Competition Boost-Gliders

Trip Barber

NAR 4322

What it Takes to Win

- Reliability
- Good Boost
- Clean Transition to Glide
- Good Glide
- Returned Model

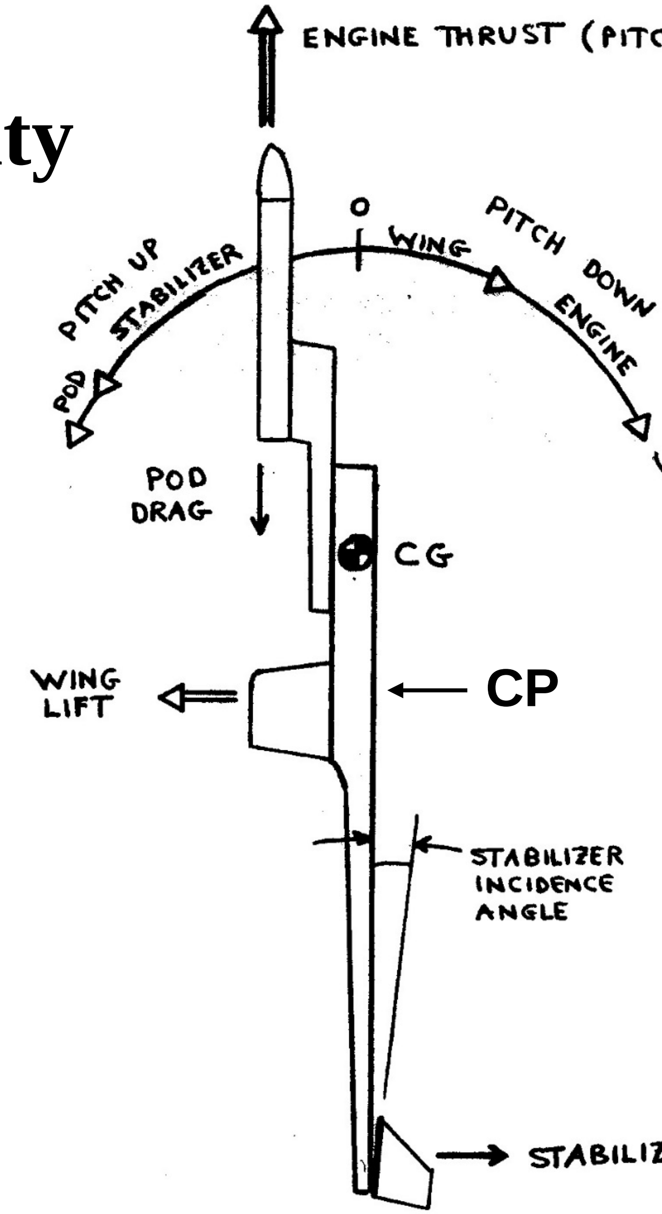
Glider Reliability

- Proper structural strength for boost
  - Balsa thickness & grain, gluing technique
  - Lower-thrust motors preferred
  - Tissue covering for B and higher power classes
- Good release from launcher
  - Restrain ignition clips from catching the tail, provide wind bracing so glider stays on pod
- Clean pod separation
  - Proper friction fit, small chute for recovery
- Practice makes perfect!

Good Boost

- Provide enough launch rod travel length
  - Use “power tower”, extended rod lengths and larger diameters if necessary
- Get the force balance and stability right
  - Thrust vs aerodynamic balance, CG vs CP
- Align wings correctly on pad
  - Wing span parallel to wind direction
- Use a smaller glider unless it’s windy
  - High altitude = long duration

