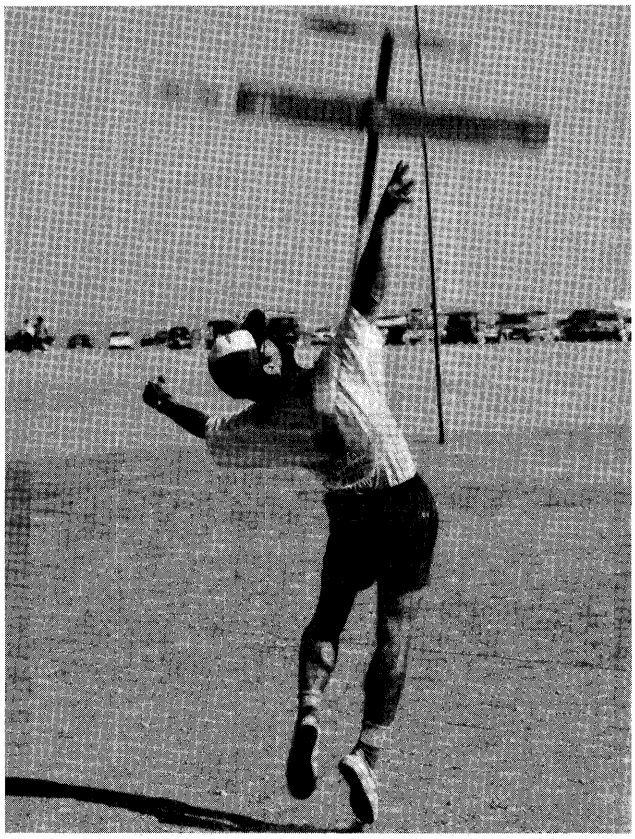
Above: Eugeny Gorban, Ukraine.
Below: Klima, Czech Republic.
Far Below: Anselmo Zeri, Netherlands.

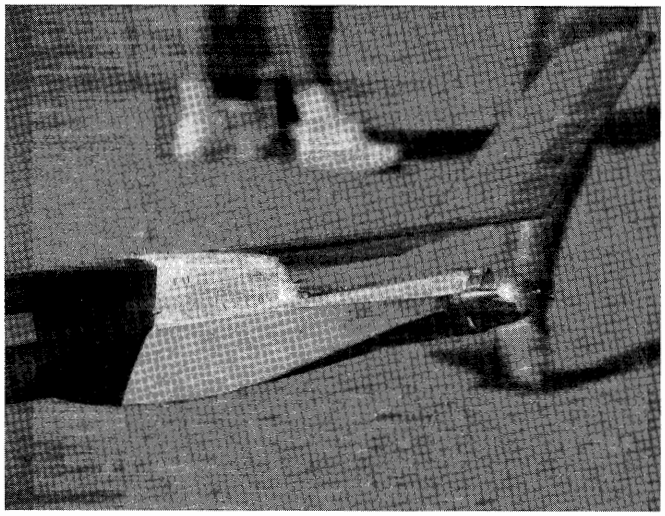




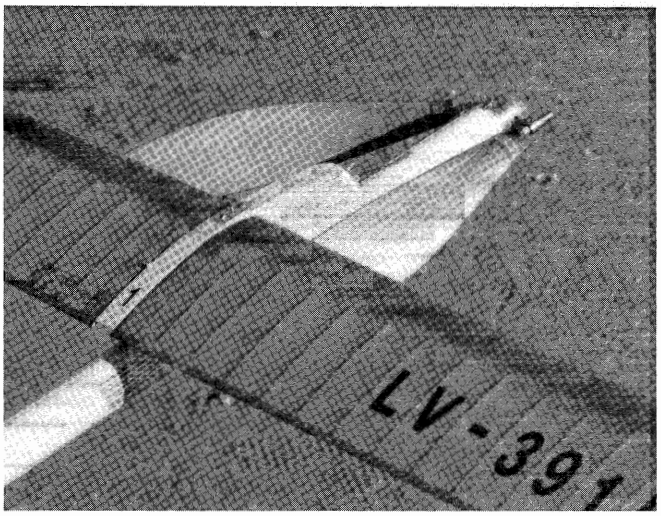


Above: E. Gorban.
Below: Budov, Russia.

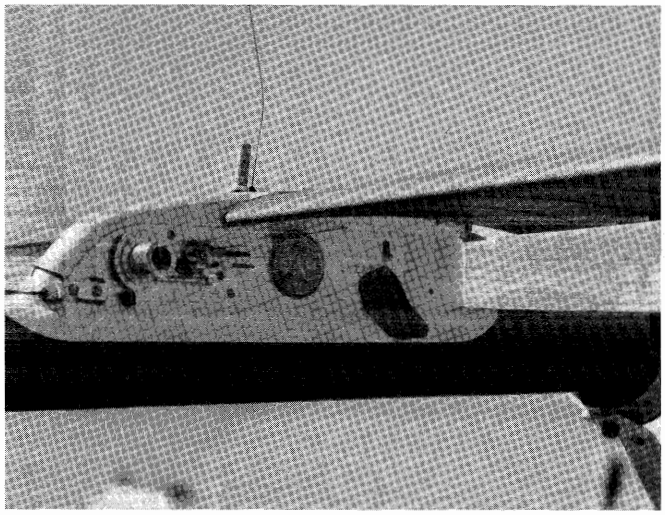




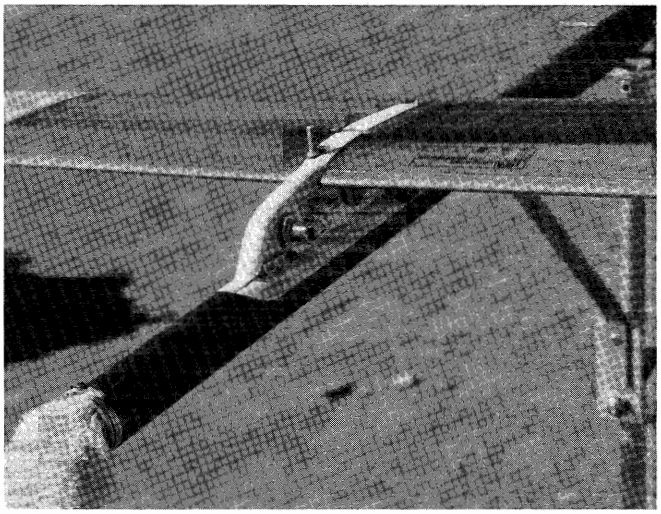
Above: Argentine F 1 B.



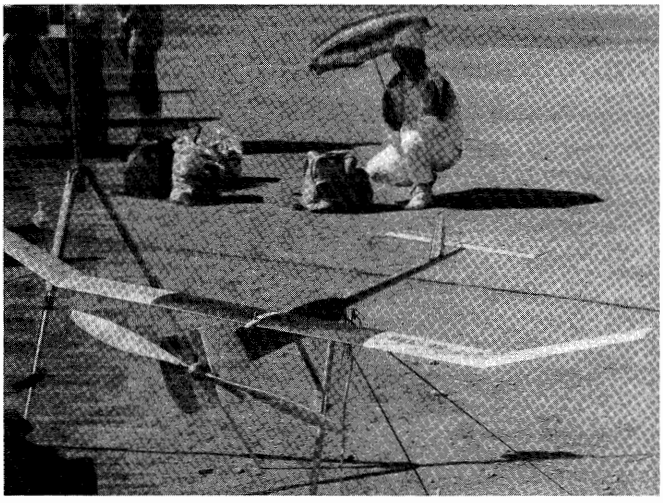
Above: Argentine F 1 B.



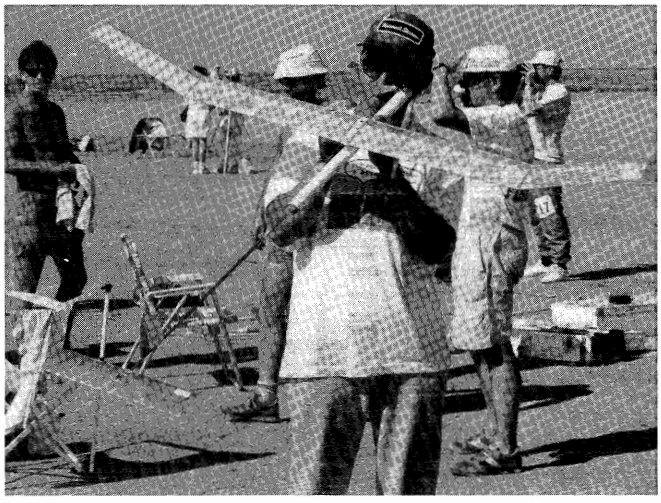
Above: Broberg, Sweden.



Above: Broberg, Sweden.



Above: Broberg, Sweden.



Above: Alexander Andruikov, Ukraine.



Above: Gringu Popa, Romania.
Below: A. Kirilenko holding A. Andruikov's model.



Above: Kusterle, Italy.
Below: Paul Lagan, New Zealand.







Photo: J. Oldencamp

Randy and Cathy Archer, F 1 C World Champion.

F1C Developments 1979 - 1993

By Doug Galbreath

After looking far and wide for someone to do an article on F1C for this publication, and finding few if any willing and able authors, I was persuaded to do it myself. So, if any of the readership have any complaints about the quality, or the contents or for that matter the lack of contents, please come forward and volunteer for the sequel authorship.

1979

In the 1979 World Championships held at Taft, the models were for the most part in the beginning stages of the present developments. I cannot recall any aluminum wings or tailbooms in 1979, but there definitely more than a few at the 1981 W/C in Spain. That being the case, the comparison between 1979 and 1993 F1C seems to encompass most of the present developments.

Engines

Engines in 1979 were mostly Rossi 2.5cc Normal with a few Cox conquest thrown in. The good examples of either engine were quite strong, but not everyone had good examples. The piston/cylinders were of the iron/steel type, with very few engines using the ABC configuration. RPM on the typical 7x3 prop was in the 27,500 range. Most of the Cox engines used had been converted to the "Cossi" by installing a Rossi piston/cylinder and head which brought the power up to or above above the standard Rossi somewhat, although the Cox crank had a tendency to snap off at inopportune times.

Fuselages

Most models had a conventional balsa fuselage with a "pan" of one sort or another to mount the engine and fuel system. More advanced builders were using molded front ends and about half were using cowls over the engine. Rolled balsa tailbooms covered with light fibreglass cloth were the hot set-up, being light and slick, although somewhat "whippy". Rudders were universally made from light C-grain sheet balsa, and most included auto-rudder and auto-stab, which at the time was considered to be state-of-the-art.

Wings

The wings of '79 were sheet balsa covered structures with a few innovations such as the foam-sheet wings. The aspect ratio of the average model was in the 10-1 area with very few being over 80 inches, most being in the 72 to 74 inch range. Most wings however, were of the two-piece construction, which was precipitated primarily by the desire for shorter model boxes. The major benefits of the 2-piece wing turned out to be the ease of fixing a crash and having a flexible joint to absorb the bending forces on landing in the DT mode. The wing wiggler made its debut at this contest as well, and has been used by a few modelers in the ensuing years. Airfoils of '79 were mostly flat bottom with thicknesses from 6.5% to 10%. A few undercambered sections were seen, but most were rather thick sections, which did not perform really well because of the low aspect ratios being used. The winner, Mario Rocca, used a NACA 6409 airfoil on his model. Immediately thereafter we began to see a rush toward undercambered sections of a thinned nature being used by the Soviets and a few others. These sections resembled the NACA 4407.5 very closely, which is a very good starting point in any airfoil development program. Wing tips ran the gamut from eliptical to square, with the 15° angled tip being the hot one. The tapered tip with either a symmetrical taper or rearward taper being about equally popular.

Stabilizers

Stabilizer size of the '79 models was on average about 25% of the wing area. Construction was balsa-spruce-tissue, with some sheet covered structures.

Propellers

Propellers of '79 were virtually all 2-blade, fiberglass copies of the Cox 7 x 3, or at least the Cox was the father of the family. Eugene Bartels of Germany was the originator of the Fiberglass prop making technology, at least to my knowledge. Bartels was making props being used in the '67 W/C, where I first saw them. Most of the people currently making props still use the technology learned from Bartels. Dave Sugden was one of the very few people trying out the then-new-to-F1C idea of folding props, although he elected not to use it in the World Champs that year, due to fear of not knowing if and when it might separate, I think.

Climb Patterns

The climb of power models in '79 was universally the half turn to the right (more or less) that we all knew and loved for so many years prior to the bunt. A smooth transition-to-glide was still not easy to achieve with only the really well-practiced and adjusted models doing it reliably. It was just as important then as now—without it, you're in trouble!

Duration

The duration of the winning models of the '79 era was in the area of 6 to 6 1/2 minutes in the good evening air, with reports of the occasional 7 minute flight being made. Considering the airfoils and the aspect ratio of the models, this was a reasonable time.

General

In '79, the average F1C modeler was a cut above the average free flight power flyer in his building ability, knowledge of materials, engine savvy, air picking, adjusting, and design skills. This is still true, only in an expanded state.

1993

Engines

2.5cc engines in the 93 W/C ranged from Rossi to Nelson with virtually everything in between. The Nelson 15 is probably the most-used engine today. It's development has been upward and steady through the last ten years and is considered the benchmark for comparison. The most recent version, popularly referred to as the "big bore", not because it is boring, but because it has an unusually large crankshaft diameter of 15 millimeters! It is of the classic F1C design of front intake rear exhaust. Another much-used Nelson is the side exhaust front intake which uses a 12 mm crank diameter. The bore and stroke of both Nelsons is .575 x .575 in. (14.6mm).

Several flyers were using various versions of the Ukranian Thermic engine. The winning engine was a Thermic with Verbitsky-made internals and flown by USA's Randy Archer. The performance of this engine is close to or equal to the best of any make of engine. I have seen examples of OPS, Picco, and CS that perform extremely well, the main reason they are not more widely used is their excessive weight. There were several one-off engines being used by the flyers from the Eastern European countries. One notable example has the case cast in the shape of a cowl. It seemed to run very strong. Dave Sugden used his homemade case engine which is of a similar design, the case being the cowl so to speak.

Engine RPM has not gone up much from the old days, largely because of the tip-speed of the prop exceeding the .9 mach theoretical limit at which reasonable drag occurs. Engines, however, are more powerful than '79, and reliability is much better, due to the ABC and AAC piston and liners exerting much lower loads on connecting rods and bearings than the old iron-piston designs. Present-day bearing technology seems to have paid off in the new plastic bearing cages lasting longer and being much less destructive when their life ends. The Nelson plug has seen wide acceptance for the following reasons: it is fast, consistent, and reliable, and it is available in quantity on a continuing basis at a reasonable price. Most engines, regardless of make, are running Nelson plugs today. Many of the European flyers want to trade for Nelson plugs when it comes to bargaining time.

Wings

This is where the most progress has been made. The average aspect ratio now is closer to 19:1 than the 10:1 seen at the 1979 Championships. This is made possible through the improved construction methods utilizing carbon fiber inside and aluminum skin on the outside. At 19 to 20 to one, the wing stiffness is the key to getting the model to hold pattern for the full seven seconds. Without stiffness the wing will start to wash out at about four seconds and have the model self bunting at six seconds.

Airfoils to match the aspect ratio have also taken a big leap. Rarely do you see a flat bottom section except on stabilizers. Mean camber lines of 4 to 5%, thickness from 6 to 7%. High aspect ratios with thick sections don't seem to give the advantage that the thinner sections do. Most wings also have a gradual thinning toward the tips as well as about 2 degrees washout at the tip and as much as 1 degree at the dihedral break. It also seems that the swept-back tip has pretty much left the scene, being replaced by the symmetrical taper of just a hint for forward sweep. This, no doubt is in response to the need to control the wash-out under high speed syndrome, brought on by the center-of pressure movement toward the trailing edge at the low lift condition found in the climb configuration. (For years it was common to hear that the stabilizer was overpowering the wing, which was sorta right, but the blame was wrongly placed on the stabilizer).

Tips haven't changed much, with the approximate 15 degree sweep being still the most popular. One exception at this year's Champs was the power model with winglets, which incidentally was one of the highest climbing models there.

Virtually all of the models used two-piece wings, the only thing new here is the size of the wing rods. Many flyers are using 5mm tool steel rods which have been drilled for lightness. Looseness in the wing attachment area is not to be tolerated. It can be responsible for inconsistency in the climb. This is one factor responsible for the lack of auto-wigglers showing up on power models--how do you make it wiggle and be tight?

Many models have wing adjusters in the pylon to adjust the incidence differential between the wing halves in order to get the proper roll in the climb. This is very important to have the model going downwind at bunt-time. The methodology on wing adjusters runs far and wide--some complicated and some simple, most are home made and the ability of the builder combined with the sophistication of his available tools being the deciding factor.

Stabilizers

While the wings have been getting longer, the stabs have been getting smaller and tail moments longer to compensate. The average stabilizer at the '93 champs was probably in the 70-74 square inch range. Construction ranges from old time technology to carbon D-box structures. The Carbon examples weigh from 13 to 15 grams and the aluminum sheet covered stabs weigh in at 17-19 grams. Both provide adequate stiffness and durability. Airfoils on stabs are in the 5 to 7% range, with some flyers touting one extreme while others claim advantages for theirs.

Bunts

With the exception of New Zealand, I think everyone in power used a bunt. It is the method of choice to transition a high aspect ratio model. I personally could not make high aspect models transition after I got to about the 13:1 ratio. They just go straight and stall off the top. Timing and severity of the bunt is something that each flyer seems to work out for himself. One thing is for sure, if your pattern is off by much, the bunt will be ugly! When it is on it's a thing of beauty.

Props

Props are being massaged constantly by every flyer I know. Consequently, prop knowledge has increased considerably. There are several designs that work well. Many times a propeller works well with one model and not another. We do know that some of the same things true in wings is true in props--aspect ratio and thickness combined with torsional stiffness being important. Most props are now made by the individual flyers using the technology learned over the last few years. Hubs have been manufactured by a few cottage industry types and run the gamut from tool steel to 17-4 stainless steel. Blades are universally carbon fiber, primarily because of the light weight and superior stiffness. Pitch and diameter has remained pretty much the same, only with chord and pitch distribution being manipulated. The fear of them blowing blades off for the most part is gone, and the consistency of flight-to-flight using the same prop is most welcome. No longer do we need to go to a meet with 12 props in the box for spares. We can use the time making better models.

Front-ends

The modern-day front end may be one of three general types: Carbon fiber, aluminum or fiberglass. Verbitsky has sold a rather large number of his aluminum front ends in the United States, and I suspect in other countries as well. They are an aluminum tube with a threaded joiner to the tail boom and a thickened portion where the engine mount is screwed on. The carbon tube variety has proven to be as durable as the aluminum tube, and somewhat lighter as well. Both aluminum and carbon tubes need to have a separate pylon glued on for the wing mount. The glass versions are molded with the pylon integral, only needing the wing center section adapted to the top. A good front end will see several models built on it during its extended life, thus saving quite a lot of time when building a new model.

Timers

Timers for power have usually 4 functions, each individually adjustable for various functions on the model. Some have 5 so that the rudder can be separated from the bunt down function. It is up to the individual what he thinks he needs. Timer types generally fall into two areas: 1. The Seelig, which is purpose-built for power models by Former World Champion Hans Seelig; 2. Russian-Ukranian-Polish timer which is produced by seemingly dozens of cottage industries from what I believe to be a Soviet camera timer called "Prinz", made in the '70s. Very few, if any, electronic timers were seen in '93. Ultimately, we will see some rather good examples of electric timers, but the small market does not interest the electronic manufacturers. Unfortunately, their resources are necessary for the production of a reasonable cost electronic timer. Realistically, the mechanical spring-powered timer is very reliable. It is primarily the attachment and rigging that causes a problem, or setting by the flyer. Electronics cannot fix brain-fade.

Performance

Performance of the models at the '93 Champs in general is awesome, especially compared to the models of '79. In '79 we felt that 6 minutes in the evening good air was pretty good with 7 minutes being the sought-after number. Now we see 11 minutes occasionally in the evening and up to 9 minutes in very early morning and over 10 minutes in the later morning times like at the '93 Champs when Archer and Watson did over 10 minutes at 7:20 which was about an hour after sunrise.

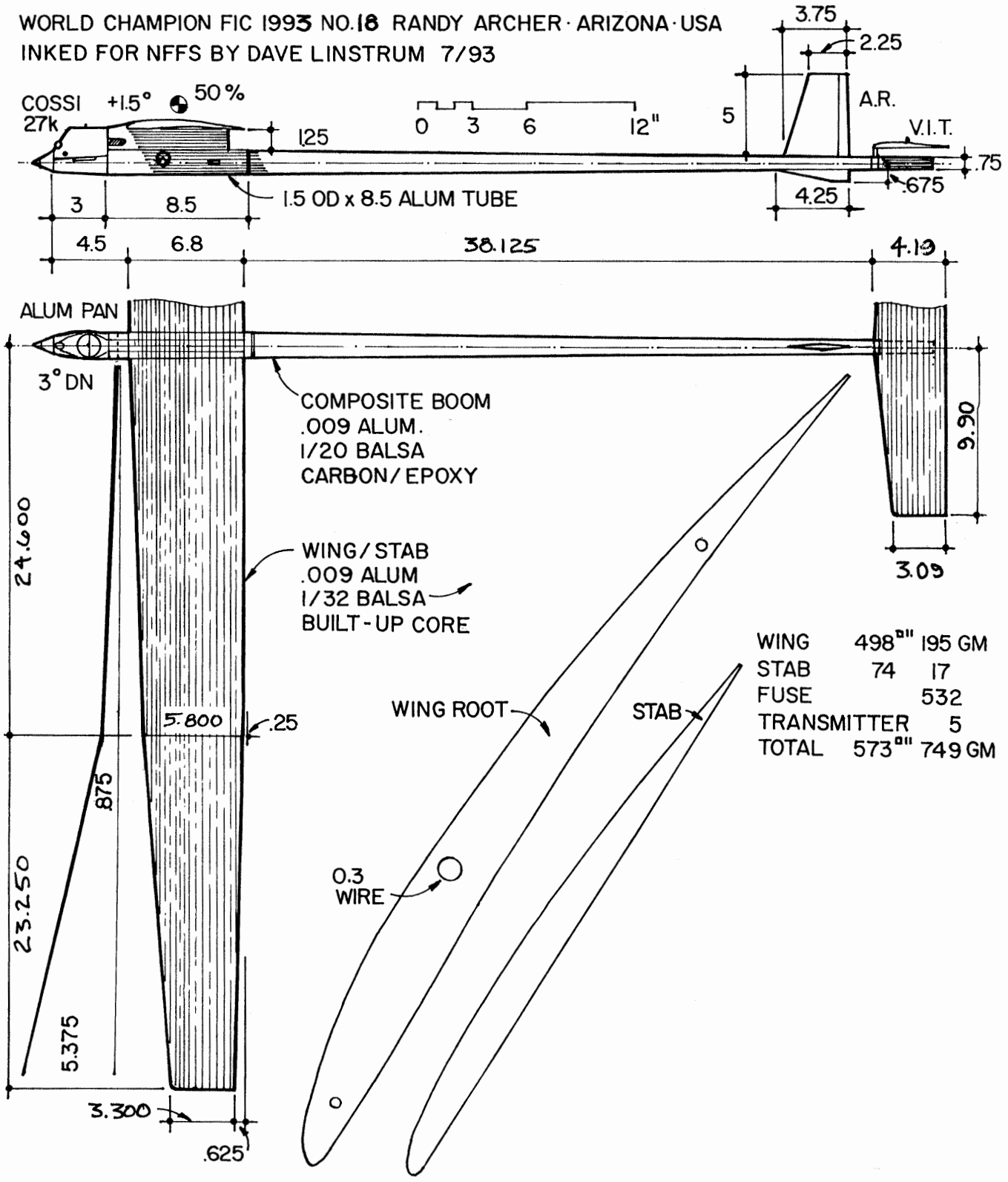
Climb performance is responsible for some of the increase in duration, with several models climbing to what was estimated to be over 700 feet. Most of the performance gain comes from the aspect ratio and airfoil improvements we have made in recent years. The amazing part of all this is that when you put the model into lousy air, it still comes down in about the same time as airplanes of lesser performance. Mother nature sure has a mean streak.

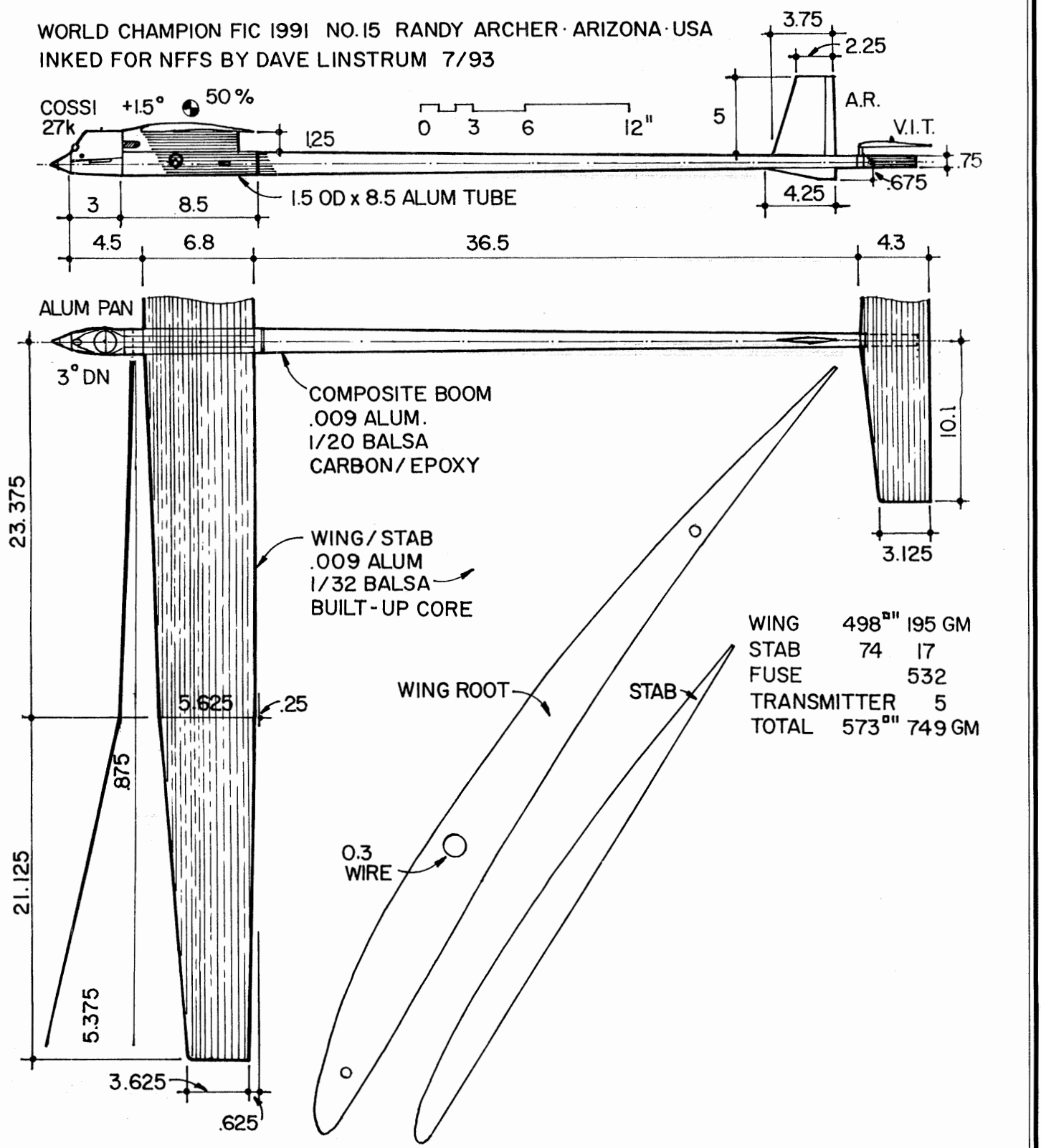
General Knowledge

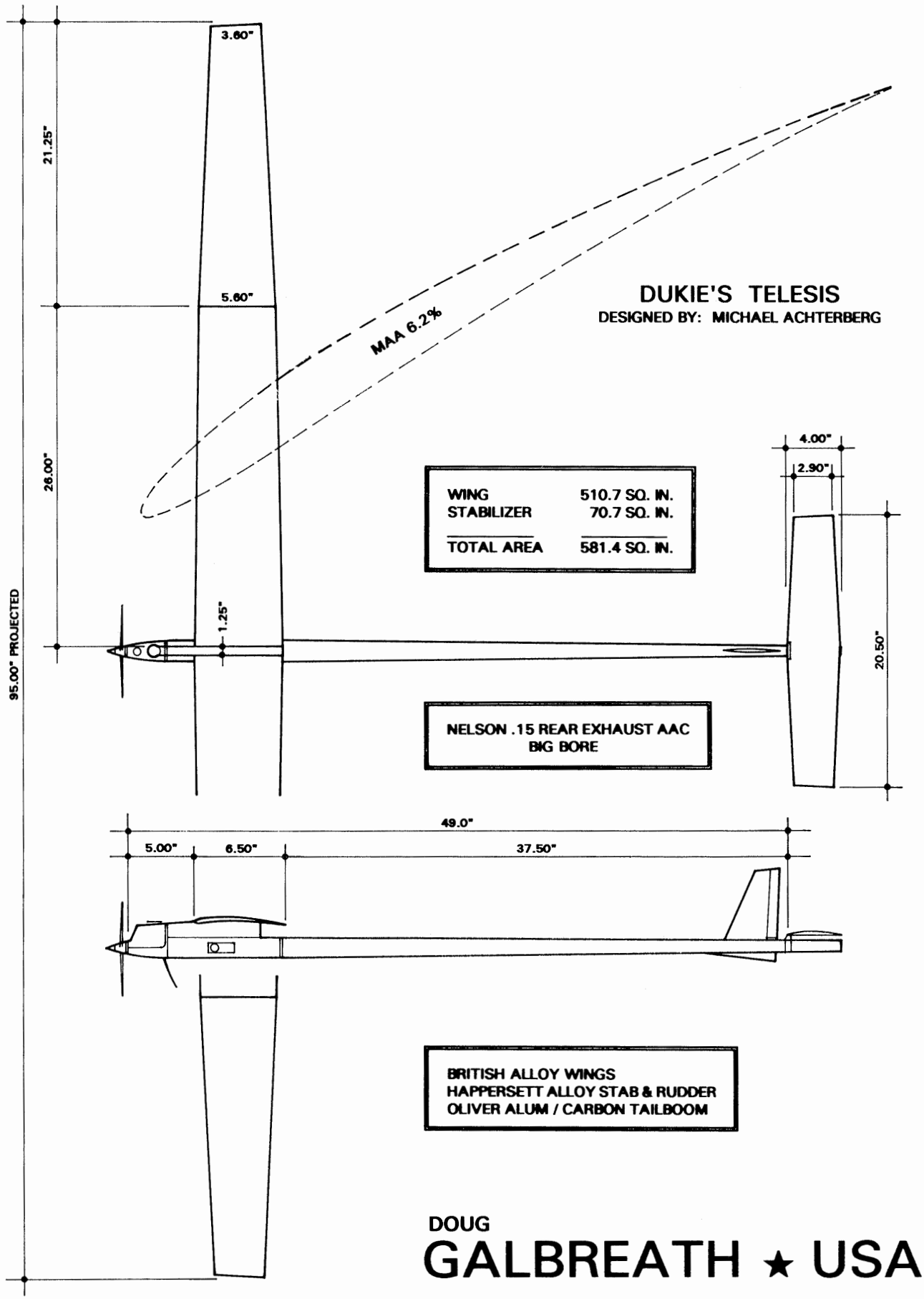
The information superhighway works in modeling. We all learn from each other through the willing exhange of technology. This is what I believe sets free flight apart from most other sports. It is a small community, but intensely friendly and sharing. The average power modeler of today knows much of things like engines, air picking, construction techniques, design, props, metallurgy and finishing. He or she probably does not realize that the knowledge they posess makes them capable of building virtually anything, large or small.

The Future

Where do we go from here? Certainly, we will continue to improve our skills, our technology and our willingness to put forth the energy to become champions. This is the nature of mankind. Where we are failing is in the nurturing of future participants in our sport. F1 should be and remain being the epitome of the sport–it needs to be the best that there can be. But without the school, so to speak, to educate the newcomer without it being so difficult that he is discouraged before he realizes that it is possible, we are on a one-way street to oblivion. In America we have what is known as AMA Gas events that do provide the school in competition free flight flying. The problem here is that the gap between AMA Gas and F1C is widening to the point where it is rare when we get a new flyer into F1C. Instead, the technology and difficulty scares them away. Typical AMA thinking generally tries to limit the technology in the gas events. With this thinking we are guaranteeing the widening of the gap instead of providing the bridge. Should we try to grade flyers in amateur, expert and master categories? Should we limit the models to something less than current F1C practice, like wing span limit, no weight limit? Span limit with no weight limit would open up the field to experimenting and certainly make it possible to use the smaller engine sizes without as much penalty, and also would certainly attract Gas flyers from other disciplines to try F1C. F1J was originally heralded as the breakthrough between AMA and FAI, but is rapidly becoming just a miniature F1C event which is just as difficult as FIC, with many F1C flyers moving into that area with their expertise and techniques. I wish I had the answer, but I do not. Every suggestion made meets with some disagreement from the current competitors. We must strive to build a bridge between the talented beginner in power free flight and the F1C event, if there is to be a viable F1C sport in the future.


