

DEFN-15-[DBF]

# PROJECT DEFINITION

## APPROVALS

ROLE	NAME	SIGNATURE	DATE
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Chief Engineer	<i>Charles Poblete</i>		
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*[Insert Logo]*

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**[AIAA  
Design/Build/Fly]**

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## Revision History

REV	DESCRIPTION	DATE	APPROVED BY
-	Initial Release	[01/25/15]	

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# 1 PROJECT OVERVIEW

## 1.1 Executive Summary

*The UC Irvine Design/Build/Fly team is a student-led project that participates in the annual AIAA Design/Build/Fly competition. The team is led by two project managers, who oversee the operation of the project, and the chief engineer, who is responsible for leading the design aspect of the project. Assisting the project leaders are the sub-team leaders, who are in charge of the design and optimization of their respective components. Each sub-team has multiple members to aid in the design, manufacturing, and testing process.*

*The AIAA DBF Competition is an annual international remote-control airplane contest with over 80 participants from all over the world. The contest rules are released in September and teams have until April to finalize the plane designs. The competition is divided into three flight missions and one ground mission, often requiring multiple types of payloads to be carried. The plane must be designed to complete these missions and must adhere to multiple other constraints and safety regulations. The written design report is also a major aspect of the competition. The 60 page design report documents the entire project, from design to manufacturing to testing.*

*As a senior design project and engineering club, DBF is meant to be a channel for students to apply analytical knowledge taught in class to real life applications. Fluid mechanics, structures of materials, programming, computer-aided design, and more are utilized in the design process of the plane. The project also provides the opportunity for students to learn information usually not taught inside the classroom. This includes extensive composite manufacturing, iterative design processes, airplane assembly, and documentation. Students are given more hands-on and practical experience, compared to the theoretical and conceptual focus of the engineering curriculum.*

### Team Summary

- Aerodynamics:** *Computes the flight characteristics and necessary wing dimensions. This team also ensures that the aircraft meets certain control and stability standards, and uses numerical modeling to predict flight performance.*
- Wings:** *Experiments with new manufacturing methods for the wings and fuselage in order to decrease overall weight while maintaining structural integrity.*
- Propulsion:** *Analyzes and tests the propulsion system to find the best motor, propeller, and battery combination for the aircraft.*
- Molding:** *Designs, experiments, and manufactures molded fairings and fuselages.*
- CAD:** *Creates detailed drawings of every component of the aircraft system and aids in the rapid visualization of possible aircraft solutions.*
- Fuselage and Payload:** *Designs and builds fuselage and payload restraint and release mechanisms.*
- Motor Mount:** *Focuses on fabricating motor mount that connect motor to fuselage boom.*
- Landing Gear:** *Designs and fabricates landing gears integrated to the fuselage.*
- Testing:** *Fabricates test apparatuses and conduct load testing for manufactured parts while collecting data for documentation purposes.*
- Test Flight and Telemetry:** *Organizes and conducts test flights, performs preflight/post-flight inspection and collects flight data.*

## 2 PROJECT DETAIL

### 2.1 Project Objective(s)

Objective 1 – *Design Plane for DBF competition*

*The UCI DBF team participates in the annual international RC airplane competition. There is a different theme every year with three flight missions and one ground mission. The team must design a plane based on the contest rules, going through several iterations until an optimal design is achieved.*

Objective 2 – *Write Design Report for DBF competition*

*The AIAA DBF competition requires documentation of the design process in the form of a 60 page written report. The report is divided up into multiple sections: executive summary, management summary, conceptual design, preliminary design, detail design, manufacturing plan, testing plan, and performance results. A CAD package is also required for the report.*

Objective 3 – *Documentation of Manufacturing Process*

*The UCI DBF team has multiple years of composite manufacturing experience. In order to pass on this knowledge to future years, a dedicated team was formed to document the entire fabrication process for each plane component: motor mount, landing gear, etc. The documentation contains pictures and detailed, step-by-step directions.*

Objective 4 – *Senior Design Project/Student-Led Engineering Organization*

*While the main objective of the team is to compete in the DBF competition, the project is also a senior design project and student organization. Students of all majors and academic level are encouraged to join. The project encourages students to apply analytical knowledge to real-life applications, participate in design and manufacturing, and learn how to lead others.*

