

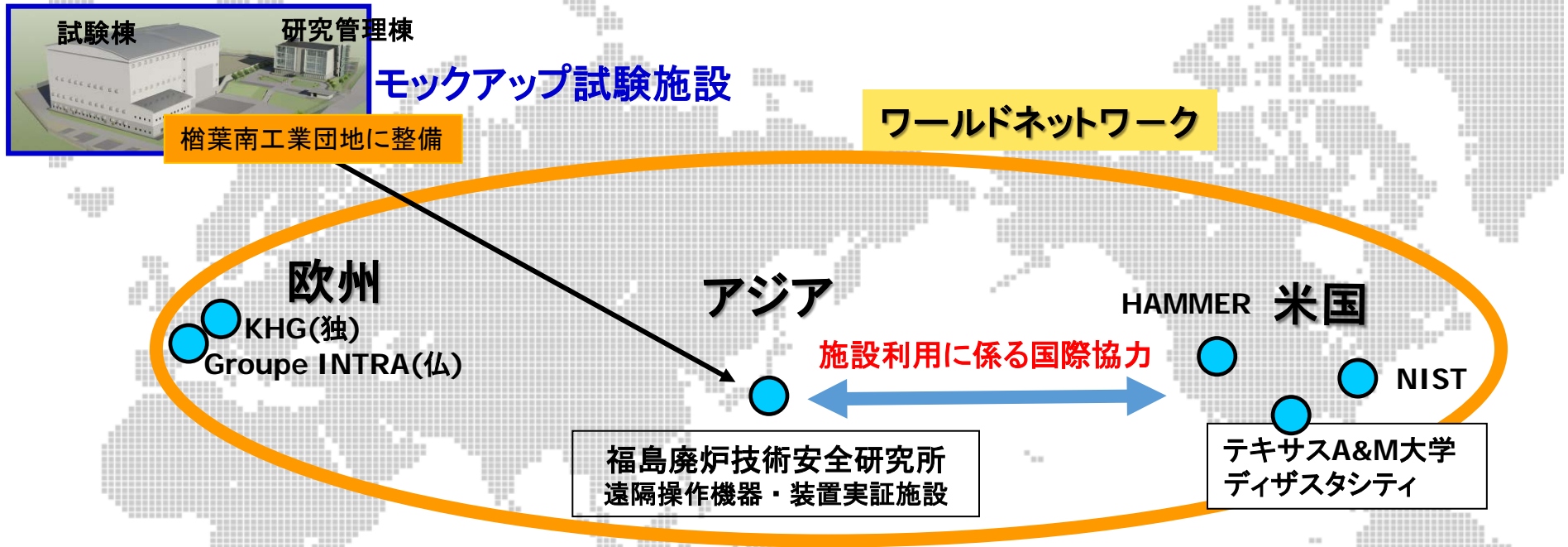


国際的な研究開発ネットワークの構築

東京大学大学院工学系研究科精密工学専攻
浅間 一

産業競争力懇談会「災害対応ロボットの社会実装」, プロジェクトリーダー
日本原子力研究開発機構(JAEA)モックアップ試験施設専門部会, 部会長
政府・東京電力廃炉・汚染水対策チーム/事務局会議, 委員

