REVEAL: Software Documentation and Platform Migration

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USRP Interns – Summer 2008

Outline

- Background
- Internship Objectives
- Project Foundation
- Platform Migration
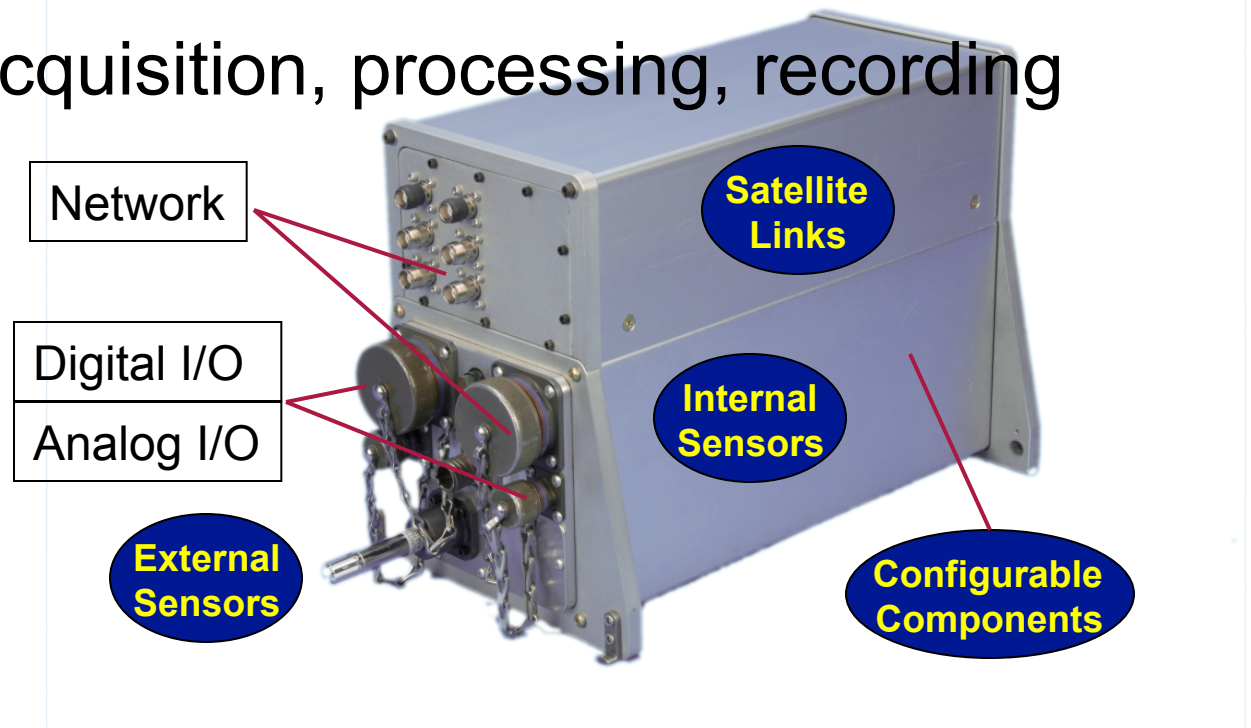- Field Test
- Next Steps
- Project Status

REVEAL

- Research Environment for Vehicle-Embedded Analysis on Linux

- Implemented on MontaVista Linux

- "Data acquisition and distribution system"

- Primarily used in aircraft

Suborbital Telepresence

- Hardware platform for REVEAL
- PC/104 Form Factor
- Configurable acquisition, processing, recording

Network

Digital I/O

Analog I/O

Satellite Links

Internal Sensors

External Sensors

Configurable Components

Internship Objectives

- Grow REVEAL's support for multiple developers
    - modern version control system
    - modern software documentation

- Verify implementation flexibility
    - implement on different CPUs
    - demonstrate end-to-end functionality

