ATEC Project No. 2015-DT-DPG-ARSPT-G1871
WDTC Document No. WDTC-RR-15-111

DEPARTMENT OF THE ARMY
US ARMY DUGWAY PROVING GROUND
DUGWAY, UTAH 84022-5000

TEST RECORD
FOR THE
SOPHOS/KYDOIMOS (S/K) CHALLENGE-II

Brief Description of Test: Open-house field test to enable industry, academia, and government and foreign nationals to demonstrate and evaluate their technologies when challenged with threat-representative chemical and biological simulant clouds in test chamber and field test environments.

Dates of Test: 1 through 11 June 2015

Type Test and Item: Open House Field Test.

Location of Test:
Active Standoff Chamber (ASC), Joint Ambient Breeze Tunnel (JABT), and Target S
West Desert Test Center (WDTC)
US Army Dugway Proving Ground (DPG).

Authority: On 9 December 2014, US Army Test and Evaluation Command (ATEC), Aberdeen Proving Ground (APG), Maryland, activated the ATEC Decision Support System (ADSS) authorizing WDTC, DPG, to conduct the Sophos/Kydoimos (S/K) Challenge I, ATEC Project Number 2015-DT-DPG-ARSPT-G1871.

1. TEST ITEM(S)

None. All S/K challenge participants brought their systems and were responsible for evaluating the performance of their technologies.

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY DUGWAY PROVING GROUND
DUGWAY, UT 84022-5000

TEDT-DPW-LS March 2016

MEMORANDUM FOR US Army Test and Evaluation Command (ATEC) Army Evaluation Center (AEC), Test Operations Division (CSTE-TM/M. Joiner), 2202 Aberdeen Boulevard, Aberdeen Proving Ground, MD 21005-5001

SUBJECT: Test Record for the Sophos/Kydoimos (S/K) Challenge-II, ATEC Project Number 2015-DT-DPG-ARSPT-G1871, West Desert Test Center (WDTC) Document Number WDTC-RR-15-111

1. Subject document is forwarded to you for information and retention.

2. The point of contact is Jeffrey Poor, DSN 789-3807, commercial (435) 831-3807, or email jeffrey.a.poor.civ@mail.mil.

3. TEAM DUGWAY – Empowering the Nation's Defenders!

Encl

RYAN W. HARRIS
Director, West Desert Test Center

2. SUPPORTING MATERIEL, FACILITIES, AND INSTRUMENTATION

a. Facilities. Field testing was conducted at the ASC, JABT, and Target S. Representative maps of these test facilities are shown in Figures 1.1 through 1.4.

b. Referee Instrumentation

(1) The Aerodynamic Particle Sizer® (APS™, TSI, Shoreview, Minnesota) was used as a point detector to measure biological and other particles per liter (PPL) of air and particle size distribution (PSD).

(2) The chemical cloud tracking system (CCTS) (MESH, Inc., Oxford, Pennsylvania) was used to construct three dimensional (3-D) concentration maps of chemical clouds.

(3) The Gasmet™ DX-4000 multi-component Fourier-transform infrared spectrometer (FTIR) gas analyzer (Gasmet Technologies Inc., Toronto, Ontario, Canada) was used as a point detector to measure the concentration of chemical simulant vapors.

(4) The laser-induced fluorescence (LIF) system was not used as a referee light detection and ranging (LIDAR) system. This is a deviation from the operations plan (OPLAN) (Reference 1).

(5) The West Desert LIDAR (WDL) system was used as a referee LIDAR system.

(6) A Portable Weather Information Display System (PWIDS) was used to record temperature, relative humidity (RH), wind speed, and wind direction during testing.

c. Dissemination Instrumentation

(1) Air cannons were used to disseminate dry simulants.

(2) A burn pan was used to produce interferents by burning rubber, brush, and alfalfa.

(3) Composition C-4 (C-4) explosive detonations were used for air vapor dissemination of chemical simulants.

(4) The dissemination cart/AU9200 was used to disseminate liquid chemical simulants.

(5) The electric Micronair® sprayer (Micron Group, Lenexa, Kansas) was used to disseminate liquid biological simulants.

(6) The large-volume aerosol dissemination system (LVAD) was used to disseminate large quantities (greater than 1 kg) of dry powder simulants.

(7) Skil® blowers (Robert Bosch Tool Corporation, Mt. Prospect, Illinois) were used to disseminate dry biological simulants or dust.

(8) The sonomist was used to disseminate liquid chemical simulants.

3. TEST OBJECTIVES

a. Allow the chemical and biological defense community, both government and private industry, early access to a threat-relevant environment in order to support a capability system, process, and procedure development.

b. Provide participants with a comprehensive data package of information collected from referee instrumentation during each trial.

c. Provide interested parties an opportunity to observe a chemical/biological field test.

4. DETAILS OF TEST

a. General Procedures

(1) All participants (DPG personnel and test participants) were assigned a unique call sign for test site entry/exit. The call sign master list was held by the S/K Challenge-II test officer (TO) and test control officer (TCO). At the end of each testing day, any anticipated changes to the S/K challenge schedule were announced at the command post (CP) before dismissal. For more immediate schedule changes, such as imminent bad weather, everyone on the grid was in radio contact.

(2) All participants attended a daily safety briefing and initialed the attendance roster.

(3) All grid access was coordinated through the CP and was approved by the TCO. All Foreign Nationals were escorted by US Government personnel at all times.

