Fluorescent Aerosol Screening Test (FAST)

Test Report

RTI Project Number: 0212534.112

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Test Series

- One Fluorescent Aerosol Screening Test (FAST) for International Personnel Protection, Inc. was performed at RTI International (RTI) on January 6, 2015.
- The test focused on evaluating standard firefighter protective gear for protection against aerosols.
- Black light (UV) photographs were taken to document areas of aerosol deposits on the skin of the test participant.
- A client representative was on-site to observe the test and to assist with proper donning of the test ensemble.
- The RTI test number was 2225.

FAST Objective and Description

- FAST provides black light visual and photographic documentation of penetration of garment fabric and infiltration of closures and interfaces. These results are the test output.
- FAST is a quick-look test specifically intended to help garment designers, manufacturers, and users see where significant aerosol infiltration is occurring and to allow rapid, same-day investigation of improvements.
- FAST does not involve quantitative sampling of deposited aerosol.

Test Conditions

- Fluorescent challenge aerosol:
  - "Nuisance dust"
  - Amorphous silica tagged with two tracers:
    - Sodium fluorescein (quantitative analysis)
    - Tinopal (visual response under black light)
  - 2.5 μm aerodynamic mass median diameter
  - Solid-phase (i.e., dry, not liquid)
- 10 mph wind speed
- 30 minute exposure time
- CT = ~ 5,000 mg m^{-3} min
- Standard motion routine

Exposure Chamber (photo from prior testing)

25’ x 50’

10 mph

~ 70° F

~ 50% RH

~ 170 mg/m^3

2.5 µm MMD

Motion Routine

- Standing
  - Walking
    - Bending
      - Reaching
        - Squatting
          - Twisting
            - Running in place
              - Prone position

