OMB Number: 0690-0032
Expiration Date: 08/31/2021

DEPARTMENT OF COMMERCE
RESEARCH PERFORMANCE PROGRESS REPORT (RPPR)

For instructions, please visit
http://www.osec.doc.gov/oam/grants_management/policy/documents/RPPR%20Instructions%20and%20Privacy%20Statement.pdf

AWARD INFORMATION	
1. Federal Agency: Department of Commerce / NOAA	2. Federal Award Number: NA21OAR4320204
3. Project Title: Cooperative Institute for Severe and High-Impact Weather Research and Operations (CISHIWRO)	
4. Award Period of Performance Start Date: 10/01/2021	5. Award Period of Performance End Date: 09/30/2026
PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR	
6. Last Name and Suffix: Peppler , null	7. First and Middle Name: Randy ,
8. Title: Associate Director	
9. Email: rpeppler@ou.edu	10. Phone Number: 405-325-3041
AUTHORIZING OFFICIAL	
11. Last Name and Suffix: Parker , null	12. First and Middle Name: Cathi ,
13. Title:	
14. Email: gradora1@ou.edu	15. Phone Number: 4053254808
REPORTING INFORMATION	
Signature of Submitting Official: Tracy Reinke	
16. Submission Date and Time Stamp: 07/29/2022	17. Reporting Period End Date: 06/30/2022
18. Reporting Frequency: (●) Annual ( ) Semi-Annual ( ) Quarterly	19. Report Type: (●) Not Final ( ) Final
RECIPIENT ORGANIZATION	
20. Recipient Name: UNIVERSITY OF OKLAHOMA	
21. Recipient Address: 1000 ASP AVE RM 105, NORMAN, OK 73019-4039 USA	
22. Recipient UEI: EVTSTTLCEWS5	23. Recipient EIN: 731377584

ACCOMPLISHMENTS

24. What were the major goals and objectives of this project?

CIWRO is a cooperative program between NOAA & OU providing a bridge that links the scientific resources at OU with the financial and technical resources at NOAA to create a center of research excellence in weather radar, storm-scale meteorological phenomena, societal impacts and related subjects with the goal of researching products and procedures for creating better forecasts and warnings that save lives and protect property. CIWRO promotes cooperation and collaboration on problems of mutual interest among OU researchers and NSSL, ROC, SPC, WDTD, NWS Norman Forecast Office, NWSTC in Kansas City, and ARL ATDD in Oak Ridge.

CIWRO contributes to NOAA's mission through improvement of the observation, analysis, understanding, and prediction of weather elements and systems ranging in size from cloud nuclei to multi-state areas. Advances in observational and analytical techniques lead to improved understanding in the evolution and structure of these phenomena. Understanding provides the foundation for more accurate prediction of hazardous weather and anomalous regional climate, which contributes to social and economic welfare.

CIWRO promotes collaboration between OU & NOAA by providing a center where government and academic scientists work together to learn about and apply their knowledge of storm-scale weather and regional-scale climate processes. CIWRO is part of the National Weather Center, a unique conglomeration of federal, state, and OU organizations that work together to improve understanding of the Earth's atmosphere.

CIWRO concentrates on the following: (1) weather radar and observations research and development, (2) Mesoscale and stormscale modeling research and development, (3) forecast applications improvements research and development, (4) Subseasonal-to-seasonal (S2S) prediction for extreme weather, and (5) social and socioeconomic impacts of high impact weather systems.

CIWRO is organized into teams to manage the 225 employees and large amount of work performed. This report contains information on the major activities and significant accomplishments of each team, opportunities for training and professional development provided, how research has been disseminated to communities, products generated (publications, patents, software, models, data products, etc.) and a list of agencies that have collaborated with CIWRO. We also document the impacts of our work beyond science and technology, on technology transfer and human resources, and describe our teaching and educational efforts.

Different teams have various foci. A detailed observation of the state of Earth’s atmosphere is an important step in improving forecasts of weather systems. Radar provides key observations for this. Within the NSSL Radar R&D team, work is improving retrievals from current radars as well as determining what the next generation of radars should look like. The NSSL Warning R&D team is researching ways to improve warnings that are disseminated to the public. The Hazardous Weather Testbed (HWT) is important for these activities as it provides a conceptual framework and physical space to foster collaboration between research and operations to test and evaluate emerging technologies. The NSSL Forecast R&D team is concentrating on research and development of improved forecasting techniques. The development of probabilistic forecast techniques and the ability to warn on forecast (rather than warn on detection) are its important activities. Training activities within WDTD aim at ensuring forecasters are able to issue the best warnings possible. The SPC is tasked at improving the forecasting of the risk of severe thunderstorms and tornadoes. Training of forecasters and development of improved forecasting techniques is taking place within the Kansas City NWS Training Center team. Improving the High Resolution Rapid Refresh forecast model is an important component of work at the ARL in Oak Ridge.