(4) Any participants arriving late were required to sign in at the CP and were informed of the information contained in the day's safety briefing.

(5) The location of all participants was confirmed before the LIDAR systems were activated and disseminations began.

(6) Any participants leaving Target S before the conclusion of testing were required to check out at the CP to remove their names from the roster.

(7) The TO, TCOs, and the DPG team ensured that all participants had the proper personal protective equipment (PPE), including respirators and laser goggles.

(8) All dissemination and referee system data were collected at the end of each night of testing and uploaded to a test computer by DPG personnel, which was not part of any participant-provided technology. All referee data were archived and stored on the test network.

b. Challenge Material Preparation

(1) Challenge materials were obtained from commercial vendors or produced at DPG. If available, the source, batch record, and lot numbers for each challenge material were recorded and provided to the test participants.

(2) Biological and chemical simulants were used as the challenge materials.

(3) DPG conducted all quality control procedures necessary to characterize the challenge materials produced at DPG. Quality control data were collected.

c. Instrumentation Setup and Calibration

(1) Private industry and government participants setup and operated their systems and maintained proprietary control of their technology and data during the test.

(2) APS™, CCTS, Gasmet™, PWIDS, and WDL were set up, calibrated, and used to monitor and referee testing.

(3) Instrumentation locations were recorded.

d. Test Execution

(1) Participant-provided technologies were positioned on the grid in accordance with (IAW) customer requirements. The locations were recorded.

(2) Before the start of dissemination each day, referee instrumentation was powered on and operated to establish background concentrations. To determine background readings, 5 minutes of particle concentration-level data were recorded with the APS™ units.

(3) Before each trial, the TO announced when the simulant or interferent dissemination would begin. Simulant or interferent was disseminated with a disseminator IAW Paragraph 2.c.

NOTE: The dissemination duration was dependent on the challenge material and all dissemination durations were recorded in the TCO log.

(4) All trial information was recorded in the TCO log, and a summary is provided in Tables 1.1 through 1.5.

(5) Selection of the challenge material for each trial was based on customer needs and conditions on the grid. The challenge material used for each trial was recorded (Tables 1.1 through 1.5).

(6) Quantity of disseminated challenge materials was determined by field personnel and recorded.

5. TEST DATA

a. Summaries of the TCO logs are in Enclosure 1.

b. A comprehensive referee data package was provided to test participants electronically using US Army Aviation and Missile Research Development and Engineering Center (AMRDEC) Safe Access File Exchange (SAFE).

c. This comprehensive referee data package with unprocessed and processed data was provided to participants that paid the fee and provided a technology for the test. The data were provided to the participants for creation of their own visualizations for comparison to DPG referee data. A file (File Name: SK Challenge 2015 Data Package Read Me) describes the data files. It was the responsibility of each participant to analyze their proprietary data and evaluate system performance.

> **NOTE**: Different referees are used to collect varying types of data and no single referee characterizes the cloud (or challenge) completely. When referees are used together, this allows for the best possible representation of the cloud.

d. The following data were provided:

(1) The SK Challenge TCO Log containing a summary of the following data:

(a) Trial name.

(b) Date of trial.

(c) Start and stop time of each trial.

(d) Start and stop time of each dissemination.

(e) Simulant disseminated and interferent.

(f) Total amount of material disseminated.

(g) Dissemination equipment or method.

(h) Release coordinates.

(i) Meteorological conditions at the start of each trial, including temperature, RH, wind speed, and wind direction.

(j) General notes addressing any issues during the trial.

(2) Position names and Universal Transverse Mercator (UTM) coordinates of each of the instrument locations.

(3) Environmental data, including temperature, RH, and wind speed during each night of testing at a reporting rate of one reading per second. Data collected during Target S testing also includes wind direction for each of the four meteorological stations in the grid.

(4) Gasmet™ concentration and detection data for each of the Gasmet™ units, broken down by trial and date/time.

(5) APS™ concentration and detection data for each APS™ unit, broken down by trial and date/time.

(6) LIDAR data for each trial. Because the LIDAR produces an extremely large amount of data, files were reduced to include only detection data (LIDAR readings that were three standard deviations or more above background). These files provide the date and time of each reading, concentration data (in PPL), and UTM coordinates.

(7) CCTS concentration and detection data with UTM coordinates.

(8) Photos taken during the SK Challenge, organized by date.

6. SUMMARY OF RESULTS

a. A summary of the completed trials is in Tables 1.1 through 1.5.

b. A total of 129 trials were completed with biological and chemical simulants (30 biological trials in the JABT, 17 biological trials in the ASC, 21 chemical trials in the JABT, 18 chemical trials in the ASC, and 43 chemical and biological trials at Target S).

(1) Biological Simulants.

(a) *Bacillus atrophaeus* (BG).

(b) *Bacillus thuringiensis* var. kurstaki (BtK).

(c) *Erwinia herbicola* (EH).

(d) Male-specific bacteriophage type 2 (MS2).

(e) Ovalbumin (OV).

(2) Chemical Simulants.

(a) Acetic acid (AA).

(b) Methyl salicylate (MeS).

(c) Triethyl phosphate (TEP).

NOTE: Syloid® 244 was used as a solid support to create a detectable aerosol with vapor instrumentation (Tables 1.3 through 1.5).

(d) Sulfur hexafluoride (SF6).