国際的な研究開発ネットワークの構築



戦略的パートナーシップの構築

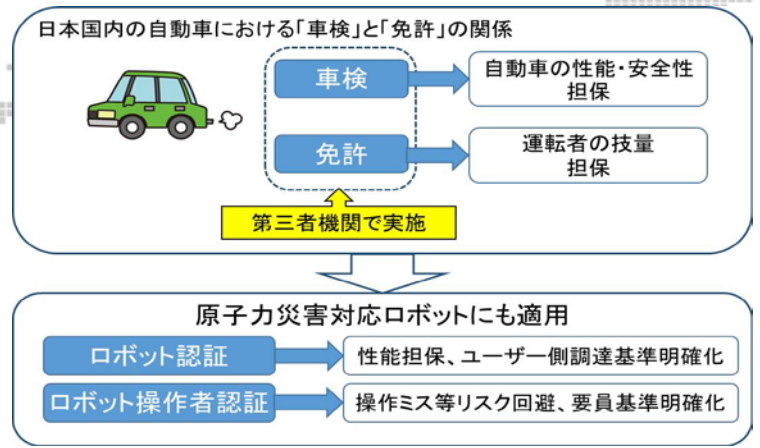
【継続的な開発と運営】

- ・ロボット及びロボット操作者の**認証制度**の構築。
- ・**ロボット競技会**の企画・運営。

【施設の利用を促進】

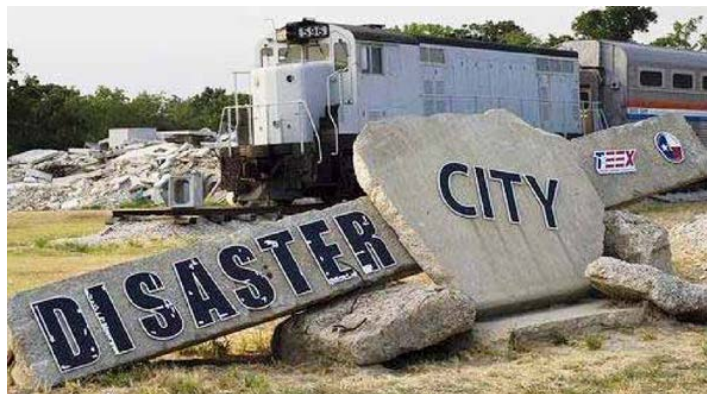
- ・海外の遠隔技術開発や災害対応で活用される施設の調査及び今後の協力体制の構築を進める。

世界規模でのロボット認証制度の構築



Disaster City

TEEX (Texas A&M Univ), Texas, USA

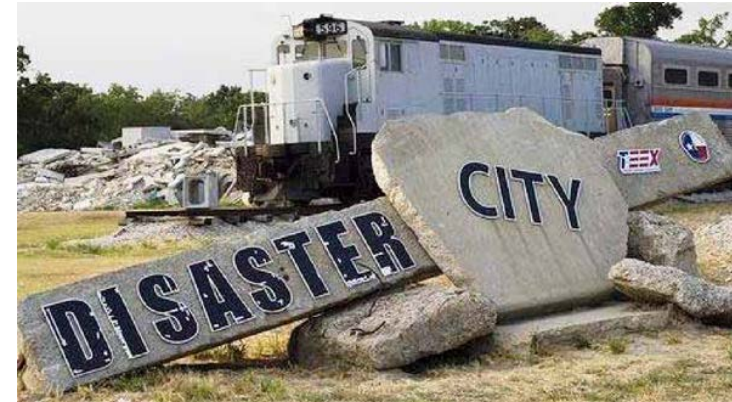


(三菱総研瀬川氏レポートより)





