

How Many Particles are Present in the Air?

Bioaerosol Detection Using an Air Particle Counter

Angie Rivera¹, Parag Vaishampayan²

¹ William Paterson University, Wayne, NJ 07470

² Biotechnology and Planetary Protection Group, Jet Propulsion Lab, California Institute of Technology

This work is performed for Planetary Protection Group: We need to be extremely careful when we send spacecraft out to space, we do not want to contaminate any planetary bodies with life from Earth [Forward contamination]. We also do not want to bring back biological material that might be harmful to our planet [Backward contamination].



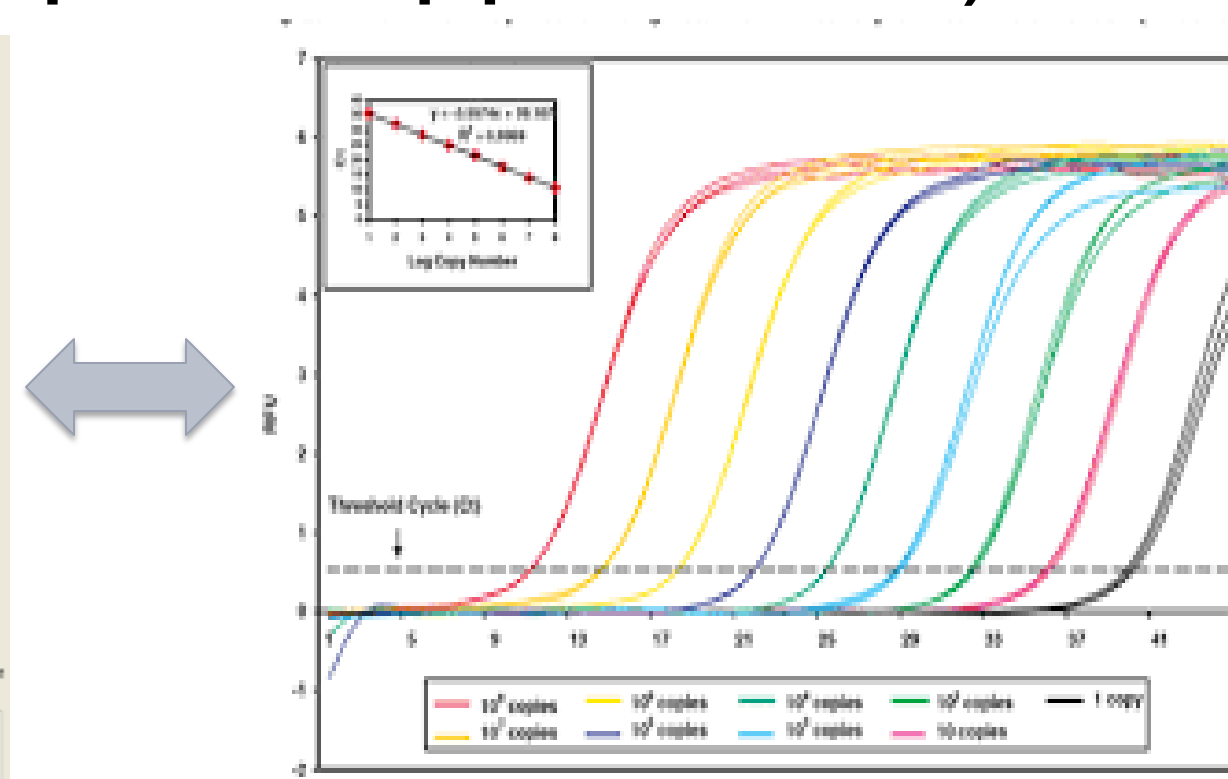
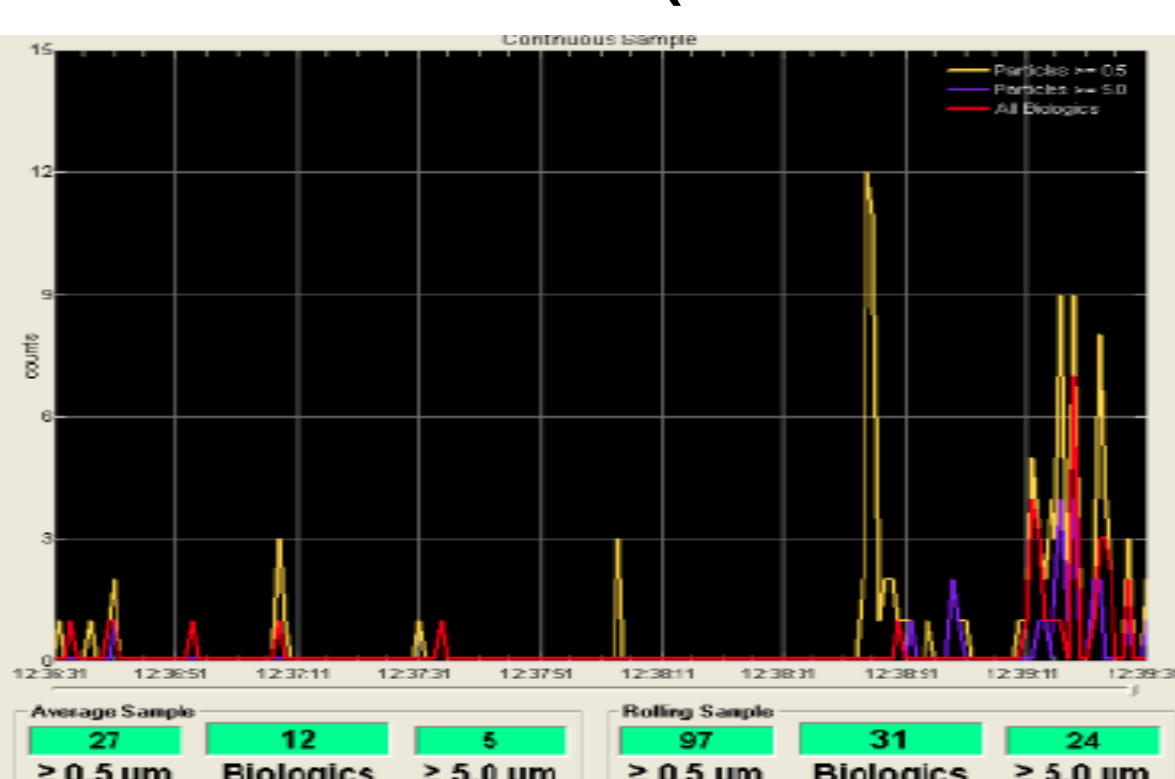
Spacecraft is assembled in clean rooms. Biological particles present in clean rooms could eventually fall and contaminate the spacecraft.

