JAUS Interface Design Document
For
International Autonomous Underwater Competition
2007

Version 1.0

June 4, 2007

1 EXECUTIVE SUMMARY 1

1.1 OBJECTIVE 1
1.2 VOLUNTARY PARTICIPATION 1
1.3 THE CHALLENGE 1
1.3.1 WRITTEN/ORAL PRESENTATION 1
1.3.2 PRACTICAL DEMONSTRATION 1
1.4 JUDGING 1
1.5 AWARD 2

2 TECHNICAL APPROACH 3

2.1 NETWORK BASED 3
2.1.1 WIRED ETHERNET (802.3) 3
2.1.2 WIRELESS ETHERNET (802.11) 3
2.2 JAUS COMMUNICATIONS 3
2.3 UDP PORT ALLOCATION 3
2.4 IP ADDRESS ASSIGNMENT 3
2.5 JAUS IDS 4
2.6 JAUS CHALLENGE 4
2.6.1 JAUS HEADER FIELDS 4
2.6.2 MOBILITY 4

RECORD OF REVISIONS			
Revision	Date	Pages Involved	Change Number
Initial	04 June 2007	Initial Release	

1 EXECUTIVE SUMMARY

INTERNATIONAL AUTONOMOUS UNDERWATER COMPETITION 2007 JOINT ARCHITECTURE FOR UNMANNED SYSTEMS (JAUS) IMPLEMENTATION

1.1 Objective

JAUS is a set of standardized messages suitable for controlling all types of unmanned systems, and is soon to become an Aerospace Standard of the Society of Automotive Engineers (SAE). IAUC officials and sponsors believe that it is valuable for student teams to be exposed to and familiar with JAUS. The intent is to start at a very simple level and incrementally increase the complexity at successive IAUCs.

1.2 Voluntary Participation

Student team participation in the JAUS portion of IAUC is voluntary. No negative implications will be assigned or implied to teams that do not participate.

1.3 The Challenge

There are two aspects to the IAUC JAUS Challenge: (1) a written/oral presentation and, (2) a practical demonstration.

1.3.1 Written/Oral Presentation

Teams will be allotted a 5 minute oral presentation slot immediately after their Static Judging time to brief a special JAUS Judge orally. A design report of up to 5 pages describing their JAUS implementation will also be due at that time. Topics addressed in the design report and presentation shall include:

1. Student team's process for learning about JAUS.
2. How JAUS messages were integrated into the design.
3. Challenges to implementation that were encountered.

1.3.2 Practical Demonstration

The practical demonstration will consist of the team's vehicle being connected to an IAUC developed operator control unit (OCU) via an Ethernet data link (either wired or wireless). The OCU will send the messages described in later sections to the vehicle. The JAUS Challenge testing will be performed at the team's on-site tent as scheduled. The vehicle will also be tested to ensure it only accepts messages intended for it. The technical requirement details are in section 2.

1.4 Judging

IAUC JAUS Challenge judging will be on a pass-fail basis. Judgment will be based on satisfactory completion of the practical demonstration and an evaluation of the JAUS implementation description in the team's paper. The JAUS judges will determine if the oral presentation and paper have sufficient detail to address the areas listed in section 1.3.

1.5 Award

Schools that successfully complete the IAUC JAUS Challenge shall receive an award of $500.00. There will only be one monetary prize per school.

All schools and teams participating in the JAUS Challenge will be individually recognized on the IAUC website.

2 TECHNICAL APPROACH

Student teams are required to implement the messages defined in this section as defined by the JAUS Reference Architecture version 3.2 Part 3 and the JAUS Header as described in the JAUS RA V3.2 Part 2. All other messages within the JAUS Reference Architecture document may be ignored for this competition. The IAUC OCU will not transmit JAUS messages that are not defined within this section. Teams are not required to develop an OCU for this competition, but are free to develop one that may help in testing. The JAUS Challenge will be conducted at the team's on-site tent. A sign-up sheet will be made available to schedule the time for the teams to be tested in the JAUS challenge.

The current JAUS RA documents can be found at:
http://www.jauswg.org/baseline/refarch.html.

2.1 Network Based

The network connection between the team's vehicle and the IAUC OCU shall be Ethernet (802.3) or Ethernet (802.11).

2.1.1 Wired Ethernet (802.3)

A JAUS judge will provide an Ethernet switch and cables needed to connect between it, the IAUC OCU, and the vehicle.

2.1.2 Wireless Ethernet (802.11)

The Radio Frequency will adhere to the 802.11g specification. The protocol will be carried using a Direct Sequence Spread Spectrum (DSSS) carrier that is prevalent in commercially available wireless Ethernet systems.

2.2 JAUS Communications

JAUS communication will be accomplished using UDP (User Datagram Protocol) over Ethernet. The UDP header, in addition to the JAUS header information and the standard UDP header information will include eight bytes containing the ASCII equivalent of "JAUS01.0". Only one JAUS message per UDP packet is allowed.

2.3 UDP Port Allocation

The following TCP/UDP ports shall be used for data transfer via Ethernet during the challenge:

Command and Control	3794

2.4 IP Address Assignment

Communications: Internal (subsystem) traffic shall not leave the subsystem.

The IP address for the OCU shall be: 192.168.128.1

The IP addresses for the student unmanned vehicles shall be selected from the following range: 192.168.128.2-254

2.5 JAUS IDs

The following values will be used for the JAUS IDs:

The last octet of the IP address will be the Subsystem ID.
The Node ID will always be 1.
The Component ID for the vehicle will be the Primitive Driver ID (33).
The Component ID for the OCU will be the System Commander (ID 40).
The Instance ID will always be 1.

2.6 JAUS Challenge

2.6.1 JAUS Header Fields

The vehicle shall not respond to messages that have an improperly formed JAUS Header. A properly formed JAUS Header consists of 16 bytes and contains the following information:

1. JAUS Message Properties
    a. Version must be set for 3.2
    b. User Defined Message bit must be set to JAUS
    c. Service Connection bit must be set to Not
    d. Ack/Nak must be set to None
    e. Priority must be set to Default
2. Command Code
3. JAUS Destination ID (as specified above for the vehicle)
4. JAUS Source ID (as specified above for the OCU)
5. JAUS Data Control (bytes)
6. Sequence Number set to zero

To pass this part of the challenge, the vehicle shall not respond to any JAUS message that has an improperly formatted Header.

2.6.2 Mobility

The vehicle's forward thrust motor(s) will turn on upon receipt of the JAUS Resume message (Cmd Code = 0004h).
The vehicle's forward thrust motor(s) will turn off upon receipt of the JAUS Standby message (Cmd Code = 0003h).
These commands will show the ability of the vehicle to start and stop its autonomous operations.