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ISA-SP100.11
Call for Proposal

Wireless for Industrial Process Measurement and Control

14 July 2006

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Call for Proposals (CFP)
SP100.11- Wireless for Industrial Process Measurement and Control

I. SUMMARY

RELEASE DATE: July 14, 2006
Candidate technical proposals are requested by the ISA SP100.11 work group (WG) to form the baseline for its draft standard that will address wireless for Industrial Process Measurement and Control. This document describes the process and requirements for responding to this call for proposals.

The SP100.11 Work Group is chartered to develop an ISA SP100 Standard that will define the OSI layer specifications (e.g. PHY, DLL, etc), security specifications, and management (including network and device configuration) specifications for wireless devices serving classes 1 through 5 industrial device applications with consideration for class 0 applications.

This CFP solicits proposals and data that will form the baseline of a draft standard that will fulfill the scope and purpose of SP100.11. Additionally, there are four (4) other documents that the proposer is advised to read: the use case summaries, draft technical requirements for securable wireless industrial field networks**,** the definition of the fundamental requirements implied by applications i.e. the technical requirements document (TRD), and a list of expected performance and attribute criteria that will be used by the SP100.11 WG to evaluate the proposals. All of these documents will be accessible on the SP100 committee web site. Please note that the target set of use cases has only been partially documented (< 10%) and therefore the technical requirements may change significantly over the next few months.

CALL FOR INTENT: Due August 1, 2006 (11 PM Eastern Daylight saving time)
The Call for Intent is a process in which all interested parties are asked to identify their intention to submit proposals. **YOU MUST DECLARE YOUR INTENT**. You may decide later, if necessary, to retract your intent, but it must be declared. The purpose of this call is to enable scheduling for the optional preliminary proposal contributions in September and the mandatory final proposal presentations in December 2006, as well as assignment of document numbers. The intent to Proposal is due on 1 August 2006. Send your notification of intent to ISASP10011CFP@isa.org. If your response is not acknowledged within two business days please resend. The meeting agenda(s) will be posted on the SP100 web site at least 30 days before the meeting. All proposers are required to join the ISA list serv for SP100.11 (instructions are on the SP100 web site).

CALL FOR PRELIMINARY PROPOSALS: Due September 8, 2006 (due 11 PM Eastern Daylight Time)
Proposers are strongly encouraged, but not required, to provide and present a preliminary version of their proposals at the September 11 – 13 meeting to the SP100.11 WG membership, to share the breadth of their proposals and the opportunity for early proposal mergers. It also allows the committee to review the requirements and selection criteria documents for correctness.

As stated above, a preliminary proposal conference will be held in the Chicago area, Illinois on 11-13 September 2006. In the open and collaborative spirit of ISA-SP100.11, this conference is intended to help people improve their proposals and identify potential collaborators.

The agenda will include:

- Presentation by ISA-SP100.11 of available Use Case information, and discussion.
- Walk-though of the ISA-SP100.11 proposal and evaluation process. At this meeting a revised project plan for the development of ISA-SP100.11 will be discussed and will include a down-selection process so as to encourage collaboration particularly if there are a significant number of proposals.
- PowerPoint or similar presentations (i.e. public disclosure) by proposing companies and individuals addressing the SP100.11 technical description questionnaire that is included in this document as Annex A.
- Panel discussion at the conclusion of the presentations where a panel (consisting of the proposers) will address questions and concerns from all attendees (including fellow panelists).

CALL FOR FINAL PROPOSALS: (tentative) Due December 4, 2006 (due 11 PM Eastern Standard Time)
All proposers are required to provide and present a final version of their proposals at the final proposal meeting to the SP100.11 WG membership, to share the breadth and advantages of their proposals and to allow the opportunity for final proposal mergers. The venue for this meeting is tentatively scheduled for the 12 - 14 December at Shell's facility in Amsterdam, NL. Final arrangements for this meeting will be released at the SP100 committee meeting in Houston in October 2006.

PROCESS:
All submissions to the CFP shall be formatted as per the ISA format with a cover page. The cover page releases the submission for the public use by the ISA. Rules for ISA submissions and formats for Microsoft Word and Power Point documents may be found on the SP100 web site.

All requests for procedural help, submissions, and questions should be submitted to ISASP10011CFP@isa.org.

The selection criteria may be used to assist the work group in evaluating the proposals. It is expected that each presentation will be one hour in length including time for questions. The submission can contain supporting documentation to provide more details than the presentation. The amount of detail and supporting material is expected to vary widely between submissions. A more complete submission could improve the candidate proposals' standing.

A panel discussion will be conducted at the conclusion of the presentations. This panel (consisting of the proposers) will address questions and concerns from all attendees (including fellow panelists).

Time will be scheduled at the end of the meeting for general discussion, clarification of questions, and ratification of the minutes, so that it can be done with the assistance of the presenters.

Once the proposal process has completed, voting will occur to determine the baseline for the draft standard. The voting process will be determined at a later time. Voting within the WG on the proposals is on a per-company basis.

II. ISA-SP100.11 Call for Proposal Scope

ISA-SP100.11 is publishing this Call for Proposal in order to encourage a variety of experts to collaboratively create a networking standard that is targeted at ISA-SP100 Classes 1-5, including such applications as automatic, direct control of primary actuators for process loops in plant controlling flow, temperature, pressure, etc. using wireless within the loop, cascaded loops controlling a process variable (such as low frequency temperature loops), coordinated interlocks between automation cells, closed loop speed controls for rotating equipment, and mobile workers with a handheld devices manually initiating process actions. During the evaluation process, preference will be given to proposals where sufficient data is readily available to assess the validity and relevancy of the claims.