General Comments on Black Light (UV) Photographs

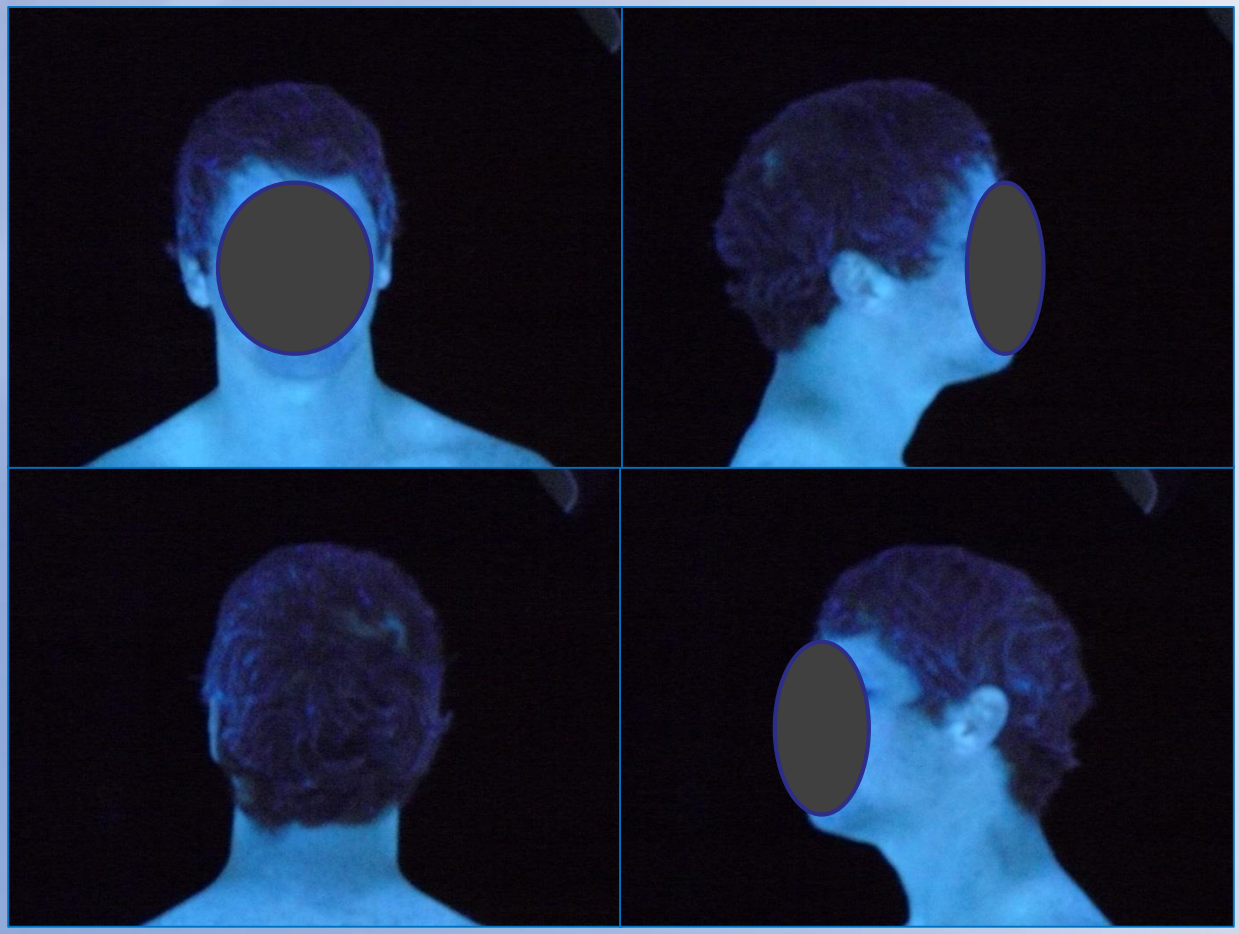
- In the black light (UV) photographs:
  - Areas of heavy aerosol deposition appear relatively bright with a yellow to green color.
  - Areas of lighter deposition appear relatively less bright and have a blue color.
- The following areas of the skin have a bright natural fluorescence even in the absence of aerosol deposits. Brightness in these areas does not necessarily indicate a problem with the garment system:
  - Backs of the elbows
  - Palms and soles of the feet
  - Toenails and fingernails
- Lint from the garment or underclothing can sometimes appear as bright specks on the skin.
- Pre-test black light photos of the test participant are included for comparison to post-test photos.

Ensemble Components

The following items were worn during the test:

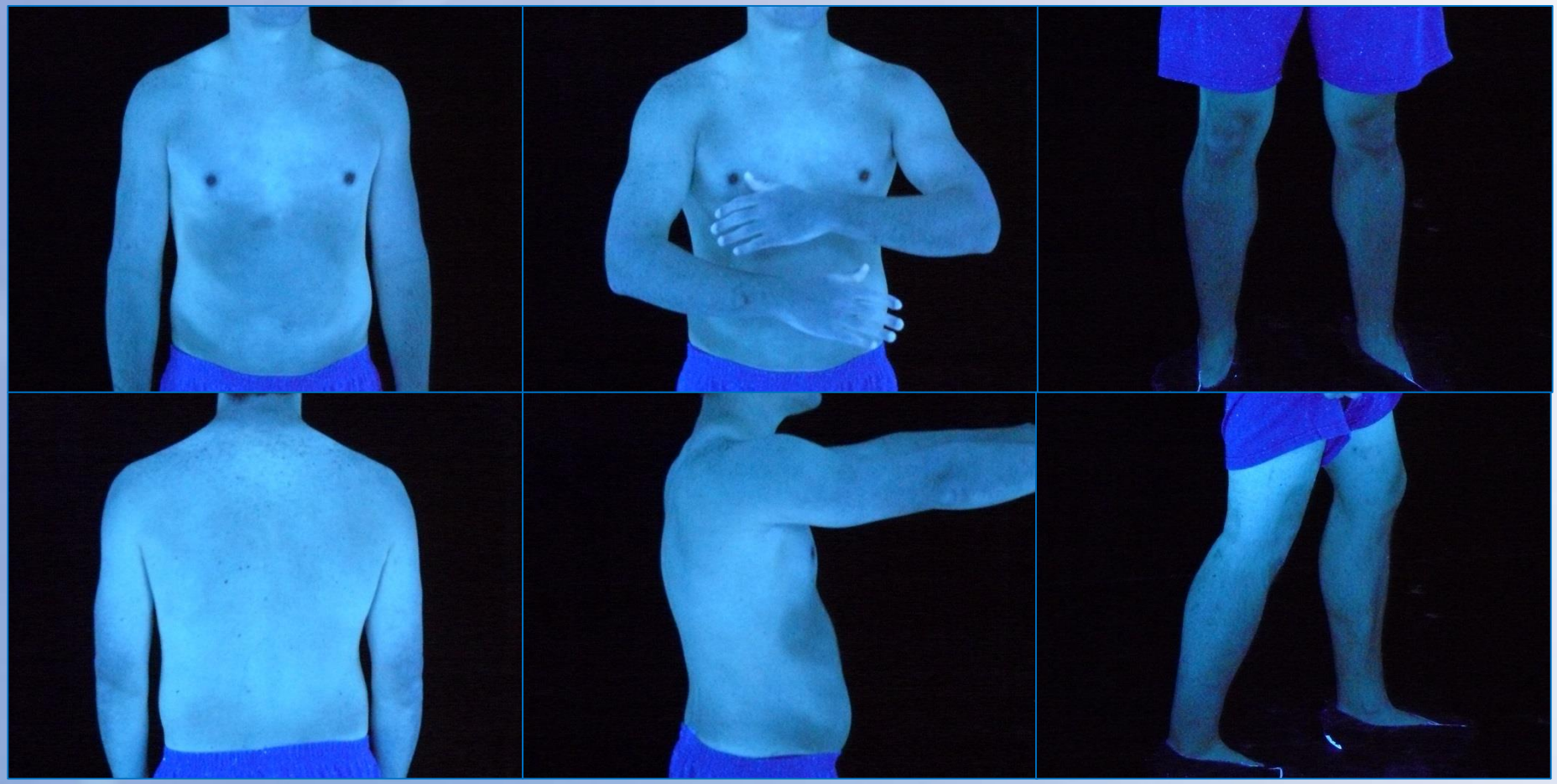
- Boxer briefs, t-shirt, and athletic socks
- Turnout coat and trousers
- Flash hood
- Firefighter helmet
- Firefighter boots
- Shelby model 5226 gloves
- Survivair SCBA mask, harness, and 60-minute tank
- Note: Clean, dark-colored shorts were donned after the test and were worn during the black light photography.

Background UV Photos (Test Participant #7)



The background photos confirm the test participant was clean prior to donning the test garment.

Background UV Photos (Test Participant #7)



The background photos confirm the test participant was clean prior to donning the test garment. Variations in skin brightness seen in these photos are due to natural skin fluorescence.