7. OBSERVATIONS/REMARKS/VISITORS

a. As the Nation's Chemical and Biological Proving Ground, DPG recognizes the need to continue to advance the collaborative and developmental efforts of our national and international chemical and biological partners. DPG offers a test tube-to-battlefield capability, with world-class equipment, personnel, and test services for test and evaluation (T&E) within a collaborative cost environment.

b. The S/K Challenge II was an open-house field test that provided an opportunity to conduct early assessment of detector systems against threat-representative chemical and biological cloud simulants at a reduced cost (due to multiple participants) and in an environment free of high-pressure evaluation. This test was conducted to enable industry, academia, Government and Foreign Nationals an opportunity to demonstrate and evaluate their technologies. The intent was to ensure that maximum innovation and collaboration are encouraged between the Department of Defense (DoD) and industry, academia, and Government developers.

c. S/K Challenge-II received support from Deputy Undersecretary of the Army Test and Evaluation (DUSA-TE) and Office of the Assistant Secretary of Defense for Nuclear, Chemical, Biological Defense Programs/Chemical and Biological Defense (OASD NCB/CB) to enable Chemical and Biological Defense Program (CBDP) international engagement efforts and other one-time startup costs. International participants included personnel from Australia, Canada, France, Israel, Norway, Poland, and South Korea.

d. S/K Challenge-II participants had early involvement in the definition of threat-relevant scenarios to support system, process, and procedure development. All participants received the same DPG support and services. Technology platforms were not subjected to formal T&E evaluation; data from each developer belonged solely to that specific developer. This allowed developers to evaluate the performance of their own breadboard, prototype, or commercial off-the-shelf (COTS) equipment in comparison to DPG's state-of-the-art test referee instrumentation.

e. Personnel affiliated with the Defense Threat Reduction Agency (DTRA) and the Maneuver Support Center of Excellence (Fort Leonard Wood, Missouri) and others observed the test. These individuals assessed the new and emerging chemical and biological defense capabilities for possible entry into military utility assessment.

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Table 1.1. Biological Releases in the Active Standoff Chamber (ASC); S/K Challenge-II.

Trial Name[a]	Trial Start		Trial Stop		Challenge Materials		Dissemination Equipment
	Date (June 2015)	Time (hhmm:ss)	Date (June 2015)	Time (hhmm:ss)	Type[b]	Total Amount	
SK2-ASC-B-001	2	0130:30	2	0210:00	BG	0.5 g	Skil® blower
SK2-ASC-B-002	2	0220:00	2	0241:00	BG	0.1 g	Skil® blower
SK2-ASC-B-003	2	0246:00	2	0305:00	OV	15 g	Skil® blower
SK2-ASC-B-004	2	2030:00	2	2043:00	OV	0.03 g	Skil® blower
SK2-ASC-B-005	2	2053:00	2	2105:00	OV	0.01 g	Skil® blower
SK2-ASC-B-006	2	2128:00	2	2143:00	BG	0.02 g	Skil® blower
SK2-ASC-B-007	2	2151:00	2	2211:00	EH	50 ml	Micronair®
SK2-ASC-B-008	2	2228:00	2	2246:00	EH	10 ml	Micronair®
SK2-ASC-B-009	2	2254:00	2	2315:00	EH	200 ml	Micronair®
SK2-ASC-B-010	2	2326:00	2	2345:00	MS2	100 ml	Micronair®
SK2-ASC-B-011	2	2356:00	3	0004:00	MS2	20 ml	Micronair®
SK2-ASC-B-012	3	0020:00	3	0039:00	MS2	200 ml	Micronair®
SK2-ASC-B-013	3	0048:00	3	0107:00	MS2	10 ml	Micronair®
SK2-ASC-B-014	3	0015:00	3	0135:00	BG	1 g	Skil® blower
SK2-ASC-B-015	3	0152:00	3	0212:00	BG	0.01 g	Skil® blower
SK2-ASC-B-016	3	0227:00	3	0248:00	OV	0.03 g	Skil® blower
SK2-ASC-B-017	3	0339:00	3	0400:00	EH	50 ml	Micronair®

[a]SK2 – S/K Challenge II; ASC – Active Standoff Chamber; B – biological trial.
[b]BG – *Bacillus atrophaeus*; EH – *Erwinia herbicola*; MS2 – male-specific bacteriophage type 2; OV – ovalbumin.

Table 1.2. Biological Releases in the Joint Ambient Breeze Tunnel (JABT); S/K Challenge-II.