III. ISA-SP100 Background and Purpose

Founded in 1945, ISA is a leading, global, nonprofit organization that is setting the standard for automation by helping over 30,000 worldwide members and other professionals solve difficult problems. Based in Research Triangle Park, North Carolina, ISA develops standards; certifies industry professionals; provides education and training; publishes books and technical articles; and hosts the largest conference and exhibition for automation professionals in the Western Hemisphere.

The ISA-SP100 Committee will establish standards, recommended practices, technical reports, and related information that will define procedures for implementing wireless systems in the automation and control environment with a focus on the field level. Guidance is directed towards those responsible for the complete life cycle including the designing, implementing, on-going maintenance, scalability or managing manufacturing and control systems, and shall apply to users, system integrators, practitioners, and control systems manufacturers and vendors.

The Committee's focus is to improve the confidence, integrity, and availability of components or systems used for manufacturing or control, and to provide criteria for procuring and implementing wireless technology in the control system environment. Compliance with the Committee's guidance will improve manufacturing and control system deployment, and will help identify vulnerabilities and address them, thereby reducing the risk of compromising or causing manufacturing control systems degradation or failure.

The overall CFP process as defined by the ISA-SP100 committee is included in this document as Annex C. The major steps in the CFP process are listed in Annex D.

The ISA-SP100.11 Working Group was created by ISA-SP100 in April 2006, with the mission of recommending a wireless communication standard for industrial loop control in addition to monitoring. Example applications include automatic, direct control of primary actuators for process loops in plant controlling flow, temperature, pressure, etc. using wireless within the loop, cascaded loops controlling a process variable (such as low frequency temperature loops), coordinated interlocks between automation cells, closed loop speed controls for rotating equipment, and mobile workers with a handheld devices manually initiating process actions.

ISA-SP100.11 Goals and Objectives

To provide a wireless connectivity standard for applications in classes 1 – 5, and possibly class 0. The intent is that this standard will allow compliant devices that are relatively low complexity, reasonable cost, and low power consumption to support long battery life where needed. The communication data rate(s) must be sufficient to satisfy the range of needs typically associated with these classes.

The standard must address the generic needs in the industrial environment of wireless sensors, actuators and other automation devices, as well as that of wireless workers and first responders and wireless infrastructure networks. Those needs include coexistence, robustness to interference, interoperability with wired plant infrastructure networks, etc.

ISA-SP100.11 Working Group Scope

This project will define the OSI layer specifications (e.g. PHY, DLL, etc), security specifications, and management (including network and device configuration) specifications for wireless devices serving classes 1 through 5 industrial device applications with consideration for class 0 applications, wireless workers and wireless first responders, and wireless automation networks operating within an automation and control environment and focusing on 'field' areas.

Many devices will operate with very limited power consumption. Many HMI devices will operate with variable latency and throughput requirements. Many control (and perhaps safety) messages will have maximum transit times.

Since the industrial environment may include high-power interference sources, the standard will also address the network's robustness. It is the intent of this project to address appropriate levels of coexistence with other wireless devices anticipated in the industrial work space, such as 802.11x, 802.15x, 802.16x, cell phones, RFID, SP100.14, Wireless-HART, etc.

It is also the intent of this project to address appropriate levels of inter-operability or inter-working with other technologies and protocols in the industrial work space.

ISA-SP100.11 Working Group Role

The ISA-SP100.11 WG's role is to develop a draft standard. The ultimate decision of whether or not to adopt and promote the standard will be made by ISA-SP100's parent organization, ISA.

On completion of the SP100.11 standard, it will be made available to other standards organizations such as IEC as a baseline for other standards initiatives.

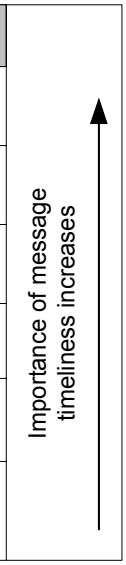
The approach used by the ISA-SP100.11 group will be open and collaborative, with the goal of achieving consensus when possible. Each participating company will get a single vote, with voting rights based on participation. The ISA-SP100 voting membership is by election and the rules are set by the ISA parent organization.

IV. ISA-SP100 Usage Classes

Analysis of the applications of inter-device industrial wireless communications resulted in a partitioning of those communications into six classes. These classes were introduced in ISA-SP100 and are summarized in tabular form in Table 1.

Table 1 – Usage classes

Category	Class	Application	Description
Safety	0	Emergency action	*(always critical)*
Control	1	Closed loop regulatory control	*(often critical)*
	2	Closed loop supervisory control	*(usually non-critical)*
	3	Open loop control	*(human in the loop)*
Monitoring	4	Alerting	*Short-term operational consequence (e.g., event-based maintenance)*
	5	Logging and downloading/uploading	*No immediate operational consequence (e.g., history collection, sequence-of-events, preventive maintenance)*



Alarms can be of any class; they may require either human or an automated response. The communications of wireless workers fall into classes 3 - 5.

ISA-SP100.11 focuses on Class 1 through 5 applications. The last digit of "ISA-SP100.11" is intended to indicate classes 1 and above.