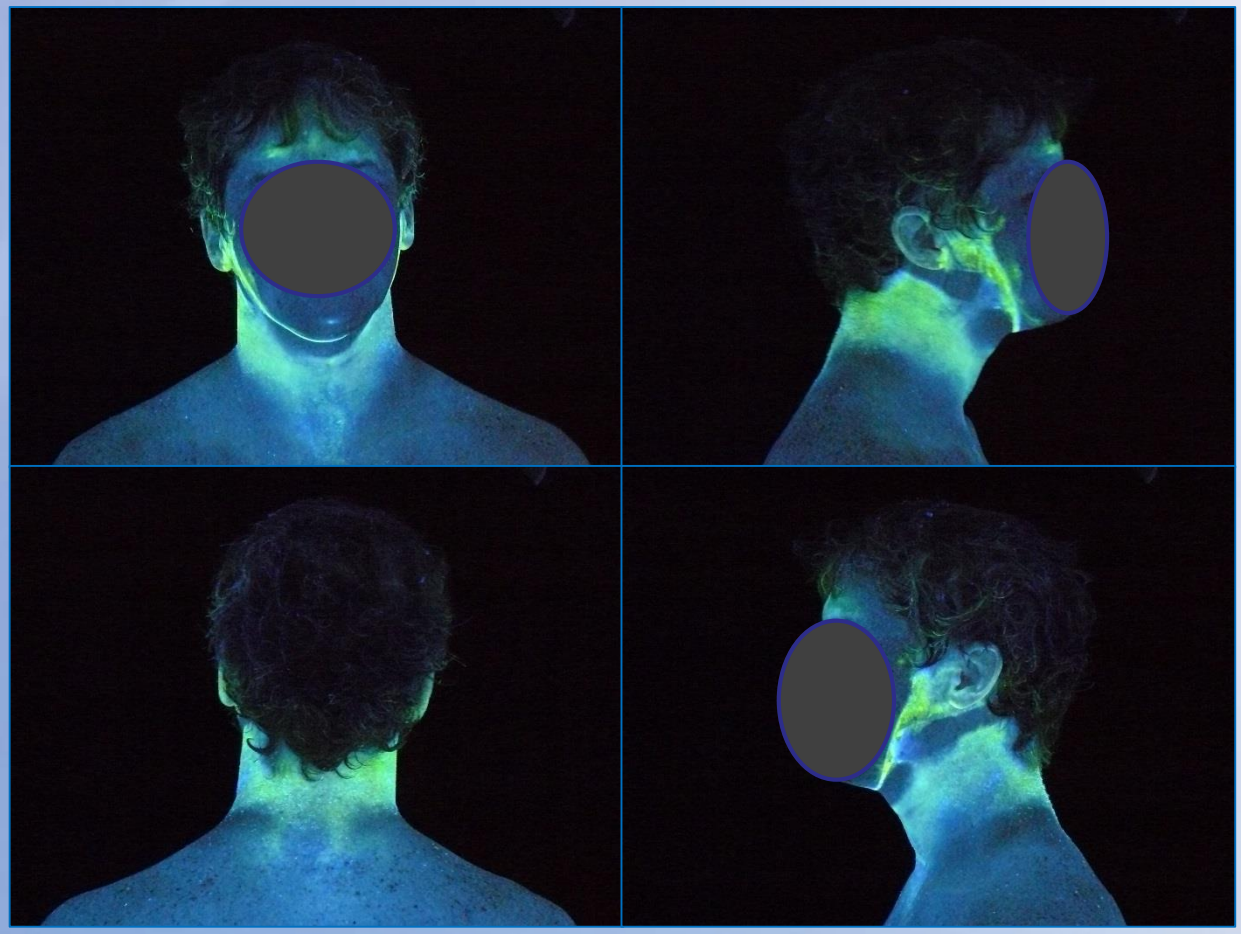
Donning Photos (RTI Test # 2225)

Donning Photos (RTI Test # 2225)

Pre-Test Photos (RTI Test # 2225)

