

LEADING-EDGE Simulation TRAINING



Skilled Mechanical Ability through Repetition of Technique

With this overarching principle, the SMART procedural training platforms - training systems with standardised user interface and scalable content - are designed for technical training institutions and engineering service providers.

The current generation of platforms combine state-of-the-art immersive AR (Augmented Reality) and VR (Virtual Reality) functionality with content in the form of 3D visual models, virtual interactivity and procedural logic. Trainees are engaged with participation to achieve new levels of learning beyond rote memorisation.

By incorporating the various SMART platforms into relevant phases of a technical training syllabus, instructors will not only be able to lead training facilitated by technology, but also allow trainees to go further with self-directed learning. Content can also be added or modified for increased training breadth and depth.

Engaging Trainees with Technology

The SMART procedural training suite consists of four platforms, each with a distinctive design and technology element to engage trainees and facilitate instruction or revision:

- Gamification
- Interactive AR
- Collaborative VR
- Assistive Live Display

Virtual Training with "Digital Twins"

The core of the content across all platforms are specific "digital twins" of appliances that allow procedures to be observed or practised virtually. Apart from avoiding resource constraints and risk of damage to operational appliances, trainees also get to visualise scenarios of malfunctions and even emergencies, along with the associated remedial procedures.

Content for Consistency and Coherence

While each of the platforms have characteristics suited for a training context - classroom teaching, lab activity or on-the-job revision - the content are unified through development and deployment processes, ensuring consistent presentation of information and coherence of learning by trainees.

Individual Proficiency and Crew Coordination

Networking is a common feature throughout the platforms, for trainees to participate in the same procedural training scenarios. In addition to building up procedural knowledge, trainees also practise communications protocol particularly for multi-crew procedures.