Trial Name[a]	Trial Start		Trial Stop		Challenge Material		Dissemination Equipment
	Date (June 2015)	Time (hhmm:ss)	Date (June 2015)	Time (hhmm:ss)	Type[b]	Total Amount	
SK2-JAB-B-018	4	0022:00	4	0034:00	BG	74.58 g	Skil® blower
SK2-JAB-B-019	4	0042:00	4	0054:00	OV	190.03 g	Skil® blower
SK2-JAB-B-020	4	0103:00	4	0115:10	EH	4800 ml	Micronair®
SK2-JAB-B-021	4	0122:00	4	0134:00	MS2	5.1 ml	Micronair®
SK2-JAB-B-022	4	0145:00	4	0202:00	BG	56.73 g	Skil® blower
SK2-JAB-B-023	4	2129:00	4	2142:00	BG	31.78 g	Skil® blower
SK2-JAB-B-024	4	2205:00	4	2228:00	BG	7.1 g	Skil® blower
SK2-JAB-B-025	4	2253:00	4	2306:00	OV	193.48 g	Skil® blower
SK2-JAB-B-026	4	2320:00	4	2333:00	OV	31.48 g	Skil® blower
SK2-JAB-B-027	4	2345:00	4	2358:00	EH	1.06 ml	Micronair®
SK2-JAB-B-028	5	0010:00	5	0022:00	EH	212 ml	Micronair®
SK2-JAB-B-029	5	0035:00	5	0047:00	MS-2	1.04 ml	Micronair®
SK2-JAB-B-030	5	0100:00	5	0112:00	MS-2	263 ml	Micronair®
SK2-JAB-B-031	5	0154:00	5	0210:00	BG-step	61.52 g	Skil® blower
SK2-JAB-B-032	5	0223:00	5	0240:00	OV-step	11.85 g	Skil® blower
SK2-JAB-B-033	5	0250:00	5	0306:00	EH-step	882 ml	Micronair®
SK2-JAB-B-034	5	0325:00	5	0338:00	BG-puff	1.92 g	Skil® blower
SK2-JAB-B-035	5	2135:00	5	2148:00	BG-puff	0.01 g	Skil® blower
SK2-JAB-B-036	5	2201:00	5	2214:10	OV-puff	0.02 g	Skil® blower
SK2-JAB-B-037	5	2227:00	5	2341:00	EH-puff	5.06 ml	Micronair®
SK2-JAB-B-038	5 June	2254:00	5 June	2308:00	BG/MS2	0.04 g/ 8.35 ml	Skil® blower/Micronair®
SK2-JAB-B-039	5 June	2321:00	5 June	2334:00	BG/EH	0.07 g/ 7.85 ml	Skil® blower/Micronair®

Table 1.2. Biological Releases in the Joint Ambient Breeze Tunnel (JABT); S/K Challenge-II (Cont'd).

Trial Name[a]	Trial Start		Trial Stop		Challenge Material		Dissemination Equipment
	Date (June 2015)	Time (hhmm:ss)	Date (June 2015)	Time (hhmm:ss)	Type[b]	Total Amount	
SK2-JAB-B-040	5	2351:00	6	0001:00	Kaolin/EH	0.08 g/ 9.54 ml	Skil® blower/Micronair®
SK2-JAB-B-041	6	0013:00	6	0027:00	BG	0.07 g	Skil® blower
SK2-JAB-B-042	6	0040:00	6	0054:00	OV	3.75 g	Skil® blower
SK2-JAB-B-043	6	0107:00	6	0121:00	EH	97.25 ml	Micronair®
SK2-JAB-B-044	6	0136:30	6	0149:30	Kaolin/EH	2.51 g/ 15.91 ml	Skil® blower/Micronair®
SK2-JAB-B-045	6	0203:00	6	0213:00	BG-puff	0.42 g	Skil® blower
SK2-JAB-B-046	6	0226:00	6	0237:00	OV-puff	0.44 g	Skil® blower
SK2-JAB-B-047	6	0250:00	6	0300:00	EH-puff	9.88 ml	Micronair®

[a]SK2 – S/K Challenge II; JAB – indicates trial was conducted in the Joint Ambient Breeze Tunnel; B – biological trial.
[b]BG – *Bacillus atrophaeus*; EH – *Erwinia herbicola*; MS2 – male-specific bacteriophage type 2; OV – ovalbumin.

Table 1.3. Chemical Releases in the Joint Ambient Breeze Tunnel (JABT); S/K Challenge-II.

	Trial Start		Trial Stop		Simulant		
Trial Name[a]	Date (June 2015)	Time (hhmm:ss)	Date (June 2015)	Time (hhmm:ss)	Type[b]	Total Amount	Dissemination Equipment[c]
SK2-JAB-C-001	2	0100:00	2	0123:00	MeS	1.680 kg	Dissem. Cart
SK2-JAB-C-002	2	0123:00	2	0137:00	MeS	1.724 kg	Dissem. Cart
SK2-JAB-C-003	2	0137:00	2	0157:00	MeS	3.745 kg	Dissem. Cart
SK2-JAB-C-004	2	0157:00	2	0221:00	MeS	3.885 kg	Dissem. Cart
SK2-JAB-C-005	2	0246:00	2	0303:00	TEP/Syloid® 244[d]	102 g	Skil® blower
SK2-JAB-C-006	2	0303:00	2	0321:00	TEP/Syloid® 244	120 g	Skil® blower
SK2-JAB-C-007	2	2004:00	2	2020:00	TEP/Syloid® 244	25 g	Skil® blower
SK2-JAB-C-008	2	2045:00	2	2058:00	TEP/Syloid® 244	18 g	Skil® blower
SK2-JAB-C-009	2	2058:00	2	2111:00	TEP/Syloid® 244	23 g	Skil® blower
SK2-JAB-C-010	2	2111:00	2	2128:00	TEP/Syloid® 244	21 g	Skil® blower
SK2-JAB-C-011	2	2204:00	2	2221:00	MeS	822 g	Dissem. Cart
SK2-JAB-C-012	2	2250:00	2	2304:00	MeS	197 g	Dissem. Cart
SK2-JAB-C-013	2	2304:00	2	2319:00	MeS	210 g	Dissem. Cart
SK2-JAB-C-014	2	2319:00	2	2338:00	MeS	89 g	Dissem. Cart
SK2-JAB-C-015	3	0019:00	3	0033:00	TEP	316 g	Dissem. Cart
SK2-JAB-C-016	3	0033:00	3	0050:00	TEP	191 g	Dissem. Cart
SK2-JAB-C-017	3	0118:00	3	0133:00	TEP	214 g	Dissem. Cart
SK2-JAB-C-018	3	0133:00	3	0151:00	TEP	110 g	Dissem. Cart
SK2-JAB-C-019	3	0225:00	3	0241:00	TEP	101 g	Dissem. Cart
SK2-JAB-C-020	3	0241:00	3	0256:00	TEP	111 g	Dissem. Cart
SK2-JAB-C-021	3	0256:00	3	0312:00	TEP	759 g	Dissem. Cart