Project Foundation: Subversion

- ## Version Control Software

- ## Motivation

  - ### Multiple people working with same files

ViewVC

Read only

Subversion Server

Browser

Read only

Subversion Client
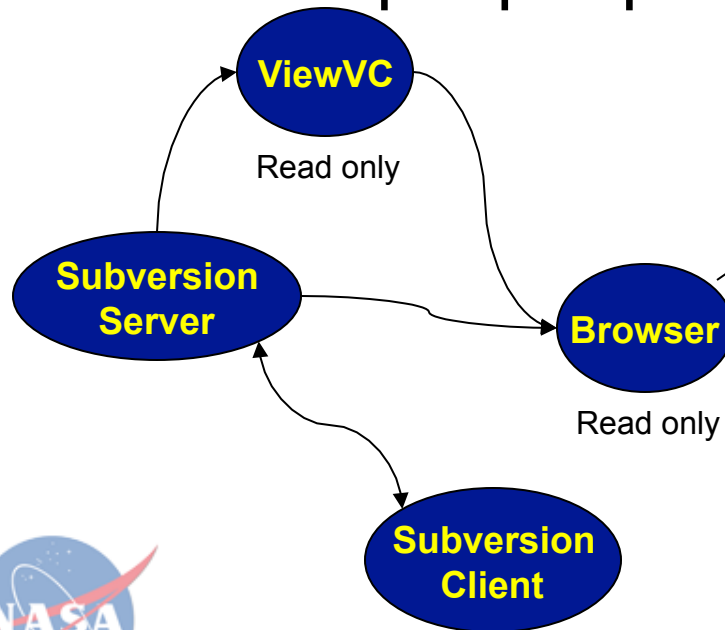
Revision 80: /

- DailyReports/
- ERAU_REVEAL_XML/
- FinalDraftVeibell.txt
- FinalOutline.txt
- NTPD_Setup
- REVEAL_MAKENOTES
- Reveal_Setup
- ToDo.txt
- USRP_Report.odt
- WeeklyReports/
- doxygen_checklist
- doxygen_manual-1.5.6.pdf
- mod_authz_svn_notes.txt
- piccolo_comms.pdf
- piccolo_notes
- svn-book.pdf
- svn_authentication_notes.txt
- xmlperl/
- xmltracer/

Powered by Subversion version 1.4.6 (r28521).

ViewVC

Browser based repository

Index of /

Files shown: **14**
Directory revision: 77 (of 77)
Sticky Revision: [ ] [Set]

File ▲	Rev.	Age	Author	Last log entry
DailyReports/	77	17 hours	erau	Added 31JUL08
ERAU_REVEAL_XML/	68	4 days	erau	Added 25JUL08 and XML files used with ERAU's Summer 2008 mission
WeeklyReports/	71	44 hours	erau	Added 30JUL08
xmlperl/	62	10 days	erau	Added Perl verison of xml graphing
xmltracer/	68	4 days	erau	Added 25JUL08 and XML files used with ERAU's Summer 2008 mission
FinalDraftVeibell.txt	76	17 hours	erau	Revised
FinalOutline.txt	60	11 days	erau	Update Outline
NTPD_Setup	48	3 weeks	erau	Added 09JUL08
REVEAL_MAKENOTES	1	6 weeks	erau	Initial Import
Reveal_Setup	54	2 weeks	erau	Added 16JUL08, updated Reveal_Setup
ToDo.txt	74	41 hours	erau	Updated USRP_Report
USRP_Report.odt	75	17 hours	erau	Updated USRP_Report
doxygen_checklist	24	5 weeks	erau	Uploaded doxygen_checklist - steps for adding documentation to REVEAL
doxygen_manual-1.5.6.pdf	22	6 weeks	erau	Added 19JUN08
mod_authz_svn_notes.txt	9	6 weeks	erau	Added more notes
piccolo_comms.pdf	49	3 weeks	erau	Added piccolo communications guide
piccolo_notes	52	2 weeks	erau	Added 14JUL08, updated Reveal_Setup, piccolo_notes
svn-book.pdf	1	6 weeks	erau	Initial Import
svn_authentication_notes.txt	9	6 weeks	erau	Added more notes

