Partners Project Title Page
Proposal for a Partners Project

Title: Establishing a relationship between mixing height and wildfire growth: An observational study

Date: 6/3/2019

Signatures for University
University Name: SDSM&T
Address: 501 East Saint Joseph Street
Rapid City, SD 57701

Principal Investigator
Name (typed): Darren Clabo
Telephone number: 605-394-1996
FAX number:
Address: 501 East Saint Joseph Street
Rapid City, SD 57701
Email: darren.clabo@sdsmt.edu

University Official (usually dept. chair)
Name (typed): William Capehart
Title: Program Chair
Telephone number: 605-394-1994
FAX number:

University Official (contract sent to)
Name (typed): Jan A. Puszynski
Title: Vice President for Research
Address: 501 East Saint Joseph Street
Rapid City, SD 57701
Telephone number: 605-394-2493
FAX number:
Email: jan.puszynski@sdsmt.edu

Signatures for NWS
NWS Office: Storm Prediction Center
Address: 102 David L. Boren Blvd
Norman, OK 73072

Principal Investigator
Name (typed): Patrick Marsh
Telephone number: 405-325-2080
FAX number:
Email: patrick.marsh@noaa.gov

Operations Branch Chief
Name (typed): William Bunting
Telephone number: 405-325-2064
FAX number:

~~SSD Chief~~ SCIENCE SUPPORT BRANCH CHIEF
Name (typed): Russell S. Schneider (Acting)

~~Regional~~ Director
Name (typed): Russell S. Schneider

SUMMARY OF BUDGET REQUEST:

COMET FUNDS: Year 1 $15,000
NWS FUNDS: FY 1 $1,000 FY 2 $1,000

Title:
Establishing a Relationship between Mixing Height and Wildfire Growth: An Observational Study

Proposal Summary:

Wildfires are by nature extreme events that require scientifically sound, coherent, and accurate forecasts to ensure efficient and safe suppression operations. In the present proposal, the Atmospheric and Environmental Sciences Program (AES) at the South Dakota School of Mines and Technology (SDSM&T) is seeking to collaborate with the Storm Prediction Center (SPC), a National Center of the National Weather Service (NWS), on a research project to better understand the relationship between the height of the well-mixed layer within the lower troposphere and the potential for large wildfire growth.

The well-mixed layer is characterized by a near-constant virtual potential temperature, decreasing mixing ratio with height, and increasing wind speed with height. Owing to buoyancy and the resultant vertical mixing, higher mixing heights allow drier, potentially warmer, and higher momentum air to be transported to the surface. Hot, dry, and windy conditions have long been known to promote large wildfire growth (e.g. Mitchell and Zon 1929). Although NWS routinely includes mixing height as part of fire weather forecasts, it has not been established how or if mixing height affects wildfire growth. A preliminary analysis of several wildfires that exhibited explosive growth (e.g. Waldo Canyon Wildfire near Colorado Springs, CO during June of 2012; Black Forest Wildfire near Black Forest, CO during June of 2013) has revealed mixing heights in excess of 5000 m which appears abnormally high for these locations. However, given the lack of a mixing height climatology to set a benchmark, it is unknown if these values are extreme or if wildfires actually have a tendency to grow large on days with elevated mixing heights. Improvements in both mixing height forecasts and in the understanding of mixing height-wildfire relationships addresses the collaborative goals of the NWS Partners Project. The results of this project may lead to improvements in forecasting for explosive wildfire behavior.

To better understand the connection between wildfire growth and mixing height, we first propose to create a mixing height climatology for each radiosonde location within the contiguous United States. This work will be done in collaboration with the Storm Prediction Center, which has already established a sounding climatology for a variety of sounding-derived parameters that is available on their web page (https://www.spc.noaa.gov/exper/soundingclimo/). Mixing heights will be calculated from the bulk Richardson number technique, the Stull method, and the modified Stull method, as outlined by Fearon et al. (2015). It is anticipated that the mixing height will be a straight-forward addition to the sounding climatology. With the climatology established, we will examine days of large wildfire growth across the United States comparing observed mixing heights proximal to the wildfire to the climatological values for that site. It is hypothesized that climatologically high mixing heights will be observed on days with explosive wildfire growth.

