Electrathon Advisor's Manual Contents

I. Getting started
   A. Written proposal with budget
      1. NECA parts list
      2. Travel budget
      3. Additional equipment and spare parts
   B. Goals and objectives – mission and vision statement
   C. Target sponsors
   D. Develop promotional materials
   E. Contact sponsors
      1. Sample letter
      2. Portfolio

II. Communications
   A. Report Writing
   B. Bookkeeping
   C. Administrative (applications, forms)
   D. Marketing/sponsors
   E. Fundraising/thank-yous
   F. Website

III. General Design/Layout
   A. Number of wheels and type, placement – footprint
      Whys!
      1. Three vs. four wheels (suspension needed to keep all wheels on ground, steering, alignment)
      2. Choice of one or two wheels in front?
      3. Air flow (air drag, friction "aero problem")
      4. Total mass of car
      5. Cost of car
      6. Stability if front wheels are used for braking (roll stability, somersault effect)
      7. Track (Should you be less than four feet, why?)
      8. Wheel base (From front to rear axel, how track shape affects choice of wheel base)

   B. Center of gravity/balance (stability)
      1. Reference to PRISMs
      2. Consider placement of motor, batteries, driver, ballast
         a. Why& how & what is - Prisms reference (Finding center of gravity of driver in various positions, explains concept of center of mass)
         b. Why – Jim Long, OPPD
         c. How - Design phase (Mike's work)
         d. How - After building, check with wheels on bathroom scales
         e. How – Bill Kalblinger, (covered by Mike?)

C. Preliminary drawings and sketches, models
   1. Why a sketch is important (time saver!)
   2. Use CAD system, if available (Why – more precise, learning incentive, some simulation or testing programs available)
   3. Does sketch communicate the idea effectively? Scale drawing!
   4. Model to estimate amounts of materials, cost, will driver fit in car

D. Frame, body and suspension
   1. Why - Geometry for the frame (triangles for strength, driver protection)
   2. Materials, considering cost, availability, strength, mass, processing restrictions
   3. Minimum guidelines required for your area
   4. Suspension (advantages & disadvantages, weight, cost, stability, tire life, contact force (acceleration and braking))
   5. Why – geometry for body, aerodynamics and driver protection

E. Reference to kit/list of components (Web sites and other suppliers)

IV. Chassis systems

A. Frame
   1. Why – Choosing materials based on weight, strength, cost, availability, processing equipment
   2. Don's how to sections
      a. Beginning (Purchasing a kit)
      b. Intermediate (How to construct with common materials
      c. Advanced (How to construct with composite materials and other materials)

B. Steering (how and why combined in each article)
   1. Axles (meet minimum requirements, generally half inch or 12 mm)
   2. Steering geometries for beginning teams: castor, camber, toe
   3. Steering geometries for maximum performance: Ackerman and slip angle (tire flex, contact patch)
   4. Choosing control systems: levers, T bars, inverted T bars, wheels
   5. Where to put tie rods, drag link, connecting link, bell crank

C. Suspension
   1. Materials from Barry Wilson

D. Wheel type
   1. Why - How size affects friction and angular velocity (rolling friction & aero dynamics, wheel covers)
   2. Why – The relationship between number and size of spokes and forces on a wheel, lateral loading factors
   3. Why – Effect of moment of inertia on wheel design
   4. Purchasing new and used wheels
   5. Constructing a hybrid wheel

6. Manufacture your own wheel

V. Drive train

A. Electrical systems

1. Why - The science of DC circuits – I and V in parallel and series circuits
2. Why - The science of DC circuits – predicting I, V, and R with Ohm's Law
3. Why - Torque explanation (references)
4. Motor
   a. Cost and reliability
   b. Load matching, power rating, torque, inertia, rpm,
   c. Interpreting motor load curves, using motor information and wheel size to determine gear ratio
5. Controller
6. Pot box, dead man feature
7. Circuit breaker
8. Gauges and wiring
9. Grounding the system, isolated system, frame is not grounded, electrical leakage, current from battery
10. Kill switches, accessible inside and outside

B. Batteries (Use materials for this section already available from manufactures, printed & web sites)

1. "Battery Book One" reference
2. Paper back, Laurie will get title
3. Charging
4. Discharging
5. Measurement of I, V and SG
6. Box/containment (acid leaks, Check rules!)
7. Battery Choices - The relationship of I and R for different battery types
8. Prolonging battery life – Strategies to keep batteries alive for one hour
9. Weight, may vary by + or - 5% of manufacturers specs
10. Short circuiting issues (now way to revive batteries)

C. Gears

1. Why – How Gear Ratios Work, How Stuff Works web site
2. References to web sites, Laurie's sheet
3. From gear ratio to speed, Jim Long's work
4. Developing a spread sheet to do gear ratio calculations
5. Sprockets & chain – Driver & Driven (#35 chain, from go cart suppliers)
6. Gear ratios chart, what speeds different ratios give for a car (Russ)
7. Other power transmission systems – belts, bicycle derailers ,etc

VI. Shell/Body

A. Materials available (fabric, aluminum, polycarbonate, steel, fiberglass, poly-vinyl's, closed cell foam, coroplast (plastic cardboard)

B. Paint advantages (aerodynamics), disadvantages?
C. Aerodynamics

VII. Testing (See local rules & regulations)
A. Safety inspections
B. Driving skills
C. Testing brakes
D. Maneuverability

VIII. Evaluation/Competition
A. Kinematics at the racetrack – calculating average velocity from lap time