WORLD CHAMPION FIC 1993 NO.18 RANDY ARCHER · ARIZONA · USA
INKED FOR NFFS BY DAVE LINSTRUM 7/93
COSSI 27k
+1.5°
50 %
0 3 6 12"
1.25
3.75
2.25
A.R.
5
V.I.T.
.75
.675
4.25
1.5 OD x 8.5 ALUM TUBE
3
8.5
4.5
6.8
38.125
4.19
ALUM PAN
3° DN
COMPOSITE BOOM
.009 ALUM.
1/20 BALSA
CARBON/EPOXY
9.90
3.09
24.600
WING/STAB
.009 ALUM
1/32 BALSA
BUILT-UP CORE
5.800
.25
.875
23.250
5.375
3.300
.625
WING ROOT
STAB
0.3
WIRE
WING 498" 195 GM
STAB 74 17
FUSE 532
TRANSMITTER 5
TOTAL 573" 749 GM


WORLD CHAMPION FIC 1991 NO.15 RANDY ARCHER · ARIZONA · USA
INKED FOR NFFS BY DAVE LINSTRUM 7/93
COSSI +1.5° 50%
27k
0 3 6 12"
1.25
3.75
2.25
A.R.
5
V.I.T.
.75
.675
4.25
1.5 OD x 8.5 ALUM TUBE
3
8.5
4.5
6.8
36.5
4.3
ALUM PAN
3° DN
COMPOSITE BOOM
.009 ALUM.
1/20 BALSA
CARBON/EPOXY
10.1
3.125
23.375
WING/STAB
.009 ALUM
1/32 BALSA
BUILT-UP CORE
WING 498 sq in 195 GM
STAB 74 17
FUSE 532
TRANSMITTER 5
TOTAL 573 sq in 749 GM
WING ROOT
STAB
5.625
.25
.875
21.125
0.3
WIRE
5.375
3.625
.625



DUKIE'S TELESIS

DESIGNED BY: MICHAEL ACHTERBERG

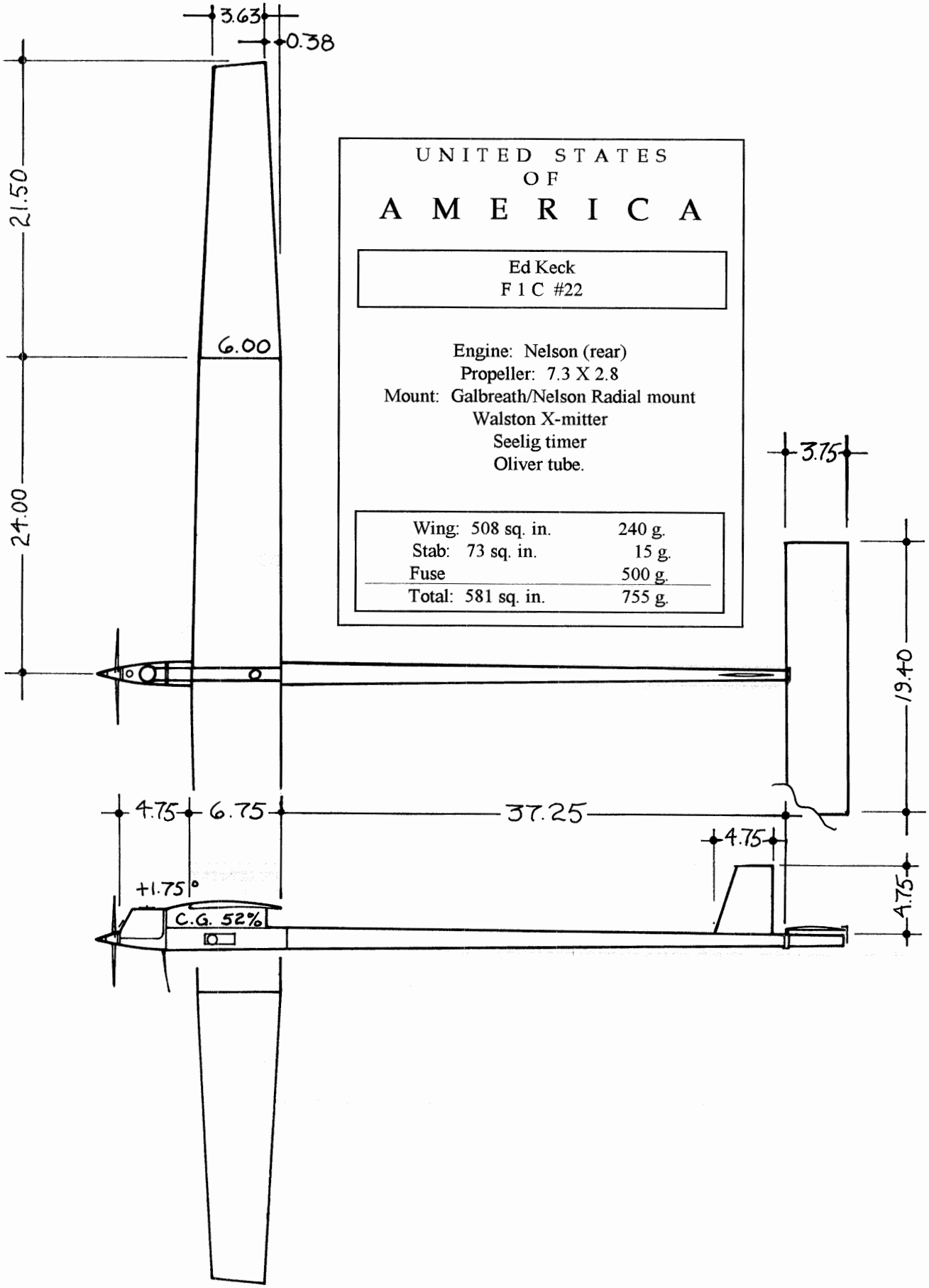
WING	510.7 SQ. IN.
STABILIZER	70.7 SQ. IN.
TOTAL AREA	581.4 SQ. IN.

NELSON .15 REAR EXHAUST AAC
BIG BORE

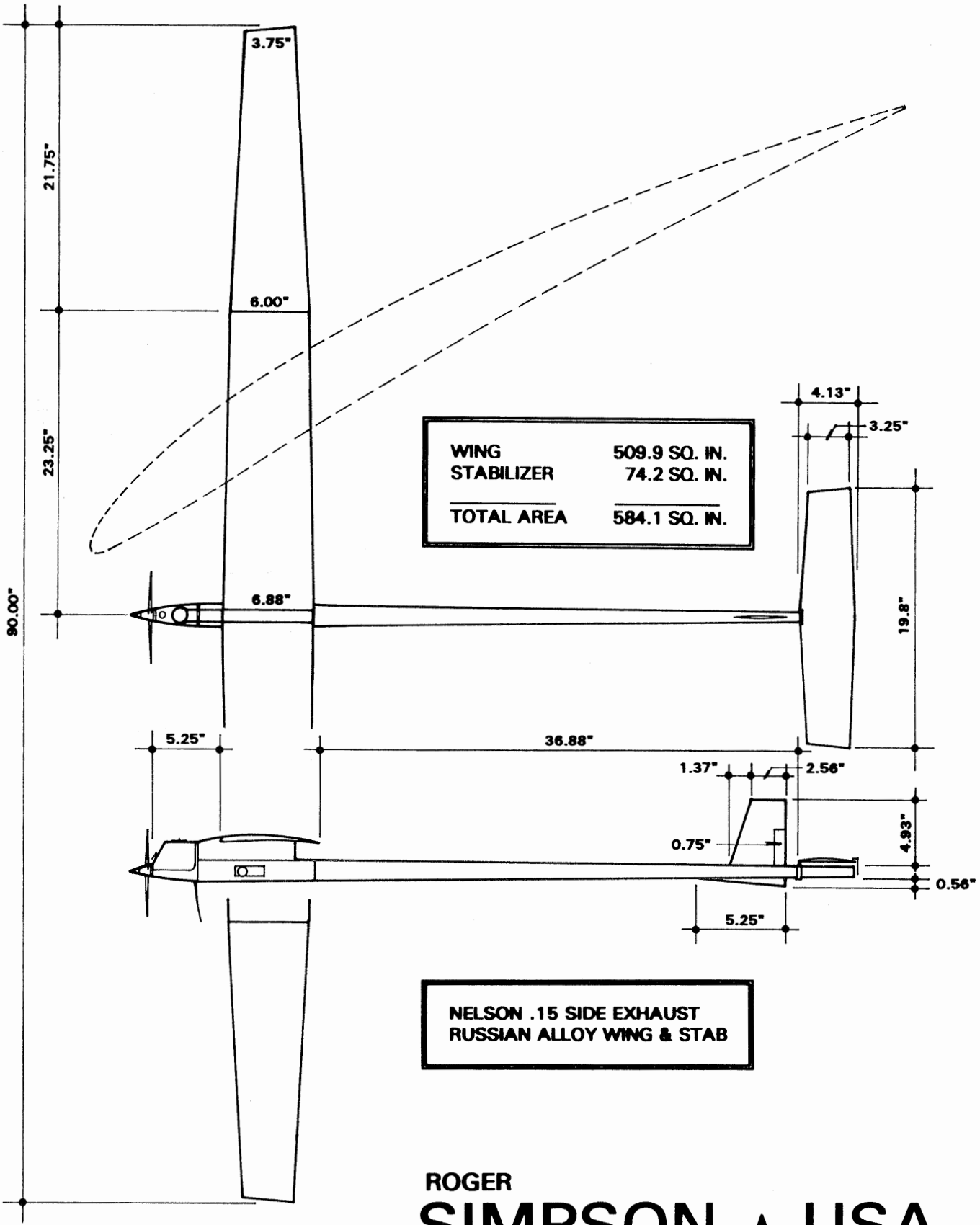
BRITISH ALLOY WINGS
HAPPERSETT ALLOY STAB & RUDDER
OLIVER ALUM / CARBON TAILBOOM

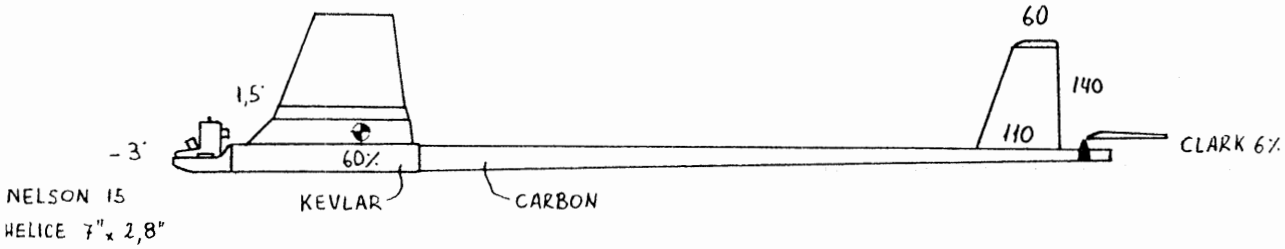
DOUG
GALBREATH ★ USA

DRAWN BY: BILL BOOTH, JR.

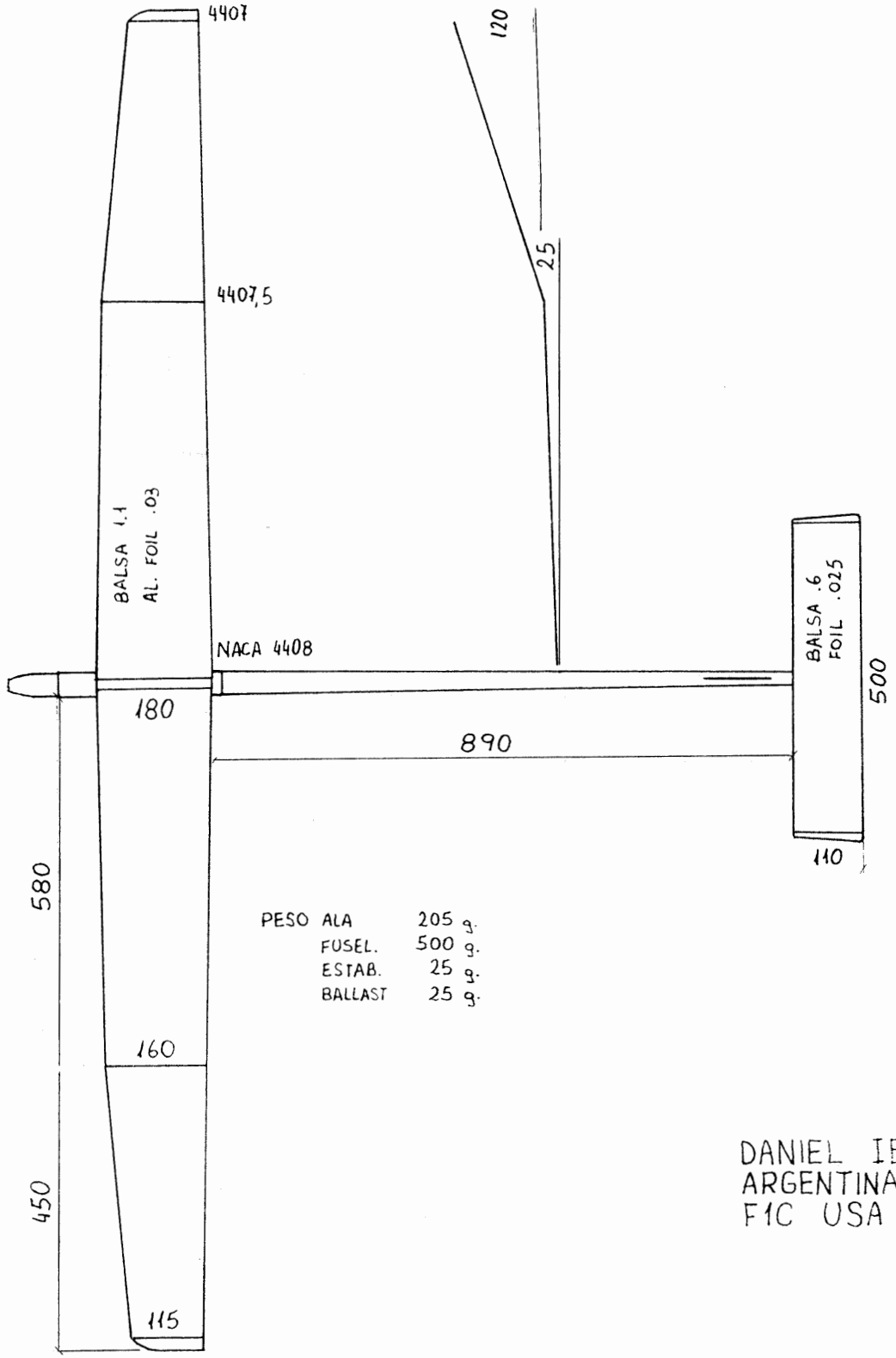


DIMENSIONS IN INCHES


3.75"
21.75"
6.00"
23.25"
90.00"
6.88"
4.13"
3.25"
19.8"
5.25"
36.88"
1.37"
2.56"
0.75"
4.93"
0.56"
5.25"
WING 509.9 SQ. IN.
STABILIZER 74.2 SQ. IN.
TOTAL AREA 584.1 SQ. IN.
NELSON .15 SIDE EXHAUST
RUSSIAN ALLOY WING & STAB
ROGER
SIMPSON ★ USA
DRAWN BY: BILL BOOTH, JR.

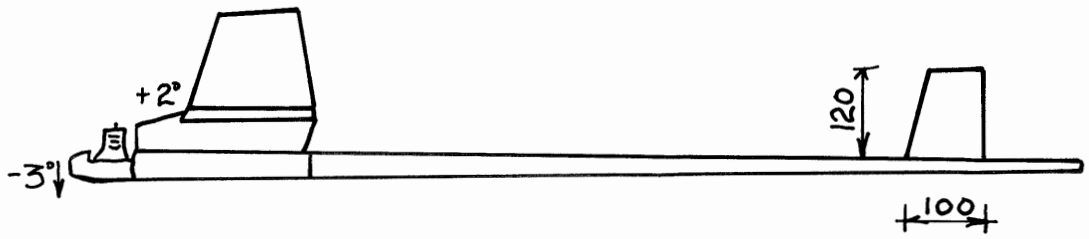


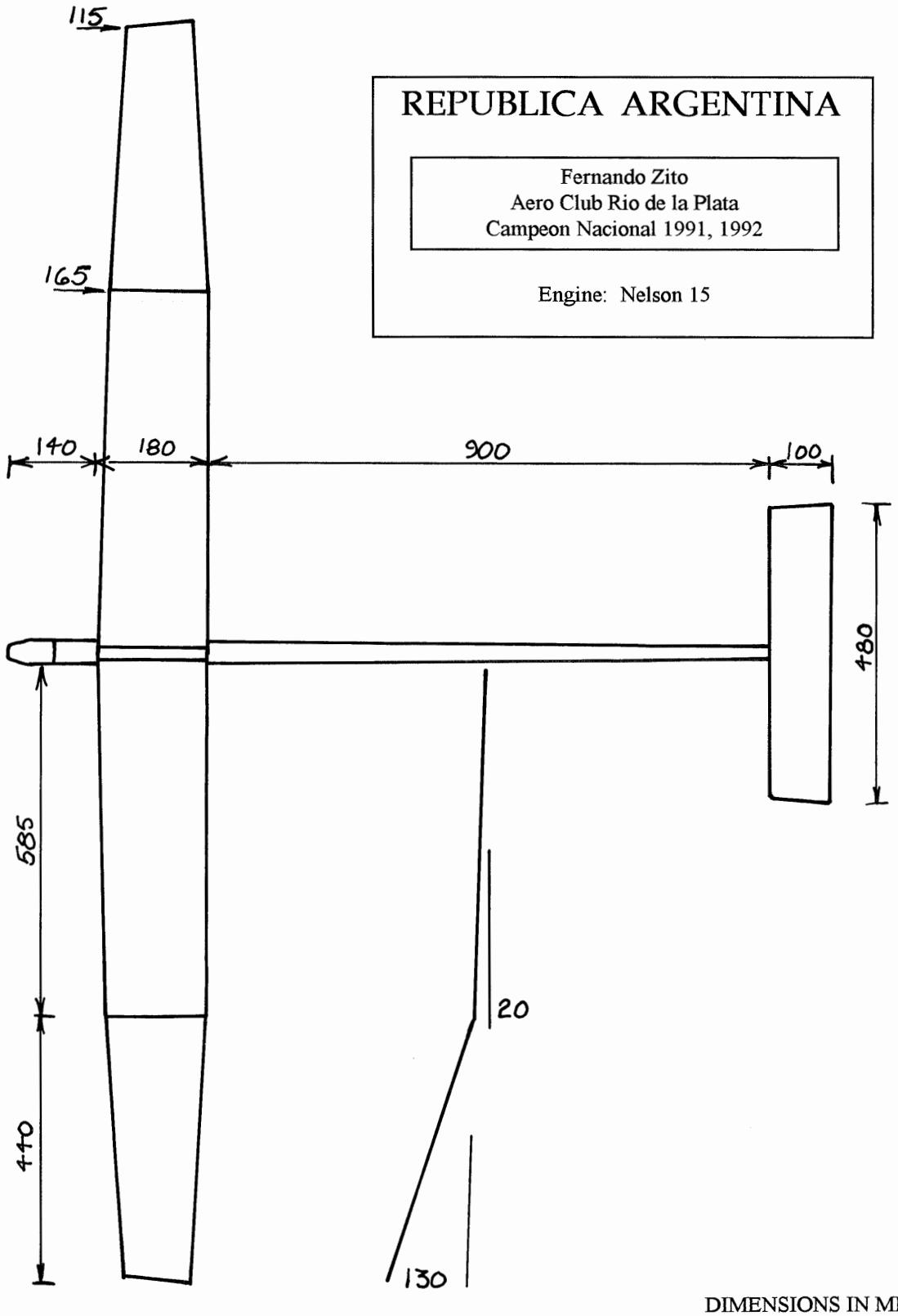
NELSON 15
HELICE 7" x 2,8"



PESO ALA	205 g.
FUSEL.	500 g.
ESTAB.	25 g.
BALLAST	25 g.

DANIEL IELE
ARGENTINA
F1C USA 93



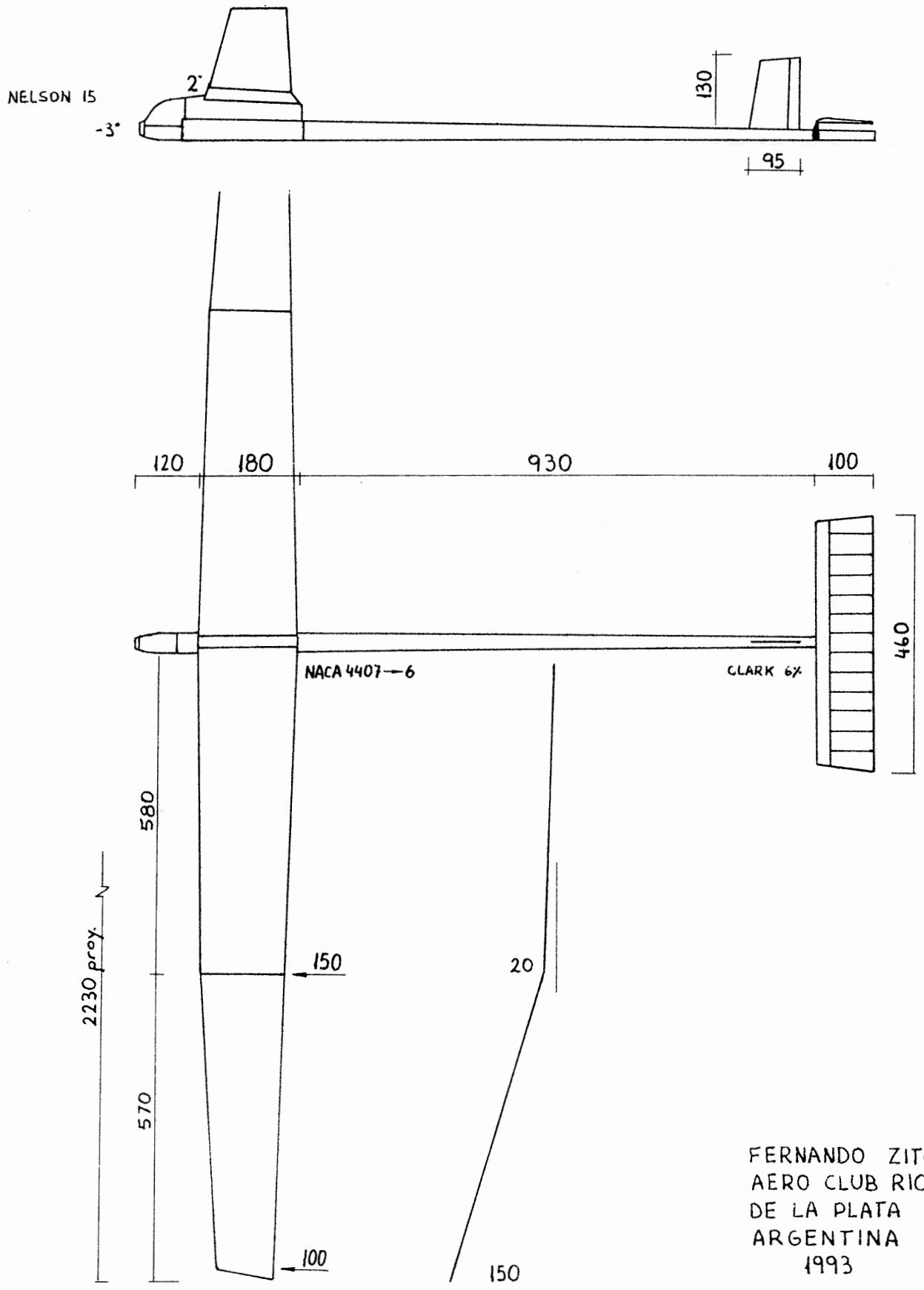


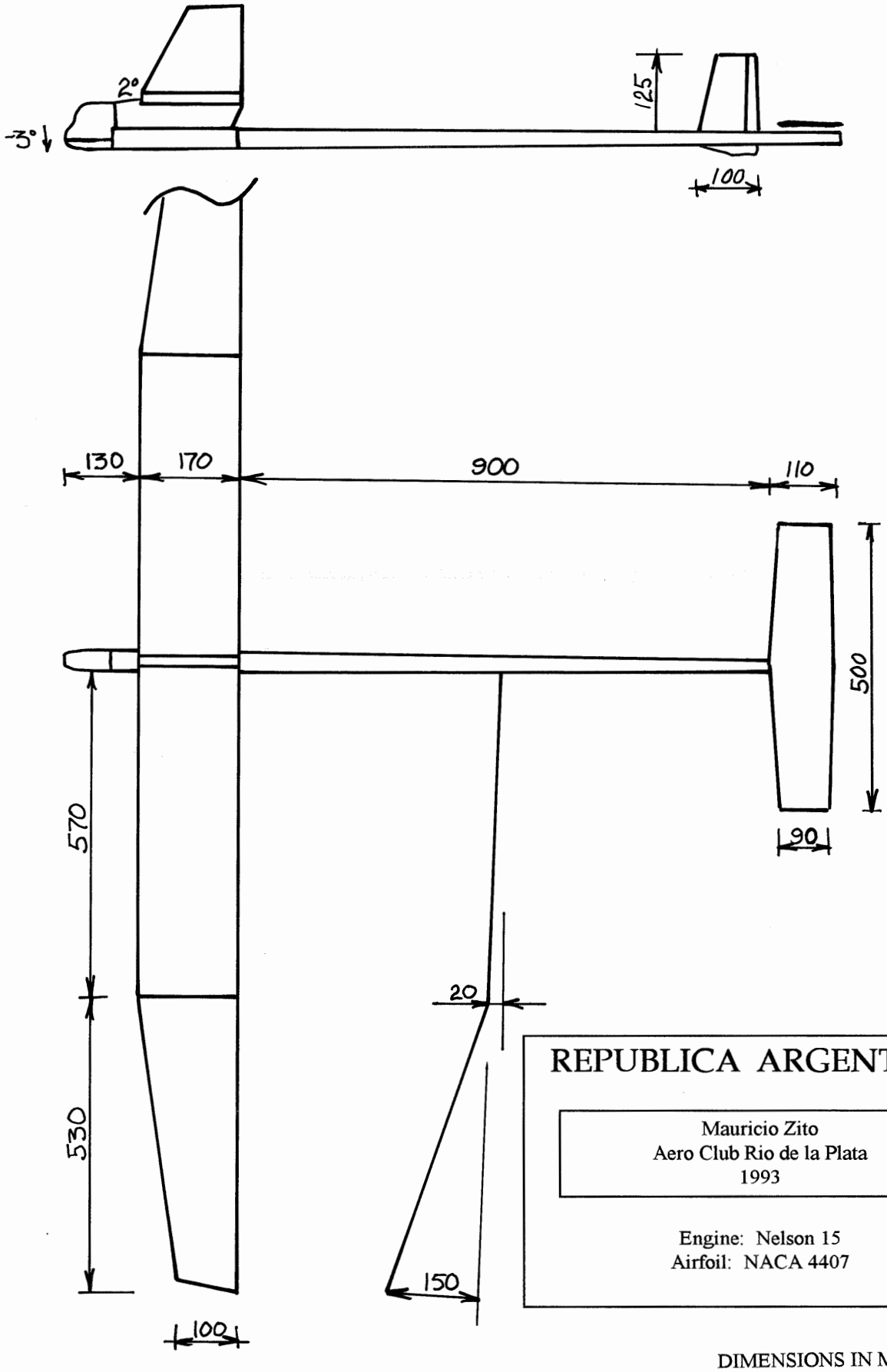
REPUBLICA ARGENTINA

Fernando Zito
Aero Club Rio de la Plata
Campeon Nacional 1991, 1992

Engine: Nelson 15

DIMENSIONS IN MILLIMETERS


NELSON 15
2°
-3°
130
95
120
180
930
100
460
NACA 4407—6
CLARK 6%
580
2230 proy.
570
150
20
100
150
FERNANDO ZITO
AERO CLUB RIO
DE LA PLATA
ARGENTINA
1993

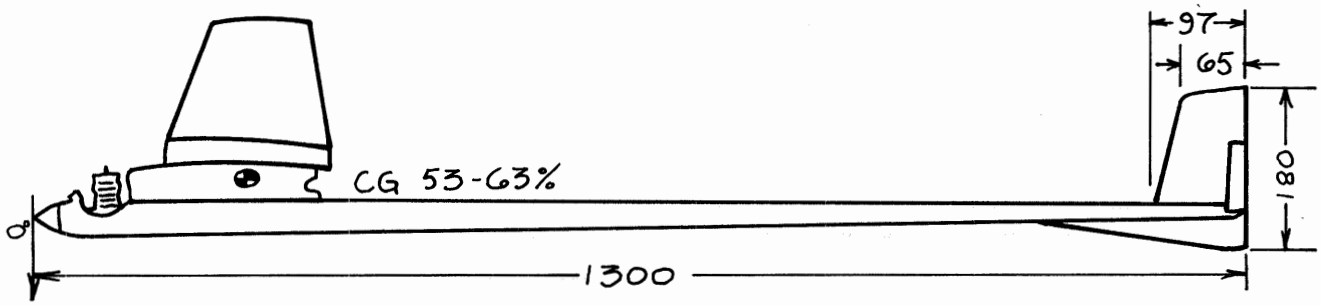


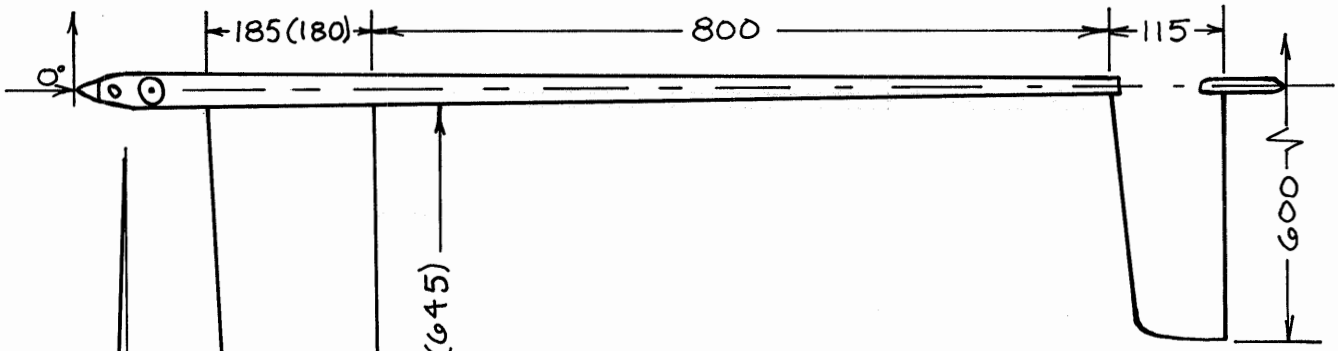
REPUBLICA ARGENTINA

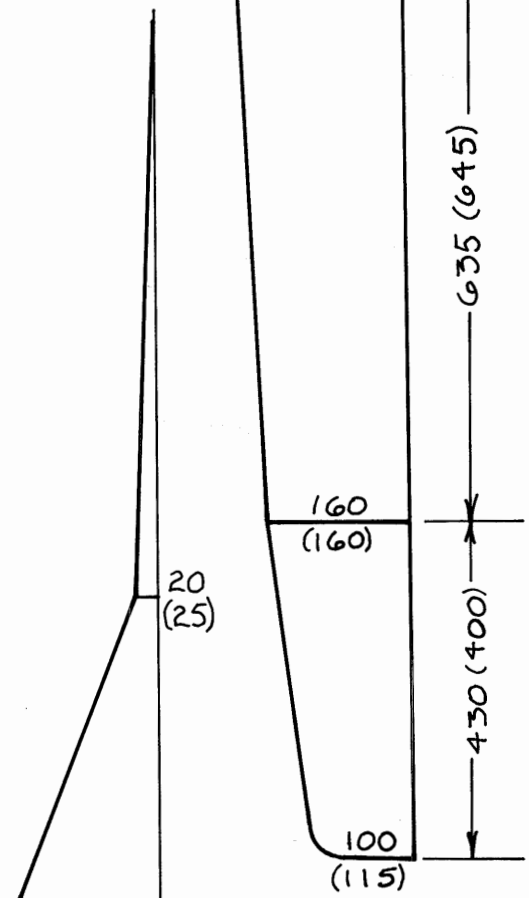
Mauricio Zito
Aero Club Rio de la Plata
1993

Engine: Nelson 15
Airfoil: NACA 4407

DIMENSIONS IN MILLIMETERS





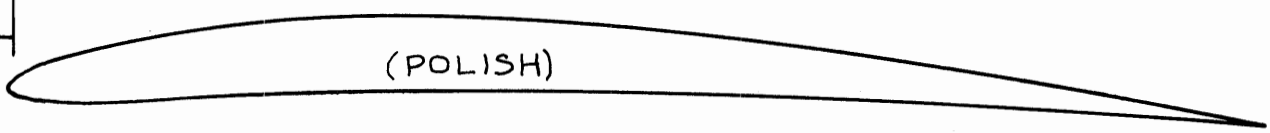


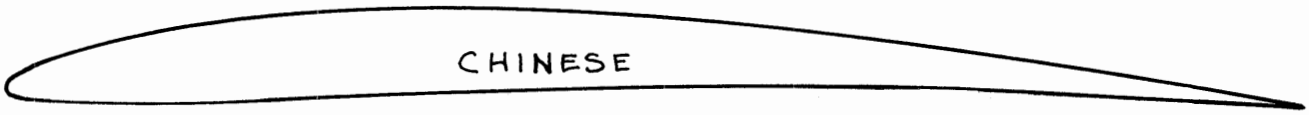
AUSTRALIA

Koei Tsuda
Cosmo Sky-Scraper
Model A: standard Chinese
(Model B: Chinese-Polish)

Wing:	31.5-32.5 dm2	180 g.
Stab.:	6.15 dm2	22 g.
Total mass:		740-770 g.