Additionally, ISA-SP100 has identified examples of the above wireless automation classes:

Class 5: Monitoring without immediate operational consequences

This class includes items without strong timeliness requirements. Some, like sequence-of-events logs, require high reliability; others, like reports of slowly-changing information of low economic value, need not be so reliable since loss of a few consecutive samples may be unimportant.

Class 4: Monitoring with short-term operational consequences

This class includes high-limit and low-limit alarms and other information that might instigate further checking or dispatch of a maintenance technician. Timeliness for this class of information is typically low (slow), measured in minutes or even hours.

Class 3: Open loop control

This class includes actions where an operator, rather than a machine, "closes the loop" between input and output. Such actions could include taking a unit offline when conditions so indicate. Timeliness for this class of action is human scale, measured in seconds to minutes.

Class 2: Closed loop supervisory control

This class of closed-loop control usually has long time constants, with timeliness of communications measured in seconds to minutes. Examples are batch unit and equipment selection.

Class 1: Closed loop regulatory control

This class includes motor and axis control as well as primary flow and pressure control.

Class 0: Emergency action

This class includes safety-related actions that are critical to both personnel and plant. Most safety functions are, and will be, performed through dedicated wired networks to limit both failure modes and susceptibility to external events or attack. Examples are safety interlock, emergency shutdown, and fire control.

V. Relationship of ISA-SP100.14 to ISA-SP100.11

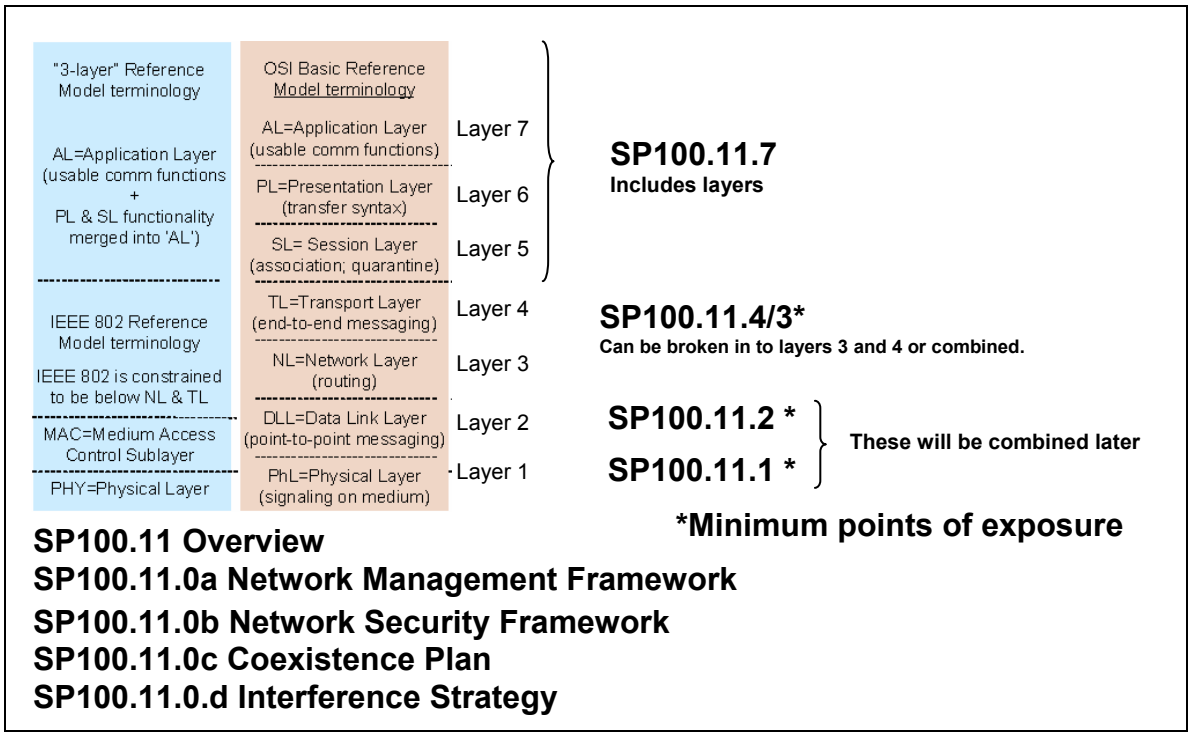
The ISA-SP100.11 Working Group was formed at the same time as ISA-SP100.14. The two efforts are intended to be complementary.

ISA-SP100.11 covers Classes 1-5, optimized for Classes 1-3, and may not meet the power and cost objectives of ISA-SP100.14. ISA-SP100.14 is optimized for Classes 4-5, and may not meet the performance objectives of Classes 0-3. ISA-SP100.11 and ISA-SP100.14 have substantially overlapping memberships, and those participants will identify common ground and assure integration of the two efforts.

VI. Structure of ISA-SP100.11 Standard

The overall structure envisioned for the ISA-SP100.11 standard is shown in Figure 1. It is expected that all sections shown, with the possible exception of ISA-SP100.11.7 (application layer), will be covered in the first version of the standard.

Figure 1 – Overview of ISA-SP100.11 Standard



Proposals may focus on certain aspects of the total solution, such as physical layer, networking, or security. Proposals that only address certain aspects or layers must be structured such that they can be used as building blocks in a total solution; these will be considered for the appropriate aspects of the overall standard. Complete proposals should address all of the requirements and use cases, and it is recommended that complete proposals be structured so that portions can be used in combination with other proposals.

