DoD Center for Geosciences/Atmospheric Research

Annual Report

under

Cooperative Agreement #W911NF-12-2-0066

between

Colorado State University

and the

U.S. Army Research Laboratory/
U.S. Army Research Office

Prepared by: Thomas H. Vonder Haar, Recipient Program Manager

For the Period: September 20, 2012 – September 30, 2013
1.0 Overview

The new DoD Center for Geosciences/Atmospheric Research (CG/AR) Cooperative Agreement for research between Colorado State University and the Army Research Office/Army Research Laboratory began September 20, 2012 and is planned for a 3-year period. This CA continues the Center into its 26th year of collaborative research with the DoD on environmental questions and concerns related to the Army, Air Force, Navy and other DoD agencies. At CSU, the Center matches subject matter expertise of faculty and graduate students to DoD lab groups and their priority questions. The Center also provides a highly trained workforce (graduated students) and multi-disciplinary environmental experts (faculty) to strengthen the core capability of DoD labs.

During the first year of the new research, five initial research projects were identified, staffed and initiated during discussions among DoD scientists and the CG/AR Recipient Program Manager and other CSU faculty. The following sections of this annual report contain details of research progress in all the areas.

Unfortunately, the severe budget constraints in 2012-2013 and continuing across many research agencies have slowed the progress and development of new collaborative research to a rate below that planned by CSU and the ARO/ARL and related agencies. Hopefully, these times will pass and the Center will again address DoD environmental issues and resume strengthening DoD core capabilities at the normal level of effort of $2-3M per year.

During these challenging times, the addition of substantial non-required CSU actual dollar cost sharing has helped all the collaborative research projects.
2.0 Research Results

Reporting period: October 1 - December 31, 2012

Task 1: Coordination and Staff Rotation with ARL Scientists to Improve Core Capabilities of ARL (Research Theme: Coordination and Staff Rotation)

This first quarter of the new Cooperative Agreement was a period primarily of project organization.

Shortly after the execution of the new Cooperative Agreement, Prof. Vonder Haar visited the ARL leadership for discussions about core capabilities. There were also telephone interactions with the Recipient Program Manager, Prof. Thomas Vonder Haar, the Program Assistant, Ms. Loretta Wilson and ARL leadership. Discussion topics included scheduling and planning of the annual research program review (currently on hold due to federal budget concerns) and potential topics for research seminars via video teleconferencing.

The Army Research Lab provided a computer (at ARL) and connectivity (at ARL and CSU) for Prof. Vonder Haar.

Tom Vonder Haar met with ARL leadership in Adelphi, Maryland, September 27 and 28.

Tom Vonder Haar was an invited guest to the dedication ceremony of the Marine Meteorology Center, Naval Research Laboratory in Monterey, CA on October 12.

Tom Vonder Haar attended the AGU Annual Fall Meeting in San Francisco, CA, December 2-6.

Task 2: System Improvements to the AFWA Cloud Advection Process (Research Theme: Clouds, Icing, and Aerosols Effects)

Task 3: Creation of an AFWA Probability of Cloud Free Line of Sight (PCFLOS) WRF Post-Processing System (Research Theme: Clouds, Icing, and Aerosols Effects)

Dr. Andrew Jones (CIRA) leads the technical activities of the AFWA ADVCLD and PCFLOS activities. Dr. Stanley Kidder (CIRA) and Mr. John Forsythe (CIRA) joined the ADVCLD project in October. Prof. Vincent Larson (Univ. of Wisconsin-Milwaukee) joined the PCFLOS project in December.

Future administrative arrangements have been made for: 1) Mr. Don Reinke (CIRA) and 2) Mr. Steve Finley (CIRA) to join our PCFLOS and ADVCLD projects, respectively.