[a]SK2 – S/K Challenge II; JAB – indicates trial was conducted in the Joint Ambient Breeze Tunnel; C – chemical trial.
[b]MeS – methyl salicylate; TEP – triethyl phosphate.
[c]Dissem. – dissemination (AU9200).
[d]Syloid®244 was used as an aerosol carrier.

Table 1.4. Chemical Releases at the Active Standoff Chamber (ASC); S/K Challenge-II.

Trial Name[a]	Trial Start		Trial Stop		Challenge Material		Dissemination Equipment
	Date (June 2015)	Time (hhmm:ss)	Date (June 2015)	Time (hhmm:ss)	Type[b]	Total Amount	
SK2-ASC-C-022	3	2141:00	3	2218:00	MeS	NA[c]	Vapor Dissem[d]
SK2-ASC-C-023	4	0010:00	4	0046:00	MeS	NA	Vapor Dissem
SK2-ASC-C-024	4	0105:00	4	0149:00	MeS	NA	Vapor Dissem
SK2-ASC-C-025	4	2058:00	4	2123:00	TEP/Syloid® 244[e]	5 g	Skil® blower
SK2-ASC-C-026	4	2155:00	4	2216:00	SF6	.06 kg	Vapor Dissem
SK2-ASC-C-027	4	2236:00	4	2300:00	SF6	.14 kg	Vapor Dissem
SK2-ASC-C-028	4	2319:00	4	2357:00	TEP/Syloid® 244	25 g	Skil® blower
SK2-ASC-C-029	5	0016:00	5	0041:00	SF6	.32 kg	Vapor Dissem
SK2-ASC-C-030	5	0131:00	5	0158:00	TEP/Syloid® 244	25 g	Skil® blower
SK2-ASC-C-031	5	0222:00	5	0245:00	SF6	.68 kg	Vapor Dissem
SK2-ASC-C-032	5	0303:00	5	0326:00	SF6	1.40 kg	Vapor Dissem
SK2-ASC-C-033	5	2125:00	5	2134:00	TEP/Syloid® 244	25 g	Skil® blower
SK2-ASC-C-034	5	2201:00	5	2227:00	TEP	123.1 g	Sonomist
SK2-ASC-C-035	5	2247:00	5	2319:00	TEP/SF6	1.04 kg/75.6 g	Sonomist
SK2-ASC-C-036	5	2341:00	6	0005:00	TEP/Syloid® 244	25 g	Skil® blower
SK2-ASC-C-037	6	0024:00	6	0113:00	TEP	127.7 g	Sonomist
SK2-ASC-C-038	6	0131:00	6	0203:00	TEP	100.4 g	Sonomist
SK2-ASC-C-039	6	0224:00	6	0241:00	TEP	170.6 g	Sonomist

[a]SK2 – S/K Challenge II; ASC – Active Standoff Chamber; C – chemical trial.
[b]MeS – methyl salicylate; SF6 – sulfur hexafluoride; TEP – triethyl phosphate.
[c]NA – not applicable.
[d]Disseminator.
[e]Syloid® 244 was used as an aerosol carrier.

Table 1.5. Chemical and Biological Releases at Target S; S/K Challenge-II.