### 2.2 Scope Details

*The long-term goal for DBF is to continually make design improvements to lighten the plane. Due to the annual rule changes and advancement of other teams, the UCI team must innovate new designs in order to stay competitive. This may include major design changes, different manufacturing techniques, or changes in choice of material. Also, in order to continue the legacy of DBF, old members pass on knowledge to new members. Alumni often serve as advisors to aid in the design process, providing experience and expertise.*

### 2.3 Project Milestones

Milestone Name	Target Date	Comments
<i>Test plane</i>	Early Oct.	Modified plane to test concepts
<i>Prototype 1</i>	Nov. 30	First plane to troubleshoot manufacturing methods
<i>Prototype 2</i>	Jan. 30	Improvement on first plane with new techniques
<i>Competition Plane</i>	Mid Feb.	Finalized design
<i>Backup Plane</i>	Early Mar.	Copy of final plane
<i>Report Outline</i>	Jan. 18	Outline of sections
<i>Report Rough Draft</i>	Jan. 26	Rough draft from team leaders
<i>Report Final Revision</i>	Feb. 21	Final report submission

**2.4 Project Team**

#	Name	Project Role	Email	Phone	Standing	Units
1	Michael Lau	Project Manager	mrlau@uci.edu	(408) 475-6868	Senior	4
2	Jocelyn Pedroza	Project Manager	joceyp@uci.edu	(909) 670-3008	Senior	4
3	Charles Poblete	Chief Engineer	cpoblete@uci.edu	(213) 215-4516	Senior	4
4	Justin Kerr	Team Leader	jpkerr@uci.edu	(408) 598-6232	Sophomore	3
5	An Do	Team Leader	adhong@uci.edu	(714) 332-8511	Senior	4
6	Violeta Ismailyan	Team Leader	vismaily@uci.edu	(818) 445-1038	Senior	4
7	Alex Kwok	Team Leader	aykwok@uci.edu	(909) 851-8511	Junior	4
8	Laliphat Kositchaimongkol	Team Leader	lkositch@uci.edu	(424) 236-9156	Sophomore	4
9	Enrique Gurrola	Team Leader	gurrole1@uci.edu	(951) 385-1113	Senior	3
10	Karla Marron	Team Leader	kmarron@uci.edu	(760) 235-5889	Senior	4
11	Arlen Magtoto	Team Leader	amagtoto@uci.edu	(818) 689-4679	Senior	0
12	Kunal Deshpande	Pilot	deshpank@uci.edu	(510) 648-4864	Junior	2
13	Andres Ruiz	Member	ruiza4@uci.edu	(909) 658-4977	Senior	2
14	Hugo Mendoza	Member	hamendoz@uci.edu	(818) 913-4137	Junior	1
15	Sonny Li	Member	snli@uci.edu	(858) 216-5567	Junior	1
16	Zulema Rodriguez	Member	zrodrig1@uci.edu	(805) 824-1628	Sophomore	1
17	Justin Williams	Member	jrwilli1@uci.edu		Senior	2
18	Caroline Alvarado Cantu	Member	carolima@uci.edu	(760) 408-9350	Junior	2
19	Edmund Situ	Member	esitu1@uci.edu	(714) 876-7450	Senior	1
20	David Nguyen	Member	davidhn2@uci.edu	(714) 855-9131	Junior	2
21	Anuj Patel	Member	anujsp@uci.edu	(714) 376-6925	Junior	1
22	Jesus Zepeda	Member	jesuszepeda29@gmail.com	(951) 288-2948	Senior	2
23	Marvin Lin	Member	marvinl1@uci.edu	7143996439	Senior	2
24	Tandy Li	Member	tandyl@uci.edu	(916) 698-6583	Sophomore	1
25	Jacob Gantz	Member	jacobgantz@live.com	(562) 760-6065	Junior	1
26	Danny Chu	Member	dschu@uci.edu	(415) 279-9641	Senior	2
27	Jamie Ibrahim	Member	jmibrahi@uci.edu		Senior	2
28	Brian Pham	Member	brianp1@uci.edu	(714) 905-4965	Senior	1
29	Ryan Razo	Member	rrazo@uci.edu	(562) 237-8416	Sophomore	2
30	Willis Zhang	Member	willisz@uci.edu	(626) 202-9976	Junior	1
31	Daniel King	Member	kingd2@uci.edu	(925) 223-7335	Junior	1
32	Sabrina Ng	Member	Sabrinn@uci.edu	(415) 613-3440	Senior	2
33	Jonathan Chen	Member	jonatc3@uci.edu	(562) 685-2939	Senior	1
34	Don Raveen Solanga Arachchige	Member	dsolanga@uci.edu	(310) 750-8325	Sophomore	2
35	Allen He	Member	ayhe@uci.edu	(626) 715-0102	Junior	2
36	Michael Luong	Member	luongmj@uci.edu	(661) 904-3351	Senior	1