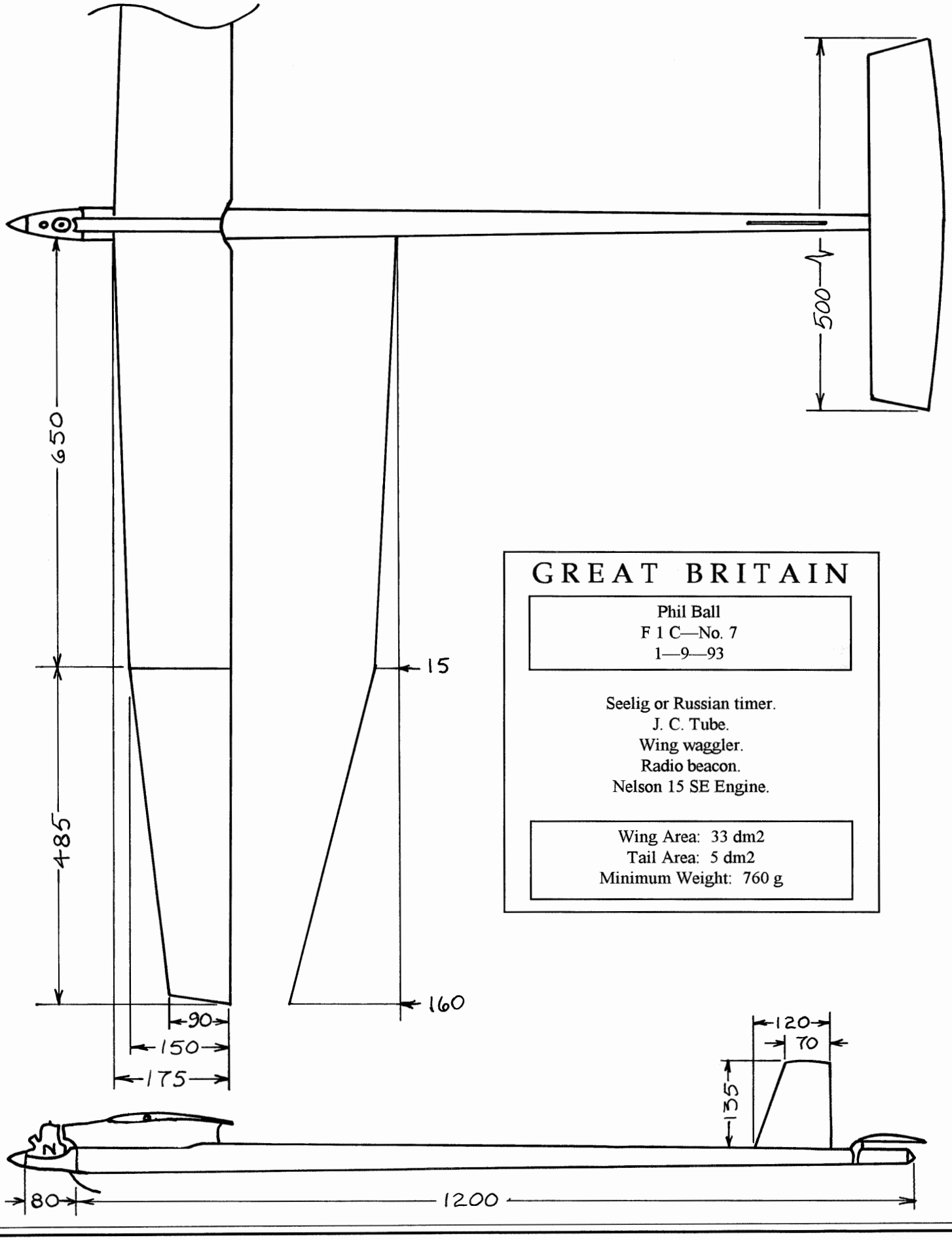
Seelig timers, Nelson engines.





DIMENSIONS IN MILLIMETERS

DIMENSIONS IN MILLIMETERS

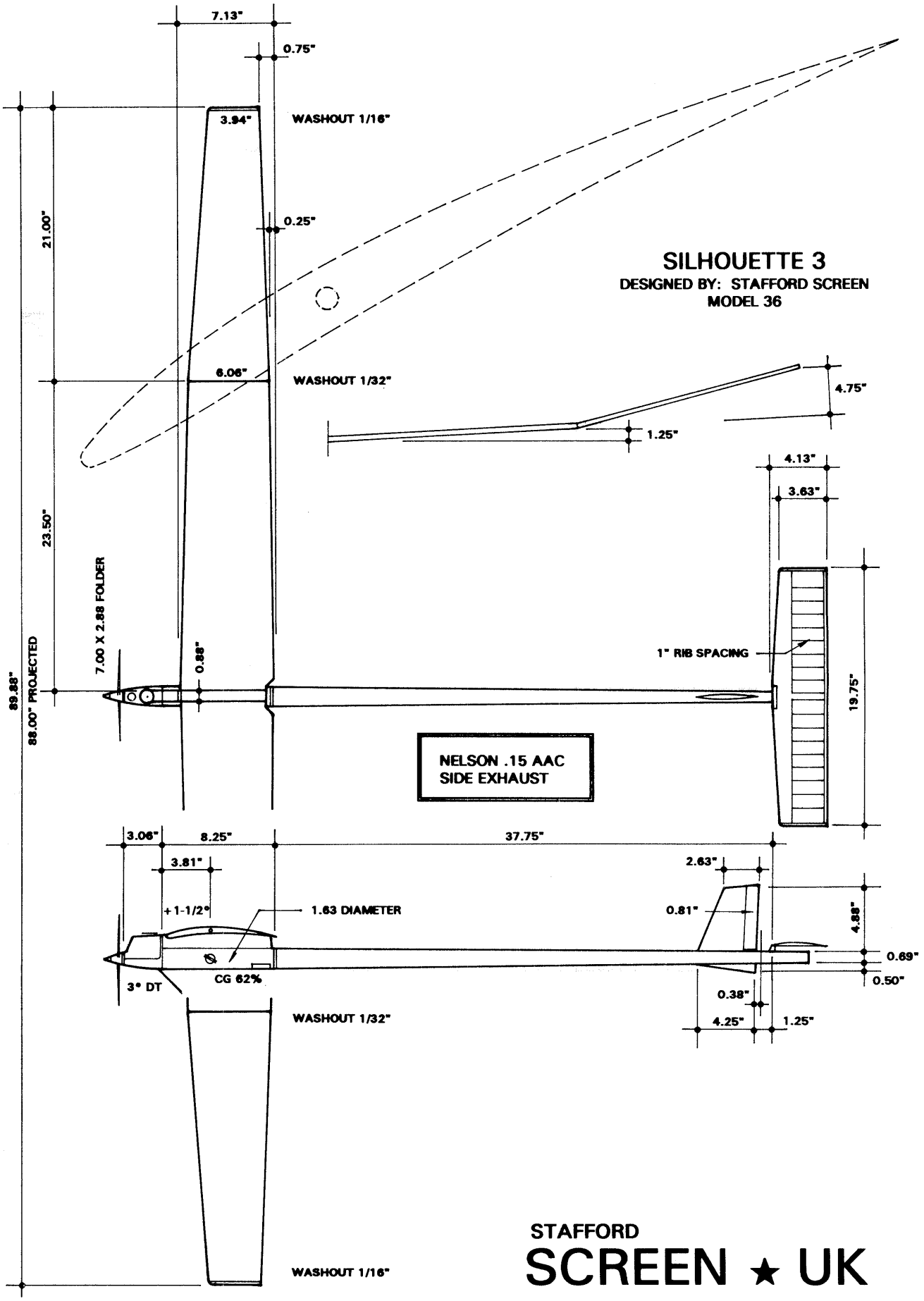


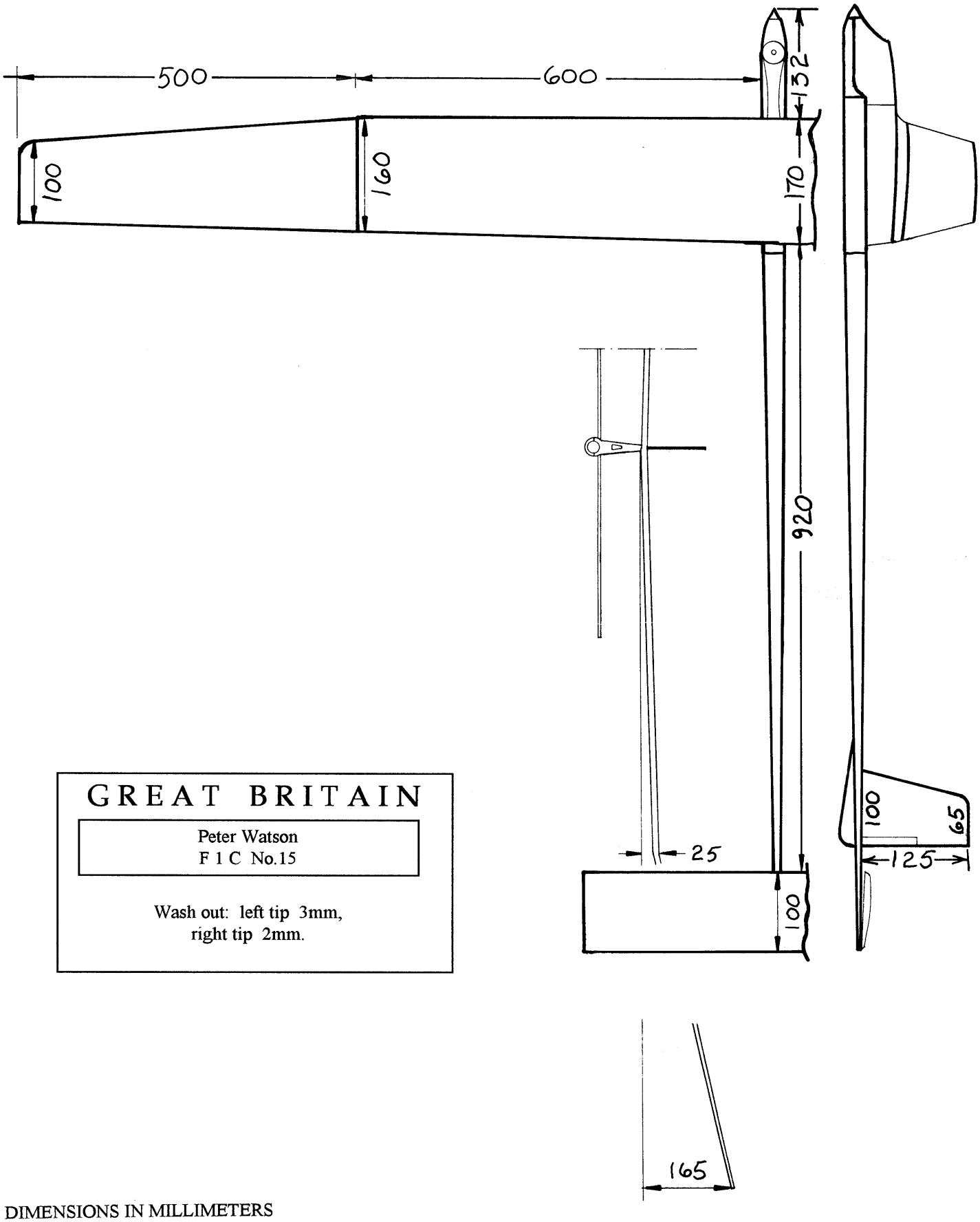
GREAT BRITAIN

Phil Ball
F 1 C—No. 7
1—9—93

Seelig or Russian timer.
J. C. Tube.
Wing waggler.
Radio beacon.
Nelson 15 SE Engine.

Wing Area: 33 dm2
Tail Area: 5 dm2
Minimum Weight: 760 g


7.13"
0.75"
3.94"
WASHOUT 1/16"
21.00"
0.25"
SILHOUETTE 3
DESIGNED BY: STAFFORD SCREEN
MODEL 36
6.06"
WASHOUT 1/32"
4.75"
1.25"
4.13"
3.63"
23.50"
7.00 X 2.88 FOLDER
0.88"
1" RIB SPACING
19.75"
89.88"
88.00" PROJECTED
NELSON .15 AAC
SIDE EXHAUST
3.06"
8.25"
37.75"
3.81"
2.63"
+1-1/2°
1.63 DIAMETER
0.81"
4.88"
0.69"
0.50"
CG 62%
3° DT
0.38"
4.25"
1.25"
WASHOUT 1/32"
WASHOUT 1/16"
STAFFORD
SCREEN ★ UK
DRAWN BY: BILL BOOTH, JR.

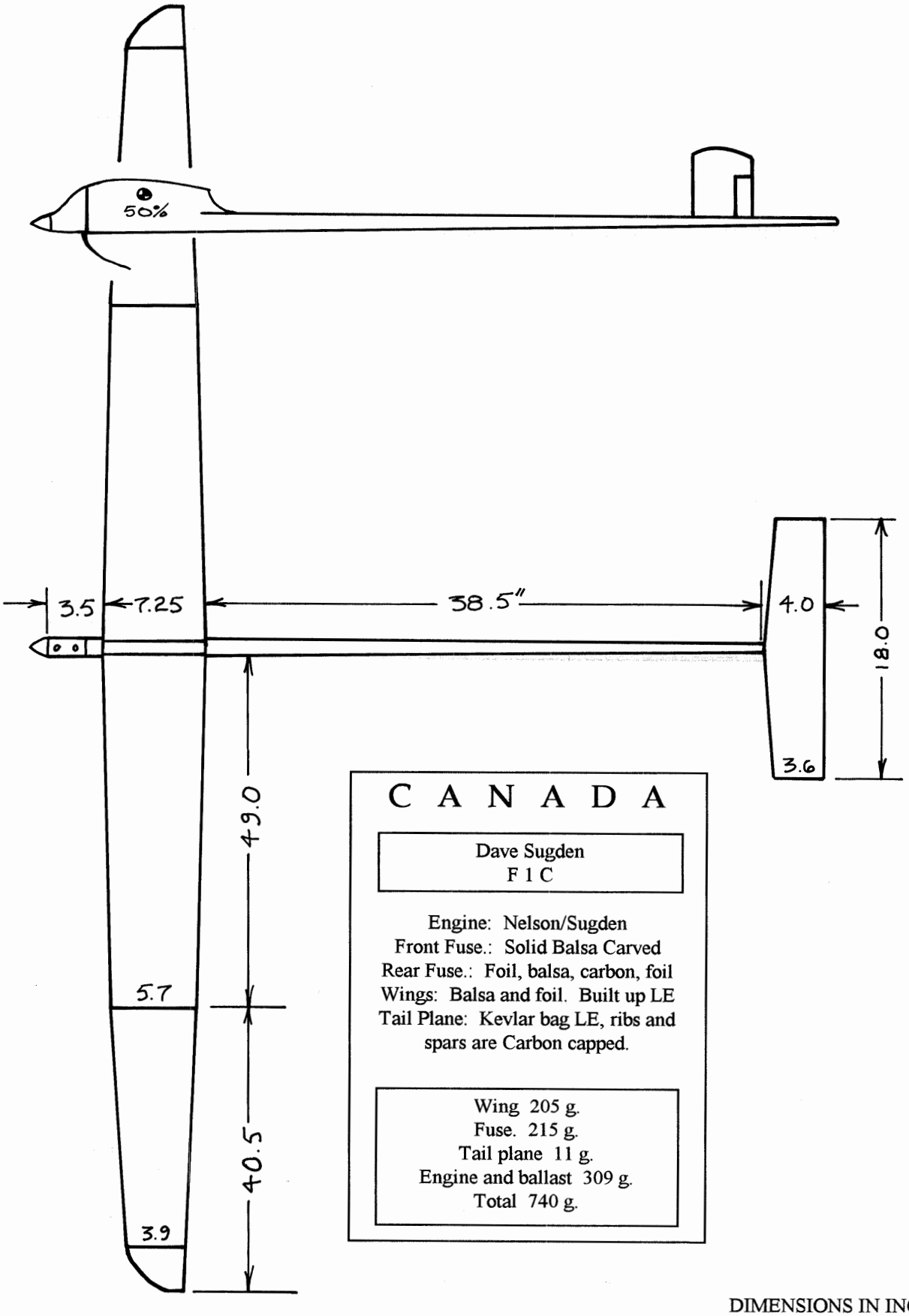


GREAT BRITAIN

Peter Watson
F 1 C No.15

Wash out: left tip 3mm,
right tip 2mm.

DIMENSIONS IN MILLIMETERS



C A N A D A

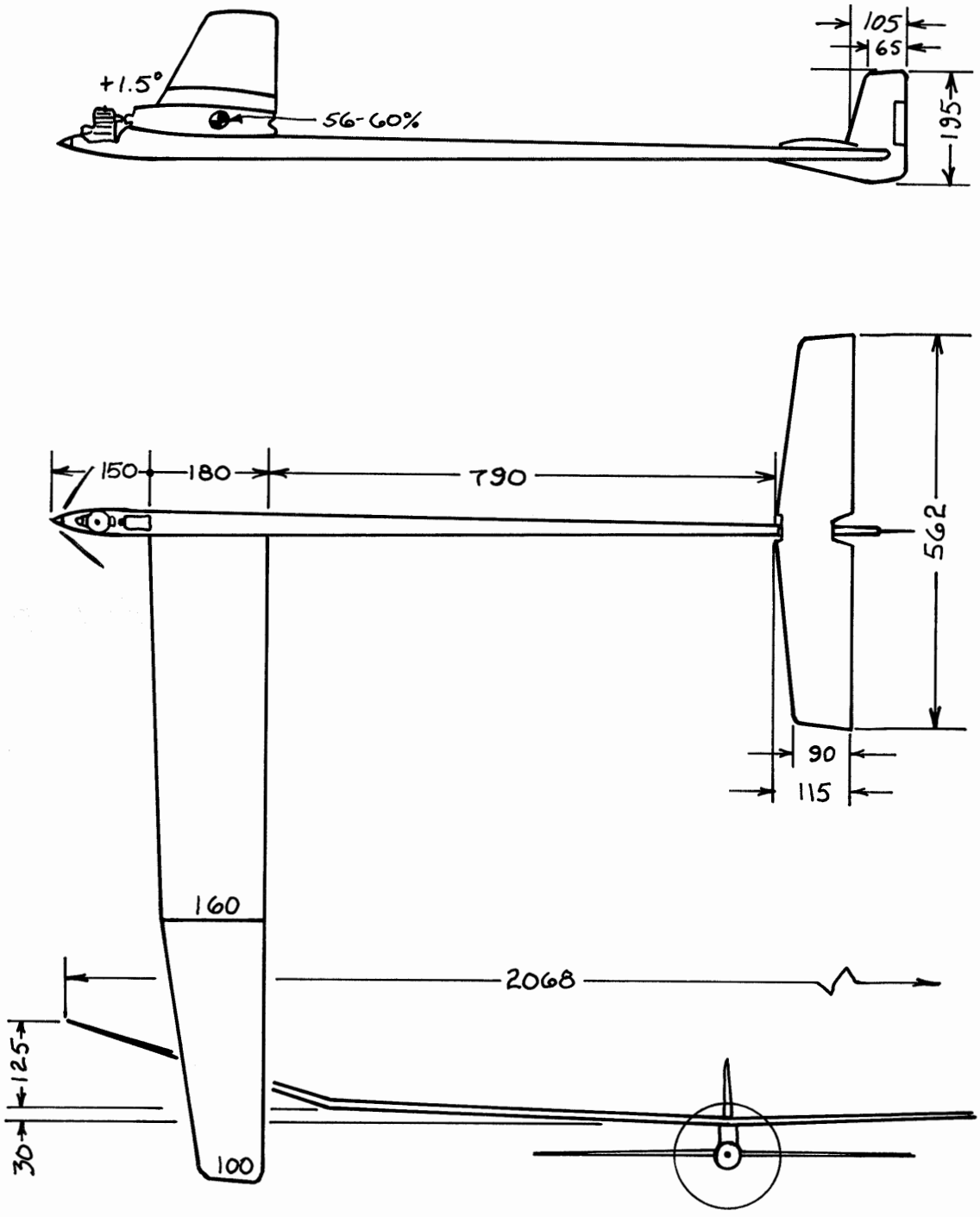
Dave Sugden
F 1 C

Engine: Nelson/Sugden
Front Fuse.: Solid Balsa Carved
Rear Fuse.: Foil, balsa, carbon, foil
Wings: Balsa and foil. Built up LE
Tail Plane: Kevlar bag LE, ribs and spars are Carbon capped.

Wing 205 g.
Fuse. 215 g.
Tail plane 11 g.
Engine and ballast 309 g.
Total 740 g.

