

ADAPT ISO Plug-In Performs Well at Plugfest

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Introduction

An important strategic decision by the AgGateway Precision Ag Council projects including ADAPT was to review and evaluate the relevance of existing data standards which fall within the scope of their projects. Then, if appropriate, actively pursue cooperation with the organization that has been granted responsibility for maintaining and advancing the standard. One example of this approach is in the SPADE project where the team members recognized that much of the data and data transfer requirements were already defined by the existing ISO 11783. This standard defines communication protocols between an agricultural implement and the terminal or controller normally installed in the tractor cab which collectively is called the MICS or Mobile Implement Control System. The fundamental objective of this effort is to enable and promote the interoperability between tractors and implements from different manufacturers or more specifically control terminals and implement control systems from different manufacturers.

AgGateway and AEF Cooperation

The electronic communication protocols and the related physical layer defined in ISO 11783 were and still are out of scope for the SPADE project. However, ISO 11783 also defines the data transfer standard (taskdata.xml) between an office FMIS (Farm Management System) and the MICS which is clearly within the scope of the SPADE project. The taskdata.xml defines a task specific work order created in an FMIS and loaded into controller. This realization led to strong and mutually beneficial cooperation between AgGateway and the Agricultural Industry Electronics Foundation (AEF) which is the entity responsible for the ISO 11783 standard. This cooperation was initially at the project and committee level which was very organic in that many AgGateway members already participated in ISO 11783 committees. However, it soon expanded to the Administrative and International level in the form of joint presence at industry shows and conferences.

AgGateway ADAPT

As the SPADE project evolved and grew into SPADE2 and SPADE3 the level of cooperation between AgGateway and AEF has also grown. It took a major leap at the end of SPADE2 with the formation of the ADAPT project in AgGateway. As the Precision Ag Council projects progressed it became evident that a likely obstacle to the adoption of the project deliverables would be the variety and complexity of the data sets or "data buckets" as they were called. This would make it very difficult, especially for smaller FMIS companies, to develop application which can fully utilize the data needed by their products. This was especially true for the electronic work records recorded by crop

input machinery such as planters and seeders which are getting increasingly complex driven mostly by customer requests.

To ease this complexity and thus promote adoption of the SPADE project deliverables AgGateway started an open source software project called ADAPT (Ag Data Application Programming Toolkit). The major components of the ADAPT project is the development of the ADAPT data model, a framework to support software "plug-in" to translate unique or proprietary data sets to and from the ADAPT data model and the "plug-ins" themselves. The plan is for the OEM manufacturers which define and implement the proprietary data sets to create their specific plug-ins. These plug-ins would not be open source and in addition their licensing and distribution would be defined and controlled by the manufacturer.

The ADAPT project plan also included the open source development of an ISO plug-in which would translate between the ADAPT data model and the ISO 11783 taskdata.xml file format and content.

AEF Plug-fest

As stated early the primary objective of the ISO 11783 was to enable the interoperability between tractors and implements of different brands. In theory, or at least it is assumed by many, if manufacturers all developed to the same "standard" interoperability would be assured. A nice theory but unfortunately not the reality. In fact the ISO 11783 standard is written such that there can be more than one interpretation and thus design of a specific functionality. In an effort to minimize multiple interpretation and also to measure the progress and success of the ISO 11783 standard AEF began sponsoring a semi-annual "hands-on" testing conference called "**Plugfest**". Plugfest is an opportunity for the manufacturers of ISO Universal Terminals and the manufacturers of implement control systems to "test" their interoperability. To be clear, for practical reasons this testing does not involve complete tractors and implements but only the electronic components (and cabling) which are controlled by the standard. The number of participants in these events and practical logistics results in a testing time of around 20 minutes for each terminal-implement pair.

Initially the AEF Plugfest involved only the Terminals and Implement controllers. However, in 2012 AEF expanded the tests to include FMIS. In these test task files created by FMIS from company A are loaded into a terminal from company B to control and implement from company C. If the task is successfully loaded and used to successfully control the implement the abbreviated work record is recorded. Time permitting this work record is then processed in the FMIS and the results are shared with all participants. If the work record processing cannot be done during the testing period the FMIS company is encourage to process after Plugfest and publish.

ADAPT ISO Plug-in Participation in AEF Plugfest

The most recent AEF Plugfest was held in Lincoln NE May 10-12, 2016. One of the FMIS participants in this event was the ADAPT ISO plug-in. To create the ISO taskdata.xml files used in the test the ADAPT framework in combination with a John Deere OEM plug-in and the ISO plug-in was used to convert a JD task file to the ADAPT data model to the ISO taskdata.xml file. From an FMIS perspective the AEF Plugfest consists of two steps. The first step is the creation of work orders or tasks. The second step is the processing of the electronic work records or as-applied files. Although the ISO plug-in in its current state could only participate in the first step and only part of those tests, overall it was a successful and encouraging first implementation. The ISO plug-in created taskdata.xml files which were successfully loaded in the majority of the testing terminals and then used to control at least two implements. These simple task data files included:

1. Grower, farm field hierarchy
2. Geo-referenced field boundary
3. Single product allocations
4. One variable rate grid.

Next Steps

Although these AEF Plugfest results were deemed successful work will continue in its development. The next AEF Plugfest is being held in Bologna, Italy Sept 2016. The projections for the ISO Plug-in at this event is that it can complete all "work order" tests and most or all of the "work record" tests.

AEF Conformance Test Participation

To complement the interoperability testing of the Plugfest, AEF is also developing an automated testing tool for Task Controller, Implement controllers and FMIS. AEF has defined nine "Functionality Labels" each of which define a marketable group of functions. Examples include the following:

- TC-Basic – Requires the successful completion of only basic tasks and reporting of only task or field summary totals.
- TC- GEO – Requires the successful completion of complex tasks including multiple product variable rate crop input applications. Also requires reporting spatially referenced high resolution application rates as well as summaries.
- TC- SC – Requires the successful implementation of section control by the TC and correct interpretation of the work record by the FMIS.

The ADAPT team is currently in discussions with CerTech LLC which administers the test to determine an appropriate set of tests given the ISO plug-in implementation architecture. The starting date for ISO plug-in participation AEF Conformance Testing is still to be determined, but should be on or before the next AEF Plugfest.