Site Admin
Powered by ViewVC 1.0.5

ViewVC

Highlighted differences

#	revision 33, Thu Jul 3 18:55:04 2008 UTC	revision 36, Tue Jul 8 22:56:50 2008 UTC
	Line 3	**Line 3**
3	CC = gcc	CC = gcc
4	CFLAGS = -I$(IXML) -I$(INOVAS) -I$(IARINC) -I$(IDSCUD) -D$(OS)	CFLAGS = -I$(IXML) -I$(INOVAS) -I$(IARINC) -I$(IDSCUD) -D$(OS)
5		
6	REVEAL = /Users/mjm/Reveal	REVEAL = ..
7	LDADS = $(REVEAL)/Revealv1.1a	OBJ = $(REVEAL)/lib
8	OBJ = $(LDADS)/LIB	BIN = $(REVEAL)/bin
	BIN = $(LDADS)/BIN	
9	IXML = /usr/include/libxml2	IXML = /usr/include/libxml2
10	OS = OSX	OS = OSX
11		THIRDPARTY = $(REVEAL)/ThirdParty
12		
13	LD_LIBRARY_PATH=$LDADS/BIN:$LDADS/LIB:/usr/lib	# LD_LIBRARY_PATH=$LDADS/BIN:$LDADS/LIB:/usr/lib

Doxygen

- Visual Interactive Code Documentation
- Motivation
  - Easy to find and interpret code
  - Parses files, functions, variables, definitions
  - Useful comment structure

```
/*****************************************************************************
 * Validates ARINC-429 parity
 *****************************************************************************
 *
 * @section func_sec FUNCTIONAL DESCRIPTION:
 * The Condor card has already checked parity and set a
 * bit in the 32-bit parameter word to let us know, we just look at the bit.
 *
 * @section revhist_sec REVISION HISTORY:
 * Date          By              Description<br>
 * --------------------------------------<br>
 * 11/24/04 Carl Sorenson     Created<br>
 * 01/31/08 Carl Sorenson     From 2 to 4 channels
 *
 * @section notes_sec NOTES:
 *   If the channel is in "raw mode" parity is not checked by card or us.
 *
 *****************************************************************************/
int checkParity(int chan, uint32_t word)
/** @return TRUE if it checks valid, otherwise false */
/** @param chan the channel index */
/** @param word the 32-bit ARINC-429 parameter word, via the Condor API */
{
 int okay = FALSE;          // return code
 uint32_t ptest;            // parity test value

 switch(chan)
 {
    case ARINC_CHAN0: ptest = ARINC_CHAN0_PARITY; break;
    case ARINC_CHAN1: ptest = ARINC_CHAN1_PARITY; break;
    case ARINC_CHAN2: ptest = ARINC_CHAN2_PARITY; break;
    case ARINC_CHAN3: ptest = ARINC_CHAN3_PARITY; break;
    default: jobMsg(LOG_BYE,"checkParity: unknown channel: %i\n",chan);
 }

 if (working) switch(ptest)
 {
    case AR_ODD:  if (!(word & ARINC_PARITY_BIT)) okay = TRUE; break;
    case AR_EVEN: if  (word & ARINC_PARITY_BIT) okay = TRUE; break;
    case AR_RAW:  okay = TRUE; break;
    default: jobMsg(LOG_BYE,"checkParity: internal error: %i\n",ptest);
 }

 return(okay);
}
```

int checkParity (int   chan,
                      uint32_t word
)

FUNCTIONAL DESCRIPTION:

The Condor card has already checked parity and set a bit in the 32-bit parameter word to let us know, we just look at the bit.

REVISION HISTORY:

Date By Description

11/24/04 Carl Sorenson Created
01/31/08 Carl Sorenson From 2 to 4 channels

NOTES:

If the channel is in "raw mode" parity is not checked by card or us.