Dr. Jones coordinated a series of telecons and visits to AFWA to start the necessary technical background discussions related to formation of the technical roadmap for the ADVCLD and PCFLOS activities. In addition, a series of CG/AR management discussions were held. Specifically, during this time period CG/AR management update meetings were held on October 4 and November 29. The trip to AFWA is reported below in the next section.
Specific tasks accomplished in this period include:

1) We conducted our primary objective which was to hold our project kick-off meetings for both the ADVCLD and PCFLOS projects. This occurred at AFWA on October 15.
2) Dr. Jones spent most of his time during this period ordering and configuring the two new workstations (see the equipment systems/status section below for more details).
3) Follow-on contacts were made with AFWA at the AMS Annual Meeting held in Austin, TX, January 7-11.
4) Dr. Jones made preparations for undertaking the PCFLOS activities, pending the upcoming addition of Dr. Larson and Mr. Reinke to the PCFLOS project who with Dr. Jones form the core of the PCFLOS research team.
5) Dr. Jones made preparations for synchronizing the DPEAS software system with the Linux system codes, including developing prototype Linux make files, and test development routines needed for porting the DPEAS Windows/AIX code base to Linux for use on AFWA computer systems. Dr. Jones gathered the software together into development trees, and readied the transfer of the software to the CIRA Linux system admin, Mr. Steve Finley, who will assist with the DPEAS Linux port.
6) The Linux DPEAS porting work will be conducted in parallel to the cloud advection developments, which will use the existing AFWA ADVCLD codes, and existing CSU advection codes contributed by Dr. Stan Kidder. Those codes are now on Andy Jones’ development machines ready for use with the AFWA cloud mask data sets when those data sets arrive at CIRA. Dr. Jones also has alternative CIRA cloud mask data identified for studies that may require higher resolution data sets, or as a temporary replacement for the AFWA data sets. The need for that alternative data source will be reassessed later in the project as time allows.

Two multi-processing Windows workstation data servers were purchased and installed during this reporting period. The systems are named CAT3 and CAT4. The systems will be used for both AFWA PCFLOS and ADVCLD projects and will serve data sets, and perform satellite data analysis as needed for the project. This completes the planned hardware purchases for the project and allows the project to move forward with technical implementation issues. In addition, a preexisting Linux data server, ATLAS, was reconfigured to work with the Linux GLS CIRA subversion source code repository system. This is to facilitate future work with a Linux version of the DPEAS ADVCLD advection software. All systems are fully functional and have passed their initial configuration steps, including installation of needed software, and synchronization with existing CIRA software systems. This will speed development of the software during the remainder of the project.

In the next quarter, we expect to configure a new DPEAS source code trunk within the Linux software repository after Mr. Steve Finley joins our project.

Dr. Jones visited the Air Force Weather Agency (AFWA) at Omaha, NE on October 15 to discuss the AFWA ADVCLD and PCFLOS projects with Drs. Jeff Cetola, Tim Nobis, Mr. Steve Rugg, and other AFWA staff. Dr. Vince Larson was able to dial-in to a joint PCFLOS telecon, where we discussed the PCFLOS project outcome objectives relative to AFWA needs. This meeting helped to shape our PCFLOS project objectives. Dr. Jones had extensive ADVCLD discussions with Drs. Jeff Cetola and Tim Nobis and likewise, near-term objectives and AFWA
needs were identified and clarified for the project’s benefit. (This meeting followed up an earlier pre-meeting at Omaha, NE that occurred on June 4-5, 2012 in which details of the AFWA ADVCLD system were communicated to Dr. Jones.)

**Task 4: Soldier Health and Aerosol Source Trajectories (Research Theme: Urban and Boundary Layer Environment)**

Dr. Sonia Kreidenweis leads the technical activities of this task. Ms. Lauren Potter (M.S. candidate) joined the project at its initiation.

In the first quarter, we conducted several conference calls/email exchanges with Drs. Tom DeFelice and Alan Wetmore of ARL to set up the ideas and goals of the project. We also received initial data from ARL that consisted of timelines of DRUM-derived aerosol chemical composition data. At this time, the data were not quality-controlled or calibrated, and there were no time stamps associated with the data, so we could not correlate with air mass trajectory information. However, the data were adequate to examine trends and to explore extraction of factors.

Ms. Potter applied some of the same techniques that we will use on the ARL DRUM data, to filter-based aerosol composition data from Mauna Loa Observatory. In this way we have progressed on technique development while awaiting the final Baghdad dataset to be used for this work.

Existing computing equipment has been used for this project thus far. The EPA Positive Matrix Factorization code was downloaded and tested by Ms. Potter.