SMART PROCEDURAL TRAINING



Gamified Computer-Based Trainer

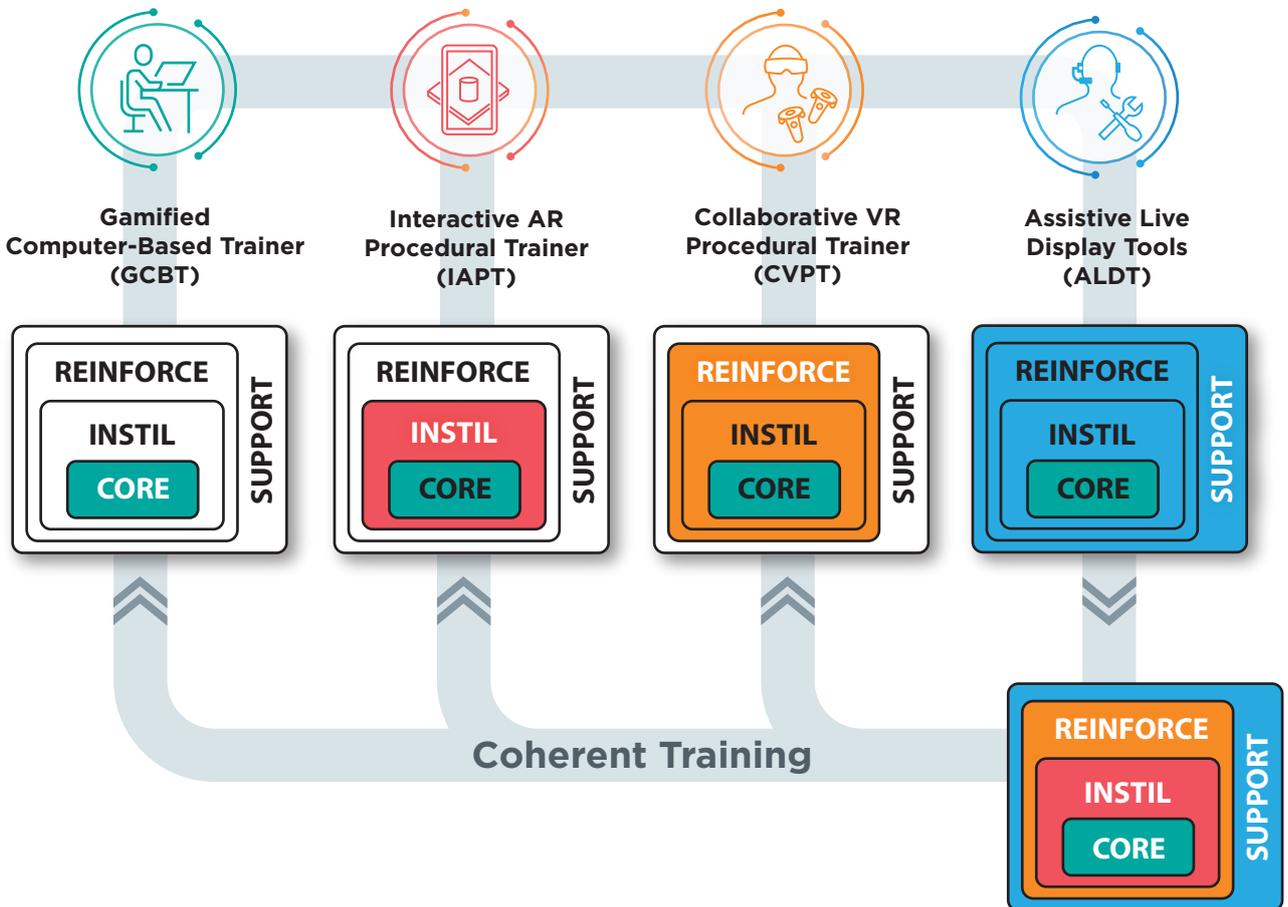
Interactive AR Procedural Trainer

Collaborative VR Procedural Trainer

Assistive Live Display Tools

3D Visual Models, Procedural Logic and Virtual Interactivity

COMMON CONTENT, PERVASIVE APPLICATION



Gamified Computer-Based Trainer (GCBT)



FEATURES

Motivational Elements

The GCBT platform is based on point-and-click adventure game design, including in-game puzzles for problem-solving exercises, and collectibles in the form of achievement badges for completing milestones - or some secret game objective. Pictorial maps help trainees to visualise their overall progress, as they seek to achieve high scores at each scenario and accumulate achievement badges for leaderboard placement.

Narrative-driven Course

In following a narrative for the course syllabus, trainees are familiarised with equipment parts and tools, as well as procedure frameworks and techniques, for core knowledge in procedural training. The incremental intensity of training modes and release of scenarios in stages provide guidance and pacing for the trainees, helping them to persist through the entire course.

Appealing Visual Aesthetics

Apart from 3D visual models replicating equipment and surroundings, the GCBT content consists of 2D artwork e.g. freehand drawings and paintings, that thematically support the narrative while delivering game-like visual aesthetics. Trainees are rewarded with "artwork trophies" or animated cutscenes upon significant milestones or completing sets of achievement badges.

Computer-Based Training (CBT) or courseware has been a cost-effective way to deliver ab-initio training courses simultaneously to many trainees - by allowing them to access training material in their own time, and learn at their own pace. In learning operations or maintenance procedures, CBT is useful for building core knowledge before the trainees proceed to hands-on practice etc. involving instructor supervision. However, it can also become an ineffective chore when trainees become bored with tedious interactions and bland visuals.

For a state-of-the-art CBT that will keep trainees engaged in the course of training, ST Engineering's platform of Gamified CBT (GCBT) offers a novel form of procedural training adapted from video games - with concepts of exploration, collection and competition. Trainees are presented the scenarios with a narrative of progressive objectives, while being treated with thematic 2D artwork and 3D visual models in a game environment, for a training experience that will leave a vivid and lasting impression.

SPECIFICATIONS

Software application for desktop, laptop or tablet PCs

- Pictorial maps for scenario selection and progress tracking
- Learning through a point-and-click interface
- Exploratory interaction with in-game elements
- Collect achievement badges and attain scores
- "Game over" for critically hazardous interactions

Self-directed training with modes for each scenario

- Step-by-step instruction by Virtual Instructor in Tutorial mode
- In-game visual aids guide trainee through procedure tasks
- Practice mode limits visual aids to encourage recall
- Assessment mode omits visual aids and generates score

Progressive objectives over course of training

- Scenarios grouped into stages for paced training
- Pictorial progress map with milestones
- Completing sets of achievement badges on the side
- Rewards of "artwork trophies" or animated cutscenes
- Compleitive leaderboard of high scores and completed sets