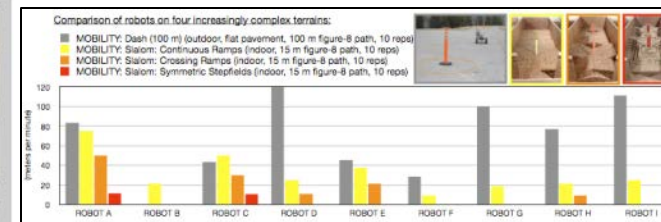
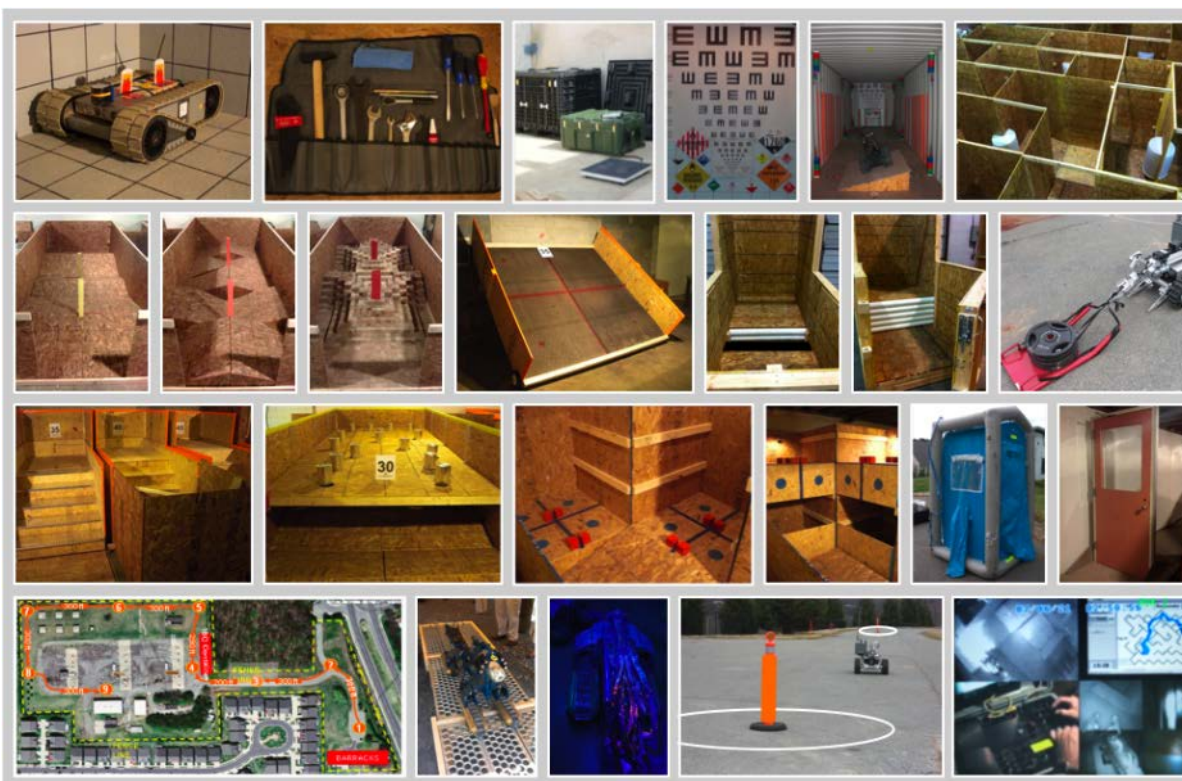
連携拠点



RoboCup Rescue



Project Overview



Test Director:

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Intelligent Systems Division

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NIST Contributors:

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Soeren Schwertfeger, Raymond Sheh