Returns:
    TRUE if it checks valid, otherwise false

Parameters:
    chan the channel index
    word the 32-bit ARINC-429 parameter word, via the Condor API

Definition at line 229 of file arinc_driver.c.

```
00233 {
00234  int okay = FALSE;          // return code
00235  uint32_t ptest;            // parity test value
00236
00237  switch(chan)
00238  {
00239     case ARINC_CHAN0: ptest = ARINC_CHAN0_PARITY; break;
00240     case ARINC_CHAN1: ptest = ARINC_CHAN1_PARITY; break;
00241     case ARINC_CHAN2: ptest = ARINC_CHAN2_PARITY; break;
00242     case ARINC_CHAN3: ptest = ARINC_CHAN3_PARITY; break;
00243     default: jobMsg(LOG_BYE,"checkParity: unknown channel: %i\n",chan);
00244  }
00245
00246  if (working) switch(ptest)
00247  {
00248     case AR_ODD:  if (!(word & ARINC_PARITY_BIT)) okay = TRUE; break;
00249     case AR_EVEN: if  (word & ARINC_PARITY_BIT) okay = TRUE; break;
00250     case AR_RAW:  okay = TRUE; break;
00251     default: jobMsg(LOG_BYE,"checkParity: internal error: %i\n",ptest);
00252  }
00253
00254  return(okay);
00255 }
```
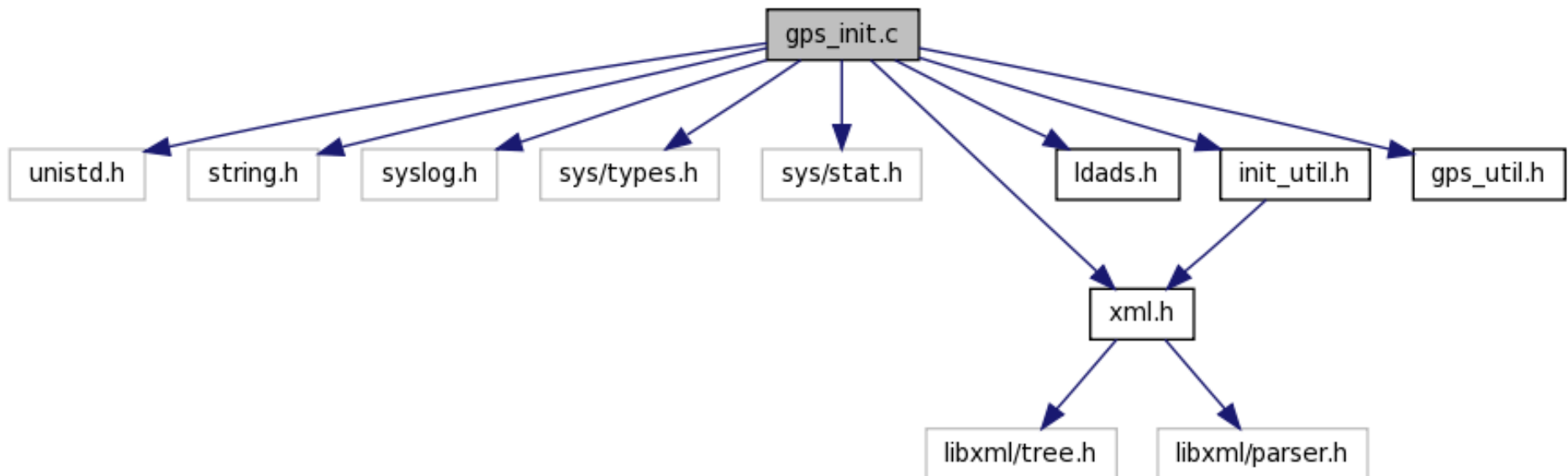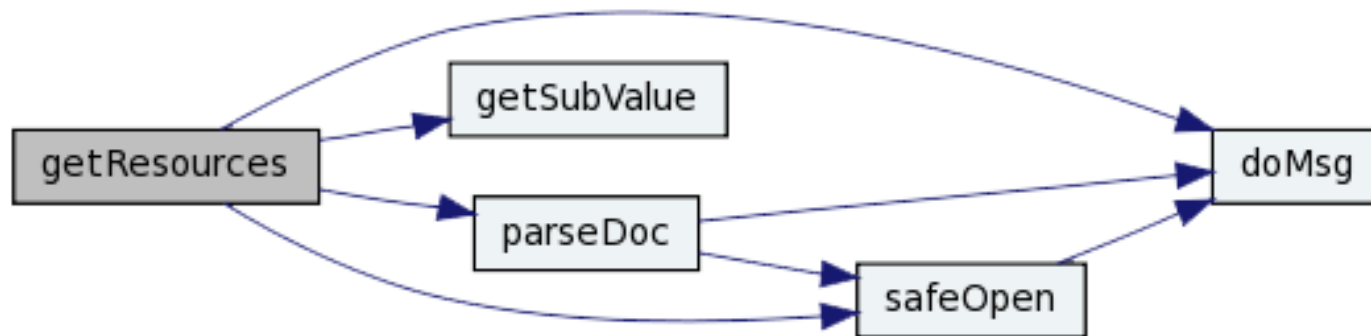
Here is the call graph for this function:

Doxygen - GraphViz

- File dependency graphs
- Clickable links

Doxygen – GraphViz (cont.)

- Functional dependency graphs
- Flow visualization
- Easy code debugging

Platform Migration

- Three considered platforms:
  - VersaLogic EPM-5 "Puma"
  - Lippert "Cool FrontRunner"
  - eBox-2300 ("NorhTec MicroClient")
- Puma and Lippert suspended due to time constraints

VersaLogic EPM-5 "Puma"   Lippert "Cool FrontRunner"
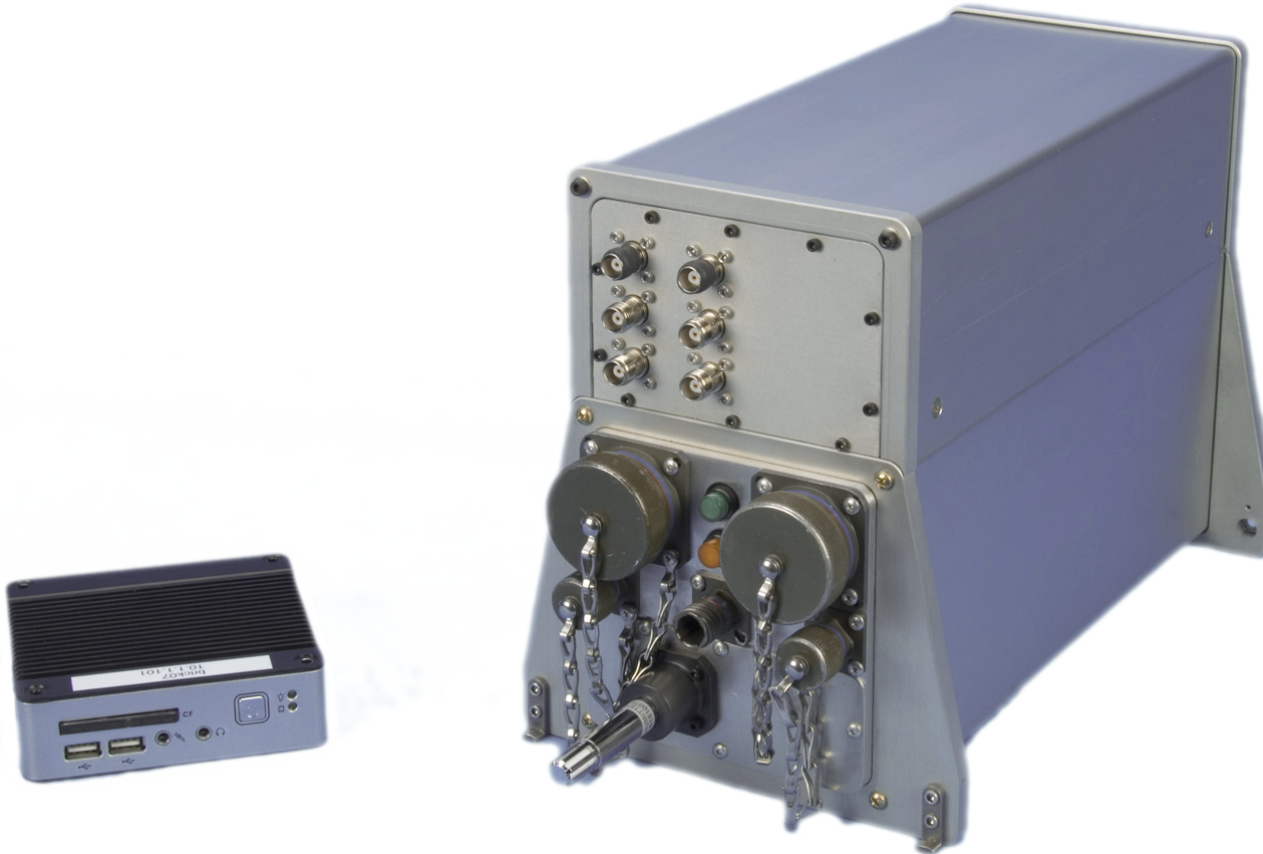
eBox-2300