Successful proposals will be scalable from tens to thousands of Field Devices, and from small clusters to a large outdoor plant. Initial installations may be limited in scope, potentially with a limited number of devices sparsely distributed through a facility. With expansion over time, there are realistic commercial scenarios for clusters of 10,000 devices actively participating in a network and reporting data periodically.

The network should be able to accommodate a heterogeneous mixture of devices utilizing a variety of power sources, ranging from primary cell batteries to line power. It is anticipated that some if not most proposals will support multihop routing. Such proposals should include plausible options for both line power and battery power for the Routing Devices. Battery-powered Routing Devices may have increased latency and reduced routing capacity. The option for a Routing Device to be battery-powered should not be at the expense of router capacity and performance when power is freely available.

VII. Intellectual Property

ISA standards are affected by intellectual property considerations including patents and copyrights.

The submission of any contribution in response to this CFP is affected by intellectual property considerations including patents and copyrights.

All written or electronic contributions in response to this CFP automatically imply that the submitting participant agrees that:

1. The ISA SP100 working group may publicly disclose the contribution, and reference the name(s) of the participant(s) for the purpose of acknowledging and publishing the contribution.
2. The participant identifies any holders of copyright interests in the contribution, and affirms that the copyright holder grants to ISA a perpetual, irrevocable, non-exclusive, royalty-free, worldwide license to include the contribution and derivative works within any document arising from the work of the SP100 committee.
3. If the resulting candidate standard(s) may require the use of a patented invention, the participant identifies any holders of patent(s) or patent interests in the contribution, and affirms that the patent holder agrees to comply with policies contained in the ANSI Patent Policy and ISA Patent Policy. The participant or patent holder must provide ISA with either: a general disclaimer to the effect that such party does not hold and does not presently anticipate holding any invention the use of which would be required for compliance with the proposed standard or a written assurance that either: (a) a license will be made available without compensation to applicants desiring to utilize the license for the purpose of implementing the standard, or (b) a license will be made available to applicants under reasonable terms and conditions that are demonstrably free of any unfair discrimination.

NOTE: The ANSI Patent Policy can be found at:
http://public.ansi.org/ansionline/Documents/News%20and%20Publications/Links%20Within%20Stories/ANSI%20Patent%20Policy.doc

NOTE: The form for the Patent Letter of Assurance can be found in Annex B

Unless there is no alternative, patented or proprietary technology should not be included in an ISA standard. ISA is a member of ANSI and follows its policy on inclusion of patents in standards. Patents may be included in an ISA standard only if the patent holder agrees to permit universal, royalty-free use of the patent for purposes of meeting the standard or agrees to license the patent on uniform, non-discriminatory, and reasonable terms. If anyone believes that a patent may cover a part of an ISA standard, it should be brought to the attention of the committee chair and ISA staff.

ISA standards are copyrighted by ISA. ISA standards should not include any materials not specifically prepared by committee members for inclusion in the standard without permission from the copyright holder (royalty-free if possible) in a form satisfactory for broad publication and distribution of the standard with that material. Committee members

should notify the committee chair and ISA staff of any excerpted text or artwork that may require a copyright release from another organization before the material is submitted to the committee for consideration.

More detail can be found at: www.isa.org/ISAStandardsProcedures

VIII. ISA-SP100.11 Working Group Technology Selection Process and Schedule

ISA-SP100.11 is publishing this Call for Proposal in order to encourage a variety of experts to collaboratively create a networking standard that is targeted at ISA-SP100 Classes 1-5, including such applications as automatic, direct control of primary actuators for process loops in plant controlling flow, temperature, pressure, etc. using wireless within the loop, cascaded loops controlling a process variable (such as low frequency temperature loops), coordinated interlocks between automation cells, closed loop speed controls for rotating equipment, and mobile workers with a handheld devices manually initiating process actions. The process is top-down, starting with presentations and proceeding to final proposals. Each stage will be increasingly selective, and involve a growing level of commitment by proposers and collaboration among proposers.

Three meetings of the full working group are planned for 2006: a Proposer Conference in Chicago IL during the week of 11 September, a White Paper review in Houston TX during the week of 16 October (tentative), and a Proposal review in Amsterdam during the week of 11 December (tentative). Exact dates and locations will be announced by 1 August 2006. ISA-SP100.11 has a scheduled weekly conference call and may call additional meetings as needed.

Additionally, there may be working sessions from time to time to create and finalize documents. These working sessions will be open, but are primarily intended for volunteers who are deeply involved in the process.

The proposal and evaluation will proceed generally as described below. Note that there are many more milestones than meetings. This process and schedule is subject to change.

14 July 2006: ISA-SP100.11 distributes Preliminary Call for Proposal (CFP). Interested companies and individuals may join an ISA-SP100.11 Proposer Mailing List at this time. Questions submitted in writing to ISA-SP100.11 will be answered in writing through the mailing list.

1 August 2006: Deadline for Intent to Propose.

31 August 2006: ISA-SP100.11 distributes an updated CFP, accounting for issues and ambiguities raised through the Mailing List. The Updated CFP will include Use Cases, Technical Requirements, Proposal Check List, and Evaluation Criteria. The Proposal Check List and Evaluation Criteria will provide a consistent basis for comparing proposals.