DIMENSIONS IN INCHES

DIMENSIONS IN MILLIMETERS

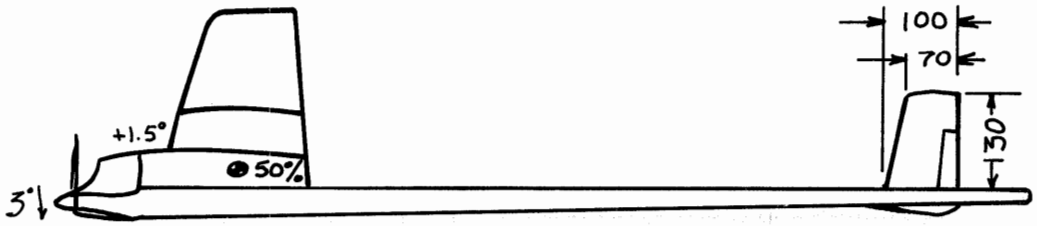


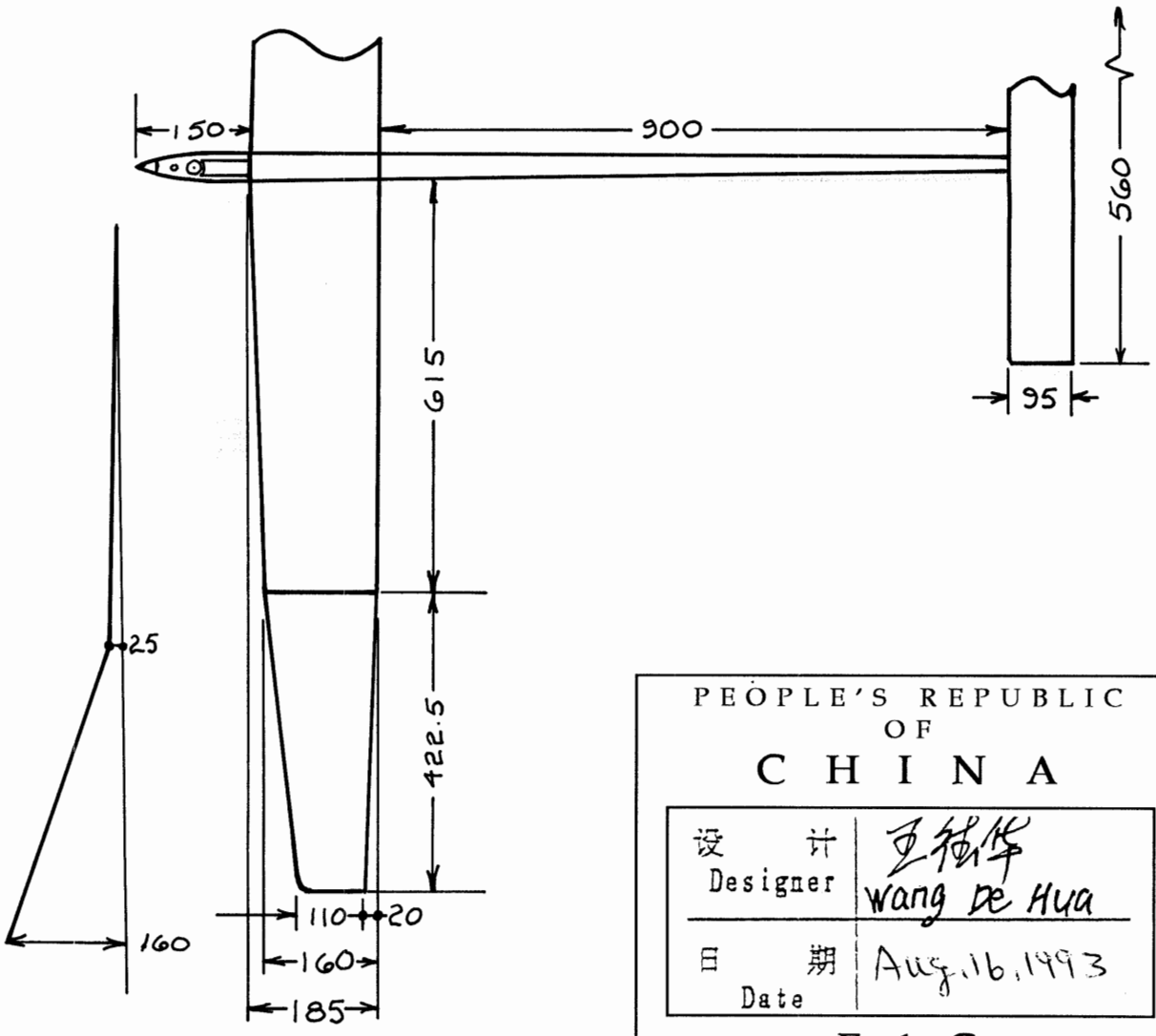
PEOPLE'S REPUBLIC OF CHINA

F 1 C

设　计 Designer	涂远华 Tu Yuanhua
日　期 Date	Aug.16,1993

DIMENSIONS IN MILLIMETERS





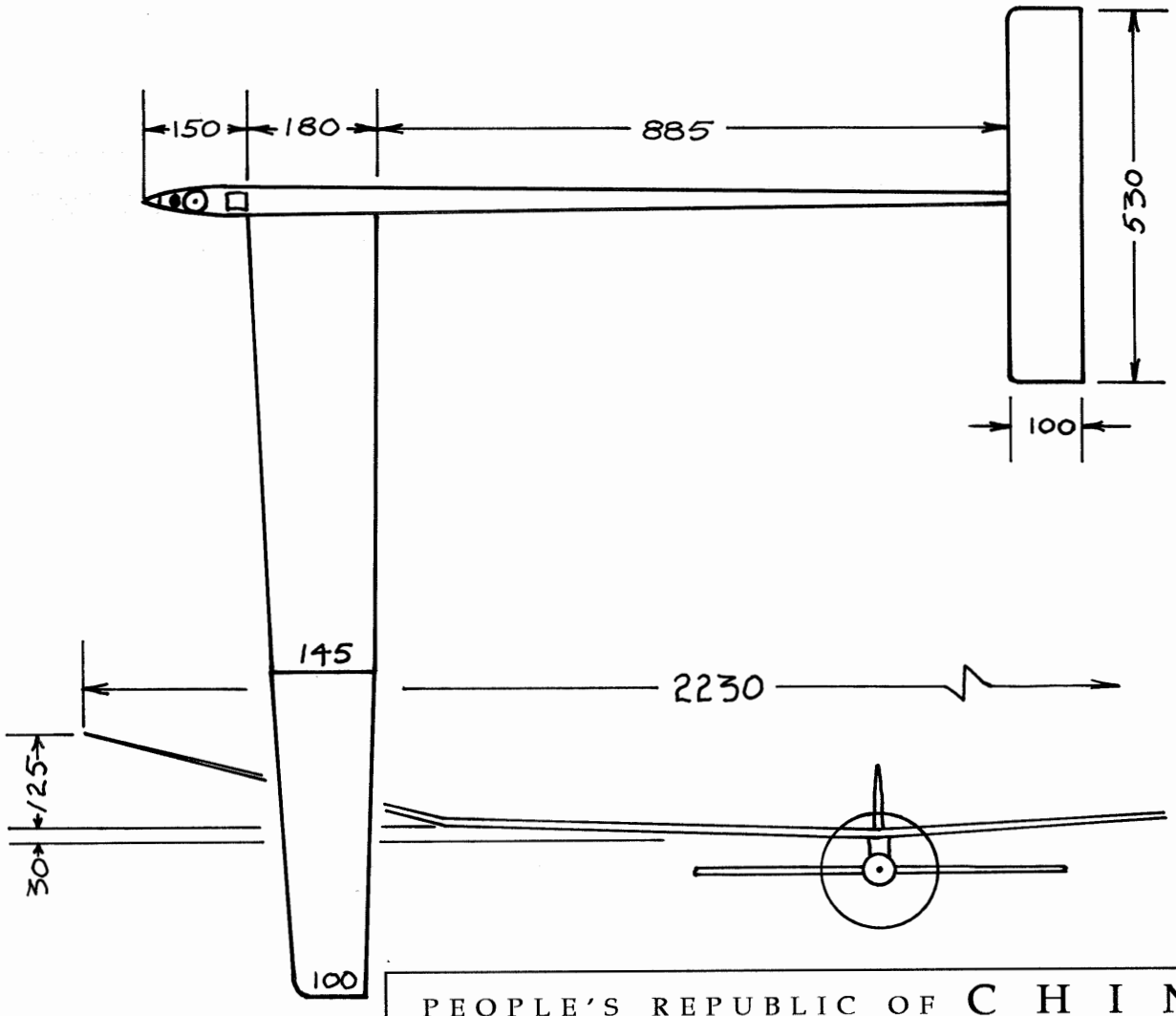
PEOPLE'S REPUBLIC
OF
CHINA

设 计 Designer	王德华 Wang De Hua
日 期 Date	Aug. 16, 1993

F 1 C

DIMENSIONS IN MILLIMETERS

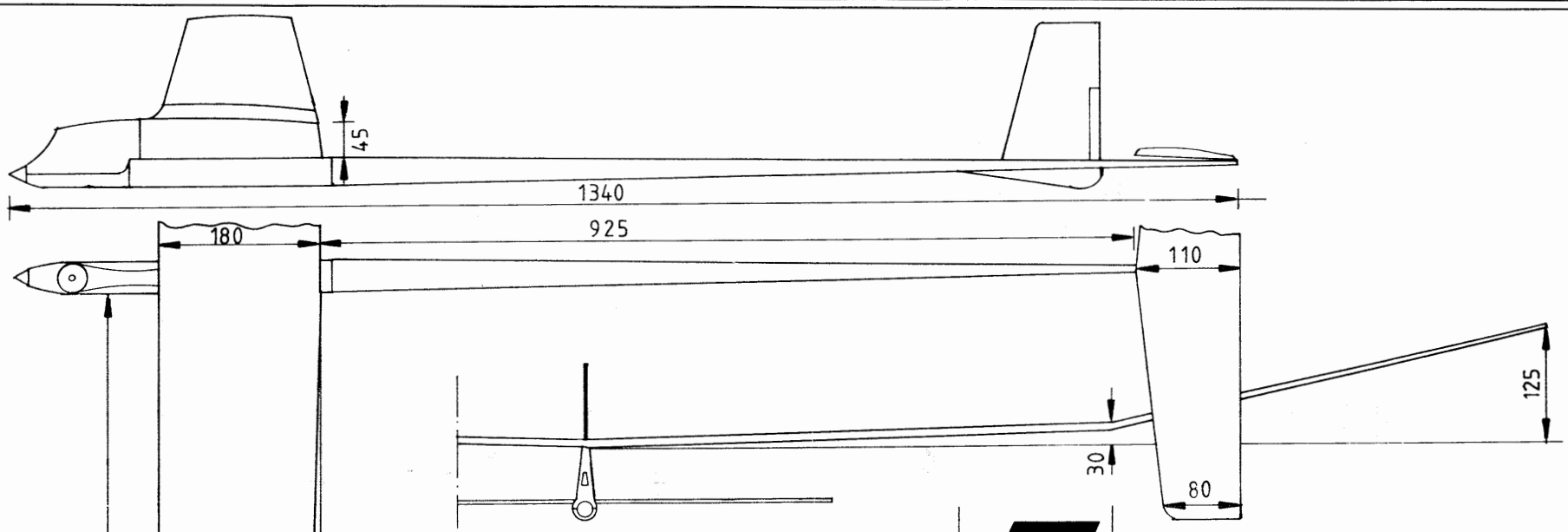


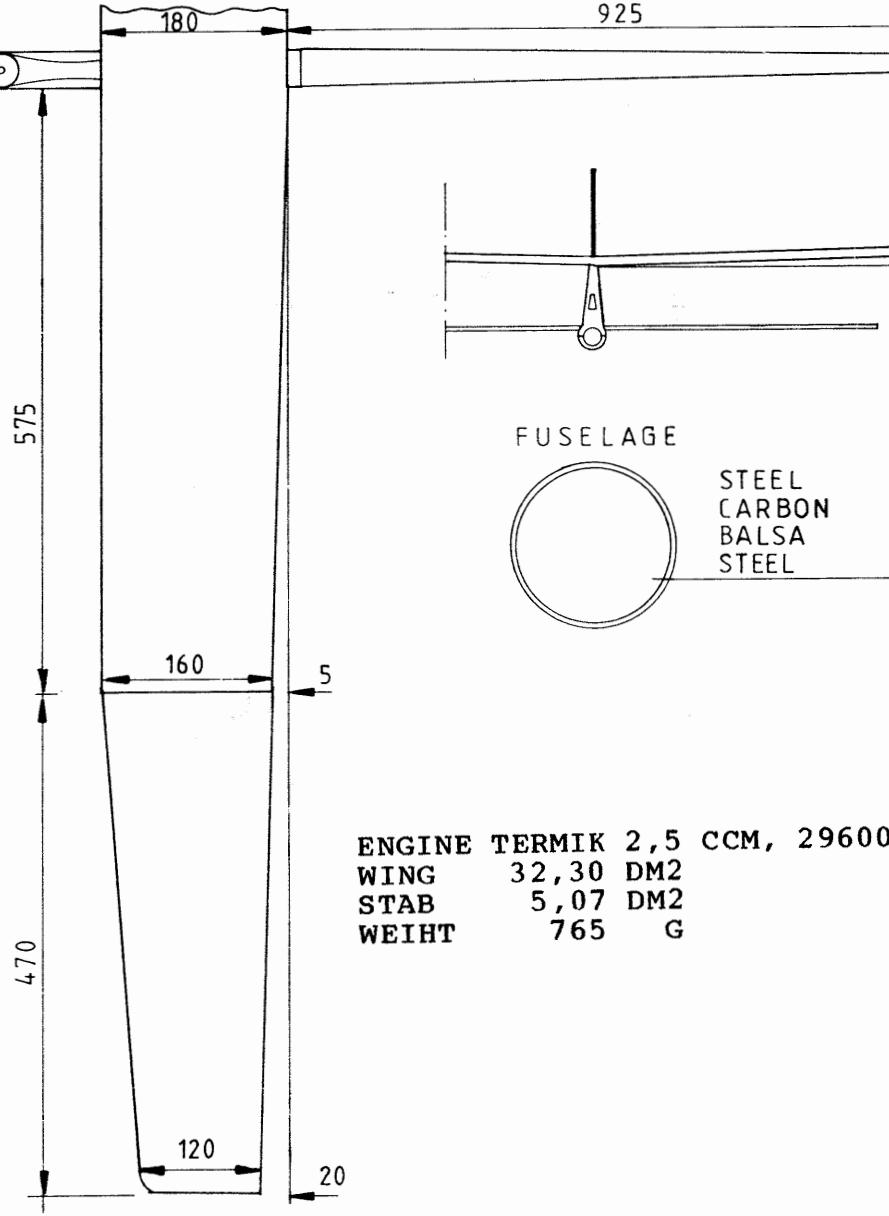


PEOPLE'S REPUBLIC OF CHINA

F1C

设 计 Designer	WANG XIAH 王 昱
日 期 Date	~~7月2日~~ Aug.16,1993





FUSELAGE

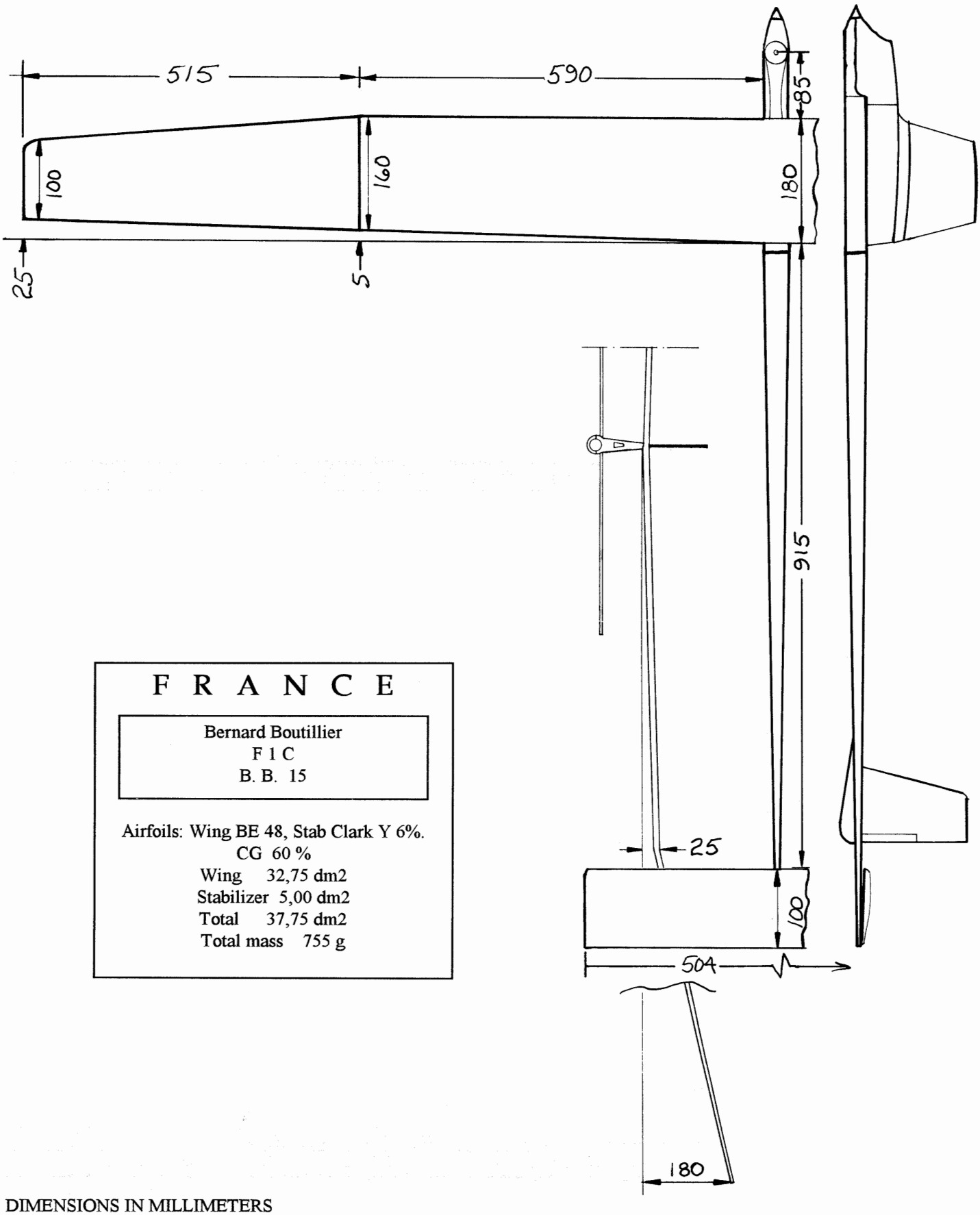
STEEL
CARBON
BALSA
STEEL

ENGINE TERMIK 2,5 CCM, 29600 RPM
WING 32,30 DM2
STAB 5,07 DM2
WEIHT 765 G



FREEFLIGHT TEAM FINLAND

F1C	KAARLE KUUKKA OH-2651		
	FINLAND		

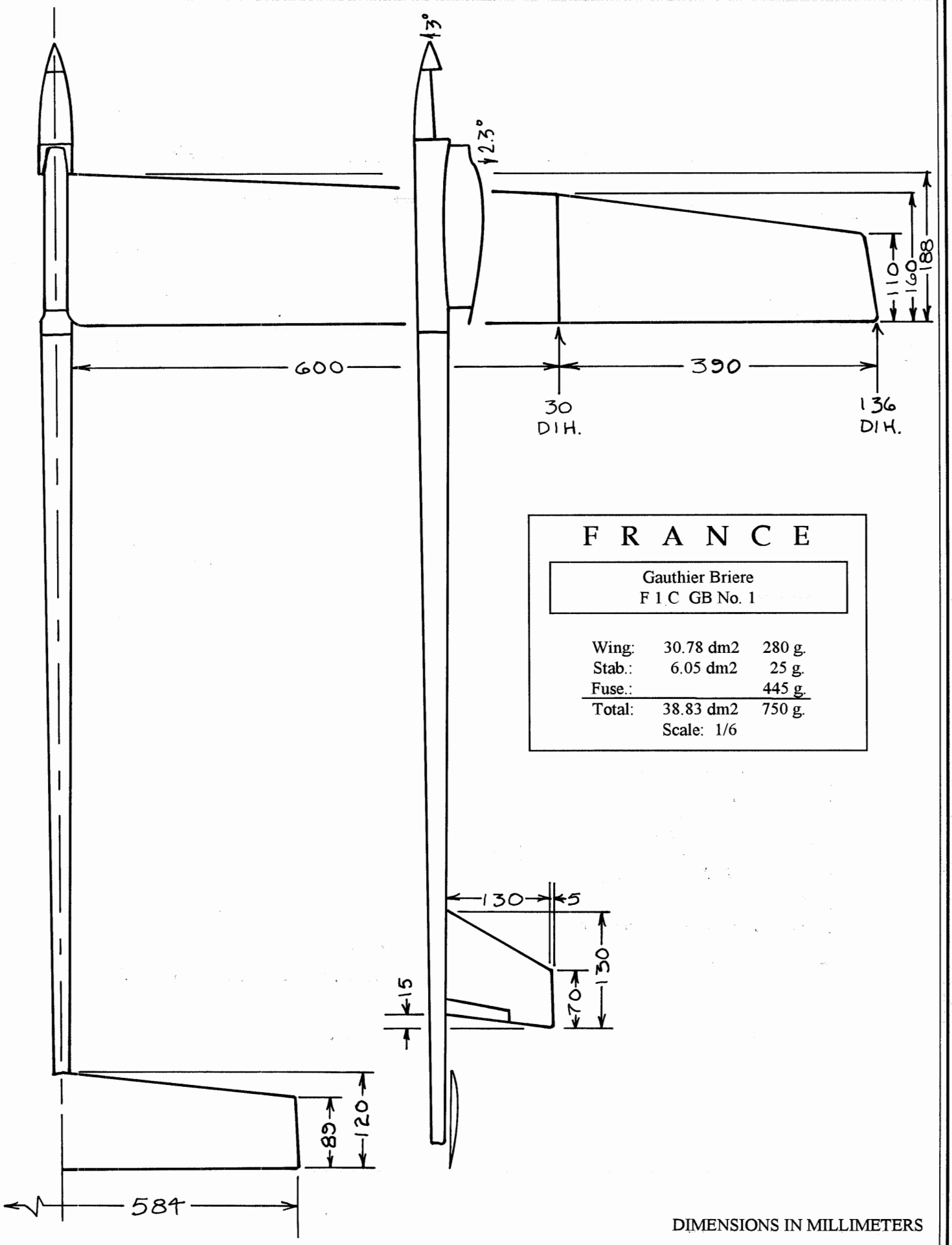


F R A N C E

Bernard Boutillier
F 1 C
B. B. 15

Airfoils: Wing BE 48, Stab Clark Y 6%.
CG 60 %
Wing 32,75 dm2
Stabilizer 5,00 dm2
Total 37,75 dm2
Total mass 755 g

DIMENSIONS IN MILLIMETERS



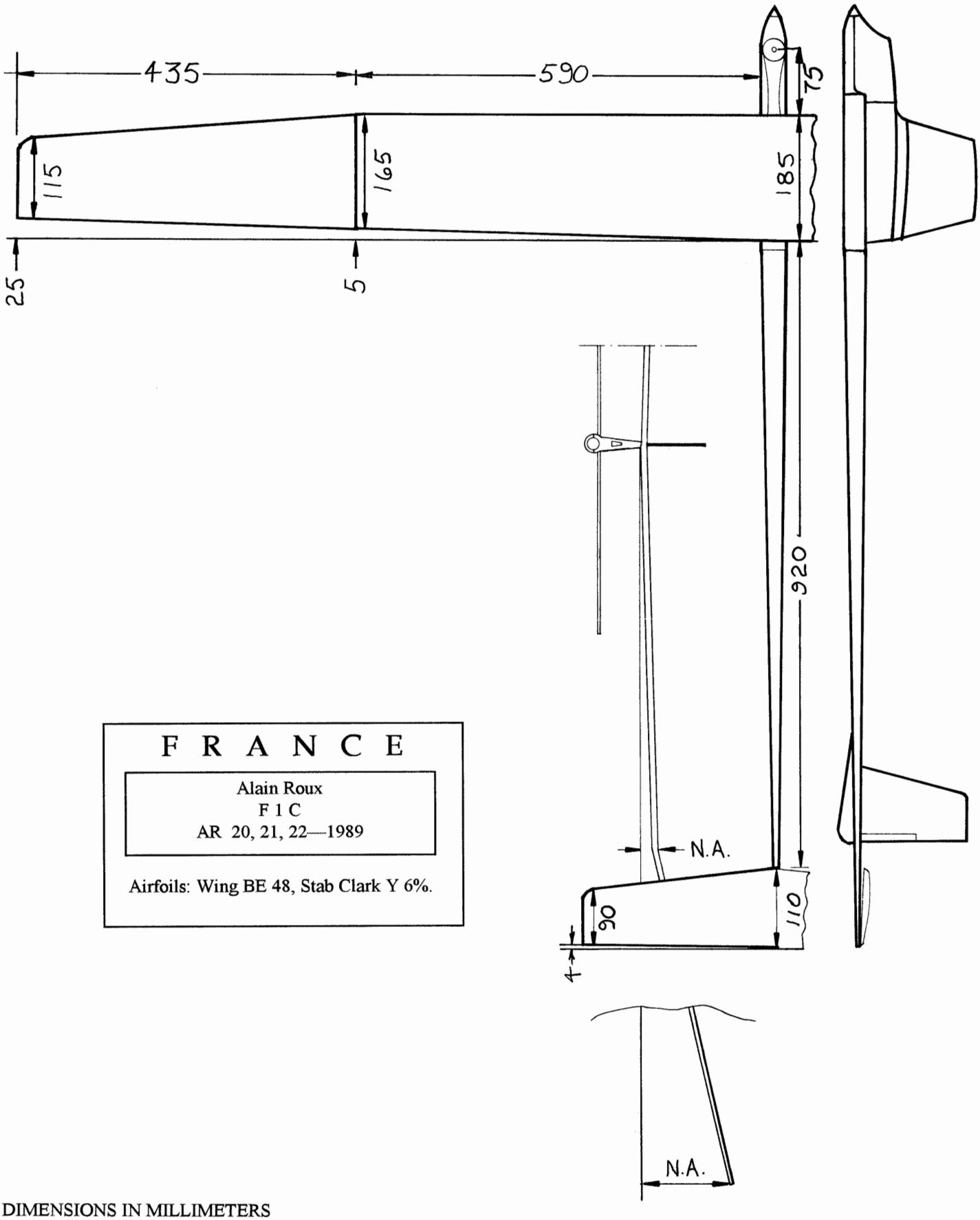
F R A N C E

Gauthier Briere
F 1 C GB No. 1

Wing:	30.78 dm2	280 g.
Stab.:	6.05 dm2	25 g.
Fuse.:		445 g.
Total:	38.83 dm2	750 g.

Scale: 1/6

DIMENSIONS IN MILLIMETERS

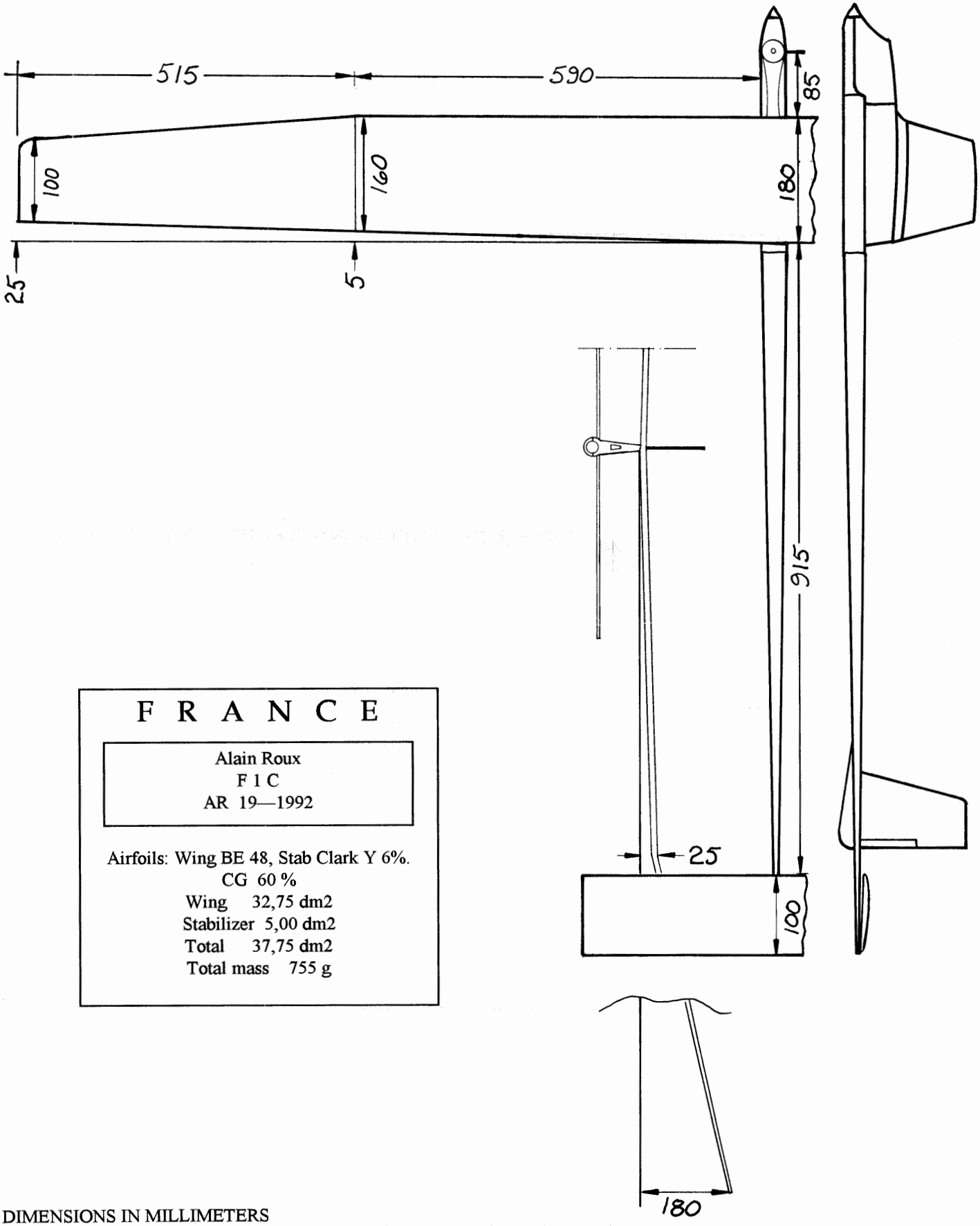


F R A N C E

Alain Roux
F 1 C
AR 20, 21, 22—1989

Airfoils: Wing BE 48, Stab Clark Y 6%.

DIMENSIONS IN MILLIMETERS



F R A N C E

Alain Roux
F 1 C
AR 19—1992

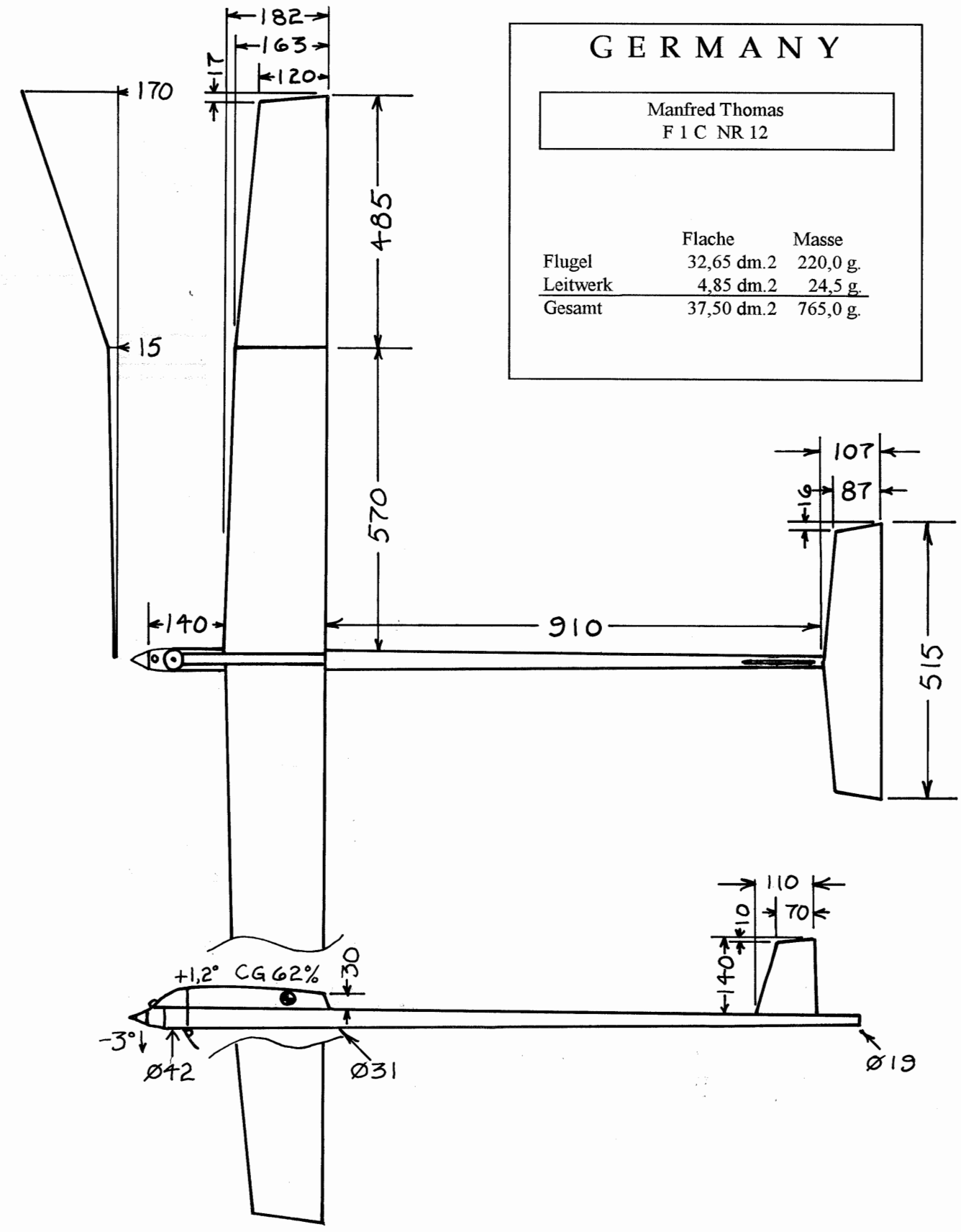
Airfoils: Wing BE 48, Stab Clark Y 6%.
CG 60 %
Wing 32,75 dm2
Stabilizer 5,00 dm2
Total 37,75 dm2
Total mass 755 g

DIMENSIONS IN MILLIMETERS

GERMANY

Manfred Thomas
F 1 C NR 12

	Flache	Masse
Flugel	32,65 dm.2	220,0 g.
Leitwerk	4,85 dm.2	24,5 g.
Gesamt	37,50 dm.2	765,0 g.