37	Patricio Guerrero Gertz	Member	patriciogguerrero@gmail.com	(310) 413-8050	Junior	1
38	Elena Vazquez	Member	levazque@uci.edu	(818) 813-2131	Junior	1
39	Amoya Lewis	Member	amoyal@uci.edu	(909) 781-7526	Junior	1
40	Ho Kyoung Lee	Member	hokl1@uci.edu	(714) 420-1393	Junior	1
41	Russell Okamura	Member	okamurar@uci.edu	(310) 658-4692	Sophomore	1
42	Saumil Shah	Member	saumils@uci.edu		Sophomore	1
43	Alex Law	Member	alaw2@uci.edu		Junior	2
44	Saho King	Member	kingsl@uci.edu	(858) 353-8163	Sophomore	2
45	Juan David Lopez	Member	jdlopez2@uci.edu	(323) 273-0788	Junior	1
46	Rongyi Zhu	Member	rongyiz@uci.edu	(213) 822-2278	Freshmen	1
47	Quan Ngo	Member	ngoqb@uci.edu		Senior	2
48	Kristanto Uisan	Member	kuisan@uci.edu	(925) 771-9820	Senior	1

## 2.5 Steering Team

#	Name	Title	Steering Role	Email
1	Colin Sledge	Safety Manager	Advisor	csledge@uci.edu
2	Robert Liebeck	Professor	Faculty Advisor	robert.h.liebeck@boeing.com
3	Paul Parcell	Alumni	Engineering Advisor	paulparcell@gmail.com
4	John Chen	Alumni	Management Advisor	johnwc91091@gmail.com
5	Guiseppe Venneri	Alumni	Engineering Advisor	seppe.venneri@mac.com
6	Lawrence Ng	Alumni	Management Advisor	lawrencesuilunng@gmail.com
7	Kamil Samaan	Alumni	Engineering Advisor	samaan@avinc.com
8	Ravi Patel	Alumni	Management Advisor	ravibpatel91@gmail.com

## 2.6 Project Costs Estimation

Project Expense	Comments	Est. Amount (\$)
Composites	Carbon fiber, kevlar, fiberglass, carbon rods	\$2200
Motor/batteries	New set used for each plane	\$2100
Tools	drill bits, dremel bits, etc.	\$200
Molding	Bondo body filler, primer, gel coat, resin	\$600
Aircraft Components	Linkages, servos, electronics	\$350
Supplies	Food, office supplies, miscellaneous building material	\$500
Travel	Transportation, room and board	\$3000
	<b>Total</b>	<b>\$9050</b>

## 2.7 Resource Estimation

Name	Est. Hours	Rate (\$/hr)	Est. Total (\$)
Michael Lau	120	50	6000
Jocelyn Pedroza	120	50	6000
Charles Poblete	120	50	6000
Justin Kerr	90	50	4500
An Do	120	50	6000
Violeta Ismailyan	120	50	6000
Alex Kwok	120	50	6000

Laliphat Kositchaimongkol	120	50	6000
Enrique Gurrola	90	50	4500
Karla Marron	120	50	6000
Arlen Magtoto	90	50	4500
Kunal Deshpande	60	50	3000
Andres Ruiz	60	40	2400
Hugo Mendoza	30	40	1200
Sonny Li	30	40	1200
Zulema Rodriguez	30	40	1200
Justin Williams	60	40	2400
Caroline Alvarado Cantu	60	40	2400
Edmund Situ	30	40	1200
David Nguyen	60	40	2400
Anuj Patel	30	40	1200
Jesus Zepeda	60	40	2400
Marvin Lin	60	40	2400
Tandy Li	30	40	1200
Jacob Gantz	30	40	1200
Danny Chu	60	40	2400
Jamie Ibrahim	60	40	2400
Brian Pham	30	40	1200
Ryan Razo	60	40	2400
Willis Zhang	30	40	1200
Daniel King	30	40	1200
Sabrina Ng	60	40	2400
Jonathan Chen	30	40	1200
Don Raveen Solanga Arachchige	60	40	2400
Allen He	60	40	2400
Michael Luong	30	40	1200
Patricio Guerrero Gertz	30	40	1200
Elena Vazquez	30	40	1200
Amoya Lewis	30	40	1200
Ho Kyoung Lee	30	40	1200
Russell Okamura	30	40	1200
Saumil Shah	30	40	1200
Alex Law	60	40	2400
Saho King	60	40	2400
Juan David Lopez	30	40	1200
Rongyi Zhu	30	40	1200
Quan Ngo	60	40	2400
Kristanto Uisan	30	40	1200
<b>Total</b>	<b>2730</b>		<b>125,700</b>