EMERGENCY RESPONDERS

PROVIDE ROBOT REQUIREMENTS WITH METRICS AND OBJECTIVES

BENEFIT FROM STATISTICALLY SIGNIFICANT PERFORMANCE DATA



RESPONSE ROBOT EXERCISES FACILITATE UNDERSTANDING OF CURRENT ROBOT CAPABILITIES



RESPONDERS TRAIN USING STANDARD TEST METHODS AND HELP VALIDATE PROCEDURES

**S
T
A
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T**



IDENTIFY RESPONDER REQUIREMENTS AND ROBOT PERFORMANCE OBJECTIVES



GENERATE STANDARD TEST APPARATUSES, PROCEDURES AND TERMINOLOGY



VALIDATE TEST METHODS AT RESPONSE ROBOT EVALUATION EXERCISES



CAPTURE STATISTICALLY SIGNIFICANT ROBOT PERFORMANCE DATA IN STANDARD TESTS



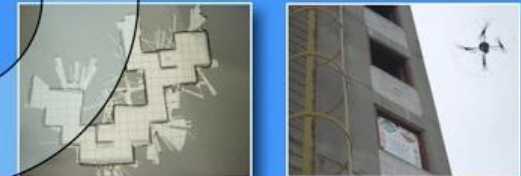
PUBLISH ASTM STANDARD TESTS, ROBOT PERFORMANCE DATA, AND USAGE GUIDES



ROBOT DEVELOPERS AND RESEARCHERS

PROVIDE ROBOTS FOR TESTING AND FEEDBACK ON TEST METHODS

BENEFIT FROM REPEATABLE TESTS TO EVALUATE AND HARDEN ROBOTS



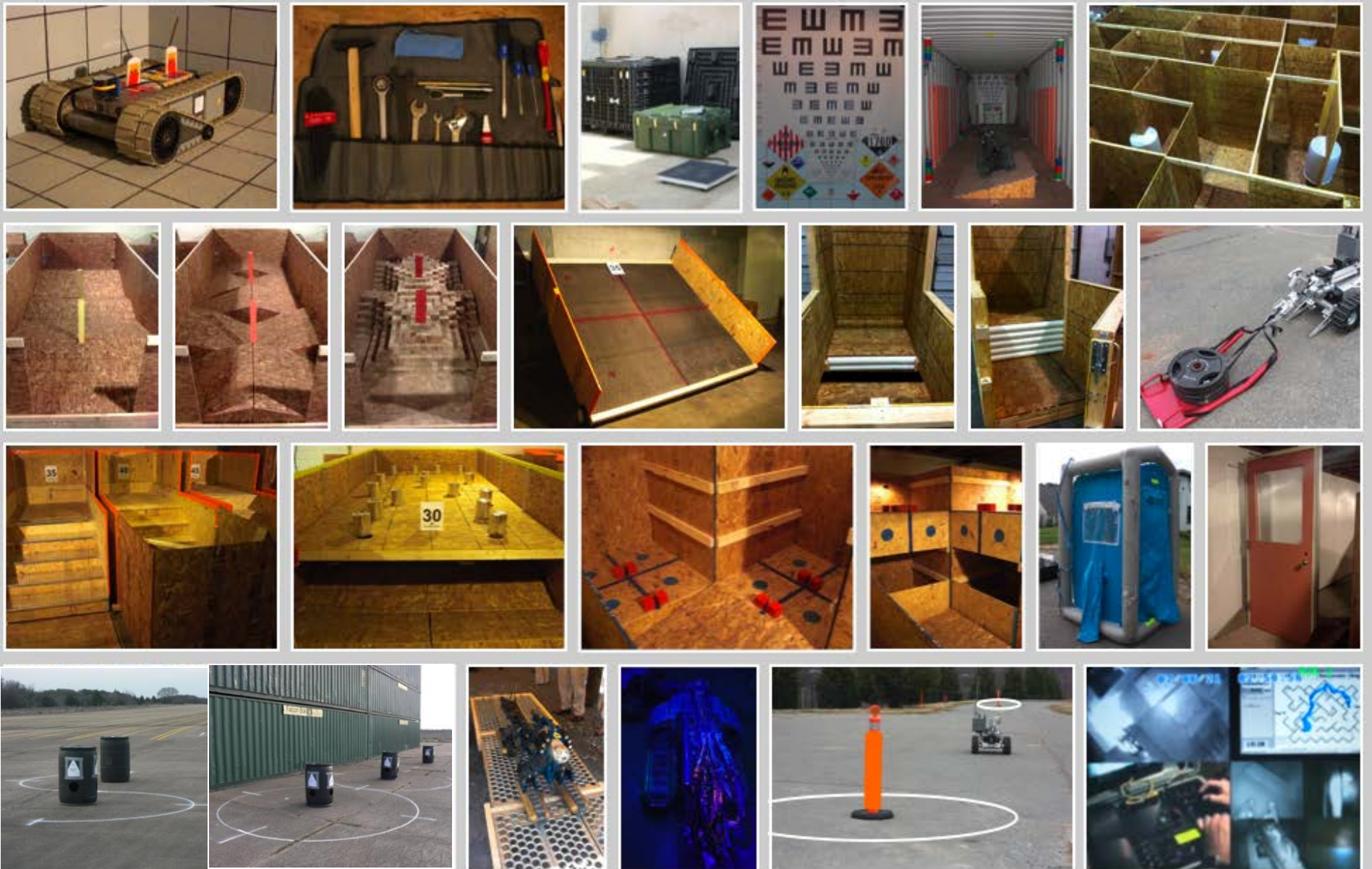
ROBOT COMPETITIONS FACILITATE PROLIFERATION OF TEST METHODS, IDENTIFY BEST-IN-CLASS ROBOTS