Visual replication of operating environments

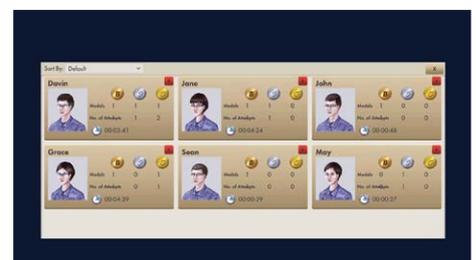
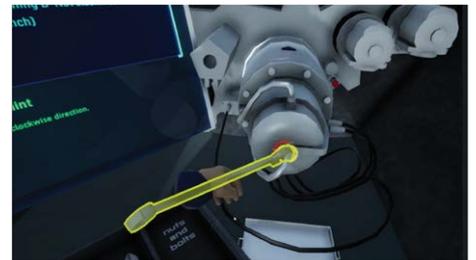
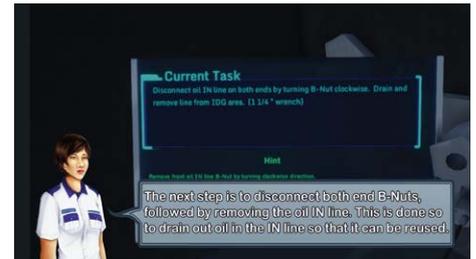
- 3D visual models of equipment and surroundings
- Navigable virtual operating environment
- Realistic rendering and lighting effects

Audio and Communications

- Sound effects and aural cues over stereo audio headset

(Optional) Monitoring Station for class supervision

- List of connected PCs on network and ongoing scenarios
- Joining the Team Chat of a selected scenario
- Remote view of trainee PC screenshots
- Retrieval of trainee profile and procedure progress log



Interactive AR Procedural Trainer (IAPT)



Maintenance training has traditionally involved live demonstrations of procedures by experienced personnel at actual equipment, to let trainees observe the actions effectively from different angles and build up their procedural knowledge. However, this is constrained by availability of the experienced personnel and demonstration equipment, as well as attendance by trainees at specific venues.

Leveraging the latest Augmented Reality (AR) technologies, the IAPT offers a mobile and engaging learning platform that allows trainees to learn - anytime and anywhere. As a software application on handheld devices, the IAPT allows simultaneous use by many trainees within or outside the typical classroom. Trainees interact with virtual equipment and view demonstrations by animated human characters, all visually rendered on real-world surfaces by tracking of reference images, for a memorable experiential learning experience.

FEATURES

Flexible AR Classroom

Trainees interact with virtual equipment visually rendered on real-world surfaces through a touchscreen user interface of a handheld device, and view procedure demonstrations with 3D perspectives according to their handling of the device. This learning experience is available to trainees anywhere they bring their IAPT device.

Group Interactivity

In Networked mode, the IAPT allows multiple trainees to view the same virtual equipment and procedure demonstrations simultaneously, while taking different viewing angles through handling of their devices. With a Group Coordinator application, they may also be assigned specific roles to interact with the virtual equipment, particularly for procedures involving crew coordination.

Advanced Visual Reference

Through detailed 3D visual modelling including the effects of procedures, the virtual equipment can serve as a "digital twin" of actual equipment for reference purposes. Visual comparisons with the virtual equipment in 3D perspectives - as it changes with procedure tasks - can help trainees to determine the state of the actual equipment and guide them on the relevant actions.

SPECIFICATIONS

Mobile software application for handheld devices

- On Android or IOS with touchscreen user interface
- Camera access to capture real-world background for augmentation
- Standalone or Networked operating modes of training

Augmented Reality (AR) visualisation

- View of virtual equipment on real-world surfaces or scenery
- Real-world placement in Tracking visualisation mode
- 3D perspectives according to physical movement and handling of device
- Alternative Non-Tracking visualisation mode

Procedure setup and observation

- Selection of procedure and specific role (where applicable)
- Touchpoints to trigger procedure tasks according to role
- View of current task description and virtual demonstration
- Logical execution for procedure completion

Animated human characters and use of hands / tools

- For demonstration of body posture (where applicable) and task actions
- Animation according to prescribed standard task execution

Group Interactivity in Networked mode

- Synchronisation with Procedure Logic Processor (PLP)
- Group Coordinator application on local network
- Procedure tasks are triggered by assigned roles
- Unassigned roles are automatically simulated for the group

Visual replication of equipment

- 3D visual models of equipment including effects of procedures
- Adjustable scale, height and rotation for visualisation



Collaborative VR Procedural Trainer (CVPT)



FEATURES

Immersive VR Lab

Through the head-mounted display and handheld controllers of a room-based VR setup, trainees are immersed in a VR environment where their procedure knowledge will be naturally reinforced through exercise of hand motion and body postures in virtual interactions with equipment. They can even be "exposed" to potentially dangerous scenarios, for practice and assessment of their individual proficiency and crew coordination.