- Motivations for choice
    - Built-in Compact Flash interface
    - Passive Cooling
    - Low Power Consumption (15W)
    - Self Contained
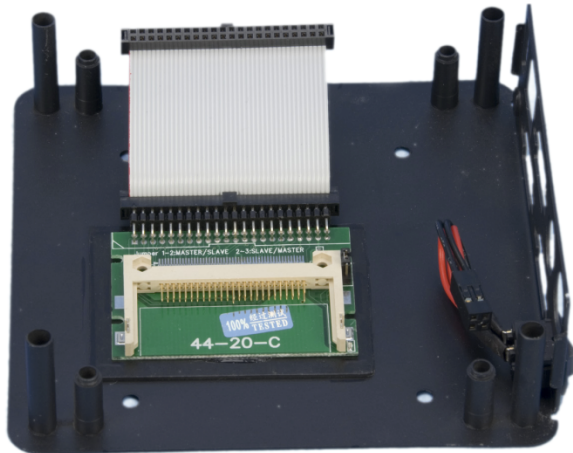   - Two Serial Ports

Front

Rear

eBox-2300 (cont.)

- Finally: small size

eBox Modification

- Added 2nd Compact Flash interface
  - Usability: separates system and data
  - Makes one complete package

Data CF card

System CF card

Testing REVEAL

- ## Data Source: Piccolo II Autopilot
  - Generates useful, verifiable data
  - Communicates over serial
  - Existing data acquisition software

Testing REVEAL (cont.)

- Network Link: Iridium 9505A Satellite Phone
  - Globally accessible
  - Allows data transmission
  - Serial accessory