8 September 2006: Due date for Preliminary Proposal presentations, and preliminary answers to the Evaluation Criteria.

11-13 September 2006: Preliminary Proposal Conference, Chicago area, IL. PowerPoint overviews of all preliminary proposals will be presented and

discussed in an open forum. In the open and collaborative spirit of ISA-SP100.11, this conference is intended to help proposers to gather feedback from the SP100 committee and facilitate the identification of potential collaborators. Electronic copies of all presentations are due on 8 September so that they may be reviewed in advance. More detail on this Conference can be found at the end of this CFP.

19-20 October 2006 (tentative): ISA-SP100.11 meets in Houston TX, for final preparations for the final proposal conference; additionally modified preliminary proposals may be presented. This meeting will be held in conjunction with an ISA-SP100 general meeting.

4 December 2006: Final proposals due, including Proposal Check List, Evaluation Criteria, and ISA Intellectual Property letters.

12-14 December 2006 (tentative): ISA-SP100.11 meets in Amsterdam to review and evaluate final proposal materials.

Q1 2007: Define the baseline for the SP100.11 draft

Q1 2007: Complete ISA-SP100.11.0: Overview

Q2 2007: Begin writing specifications based on ISA-SP100.11.0. The identified documents are:

ISA-SP100.11.0a: Network Management Framework
ISA-SP100.11.0b: Network Security Framework
ISA-SP100.11.0c: Coexistence Report Card
ISA-SP100.11.0d: Interference Strategy
ISA-SP100.11.1: Radio
ISA-SP100.11.2: MAC
ISA-SP100.11.4: Transport and Network

Q3 2007: Complete draft specifications; distribute to ISA-SP100.11 for comments.

Q4 2007: Ballots and comment resolution within ISA-SP100.11.

H1 2008: Ballots and comment resolution within ISA-SP100.

H1 2008: Recommendation to ISA by SP100 to adopt the SP100.11 standard.

IX. ISA-SP100.11Proposer Conference and Mailing List

As stated above, a preliminary proposal conference will be held in the Chicago area, Illinois on 11-13 September 2006. In the open and collaborative spirit of ISA-SP100.11, this conference is intended to help people improve their proposals and identify potential collaborators.

The agenda will include:

- Presentation by ISA-SP100.11 of available Use Case information, and discussion.

- Walk-though of the ISA-SP100.11 proposal and evaluation process. At this meeting a revised project plan for the development of ISA-SP100.11 will be discussed and will include a down-selection process so as to encourage collaboration particularly if there are a significant number of proposals.
- PowerPoint or similar presentations (i.e. public disclosure) by proposing companies and individuals addressing the SP100.11 technical description questionnaire that is included in this document as Annex A.
- Panel discussion at the conclusion of the presentations where a panel (consisting of the proposers) will address questions and concerns from all attendees (including fellow panelists).

All proposing companies and individuals are requested to:

- Provide an Intent to Propose by 1 August 2006. Although additional information is not required, it is preferred that this intent also indicates whether the intended proposal is for the whole system or just a part(s). This will enable ISA to select an appropriate venue, and schedule presentations. Please send this information to ISASP10011CFP@isa.org. If your response is not acknowledged within two (2) business days please resend.
- Attend the Preliminary Proposal Conference in September 2006.
- Provide electronic copies of all presentations by 8 September so that they may be distributed and reviewed in advance.
- Present an overview of their proposals at the Preliminary Proposal Conference, in an open forum.

Participation in the Preliminary Proposal Conference is strongly recommended. Non-descriptive abstracts and/or proposals may be excluded from subsequent consideration.

Participation in the Final Proposal Conference is required. The venue for this meeting is tentatively scheduled for the 12 -14 December at Shell's facility in Amsterdam, NL Non-descriptive abstracts and/or proposals may be excluded from subsequent consideration.

Participants in the conferences are expected to cover their own travel expenses. There may be modest fees to cover the cost of holding the events.

In addition, the ISA-SP100.11 Working Group will accept written questions and distribute responses through an email mailing list. Questions and requests to be included on the mailing list (with primary and secondary email contact) should be sent to ISASP10011CFP@isa.org.

Thank you in advance for your constructive participation in ISA-SP100.11.

Annex A

Preliminary Proposal Checklist Revision 1.0

This Annex includes a preliminary draft of the ISA-SP100.11 Proposal Checklist.

This list is not intended to be an outline for the proposal or imply a structure. It should be used as a check list by the CFP responder to measure how complete the proposal is. Topics to be considered are:

	Check Addressed Topics	
	Final proposal	
	Preliminary Proposal	
Robustness of the design		
How does the system deal with:		
1.1. Poor quality RF links due to		
1.1.1. high noise?		
1.1.2. low signal strength caused by long path lengths or obstacles?		
1.1.3. multipath fading?		
1.1.4. Interference?		
1.1.5. Give an example of what end-to-end data delivery reliability is achieved in the presence of noise, unreliable links in a multi-hop network. State the assumptions.		
1.2. Does the system support guaranteed delivery of packets?		
1.2.1. Per link		
1.2.2. End-to-end		
Discuss how the system adapts to		
1.3. Changing RF environments.		
1.4. Loss of key components such as routing nodes, gateways and network managers? What network components can be made redundant?		
2. Coexistence		
2.1. How does the system mitigate its effects on other systems operating in the same band? (see the ISA-SP100 Coexistence Report Card)		
2.2. How will this system coexist with other likely wireless systems within a facility – how will it mitigate the effects of other systems and interference sources?		
3. Security		
Discuss the systems support for:		
3.1. Data privacy (encryption).		
3.1.1. Number of keys		
3.1.1.1.Is there a network key?		
3.1.1.2.Is there a different key between each node pair?		
3.1.1.3.Is there a transport layer key?		
3.1.2. Encryption type		
3.1.3. Encryption key management. Where are they generated and how are they distributed? Can keys be periodically changed in the network?		