Objectives



This study has the following objectives:

1. Test BioVigilant air monitoring system in JPL clean rooms for particle size distribution and biological particle counting simultaneously.
2. Test a relationship between JPL clean room class levels and total particle counts while in operation.
3. Test statistical correlation between biological particle counts by BioVigilant and conventional air sample system based bioburden (ATP and qPCR approaches).



Methods

Air samples were collected inside several clean room levels: ISO 8, ISO 7 & ISO 6



ISO-8
SAF HB1 airlock



ISO-8
318- Optics Lab



ISO-7
103-Electrical Engineering



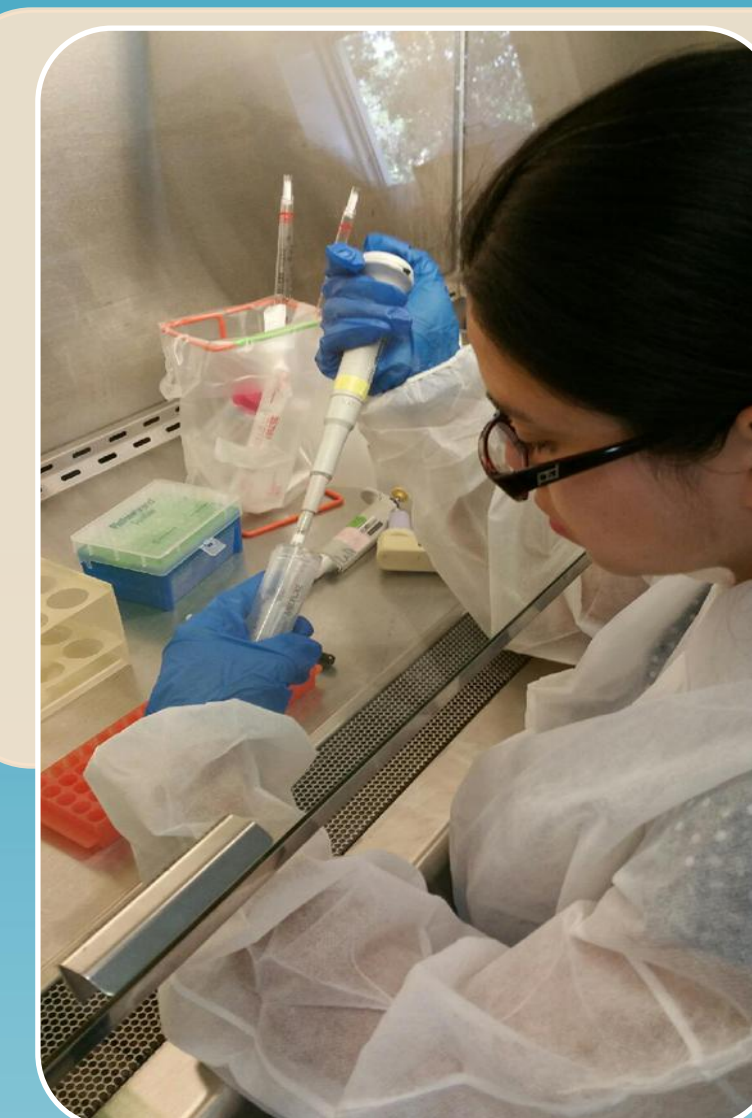
ISO-6
233- Cleaning Facility

•BioVigilant IMD-350 and Coriolis instruments ran in parallel inside each clean room.

•Work and night samples were taken for at least three consecutive days in the same room.

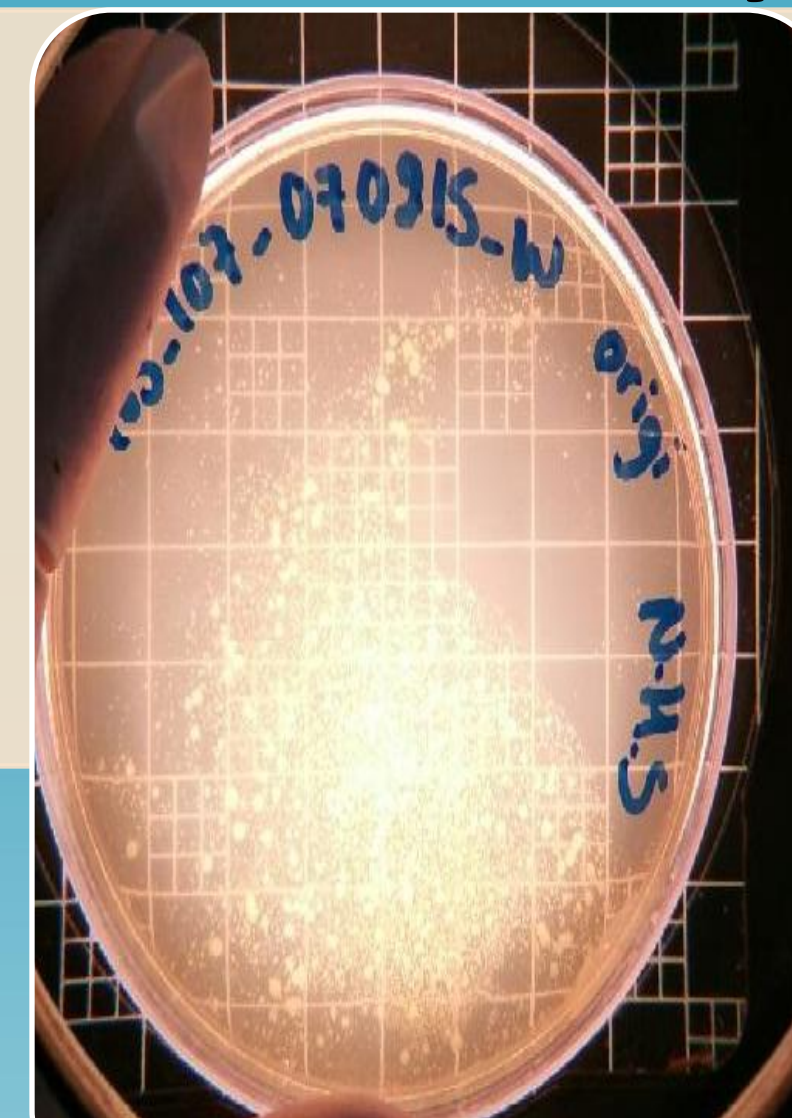
•Two samples a day were collected along with the metadata: 6 hours working shift and 6 hours at rest, overnight.