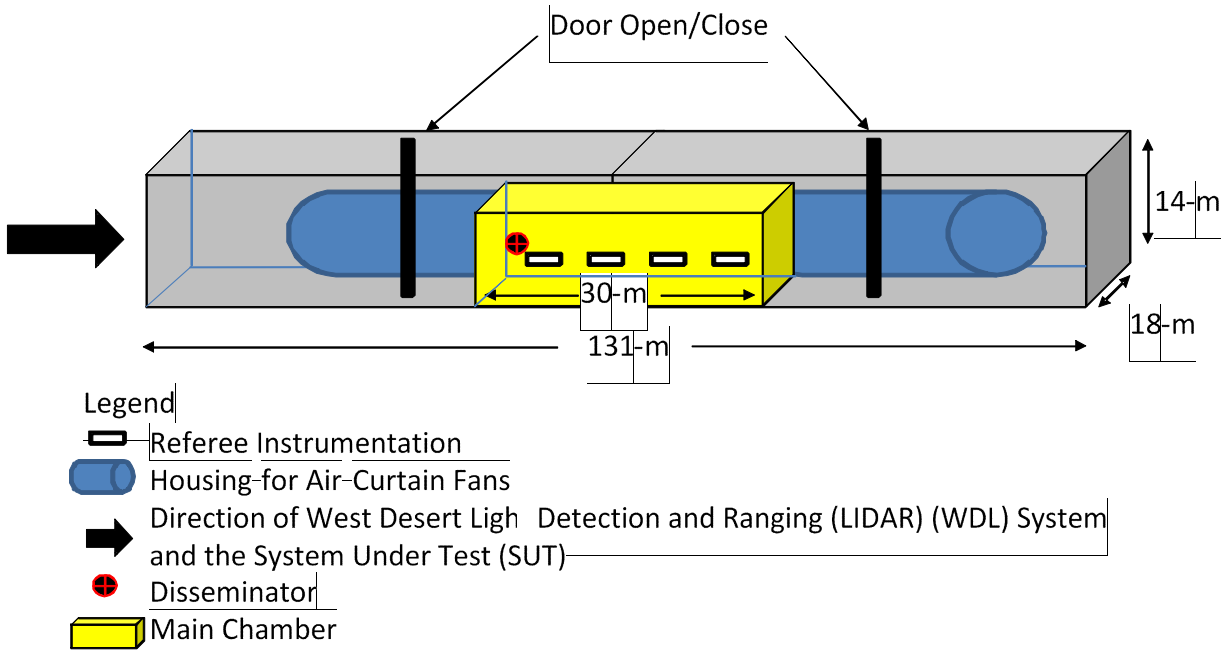
Trial Name[a]	Trial Start		Trial Stop		Simulant		Dissemination Equipment
	Date (June 2015)	Time (hhmm:ss)	Date (June 2015)	Time (hhmm:ss)	Type[b]	Total Amount	
SK2-VT-1A[c]	8	2233:00	8 June	2252:00	BtK	16 g	Skil® blower
SK2-VT-1	8	2308:33	8 June	2350:00	MeS	20 gal	C-4
SK2-VT-5A	9	0034:00	9 June	0057:00	AA	20 gal	C-4
SK2-VT-2A	9	2201:00	9 June	2226:00	OV	757.5 g	Skil® blower
SK2-VT-3A	9	2236:00	9 June	2303:00	TEP	10 L	AU9200
SK2-VT-5B	9	2311:30	9 June	2334:00	MS2	15 L	Micronair®
SK2-VT-6A	9	2354:00	10 June	0013:00	SF6	2.5 kg	C-4
SK2-VT-4A	10	0036:00	10 June	0056:00	TEP	5 lbs	C-4
SK2-VT-6B	10	0118:00	10 June	0139:40	TEP/EH	20L/18L	AU9200
SK2-VT-2B	10	0231:00	10 June	0245:00	BG	321.0 g	Skil® blower
SK2-VT-7A	10	0245:00	10 June	0307:00	Tire	1 tire	Burn Pan
SK2-VT-7B	10	0250:00	10 June	0307:00	EH	20 L	Micronair®
SK2-VT-22	10	2034:00	10 June	2105:00	Tire	1 tire	Burn Pan
SK2-VT-15	10	2119:00	10 June	2126:00	TEP	1 gal	High Alt SPAL
SK2-VT-24	10	2203:30	10 June	2240:00	Road Dust	NA[d]	Moving Truck
SK2-VT-25	10	2203:30	10 June	2240:00	Wood	NA	Burn Pan
SK2-VT-26	11	0118:00	11 June	0155:00	Kaolin (Dust)	138.5 g	Skil® blower
SK2-VT-27	11	0118:00	11 June	0155:00	Brush	NA	Burn Pan
SK2-VT-18	11	0205:00	11 June	0227:00	SF6	2.5 kg	Explosive detonation cord
SK2-VT-23	11	0322:03	11 June	0356:00	BtK	260.0 g	Skil® blower
SK2-VT-28	11	NA	11 June	NA	TEP	5 gal	High Alt SPAL
SK2-VT-29	11	NA	11 June	NA	TEP	5 gal	High Alt SPAL
SK2-VT-30	11	NA	11 June	NA	TEP	5 gal	C-4 (5 lbs.)

Table 1.5. Chemical and Biological Releases at Target S; S/K Challenge-II (Cont'd).

Trial Name[a]	Trial Start		Trial Stop		Simulant		Dissemination Equipment
	Date (June 2015)	Time (hhmm:ss)	Date (June 2015)	Time (hhmm:ss)	Type[b]	Total Amount	
SK2-VT-31	11	NA	11	NA	MeS	5 gal	C-4 (5 lbs.)
SK2-VT-32	11	NA	11	NA	AA	5 gal	C-4 (5 lbs.)
SK2-VT-33	11	2105:05	11	2218:00	TEP/MeS	5 gal	C-4 (10 lbs.)
SK2-VT-34	11	2105:05	11	2218:00	TEP/AA	5 gal	C-4 (10 lbs.)
SK2-VT-35	11	2105:05	11	2218:00	TEP	20 L	AU9200
SK2-VT-21	11	2105:05	11	2218:00	BG	339 g	Skil® blower
SK2-VT-17	11	2105:05	11	2218:00	MS2	20 L	Micronair®
SK2-VT-36	11	2105:05	11	2218:00	TEP	20 L	AU9200
SK2-VT-08	11	2301:00	12	0005:00	AA	5 gal	C-4 (5 lbs.)
SK2-VT-11	11	2301:00	12	0005:00	MeS	5 gal	C-4 (5 lbs.)
SK2-VT-37	11	2301:00	12	0005:00	TEP	20 L	AU9200
SK2-VT-09	11	2301:00	12	0005:00	BG/OV	500 g	Air Cannon
SK2-VT-19	11	2301:00	12	0005:00	TEP/Syloid® 244[e]	500 g	Air Cannon
SK2-VT-10	12	0027:00	12	0130:00	MeS	10 L	AU9200
SK2-VT-13	12	0027:00	12	0130:00	TEP	10 L	AU9200
SK2-VT-12	12	0027:00	12	0130:00	EH	12 L	Micronair®
SK2-VT-14	12	0027:00	12	0130:00	BG	155.0 g	Skil® blower
SK2-VT-16	12	0027:00	12	0130:00	OV	360 g	Skil® blower
SK2-VT-20	12	0027:00	12	0130:00	MS2	12 L	Micronair®
SK2-VT-38	12	0027:00	12	0130:00	Dust	25 lbs	C-4