3.1.4. Key updates		
3.2. Message integrity		
3.2.1. How is the integrity of the data on the network protected?		
3.2.2. What portions of the packet are protected?		
3.3. Authentication		
3.3.1. How are devices on the network authenticated?		
3.3.2. How is the network authenticated to devices?		
3.4. Freshness: how are replay attacks detected and discarded?		
4. Performance		
4.1. Throughput		
4.1.1. The system operates on one or more channels. How many RF channels are there and what is the available data rate of one of the RF channel? For example the IEEE802.15.4 system in the 2.4 GHz band has 16 separate channels and in each channel the radio has a raw transmission rate of 2 Mcps and an available transmission rate of 250 Kbps after coding.		
4.1.2. What is the available transmission rate per gateway?		
4.1.3. Are multiple gateways supported?		
4.2. Quality of Service		
4.2.1. Latency		
4.2.1.1. Is latency managed in the network? If so how?		
4.2.1.2. Give examples of per link latency and end-to-end latency using an example network.		
4.2.1.3. How does adding other services affect latency of an existing service in the network?		
4.2.2. Bandwidth		
4.2.2.1. Can bandwidth be assigned or reserved for an application?		
4.2.2.2. How quickly can the network adapt to changes in device bandwidth requirements?		
4.2.3. Priority		
4.2.3.1. Does the network support packet priority?		
4.2.3.1.1. What is the algorithm for determining priority?		
4.3. Frame Coding Efficiency		
4.3.1. What is the effective network layer payload throughput of an RF channel when RF, MAC, and network layer overheads are taken into account? The overheads should include such items as guard times and acknowledgement packets that are required.		
4.3.2. Describe the packet structure		
4.3.2.1. What is the maximum and minimum packet size?		

4.3.2.2. Diagram the packet header fields for the RF preamble, MAC and Network layers for each significant packet size. For example if data and control packets follow the same format a common diagram can be given. If Acknowledgement packets are used and they follow a different format then show that.		
4.4. Operational Power		
4.4.1. How does the system manage power of battery operated nodes?		
4.4.2. What is the energy required to transmit a minimum sized packet at a specified transmit power level?		
4.4.3. What is the energy required to receive a minimum sized packet?		
4.4.4. What power is required to listen for a packet?		
4.4.5. What power is required by a node when it is idle?		
4.4.6. Give a battery life calculation example for an application and a specified battery type.		
5. Radio		
5.1. What are the frequencies of operation?		
5.2. Describe the modulation(s) used to for transmission		
5.2.1. What is the radio's performance in the presence of noise?		
5.2.2. What is the maximum range of any length and what is the confidence level that this range can be achieved?		
5.3. What bandwidth is used per channels and how many channels are required for basic operation?		
5.4. What is the channel spacing and how many channels are available?		
5.5. What RF overheads are required? Preamble and sync symbols.		
5.6. What regulatory issues need to be addressed for by the radio technology?		
5.7. What is the typical transmit power level(s) of the radio?		
5.8. What antenna type is typically used? Are restrictions on the types of antennas required?		
5.9. Show a block level diagram of a typical implementation of the transmitter and receiver portions of the radio from the digital data input/output to the antenna.		
5.10. What coding techniques are used, is the network relying on error correction or coding, what type of BCCs (CRC) are used.		
5.10.1. What is the realized data rate after coding?		
5.11. State any channel assumptions and models that are used.		
5.12. Supply the international certification plan, what countries will have restrictions or how will the product operation be restricted in other countries.		
5.13. State any special antenna system considerations and provide antenna characteristics that were assumed.		
6. MAC		

6.1. What topologies are supported? Examples are peer to peer and star.		
6.2. Describe the MAC addressing		
6.2.1. Address size and address structure		
6.2.2. How is address assignment done?		
6.2.3. Is there support for broadcast and multicast messages?		
6.3. Does the MAC support sleeping end nodes? How much buffering is anticipated?		
7. Network		
7.1. What network topologies are supported? Examples are mesh, tree and star.		
7.2. What network services are available like packet resequencing? duplicate packet deletion		
7.3. Describe the network addressing scheme		
7.4. Can an end node also act as a routing node or other infrastructure node?		
7.5. Does the network support mobility? For example can a node move throughout the network?		
7.5.1. Does the network require a mobile device to obtain a new address after it moves?		
8. Transport		
8.1. What transport layer services are provided? Principles of operation and performance metrics for each.		
8.1.1. Best effort of service		
8.1.2. Guaranteed service		
8.1.3. Data fragmentation, streaming, and reassembly, to & from gateway		
8.1.4. Firmware code image transmission & reflash		
8.1.5. What flow controls are supported?		
9. Application Layer Interface		
9.1. What services are available to applications? Examples are universal time, priority settings, encryption control.		
9.2. Can a network device support more than one application? If so how are the multiple endpoints distinguished?		
9.3. What are the energy-sparing capabilities of the proposed application layer? What are the constraints caused by this capability?		
10. Scalability		
10.1. How many devices can a network support?		
10.2. What is the maximum cumulative effective throughput of the network, what are the dependencies? How does the number of nodes affect this?		
10.3. How is battery life affected by scalability?		
10.4. How is device bandwidth affected by scalability – can devices still readily obtain extra bandwidth.		