Expected results will be valuable for both prescribed and wildland fires. Mixing height is a key component in determining smoke dispersal and establishing a mixing height climatology should enable land managers to better identify periods with optimum smoke dispersal for prescribed fires. If a correlation is found between large wildfire growth and climatologically high mixing heights, wildland fire managers will be better informed on days when the potential exists for explosive fire growth.

Proposed Project Objectives:

The proposed project has two primary science objectives:

1) In collaboration with the SPC, a mixing height climatology for United States radiosonde locations will be created and added to the SPC online sounding climatology page. The main deliverable for this part of the project will be this climatology, which will be accessible by NWS forecasters and other stakeholders through the SPC webpage.

2) Research comparing observed mixing height values for cases of extreme fire growth to this climatology. The main deliverable for this will be a peer-reviewed publication detailing the analysis of a large number of fire cases to establish the relationship between mixing height and wildfire growth.

The project will support the NWS by: 1) improving the understanding of local mesoscale forecasting problems, 2) assisting operational forecasters in enhancing their educational backgrounds and in staying abreast of developments in research, and 3) creating case studies and new data analysis techniques with wide applications for teaching, research, and operational forecasting.

Results of the proposed project are expected to directly benefit several NWS entities: the SPC through their Fire Weather Outlooks, NWS Forecast Offices through the Fire Weather and Spot Weather Forecasts, and to the Incident Meteorologist community. Current NWS Fire Weather Forecasts, while often listing mixing height as a forecast variable, do not have a climatological context for the mixing height limiting its usefulness. Thus the results of the proposed project would give both context to, and a basis for, including mixing height within operational fire weather forecasts. Benefits of the proposed project would then extend to the wildland firefighting community through anticipated improvements in forecasting for smoke dispersal and explosive wildfire growth.

Proposed Tasking:

SDSM&T Researchers

- Establish a methodology for automated calculation of the mixing height from radiosonde data
- Collect wildland fire data from various sources (e.g. Monitoring Trends in Burn Severity program, the National Interagency Fire Center, state wildfire databases)
- Identify large fire events exhibiting explosive wildfire growth within 160 km of a radiosonde site
    - Determination of mixing height during explosive wildfire event
    - Documentation of other relevant meteorological variables

SPC Researchers

- Establish a mixing height climatology, using the predefined methodology, for each radiosonde location in the United States.
    - Climatology to be made available to the public via the established Sounding Climatology webpage hosted by the SPC

Periodic educational exchanges between SDSM&T and the SPC and NWS Weather Forecast Offices will occur via online conferencing tools throughout the duration of the project.

Proposed Time Schedule:

Months 1 – 4: Mixing height calculation method development, data collection, creation of mixing height climatology, identification of wildfire growth days and case studies

Months 5 – 9: Data analysis for each case study, examination of wildfire records to determine likely cause(s) of explosive wildfire growth, hypothesis testing, and dissemination of required six-month report

Months 10 – 12: Final report, data publication, educational exchanges, development/implementation of webinars

Principle Investigators (Vita Attached):

PI: Darren Clabo, Ph.D., Research Scientist III and South Dakota State Fire Meteorologist, Department of Civil and Environmental Engineering, South Dakota School of Mines and Technology

Co-PI: Adam French, Ph.D., Associate Professor, Department of Physics, South Dakota School of Mines and Technology

University Contributions:
The PI and Co-PI for this project will be donating their time to this project in order to more fully support one graduate student.

Budget Summary (Budget Request Attached):
The primary cost of this project is the partial funding for one master's-level graduate student for one academic year. The two senior university personnel will be donating their time to this project. It is anticipated that scientists at the Storm Prediction Center will contribute 80 hours of their time towards the project with associated NWS costs related to data processing.

Literature Cited:
Fearon, M. G., T. J. Brown, and G. M. Curcio, 2015: Establishing a national standard for methodology for operational mixing height determination. *J. Operational Meteor.,* **3** (15), 172-189.