RESEARCHERS PRACTICE USING STANDARD TEST APPARATUSES AND HELP REFINE DESIGNS

Standard Test Methods for Response Robots

Test Apparatuses, Procedures, Metrics and Forms





Performance Data Collection Forms

NIST
National Institute of
Standards and Technology
U.S. Department of Commerce

Standard Test Methods For Response Robots
ASTM INTERNATIONAL COMMITTEE ON HOMELAND SECURITY APPLICATIONS;
OPERATIONAL EQUIPMENT; ROBOTS (E54.08.01)

STATUS: VALIDATING-WK21819 Version 2009.88

ENERGY/POWER: ENDURANCE: PITCH/ROLL RAMP TERRAIN TRIAL

DATE 2009.____ ROBOT _____
FACILITY _____ ORGANIZATION _____
LOCATION _____ OPERATOR _____
EVENT _____ ORGANIZATION _____

BATTERY: NEW USED TEMPERATURE: -20°C 20°C 50°C

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U.S. Department of Commerce

Standard Test Methods For Response Robots
ASTM INTERNATIONAL COMMITTEE ON HOMELAND SECURITY APPLICATIONS;
OPERATIONAL EQUIPMENT; ROBOTS (E54.08.01)

STATUS: VALIDATING Version 2009.88

MOBILITY: OBSTACLE: STAIRS (30°/35°/40°/45°; WOOD/METAL) TRIAL

DATE 2009.____ ROBOT _____ LIGHTING: >100 LUX <1 LUX
FACILITY _____ ORGANIZATION _____
LOCATION _____ OPERATOR _____ COMMUNICATIONS: TETHER RADIO
EVENT _____ ORGANIZATION _____

START TIME (HH:MM) — END TIME (HH:MM) = ELAPSED (MM:SS) —

TEN LAPS THEN 1 MIN. DWELL TIME vBOT V

0 LIGHT

20 DARK

50

100

150

200

NOTES:

VIDEO FILE NAMING CONVENTION
ROBOTNAME-ENE-END

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U.S. Department of Commerce

Standard Test Methods For Response Robots
ASTM INTERNATIONAL COMMITTEE ON HOMELAND SECURITY APPLICATIONS;
OPERATIONAL EQUIPMENT; ROBOTS (E54.08.01)

STATUS: VALIDATING-WK21815

MANIPULATION: DIRECTED PERCEPTION: OBJECT IDENTIFICATION TRIAL

DATE _____ ROBOT _____
FACILITY _____ ORGANIZATION _____
LOCATION _____ OPERATOR _____
EVENT _____ ORGANIZATION _____

| | | | | | |
|---------------|----------------|-----------------|-----------------|------------------------|-------------|
| START (HH:MM) | FINISH (HH:MM) | ELAPSED (MM:SS) | CORRECT (PER #) | AVERAGE (MIN PER TASK) | % TASKS (%) |
| START (HH:MM) | FINISH (HH:MM) | ELAPSED (MM:SS) | CORRECT (PER #) | AVERAGE (MIN PER TASK) | % TASKS (%) |

SHELF LEVEL 100 CM

15° RAMP

NOTES:

VIDEO FILE NAMING CONVENTION
ROBOTNAME-MANIP-PER-#CM

| | | | | | |
|---------------|----------------|-----------------|-----------------|------------------------|-------------|
| START (HH:MM) | FINISH (HH:MM) | ELAPSED (MM:SS) | CORRECT (PER #) | AVERAGE (MIN PER TASK) | % TASKS (%) |
| START (HH:MM) | FINISH (HH:MM) | ELAPSED (MM:SS) | CORRECT (PER #) | AVERAGE (MIN PER TASK) | % TASKS (%) |