Boost Stability



Boost CG must be well ahead of CP

Boosts nose-down, pod height governs how much

Coasts with nose-up loop, stab incidence governs how much

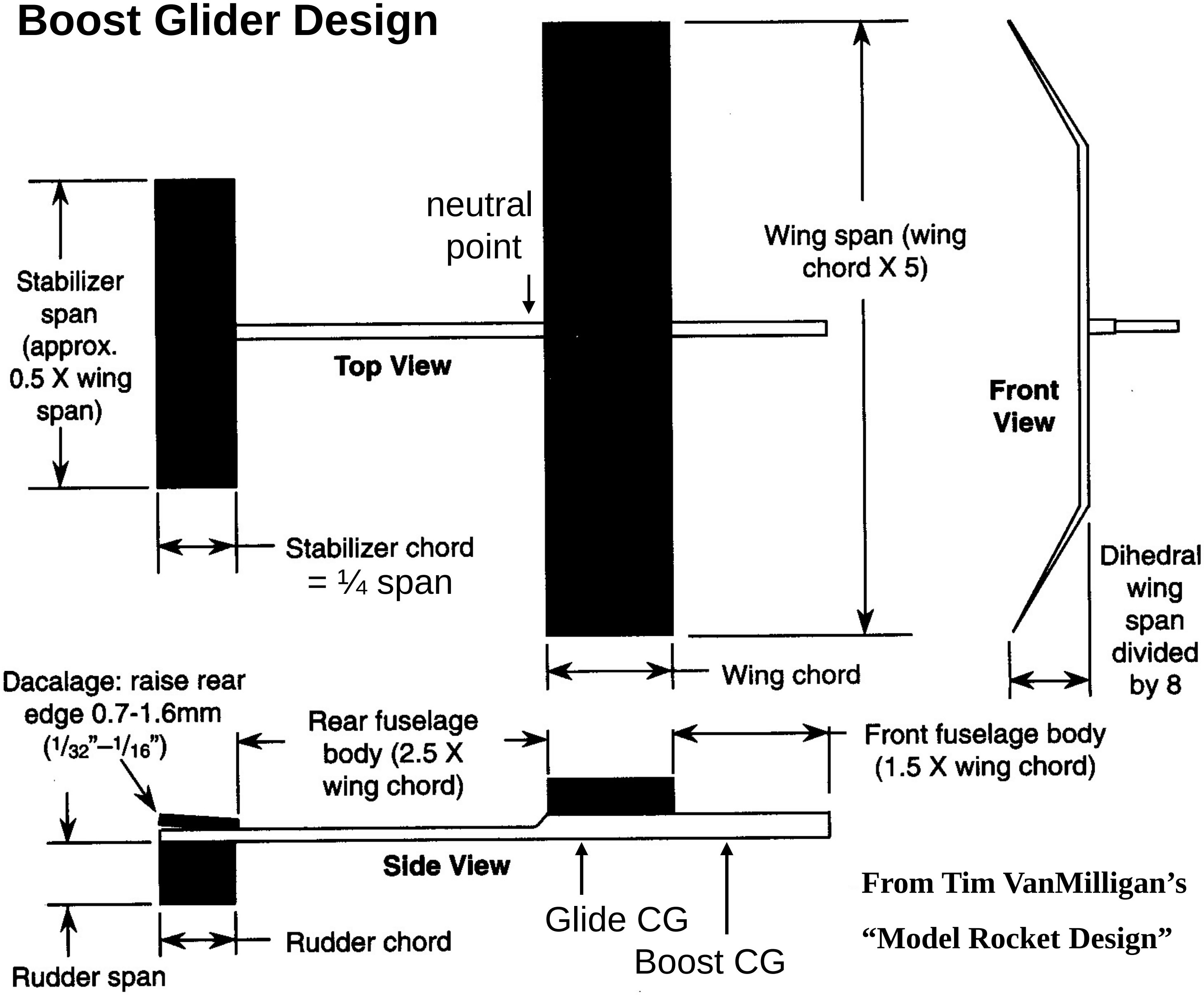
Clean Transition

- Put some (~2%) incidence on stabilizer
  - Pulls out of “death dives”
  - Too much incidence will cause boost loops & glide balance issues
- Trim for wide-diameter right turn
  - Start with horizontal toss at normal glide speed
  - Check with hand launches nearly straight up
- Choose proper motor delay time
  - Eject pod on the way up, not down

Good Glide

- Minimize glider drag and weight
  - Smooth wing surface, without paint
- Select and shape an appropriate airfoil
  - High point at 30% chord, taper wing thickness
- Minimize wing loading (weight / wing area)
- Trim to glide at a small angle of attack
  - Maximize $C_L^{1.5}/ C_D$ for max duration
- Get the CG vs neutral point balance right
  - Glide CG at ¾-chord point is ideal

Boost Glider Design



From Tim VanMilligan's "Model Rocket Design"