Mitchell, J. A., and R. Zon, 1929: Forest fire hazard. *Bull. Amer. Meteor. Soc.,* **10** (12), 239-241.

Darren R. Clabo, Ph.D.

South Dakota State Fire Meteorologist/Research Scientist III
Department of Civil and Environmental Engineering
South Dakota School of Mines and Technology
501 East Saint Joseph St., Rapid City, SD 57701
(605) 394-1996 darren.clabo@sdsmt.edu

Education

Ph.D., Atmospheric and Environmental Sciences; South Dakota School of Mines and Technology (SDSM&T), 05/2017
- Dissertation title: *Multi-timescale Methods of Forecasting Wildfire Growth and Potential in South Dakota, USA*

M.S., Atmospheric Sciences; SDSM&T, 08/2009
- Thesis title: *Polarimetric Radar Signatures of Hydrometeors Observed within Mature Convective Storms*

B.S., Meteorology with Mathematics Minor; University of Oklahoma, 05/2007

Academic Experience

Research Scientist III/South Dakota State Fire Meteorologist, SDSM&T, Department of Civil and Environmental Engineering, *11/2017 - present*
Instructor/South Dakota State Fire Meteorologist SDSM&T, Atmospheric and Environmental Sciences, *1/2010 - 10/2017*
Graduate Research Assistant, Department of Atmospheric Sciences, University of Wyoming, *6/2009 - 12/2009*
Graduate Research Assistant, Department of Atmospheric Sciences, SDSM&T, *6/2007 - 5/2009*

Publications

- Bunkers, M. J., **D. R. Clabo**, and J. W. Zeitler, 2009: Comments on "Structure and Formation Mechanism on the 24 May 2000 Supercell-Like Storm Developing in a Moist Environment over the Kanto Plain, Japan." *Mon. Wea. Rev.*, **137,** 2703-2712.
- **Clabo, D. R.**, 2018: Contemporary Pyrogeography and Wildfire-Climate Relationship of South Dakota, USA. *Atmosphere*, **9(6),** 207 – 217.

Conference Presentations

- **Clabo, D. R.**, 2018: Climate and weather conditions governing the explosive growth of the Legion Lake wildfire. *Western South Dakota Hydrology Conference*, Rapid City, SD.
- **Clabo, D. R.**, and J. Weiss, 2015: Prediction of seasonal wildland fire severity in South Dakota using Artificial Neural Networks. *Preprints, 11th Symposium on Fire and Forest Meteorology*, Minneapolis, MN, American Meteorological Society. 8.4.
- **Clabo, D. R.**, and O. H. Shieh, 2014: Forecasting thunderstorm outflow boundaries: Impacts and implications for wildland firefighting. *26th Conf. on Weather Analysis and Forecasting. 94th AMS Annual Meeting*, Atlanta, GA, American Meteorological Society. P110.
- Walter, E. R., A. J. French, W. J, Capehart, and **D. R. Clabo**, 2014: An analysis of dryline structure and propagation influenced by the Black Hills. *26th Conf. on Weather Analysis and Forecasting. 94th AMS Annual Meeting*, Atlanta, GA, American Meteorological Society. 3B.4.
- **Clabo, D. R.**, T. Mathewson, and D. Borsum, 2013: Making the invisible physical: effectively communicating fire weather in the third dimension. *Preprints, 4th Fire Behavior and Fuels Conference*, Raleigh, NC. P44.