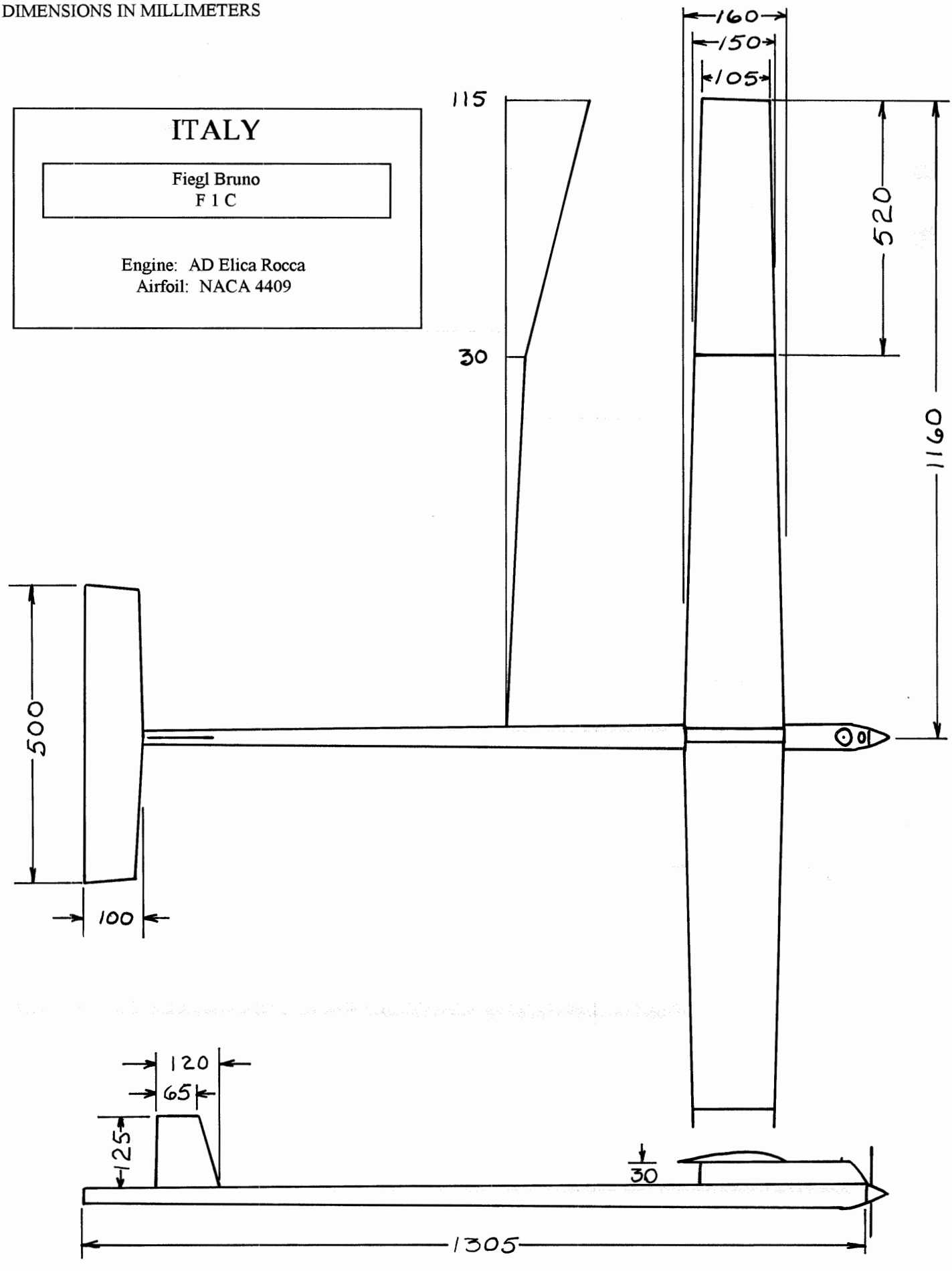
DIMENSIONS IN MILLIMETERS

DIMENSIONS IN MILLIMETERS

ITALY

Fiegl Bruno
F 1 C

Engine: AD Elica Rocca
Airfoil: NACA 4409

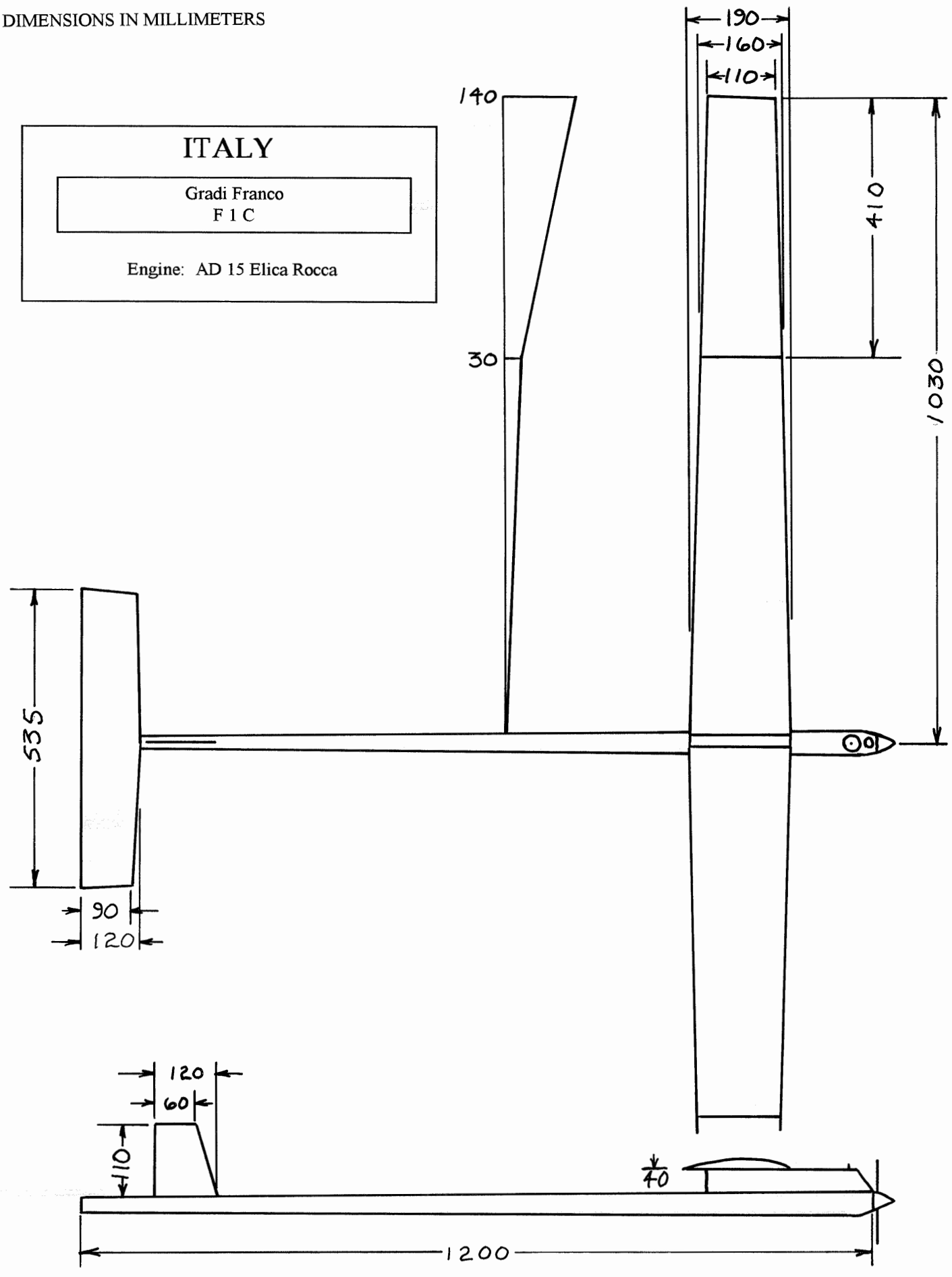


DIMENSIONS IN MILLIMETERS

ITALY

Gradi Franco
F 1 C

Engine: AD 15 Elica Rocca

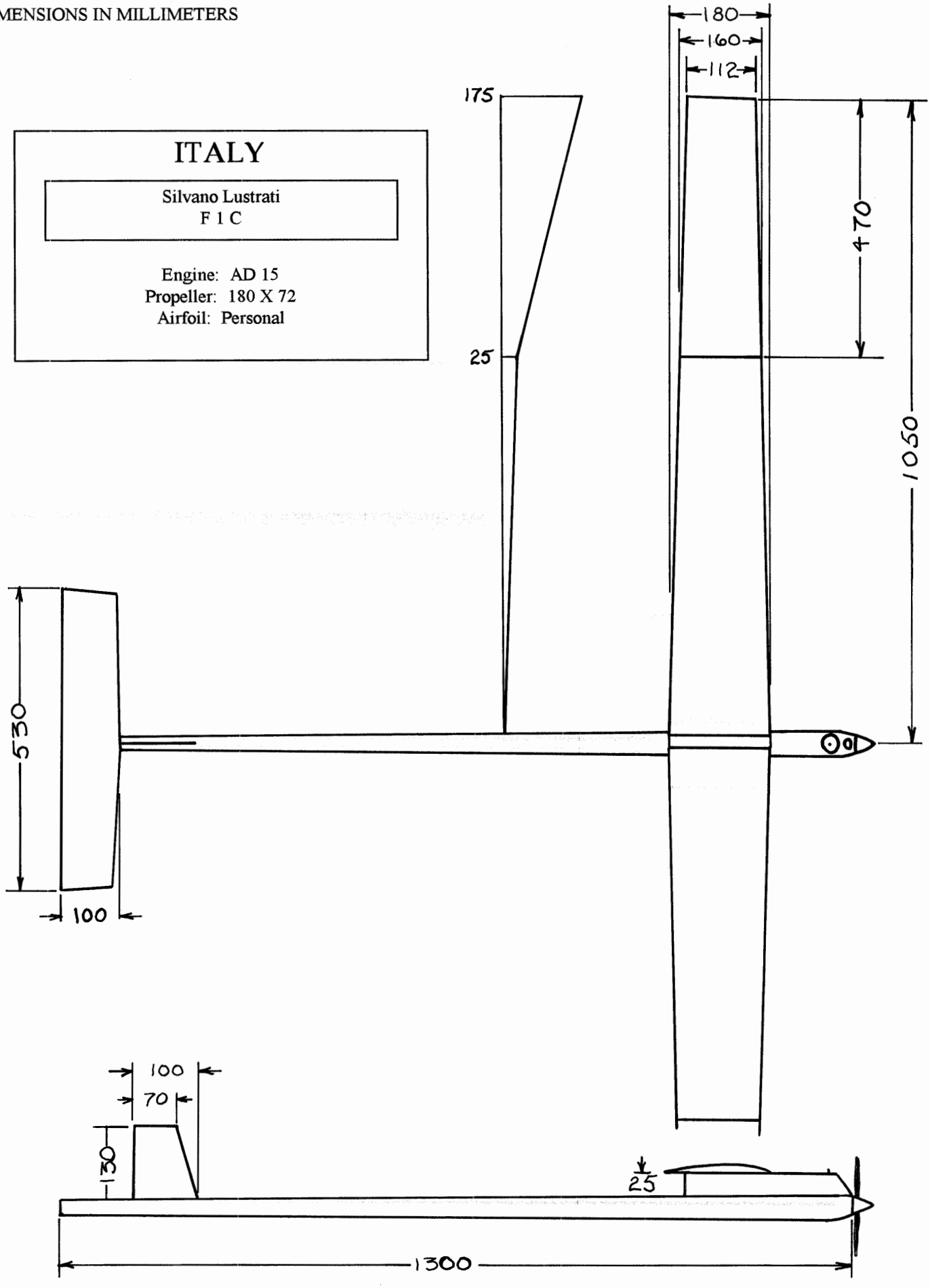


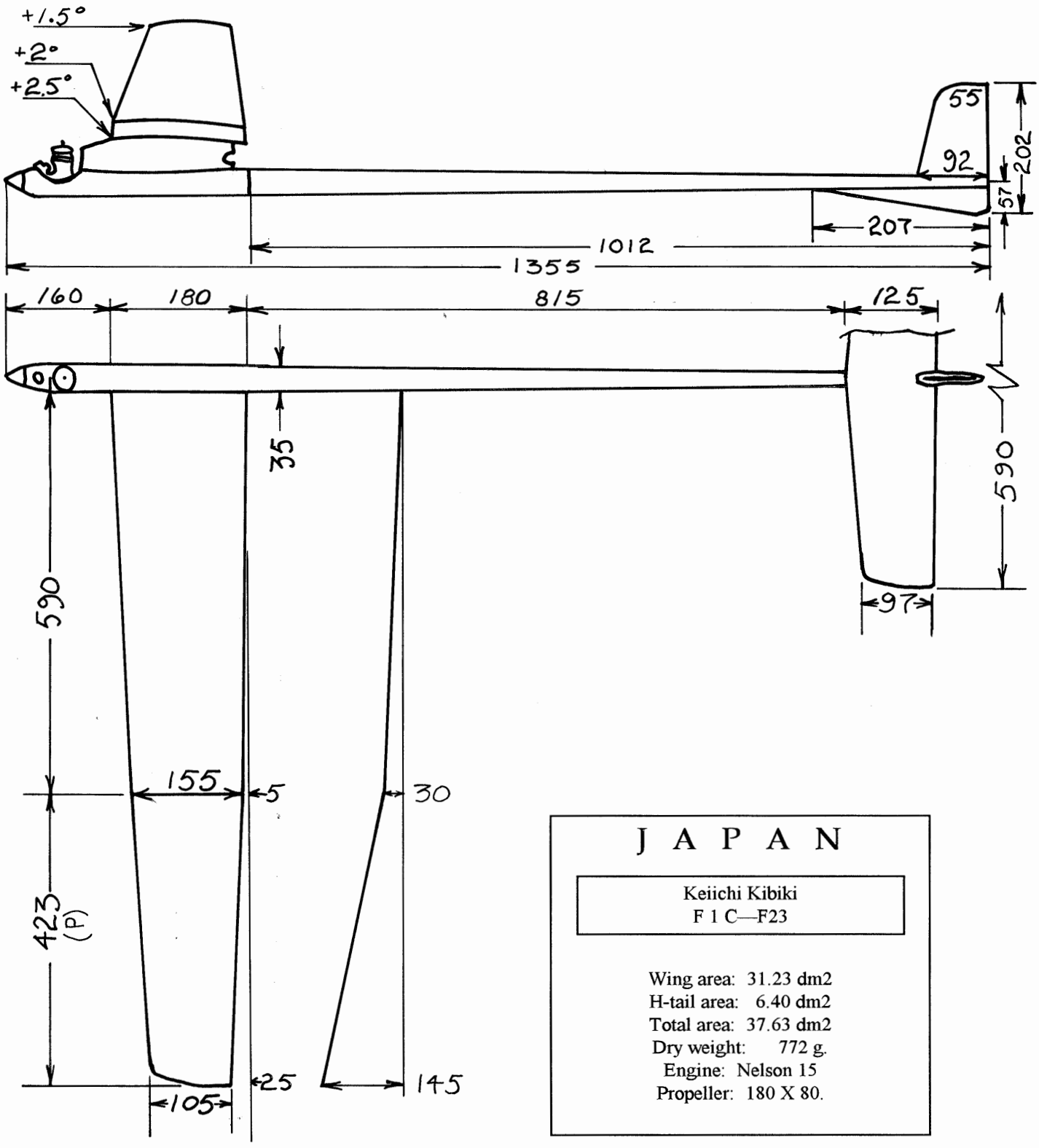
DIMENSIONS IN MILLIMETERS

ITALY

Silvano Lustrati
F 1 C

Engine: AD 15
Propeller: 180 X 72
Airfoil: Personal



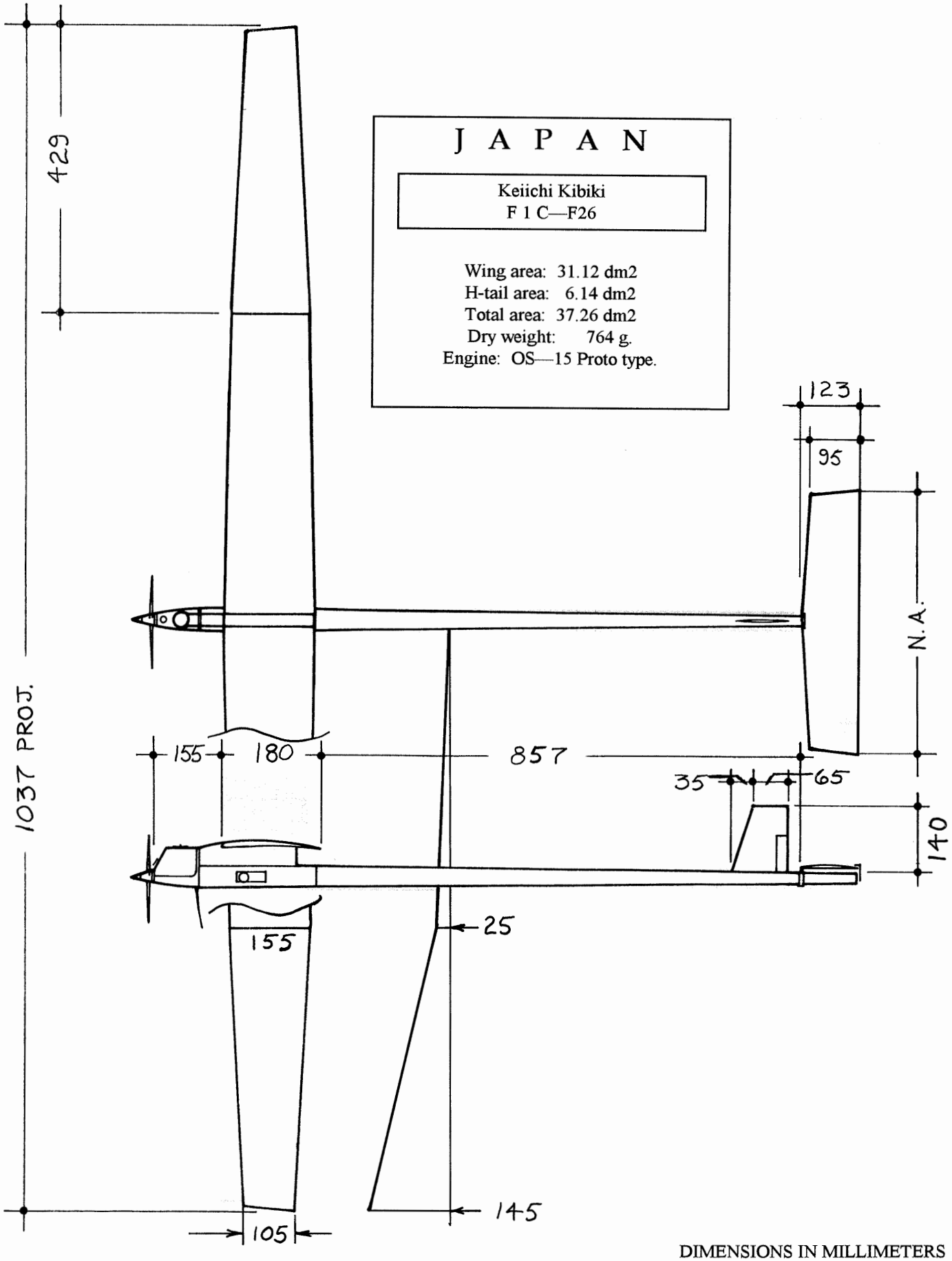


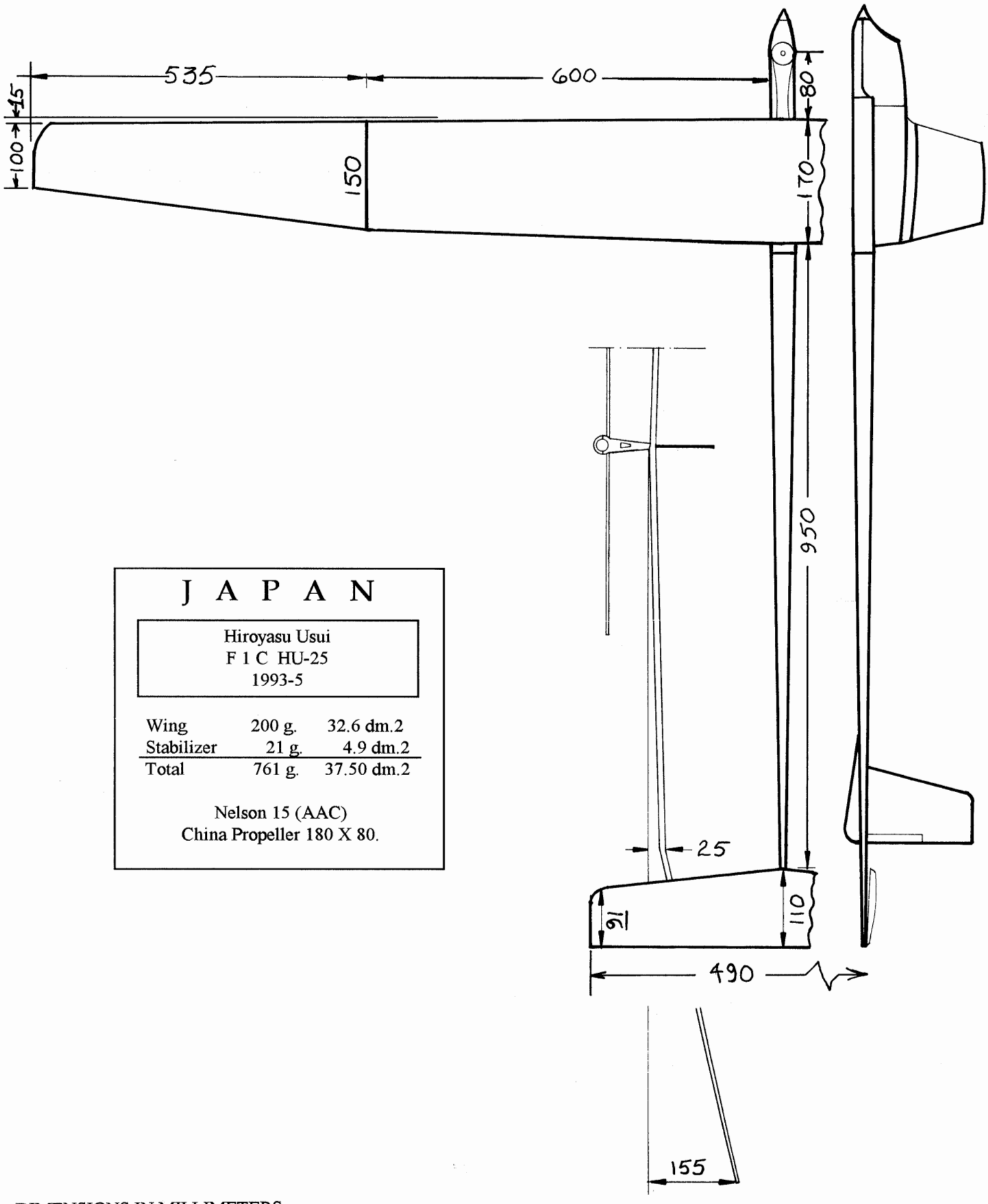
J A P A N

Keiichi Kibiki
F 1 C—F23

Wing area: 31.23 dm2
H-tail area: 6.40 dm2
Total area: 37.63 dm2
Dry weight: 772 g.
Engine: Nelson 15
Propeller: 180 X 80.

DIMENSIONS IN MILLIMETERS


JAPAN
Keiichi Kibiki
F 1 C—F26
Wing area: 31.12 dm2
H-tail area: 6.14 dm2
Total area: 37.26 dm2
Dry weight: 764 g.
Engine: OS—15 Proto type.
429
1037 PROJ.
123
95
N.A.
155
180
857
35
65
140
155
25
145
105
DIMENSIONS IN MILLIMETERS



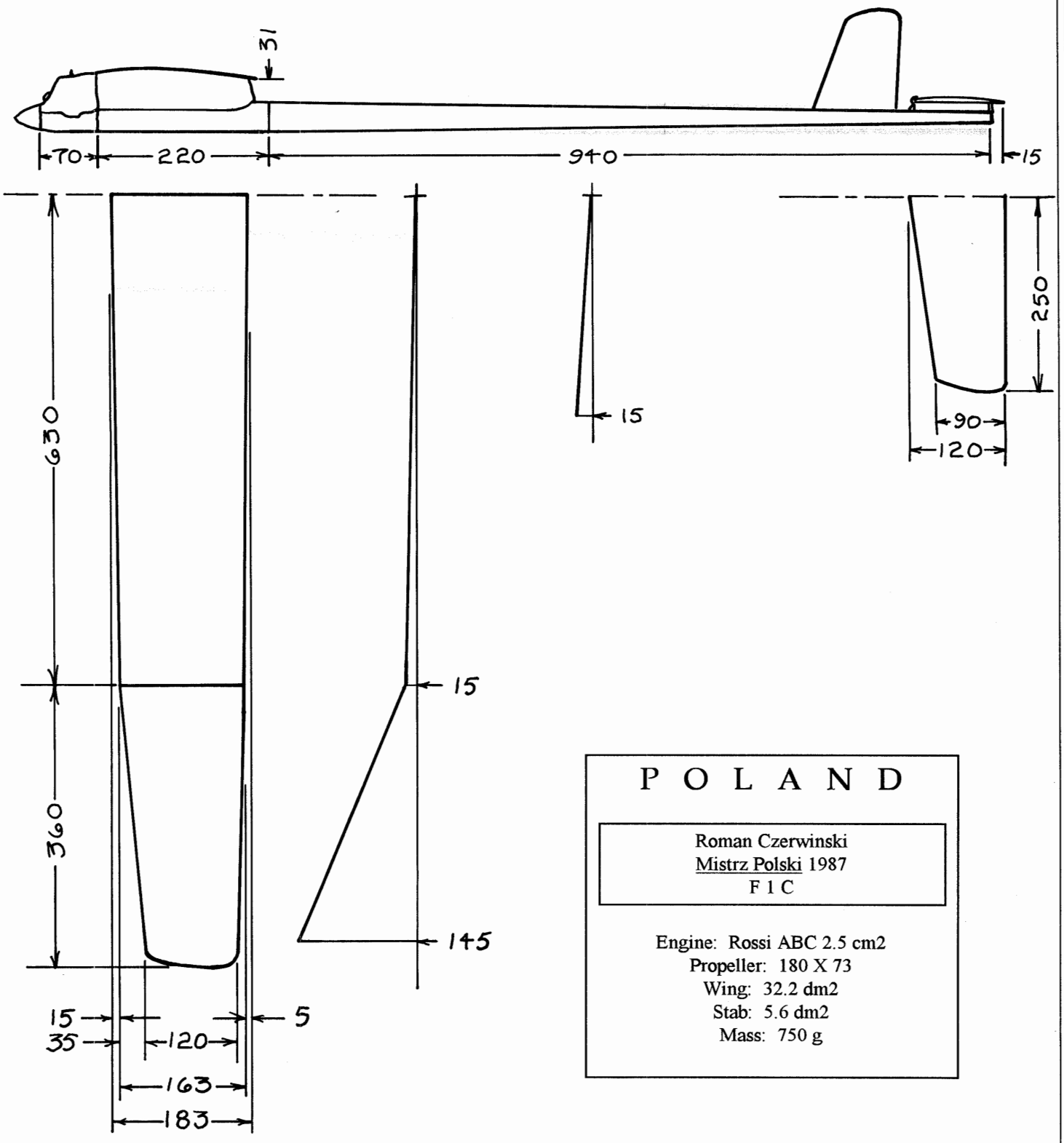
J A P A N

Hiroyasu Usui
F 1 C HU-25
1993-5

Wing	200 g.	32.6 dm.2
Stabilizer	21 g.	4.9 dm.2
Total	761 g.	37.50 dm.2

Nelson 15 (AAC)
China Propeller 180 X 80.

DIMENSIONS IN MILLIMETERS

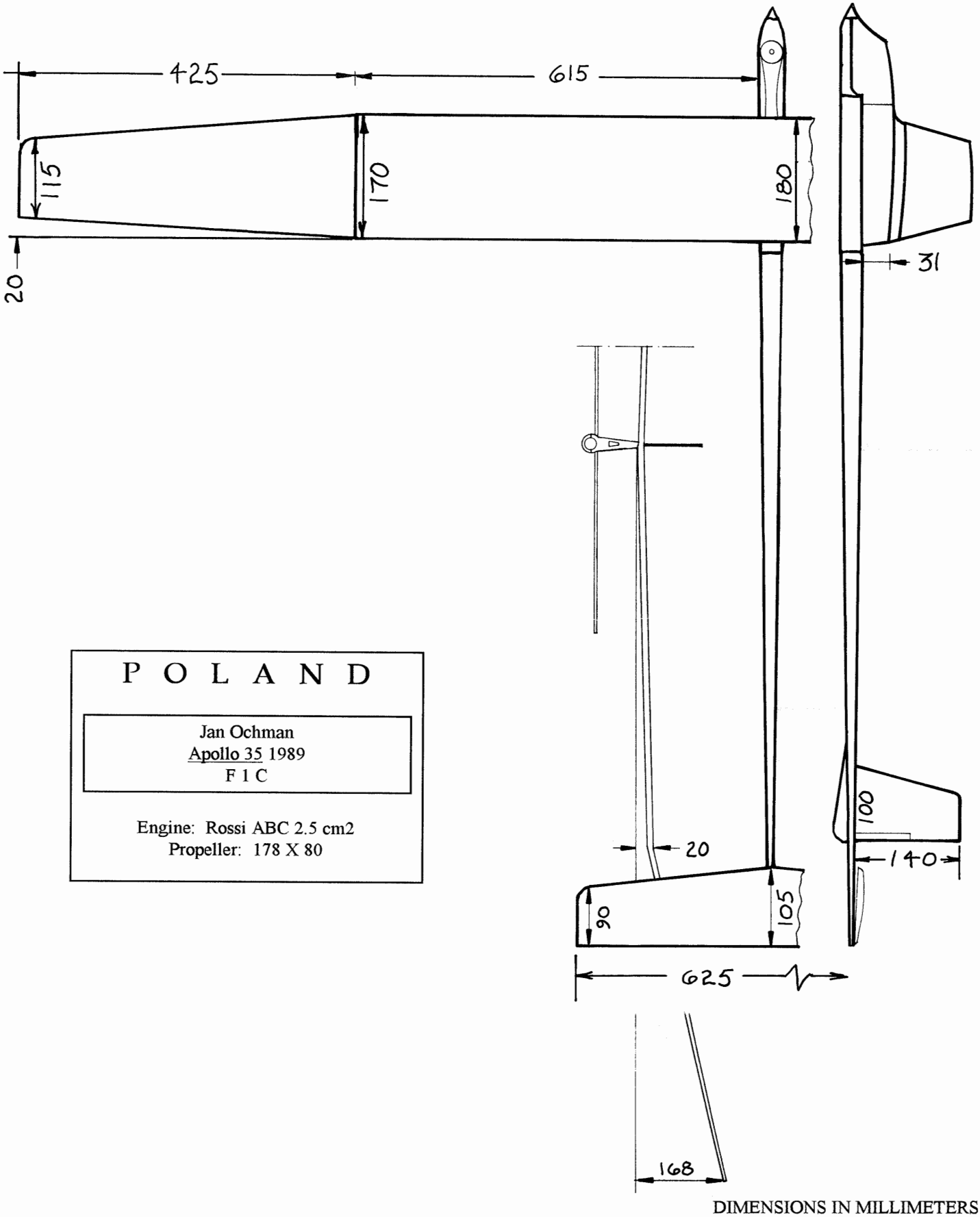


P O L A N D

Roman Czerwinski
Mistrz Polski 1987
F 1 C

Engine: Rossi ABC 2.5 cm2
Propeller: 180 X 73
Wing: 32.2 dm2
Stab: 5.6 dm2
Mass: 750 g

DIMENSIONS IN MILLIMETERS

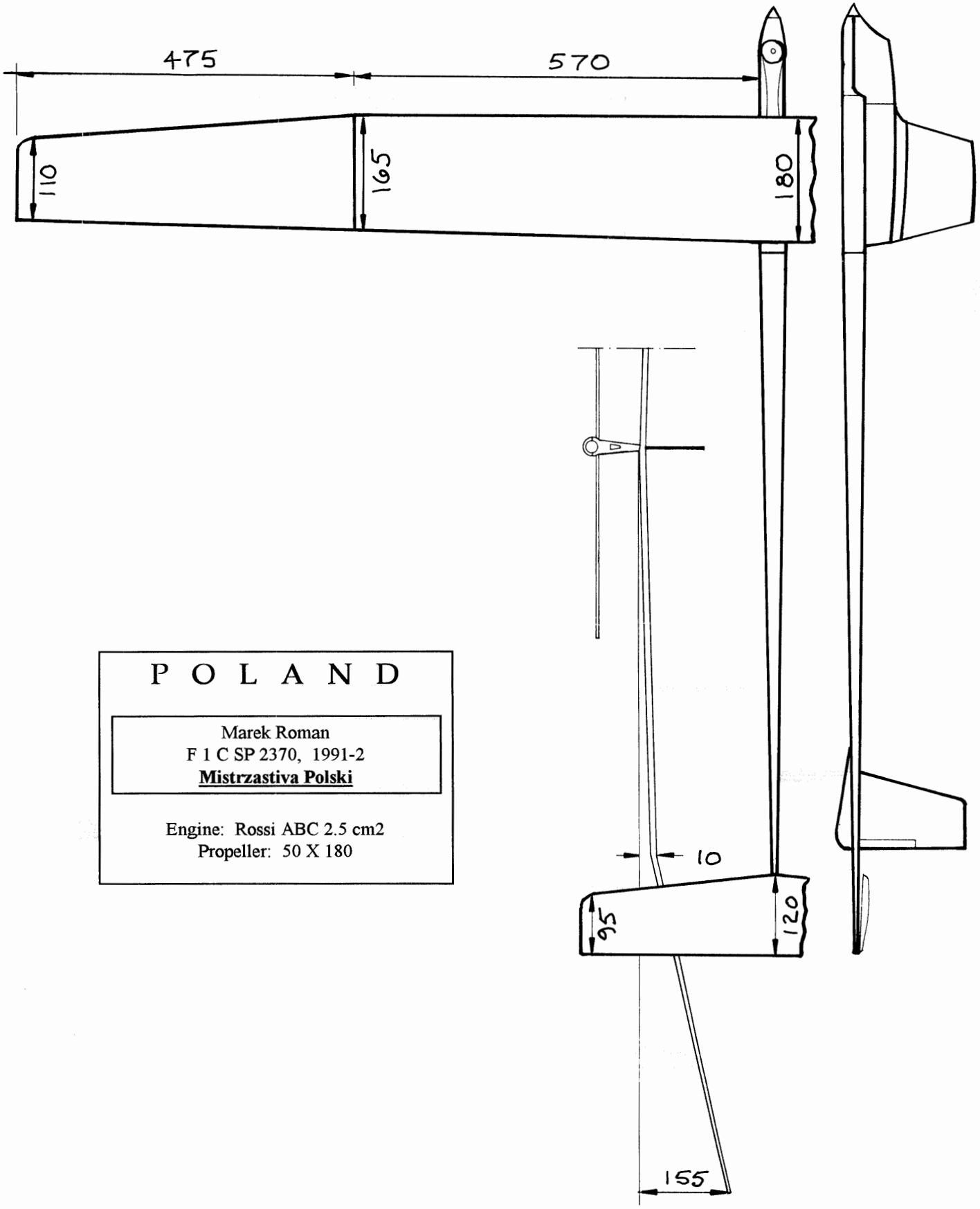


P O L A N D

Jan Ochman
Apollo 35 1989
F 1 C

Engine: Rossi ABC 2.5 cm2
Propeller: 178 X 80

DIMENSIONS IN MILLIMETERS

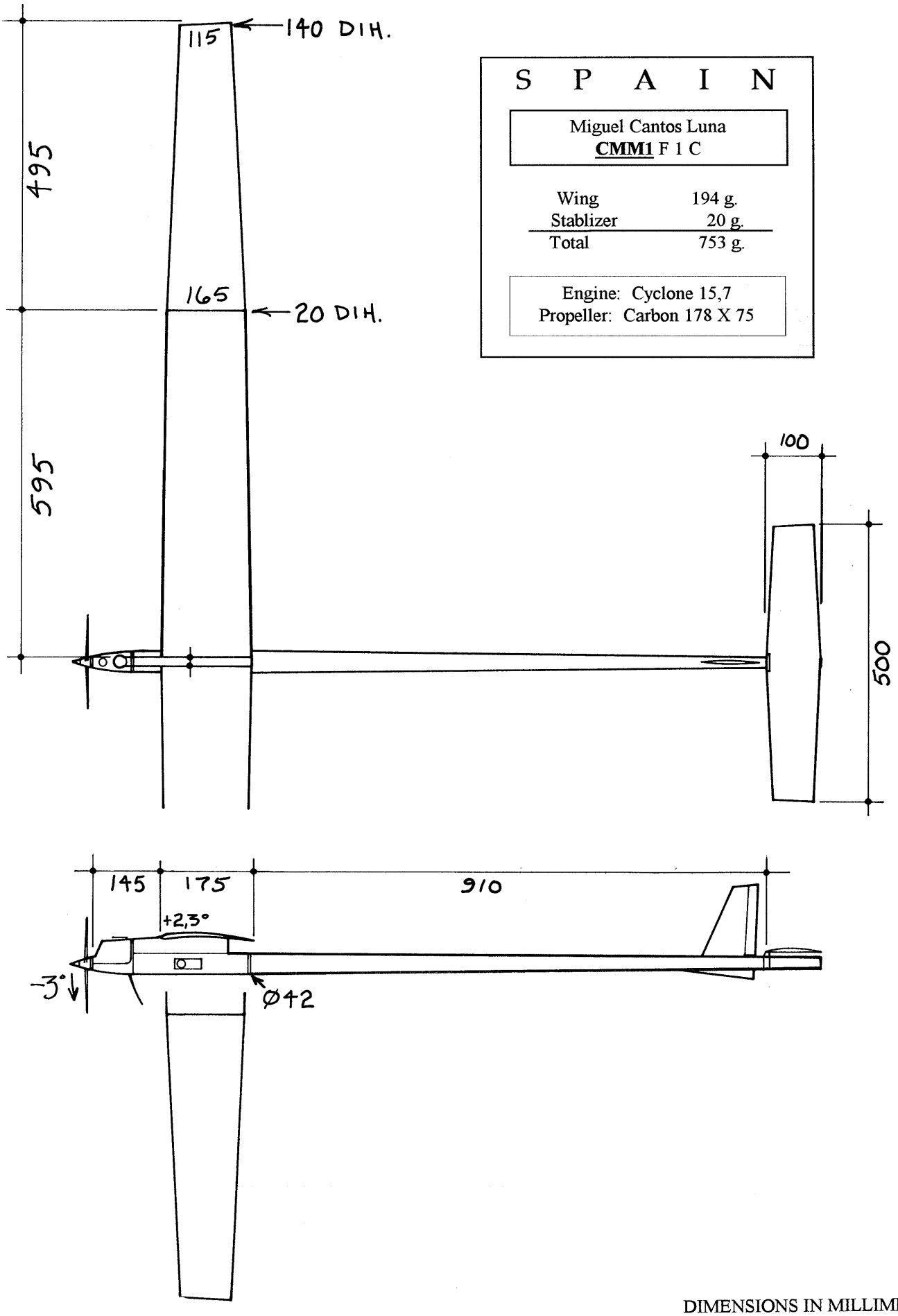


P O L A N D

Marek Roman
F 1 C SP 2370, 1991-2
Mistrzastiva Polski

Engine: Rossi ABC 2.5 cm2
Propeller: 50 X 180

DIMENSIONS IN MILLIMETERS



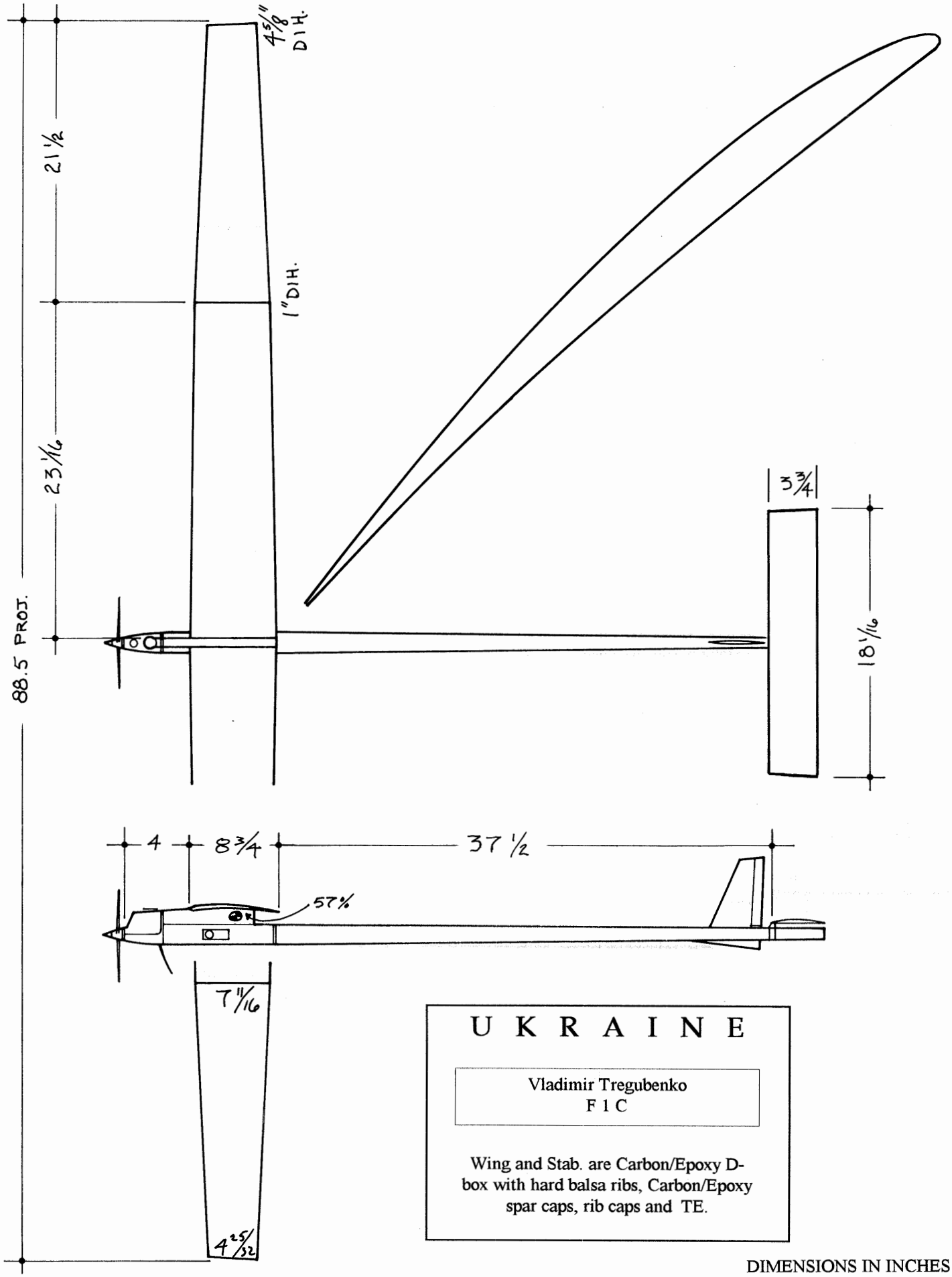
S P A I N

Miguel Cantos Luna
CMM1 F 1 C

Wing	194 g.
Stablizer	20 g.
Total	753 g.

