

Preliminary Proposal for Engagement in Camden County

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Introduction

ABL Space Systems Company (“ABL”) is evaluating entering into an agreement with Camden County (“Camden”) with a variety of possible dimensions surrounding launch vehicle manufacturing, test and launch. ABL representatives traveled to Camden, Georgia to meet with Camden officials on November 29th, 2017. At this meeting, different mechanisms for engagement were discussed. This proposal builds on those discussions to identify ways for the parties to engage in a mutually beneficial manner.

The content in this document is deliberately kept high level and de-granularized to enable us to establish an agreement in principle. Subsequently, detailed terms will be established. There are many ways for ABL and Camden to engage and each is outlined in this document. ABL also welcomes other ideas from Camden not included in our list.

Relationship and Benefits

We’ve tried to clearly define what is important to ABL and also present our assessment and understanding of what is important to Camden. We welcome any feedback and guidance on Camden’s priorities. The better that ABL can understand how Camden can benefit from a relationship, the better ABL will be able to tailor the terms of the relationship in a favorable manner. Table 1 defines ABL’s perception of how Camden and ABL each benefit from the relationship.

Table 1

	Camden	ABL
Benefits from	<ul style="list-style-type: none"> Anchor spaceport tenant Job creation Activity at spaceport Infrastructure development 	<ul style="list-style-type: none"> Low inclination launch site High-rate manufacturing site Strong local workforce Non-dilutive grant funding Equity investment Long term debt financing
Provides	<ul style="list-style-type: none"> Launch site operator license Strong local workforce Support for funding 	<ul style="list-style-type: none"> Job creating Technical training for transitioning Navy Activity and publicity at spaceport Infrastructure development

ABL Information

To provide context for this proposal, the RS1 launch vehicle and high-level background info on ABL are presented.

RS1 Vehicle Description

The RS1 launch vehicle is a two-stage, liquid propellant launch vehicle and defined by the attributes in Table 2.

Table 2

Stages	2
Propellant (both stages)	Liquid Oxygen Rocket Propellant-1

Length Overall	65 feet
Outer Diameter	5.5 feet
Stage 1 Thrust	70,000 lbf
Stage 2 Thrust	5,900 lbf
Payload Capacity	650kg to 200km x 28.5 deg

Development Schedule

ABL’s development schedule is presented in Table 3. Dates are tentative and conservative. When engaged formally with Camden, ABL can commit to regular schedule updates to ensure readiness transparency.

Table 3

Date	Item
December 2018	Critical Design Review
June 2019	Tank Structural Qualification Campaign
August 2019	Wet Dress Rehearsal Campaign
April 2020	Ground Test Campaign
June 2020	First Launch
October 2020	Second Launch
February 2021	Third Launch

Launch Cadence

After the development period, ABL intends to scale launch rate on the following cadence.

Table 4

Year	Number of Launches
2021	3*
2022	6
2023	12
2024	18
2025	24

* Launches in 2021 include the launches listed under the development cycle.

Per Launch Concept of Operations

The per launch concept of operations is presented in Table 5 to provide a high-level understanding of the launch workflow. General resources requirements for each operation are presented. The structure for how resources are provided and by which party can be established in later discussions. Operations can be segmented into:

1. Hangar operations
2. Payload processing
3. Staticfire (short duration, <10s vehicle test)
4. Launch

Table 5

Category	Operation	Resources and Notes
Vehicle Shipping and Integration	Vehicle shipping (stages, fairing and payload; possibly shipping together or separately)	Early development vehicles to be built in Los Angeles. If high-rate production facility is located in Camden county, shipping is largely simplified.
	Vehicle receipt at Camden	Lifting of container(s) from trucks onto ground level
	Vehicle checkouts and in-hangar integration	<ol style="list-style-type: none"> 1. Use of hangar facility 2. 5,000 psia gaseous helium supply 3. 5,000 psia gaseous nitrogen supply 4. Internet connection 5. Power
	Stage mate in-hangar	
Staticfire Operations (including on-site transport)	Vehicle rollout to launch pad (without payload)	
	Vehicle lift vertical	
	Vehicle staticfire test on launch pad	<ol style="list-style-type: none"> 1. Launch pad 2. Security to enforce the blast danger area 3. S-band telemetry downlink test 4. Bulk liquid oxygen 5. Bulk RP-1 6. Bulk gaseous helium 7. Bulk gaseous nitrogen 8. Launch control center
	Vehicle lower to horizontal	
	Vehicle roll in to hangar	
Payload Processing	Payload processing and fairing encapsulation	Payload processing clean room
	Payload transportation from processing facility to hangar	
	Payload mate in-hangar	
Launch Preparation	Vehicle rollout to launch pad (with payload)	
	Vehicle lift vertical	
Launch Operation	Launch vehicle	<ol style="list-style-type: none"> 1. Launch pad 2. Deployment of weather balloons 3. Issuance of notice to mariners 4. Issuance of notice to airmen 5. Security to enforce the blast danger area 6. S-band telemetry downlink 7. Range tracking video 8. Bulk liquid oxygen