10.5. Please elaborate on any tools or techniques whereby the user will be able to predict the impact of adding additional devices or application traffic to the network.		
10.6. Give an example of a network with a large number of nodes. Describe the performance. How is the performance measured: by calculation, simulation or measurement?		
10.7. Give an example of a network with a large geographic area that spans several maximum RF path lengths. Describe the performance. How is the performance measured: by calculation, simulation or measurement?		
10.8. Can multiple overlapping networks be supported? How?		
10.9. How many hops can the network support?		
11. Network Management		
11.1. How does the network form? How long does this process take and under what conditions?		
11.2. How does a new device join the network? How long does this process take?		
11.3. How does a device respond to the absence of an operating network?		
11.4. Does the network support preprogramming devices?		
11.5. How does the network support heterogeneous devices (from different vendors, with different capabilities)		
11.6. What MIBs are proposed?		
11.7. How can the MIBs be accessed; from within the network, from outside the network?		
11.8. What are the security aspects of network management access?		
11.9. What network management standards are used?		
12. Device		
12.1. Show a block diagram of a typical node device with processor, and memory requirements. What are the typical data storage, and program storage requirements?		
13. General Operation Overview		
13.1. Describe the typical packet transmission process		
13.2. Describe the typical packet reception process		
13.3. Describe the multi-hop downstream transmission process		
13.4. Describe the multi-hop upstream transmission process		
13.5. Describe the effects of loss of power to the system and each node		
13.6. Describe how a system would be configured; including end nodes, router nodes, and other infrastructure nodes		
13.6.1. Is there service discovery?		
13.7. If the system is synchronized, describe how synchronization is maintained.		
13.7.1. If the system provides a universal clock, describe how the clock is propagated. Specify the clock accuracy the system can provide.		

13.7.2. What system overhead is required to maintain synchronization?		
13.7.3. What device clock accuracy is required?		
13.7.4. How is network time maintained across devices, and what is the accuracy?		
13.7.5. Please describe synchronization aspects such as:		
13.7.5.1. scheduling control		
13.7.5.2. handling missed updates		
13.7.5.3. jitter		

Annex B
PATENT LETTER OF ASSURANCE

[Date]

ISA
67 Alexander Drive
Research Triangle Park, NC 27709
Attention: _____

Dear Mr./Ms. _____:

This is to confirm that [Company Name] ("the Company"), in consideration of being permitted to participate in the development and/or revision of [Name of Proposed or Current Standard] ("the Standard") through its authorized representatives, agrees to disclose any and all patents owned or controlled by Company that may be relevant to the Standard. Pursuant to this commitment, the Company states that:

- ❑ There are no patents, granted or pending, owned or controlled by the Company that may be relevant to the Standard; or
- ❑ The following patents, granted or pending, may be relevant to the Standard: _____ _____ _____.

The Company understands that this disclosure obligation is a continuing one, and therefore should the Company at any time become aware of any patent that may be relevant to the Standard, the Company shall disclose the same on a timely basis.

With respect to any granted or pending patent owned or controlled by the Company, whether or not currently known or disclosed, that may be infringed by compliance with the Standard, the Company agrees that it shall grant a license to an unrestricted number of applicants on a worldwide, non-discriminatory basis, with a fair and reasonable royalty rate and fair and reasonable terms and conditions, in order to allow such applicants to comply with the Standard.

This Letter of Assurance is a binding legal document that is irrevocable unless and until the Standard is withdrawn by ISA, and it incorporates a covenant of good faith and fair dealing. The Company acknowledges that other participants in the development or revision of the Standard are third party beneficiaries of the Letter of Assurance.

[Company Name]

_____	_____	_____
Signature of Authorized Representative	Printed Name	Date

Annex C

I. SP100 Mission & Goals

The mission of the CFP process must support the overall SP100 mission, which is: Deploying wireless technology with confidence in industrial automation applications. The trickle down goals for the CFP process would be to support:

a. life-cycle management
b. stake holder needs
c. improved confidence in deployments

II. CFP Mission and Goals

The CFP process is designed to allow the SP100 committee to benefit from the expertise, talent, and efforts of contributors who are not necessarily on the committee. The SP100 committee recognizes that the committee itself can't and shouldn't solve all the problems associated with meeting the mission and goals of SP100. We want to solicit ideas from the technical community as to how to solve the problems identified. The key, then, is to recognize what those issues are, including some the committee may not have thought of, and identify where solutions might be available to solve those problems.

a. What the CFP process is

The process solicits ideas (including issues, alternatives, and criteria for evaluating alternatives) from potential contributors that can be used to construct the work products to be produced by the committee. The process should encourage proposed solutions but only in so far as they can be compared, quantitatively and objectively, against other alternatives proposed. Unsubstantiated opinions, solutions, or designs should be discouraged unless others (other than the contributor) are willing and able to provide the requisite substantiation processes.

b. What the CFP process is NOT

The process is not about "selecting the best of the best" without criteria. It's not a voting process that uses subjective characteristics to create a "popularity contest" to down select from a suite of alternatives. It's quite feasible that no proposals can adequately address all the issues. The key is to allow the stake holders to be fully informed about the risk and subsequent probability of success if a particular option is selected for deployment in a particular application in a particular environment.

c. Expectations

The expectation is that the committee will create the numbered clauses (SP100.11, SP100.14) from the material received in response to the CFP but it is unlikely that large portions of the actual standard will be lifted directly from any particular proposal submitted.