Engine: Cyclone 15,7
Propeller: Carbon 178 X 75

DIMENSIONS IN MILLIMETERS

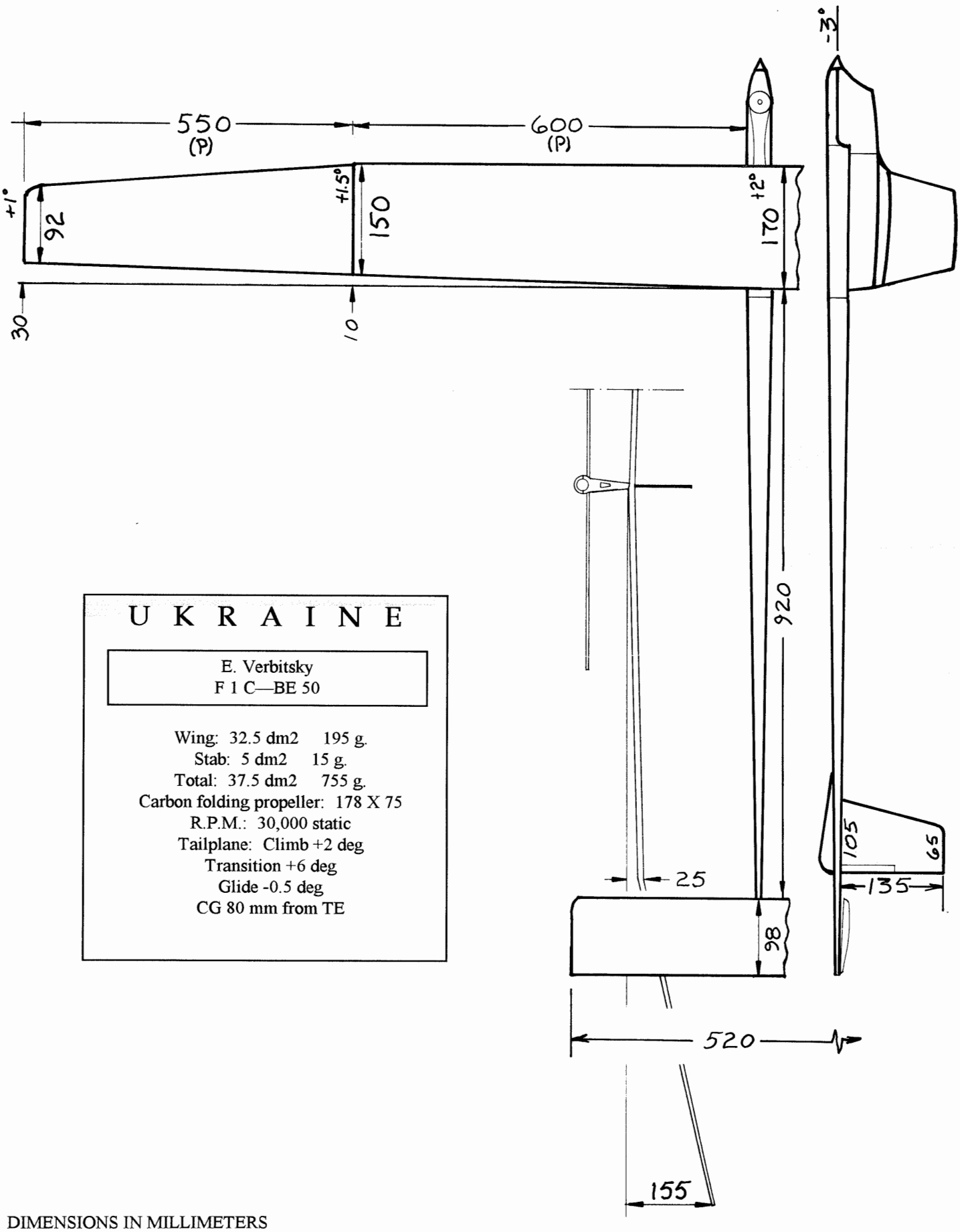


U K R A I N E

Vladimir Tregubenko
F 1 C

Wing and Stab. are Carbon/Epoxy D-box with hard balsa ribs, Carbon/Epoxy spar caps, rib caps and TE.

DIMENSIONS IN INCHES

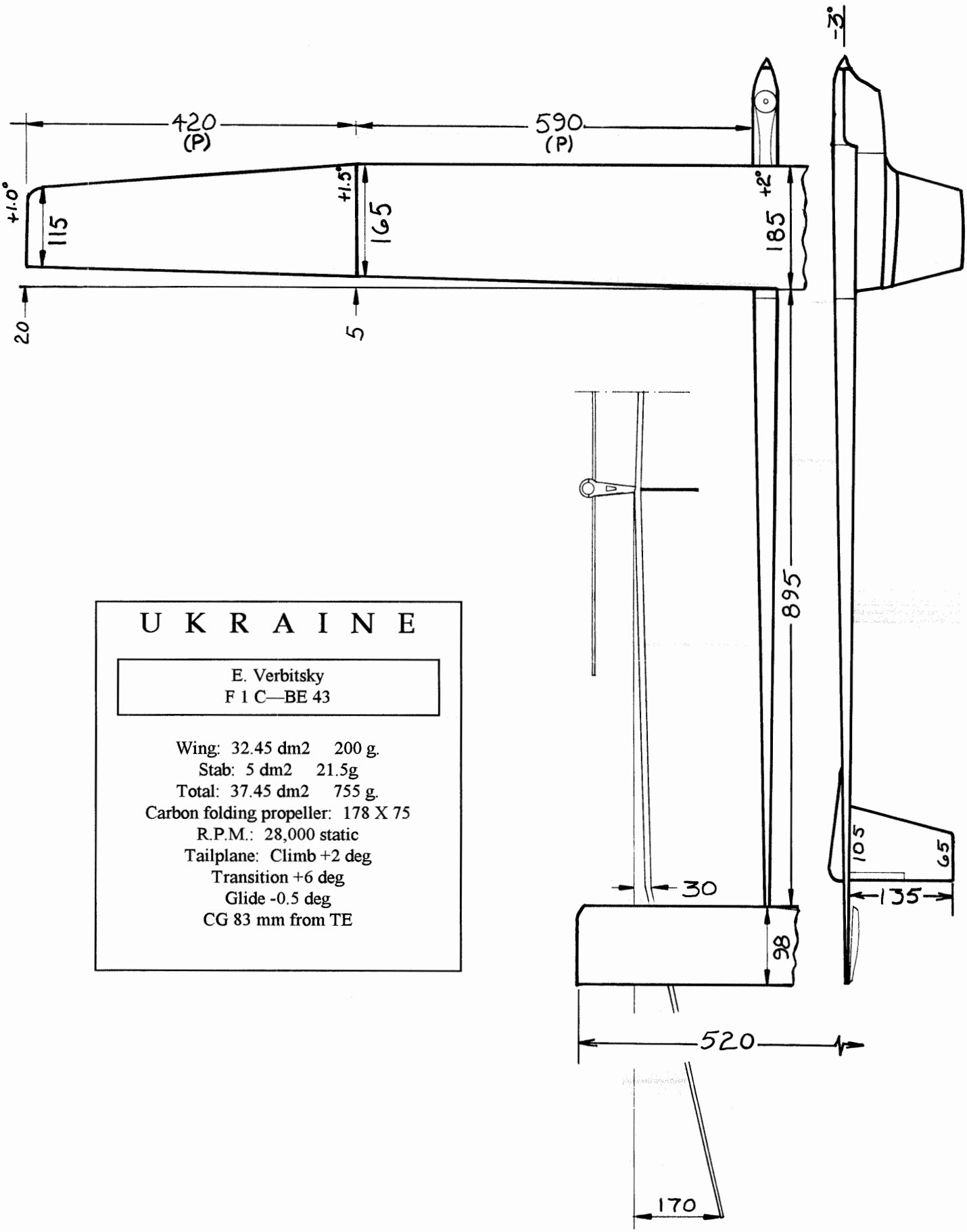


U K R A I N E

E. Verbitsky
F 1 C—BE 50

Wing: 32.5 dm2 195 g.
Stab: 5 dm2 15 g.
Total: 37.5 dm2 755 g.
Carbon folding propeller: 178 X 75
R.P.M.: 30,000 static
Tailplane: Climb +2 deg
Transition +6 deg
Glide -0.5 deg
CG 80 mm from TE

DIMENSIONS IN MILLIMETERS

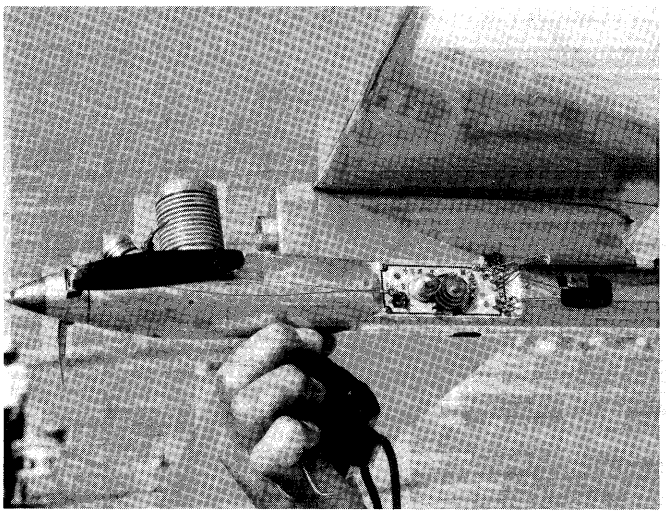


U K R A I N E

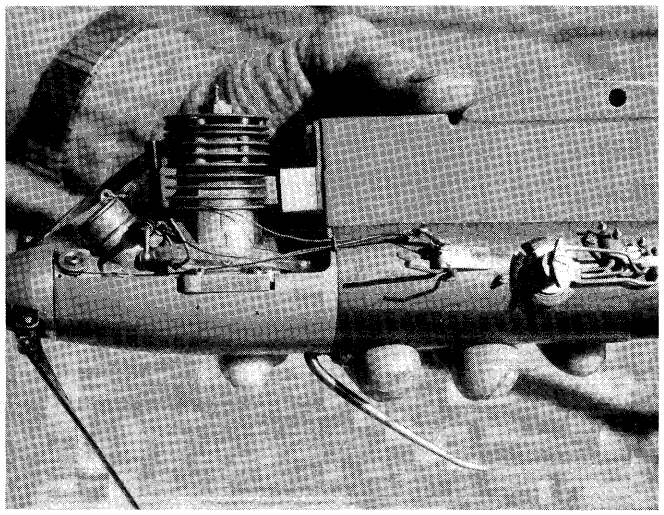
E. Verbitsky
F 1 C—BE 43

Wing: 32.45 dm2 200 g.
Stab: 5 dm2 21.5g
Total: 37.45 dm2 755 g.
Carbon folding propeller: 178 X 75
R.P.M.: 28,000 static
Tailplane: Climb +2 deg
Transition +6 deg
Glide -0.5 deg
CG 83 mm from TE

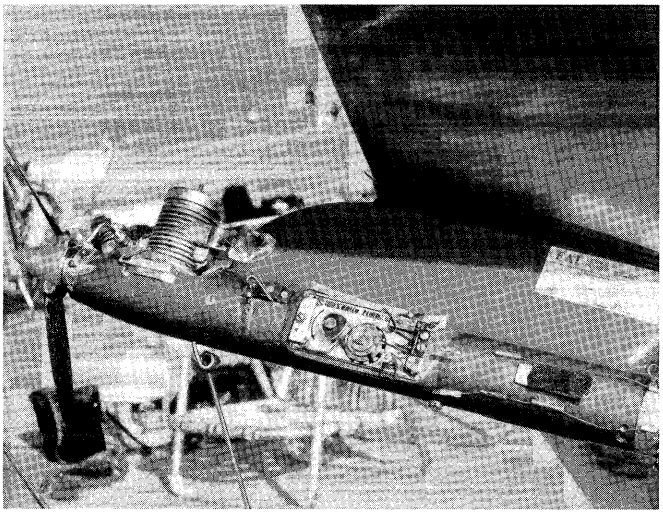
DIMENSIONS IN MILLIMETERS



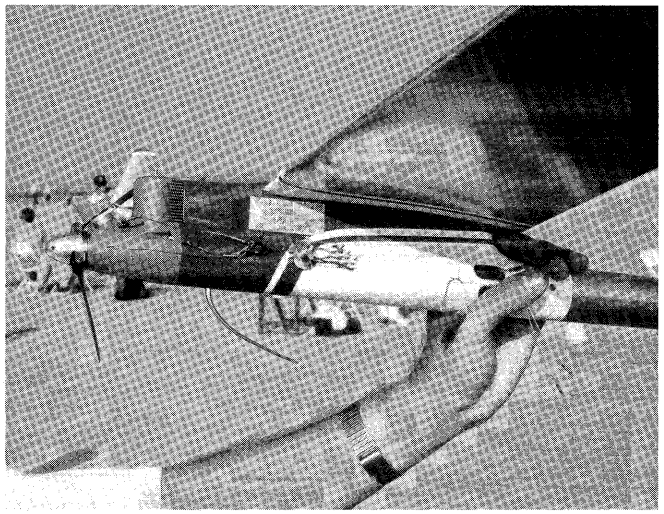
Above: Tu, China.



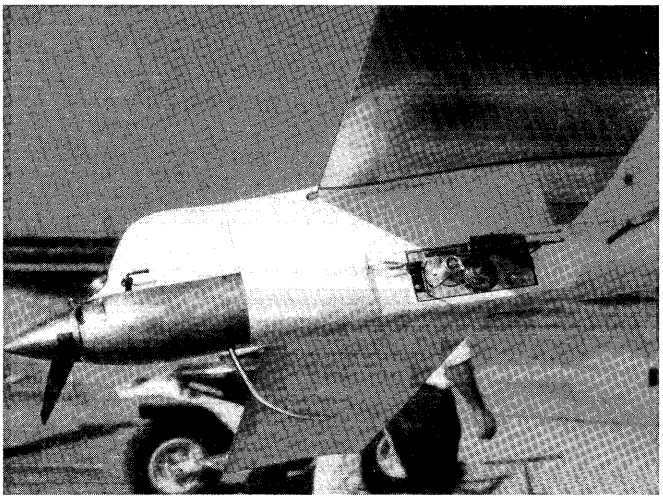
Above: Eugeny Verbitsky, Ukraine.



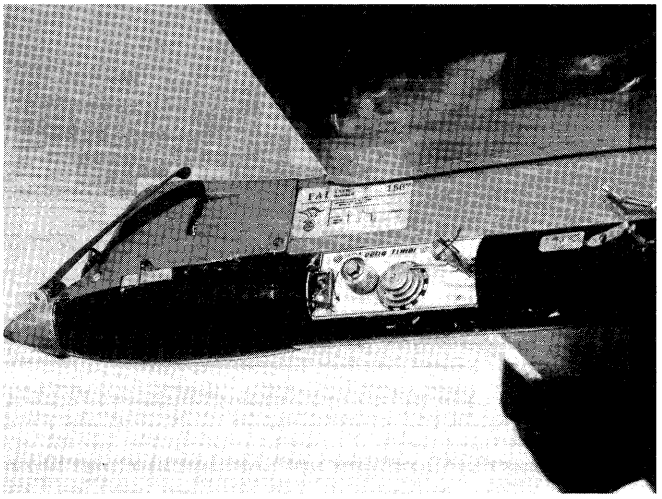
Above: Gunnar Agren, Sweden



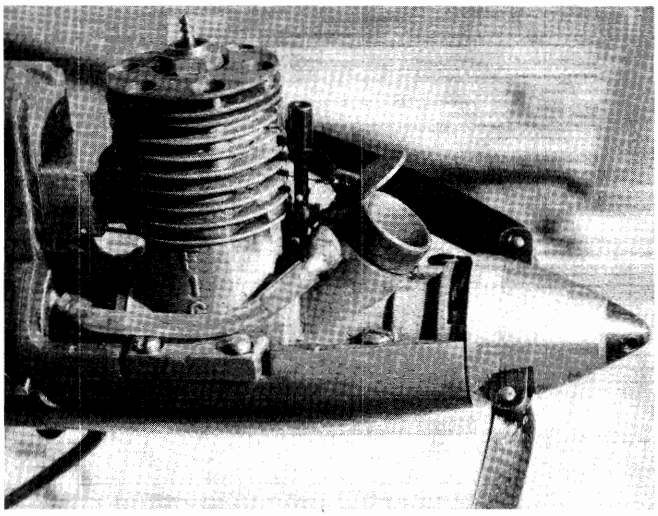
Above: Leonid Fouseev, Russia.

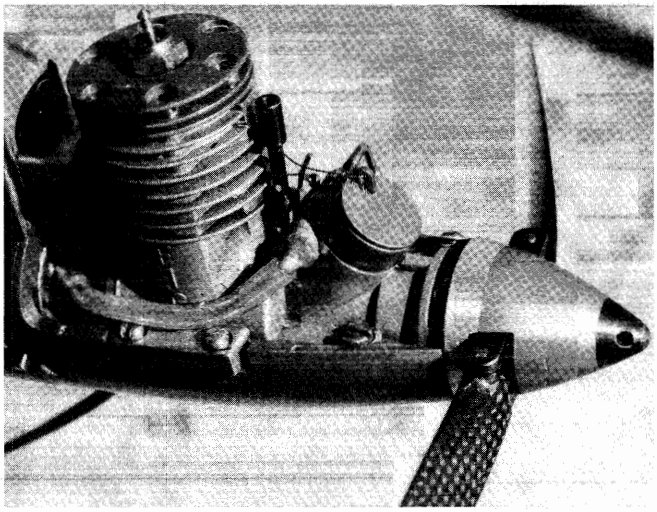


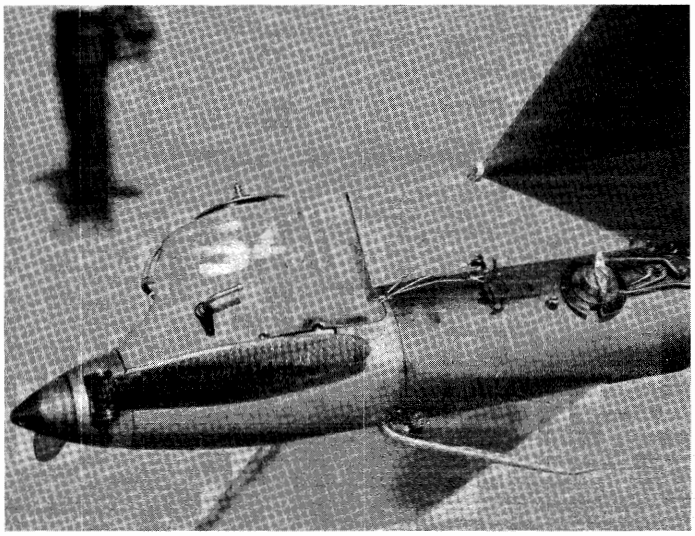
Above: Doug Galbreath, USA.



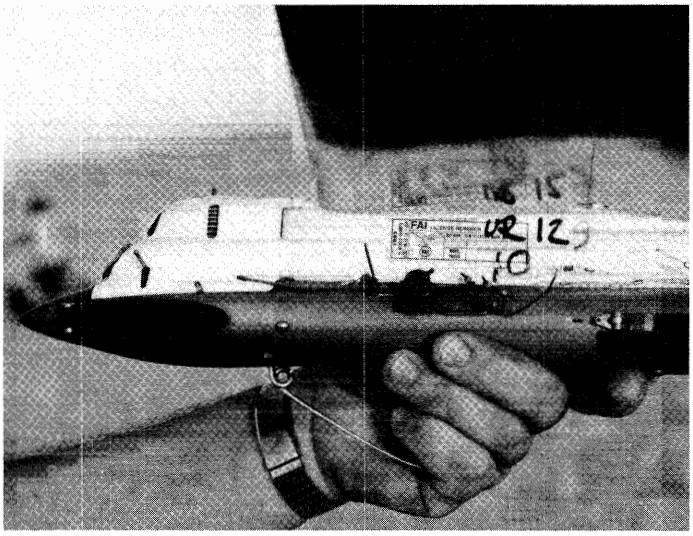
Above: Bruno Fiegl, Italy.

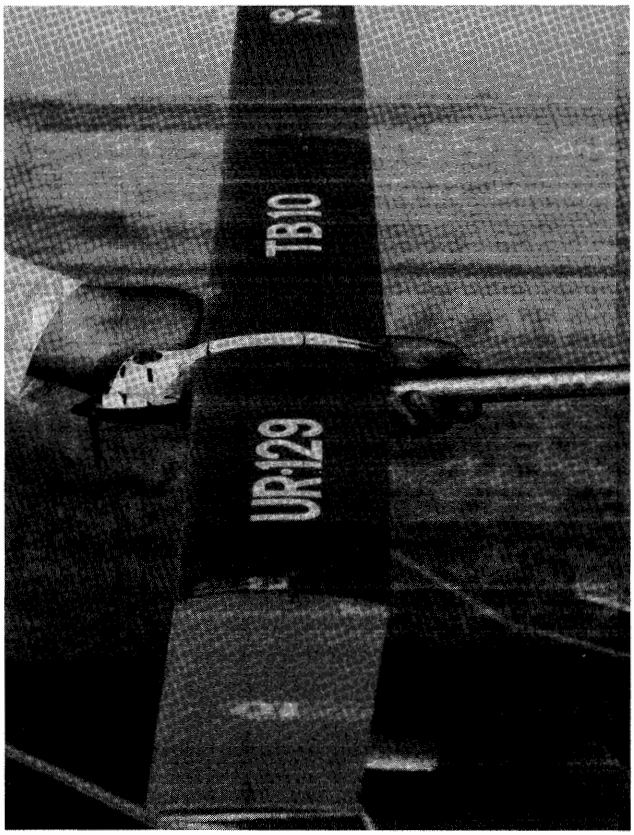


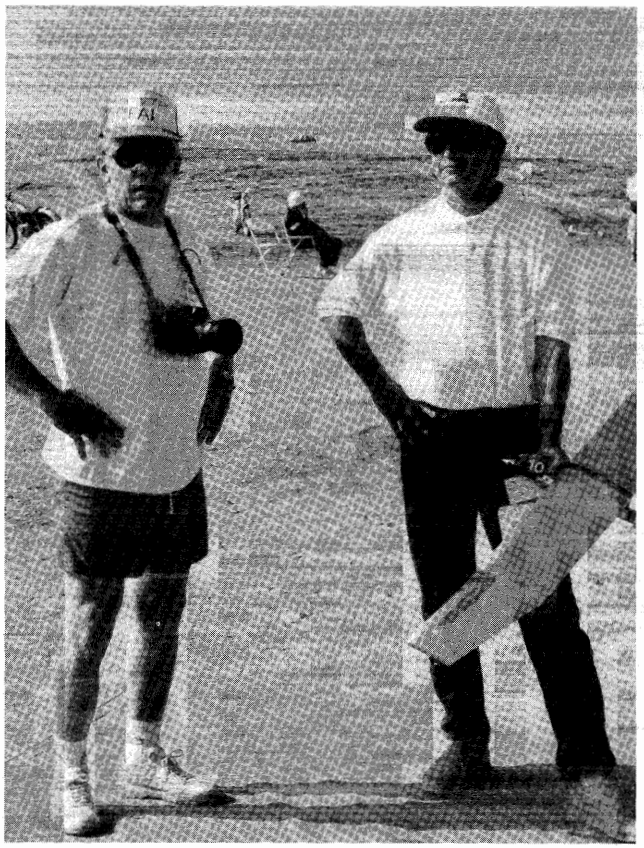




Above Left: Eugeny Verbitsky, Ukraine.
Above: E. Verbitsky.
Left: E. Verbitsky.
Below Left: Vladimir Tregubenko, Ukraine.
Below: V. Tregubenko.

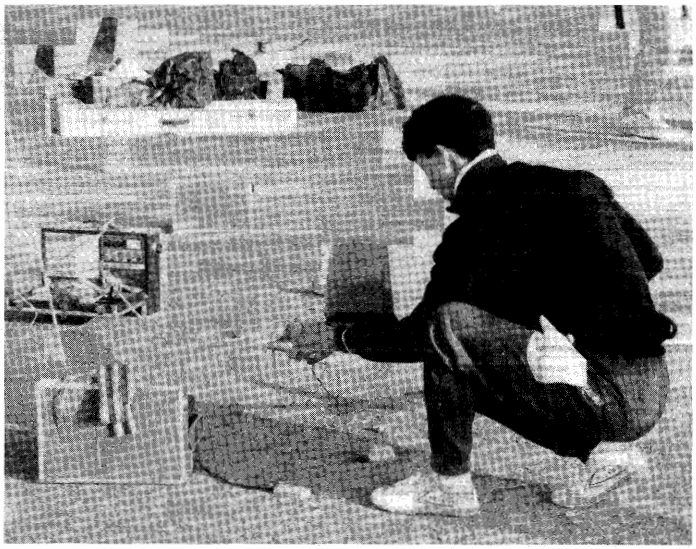






Above: Sandy Pimenoff and Randy Archer.
Below: Alain Roux, France.

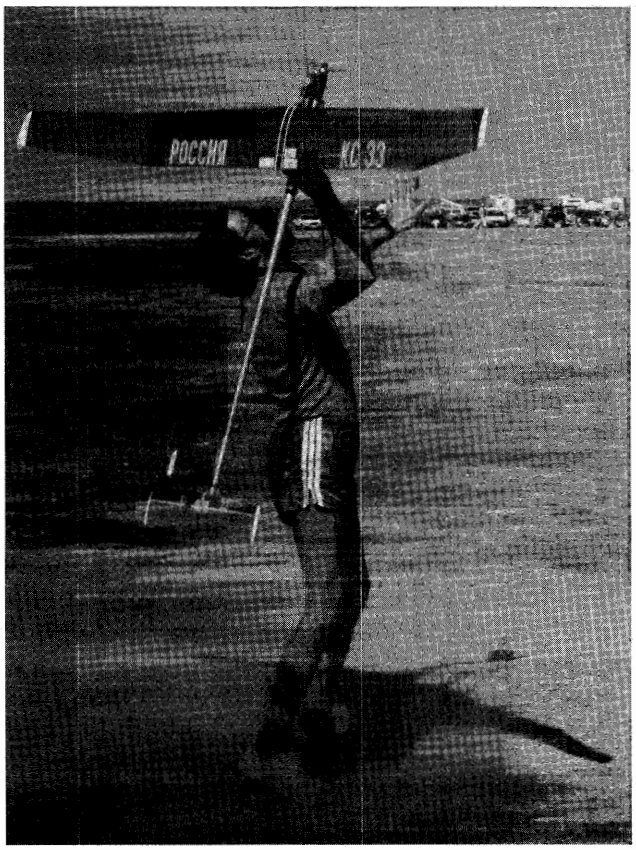




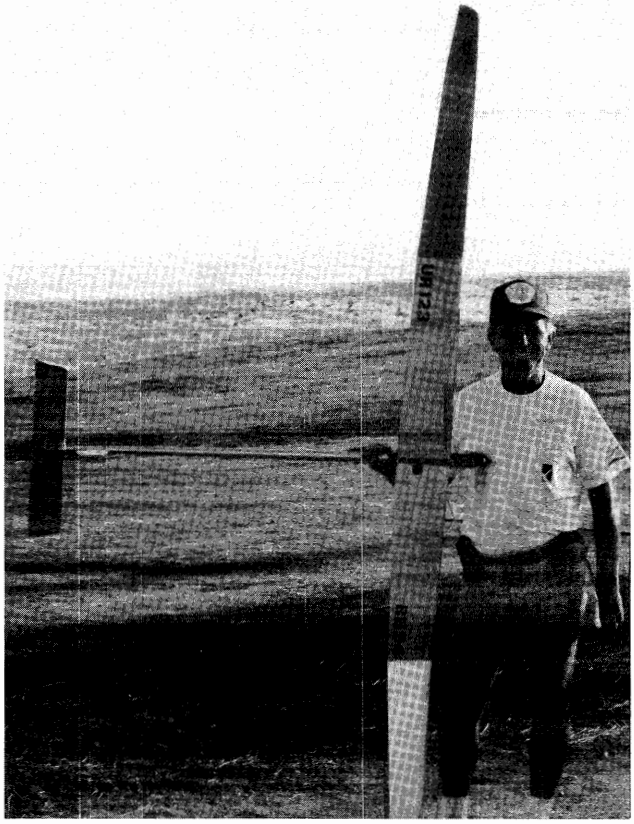
Above: D. Wang, China.
Below: Jan Ochman, Poland.
Far Below: Sergey Korban, Russia.





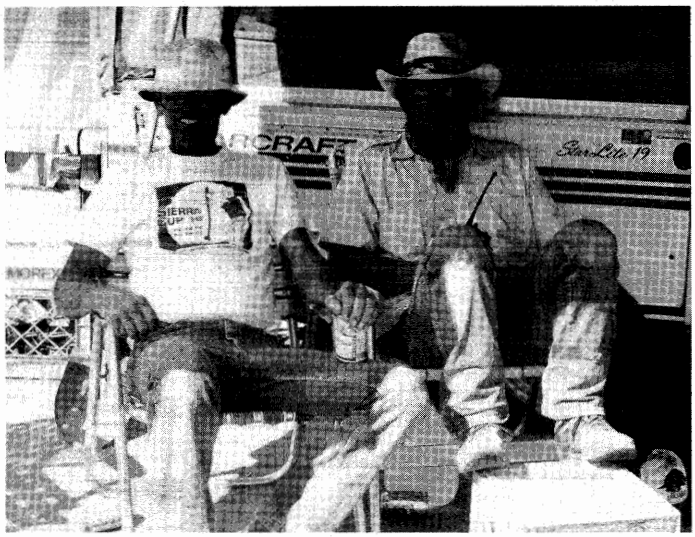


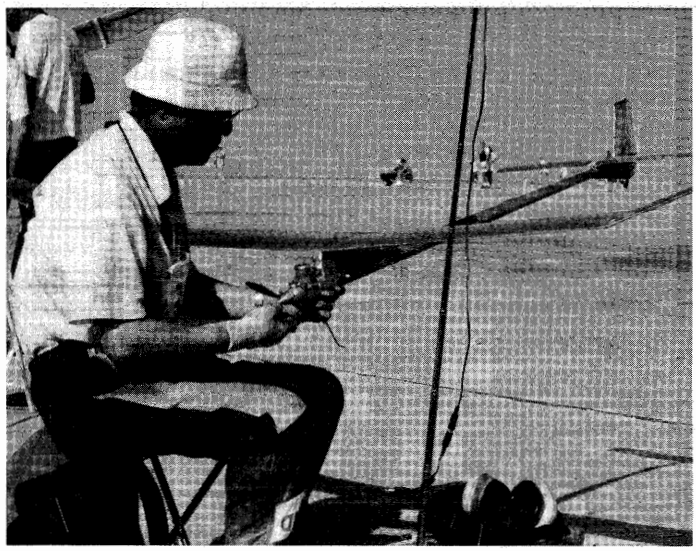
Above: Sergey Korban, Russia.
Below: Eugeny Verbitsky, Ukraine.

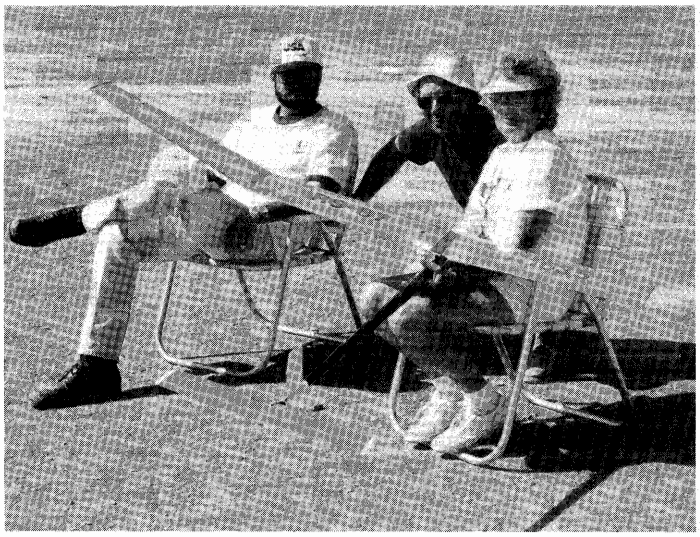




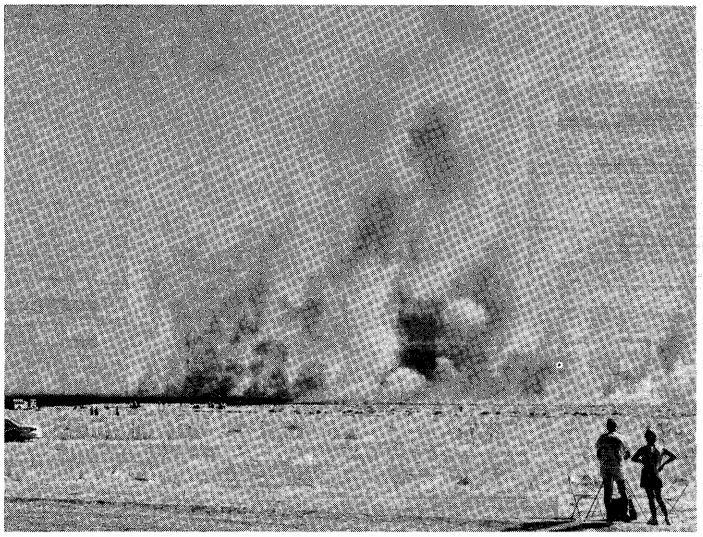
Above: Alexander Mikheilenko, Russia.
Below: Ken Oliver and Russell Hartill.
Far Below: Koei Tsuda, Australia.



