How To Win At DBF - Based On My Experience

By Greg Marien

This is not a complete listing of advice, but will maximize your chances of success. I thought I could have done this in a shorter list, but as I reflected back, there were many reasons for the success, and any one area that was lacking would have cost us the competition. Since it is a long list it may look to be an impossible task, but year after year, teams prove that wrong. But why even go through the trouble? You don't get a paycheck for it. You may even spend some of your own money to accomplish a task. Simple answer is that it is a learning event that no college can teach you in the classroom. Those that may say, "Well, I will learn all of that at my first job." My response is, "Best way to get that job is to know how to do the job before you get to the interview." That puts your resume at the top of the pile.

So, what are the benefits?

- Learn how to design, build and fly an aircraft
- Learn teamwork
- Camaraderie
- Interface with other students, maybe in other disciplines
- Recognition by future employers (Northrop Grumman and General Atomics –Aeronautical Systems are the main sponsors of SDSU and UCSD teams)

Why do large companies sponsor these types of competition?

Companies want to hire you, but they want to hire the best trained.
They give the team a few dollars to "break in" the students. This means that they will get a better product once graduated.

- **Start your team recruiting effort ASAP**
  - Aero Team – 400 level students
  - Structures Team – 300 & 400 level students
  - Fabrication Team – Everyone
  - Payload Team – AE123 students with structures assistance
  - Fundraising Team – Project Manager with team support
  - Systems Engineering Team – Two people to verify requirements are met at all levels (although all team members should know the requirements) – Good task for AE123 students
  - Report Team – Project Manager, team leaders, and one person to format report (can be anyone with excellent Word skills)
  - Multimedia Team – Documents events with video and pictures for the entire year
  - Utilize AE123 students in each team to assist and "learn the ropes"
  - CAD Team – as many as possible – recruit from the 2nd semester CAD classes, get people that are interested in performing stress analysis

- Don’t get frustrated when only 30% of the members signing up stick around to the end
- Make sure to meet the rule that 1/3 of students must be Juniors, Sophomores, and Freshman
- All team members must be AIAA members

- **Early Research**
  - Can be accomplished before the rules are released
  - Review previous SDSU reports and the competition winning reports
  - Review report scores and determine what is needed to improve the DBF program at SDSU
  - The report alone can be a losing or a winning factor in the competition

- **Schedule**
  - Set up a schedule and stick to it, but be flexible
  - Have Systems Engineering Team be responsible for creating the schedule
  - Program Manager is still in charge of making it happen

- **Rules**
  - As soon as the DBF rules are released have a team meeting to present the rules and set up teams, even it is before school starts
  - Have the Systems Engineering team create a check-off list along with the milestone dates

- **Fundraising**
  - Fundraising goes on from the beginning to end of the year
  - Solicit funds and materials from companies
  - Keep donors up to date
  - Make sure to advertise as required on the aircraft or website for the support you get from donors
  - Thank donors for their donation, written letter a must
  - Report competition results to the donors and thank them again
  - A video or picture of the team is always nice

- **Conceptual Design (3 weeks total)**
  - Conduct daily meetings to discuss concepts with full team
    - Create scale drawings of concepts
      - Use pencil and graph paper
      - Show locations of aircraft components
        - Payload
        - Frames, bulkheads, ribs, longerons, fuselage skins, wing, component attachment points, ect.
        - Landing Gear
        - Propulsion

                - Mounting provisions
                - Battery pack(s)
                - Speed control(s)
            - Empennage
            - Batteries
            - RC transceiver and antenna routing
            - Servo controllers
            - Wire routing
        - Maintain weight & balance up to date
        - Payload deployment
        - Aircraft assembly concepts
    - Determine Rated Aircraft Cost (RAC) for each configuration to determine best scoring
    - Create a “DBF wall” in the aero lab and leave concepts on the wall to foster discussion
    - CAD Team begins modeling ideas – Keep detail to a minimum, payload may be detailed because this is a “known” quantity
- Significant to configuration discussions:
    - Utilize typical scoring algorithm factors
        - Rated Aircraft Cost
        - Weight! Weight! Weight!
        - Dimensions
        - Report Score
        - Flight Score
        - Assembly/Disassembly Time
    - Assembly/disassembly strategies
- Conduct weekly design reviews with your team and any invited advisors
    - This is a major part of the learning experience
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- Compile and send questions to contest administrators as often as needed
    - If it is a question that could be proprietary in nature, ask to keep it confidential
- Results of Conceptual Design
    - Basic configuration complete (component locations, estimated weight, propulsion type, etc)

- **Preliminary Design (Finish by Thanksgiving)**
    - Any AE403 research should be used that has been discovered to date
        - Not all wind tunnel testing/CFD needs to be complete to begin Detailed Design
    - CAD work should build on from Conceptual Design
    - Choose airfoil

- Design wing planform and perform wing sizing
- Preliminary Stability and Control should be determined
  - Hint: If the plane looks correct, it probably is.
  - Hint: If it is a weird configuration more detailed analysis may be required to determine feasibility of design
- At the end of Preliminary Design the configuration is frozen
  - Wing size/shape (including airfoil)
  - Propulsion choice
  - Horizontal/vertical Stab sizing
  - Loft - Fuselage Outer Mold Line (OML)
- AE403 contribution should continue to perform testing and analysis to be added to the report

- **Detailed Design (Finish By Holiday Break!)**
  - Continue CAD models
  - Use CAD to perform stress analysis as required
  - Create drawing tree
  - Create fabrication drawings
    - Team can continue to improve on drawings for the report

- **Fabrication**
  - Begin ASAP – When you know the design of something get it done. Don't wait until last minute. Payload is a good example. This is usually a predetermined configuration so it can be the first thing fabricated.
  - Begin fabrication (in series or in parallel)
    - Payload
    - Wings and control surfaces
    - Fuselage
    - Propulsion
    - Landing Gear
    - Shipping Crate

- **Testing**
  - Have a testing plan and documentation of test points
  - Document testing for report
    - Wind tunnel testing
    - Stress testing - minimal
    - Subsystem testing
      - Propulsion Subsystem
      - Assembly Task Subsystem
      - Payload Subsystem
      - Flight Control Subsystem
    - Taxi testing
    - Flight testing

- Hint: Earlier the flight tests, more time you have to be able to adjust for unforeseen circumstances
- Empty Flight
- Payloads Flight
- Timed Flight Course
- Payload Task – depends on the task, payload change out, dropping payload, etc

- **Report**
  - Report sections should be written as you go along
  - Have advisors review the report during the year; don't wait until the last minute!
  - Review old winning reports
  - Set up a report outline early
    - Assign section to each team
  - Don't wait to the last minute!

- **Travel (start about Mid-January)**
  - Determine number of people going, you should know by then the number by the participating members that have "earned" the trip
  - Ensure members buy their own tickets and reimburse them if they go, this ensures you don't quit at the last minute and stick you with a pricey unusable ticket
    - Give them a cost limit based on the ticket price
    - Everyone should book the same flight so the cost will be about the same
  - Vehicle transportation from airport
    - If a lot of people go, make sure to rent a van.
    - Remember you have to be 25 years old to rent.
    - Driver should be a responsible adult