

**10 SI03-032: Measurement and Modeling of Fugitive Dust from Off-road DoD Activities
(Dr. Larry E Wagner)**

Technical Merit

Reviewer 10453 (Score = 4)

This is a 3 year project proposal focused on SON Objectives 1, 2, and 3 in totality. The project scope is very broad yet extremely detailed. The project involves both intensive research conducted in the lab and in the field. Both lab and fieldwork entails standard methods and technical expansion utilizing newer techniques (and in such a way as to make this overall design appealing). These techniques, CFD, LiDAR, and developing updates for models for example, represent the correct approach at advancing understanding of particle entrainment, transport, and deposition processes.

The project has three research partners that are all associated with universities. Between the WERU and these partners, a significant amount and type of equipment will be brought the bear on the proposed research effort.

The highest appeal for this project is the utilization of emerging technologies. The largest single missing data for aerosol studies is the fine level of detail between the wind and particle. There simply is not much room for advancement of understanding using traditional methods of just wind tunnel and particle collectors. However, when these standard methods are enhanced using newly developed instruments capable of detecting particles in motion and measuring turbulent parameters, opportunity for advancement grows. This comprehensive project contains these elements.

Reviewer 10553 (Score = 3.5)

- Most thorough of all the proposals

- Covers aspects from emission quantification, dispersion and deposition, and development of refined models for replicating / predicting these affects from vehicle movements and wind erosion.

- Suggest re-working proposal with elimination of CFD component (no real additional value for the cost).

- Would also suggest that all of Phase 3 (development f an integrated dust emission monitoring system) is not necessary and hence should be treated as a separate proposal

- No specifics provided in terms of how AERMOD or DUSTRAN would (can) be modified with new information on deposition.

Reviewer 10454 (Score = 3)

Overall the tasks are well defined. There are some items in the proposal that should be addressed to clarify their purpose.

Task 1 is very well defined as its scope is to characterize the field plots defining soil types and characteristics and vegetation types and characteristics for their effect on dust emission potential.

Task 2a uses a wind tunnel to develop dust plumes for testing. The testing needs to be better defined, specifically how the wind tunnel will be used. Questions arise as to how you will know what the particle size distribution of the material should be to properly simulate wind erosion, and emissions from military operations? Will the wind tunnel simulate these erosion and emissions processes accurately? Wouldn't it be better to measure the emissions as stated in task 2b?.

It is not understood what the purpose of Task 2c and 2d are, except to review the performance of CFD, AERMOD, ISCST3, and DUSTRAN models. 1) Why are these models being reviewed? Is it because there are problems with the predictability of the models? If so, how will this evaluation solve the modeling problem. Will these models be corrected, validated, and presented to DoD for use with their operations? 2) Or will these models be used in the development of the VAEPRS model mentioned later?

The creation of the VAEPRS model is the focus of Task 3. After reading the proposed task, it seems that the this model will be a simulation of actual events that are ongoing simultaneously as the model is running to provide real-time results (is this correct?). How will this model be used as a predictor of dust emissions from the military facilities?

Another concern is that this new model requires data that is obtained from task 1. Will this model be practical if measurements as performed in task 1 have to be completed before using the new modeling system or will the catalgo system address this issue?

Reviewer 169 (Score = 3)

This is by far the most ambitious proposal I read from the response to this SON. The proposal claims it will respond to all aspects of the SON, accordingly the proposal budget is far in excess of any of the others I reviewed, and the proposal was one of the least detailed. Given the scale and scope of the proposed research it is all the more regrettable that the proposal contains no comprehensive integration plan. The methods associated with each task are by necessity only briefly described, but several aspects of the proposal are unclear. For example:

- How do tasks 1a-1c lead to the data necessary to conduct task 1d (as is specified in the proposal on page 7)? I.e. characterizing soils and soil disturbance is a component of what is needed for developing algorithms of dust emission but tasks 1a-1c do not include any effort on actually conducting size resolved particle concentrations or fluxes under measured wind conditions. I guess that the PIs meant to refer to a later task - but even in the later tasks the PIs are not clear if they intend to measure particle fluxes OR concentrations, at what heights and using which techniques, and how the measurement campaigns will be conducted.
- The back-casting of emissions using AERMOD is certainly appropriate and useful ζ but would be enhanced by uncertainty and sensitivity analyses (i.e. is the inverse modeling assured to generate a single unique solution in the face of multiple sources of uncertainty?)
- Is FLUENT the ideal model for application to Task 2c? How will the boundary conditions be specified? The PIs mention ζ Predicted results will be validated by comparing with experimental data ζ . What if they differ? What is the expected level of agreement? What metrics will be used? How will differences be reconciled? How will the other models (Task 2d) be inter-compared? Again which metrics? Which scenarios? Which common data inputs will be used?
- Task 3a-c are very ambitious but are described in only very general terms. Converting lidar backscatter to aerosol mass and size distributions is far from trivial, and lidars are of course relatively costly (i.e. how operational will such system be ζ my experience with lidars is that they require very specialized operators). Is this system ζ even if it can be developed - more fit for purpose than transmissometers? Removal of this task would (according to Appendix A2) substantially reduce the project costs.