25. What was accomplished under these goals?

See attachment 25

Attach a separate document if more space is needed for #6-10, or #24-50.

ACCOMPLISHMENTS *(cont'd)*

26. What opportunities for training and professional development has the project provided?

See attachment 26

27. How were the results disseminated to communities of interest?

See attachment 27

Attach a separate document if more space is needed for #6-10, or #24-50.

ACCOMPLISHMENTS *(cont'd)*

28. What do you plan to do during the next reporting period to accomplish the goals and objectives?

See attachment 28

PRODUCTS

29. Publications, conference papers, and presentations

See attachment Publications
See attachment Presentations

PRODUCTS *(cont'd)*

30. Technologies or techniques

See attachment 30

31. Inventions, patent applications, and/or licenses

ART & RED Teams:

Continued to license CLEAN-AP, a ground clutter mitigation technique, to Baron Services, Inc.

Observations & Processes Team:

Patent pending since February 2021: Unmanned Aerial System for sampling atmospheric data. US20210214079A1. United States

Open-source Drone autopilot software releases: https://doi.org/10.5281/zenodo.6365760

PRODUCTS *(cont'd)*

32. Other products

See attachment 32

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

33. What individuals have worked on this project?

Cooperative Institute for Severe and High-Impact Weather Research and Operations (CIWRO) Senior Personnel
Greg McFarquhar, PhD - Principal Investigator and CIWRO Director
Randy Peppler, PhD - Co-Principal Investigator and CIWRO Associate Director
Heather Reeves, PhD - CIWRO Assistant Director
Sebastian Torres, PhD - CIWRO Assistant Director for Radar Development
Tracy Reinke - CIWRO Executive Director, Finance and Operations

Refer to Annual Report Demographics appendix for CI Employee Support Table

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS *(cont'd)*

34. Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Nothing to Report

35. What other organizations have been involved as partners?

Nothing to Report

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS *(cont'd)*

36. Have other collaborators or contacts been involved?

See attachment 36

IMPACT

37. What was the impact on the development of the principal discipline(s) of the project?

See attachment 37

IMPACT *(cont'd)*

38. What was the impact on other disciplines?

Nothing to Report

39. What was the impact on the development of human resources?

Nothing to Report

Attach a separate document if more space is needed for #6-10, or #24-50.

IMPACT *(cont'd)*

40. What was the impact on teaching and educational experiences?

See attachment 40

41. What was the impact on physical, institutional, and information resources that form infrastructure?

Nothing to Report

Attach a separate document if more space is needed for #6-10, or #24-50.

IMPACT *(cont'd)*

42. What was the impact on technology transfer?

See attachment 42

43. What was the impact on society beyond science and technology?

See attachment 43

Attach a separate document if more space is needed for #6-10, or #24-50.

IMPACT *(cont'd)*

44. What percentage of the award's budget was spent in foreign country(ies)?

0 , No foreign expenditures

CHANGES/PROBLEMS

45. Changes in approach and reasons for change

Nothing to Report

Attach a separate document if more space is needed for #6-10, or #24-50.

CHANGES/PROBLEMS *(cont'd)*

46. Actual or anticipated problems or delays and actions or plans to resolve them

Nothing to Report

47. Changes that had a significant impact on expenditures

Finishing no-cost extension on NA16OAR4320115

Attach a separate document if more space is needed for #6-10, or #24-50.

CHANGES/PROBLEMS *(cont'd)*

48. Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to Report

49. Change of primary performance site location from that originally proposed

Nothing to Report

Attach a separate document if more space is needed for #6-10, or #24-50.

PROJECT OUTCOMES

50. What were the outcomes of the award?

See attachment 50

DEMOGRAPHIC INFORMATION FOR SIGNIFICANT CONTRIBUTORS (VOLUNTARY)

Gender:

- ◯ Male
- ◯ Female
- ◯ Do not wish to provide

Ethnicity:

- ◯ Hispanic or Latina/o Not
- ◯ Hispanic or Latina/o Do not
- ◯ wish to provide

Race:

- ◯ American Indian or Alaska Native Asian
- ◯ Black or African American
- ◯ Native Hawaiian or other Pacific Islander
- ◯ White
- ◯ Do not wish to provide

Disability Status:

- ◯ Yes
  - [ ] Deaf or serious difficulty hearing
  - [ ] Blind or serious difficulty seeing even when wearing glasses
  - [ ] Serious difficulty walking or climbing stairs
  - [ ] Other serious disability related to a physical, mental, or emotional condition
- ◯ No
- ◯ Do not wish to provide

Attach a separate document if more space is needed for #6-10, or #24-50.