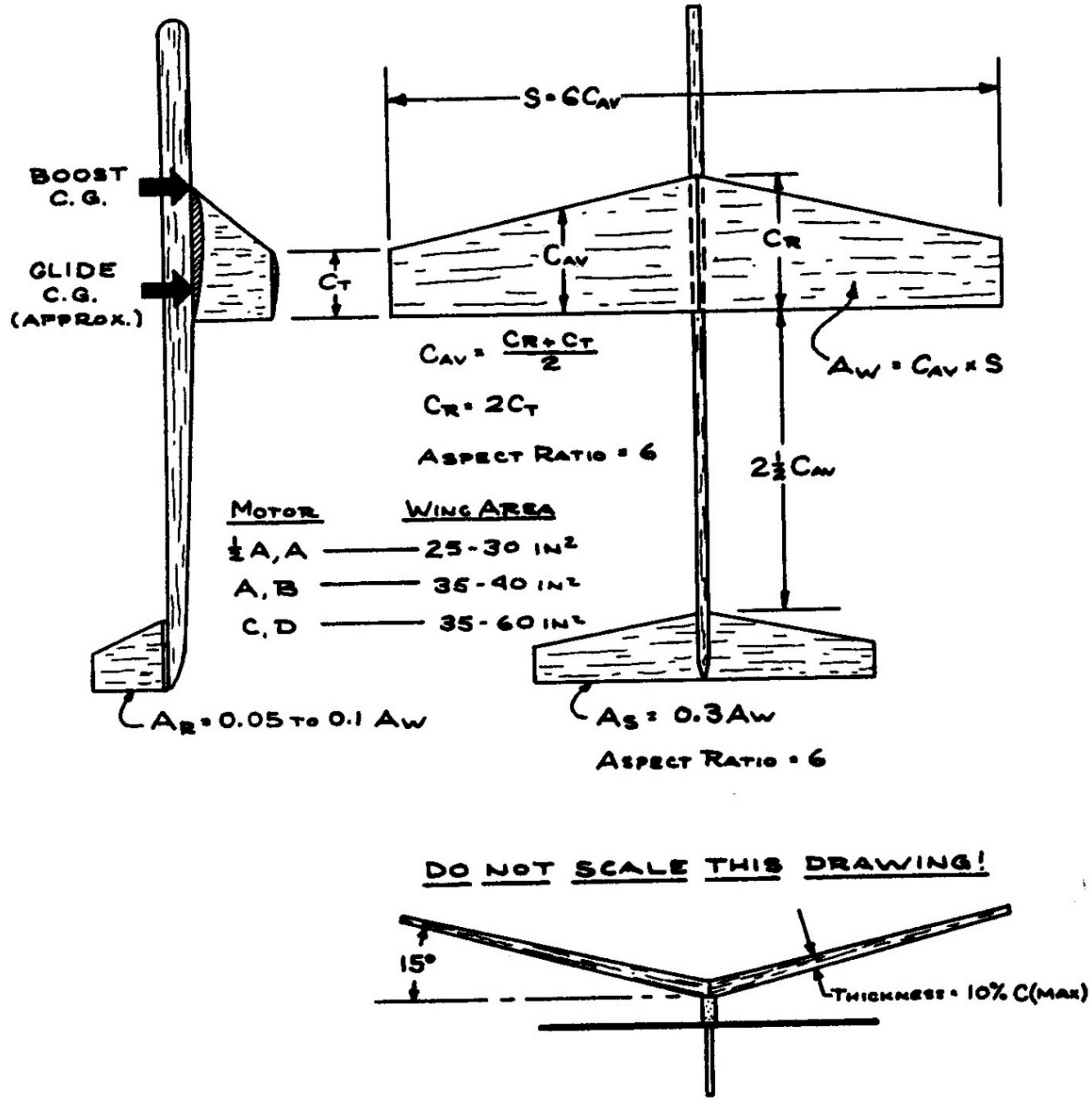


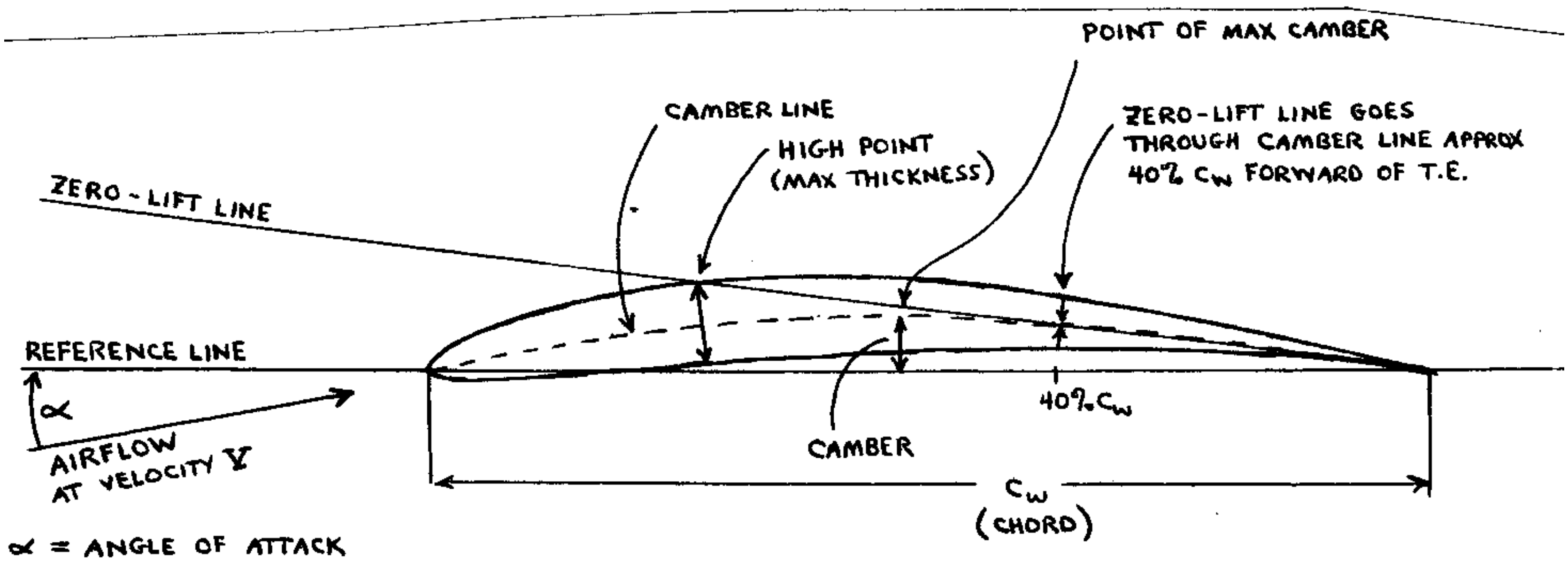
FIGURE 13-18 Stine's Basic B/G Design Rules.