Adam French, Ph.D.
Associate Professor
Department of Physics and Atmospheric and Environmental Sciences Program
South Dakota School of Mines and Technology
adam.french@sdsmt.edu

Professional Preparation

Valparaiso University	Valparaiso, IN	Meteorology	B.S. 2005
North Carolina State University	Raleigh, NC	Atmospheric Sciences	M.S. 2007
North Carolina State University	Raleigh, NC	Atmospheric Sciences	Ph.D. 2011

Appointments

2017-present	Associate Professor, South Dakota School of Mines and Technology
2011-2017	Assistant Professor, South Dakota School of Mines and Technology
2005-2011	Graduate Research Assistant, North Carolina State University
2009	Laboratory instructor, North Carolina State University
2005-2008	Graduate Teaching Assistant, North Carolina State University

Peer-reviewed publications

1. **French, A. J.** and M. D. Parker, 2014: Numerical Simulations of Bow Echo Formation Following a Squall Line-Supercell Merger. *Mon. Wea. Rev.***142**, 4791-4822.
2. Letkewicz, C. L.**, A. J. French** and M. D. Parker, 2013: Base-state Substitution: An Idealized Modeling Technique for Approximating Environmental Variability. *Mon. Wea. Rev.*,**141,** 3062-3086.
3. **French, A. J.** and M. D. Parker, 2012: Observations of mergers between squall lines and isolated supercell thunderstorms. *Wea. Forecasting*,**27,** 255-278.
4. French, A. J. and M. D. Parker, 2010: The response of simulated nocturnal convective systems to a developing low-level jet. *J. Atmos. Sci.*, **67**, 3384-3408.
5. **French, A. J.**, and M. D. Parker, 2008: The initiation and evolution of multiple modes of convection within a meso-alpha scale region. *Wea. Forecasting*, **23**, 1221-1252.

Conference presentations (last 3 years)

1. **French, A. J.** and J. Wipf. 2017: Mesovortex production in simulated interactions between quasi-linear convective systems and supercell thunderstorms, *28th Conference on Weather Analysis and Forecasting/24th Conference on Numerical Weather Prediction*, AMS 21-26 January, 2017. Seattle, WA.
2. Montalbano, M. and **A. J. French.** 2017: The effects of anvil shading from a nearby squall line on the structure and evolution of a discrete supercell thunderstorm, *The Lance Bosart Symposium, 97th Annual Meeting of the American Meteorological Society*, AMS, 21-26 January, 2017. Seattle, WA.
3. **French, A. J.** 2017: A tale of two mergers: Comparing examples of tornado-producing and non-tornado producing QLCS-Supercell mergers in western South Dakota, *Special Symposium on Severe Local Storms: Observation needs to advance research, prediction, and communication*, AMS 21-26 January, 2017. Seattle, WA.
4. **French, A. J.** 2015: Severe weather proxies in a simulated supercell thunderstorm responding to environmental perturbations induced by a nearby squall line, *41st Annual meeting of the National Weather Association*, NWA, 17-22 October, 2015. Oklahoma City, OK.
5. Wagner, K. and **A. J. French.** 2015: An observational examination of supercell and squall line thunderstorm interactions. *16th American Meteorological Society Conference on Mesoscale Processes*, AMS, August 2-6, 2015. Boston, MA.
6. **French, A. J.** 2015: The response of a simulated supercell thunderstorm to environmental perturbations induced by a nearby squall line. *16th American Meteorological Society Conference on Mesoscale Processes*, AMS, August 2-6, 2015. Boston, MA.

Project Budget Page

	COMET Funds	NWS Contributions
University Senior Personnel		
1. Darren Clabo	**$0**	**NA**
2. Adam French	**$0**	**NA**
Other University Personnel		
1. Christopher Woody	**$10,003**	**NA**
2.		**NA**
Fringe Benefits on University Personnel	**$789**	**NA**
Total Salaries + Fringe Benefits	**$10,792**	**NA**
NWS Personnel		
1. Patrick Marsh	**NA**	60 hours
2. Nick Nausler	**NA**	20 hours
Travel		
1. Research Trips	**$0**	$0
2. Conference Trips	**$0**	$0
3. Other	**$0**	$0
Total Travel	**$0**	$0
Other Direct Costs		
1. Materials & Supplies	**$0**	**NA**
2. Publication Costs (put in the NWS column if a co-author will be an NWS employee)	**$0**	$0
3. Other Data	**$0**	$0
4. NWS Computers & Related Hardware	**NA**	$0
5. Other (specify)	**$0**	$2000 (data processing)
Total Other Direct Costs		
Indirect Costs		**NA**
1. Indirect Cost Rate	**39%**	
2. Applied to which items?		
Total Indirect Costs	**$4,208**	**NA**
Total Costs (Direct + Indirect)	$15,000	$2000