SHELF LEVEL 50 CM

15° RAMP

NOTES:

VIDEO FILE NAMING CONVENTION
ROBOTNAME-MANIP-PER-#CM

| TASK DESCRIPTION | START TIME (MIN) | REPETITIONS | END | ELAPSED | AVG |
|-------------------------|----------------------|---|-----|---------|-----|
| 45 DEGREE STAIRS | | | | | |
| WOOD | <input type="text"/> | <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 | | | |
| STEEL | <input type="text"/> | <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 | | | |
| 40 DEGREE STAIRS | | | | | |
| WOOD | <input type="text"/> | <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 | | | |
| STEEL | <input type="text"/> | <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 | | | |
| 35 DEGREE STAIRS | | | | | |
| WOOD | <input type="text"/> | <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 | | | |
| STEEL | <input type="text"/> | <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 | | | |
| 30 DEGREE STAIRS | | | | | |
| WOOD | <input type="text"/> | <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 | | | |
| STEEL | <input type="text"/> | <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 | | | |

NOTES:

VIDEO FILE NAMING CONVENTION
ROBOTNAME-MOB-STAIRS-##DEG-WOOD/METAL

NOTES:

LEGEND: CORRECTLY IDENTIFY 3 OF 4 VISUAL INDICATORS
COLOR(C), ICON (I), NUMBER (#), WORD (W)

TEST ADMINISTRATOR NAME/ORGANIZATION: _____
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Standard Test Methods For Response Robots
ASTM INTERNATIONAL COMMITTEE ON HOMELAND SECURITY APPLICATIONS;
OPERATIONAL EQUIPMENT; ROBOTS (E54.08.01)

STATUS: VALIDATING-WK11331 Version 2009.88

HUMAN-SYSTEM INTERACTION: RANDOM MAZE SEARCH TRIAL

DATE 2009.____ ROBOT _____ LIGHTING: >100 LUX <1 LUX
FACILITY _____ ORGANIZATION _____
LOCATION _____ OPERATOR _____ COMMUNICATIONS: TETHER RADIO
EVENT _____ ORGANIZATION _____

START TIME (HH:MM) _____
FINISH TIME (HH:MM) _____
ELAPSED (MM:SS) _____

START RETURNED TO START POINT?

START END

LEGEND: PARTIAL ID CORRECT ID MULTIPLE ID / MISSED TARGET ELEVATION COLOR ICON NUMBER WORDS

NOTES:

VIDEO FILE NAMING CONVENTION
ROBOTNAME-HSI-MAZE-SEARCH

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防爆性の必要性

JR西日本福知山線脱線事故
2005年(平成17年)4月25日



1階駐車場でガソリン漏れ

新潟県南魚沼市トンネル内爆発事故
2012年5月24日



トンネル内で可燃性天然ガスが発生

引火の恐れがある機器は導入できず



防爆性の機能評価
認定された機器の導入

国際的な研究開発ネットワークの構築

- 国際的な研究開発協力(国内外の叡智の結集)
- 施設の相互利用(実証試験・機能評価・オペ訓練の機能の相互補完)
- 研究者交流, 人材育成, ワークショップ・競技会開催
- 国際標準化の拠点構築(ロボットの性能評価や操作方法の標準化, 国際的な認証制度)
- 遠隔操作・ロボット技術やそのニーズに関するデータベースの構築・維持管理
- 国内の体制構築
 - 実証研究・訓練・配備の連携体制(JAEA, 産総研, 日本原電原子力緊急事態支援センター, 等)
 - 研究開発と人材育成の連携体制(JAEA, 大学, 研究機関)
 - 継続的な議論と恒久的な運用組織
 - 研究開発機関の職員枠の拡充