RS1 Development and Qualification Testing

In Q3 2018 (or as early as Q2 2018), ABL will be ready to perform structural testing on the RS1 launch vehicle. The vehicle will be tested without engines. For this battery of testing, ABL will lift the vehicle into a vertical configuration using launch-like infrastructure (ABL to supply). In the vertical configuration, the vehicle will be hydrostatically pressurized to qualify the design of the structure. Additionally, ABL will use actuators to apply loads to the vehicle to further test the structure. ABL will supply all required test infrastructure. ABL will require gaseous nitrogen, liquid nitrogen and liquid kerosene bulk commodities and can coordinate local deliveries as necessary or work with Camden to secure the resources.

There likely will be multiple segments to the test campaign, each lasting one to three weeks. During each segment, approximately 10 to 20 individuals will be onsite.

RS1 Ground Test

In early 2020, ABL will be ready to perform a vehicle ground test of the RS1. This will involve holding the vehicle on the ground and firing off the engines to test the integrated launch vehicle. It is logical for ABL to perform this test at the launch site to utilize the same infrastructure and personnel. This will be a very similar operation to launch. ABL will supply all infrastructure required. ABL will require gaseous nitrogen, liquid nitrogen and liquid kerosene bulk commodities and can coordinate local deliveries as necessary or work with Camden to secure the resources. The campaign will likely last two months with an average of 25-35 individuals onsite for the campaign.

RS1 Early Flights

In mid 2020, ABL will be ready to launch the RS1. ABL will supply all infrastructure required and simply requires a flat space to launch from. A dedicated launch pad is not required, but could be useful if available. ABL will require gaseous nitrogen, liquid nitrogen and liquid kerosene bulk commodities and can coordinate local deliveries as necessary or work with Camden to secure the resources. The campaign will likely last two months with an average of 25-35 individuals onsite for the campaign.

ABL Dedicated Launch Pad

As ABL grows, we will want a dedicated launch pad for the RS1. We hope to situate this pad on the Camden site, especially if we can collocate our manufacturing facility nearby. With a dedicated launch pad, ABL would permanently locate staff in Camden county.

RS1 Manufacturing Headquarters

If Camden county is the primary launch location for the RS1 launch vehicle, it would be logical to locate the RS1 manufacturing headquarters in the area. This will reduce the need to transport the integrated rocket over long distances. If ABL locates the RS1 manufacturing headquarters in Camden county, it is expected that 150 jobs would be created. ABL would be ready to set up a high rate manufacturing facility after the initial three launches, which are expected to be complete in 2021.

ABL Payload Processing Facility

Separate from the manufacturing facility, ABL is interested in building a payload processing facility and cleanroom at the Camden Spaceport. We would use this facility to integrate and encapsulate payloads into our fairings. ABL would also be interested in building a facility that is available for use by other

		<ul style="list-style-type: none"> 9. Bulk RP-1 10. Bulk gaseous helium 11. Bulk gaseous nitrogen 12. Launch control center
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Methods of Engagement

Table 6 defines a variety of mechanisms in which ABL and Camden can engage. In general, the objective is to establish relationships that are mutually beneficial to both parties and help foster a long-term commitment. Following the table, specific detail is provided for each possible mechanism.

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launch vehicle providers at the Camden spaceport. This would establish common infrastructure at the site and help to attract other users.

Site Operating Protocols

As early users of the Camden Spaceport, ABL would be interested in helping to develop the gold standard for Camden's launch site and range operational procedures. ABL can help to create and write the launch service provider "operating manuals" at the site. These can include safety protocols, operating procedures, vehicle standards etc. This set of documents would be similar to the Range User's Guide available at other launch sites.