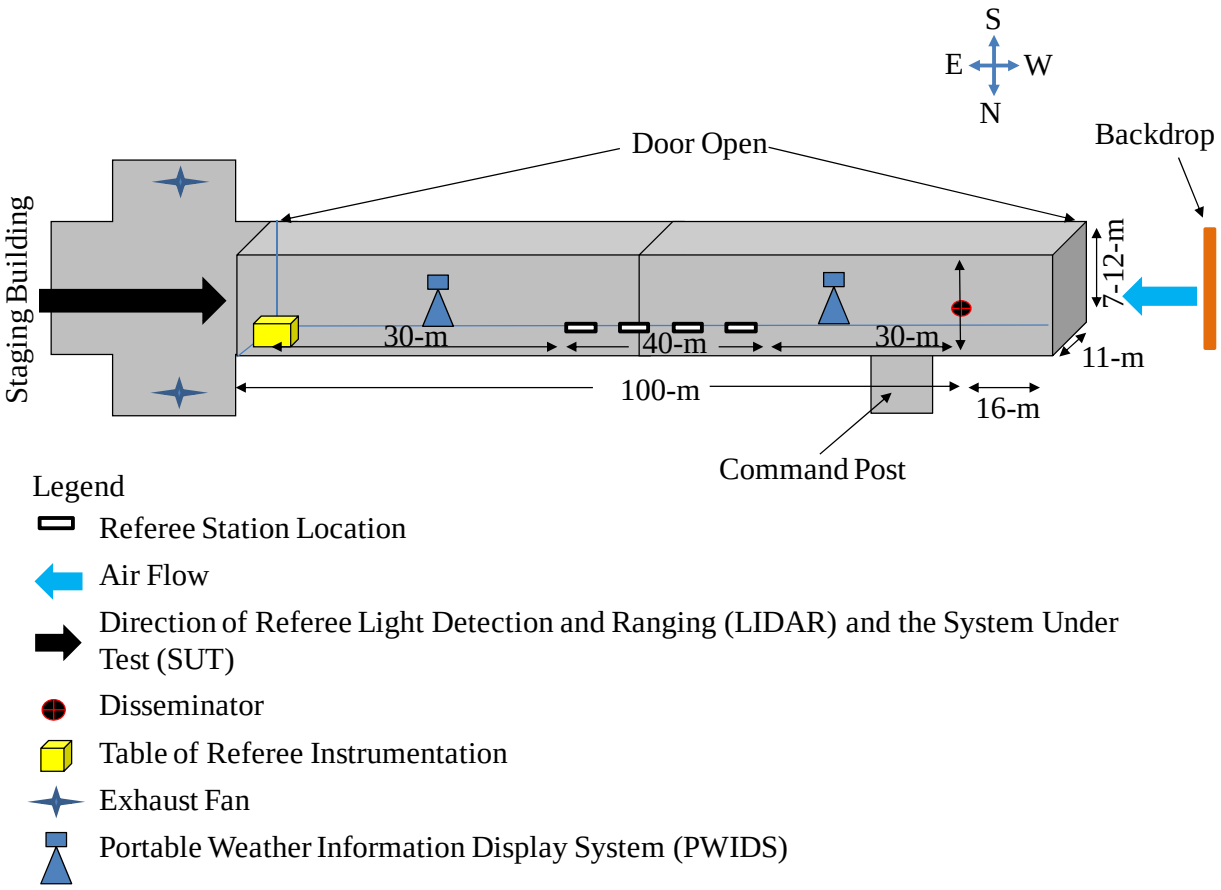
[a]SK2 – S/K Challenge II; VT – verification test.
[b]AA – acetic acid; BG – *Bacillus atrophaeus*; BtK – *Bacillus thuringiensis* var. kurstaki; EH – *Erwinia herbicola*; MeS – methyl salicylate; MS2 – male-specific bacteriophage type 2; OV – ovalbumin; SF6 – sulfur hexafluoride; TEP – triethyl phosphate.
[c]Trial scenarios were determined prior to start of test. Trials were not conducted in numerical order, and not all trials were executed.
[d]Syloid® 244 was used as an aerosol carrier.

Figure 1.1. Active Standoff Chamber (ASC) and Joint Ambient Breeze Tunnel (JABT) Locations; S/K Challenge-II.