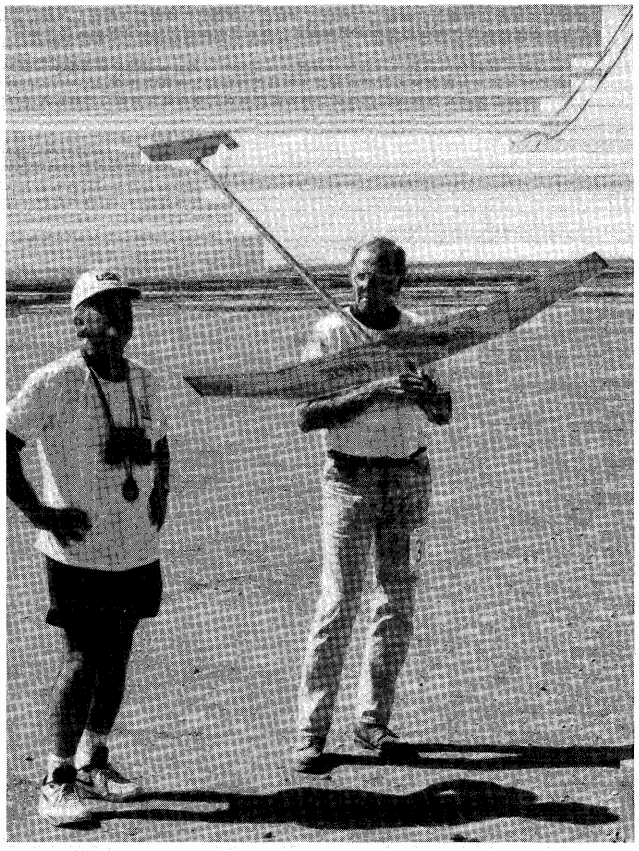




Above: Ralda and Lance Simpson.
Below: Fire.
Far Below: Mrs. Zsengller.







Above: Sandy Pimenoff and Roger Simpson.
Below: Gabor Zsengller.



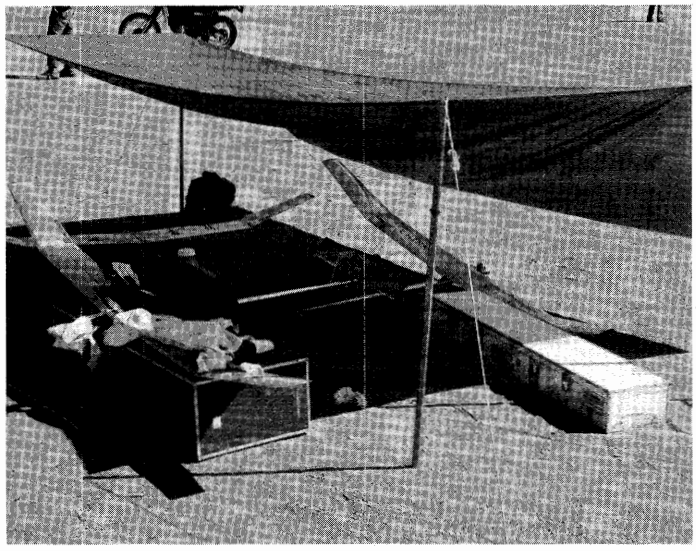


Above: Ukraine F 1 C Team.
Below: Leonid Fouseev, Russia.
Far Below: Little China.





Above: B. Boutiller, France.
Below: Phil and Anthony Ball, United Kingdom.









Above: Randy Archer, USA.
Below: Lindgen, Finland.
Far Below: Daughter and translator of Silvano Lustrati, Italy.

Above: Alain Roux, France.
Below: Vladimir Tregubenko, Ukraine.

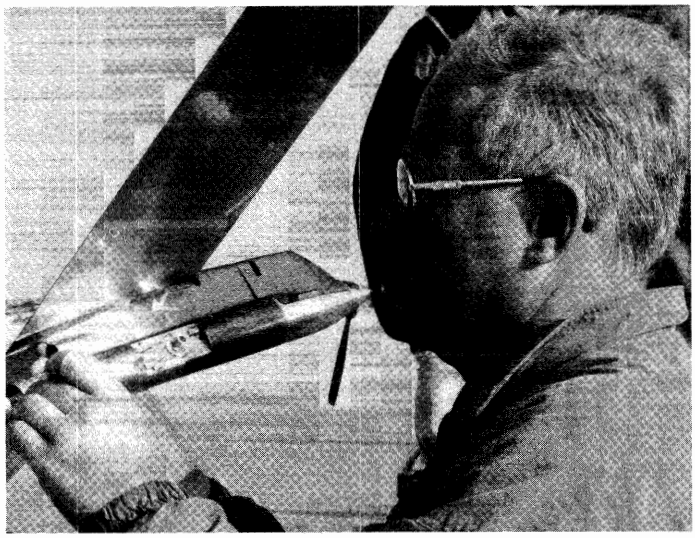








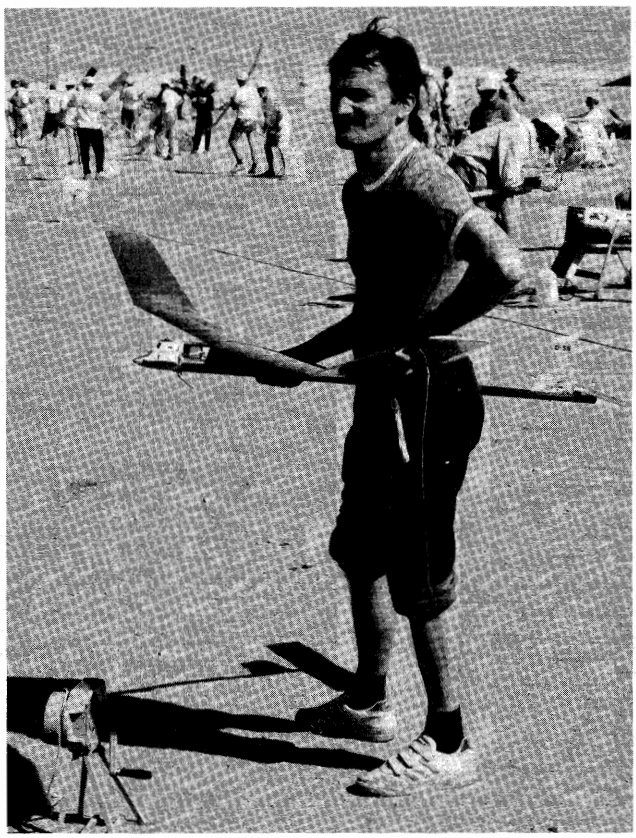
Above: Reinhard Truppe, Austria.
Below: R. Truppe.
Far Below: Y. Saki.

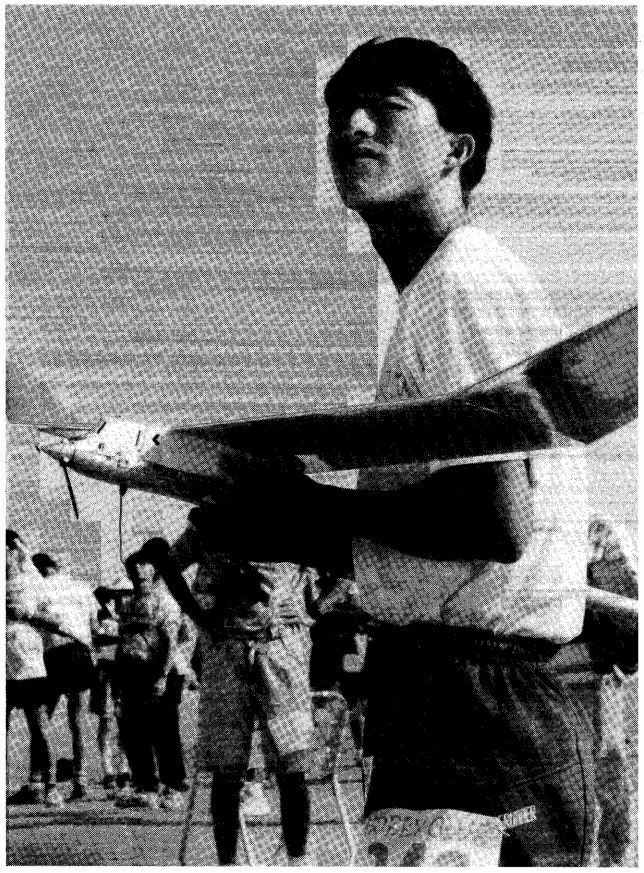






Above: Yama Saki, Japan.
Below: R. Limberger, Germany.





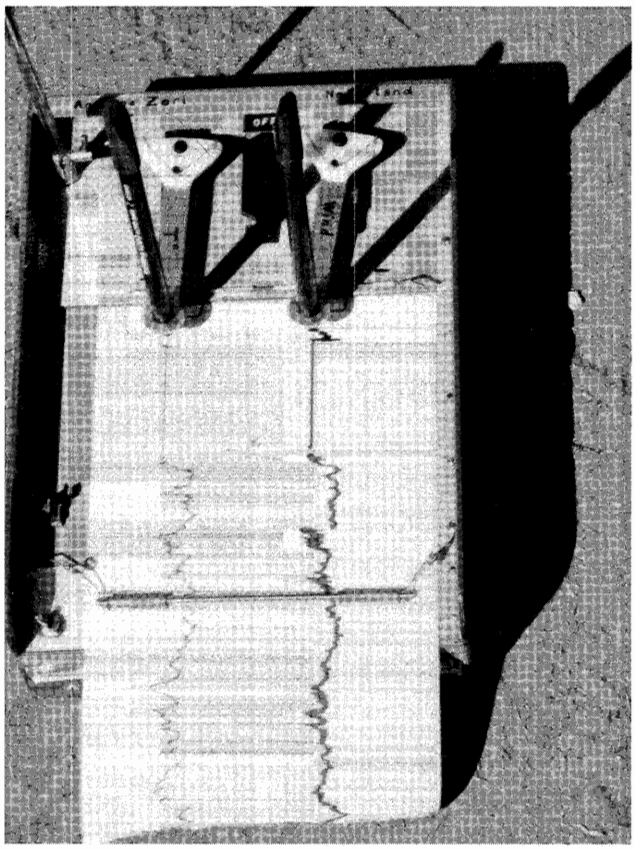
Above: D. Wang, China. Below: Tu, China.

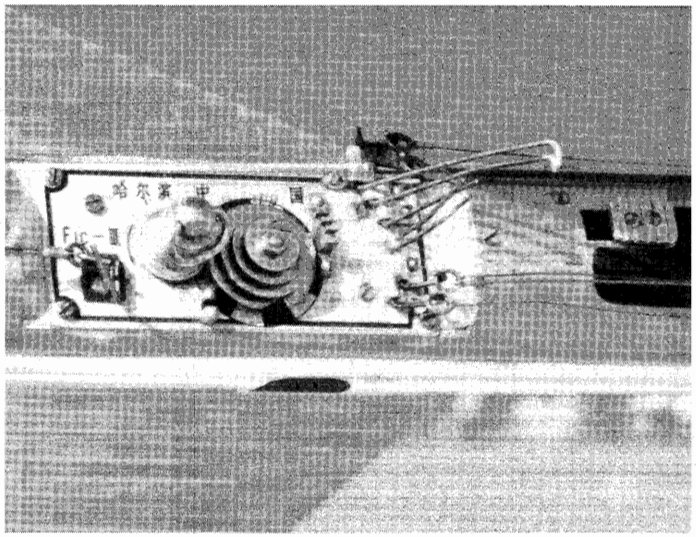


Above: Ed Keck, USA. Below: Muradian, Armenia.

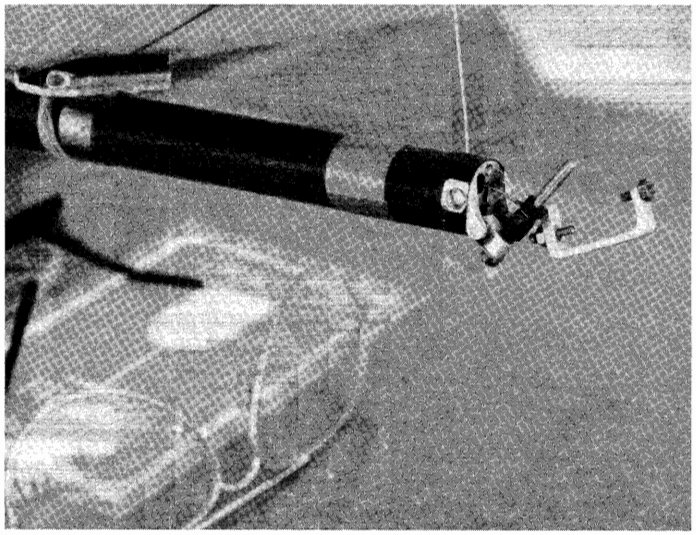


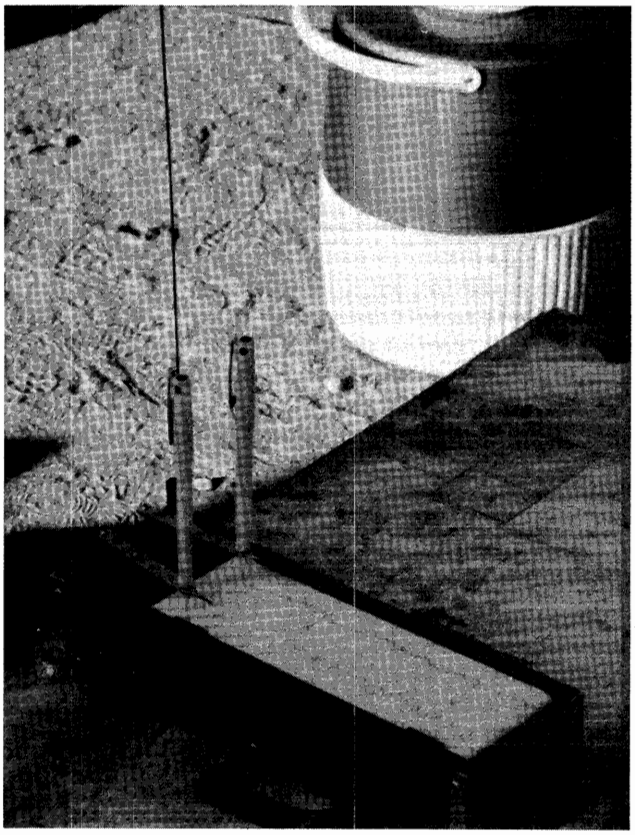


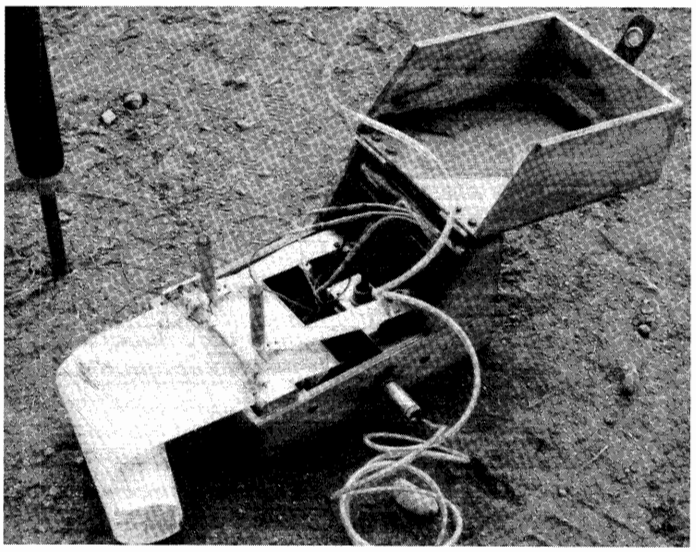


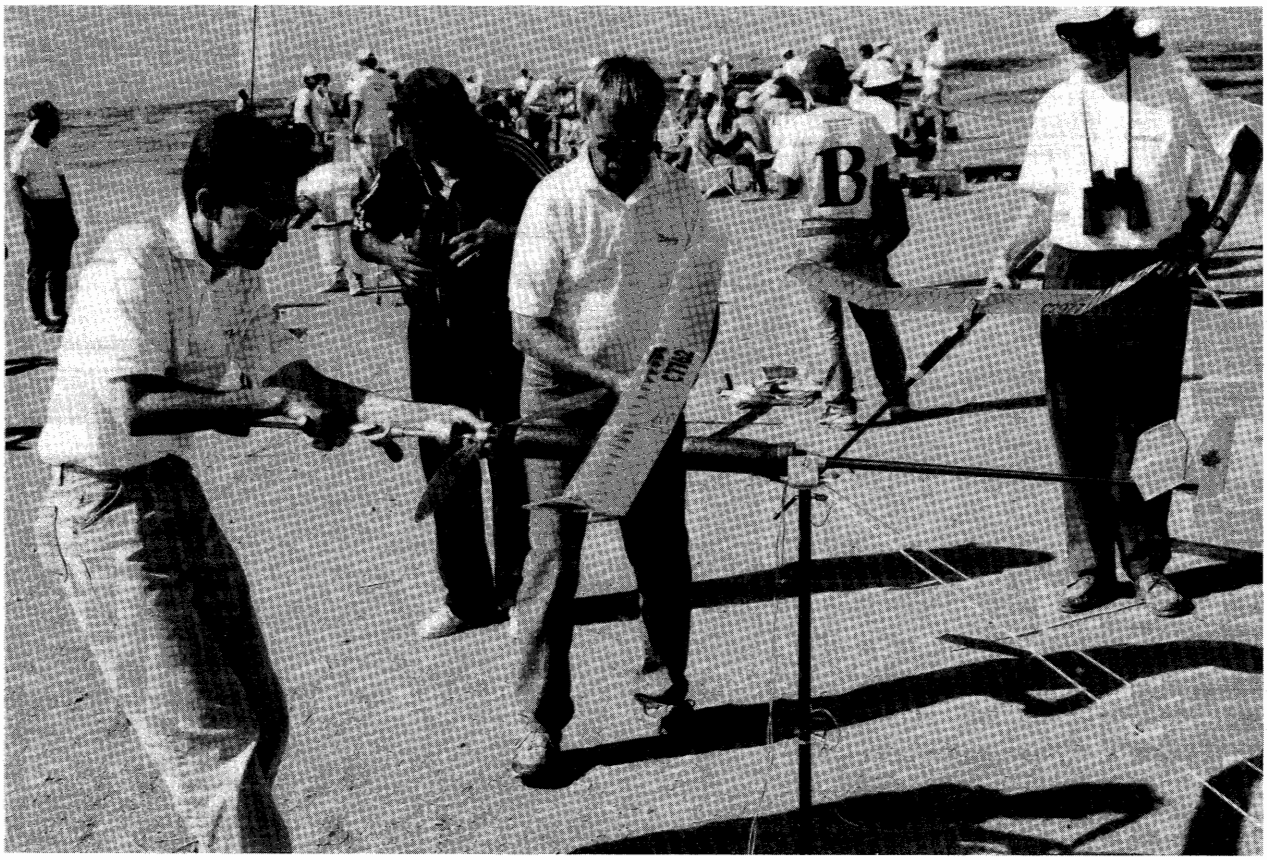


Above: Tu, China.
Below: G. Agren, Sweden
Three Thermisters.









Above: Tony Mathews, Canada. Below: Jifa Lu, China



Address Book

The following names and addresses are the lists supplied by the Team Managers for the individual teams.

We are sorry if there are errors or omissions that are beyond our control.

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Garay 771
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Klaus Salzer
Embelgasse 3/12
A 1050, Wien, Austria

Ersnst Reitterer
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A-5020, Salzburg, Austria

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Reinhard Truppe
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3730 Hoeselt

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Apto. 141--Sao Paulo--SP

Fabio Nutini
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Sao Paulo--SP

Paulo Solon Ribiero
Rua Prof. Fabio Fanucchi, #152
Sao Paaulo--SP

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Targovichte, Bulgaria

Nikolay Haveson
K.V. Russalia, bL50, B, 8,
Popovd, Bulgaria

Momtchil Yordanov
K.V. Zapad, bL38 G 76
Targovichte, Bulgaria

Sacho Yordanov
G.K. Ortcha Kupel 2 bL 25, Apt. 27
Sofia, Bulgaria

Vladimir Mirov
Drugba bL7, B
Varna, Bulgaria

Alexander Mikov
K.V. Tchaika bL55, B, 33
Varnu, Bulgaria

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Dave Sugden
RR#1
Enniskillen, Ont. L0B 1J0

Frank Schlacta
McGuire Rd. RR#3
Smith Falls, Ont. K7A 4S4

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(All team members use same address)

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Beijing, China

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Yongliang Huang Asst. Team Manager
Cunzhi Lu
Qing Liu
Linping Yu
Yuezhong Lu
Kunjiang Dong
Jifa Lu
Xian Wang
Yuanhua Tu
Dehua Wang

Czech Republic

Jiri Kalina
Praha, Tasovska 365

Ivan Horejsi
Plzen, Nad Prehradou 15

Jan Vosejpka
Plzen, Nad Tyncem 10

Pavel Motalik
Sezimovo Usti, Taboritu 607

Vladimir Kubes Jr.
Vladimir Kubes Sr.
Sezimovo Usti, T. Bati 663/18

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Denmark

Bo Nyhen
Birkevaenget 2, 3400 Hilleroed
Denmark

Henning Nyhen
Industrivaenget 28, 3400 Hilleroed
Denmark

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Edvin Penart
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Kannikese 14-15

Ivar Traksmann
Estonia EE3600 Parnu
Tammsaare 32-40

Ants Selgoja
Estonia EE3600 Parnu
Ehitajate tee 1-277

Andres Lepp
Estonia EE2400 Tartu
Moisavahe 20-9

Tiit Lilloveer
Estonia EE0001 Tallinn
Kraavi 13a-11

Indrek Harjo
Estonia EE0026 Tallinn
Ehitajate tee 49-80

Toomas Grossschmidt
Estonia EE0003 Tallinn
Sole 15-58

Juri Roots
Estonia EE0016 Tallinn
Randvee 33-4

Raimond Naaber
Estonia EE0003
Herzeni 16-53

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Ossi Kilpelainen
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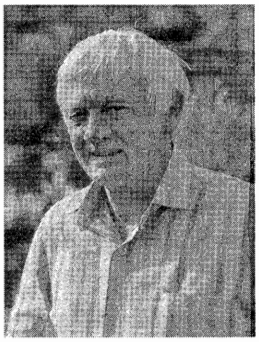
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Biographies

ARGENTINA

JORGE BOVIO, F1A. Married with 2 children 33 years old. Manager of Indugom S.R.L. (Rubber products). He has been on 2 Argentine teams at 91 and 93 World Championships. His major placings include Runner-up Argentine Champion, 1991; Republic Center Chasmpion, 1991; Argentine Champion 1992; Runner-up Champion Republic Center 1992; Runner-up Champion Provincial 1992; Argentineian Champion 1994, Champion Republic Center 1994; and Champion Provincial 1994

AUSTRALIA



ALLAN EDWARDS, F1B . The three models which I will bring to Lost Hills are "After Shock," and two "Betelgeuxs". "After Shock" was built to replace "Super Nova" after this model exploded when it hit power lines. No more carbon tubes for me. I used "After Shock" to place on the team. I will bring two "Betelgeuxs". One has a lower A.R. wing and was actually built before the one shown on the drawing. Lost Hills will be my 9th World Championship, 10th including F1B at West Baden. I competed at Taft without success due I think to "Horseshoe" thermals and "Issacsons Hole". Hope to do better this time.

RICHARD BLACKMAN, F1B. I'm 36 years of age, and work as a Computer Systems Manager for the RMIT University in Melbourne, in a department which specializes in computer-aided art and design. I've been flying free flight since I was a kid, maybe around 8 or 9 years old. I was introduced to the sport by my father who is still highly competitive, placing a close 4th in this year's F1B trials. I have flown most classes of free flight, being most interested in the FAI: F1A, B, C and D. I became seriously interested in competition in about 1981 after a couple of years layoff. Initially this was in F1D, but a lack of suitable local sites forced me to move outdoors in 1985. I have won a team place in every trials in which I have competed. These include the 1984 F1D World Champs, the 1987, 1991 and 1993 Free Flight World Champs and the 1986, 1988,1990 and 1992 Pacific Championships. In competition I have won either the National Championships and/or the Australian Free Flight Championships (they are different!) in each of the four main FAI classes. I also won the F1B Pacific Championship in 1990 and placed 2nd in 1992, as being the overall event director. I hold Australian records in several categories including F1D categories 1,2 and 4. Of these , category 2 is my proudest F1D achievement. It is 33:47 in a 10 meter ceiling. I was beaten to the world record by only a few months. By who? Who else, Jim Richmond!

MARTIN WILLIAMS, age not divulged. He has been in aeromodeling for an undisclosed number of years, apparently most of them in free flight. He has represented Australia eight times at 4 World Championships and 4 Trans Tasmans. His hobby is writing humorous letters.

PEITER de VISSER, F1A. I have been aeromodeling for the past 23 years, 14 of which have been in serious Free Flight. I have flown all classes over the years but now I concentrate on glider and rubber events. I have won many events including State and National Championships and at the moment hold the Airborne Perpetual Trophy for Australian Free Flight Society Annual Champion. I have also been selected for two previous World Championship Teams but was unable to attend on those occasions. As my time is limited my aircraft are designed to be easily constructed. I now have four gliders to choose from. The new glider DV13 is of composite materials with a bunt system, for early rounds and flyoffs. I also have a Horejsi `HIT' and a `CZECK MATE' design and an alloy foil D box glider, DV14. I have been a Licensed Aircraft Maintenance Engineer since 1975 and I currently work for Ansett Australia on the Gold Coast. My other interests are cycling, metal machining and equestrian activities.



KOEI TSUDA, F1C. I have been flying Free Flight models since 1960. I am a Japanese who was born in 1939. I am a international banker by profession. In the past my job has taken me to the U.S.A. (was a member of the Brooklyn Sky Scrapers in 1970-1972) Indonesia and Australia. I have been flying F1A (Japanese champ some 20 years ago) F1B Wakefield, F1C (Japanese, Australian and New Zealand Champ.) Finally, I won F1C World Cup in 1992. I am now in Australia as a member of Brisbane Free Flight Society, flying F1C and F1J only.



AUSTRIA



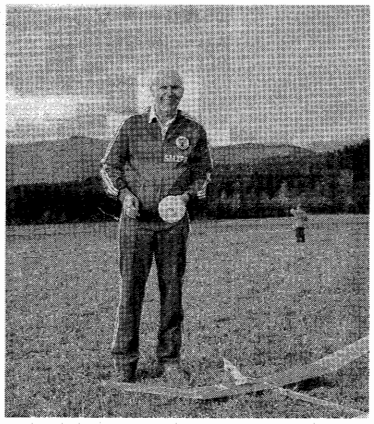
VERENA W. GREIMEL, F1B. I started flying F1A gliders in 1979 and F1E gliders in 1980. To increase the number of Austrian Wakefield flyers I started in 1985 with F1B and this is now the category I prefer. My biggest success was the 1st place at the Austrian Nats in 1988. I have been a member of the Austrian F1B team in 1988,1989,1990,1991 and 1993. Austria did not participate in Zrenjanin. My models will be modifications of a design by Arno Haacken, NL.



ERNST REITTERER, F1B. Ernst Reitterer, 62, has been involved in Free Flight for 50 years. He flies F1A, F1B and F1E. His major competition placings include 4 times at Staatsmeister, EM74: 1st place team member (F1B) and 1975 World Championship 3rd place team member.

KLAUS W. SALZER, F1A and F1B. Having built all sorts of free flight models since 1958, I began flying international classes around 1970 and started competing for a team place in F1A in 1975. Made the

F1A team for the European champs in 1978 (Ansbach, Germany) and for every European champs since then save 1982. World Champs participations were 1981 (Burgos, Spain), 1983 (Goulburn, Australia), 1987 (Poitou, France), 1989 (Embalse, Argentina). Made the 1991 team, too, but Austria was one of the few which did not participate in the Yugoslav/Serb war-champs 1991. Several wins at Austrian national competitions, including a national championship, helped to make the team all those times. Internationally I have been mostly yapping at the heels of the experts. I did win, however, international contests in Austria and Hungary, 2nd places in The Netherlands and Switzerland and was a member of the 3rd place team at the World Champs in Argentina. I began flying F1B in 1992, so the 1993 World Champs is my first in this class. First place in the 1992 National Championships, two 1st and two 2nd places in national competitions, and reaching the flyoff at Maniago, Italy this year sums up my successes in F1B.



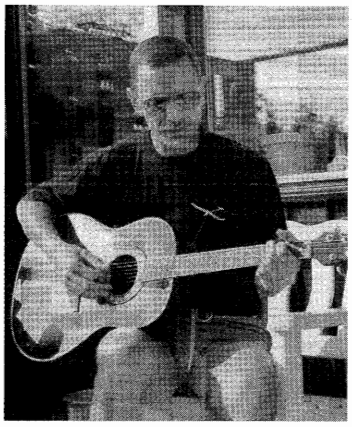
REINHARD TRUPPE, 52, is a mechanic and electrician master and autohandler for BMW Toyota. He has been in aeromodeling and free flight for 39 years. His hobbies are rallysport, boating, swimming and biking.

BELGIUM

CENNY BREEMAN, F1A., 45, is an Air Traffic Controller with Eurocontrol. He has been in Free Flight for 32 years. His other interests include computer hustling. Cenny's aeromodeling achievements include being a two time European Champion (1982,1984), team manager of the winning junior team for the World Championship, F1A. He has also been the recipient of two awards, the La nervure d'or award of Vol Libre and the model of the year award of NFFS.

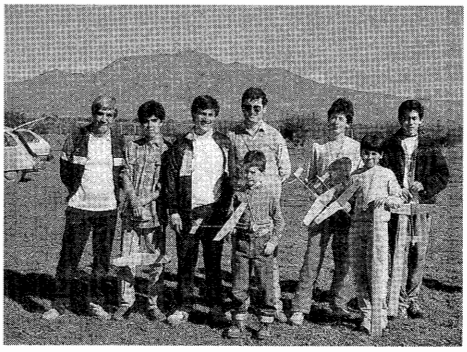


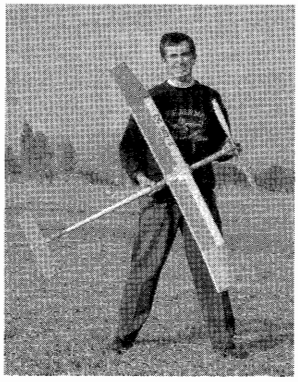
JOS MELIS. I'm almost 42 years old. I'm employed at Ford Motor Company Genk since 1976. My modeling career started way back in 1965. Most of the time I practiced Free Flight, but with some interruptions and pauses caused by other interests-playing and singing in a two men band, photography and many other things-so, I've never been a real "fanatic". I have participated at several European and World Champs in the past and my best result so far: 10th place at the European Champs 1992 in Sibiu. Besides my aeromodeling activities at this moment I also distribute bits and parts constructed by Lithuanian aeromodelers Vidas Dimavitchius and Vidas Nicolajevas. These W-HOBBY products are of excellent quality and cheap... I admire the social contacts as a result of this small business.



CHILE

SERGIO MELENDEZ , 57, is an Electronic Technician. He has been involved in aeromodeling for 48 years, beginning with gliders and small rubber models. He began flying Nordic A2 and F1A in 1951 and in 1958 he began flying Wakefield F1B. Sergio has been teaching children to build primary models since 1974 as it is important to him to sustain an interest in Free Flight. His achievements in aeromodeling include being an 8 time national team member at the South American championship (F1A and F1B), 2nd place at the 1972 South American Championship (F1A), national team member at the 1989 World Championship (F1B) and 1st place at the National Championship in 1983,1985,1986,1988 and 1989.

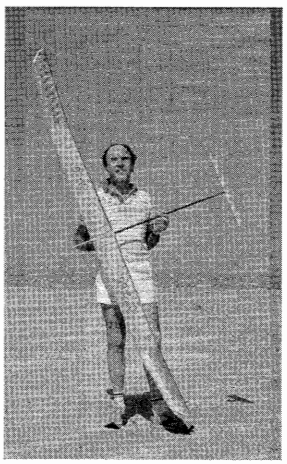




RAFAEL SVILANOVICH, F1B, 46, is a Mechanical Engineer. He has been in aeromodeling for 10 years, all 10 of which he has flown in Free Flight. This is Rafael's first time on the national team in the F1B category. His past aeromodeling achievements include 4th place at the 1992 Panamerican Championship (F1B) and 2nd place in 1991 and 1992 at the national championship.