### 3 Project Risks and Communication

#### 3.1 Risk Mitigation Plan

Risk	Severity	Probability	Mitigation
Rules changes	High/medium	High	Quick design and prototype process
Test plane fails	High	Low	Design easy to repair plane
Competition plane fails	High	Low	Backup plane
Poor weather conditions	Medium	Medium	Test plane in all situations
Mode of transportation fails	Medium	Low	Plan beforehand

#### 3.2 Communication Plan

Communication Type	Audience	Frequency	Responsibility
Weekly general meeting	Everyone	Every Monday at 7pm	Project/team leaders
Team leader meeting	Team Leaders	Every Tuesday at 7pm	Project leaders
Team meeting	Sub-team members	About once per week or when necessary	Team leader
Management meeting	Project leaders	Multiple times a week or when necessary	Project leaders

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## 4 Additional Project Details

*Summary of 2014-2015 AIAA DBF Contest rules*

### Remote Sensor Delivery and Drop System

Visit [http://www.aiaadb.org/2015\\_files/2015\\_rules\\_final\\_20141031.html](http://www.aiaadb.org/2015_files/2015_rules_final_20141031.html) for more detailed rules

#### **Restrictions**

Propulsion

- NiCad/NiMH batteries
- Commercial electric motors driving propellers
- Battery weight less than 2lbs
- No fuse limit

Nothing can come off in flight

60 ft takeoff field length

#### **Missions**

Ground Mission – Payload Loading Time

- Load team-selected amount of balls in the least time possible

Mission 1

- Maximum number of laps in 4 minutes

Mission 2

- Payload: one stack of three 10" long 2x6's weighted to 5lbs
- 3 laps in least time possible
- Payload must be **internally** stored (no airflow over payload)

Mission 3

- Payload: team-selected number of 12" wiffle balls weighted to ~2.4 ounces
- Drop balls within drop zone each lap
- Payload must be stored **externally** (exposed to airflow on at least 3 sides)

#### **Scoring**

Ground mission (GS) = (fastest loading time / loading time) or 0.2 if not completed

Mission 1 (M1) = 2 \* (number of laps flown / max number of laps flown)

Mission 2 (M2) = 4 \* (fastest time flown / time flown)

Mission 3 (M3) = 6 \* (number of laps flown / max number of laps flown)

Empty weight (EW) = max (EW1, EW2, EW3)

Rated aircraft cost (RAC) = **EW \* number of servos**

\*servo includes any mechanical and electrical component used for propulsion and payload (excluding motor)

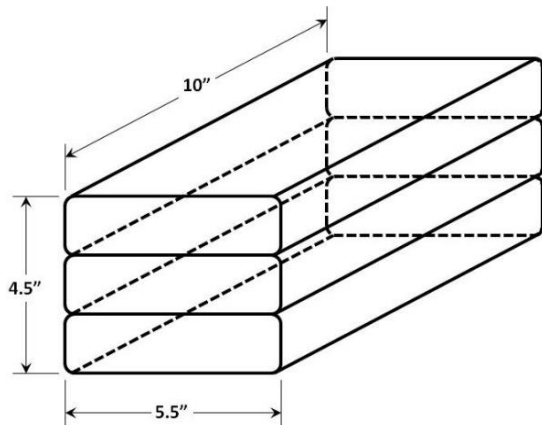
Flight score (FS) = M1 + M2 + M3

Total Mission Score = **GS \* FS**

Total Score = Written Report Score \* Total Mission Score / RAC



Mission 3 Payload



Mission 2 Payload