Collaborative Functions

The CVPT caters to team-based training. Through the networking of multiple Trainee Stations with centralised procedure synchronisation, many trainees can participate in a single training scenario, each taking on a different role to learn its specific tasks. Where the number of trainees are fewer than the number of roles, Non-player Characters (NPCs) will automatically fill in the roles and complete the procedure with the participating trainees.

Instructional Facility

With a comprehensive Instructor Station to setup, monitor and control the training scenario over network - including integrated voice communications - instructors are able to turn-around scenarios quickly and conduct team-based training efficiently. The CVPT also includes simulation data recording and playback of training sessions, allowing instructors to debrief trainees with alternative perspectives and enhance training outcomes from each session.

Traditional maintenance training typically requires system downtime, availability of spares or dummy equipment for hands-on practice. Trainees are also exposed to risks of injury when handling heavy machinery, especially when they have no prior experience.

Harnessing the latest Virtual Reality (VR) technologies, the CVPT offers next-generation immersive training capabilities - allowing trainees to practise and assess their procedure knowledge, without the hassle of system downtime or provisioning of spares. The customisable VR environments of the training scenarios - replicating the relevant tools, equipment and surroundings in 3D visual models - also enables trainees to experience scenarios that are not feasible with dummy equipment, or just too dangerous to be simulated in live training.

SPECIFICATIONS

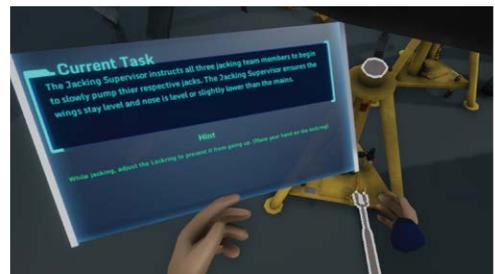
Trainee Stations with room-scale VR technology

- Immersive visuals with Head-mounted Display (HMD)
- Precision handheld controllers for virtual interactions
- (Optional) VR gloves for free-hand and finger motion
- Procedure guidance with visual aids in Practice mode
- Visual warnings of collisions with virtual objects
- Failure upon critically hazardous contact or interactions



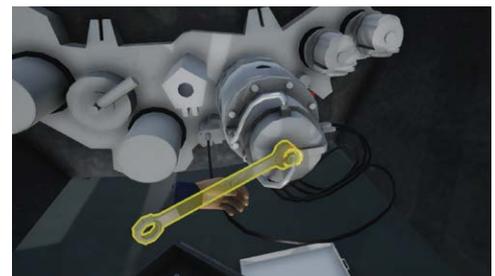
Instructor Station for setup, monitoring and control

- Scenario selection and role assignment
- Briefing, Practice and Assessment modes of training
- Activation of emergency procedures
- Repeater views of trainee HMDs
- Adjustable tactical camera view of trainee avatars
- Procedure progress on task tree chart
- Event logging, alerts display and timeline markers
- (Optional) Synchronised separate Observer Station



Cooperative Non-player Characters (NPCs)

- Automatically simulated to take on unassigned roles
- Logical execution for procedural task completion
- Animation according to prescribed standard task execution
- NPC-only virtual demonstrations in Briefing mode



Multiple trainee participation over network

- Synchronisation with Procedure Logic Processor (PLP)
- Scalable NPC simulation allows variable number of trainees
- Centralised control from a single Instructor Station



Visual replication of operating environments

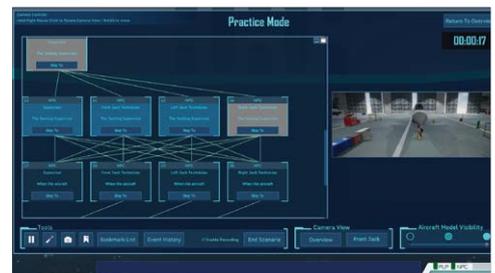
- To-scale 3D visual models of equipment and surroundings
- Navigable virtual operating environment
- Realistic rendering and lighting effects
- Configurable weather and visibility

Audio and Communications

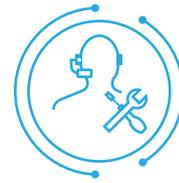
- Sound effects and aural cues over stereo audio headset
- Team Chat among Trainees in the same scenario
- Private Chat selection between Instructor and Trainee

Recording and playback for Debriefing

- Re-enactment of procedure from simulation data
- Adjustable tactical camera for alternative perspectives
- Synchronised audio and communications on Team Chat
- Review events with set timeline markers
- (Optional) Compatible standalone Debriefing Station



Assistive Live Display Tools (ALDT)



Whether as trainees in On-Job-Training (OJT), or experienced personnel in job assignments, maintenance workers need access to information on procedures to supplement their memory, even if just to check their knowledge e.g. to ensure safety precautions are complete. However, many types of maintenance work require the use of both hands and constant visual attention on equipment, making it difficult if not dangerous to handle hardcopy manuals or handheld display devices.

