Group #	1	
Item	Name	
1) Concept Overview / Design Philosophy		
a) Overview and objectives of vehicle design approach (fully describe your approach to completing the requirements and the overall vehicle)	All	
b) Requirements Compliance Matrix (Attachment 1)	Jacob L	
i) Complete and submit Attachment 1: provide a full answer as to how you are going to fulfill that requirement with the design of the vehicle.	Jacob L	
c) Concept of Operations (CONOPS)	Jack K	
i) 1 page graphic, 1 page narrative event listing with timeline	Carter D (Graphics)	
d) Human rating certification process		
i) Briefly describe what human rating means	Christian B	
ii) Detail how to human rate the launch vehicle regarding statistics.	Christian B	
e) Budget (basic – overview)	Jack K	
i) Chart type, year by year, 20% 0f NASA budget, FY19 inflation yearly, provide a total at the end.	Jack K	
ii) Complete AMCM and compare to budget availability estimation	Jack K	
f) Timeline (GANTT chart, by year) of critical	Jackson T	
2) Overall vehicle specifications	Jack K	
a) Mass, dimensions, etc. (Fly Sheet Example – make as a handout for reviewers)	Carter D (Graphics/Schematics)	
3) Staging (1 page)	Jack K	
a) For each stage, provide a 1 page detail of the following items	Jack K	
i) CAD drawing identifying significant design features and dimensions	Carter D	
ii) Mass and volume requirements (Matlab calculations)	Jack K (staging/ascent req)	Carter D (Tank sizing)
iii) Mass and volume as designed / to be built	Jack K (staging/ascent req)	Carter D (Tank sizing)
(1) Inert and Payload mass fractions	Jack K	
(2) Wet / Dry mass	Jack K	
4) Capsule Design (Option 1 only)	N/A	
a) CAD	N/A	
b) Layout	N/A	
c) Capabilities	N/A	
5) ECLSS (Option 1 only)	N/A	
a) Air supply (O2 / N2)	N/A	
b) CO2 / Trace Contaminant control	N/A	
c) Water supply / regeneration	N/A	
d) Food	N/A	
e) Thermal regulation	N/A	
f) Sleeping	N/A	
g) EVA capabilities	N/A	
6) Cargo Module (Option 2 only)		
a) Structure layout	Grant T (In Fairing)	Carter D (paylaod support)
b) Propulsion (primary and secondary)	Grant T	
c) Docking Method and Equipment (Design and CAD)	Jacob L	
7) Main Propulsion (for each stage)	Carter D	
a) Power Cycle(s) (e.g. gas generator, staged combustion, etc.)	Carter D	
b) Isp, burn time, characteristic velocity, total impulse	Carter D	
c) Propellant type (Fuel, Oxidizer, Binder (if applicable))	Carter D	
d) Mass and volume of each engine	Carter D	
e) Propellant flow rate (each and total)	Carter D	
f) Main Propulsion Feed Assembly (electric pumps, turbopumps, inducer, pogo suppressor, electric valves, pyrotechnic valves, actuators, anti-swirl vanes, slosh baffles, low-level sensor(s), etc.)	Carter D	
g) Thrust vector control:	Carter D	
i) Type (liquid injection thrust vector control, hydraulic gimbal actuator(s), electromechanical gimbal actuator(s), electrohydraulic gimbal actuator(s), jet vanes, etc.)	Carter D	
ii) Requirements (response rate (deg./sec.), maximum-commanded deflection (deg.))	Carter D	
iii) Effective deflection arc fan	Christian B	
iv) Applicable trade studies	Carter D	
8) Secondary/Auxiliary Propulsion (fixed or separating strap-on solid or liquid rocket, retro motor(s), roll control, attitude/attitude-rate control, ullage ΔV (settling-burn))	Grant T (RCS)/Carter D (ullage)	
9) Liquid Main Engine Control (throttle, mixture ratio, thrust vector control loop closure, linear variable differential transformer(s) for actuator position, FADEC/ ECU)	Jacob L	

10) Solid Rocket Motor Thrust Termination Approach (if applicable)	N/A
Group #	1
11) Liquid Propellant Tank Pressurization	
a) Type (blow-down, pressure-regulated), initial ullage pressure	Carter D
b) Pressurant (autogenous (self-pressurizing), helium, Tridyne, etc.)	Christian B
12) Structural	
a) Overall design (parallel, stacked, etc.)	All
b) Center of gravity (range)	Carter D
c) Stability margin (CP to CG distance)	Grant T
d) Type of structure for each section (isogrid / orthogrid / rib - stringer, etc.)	Carter D
e) Structural analysis of tanks and overall structure (Patran / Nastran / Apex analysis)	Carter D
f) Hand calculations for structural loads (main structures only)	Carter D
g) Materials / trade studies	Christian B
i) Tanks, Engine Mounts, skin, thermal control (materials, design)	christian B
ii) Fairings / aerodynamic coverings / Thermal control surfaces	Carter D/Jacob L
13) Aerodynamic	Jack K
a) Drag calculations (hand calculations and CFD)	Jack K
b) Heating calculations during ascent (hand calculations and CFD)	Jack K
c) Center of pressure (Barrowman's Calculations)	Grant T
d) Flight dynamics analysis (CFD)	Jack K
14) Electrical	Jacob L
a) Voltage(s) and Power bus block diagram	Jacob L
b) Power routing diagrams	Jacob L
15) Avionics and guidance / navigation/ control (GNC)	Grant T
a) Block diagram (major components)	Grant T
b) Function of each component - redundancy	Grant T
16) Communications	Jackson T
a) Objective of communications system	Jackson T
b) Requirements	Jackson T
c) Uplink / downlink	Jackson T
i) Transmission band(s) / Frequency ranges	Jackson T
ii) Equipment including antenna(s)	Jackson T
iii) Block diagram of data / comms system	Jackson T
17) Health monitoring of vehicle	Jacob L
a) Objective of health monitoring system	Jacob L
b) Requirements and sensors	Jacob L
c) Data handling system (M-DM, etc.)	Jacob L
18) Flight termination system (FTS)	Jackson T
a) Requirement of system and overview	Jackson T
b) Adherence to requirements (Doc. 319-10, Flight Termination Systems Commonality Standard)	Jackson T
c) Components, locations, and proposed outcomes	Jackson T
19) Flight test plan (timeline and compliance with human rating requirements)	Jackson T
20) Final overview of vehicle systems	Grant T
21) 2-D Drawings / 3-D CAD of vehicle segments and overall vehicle with dimensions.	Christian B