**Other Cooperative Research**

Kimberly Erickson, co-advised by Profs. Tom Vonder Haar and Chris Kummerow (and supported by CG/AR 50%), is in her second year masters program in the Department of Atmospheric Science. Following is an abstract of her research topic and progress to date.

The Tropical Rainfall Measuring Mission (TRMM) was launched in 1997, and among the instruments onboard, it contains a precipitation radar (PR) and a passive microwave imager (TMI). The TMI observes radiation in five separate channels, 10.7, 19.4, 21.3, 37, and 85.5 GHz, and has a swath of 878km. The radiation measured is related to the brightness temperature (Tb), which is the black body emission temperature of the surface being observed. The Goddard Profiling Algorithm (GPROF) uses these observed Tbs and other ancillary data, such as ECMWF ERA-Interim, data, and compares these data through a Bayesian inversion scheme to an a priori database of atmospheric profiles of moisture and their corresponding brightness temperatures. The database was created from the output of a combination of cloud resolving models and a forward passive microwave radiometer model, and leads to a best guess to the atmospheric profile of moisture and thus rainfall from the measured Tb. The PR measures a profile of precipitation in a 247km swath in the same path as the TMI, and can be used as a check against the TMI retrieval. Over land, the TMI is limited to the high frequency channel (85.5 GHz) because of the lack of temperature contrasts between cloud top and the surface of the Earth. The
high frequency channel is able to measure the scattering of radiation by ice particles within cold clouds, which depresses the cloud top temperature from the surface temperature, and gives enough of a signal to retrieve a profile. However, this poses a problem when warm, shallow clouds are precipitating, as they contain little or no ice, which leads to a drier and non-precipitating profile. These warm, shallow clouds are generally found within areas of prominent and efficient orographic lifting, so missed retrievals of precipitation can greatly underestimate the calculated water budget for a specified region. The retrieval of orographic precipitation needs to be improved, and in a manner similar to Shige et al. 2013, a Orographic Lifting Index (OLI) is calculated and used to subset the a priori database of profiles in GPROF. The OLI is the probability of precipitation in a 1° x 1° box, and is calculated with the same ancillary data that the GPROF algorithms use, ECMWF reanalysis. To find the OLI, the moisture convergence into a box is calculated with the ECMWF winds and moisture, the moisture is then lifted over the mean elevation of the box, and the water that must condense out is calculated and related to the OLI. Eight significant orographic lifting regions have been identified in Figure 1, and the utility of the OLI subsetting will be determined. More results will be presented at a later time.

Figure 1. This figure contains eight orographic regions where the effectiveness of the OLI subsetting will be determined. The regions were picked because they lay within the 35°N to 35°S band where TRMM operates and because they often experience orographic precipitation that greatly increases their annual precipitation.

Other research tasks are being discussed with DoD, ARL, ARL, and AFWA staff. Some are being explored with the aid of CSU cost-share funding.
Task 1:  Coordination and Staff Rotation with ARL Scientists to Improve Core Capabilities of ARL (Research Theme: Coordination and Staff Rotation)

This second quarter of the new Cooperative Agreement was a period primarily of Task definition and exploration in view of current events.

Due to uncertainties following Congressional legislation on DoD budget sequestration, federal employee furloughs, and travel restrictions, little planning was possible in the area of Improving Core Capabilities of ARL. Dr. Vonder Haar had informal discussions with Navy science representatives (ONR and NRL-Monterey) on a new University Affiliated Research Center (UARC) for Environmental Research. They were positive as were the initial discussions with ARL and ARO. Meanwhile, CG/AR, CSU has received support for the new UARC from three potential faculty Co-Pis at Colorado State University. In addition, several candidates for the UARC Executive Scientist position have been discussed. All have DoD experience with environmental research and priorities.

The Program Assistant for CG/AR, Ms. Loretta Wilson, communicated with ARL leadership regarding potential venues and tentative dates for a review of the research program, which is typically done on an annual basis.

