A long-term space mission requires efficient air revitalization performance to sustain the crew. Prefilter and particulate air filter media are susceptible to rapid fouling that adversely affects their performance and can lead to catastrophic failure of the air revitalization system, which may result in mission failure. For a long-term voyage, it is impractical to carry replacement particulate prefilter and filter modules due to the usual limitations in size, volume, and weight. The only solution to this problem is to reagentlessly regenerate prefilter and filter media in place. A method was developed to modify the particulate prefilter media to allow them to regenerate reagentlessly, and in place, by the application of modest thermocycled transverse or reversed airflows. The innovation may allow NASA to close the breathing air loop more efficiently, thereby sustaining the vision for manned space exploration missions of the future.

A novel, self-cleaning coatings technology was developed for air filter media surfaces that allows reagentless in-place regeneration of the surface. The technology grafts thermoresponsive and nonspecific adhesion minimizing polymer nanolayer brush coatings from the prefilter media. These polymer nanolayer brush architectures can be easily re-created, RICA has proven to be a viable choice for high-speed hyperbolic entry trajectories, both in methane (Titan) as well as in air (Earth) atmospheres. Further assessment and characterization of spallation and an exact determination of its onset heat flux (if present for intended applications) still remain to be measured.

This work was done by Jaime Esper of Goddard Space Flight Center and Michael Lengowski of the University of Stuttgart. Further information is contained in a TSP (see page 1), GSC-16183-1.
media, and thermocycled air streams applied to the media allow easy detachment and in-place regeneration of the media with minimal impact in system downtime or astronaut involvement in overseeing the process.

The novel feature of this self-cleaning coatings approach is that this is an enabling technology that can actively, controllably, and reagentlessly regenerate filter media. The coatings application is amenable to industrial-scale manufacturing processes and should allow significantly increased useful lifetime for the filter media in an inexpensive fashion. The energy required to trigger the thermocycled self-cleaning is minimal, and can easily be diverted from heat exchange modules further downstream in the air revitalization system. The approach will further lower loads downstream in the air revitalization system, thereby contributing to increasing the lifetime of these modules, and decreasing the amount of replacement modules. These salient features will enable NASA to design more efficient and reliable, and less cumbersome, air revitalization systems for future manned missions.

This work was done by Olivia Weber, Sanjiv Lalwani, and Anjal Sharma of Lynntech, Inc. for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18848-1.