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
National Centers for Environmental Prediction
Storm Prediction Center
120 David L Boren Blvd, Suite 2301
Norman, Oklahoma 73072
Telephone: 405-325-2067

May 28, 2019

Elizabeth Mulvihill Page
Director
The COMET Program
3085 Center Green Drive
Boulder, CO 80301

Dear Dr. Page:

I am offering my support for the CSTAR proposal "**Establishing a Relationship between Mixing Height and Wildfire Growth: An Observational Study**" submitted by faculty at the South Dakota School of Mines and Technology.

This proposal focuses on studying the relationship between the mixing height and explosive wildfire growth. The principal investigators are established experts within the fire-weather community, including the South Dakota State Fire Meteorologist, and have a track record of advancing our understanding of fire-weather environments through their efforts. This work aims to utilize SPC tools and datasets to quantify foundational information related to a key component of fire-weather forecasts. In addition to connections to explosive wildfire growth, the mixing height has important indirect effects on human health, as the mixing height is related to the air quality in the vicinity of fires via mechanisms like smoke dispersal.

The SPC looks forward to working with South Dakota School of Mines and Technology in examining and studying the relationship between mixing height and wildfire growth. This observational study should yield information helpful for identifying potential explosive fire-growth regimes in otherwise non-traditional situations. The research emphasis on fire weather is of significant importance to SPC, along with the fire-weather community, and therefore will play an important role in cultivating relationships between the NWS and core fire-weather partners as well as improving NWS fire-weather services; therefore, I recommend funding of this proposal.

Sincerely,

Russell Schneider

Dr. Russell S. Schneider
Director, SPC

NWS Checklist for Submitting a COMET Outreach Proposal

Actions Before Proposal is Submitted to COMET	YES	NO	DATE
1. Did NWS office staff and university staff meet to discuss and form outline and scope of project?	X		
2. Did NWS office consult Scientific Services Division (SSD) staff?	X		
3. Was Statement of Work and budget formulated as a team effort between university and NWS staffs?	X		
4. Was proposal submitted to SSD for review?	X		
5. Did SSD forward copies of proposals dealing with WSR-88D data to Radar Operations Center (ROC), Applications Branch Chief for review?	N/A		
6. Did SSD forward copies of proposals dealing with hydrometeorology to the Senior Scientist of OHD for review?	N/A		
7. Did SSD review the data request for project to ensure its scope and criticality for proposal?	X		
8. Is all data for the project being ordered by NWS offices through the National Climatic Data Center's (NCDC) Research Customer Service Group free of charge?	N/A		
9. Does budget include publication charges and travel costs for NWS employees to present results at scientific conferences?	N/A		
10.Does budget separate NWS costs into fiscal year costs and university costs into calendar year costs?	X		
11.Does proposal include a separate justification for university hardware purchases which are usually not funded by the COMET Outreach Program?		X	
12. Have the following people signed off on the proposal cover sheet: - MIC/HIC? - SSD Chief? - Regional Director?	X		
13. Is a letter of endorsement signed by regional director attached?	X		

NWS Checklist for Submitting a COMET Outreach Proposal

Actions after Endorsement by NWS	YES	NO	DATE
1. University submits proposal to the COMET Program.			
2. Proposal acknowledgment letter sent by the COMET Program to submitting university with copies to SSDs and NWS office.			
3. COMET review of proposal (internal review for Partners Project proposals and formal review for Cooperative Project proposals).			
4. The COMET Program sends acceptance, rejection, or modification letters to university with copies to SSD, NWS office, and OST12.			
5. The COMET Program allocates funds for university.			
6. OST12 obligates funds for NWS offices.			
7. SSD/NWS office orders data from NCDC.			
8. NWS office or SSD calls OST12 for accounting code for expenses.			
9. NWS office sends copies of all travel vouchers and expense records to OST12.			
10. NWS office or SSD sends copies of publication page charge forms to OST12.			
11. NWS office keeps SSD informed of progress on the project and any results or benefits derived from the project.			