Task 2:  System Improvements to the AFWA Cloud Advection Process (Research Theme: Clouds, Icing, and Aerosols Effects)

Task 3: Creation of an AFWA Probability of Cloud Free Line of Sight (PCFLOS) WRF Post-Processing System (Research Theme: Clouds, Icing, and Aerosols Effects)

Mr. Don Reinke joined the PCFLOS project efforts in January. Mr. Steve Finley joined the ADVCLD project efforts in January.

Arrangements are being made to continue Dr. Vincent Larson’s involvement with the PCFLOS project by a CIRA Visiting Scientist slot or possibly a subaward arrangement. This will be determined by management in the near future.

Prof. Tom Vonder Haar had telecons with Jeff Cetola and others at AFWA regarding: progress of Tasks 2 and 3; AFWA visits to CSU for a program review; and an internal CSU pilot study on aerosol data sets and forecasting activities of interest to AFWA, ARL and CSU.

Dr. Jones coordinated a series of meetings and telecons with AFWA to continue the necessary technical background discussions related to formation of the technical roadmap for the ADVCLD and PCFLOS activities. In addition, CG/AR management discussions were held.

Specifically, during this time period CG/AR management update meetings were held on February 7. Dr. Jones held technical telecons with AFWA regarding the PCFLOS and ADVCLD projects on January 18. Dr. Jones and Mr. Reinke held technical telecons with
Dr. Vince Larson on January 25 and February 12. No external trips by CSU staff to AFWA were conducted during this reporting period.

Specific tasks accomplished in this period include:

7) On February 12 we held a more detailed project status update meeting with AFWA that outlined our planned PCFLOS project schedule, with a target completion date of October 2013.

8) Dr. Larson continues to refactor the PCFLOS codes, and will be delivering his source code in ~April to CSU for initial internal portability tests on independent CSU computer hardware. This test will be used to verify codes before initial delivery of software to AFWA for examination and feedback purposes.

9) On January 31 a local ADVCLD technical working group meeting was held, and plans were made for the ADVCLD project schedules and team availability with that schedule. Dr. Jones is taking the lead with Mr. Finley on the Linux DPEAS port efforts, and he is also working with Dr. Kidder on use of his orographic rain index (ORI) advection source code modules. Dr. Jones and Mr. Forsythe continue to work on GFS model data access issues for the source of the wind data sets.

10) In mid-February Dr. Jones updated a draft of the ADVCLD project schedule.

11) March 1 and 8, Dr. Jeff Cetola provided Dr. Jones with AFWA ADVCLD source code for use by CSU in development of the DPEAS ADVCLD models, to ensure that the new DPEAS ADVCLD code could support similar data interface requirements.

12) Dr. Jones and Mr. Finley discussed progress with the port of the DPEAS software library from Windows to Linux computational hardware on March 11 and 22. Dr. Jones and Mr. Finley met roughly bi-weekly for updates, and more frequently for technical interactions to overcome issues in the Linux DPEAS porting effort as technical issues arise.

13) The Linux DPEAS porting work continues to make progress, with all major DPEAS software modules compiling cleanly on the host Linux machine. Work that remains is reverification of the Linux DPEAS system module, and linkage to the Linux libraries such as the netCDF4, HDF5, HDF4, HDFEOS2 libraries, and their supporting sublibraries. That works remains the focus of the current DPEAS porting activities.

14) We are currently conducting tests of the Linux IMSL math libraries to enable advanced DPEAS functionality using the Linux Intel 12 Fortran compiler. IMSL configuration tests are continuing, but appears to offer us a promising compatibility solution.

A temporary version of the IMSL math software libraries was obtained by Mr. Finley for DPEAS portability tests. Mr. Finley also created a new DPEAS source code trunk within the CIRA Linux software repository. Dr. Vince Larson exchanged information with Mr. Finley on use of his SVN source code repository on the projectlocker.com web site, and the CIRA Linux machines will link to that code repository for sharing the PCFLOS software activities, as it provides Dr. Larson with easy manageable access.

Dr. Jones attended the AMS Annual Meeting in January under separate project funding, and briefly visited with Dr. Tim Nobis about these CG/AR AFWA activities while at the AMS conference.
Task 4: Soldier Health and Aerosol Source Trajectories (Research Theme: Urban and Boundary Layer Environment)

Ms. Potter prepared her MS thesis during this quarter and successfully defended it on February 20. Her thesis focused on analysis of 20 years of aerosol composition data from the Mauna Loa Observatory. She applied analysis techniques and developed approaches that can be used for the analysis of the Baghdad aerosol data. Ms. Potter also spent time preparing a manuscript from her thesis.