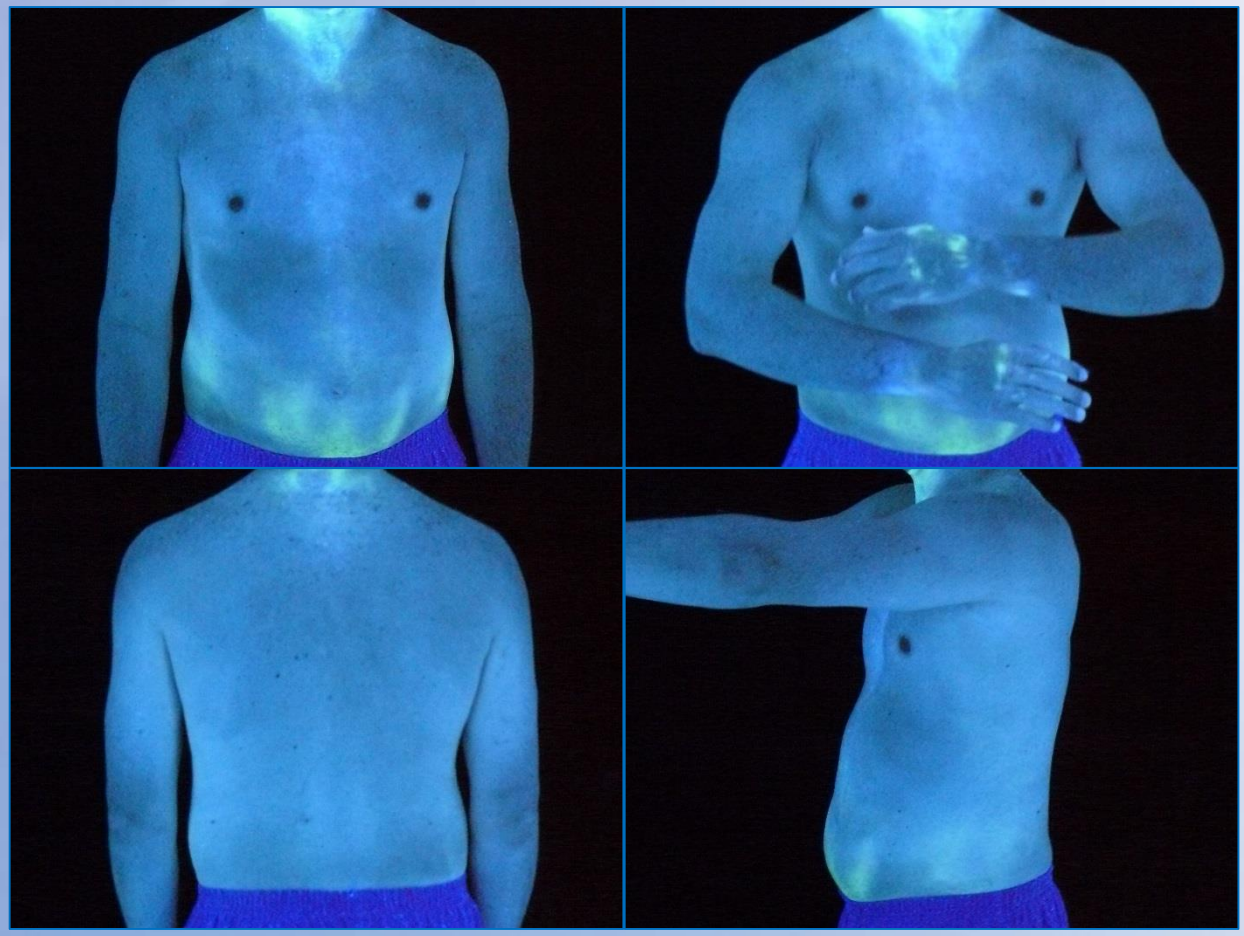
Pre-test photos were taken prior to wind tunnel entry. To preserve air in the tank, the SCBA regulator was not connected until immediately before wind tunnel entry.

UV Photos: Head and Neck (Test # 2225, TP #7)