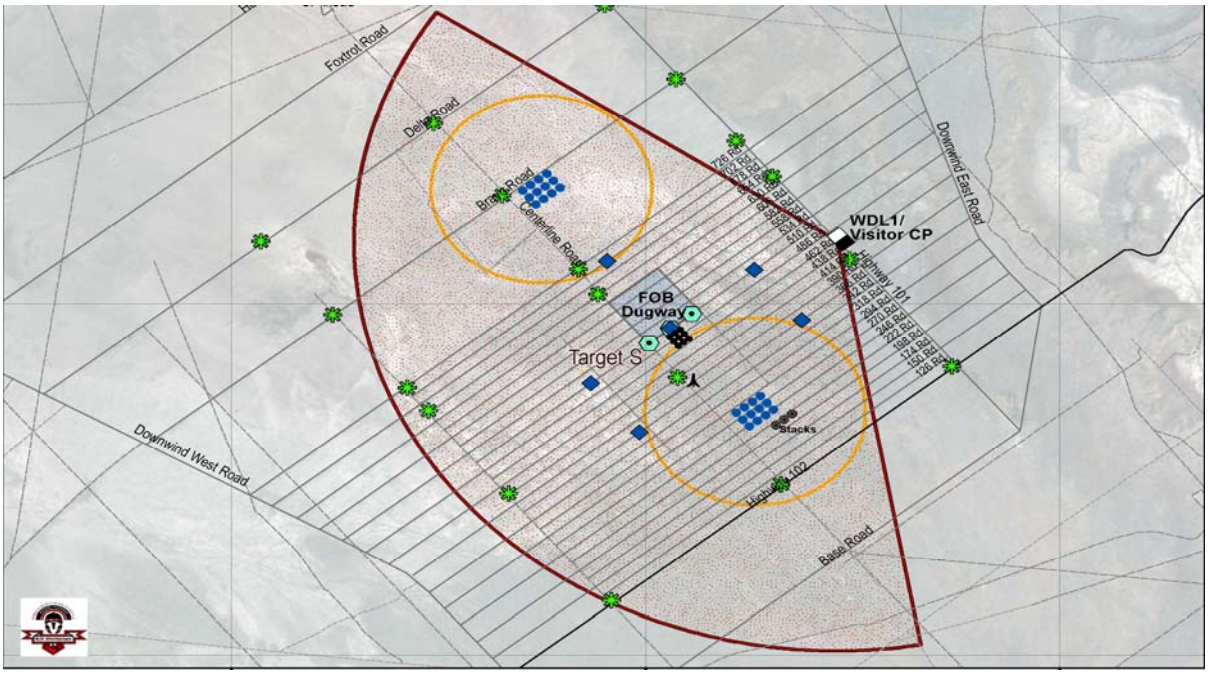
NOTE: Drawing not to scale.

Figure 1.2. Active Standoff Chamber (ASC) Layout; S/K Challenge-II.



NOTE: Drawing not to scale.

Figure 1.3. Joint Ambient Breeze Tunnel (JABT) Layout; S/K Challenge-II.



NOTES: 1. These data are from the chemical cloud tracking system (CCTS) (red hatches) during Trial RT-22 on 16 September 2014. Triethyl phosphate (TEP) was disseminated from an AU9200.
2. The five blue circles (P01 through P05) are for reference and do not show whether anything was detected by the Gasmet™.
3. APS – Aerodynamic Particle Sizer®; CP – command post; FOB – forward operating base; LIDAR – light detection and ranging; WDL – West Desert LIDAR.

Figure 1.4. Target S Location; S/K Challenge-II.

ENCLOSURE 2. REFERENCES

1. US Army Dugway Proving Ground (DPG), Utah, *Operations Plan (OPLAN) for the Sophos/Kydoimos (S/K) Challenge II*, US Army Test and Evaluation Command (ATEC) Project Number 2014-DT-DPG-ARSPT-G1871, West Desert Test Center (WDTC) Document Number WDTC-OP-15-025.

ENCLOSURE 3. ABBREVIATIONS

3-D – three dimensional

AA – acetic acid

ADSS – ATEC Decision Support System

AMRDEC – US Army Aviation and Missile Research Development and Engineering Center

APG – Aberdeen Proving Ground

APS™ – Aerodynamic Particle Sizer®

ASC – Active Standoff Chamber

ATEC – US Army Test and Evaluation Command

B – biological

BG – *Bacillus atrophaeus*

BtK – *Bacillus thuringiensis* var. kurstaki

C – chemical

C-4 – composition 4

CBDP – Chemical and Biological Defense Program

CCTS – chemical cloud tracking system

COTS – commercial off-the-shelf

CP – command post

Dissem. – dissemination

DoD – Department of Defense

DPG – US Army Dugway Proving Ground

DTRA – Defense Threat Reduction Agency

DUSA-TE – Deputy Undersecretary of the Army Test and Evaluation

EH – *Erwinia herbicola*

FOB – forward operating base

FTIR – Fourier-transform infrared

IAW – in accordance with

JAB – indicates trial was conducted in the Joint Ambient Breeze Tunnel

JABT – Joint Ambient Breeze Tunnel

LIDAR – light detection and ranging

LIF – laser-induced fluorescence

LVAD – large volume aerosol dissemination system

MeS – methyl salicylate

MS2 – male-specific bacteriophage type 2

NA – not applicable

OASD NCB/CB – Office of the Assistant Secretary of Defense for Nuclear, Chemical, Biological Defense Programs/Chemical and Biological Defense

OPLAN – operations plan

OV – ovalbumin

PPE – personal protective equipment

PPL – particles per liter

PSD – particle-size distribution

PWIDS – Portable Weather Information Display System

RH – relative humidity

S/K – Sophos/Kydoimos

SAFE – Safe Access File Exchange

SF6 – sulfur hexafluoride

SK2 – S/K Challenge

SOP – standing operating procedure

SUT – system under test

T&E – test and evaluation

TCO – test control officer

TEP – triethyl phosphate

TO – test officer

UTM – Universal Transverse Mercator coordinate system

VT – verification test

WDL – West Desert LIDAR

WDTC – West Desert Test Center

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