We continued to remain in intermittent contact with Dr. Tom DeFelice and Dr. Alan Wetmore of ARL to discuss the status of data delivery to CSU. We did not receive any data from ARL during this quarter.

Other Cooperative Research

Andrew Jones discussed the new Soil Moisture project with Gary McWilliams and other Army subject matter experts.

Tom Vonder Haar, Vince Larson, Russ Schumacher and John Forsythe hosted Dr. James Cogan and Mr. Bob Dumais (ARL) for discussions of the new Feasibility Study for new technology methods and data for improved, high-resolution forecasts of winds and density.

Reporting period: April 1 - June 30, 2013

Task 1: Coordination and Staff Rotation with ARL Scientists to Improve Core Capabilities of ARL (Research Theme: Coordination and Staff Rotation)

Prof. Tom Vonder Haar and Ms. Loretta Wilson hosted Dr. James Cogan and Mr. Bob Dumais from the Army Research Laboratory for a two day visit to CG/AR on June 5 and 6. Multiple topic-specific meetings were arranged to enable review of research in progress as well as discussion of possible new research projects and collaboration opportunities.

Dr. Stan Kidder traveled to the Baltimore, MD area April 28 - May 1 to participate in the NASA Workshop “Water Cycle Mission Planning for the Next Decade” relevant to current, cooperative research projects.

Ms. Loretta Wilson helped to coordinate the visit to CG/AR by Dr. James Cogan, which ultimately occurred in June. At the request of ARL, she also prepared a draft budgets for potential activities through the CA: establishment of an artillery/met study; hire of a senior research associate; and hire of several postdoctoral fellows to collaborate with researchers at Adelphi, White Sands and Fort Collins.
Task 2: System Improvements to the AFWA Cloud Advection Process (Research Theme: Clouds, Icing, and Aerosols Effects)

Task 3: Creation of an AFWA Probability of Cloud Free Line of Sight (PCFLOS) WRF Post-Processing System (Research Theme: Clouds, Icing, and Aerosols Effects)

Arrangements were made to continue Dr. Vincent Larson’s involvement with the PCFLOS project by a CIRA subaward arrangement.

During this time period CG/AR management update meeting was held on April 11. Several informal technical telecons were held with AFWA regarding the status of both the PCFLOS and ADVCLD projects. Dr. Andy Jones and Mr. Don Reinke held technical telecons with Dr. Vince Larson on June 3. No external trips by CSU staff to AFWA were conducted during this reporting period.

Specific tasks accomplished in this period include:

15) Dr. Larson completed the first refactoring of the PCFLOS codes, and a unit test sequence was developed for final delivery to USAF AFWA technical staff.

16) Dr. Jones and Mr. Finley continued to make significant progress on the Linux DPEAS porting efforts. Dr. Jones and Mr. Forsythe continued to work on GFS model data access issues for the source of the wind data sets. Mr. Forsythe has a prototype GFS GRIB-2 data readed working which is a major milestone for the effort.

17) The Linux IMSL library tests were completed and a full IMSL library license was purchased to continue the efforts of the DPEAS software port.

Dr. Jones visited with Dr. Cogan and Mr. Dumais (ARL) June 5 and gave them an update about the USAF AFWA PCFLOS and ADVCLD projects.

Dr. Jones visited with Mr. Dumais (ARL) June 24 at the WRF User’s workshop held at Boulder, Colorado.

A full version of the IMSL math software libraries was ordered by Mr. Finley for DPEAS portability as the initial tests were successful.

Task 4: Soldier Health and Aerosol Source Trajectories (Research Theme: Urban and Boundary Layer Environment)

Dr. Sonia Kreidenweis leads the technical activities of this task. Ms. Lauren Potter (M.S. candidate) joined the project at its initiation. Dr. Emily Bian began employment at CSU April 1. Her primary responsibilities are to another project and is supported by other funding, but as an expert in PMF and source apportionment, she has provided technical services to this project at small fractional time contributions.