III. Strategy

Accordingly, the strategy of the CFP shall be focused on soliciting input that provides the best approach to solving the critical issues associated with deployment of wireless technology for industrial automation. This implies that the responses should have the following attributes:

1) Modular – allows the committee to pick and choose appropriate sections for inclusion in the final work product and even in other SP100 work products.
2) Specific – allows the committee to cut-and-paste technical sections without heavy editing
3) Consistent – terminology and structure of the responses should ease the editing requirements and not require re-formatting
4) Thorough – responses should be sufficiently detailed to assure the proposal can be adequately evaluated. The responses should include proposed quantitative, objective measures against which committee members can compare options.

IV. CFP Format

All Calls for Proposals from SP100 will follow a logical, consistent format that may be tailored for the specific WG. The committee may decide to update the format and required responses as it determines there are opportunities to improve the process. The current model for a CFP format follows:

a. Introduction – SP100 background, specific clause being addressed (for example SP100.11), and where this particular clause fits into the overall SP100 mission, goals, and strategy.
b. Environments – discussion about the target environments or categories and ranges of environments seen as appropriate for this numbered clause.
c. Application Focus – specific information about the types of applications and/or Use Cases targeted by this particular clause. Reference to more details (perhaps on the SP100 web site) would be appropriate.
d. Constraints – Responses are expected to use terminology consistent with the ISA dictionary and the SP100 glossary. All responses must address proposed solutions in an architecture consistent with the ISO/OSI 7-layer model. All interfaces between/among layers must be specified or declared as internal. Any proprietary segments must be identified with appropriate understanding that, if selected, arrangements can be made for universal access.
e. Schedule – intent, workshops, drafts, responses, best-and-finals, etc.
f. Disclaimer – SP100 can choose to use any part and submitted material becomes property of ISA.
g. Expected Response Format – Details how the proposed solutions address the following:
    1) Introduction – scope of response, general applicability in range of environments, applications, and even some use case examples. How this proposal is seen with respect to overall SP100.
    2) ISO/OSI layers included and interfaces defined with sufficient detail to allow assessment of third-party suppliers of subsequent layers.
    3) Performance Issues Addressed and proposed metrics. This section should provide sufficient detail to allow the committee to ascertain the probability of success of the proposed solution in

the proposed application in the proposed suite of environments. These four parameters are, of course, not orthogonal, so responders must provide estimates of each with respect to the other three. For example, expected throughput varies from xxxx KB/s to zzzz KB/s as range varies from 1 to 100 m as security ranges from none to AES as reliability varies from 1 failure to deliver per day to 1 failure in 20 years as expected latency varies from 1 second to 0.010 seconds.

1. Throughput – valid, relevant data rate
2. Range – end-to-end of wireless link proposed
3. Security – authentication, etc.
4. Reliability – includes probability of failure defined as failure to meet expected performance. Includes mean time between attention – includes battery life expected and MTBA it is computed
5. Latency – end-to-end – could be quoted as worst case or as some sort of stochastic assessment, if desired. Again, the method used to estimate must be provided.

4) Interoperability – with compatible (eg SP100.11) devices.
5) Coexistence – with expected potential interferers (other wireless communication devices – pagers, walkie-talkies, etc.)
6) EMI – expectations of interference from other industrial processes (ovens, welders, etc.)
7) EMC – expectations that supplied devices will interfere with other devices in the environment (eg old instruments, other networks)
8) Expandability – architecture for growing the network – maximum sizes of each layer, flexibility within layers, hierarchical vs. ad hoc,
9) Environments – ranges of temperature, vibration, humidity, etc over which the performance statistics quoted above, can be expected.

Annex D

Major Steps in ISA-SP100.11 Call for Proposal Process

Date	ISA-SP100.11 Responsibility	Proposer Responsibility
14 Jul 2006	Issue Call for Proposal	
14 Jul – 31 Aug 2006	Committee continues solicitation and development of customer requirements for inclusion in updated CFP (see subsequent step)	
1 Aug 2006		Communicate intent to respond
31 Aug 2006	Issue updated CFP, accounting for issues and ambiguities raised since initial issue and including available Use Cases, Technical Requirements, Proposal Check List, and Evaluation Criteria.	
8 Sep 2006		Submit preliminary proposal and preliminary answers to Evaluation Criteria
11-13 Sep 2006	Convene Proposal Conference	Attend Proposal Conference
19-20 Oct 2006	Tentatively planned committee meeting	Modified preliminary proposals may be submitted
4 Dec 2006		Submit final proposal with Check List, Evaluation Criteria, and ISA Intellectual Property letter
12-14 Dec 2006	Tentatively meet to review final proposals	
Q1 2007	Select optimal proposal or portions of multiple proposals or no proposal to incorporate in draft standard	