State grant funding

If Camden can help ABL secure non-dilutive grant funding from the State of Georgia, ABL will apply that funding directly towards infrastructure to launch and/or manufacture the RS1 launch vehicle in Camden County

Support from local private investment

ABL is aware of the Invest Georgia initiative, with the State of Georgia holding a Limited Partner position at four venture capital firms in Georgia. ABL would appeal to Camden to assist ABL with fundraising from Mosley Ventures, TechSquare Capital, Engage Ventures or similar. Funding from here would be directed towards infrastructure to launch and/or manufacture the RS1 launch vehicle in Camden County

Similarly, there may be other private investment firms or individuals in Georgia or specifically Camden. If Camden can help secure private funding from these sources for ABL, the funding can be directed towards infrastructure to launch and/or manufacture the RS1 launch vehicle in Camden County

SBIR Match Funding

ABL has applied for (and will additionally apply for in the future) SBIR grants from DARPA. The first decision on these grants is expected in February 2018. It seems that Georgia previously had SBIR grant matching programs, but it is unclear if they are still active. If Camden can help ABL to secure SBIR matching funding, ABL will apply the funding directly towards infrastructure to launch and/or manufacture the RS1 launch vehicle in Camden County.

Local High School Support

ABL works with local Camden County high schools through a variety of STEM programs to introduce students to engineering. ABL can support in classroom curricula as well as help with launch vehicle hardware demonstrations at the spaceport.

Internships for Georgia Tech Students

ABL can set aside a dedicated pool of paid internship spots for students at Georgia Tech. The internships can be at ABL's design facility in Los Angeles or future manufacturing and launch facilities in Camden. Georgia Tech is an incredibly strong aerospace program and ABL would benefit from the talent base. Similarly, ABL would increase ties with the Georgia community.

Launch Vehicle Technician Programs at Coastal Pines Technical College (or similar)

ABL can work with Coastal Pines Technical College to create one or more programs to train students as Launch Vehicle Technicians. Different, specialized curricula can be created to tailor skill sets towards structures, avionics, propulsion and vehicle operations. These programs will help create a specialized labor force in the area to support the growing Georgia space community. We are unaware of any similar programs in the United States and this would be a national first. ABL would benefit from having a skilled workforce in the area and it would be our way to help jumpstart the local labor force.

Coastal Pines Technical College was identified from Camden's Mission Possible publication and ABL is open to working with other local institutions as identified by Camden.

Collegiate Rocket Competition at Camden Spaceport

ABL is interested in continually engaging with collegiate rocket and space clubs nationwide. By working with young engineers, ABL strengthens the technical student force and also identifies top candidates for future employment. ABL is interested in hosting an annual rocket competition in which student teams bring their vehicle to demonstrate and compete. Events may include ground tests of engines and flight tests. If ABL has a presence in Camden, it would be logical for us to host the event at the spaceport. Similar events (but not hosted by commercial companies) are common throughout the United States. Such an event would attract visitors to the area and continually reinforce Camden's presence in the aerospace world.

Navy Transition Program

To support the military force from the King's Bay submarine base, ABL will set aside a minimum number of jobs on an annual basis for transitioning service members. ABL will develop the program with the submarine base officials to enable a seamless transition for the service member.

Innovation Park Anchor Tenant

ABL is interested in having a local engineering presence and can help the development of Camden County's innovation park by being the anchor tenant in the complex. ABL will locate engineering operations that support launch and build operations in the complex. This can become a workplace for further innovation in the RS1 launch vehicle program.

Shipping Through Georgia Ports

ABL imports some raw stock commodities from Europe and can route the containers through Georgia ports to help solidify the tie between ABL and the state.

Media Exposure

ABL is excited about the opportunity to work with Camden County and is ready to support the spaceport development effort through a variety of public relations efforts. ABL will work with Camden County to establish the proper media program that benefits both parties. This can include public appearances, hardware demonstrations or similar.

State Lobbying

The Camden Spaceport program is important to ABL. We will rally our lobbying resources to help encourage further state support for the Spaceport project as appropriate.

Local Vendors

ABL wants to further the development of the local Camden manufacturing ecosystem. ABL will support local industry by purchasing machined parts, components and other items locally. Similarly, ABL will work with the Camden County to identify which types of machine shops would be best utilized by our production process. We can help identify requirements, which can be used to attract other businesses to the area.

Next Steps

ABL is highly interested in working with Camden to develop a long-standing relationship that supports ABL's commercial space activities and Camden's aerospace and spaceport presence. We respectfully request that Camden review this document and provide feedback on possible methods for engagement. Additionally, ABL requests that Camden provide further guidance on Camden's priorities and how ABL can best serve them. As our parties come to a mutual understanding and an agreement in principle, we can formalize terms in subsequent documents.