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN:

ORGANIZATION:

South Dakota School of Mines and Technology

501 E. St. Joseph Street

Rapid City, SD 57701-3995

DATE:05/01/2017

FILING REF.: The preceding agreement was dated 01/24/2014

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: Facilities And Administrative Cost Rates

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

	EFFECTIVE PERIOD				
TYPE	**FROM**	**TO**	**RATE(%)**	**LOCATION**	**APPLICABLE TO**
PRED.	07/01/2017	06/30/2019	39.00	On-Campus	Organized Research
PRED.	07/01/2017	06/30/2019	26.00	Off-Campus	Organized Research
PRED.	07/01/2017	06/30/2019	50.00	On-Campus	Instruction
PRED.	07/01/2017	06/30/2019	26.00	Off-Campus	Instruction
PRED.	07/01/2017	06/30/2019	35.00	On-Campus	Other Sponsored Activities
PRED.	07/01/2017	06/30/2019	26.00	Off-Campus	Other Sponsored Activities
PROV.	07/01/2019	Until Amended			Use same rates and conditions as those cited for fiscal year ending June 30, 2019

*BASE

Modified total direct costs, consisting of all direct salaries and wages, applicable fringe benefits, materials and supplies, services, travel and up to the first $25,000 of each subaward (regardless of the period of performance of the subawards under the award). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, rental costs, tuition remission, scholarships and fellowships, participant support costs and the portion of each subaward in excess of $25,000. Other items may only be excluded when necessary to avoid a serious inequity in the distribution of indirect costs, and with the approval of the cognizant agency for indirect costs.

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

The fringe benefits are specifically identified to each employee and are charged individually as direct costs. The directly claimed fringe benefits are listed below.

TREATMENT OF PAID ABSENCES

Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims are not made for the cost of these paid absences.

OFF-CAMPUS DEFINITION: For all activities performed in facilities not owned by the institution and to which rent is directly allocated to the project(s) the off-campus rate will apply. Grants or contracts will not be subject to more than one F&A cost rate. If more than 50% of a project is performed off-campus, the off-campus rate will apply to the entire project.

DEFINITION OF EQUIPMENT
Equipment is defined as tangible non-expendable personal property having a useful life of more than one year and an acquisition cost of $5,000 or more per unit.

The following fringe benefits are treated as direct costs:
FICA, WORKERS COMPENSATION, HEALTH/LIFE INSURANCE, UNEMPLOYMENT INSURANCE, AND STATE RETIREMENT.

The two year extension of the indirect cost rate was granted in accordance with 2 CFR 200.414(g).

NEXT PROPOSAL DUE DATE
A proposal based on actual costs for fiscal year ending 06/30/18, will be due no later than 12/31/18.

SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

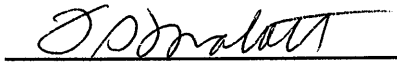
If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Title 2 of the Code of Federal Regulations, Part 200 (2 CFR 200), and should be applied to grants, contracts and other agreements covered by 2 CFR 200, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:	ON BEHALF OF THE FEDERAL GOVERNMENT:
South Dakota School of Mines and Technology	DEPARTMENT OF HEALTH AND HUMAN SERVICES
(INSTITUTION)	(AGENCY)
	Arif M. Karim -A Digitally signed by Arif M. Karim -A DN: c=US, o=U.S. Government, ou=HHS, ou=PSC, ou=People, cn=Arif M. Karim -A, 0.9.2342.19200300.100.1.1=2000212895 Date: 2017.05.04 09:34:48 -05'00'
(SIGNATURE)	(SIGNATURE)
F. Stephen Malott	Arif Karim
(NAME)	(NAME)
Vice President Finance & Administration	Director, Cost Allocation Services
(TITLE)	(TITLE)
May 19, 2017	5/1/2017
(DATE)	(DATE) 1084

HHS REPRESENTATIVE: Jeanette Lu

Telephone: (415) 437-7820