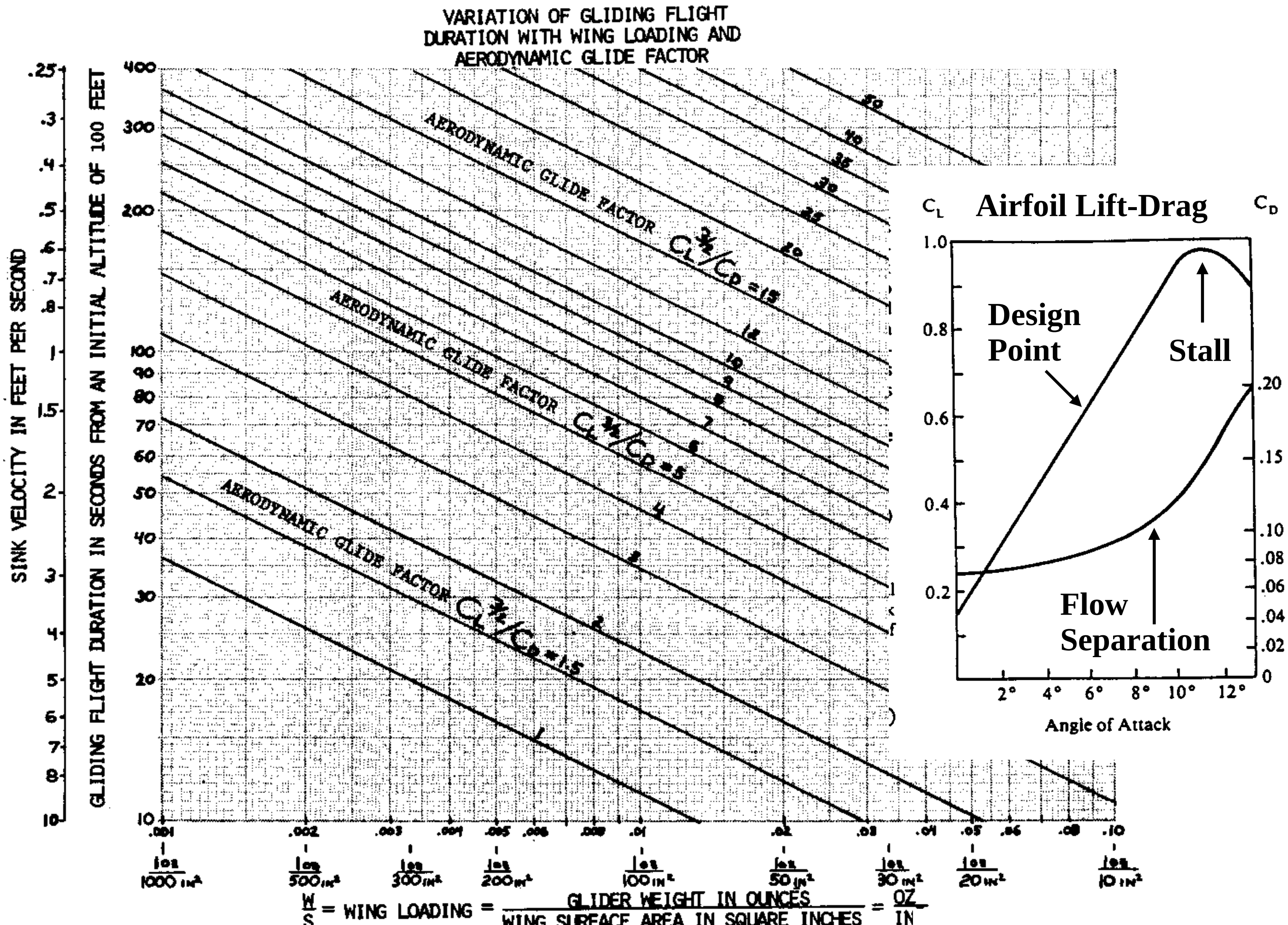
Glider Sizes

Engine Power	Wing Area (Sq. inches)	Wing & Boom Thickness	Stab/Rudder Thickness
½ A	15 – 25	3/32	1/32
A	20 – 35	1/8	1/16
B	30 – 45	1/8 – 3/16	1/16
C	40 – 60	3/16	3/32

Wings & stabilizers from 6 lb/ft^3 density C-grain balsa
Fuselage booms from 12-16 lb density