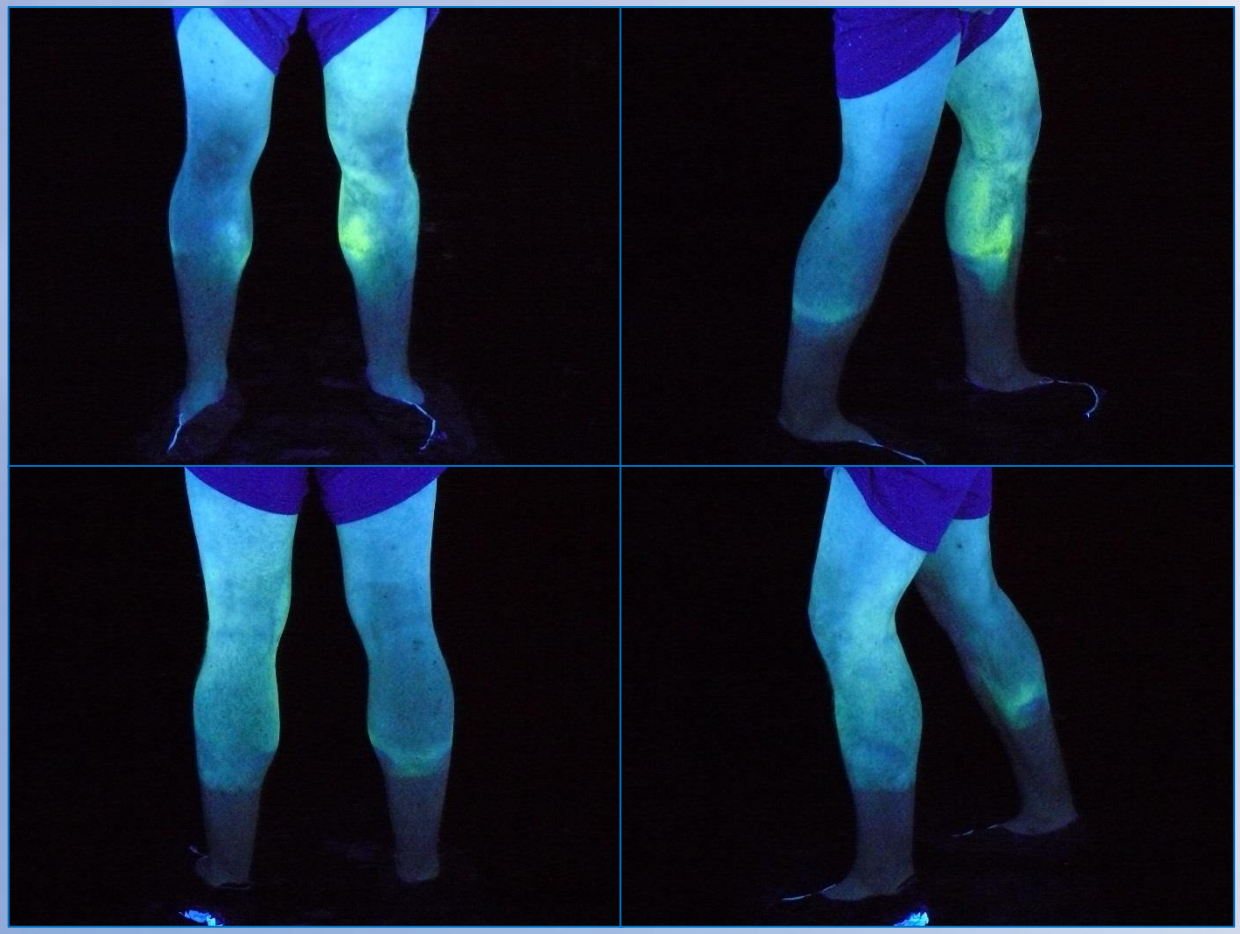
There were very heavy aerosol deposits on the neck, cheeks, ears, and hair due to penetration through the hood. The dark bands below the ears were relatively clean areas that were covered by the mask straps.

UV Photos: Torso and Arms (Test # 2225, TP #7)



The lower front torso showed moderate to heavy aerosol deposits, and the location and pattern suggest infiltration through the coat-trouser interface. The bright spots on the hands and wrists could have been due to aerosol penetration, an artifact from doffing, or a combination of both.

UV Photos: Legs (Test # 2225, TP #7)



The lower legs had a high level of deposited aerosol. The patterns suggest aerosol infiltration through the boot-trouser interface and possible penetration through the trouser fabric.

Summary

- A single FAST test was performed on a standard firefighter turnout gear.
- The test ran smoothly with no significant donning, doffing, or test condition issues, with the possible exception of doffing artifacts on the hands.
- The most prominent feature of the test was the very heavy level of aerosol deposited on the head and neck, indicating penetration of aerosol through the hood.
- The deposits around the waist suggest infiltration through the coat-trouser interface.
- The heavy deposits on the legs suggest infiltration through the boot-trouser interface.