Validation Analysis



qPCR:

Search for amount of DNA in the sample which amplify portions of 16S rRNA.



NASA Standards Spores Assay:

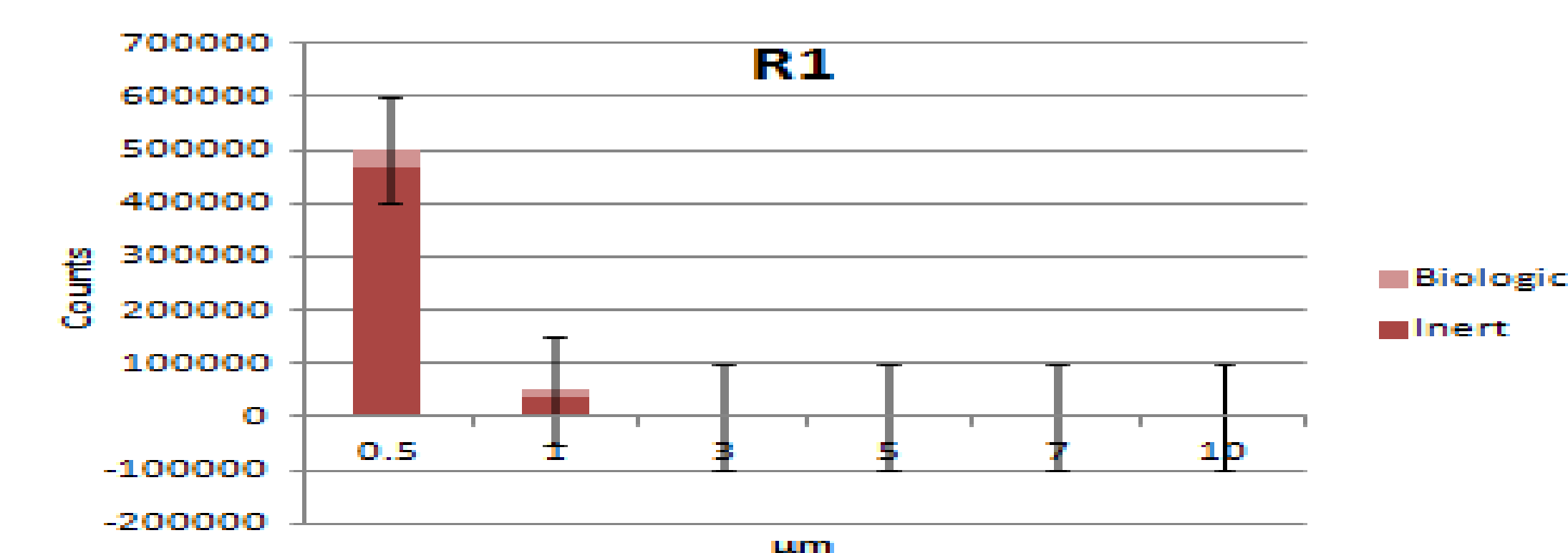
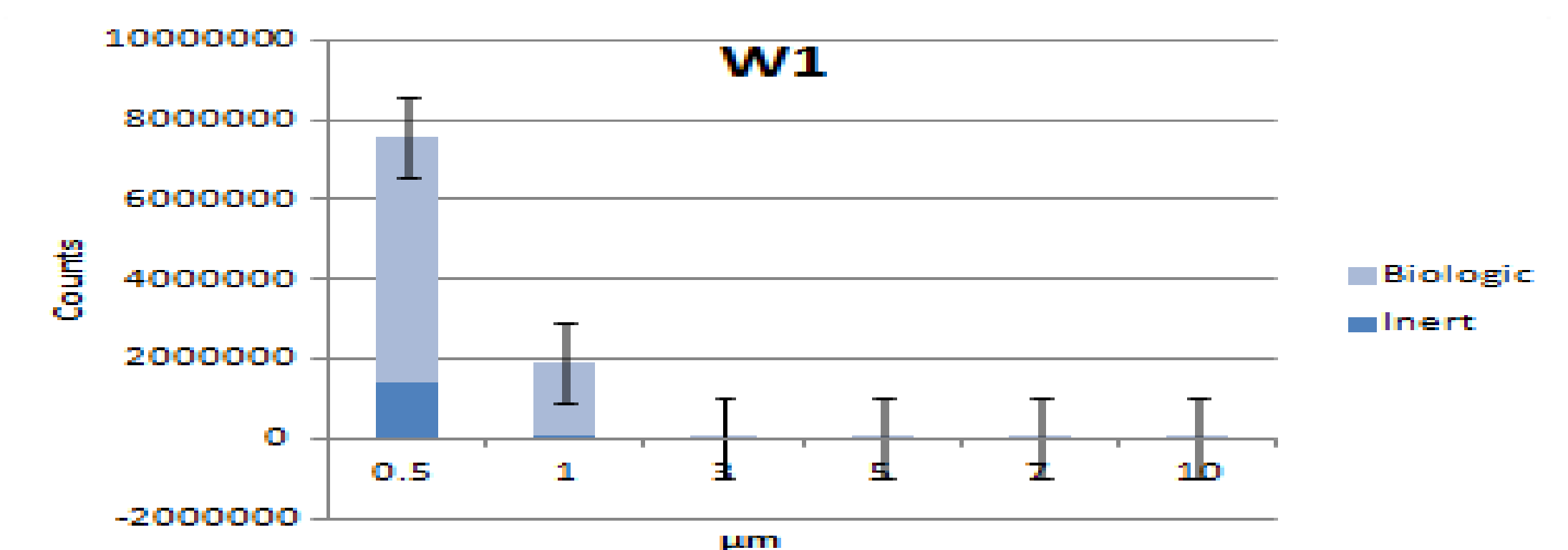
The higher the colonies counted, the higher microbial presence in the sample.



ATP: ATP is the energy in the cell, we check for internal and external ATP to see the presence of active biological particles.

Results

- Clearly observe higher biological particles during working hours than rest hours.
- Particle size distribution and relative biological particle counts were obtained.
- Relative high numbers of 0.5- 1 micrometer size particles were obtained in most of the samples.
- Data obtained by techniques such as ATP and qPCR will be correlated with BioVigilant particle counts



Applications

- BioVigilant system could potentially be used for real-time, continuous environmental monitoring of clean rooms during assembly.
- Data obtained from continuous air monitoring using BioVigilant system could result into a reliable model of bioaerosol-particle transport, which will help us to predict the cross contamination risks during spacecraft assembly.