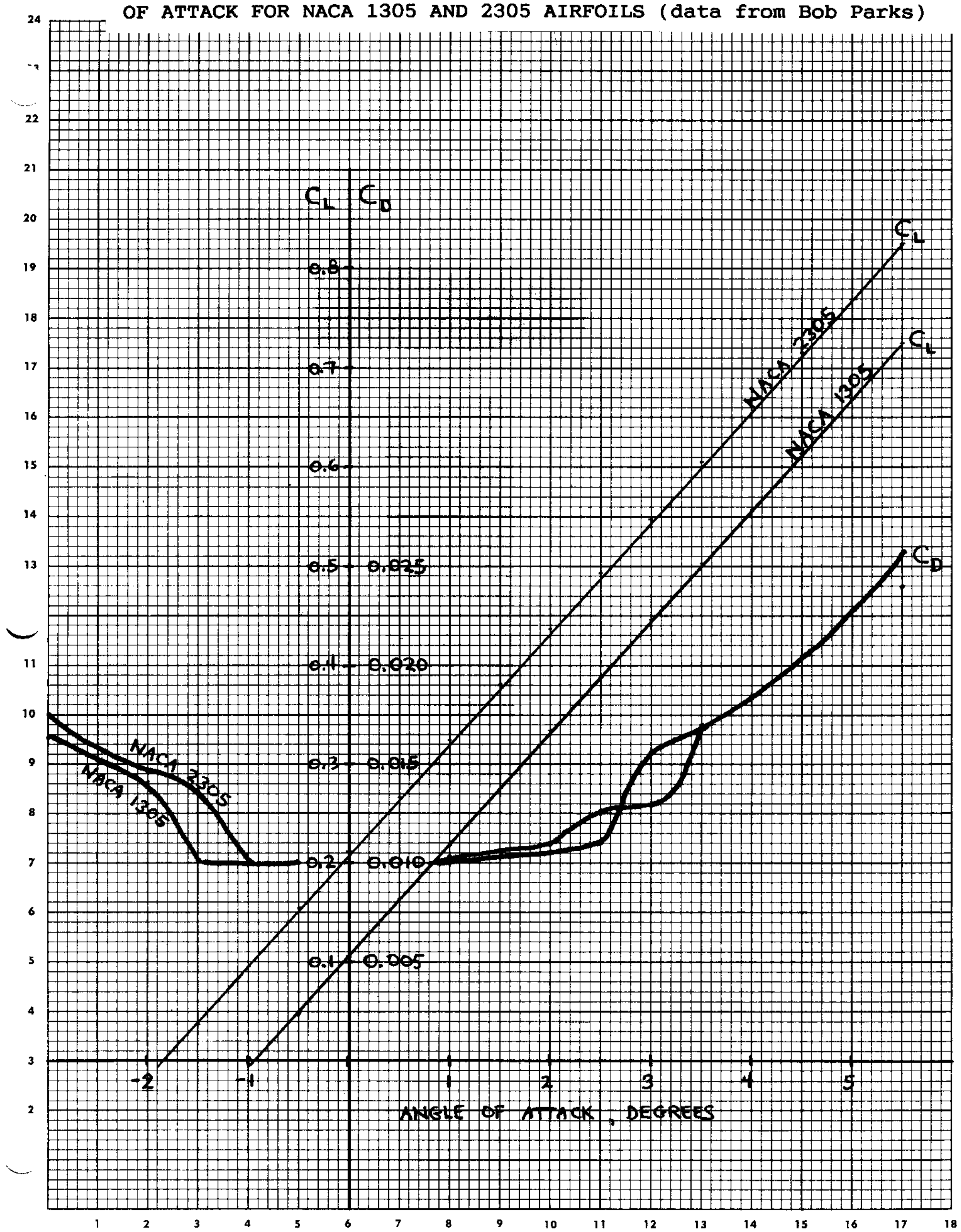
Glider Airfoil





Graph by Doug Malewicki

GRAPH OF THEORETICAL LIFT COEFFICIENT AND DRAG COEFFICIENT VS ANGLE OF ATTACK FOR NACA 1305 AND 2305 AIRFOILS (data from Bob Parks)



Picking Air

- Good durations require flying in air that is warmer than the surrounding air and is rising – a “thermal”
- Most likely to occur on sunny afternoons, downwind of areas (plowed dirt, asphalt) that absorb sun heat
- Generally occur in “waves” – a bubble of warmth for a minute or two followed by cool downdraft for a longer period – on a regular cycle
- Detected by thermal streamers, sudden calm and warming, recording thermometers, or circling birds
- Aim slightly downwind to boost into the thermal

Returning Models

- Enhance glider visibility
  - Dark magic marker on underside of wings, aluminized mylar on tops of wingtips
  - Use larger gliders in windy weather
- Use radio control
- Use a dethermalizer
  - Wing flap, “beer can” or drop weight

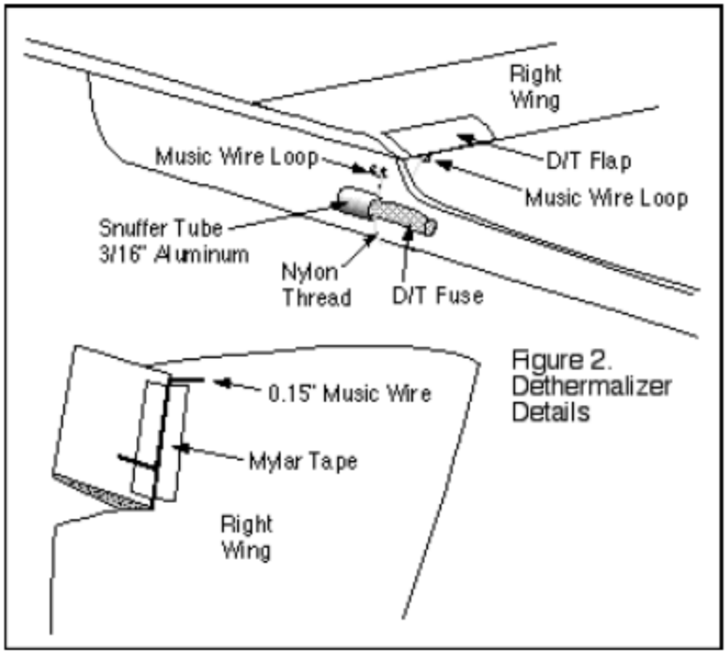


Figure 2.
Dethermalizer
Details