The transition plan speaks mainly to dissemination to the scientific community at large also does not address any of the specifics of who the knowledge transfer might occur to, or how the team will liaise with military personnel at the (largely unnamed) military facilities. No letter of support from Fort Riley is included, but Philip Woodford is listed on Page 13, so maybe a cooperative agreement is in

place.

It is a comparatively minor point but the figures in the appendix were completely illegible due to the fact that they have clearly been scanned and reproduced in black and white. This compromised some of the proof-of-principle.

The instrumentation listed in Table 1-3 are impressive but there is not a comparably detailed description of the intentions for their deployment - thus it is not clear if this is simply an inventory or a research plan for this project.

Personnel

Reviewer 10453 (Score = 3.5)

Many personnel are involved in this study but each appears to be well qualified at the specific duties assigned. At least 2 post-Docs, grad students, and UGs are provided for. If funded, this project would provide ample opportunity for training. Combined with the fact that emerging technologies are used, it ensures a newer generation of adequately trained personnel to continue in this line of research.

Reviewer 10553 (Score = 3.5)

- Team members have proven experience in related fields of wind erosion and dust emission quantification in agricultural lands.

- Less experience with military training activities relative to other

Reviewer 10454 (Score = 4)

The lead personnel included on this project seem to have the experience required to complete the project. There is personnel with experience in field testing, computer modeling, and hardware development.

Reviewer 169 (Score = 3)

The research team is qualified (though strangely the PI lists no publications on his CV after 2005), but the proposal is so ambitious and broad in scope it is not quite clear how the project team or project components will be integrated. It is not clear if any team members have secured previous SERDP support. The proposal does not include a detailed review of the relevant literature likely due to space restrictions

Fund Proposal

Reviewer 10453 (Answer = Yes)

Funding is high, however the primary WERU personnel are not charging time to the project, which would be considered a substantial in-kind match. None the less, the intense schedule of field work comes with a high price. If only the standardized field methods were being utilized, recommended funding would be low. That the approach is rather novel on several fronts, the appeal is high and there is high probability for useful advances to be made in measuring and predicting emissions from military activities.

Reviewer 10553 (Answer = Yes W/ Mod)

- Suggest re-working proposal with elimination of CFD component (no real additional value for the cost).

- Would also suggest that all of Phase 3 (development of an integrated dust emission monitoring system) is not necessary and hence should be treated as a separate proposal

Reviewer 10454 (*Answer = Yes W/ Mod*)

Overall, the proposal is well defined. However, the authors tend to focus more on the results of measurements of the soil and vegetation types and characteristics and on the dust emission measurements, when the ultimate outcome of this entire project is the development of the new VAEPRS model. The authors are shortchanging themselves. Sure the characterization of soil and vegetation, and measurements of the dust emissions are important considerations of the project, but the ultimate result is the development of the VAEPRS model.

The proposal should be modified to emphasize the model development. Provide reasoning for evaluating the CFD, AERMOD, ISCST3, and DUSTRAN models. These are important steps that are needed in the development of the VAEPRS model.

The timeline may be a little optimistic. All the field testing and analysis could be completed in this timeframe, but the modeling aspect may take longer as the validation of the VAEPRS model may be delayed due to model (both hardware and software) development. Additionally, the budget seems to be more skewed toward field testing, which is understandable as it is an expensive component to the project. However, the modeling portion of the budget may be underestimated.

Reviewer 169 (*Answer = No*)

Not without major clarifications of the points I raise above. Doubtless this project if funded will generate some interesting results. What is less clear is if it can deliver all that it promises, and how well it is integrated with other SERDP supported activities. Maybe if these symbioses could be articulated, then a more compelling case could be made for at least partial funding.