CANADA

CAMERON ACKERLY , F1B 41, is a Staff Scientist at Toronto Hospital for Sick Children. He has been building Wakes for 21 years. Aeromodeling achievements include 2nd place American Nationals in 1972, 3rd member on 1991 Canadian F1B team, 1st in team finals for 1993 Canadian F1B team, 4th place 1993 Max-Men. Cameron flies left-right as he is left handed. He built a copy of No. 23 in 1990 and made his first Wakefield team. He now uses this basic design exclusively but modified for left hand trim (including left-hand propellers!)



PETER ALLNUTT F1A, born March 1933, now 60, is retired from Hawkins AVRo and Air Canada. His winters are spent in Taft and summers in Canada and Europe. Peter has been building models for over 40 years. He has been on many Canadian National teams and successful in many American, Canadian and international com-

petitions. His first World Championship competition was in 1965 in Finland. His best results at World Championships include 2nd place in 1975 in Bulgaria and 11th place in 1989 in Argentina.

GORD MACKENZIE, F1A. Over a period of some 25 years, he probably has built 50 or more A/2 Nordic gliders, using a number of different concepts and airfoil sections. The latest model designed in 1987, which he will be using at this years Champs was a model intended for all weather conditions, with good thermal, towing characteristics and would perform in the early morning/late evening rounds with light thermal conditions. During the last 3 years he has been experimenting with the aspect ratio by increasing it somewhat. In the near future a bunting, long wing version will be on the board, taking advantage of the many different types of composites available today. Most of his models are equipped with Bradley circle tow hooks and Seelig timers.



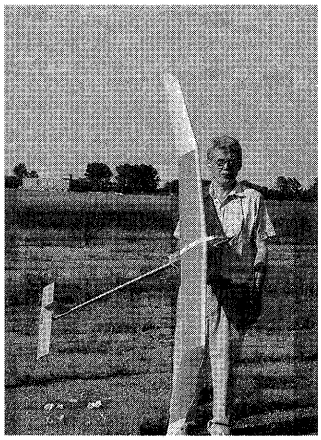
He enjoys fishing, music, a few pints with the boys, and is single. He works for Mclean McCarthy Inc./ Deutsche Bank (Canada) as an Investment Securities Manager. Recent accomplishments include 1988 Canadian champ, 1st 1990 Max-Men annual and this will be Gord's 10th time as a Canadian F1A team member.

TONY MATHEWS, F1B, is a Tooling Engineer at a small advanced Research and Development company. He is a 3 time member of the Canadian F1C Team. Tony switched to Wakefield in 1988. He worked with Doug Rowsell as a team effort to design a new series of Wakefields. The 1989 model #23 was designed with influences from Bob White and Jean Wastzenreither-composites used extensively. Aeromodeling achievements include 11th place at the 1989 World Championships (F1C), 1990 Canadian F1B team for 1991 W.C., 2nd place F1B 1991 W.C., Canadian F1B team for the 1993 W.C. No. 23 placed 1, 2 and 3 at Canadian team trials. No.23 variants placed 1,4,5 and 11 at 1993 Max-Men in California. The new model was designed as successor to No. 23 using computer analysis, CNC machining, and extensive testing, including towline testing to determine sink rate, etc.

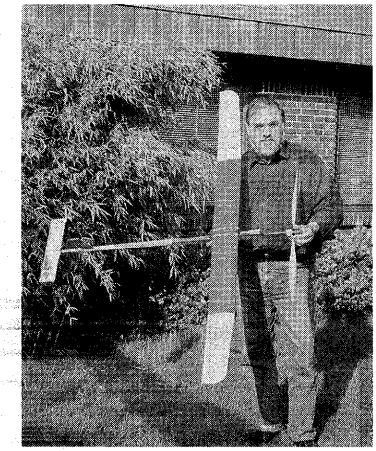
DOUG ROWSELL, 49, works in construction administration. He started building Wakes in 1970. He is a 3 time member of the Canadian F1B team (1981, 1989, 1991). Doug's aeromodeling achievements include 3rd place F1B at the 1991 W.C., 1st place 1993 Max-Men and the Canadian F1B team for 1993 W.C. Doug builds and flies with Tony Mathews as a team effort to design a new series of Wakefields.



DAVE SUGDEN, dentist, married to June, son Kevin, architect, daughter Carol, lawyer. F1C is his principal modelling interest. He has been on every Canadian team since 1971, although he refused to go to the last W/C in Yugoslavia. He says "Recently my contest results have not been good. Poor weather and limited access to decent flying sites do not help. Neither does having the contest halted due to fire, or having to quit flying to catch an airline flight, or losing a round with a timer lock up. Things must improve!"



DENMARK



FRANK DAHLIN is a member of the Danish Wakefield Team for the W/C 1993. The first time I was a team member was in 1987 for W/C in France. In 1989 and in 1991 I was a team member but did not go. My best result so far has been a 6th place at the European Championships 1990 in Hungary. My favorite model is Wakefield, both F1B and Oldtimers. I also enjoy flying Coupe d'Hiver a few times a year in southern Europe, as practically nobody flies Coupe in Denmark. I'm also very fond of indoor flying but in the recent years it has been very little. I flew F1D in the 1986 W/C in Cardington.

ENGLAND

PHIL BALL, 47, F1C. Has been in aeromodelling for 40 years, starting with small rubber powered models. He started Free Flight competition at about age 14, flying A1 gliders. At age 25 became serious about competition. Phil started flying power in '86 and made his first F1C in 1990. His contest successes include Overall British Champion 6 times, 11 Nationals wins in Open Rubber, Hand Launch Glider, Co2 vintage, and Slow Open Power. Other hobbies include Squash, football, and basketball

J. COOPER. I am aged 42 and have been flying free flight for around 30 years! I work for Customs and Excise as an internal auditor and am married with three daughters. I have won many British events and have been overall Nationals glider champion on four occasions. I have qualified for the World Champs on 5 previous occasions: Austria 1973- placed 35th



Bulgaria 1975- placed 35th again Denmark 1975- placed 13th America 1979- placed 22nd Australia 1983- couldn't get enough time off work to attend. Apart from the World Champs I haven't flown abroad much but my best placing have been as follows: Sierra Cup 1979- placed 4th Pierre Trebod 1981- placed 3rd Poitou 1983- placed 4th I hope to have 8 models with me for the World Champs, 4 tried and tested ones similar to the drawings of no. 30 and 4 new models, two of which are high tech with carbon/kevlar construction, bunt systems and high aspect ratio. I just need some time (and good weather) to get them trimmed. I enjoyed the trip to Taft in 1979, hopefully Lost Hills will be just as good, if not better.

MICK CHILTON. Has been flying models since age 10 with control line combat and at the age of 18 began flying team race. He has been flying free flight for 14 years and has been national champion three times and been on four W/C teams.

JOHN BAILEY, 53, is a technology teacher at a middle school. He has been in aeromodeling for 45 years and in free flight competition since 1956. He has been National Champion in F1B and F1C, and also F1H twice. He has represented GB five times in the W/C and the E/C once.

BRIAN RUSSELL PEERS, 49, He has been in aeromodeling for 42 years, mostly in free flight. He has been the Senior Free Flight champion as well as several F1B teams representing GB at the World Champs and the European Champs.

MIKE FANTHAM, 44, is an Aerospace Engineer. He has represented the UK in four World and six European Championships—all in the F1A class. Mike has been flying models for nearly thirty years and has competed in Free Flight competition for the last 27 years. His international F1A contest wins include the Dutch International '79, Pierre Trebod '79, Livotto '79 & '92, Max men '86, U.S. FF Champs '87, The Putza Cup '89 and the Sierra Cup '82 and '93.

Mike's greatest contest success to date is winning the '93 World Championships in California. The contest was the culmination of a period of intense work on a new model which was finished in Motel 6 at Lost Hills and first flown on Saturday, Ootober 2nd, 1993. This was Mike's first carbon/kevlar bunt-equipped model.

Mike is married to his best friend, Lauren, has two cats and lives in Surrey, England.

Mike says that more than half of his wins are in California. He says thanks for all the hard work of the California guys!

STAFFORD SCREEN, 59, is the technical director of Colson Castors, an American owned engineering company in the U.K.



Retired from aeromodeling in 1958 after completing National Service in the RAF to concentrate on sport. Played both cricket and football, still plays cricket when time allows but is now involved in the management and administration of both clubs.

Returned to aeromodeling in 1974. Flies all power clases although primary interest i in F1C because he enjoys the engineering aspects of the models' construction. Builds models late evening and early morning, known by fellow modelers for his late telephone calls. Current F1C National Champion, an award he has held on a number of occasions. Has had many domestic and International successes over the years.

He has been a member of the British F1C team for World Championships for nineteen consecutive years.

His model was chosen NFFS F1C Model of the year in 1987.

Gold and Silver medal winner at Model Engineering Exhibition with F1C models. National award by Royal Aero Club for services to Aeromodeling.

He is still obsessed with the desire to win a World or European Championship but finds it increasingly difficult to maintain his own standards due to limited availability of practice sites. Only complaint is flying in U.K. to qualify for team places with the current rules, limits the development of, and need for, high performance models. This is because BMFA domestic competitions are flown, even when the conditions are appalling,

FRANCE

BERNARD BOUTILLIER 51, F1C, is a retired engineer with Rosieres. He has been involved in Free Flight For 26 years. Other hobbies include Scuba diving and windsurfing. His aeromodeling achievements include 12 times a national champion (any prop driven category) and 5 time winner of International contests.

GAUTHIER BRIERE 31, F1C, is a Projecteur with the Societe European de Propulsion. He has been involved in aeromodeling and in Free Flight for 19 years. Gauthier's aeromodeling achievements include 3rd place at the national championship in 1990 and 1992 and 2nd place in 1991. He placed 5th at the European Championship in 1992.

PIERRE CHAUSSEBOURG 56, is a sport teacher with the Ministry of Agriculture. He has been in aeromodeling for 45 years. Other hobbies include gliding, skiing, sailing, windsurfing and fishing. He has been a private pilot and a skiing instructor. Pierre's aeromodeling achievements include 1st place at the Bohemia Cup in 1977 (F1B), 1st Vice President of CIAM and of FFAM, 4 time team manager and 2 time team member.

JEAN-CLAUDE CHENEAU, F1B, 50, is a teacher of Mechanical Engineering with the National Education Ministry. He has been in aeromodeling for 19 years. His other hobbies include aircraft pilot, volley ball and nautical sports. Jean-Claude's major competition placings include the following: 1st team place European Champs 1980, 1986,1988, 10th at W/C 1989 in Argentina, 4 times National Champion and 3rd Poitou FAI 1990.

JEAN-LUC DRAPEAU, F1A 40, is a technician with the Ministry of Agriculture. He has been in aeromodeling for 30 years. Other interests include reading and municipality responsibilities (Major of his village) Jean-Luc's aeromodeling achievements include being a national champion in 1981 and team manager (Junior W/C) 1986-1987,1990-1992, Poitou 1st place in 1984 and 2nd place in 1986.

LOUIS DUPUIS, F1B, 62, is a retired Professor with the National Education Ministry. He has been aeromodeling in Free Flight for 50 years. His other hobbies include mountain climbing. Louis' aeromodeling achievements include the following: 6 time national champ, 11th place at the 1971 World Championship in Sweden, 10th place at the 1981 World Championship in Spain, 4th place at the European Championship held Mostar in 1980. He has also been a National team member 10 times.

PHILLIPPE GERARD, F1B, 34, is an Acoustic Engineer at Bertin and Co. He has been involved in aeromodeling for 28 years. Philippe's major competition placings include French champion F1G-Junior 1973-1975, French Champion F1H-Junior 1975, National team F1A 1983 and 1st place CAMBRAI F1B 1990.

MICHEL REVERAULT, 46, is a teacher employed by the National Education Ministry. He has been in aeromodeling for 33 years. Other hobbies include photo-"parapeure" and gliding. Aeromodeling

achievements include 2nd place at the national championships F1C in 1981, 3rd place Glider French Championships in 1988 and 1990 and 6th place at the Pampa Cup F1A in 1990. Michel was also the organizer of the 1987 World Championship in Thouars.

ALAIN ROUX, F1C, 43, is a technician with SNCF. He has been in aeromodeling and in Free Flight for 33 years. Alain's aeromodeling achievements include 2nd place at the World Cup in 1991 F1C, national champion 1977-1978, 1987-1988, 1991 and 1992 and team manager at 1991 World Championship. He is also a member of FFAM Council and French Free Flight Technical Committee member.

BERNARD TRACHEZ, F1A, 34, is a technician by trade. He has been in aeromodeling and in Free Flight for 24 years. His modelling acievements include several times on the podium in F1D and F1C nationals and several times on National team for W/C F1D, National team F1A in 1991-1992 and 1993.

GERMANY

ULRICH SCHMELTZER, 52, is a personnel manager for Energy Trust. He has been in aeromodeling and free flight for 42 years. Some of his major competition placings are German Champ F1A 1986, E/Ch. 1st place 1978, and E/Ch. team 2nd place 1988. He is a member of the FAI -CIAM Free Flight Subcommittee and Chairman of the German Free Flight Commission. His hobbies are tennis and automobile racing.

MANFRED THOMAS, 39, is an electrician. He has been in aeromodeling for 23 years and in free flight for 21 years. His major competition placings are W/Ch. 3rd and 2nd place teams in 1987 and E/Ch. 3rd and 1st place teams in 1987. His hobbies are electronics, music and skiing.

DIETER DUCKLAUSS, 58, is a journalist. He has been in aeromodeling for 44 years and has been in free flight for 42 years. His major competition placings are 2nd place teams W/Ch. 1967 and 3-time champion of the German Democratic Republic. He was the team manager for the GDR from 1963-1977. His hobby is photography.

SIEGFRIED LIMBERGER is a pilot.

MATHIAS FAERBER is a pilot.

FRANK ADAMETZ, 19, is a student at Technical High School. He has been in aeromodeling and free flight for 7 years. His major competition placing is German Junior Champion in 1991. His hobbies are wind-surfing, dancing and books.

PETER WINDISCH, 35, is a self employed electrician. He has been in aeromodeling and free flight for 25 years. His major competition placings include two-time Champion of German Democratic Republic. His interest is his family.

REINER HOFSASS, 56, is a retired diploma engineer. He has been in aeromodeling and free flight for 42 years. His major competition accomplishments include placing five times among the ten best of Wakefield Cup. His hobby is skiing.

DR. LOTHAR DORING, 40, is a doctor of medicine, neurology and psychiatry. He has been in aeromodeling and free flight for 30 years. His major competition placings include World Champion F1B 1981, World Champion F1B 1983, and 2nd place 1985. His hobby is sailing.

ANTON WEBER, 49, is a project planner for BMW. He has been in aeromodeling for 36 years and he has been in free flight for 32 years. His major competition placings are E/Ch. 1st place team 1978, German Champion 1974 and 1982 and E/Ch. team 1978. His hobbies are making pipes, books and biking.

MANFRED GRUNETS, 36, is an engineer. He has been in aeromodeling and free flight for 25 years. His hobbies are boating, biking and tennis.

WILHELM KAMP, 53, is an automobile engineer for Mercedes Benz. He has been in aeromodeling for 36 years and he has been in free flight for 30 years. His major competition placing includes 11th place in F1A World Championships 1981. His hobbies are skiing and traveling.

BERND SILZ, 51, is a gas station operator in Mainz, Germany. He has been in aeromodeling and free flight for 40 years. His aeromodeling successes include 12 team positions and 2nd place at the E/Ch., 1978, 2nd place at the E/C 1982, 3rd place at the W/Ch. 1987 and 3rd place at the E/ch. 1990.

HOLLAND

ALLARD VAN WALLENE , 30, engineer in mechanics Occupation: Patent Examiner for the European Patent Office .

MAARTEN VAN DIJK. His competition successes include 1st Junior World Championships, 1988, 6th at Cambrai 1992, and 5th Helchteren 1992.

SIMON (Pim) RUYTER, 55, has been in aeromodeling for 44 years and in free flight for 10 years. His competition successes include many times National Champion and positions on most of the teams at the World Championships.

ITALY

VITTORIO BRUSSOLO, 38, is a technician at Benneton. He has been in aeromodeling for 23 years and in free flight for 22 years. He was World Champion in 1987 and a member of the winning Italian team at the European Championships in 1988. His hobbies are running and cross country skiing.

MASSIMILANO GOBBI, 45, is a furrier. He has been in aeromodeling for 20 years and in free flight for 18 years. He was 5th in the World Championships in Argentina in 1989 and 2nd at the European Championships in Hungary in 1990. His hobby is running.

PAOLO SOAVE, 59, is an industrial general manager for Soncini Sr. I. Co. He has been in aeromodeling for 40 years and in free flight for 40 years. He placed 2nd at the World Championships in 1961. His hobbies are skiing and sailing.

PIETRO ZINNO, 69, is a retired police sergeant for the Italian Government. He has been in aeromodelonf for 39 years. His hobby is painting.

SILVANO LUSTRATI, 65, is a retired mechanical engineer. He has been in aeromodeling for 50 years and in free flight for 50 years. He placed 7th in Wakefield World Championship in 1950, 3rd in 1951 and 4th in 1952. He placed 2nd at the European Championship in 1951, 8th at the World Championship in F1C in 1977 and 1st in 1983 and 4th at the European Championship F1C in 1984. His hobbies are cycling and cross country skiing.

BRUNO FIEGEL, 54, is a manager at Fiat Auto. He has been in aeromodeling for 40 years and in free flight for 40 years. He was a member of the winning Italian Team at the World Championship at Denmark in 1977.

FRANCO GRADI, 49, is self employed as a weaver. He has been in aeromodeling for 25 years and in free flight for 25 years.

MARIO KUSTERLI, 44, is an electronic engineer for Elekser S.N.C. He has been in aeromodeling for 44 years and in free flight for 25 years.

ANTONIO SANAVIO, 52, is self employed as a dealer. He has been in aeromodeling for 22 years and in free flight for 22 years.

ISIDORO FICHERA, 57, is a primary school teacher for the Italian Government. He has been in aeromodeling for 42 years and in free flight for 38 years. He was the Italian Champion in 1985. His hobby is sailboat modeling.

JAPAN

SHINICHI SHINAGAWA, 54, is the president of Belgard INC. He has been in aeromodeling for 17 years and in free flight for 17 years. He was a National Champion in the F1G/H/J mixed classes in 1992. His hobby is PC programming.

MITSUNOBO WADA, 42, is a technical director of T.V. and filming at Bunkakobo, Inc. He has been in aeromodeling for 30 years and has been in free flight for 12 years. He placed in the last World Championship. His hobbies are motorcycling and swimming.

TETSUO KIKINAMI, 65, is a retired school teacher. He has been in aeromodeling for 35 years and has been in free flight for 35 years. He is a 2nd place Japan FIA champion in '92. His hobbies are art and fishing.

NAMIO TAKAHASHI, 64, is a graphic designer and art director at SPICE CO., LTD. He has been in aeromodeling for 11 years and in free flight for 9 years. He placed 2nd in the 1991 Japan Championship. His hobby is R.C. airplane models.

MITSUO KOBORI, 64. He has been in aeromodeling for 55 years and has been in free flight for 33 years. He placed 3rd in 1986 and 1988 at the friendly contest in China with a F1B model.

MAKOTO TAOKA, 47, is a display designer. He has been in aeromodeling for 15 years and has been in free flight for 15 years. His hobby is painting.

MINORU NISHIZAWA, 40, is a public servant for Aichi Prefeatural Office. He has been in aeromodeling for 10 years and has been in free flight for 10 years. He placed 2nd in the 1992 Japanese Championship.

ATAE YAMASAKI, 46, is a machinist at Hanshin Iron Works Co. Ltd. He has been in aeromodeling for 35 years and has been in free flight for 17 years. He placed in the 1991 F1C Japan Championship and took part in the control line World Championships in 1971, 1974, 1978 and 1990. His hobby is radio control models.

KEIICHI KIBIKI, 49, is manager of International Products Support at Sumitomo Precision Products Co. Ltd. He has been in aeromodeling for 42 years and has been in free flight for 31 years. He placed 2nd in 1979 World Championships and National Championship from 1895 through 1990 and 1992 with F1C models.

HIVOYASU USUI, 53, is a painter at Independent Enterprise. He has been in aeromodeling for 40 years and has been in free flight for 15 years. He placed in the Spanish Championships in 1981 and 1st in the Shonan Cup in Japan. His hobbies are playing the guitar and painting.

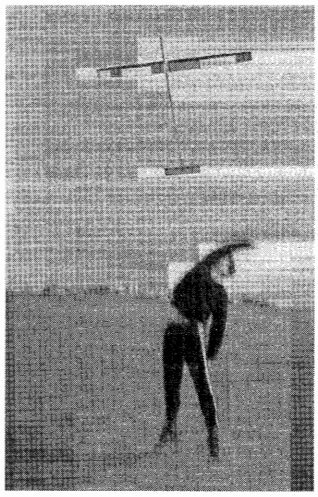
MINORU NISHIZAWA. I took up F1B about 10 years ago. This airplane is my latest model. This is a high aspect ratio plane in comparison to my other planes. No. 12 uses a Kevlar motor tube and a carbon tailboom. My recent contest results are 2nd place in 1990 at the Japanese championship and 3rd place in 1992 at the Japanese championship.

LATVIA

VICTOR ROSHONOK Victor Roshonok's achievements in free flight include 4th place at the Bohemia Cup in 1993. He also attended the 1977 W/C in Denmark and the 1981 W/C is Spain as the USSR national team member.



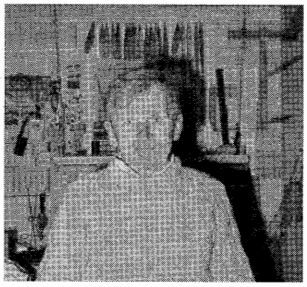
NEW ZEALAND



DAVID ACKERY, F1B. I am 38 years old and work for Telecom as a Technician. I am unmarried. I have been flying free flight for 13 years and Wakefield for 9 years. F1B is my main interest but I like all forms of free flight. I also fly RC gliders and I am getting interested in F1C, but this is just for fun. I also enjoy rock climbing and travel. Free flight is a great sport that has enabled me to travel to many parts of the world for competition and to make many wonderful friends. Long may our enjoyment continue.

PHILIP CRUMP. I am a single 28 year old joiner/cabinetmaker. I an the secretary of the Gore club (about 25 members.) I mainly fly gliders F1A but also R/C gliders, a bit of aerobatics, vintage and indoor peanut and HLG. I have a wide interest as you can see. The past few years I've been flying F1A seriously. Contest career includes wins in several classes at N.Z. Nationals doing the best in 1992 with a 2nd place in F1A and 1st place in 1992 at the Pacific Free Flight Championships in Australia. The only other team place was at the Pacific Free Flight Champs in Australia.

J. MALKIN. I am 61 years of age and have been modeling for a lot of those years. I have been on a few W/C teams but never made the top slots to be called a competitor. The models I am currently flying could only be termed "Russian look-alikes" and I would like to think they fly like their counterparts but am really under no illusion, however, at Lost Hills I will be giving it my very best shot. I started work on these models in November 1991 and it has taken all my time up until now to get them going.



POLAND

STANISLAW SKIBICKI, 30, is a teacher at the Suwalki Aero Club. He has been in aeromodeling for 21 years and in free flight for 14 years. His major competition placings include 1992 Vice Champion of Poland. He was the instructor and coach of the 1992 Junior F1B team, which placed first at the Junior World Championships. His hobby is R.C. Models.

PAWEL WLODARCZYK, 46, is the Manager of Aeromodeling Division of the Polish Aero Club. He has been in aeromodeling and free flight for 33 years. His major competition successes include many times champion of Poland in F1B and F2C, Member of the 1st place F1B team at the 1975 W/C. Since 1973 he has been the manager of the aeromodeling division of the Polish Aero Club and is deeply involved in the organization of all European and World Championships (8) held in Poland.

CZESLAW ZIOBER, 35, is a chemist at Technical University. He has been in aeromodeling for 20 years and free flight for 20 years. His major competition successes include 1 time Champion of Poland and 2 times Vice Champion of Poland.

KRZYSZTOF ROZYCKI, 32, is a self employed electrical engineer. He has been in aeromodeling and free flight for 20 years. His major competition successes are 1987 F1B World Vice Champion and 5 times Champion of Poland.

SWEDEN

PER FINDAHL. I have sent 3 plans of my newest models. They are developed from my old "Black Adders" but I have changed names on my models to "Mr. Bean". After a series of 40 "Black Adders" I thought it would be good with a new name! All 3 models have got a bunt system and the last 2 have also got carbon/kevlar fronts of the fuselage. All models also have a wing-wiggler for easier turn on the line. Some of my best contest results are as follows: 2nd in the World Cup 4th and 5th in the European Championships. Some Swedish championship victories. I have been on the Swedish team since 1984, except for the W/C in 1991.

U.S.A.

CHRIS MATSUNO, 45, is a cost estimator for McDonnell-Douglas. He has been in aeromodeling for 35 years and has been in free flight for 28 years. He placed in F1B, A-1 and various AMA Nats. He is NFFS Symposium co-editor, F1B design was model of the year. His hobbies include running, kayaking, triathlons and gardening.

MATT GEWAIN, 45, is a model development engineer at Composite Structures Tech. He has been in aeromodeling for 33 years and has been in free flight for 32 years. He placed 1st in F1A World Championship in 1983. He also flies RC Glider competition.

ROGER SIMPSON, 57, is a retired computer programmer analyst. He has been in aeromodeling for 47 years and has been in free flight for 36 years. He was on the first place F1C team at the 1981 World Championships in Spain, he was the German and European Champion in 1970. He was also the USA F1C Champion in 1964 and 1965. He was on the USA F1C Team in 1979 and 1981.

THOMAS COUSSENS, 37, is an aerospace engineer at Hughes Space and Communications. He has been in aeromodeling for 10 years and has been in free flight for 10 years. He placed 1st in the Max Men FAI Annual in 1989, 3rd in 1993 and 1st in the Patterson Memorial in 1987 and 1988.

HECTOR DIEZ, 56, is self employed as an auto body shop manager. He has been in aeromodeling for 47 years and has been in free flight for 47 years. His hobbies include R.C. Soaring and control line stunt and racing.

RANDY ARCHER, 35, is a body-shop owner. He has been in aeromodeling for 27 years and has been in free flight for 23 years. He placed 2nd in F1C at the 1989 World Champs and 1st place in 1991 World Championships. His hobby is cars.

GEORGE XENAKIS, 65, is an aeronautical engineer for Lockheed Missiles and Space Co. He has been in aeromodeling for 53 years and in free flight for 53 years. He was Michigan Senior Champ in 1949, NATS F1B winner in 1964, USA FAI F1B Team member in 1967, 1969, 1987, 1991, 1993, F1A team in 1969 as well. His hobbies are free flight tech analysis and computers.

DOUG GALBREATH, 59, is a self-employed printer. He has been in aeromodeling for 53 years and has been in free flight for 34 years. He placed 3rd in the 1963 World Championships, 6th in 1967, 3rd (dq'd) in 1979, 13th in 1981, 25th in 1989, and 21st in 1993, was on the World Championship F1C teaam in 1981. Currently holds AMA Cat I C-gas record at 100 minutes. His hobbies include street rods, motorcycles, machine shop and benchrest rifles. Doug also operates a part-time field service shop for competition engines, doing rework, build-ups and repairs on all makes of engines. He has been the Seelig timer man in the U.S. since 1964.

RANDY WEILER. Surprisingly, at 35 years old, Randy is one of the youngest Nordic flyers in the US, yet with four Team places already he is one of the most consistent. Encouraged by his father, Randy



U.S. Team. Front row: Roger Simpson, Randy Archer, Chris Matsuno, George Xenakis, Ed Keck, Hector Diez, T.M. Back row: Fred Pearce, Randy Weiler, Doug Galbreath, Matt Gewain, Tom Coussens, Bob Issacson, Asst. T.M.

became an early Champion before the age of 10. At his first Nats at Los Alamos in '67, he won A Gas , and was the first to win the Ocie Randall High Time Trophy at the '73 US Free Flight Champs, while still a Junior.

Turning to F1A glider in 1981 under the principal guidance of coach Bob Isaacson, Randy acknowledges the important formative influence of others including Jim Wilson, Lee Hines and Walt Ghio in helping his rapid progress.

Team places followed quickly in '85 Livno, '87 Thouars, '91 Zrenjanin and '93 Lost Hills. A dedicated Team member, in France he not only retrieved all of Bob White's winning flights, but took a perverse pride in running to catch every flight — so that throughout the Champs Bob's model never even touched the ground! It was at these events that Randy also met Ukrainian, Victor Stamov, recognizing in him a similar, uncompromising fusion of perfection and performance, that led to their remarkable teamwork during the Endless October in California.

Despite these other good influences Randy attributes his bad habits to Martyn Cowley, and having himself now perfected the 11th hour competitive style, recently endorsed by the reigning World Champion, he appears to be definitely on the right track for a gold medal!

ED KECK . I have been a modeler for over 50 years. I flew Free Flight as a kid and set the junior class A record at age 14. I currently hold the C and D records for CAT.III. I flew RC FAI for 35 years but got smart 7 years ago and started flying FF again. I most appreciate all the help from FF modelers to "catch up" after no FF for 35 years. I was in the special machine automation business but sold it and retired at age 54. I then worked as a consultant 2 days a week. I was part owner in "Pro Line" RC radio equipment, Radio South and Southern RC products. I graduated as a mechanical engineer from the General Motors Institute. I have been married to Sue for 35 years (the best decision I've ever made!). We have 2 children, Heidi, 28 and Fred, 26 . The best part about modelling is the great friends all over the world.

FRED PEARCE. Retired NASA. Now a consultant on optical systems and astronaut photography. I developed virtual reality flight simulators with computer-generated images for NASA in 1963. I have done extensive rubber energy testing and publications on wing wake impingement on tail and on thermal detectors. Aeromodeling achievements include a Mulvihill Trophy, Dick Black Trophy, Dawn Unlimited (Korda Trophy twice) and National Wakefield Trophy 3 times.

VENEZUELA

OSWALDO VASQUES, 64, Aeronautical Engineer, retired after 36 years in Airline Maintenance Management. I have been aeromodeling for 50 years. In the early 1940s, I started having a lot of fun with Wakefield (Korda's days). While attending Engineering School in California, I participated in the U.S. Nationals held in Los Alamitos (1952). I hold an AMA licence, No. 4448. I have a passion for the Wakefield class F1B but have tried all types of flying models following the interest of the Venezuela modeler (U/C and R/C the last two decades). As President of the Venezuela Model Association I promoted the affiliation in FAI as Associated Member in 1981, and attended CIAM meetings as a delegate. Competition placings are numerous in different types of model events like FF, U/Control, and R/C held in Venezuela. I am married to Teresa and we have two children. Jose, the elder, is my helper. We also have three granddaughters. This F1B model is my own design, a conventional type and built with the materials available in the country. Wings (55 gm) and elevator (4gm) are of ribbed construction, covered with fiberglass (.6 oz) with Stefanchuck outline and pitch distribution. The mechanism of the prop. (IPR) is alum. with Montreal stop by Argentinian Donelli. I used FAI tan rubber (1x3-28St). Model flies R-R with auto rudder and VIT. This is my third Championships. (1979-Taft) (1989-Cordoba, Argentina) (1993-Lost Hills).

Participants Roster

Argentina
Walter Palmieri
Mauricio Zito
Rodencio Bonetto
Rudecindo Horacio Marquez
Horatio Osvaldo Ortiz
Adolfo Principe
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Stansilaw Skibicki
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Gheorge Guta
Cringu Emilian Popa
Marian Popescu

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Khrebtov
Mikhailenko
Korban
Fedoroff
Burdov
Makarov
Miklok Kocharov
(1991 World Champion F1A)
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Frantisek Rado
Peter Kapusta
Mioslav Sulc
Ivan Treger
Peter Magdolen

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Ricardo Rodriguez
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Francisco Font
Vincente Navarro
Pedro Jose Jiminez Alfaro
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Per Findahl
Hakan Broberg
Eddy Astfeldt
Anders Persson
Jan-Erik Anderson
Thomas Alm
Gunnar Agren

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Josef Bebes
Kurt Bleuer
Peter Maurer
Hans Schoder
Kurt Sager
Walter Eggimann

Ukraine
Alexander Andriukov
(1991 World Champion F1B)
V. Pisany
Victor Isaenko
Siergi Remiga
Eugene Gorban
Yuri Blagnevich
Kirilenko
Igor Vivchar
Eugene Verbitsky
Vaelrij Strukov
(Victor Stamov)
Vladimir Tregubenko

United States
Chris Matsuno
Matt Gewain
Ed Keck
Roger Simpson
Randy Weiler
Fred Pearce
Thomas Coussens
Hector Diez, T.M.
George Xenakis
Doug Galbreath
Randy Archer
(1991 World Champion F1C)

Venezuela
Oswaldo Vasquez


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USA ★ 93
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