Justification and Approval for Sole Source Procurement

Simplified Acquisition

1. Name of Requiring and Contracting activity.

NAVAL POSTGRADUATE SCHOOL

2. Nature and/or description of the action being approved.

Advanced Controls Teaching / Research Laboratory Setup items from Quanser, Inc.

3. A description of the supplies and services being procured and their estimate value.

The items include three Qball Rotorcraft, three Rotary Servo Plants with different replaceable modules, Rotary Servo Plant with Solar Tracker Module, three Self-Erecting - Linear Inverted Pendulum modules, Seesaw Module, Double Inverted Pendulum Module, Linear Flexible Joint with Pendulum, supplemental equipment and software licenses.

4. Statutory authority to procure requirement under sole source procedures. The Contracting Officer shall state here that the procurement is under the "test program" for commercial items. (Regulatory authority will be either Clinger –Cohen Act 10 U.S.C. 2304 (g)(1)(B) or 41 U.S.C. 253)

5. A description of the unique capabilities or qualifications, which requires acquisition under sole source procedures.

The Advanced Control Laboratory at the Naval Postgraduate School is actively pursuing research in navigation and control. Our market research shows that the Quanser, Inc. offers a complete controls teaching solution from very basic controls all the way up to control very complex systems requiring advanced control theory their software is user-friendly and works directly under Matlab/Simulink, the environment we are offering in out other classes on controls. On top of this, Quanser software is a real-time control tool. It takes Simulink diagrams and allows them to run in real-time. As the controller is running, students can tweak gains and immediately see its effect on the hardware all experiments are open architecture, so they we can easily tweak them for use on research projects for the US Navy, US Army and US Air Force complete curriculum enabling full capacity of the hardware/software

The controls experiments supported by Quanser equipment are complete turnkey systems for teaching a wide range of topics within control theory. The open architecture nature of the system means that it can be expanding upon and integrated with a larger variety of experiments and can be used for research purposes.
The micro aerial (UAV) and ground (UGV) vehicles designed and manufactured by Quanser are not comparable to any other system currently available on the market. The uniqueness of the solution is found in the protective cage surrounding the UAV that allows it to remain operationally after multiple crashes and in the software, QUARC, which enables rapid deployment of controllers and significantly reduces design cycle time. QUARC interfaces with Matlab Simulink and produces software code that runs on a version of the Linux operating system running on a wireless computer, the Gumstix. The software for the micro UAV lab also includes pre-designed modules for deploying adaptive and collaborative control algorithms simultaneously on multiple vehicles. Quanser is the only company to produce software that allows the researcher to deploy controllers designed in Matlab Simulink on a wireless Linux Gumstix computer.
In FY2010, after a thorough review of the market, we found that this company, Quanser, Inc., is the only company in the North America, which offers educational equipment we need. The only other company offering some of equipment, not a complete set, which is also not MATLAB-compatible is ECP, Education Control Products. The ECP does not offer ground or aerial vehicles, but just two plants: Rectilinear Plant and Torsional Plant with the Inverted Pendulum. Hence, we knew upfront that Quanser offers the better product. Nevertheless, we bought one set of those educational plants from ECP and also some of Quanser equipment:

- **-one Qball UAV**
- **-four Qbot UGV**
- **-a single rotary platform equipped with a flexible joint (to study vibration suppression and weapons aiming), self-erecting inverted pendulum (to study stability and controllability is-sues) and gyro-stable platform (to learn about gimbaled platform including those used in INS)**

We compared the products offered by both companies during three quarters, teaching controls courses and doing research, and came to an unambiguous conclusion that it is Quanser equipment we need to buy to finalize equipping the Advanced Controls Lab at NPS. Specifically, we need to buy the following additional equipment:

-three more Qball rotorcraft (a quadrotor helicopter with four motors and speed controllers fitted with 10-inch propellers). This vehicle is an ideal tool for teaching basic vehicle navigation and control, and it can also be used in more advanced multi-agent missions involving other Qball UAVs and Qbot UGVs.)
-three more rotary platforms equipped with the single- and two-degree-of-freedom ball and beam modules (to study feedback stabilization), double inverted pendulum, rotary flexible link module (these platforms are equipped with the data acquisition board, amplifier, control software, pre-designed controllers and are accompanied by a complete sets of the course materials for seven completely different control challenges which maximizes the return on investment)
-rotary servo plant with solar tracker module
-three linear platform equipped with self-erecting linear inverted pendulum, double inverted pendulum, seesaw module and linear flexible link module (the platform are based on high fidelity linear cart powered by a 400-Watt brushless servo motor which gives students the power to successfully perform the most challenging of control experiments)

This additional equipment will allow us to start using this complete set in our classes to support all content of the control courses offered by three different departments. Having multiple setups will enable to have less students in each study group, and having multiple heterogeneous autonomous vehicles will support NAVY's research agenda on collaborative control of multiple heterogeneous agents.

To summarize,

-We conducted market research and compared Quanser products with the limited line of products from ECP and concluded that Quanser offers equipment with much wider capabilities
-We are currently using software and hardware from Quanser and must continue to use it in order to meet NPS's mission which supports the information listed above
-Due to the current limited number of sets being used in the classrooms and in order to provide continuity with the new required sets, it is essential that the equipment is purchased from Quanser and no other company

6. A description of efforts made to ensure that offers are solicited from as many potential sources as is practicable. (i.e. FACNET, CBD Synopsis or documentation explaining exception to synopsis requirement)

Quanser system is unique because it offers a complete Autonomous Systems Controls setup as opposed to a single robots. The Quanser setup will allow us to explore coordinated and collaborative control between multiple agent and its friendly environment will allow out students to be easily and fully involved into designing low and high-level control algorithms for multiple agent.

7. A determination that the anticipated cost to the Government will be "fair and reasonable".

Contracting Officer will determine prior to award

8. A description of the "Market Research" conducted and the results or a statement explaining the reason market research was not conducted.

Ongoing surveillance of the related market indicates that no other source can satisfy the requirements identified in paragraph 5.

9. Any other documentation that would lend support to the sole source justification.
N/A

10. Listing of Interested Sources.

11. A statement of the actions, if any, to remove barriers to competition.

There are software continuity or compatibility issues that would arise if this contract was awarded to another company besides Quanser. The equipment is ONLY produced by Quanser and it comes with their specified software. Any other equipment will not support our mission and will not work with Quanser software at all
We are unaware of any patents or copy rights issues with Quanser. Their equipment is commercially available and sold to tens and tens of universities both nationwide and worldwide.

12. Contracting Officer Certification that the justification is accurate and complete to the best of the contracting officer's knowledge and belief. Supporting data is required.

13. Total estimated dollar value of the Acquisition covered by this J&A
including S&H, setup and training.

14. Contracting activity point of contact.

Professor Oleg Yakimenko

June 22nd, 2011

Program Manager Date

Contracting Officer Certification