Ms. Potter applied to and was accepted to the Ph.D. program in the Department of Atmospheric Science at Colorado State University. She continued work on Mauna Loa dataset and added a new activity with IMPROVE data from their Mauna Loa field site.
Colleagues at the Army Research Laboratory provided the Baghdad DRUM data sets at the end of May. We communicated with Dr. Tom DeFelice and Dr. Alan Wetmore of ARL regarding questions about the data, including data quality screening. During this quarter Ms. Potter prepared an initial summary of her work with the Baghdad data that we provided to ARL at the start of the third quarter of 2013.

Ms. Potter attended the International Conference on Nucleation and Atmospheric Aerosols, held in Fort Collins, CO, in June. She presented a poster on her analyses of the Mauna Loa datasets.

Other Cooperative Research

At the request of Gary McWilliams (ARL) a statement of work and budget were developed for the Army DMSP follow-on work.

Tom Vonder Haar, Vince Larson, Russ Schumacher and John Forsythe met with Dr. James Cogan and Mr. Bob Dumais (ARL) on June 5 and 6 for discussions of the new Feasibility Study for new technology methods and data for improved, high-resolution forecasts of winds and density.

A summary document was drafted for the feasibility study for new technology methods and data for improved, high-resolution forecasts of winds and density, previously discussed by ARL and CGAR researchers.

Ian Wittmeyer was rehired at CIRA and started May 28. He will work with Prof. Vonder Haar on a pilot study of global aerosol climatologies and forecasts, supported by CSU cost-sharing funds to this Cooperative Agreement.

Draft budgets and statements of work were prepared for two additional possible scenarios and research tasks at the request of ARL.

Reporting period: July 1 - September 30, 2013

Task 1: Coordination and Staff Rotation with ARL Scientists to Improve Core Capabilities of ARL (Research Theme: Coordination and Staff Rotation)

Dr. James Cogan participated by telecon in the August 29 CG/AR meeting with Dr. Jeff Cetola (AFWA), Mr. Steve Rugg (AFWA), and Mr. John Eylander (ERDC/CRREL) at CIRA, Fort Collins.

Prof. Thomas Vonder Haar traveled September 14-21 to Vienna, Austria to participate in the joint EUMETSAT and AMS Satellite Meteorology conferences and co-present research results. (Approximately 50% of the travel costs were supported by CG/AR including prior airfare credit from a cancelled trip to Adelphi, MD under the previous CA.)
Ms. Loretta Wilson finalized CSU’s proposal for the artillery/met study and submitted it to ARL leadership. She also worked with the Recipient Program Manager, Prof. Vonder Haar, to respond to a new request to potentially add a new acoustic research component to the cooperative agreement and developed a draft budget for this purpose. A pre-proposal was submitted to Dr. Cogan in August.

**Task 2:** System Improvements to the AFWA Cloud Advection Process (Research Theme: Clouds, Icing, and Aerosols Effects)

**Task 3:** Creation of an AFWA Probability of Cloud Free Line of Sight (PCFLOS) WRF Post-Processing System (Research Theme: Clouds, Icing, and Aerosols Effects)

An Interim Summary Technical Progress Report, prepared for the sponsors of these research tasks in April, was designated as a CG/AR Technical Report under CIRA’s ISSN number and distributed.

Dr. Jones coordinated a series of meetings and telecons with AFWA to continue the necessary technical background discussions related to formation of the technical roadmap for the ADVCLD and PCFLOS activities. In addition, CG/AR management discussions were held. AFWA and ERDC/CRREL management came for an on-site visit and discussions on August 14, and September 12.

A CG/AR management update meeting was held on August 29. Most management discussions occurred at the intensive on-site visit to CSU on August 14 by Dr. Jeff Cetola (AFWA), Mr. Steve Rugg (AFWA), and Mr. John Eylander (ERDC/CRREL).