Combining Augmented Reality (AR) technologies with a head-mounted device for hands-free usage, the Assistive Live Display Tool (ALDT) offers a safe and convenient solution for maintenance workers to check their knowledge and obtain step-by-step guidance - anytime and anywhere. With durable hardware compatible with safety helmets and option of intrinsic safe specifications, the ALDT can be used even in the challenging work environments of Oil & Gas.

FEATURES

Live Display Overlays

Viewed on a virtual tablet through the "viewfinder" on the head-mounted device, live display overlays are contextually positioned on real-world scenery and equipment with AR, to provide information on procedures without obstructing the user's normal view of surroundings. The ALDT serves as a "digital assistant" for self-directed OJT and workflow automation.

Hands-free User Interface

All functionality are completely accessible with voice control alone, facilitated by a consistent user interface including visual cues and voice guidance visible on the virtual tablet. Furthermore, there is automatic detection of visual elements in real-world scenery and equipment for context. The ALDT augments individual proficiency and increases the efficiency of maintenance work.

Integrated Communications

ALDT devices networked with a central server can tap into an expanded and shared repository for procedure information. While troubleshooting, users can also use the IP telephony features on the ALDT to communicate with other users and call for support.

SPECIFICATIONS

Mobile software application on a head-mounted device

- Integrated camera and viewfinder-style display with a Virtual Tablet
- Non-obstructing of normal view and usable with eyewear
- Mounting compatible with safety helmets
- Rugged device with option of Intrinsic Safe specifications

Augmented Reality (AR) visualisation

- Live display overlays on actual equipment in real-world scenery
- Tracking of visual elements for positioning of overlays
- 3D perspectives according to physical movement with device

Procedure selection and guidance

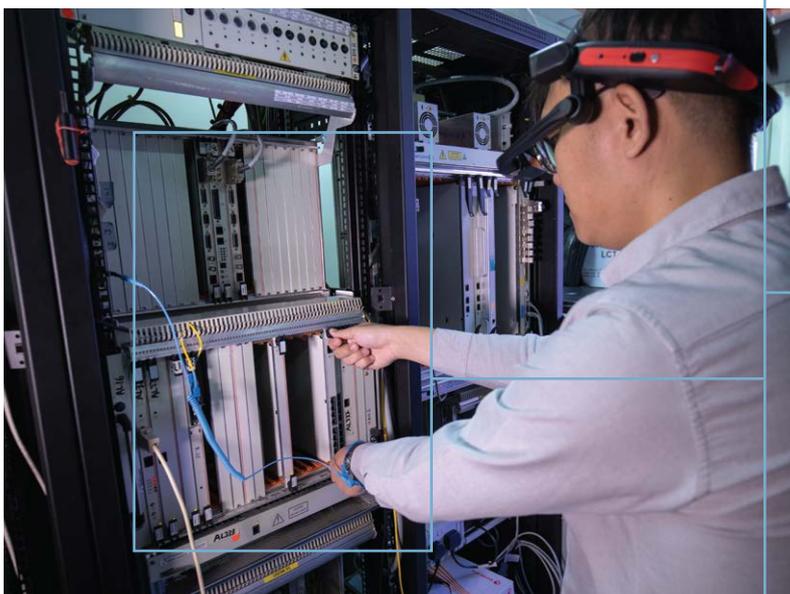
- Selection of procedure and specific role (where applicable)
- Suggested procedure for selection upon detection of visual elements
- Step-by-step control of procedure information

Accessibility of voice controls

- Visual cues show what are detected and their related voice controls
- Voice guidance by contextual menu of valid voice commands
- Navigation of Virtual Tablet UI by voice controls alone

Remote support and monitoring over network

- Viewing a list of connected users within the same network
- Making calls to other users with hands-free operation
- Sending photo snapshots to other users for supporting diagnosis



www.stengg.com
trainingsimulation@stengg.com

© 2021 ST Engineering Training & Simulation Systems Pte Ltd. All rights reserved.

DOP 0121



www.stengg.com/training-and-simulation