Iridium 9505A

Antenna
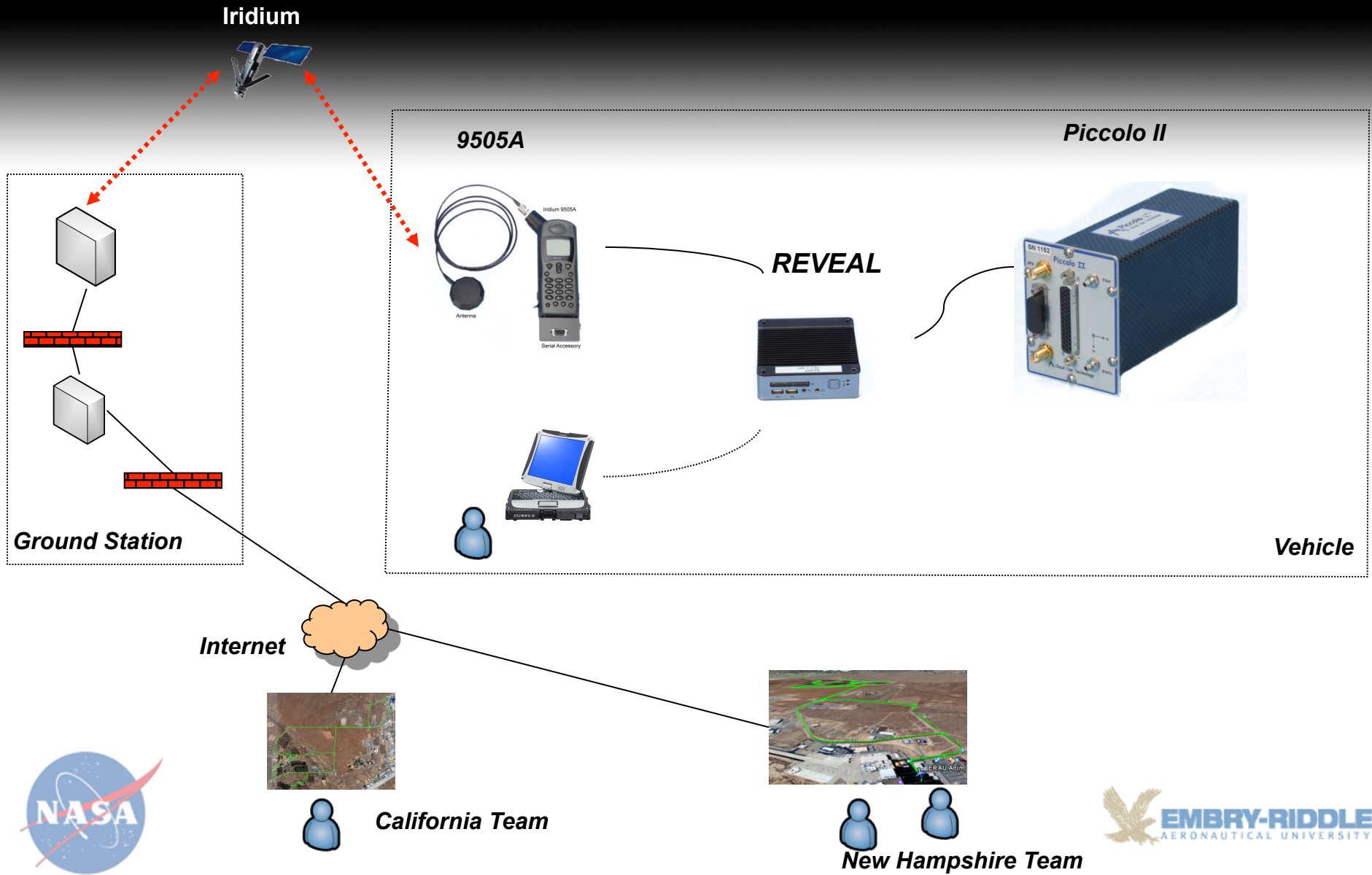
Serial Accessory

Field Test

- Proof of Concept

Truck Setup

Terminal

Physical Network Architecture

Iridium

9505A

Piccolo II

REVEAL

Ground Station

Vehicle

Internet

California Team

New Hampshire Team

Field Test (cont.)

Next Steps

- Further documentation
  - XML configuration files
  - Data flow
  - Accessibility to a broader audience
- Further miniaturization of REVEAL hardware
  - Current size is restrictive
- Expanded applications of REVEAL software

Project Status

- Implemented multi-developer capability for REVEAL

  - Created interactive REVEAL documentation.

- Became first users

- Migrated REVEAL to low-cost hardware (eBox-2300)

  - Field tested system

  - Verified end-to-end operation

Acknowledgments

- Larry Freudinger
- Brent Bieber
- Sky Yarbrough
- Jim Murray
- Shari Olson
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- Matt Miller & John Wilson
- Professor Gary Gear

Questions?