Specific tasks accomplished in this period include:

18) Dr. Larson started a second series of end-to-end tests for the PCFLOS codes, focusing on the 3D attributes, and use of actual WRF model output data as the PCFLOS input variables. This will complete the set of software tests that will accompany the PCFLOS software to be delivered to AFWA in the near future. We had a series of discussions of targeted end users and how this was going to be handed-off to AFWA technical staff. We anticipate that the technical hand off will occur in November 2013, with internal AFWA tests to occur after that date.

19) Dr. Jones updated his DoD HPCMP account access with the help of CSU Ventures, USAF AFWA, and CCAC helpdesk staff. This will enable future AFWA model interactions and testing which will be part of follow-on Army/USAF activities pending new funds. The accounts could also be used for initial DPEAS portability tests, assuming that the DPEAS Linux port starts to mature to that testing phase.

20) The DPEAS Linux porting efforts of Dr. Jones and Mr. Finley are progressing to where Mr. Finley has a fully testable executable, and Dr. Jones has provided test input scripts. Dr. Jones is currently starting a series of internal DPEAS tests, and will be interacting with Mr. Finley to resolve the remaining incompatibilities. Dr. Jones also synchronized with the NOAA DPEAS Linux/AIX porting efforts, and now has some synchronization capabilities between the institutions, which will enhance the final port of the DPEAS codes to the AFWA target machine architectures.
CG/AR supported travel for Dr. Vincent Larson from Milwaukee, Wisconsin to participate in the mid-course review of the CG/AR PCFLOS and ADVCLD projects on August 14.

**Task 4: Soldier Health and Aerosol Source Trajectories (Research Theme: Urban and Boundary Layer Environment)**

Ms. Lauren Potter conducted initial reviews of the data set and we provided a research summary to Dr. Tom DeFelice and Dr. Alan Wetmore of ARL in early July, followed by a conference call to discuss the findings and remaining questions about the data. We forwarded a second report in September and followed that with another conference call. Some issues regarding data quality remain but could not be resolved by either CSU or ARL, so it was decided to proceed with analyses keeping these limitations in mind.

Research progress was deemed good by our ARL contacts, and Ms. Potter and Dr. Bian continued to work on data analyses during this quarter, refining the initial quick-look products.

A final report will be completed in the fourth quarter to close out this project.

**Task 5: Army DMSP Follow-on Soil Moisture Project (Research Theme: Hydrometeorology)**

Modification to the Cooperative Agreement for this new project was executed on 02 July 2013. Dr. Jones and Mr. McWilliams had technical exchange meetings on August 5 and 22.

Dr. Jones attended the DMSP Follow-on Soil Moisture kick-off meeting that occurred on September 25-26 at Adelphi, MD.

Under this project, 2 data servers were ordered to host the soil moisture satellite and model data sets for the DoD Soil Moisture Working Group activities. Dr. Jones started the configuration process for the systems, and continues to work on their integration into the DPEAS processing network at CSU.

**Other Cooperative Research**

Ian Wittmeyer and Tom Vonder Haar have completed a project supported by CSU cost-sharing funds to this Cooperative Agreement. It is a detailed review of current global aerosol data sets and realtime aerosol forecast products with annotated metadata and urls. This was a topic of interest at the last CG/AR Annual Program Review in Fort Collins. A presentation was given on August 14 during the mid-course review of the CG/AR PCFLOS and ADVCLD projects of particular interest to AFWA (and funded by AFWA to the Center via the DoD Cooperative Agreement). The PowerPoint file was also sent to Dr. Tom DeFelice (ARL), who expressed early interest in this topic, together with Dr. Jeff Cetola (AFWA) and is available upon request.

At the request of ARL, a draft budget and statement of work were prepared for the possible addition of a specific task involving the acoustic work of Dr. Vladimir Ostashov.
With contributions from Tom Vonder Haar, Vince Larson, Russ Schumacher and John Forsythe the white paper for the feasibility study for new technology methods and data for improved, high-resolution forecasts of winds and density was submitted to the sponsor. The submission was titled “Feasibility Study of Innovative New Methods to Improve “HIRES” Forecasting of Local Area Environmental Conditions Important to Artillery Operations.”
## Appendix 1

### CG/AR Researchers under Cooperative Agreement W911NF-12-2-0066

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### CG/AR Graduate Students

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<th>E-mail</th>
<th>Advisor</th>
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Appendix 2
Publications