A-P-T RESEARCH, INC.
AN EMPLOYEE-OWNED COMPANY

CEAEC SPRING MEETING
IMESAFR© UPDATE

Niagara – 05/23
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Presented by: Bill Evans

OUTLINE

- Funding Update
  - Sponsorship Group
  - Licenses
  - Summary of Users (v2.2)
- Features Added for IMESAFR v2.2
  - Summary of Improvements
    - New P_e Table
    - New EF Table
  - Changes Since Introduction
  - Future Plans
- Sponsorship Level Summary
- Future Training Opportunities (Tentative)

SPONSORSHIP GROUP UPDATE

- Sponsors/primary contacts
  - Orica – Gold (POC: Noel Hsu)
  - Nelson Brothers – Silver (POC: Clint Fritz)
  - Austin – Silver (POC: Tom Cochran)
  - Dyno – Silver (POC: Kevin McNeil)
  - IME – Bronze (POC: Josh Hoffman)
  - Other/higher level Sponsors being sought
- Licenses
  - Annual cost USD 2000
    - Expected annual licenses: 20 (18 current)
      - Over 50% expected to be regulators
      - Expect to lose most 'independent' trainees
- Total Planned Annual Budget +/- USD 200-220,000
  - 2022/23 at 60-70% of planned
  - This excludes training. Training courses pay for themselves.

USER COMMUNITY STATUS

Sponsored

- 25 trained (9 full; 16 upgraded)

- 23/28 licenses activated

Non-Sponsored

- 74 trained (18 full; 56 upgraded)

- 18 licensed
  - Johanna Viljoen (Viljoen Consulting Services)
  - Josef Hart (USDOE)
  - Tyler Boutilier (Port of Halifax)
  - Sebastian Towler (NRCan-ERD)
  - Rebecca Holmberg (NRCan-ERD)
  - David Mohn (NRCan-ERD)
  - Richard Bertrand (Consbec)
  - Crystal Clardy (ATF-EIPB)
  - Michael O'Lena (ATF-EIPB)
  - Bill O'Brien (ATF-EIPB)
  - David Rodriguez (Baker Risk)
  - Dylan Haddix (Nelson Brothers)
  - Misty Scott (Halliburton)
  - Jessie Kelsey (AES)
  - Joshua Zimitat (RSHQ)
  - Yuh Inn Liong (Thales Group Australia)
  - Doug Maggard (Quick Supply)
  - Jeremy Delcourt (Tiecoura SINABA/ISSeP)

V2.2 TRAINED – DEMOGRAPHICS

Country	# of People Trained
US	30
Australia	27
Canada	25
Peru	1
Belgium	3
UK	2
Turkey	1
Norway	1
Portugal	1
Malaysia	3

Last Trained On	
V2.0	5
V2.1	71
Other (New)	18

Agency	# of People Trained
Industry	62
Regulatory	19
Government	9
Consulting	4

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V2.2 FEATURES ADDED

Feature	Item	Functionality
Barricade Batch Black Box	Add barricade to all ES	Adds barricade to affected ES or all ES if specified
	Remove barricades from all ES	Removes barricade for the selected PES for all ES
	Only add barricades for ES on certain sides of the PES	If particular PES sides are selected, only ES on that side should have a barricaded added, relative to the front of the PES. Rotation of the PES should be accounted for.
	"Are you sure?" prompt for removing barricades	Application should ask user if they are sure when removing barricades. OK and Cancel buttons should function appropriately.
	Adding barricades should not overwrite existing barricades	Using the bulk took should not overwrite any existing barricades defined at each ES.
	Bulk barricade tool is listed in the "Tools" menu	The barricade utility should be listed in the new "Tools" menu on the menu bar.
New Barricade Indicators	Barricade indicator visibility can be set in the context (right-click) menu	Menu exists
	Display – barricade – when selected	For ES with this option on, barricade indicator lines should only be drawn when the ES is selected
	Display – barricade – always	Barricade indicator lines always drawn
	Display – barricade – never	Barricade indicator lines are never drawn
	Menu bar – View – show barricade lines	When selected (a check will appear next to the item)
	Menu bar – View – show barricade lines	When selected, barricade lines will be drawn per each ES display option
	Menu bar – View – show barricade lines	When unselected, all barricade lines will be removed

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V2.2 FEATURES ADDED

Feature	Item	Functionality
	Menu bar – View – show barricade lines	When reselected, all barricade lines will be drawn according to the ES option, so if there were ES using the "Always" option, those lines should reappear.
	Barricade indicator lines should update	While barricade lines are being drawn, they should update as the barricade information is updated.
Active and Display options for structures	PES and ES "Visible" and "Active" options	Options should appear under "Display" in the context menu
	PES and ES "Visible" and "Active" options	Options are in the main ES properties dialog
	PES and ES "Visible" and "Active" options	Options are in the main PES properties dialog
	Visible option	When unselected, structure should not be visible in the site view but will still be included in calculations
	Visible option	When unselected, in the scenario tree, the name should be in italics and include "[hidden]"
	Active option	When unselected, the structure will not be included in any calculations
	Active option	When unselected, the structure will be hidden
	Active option	When unselected, the name in the scenario tree should be in italics and include "[deactivated]"
	Visible and Active in QD	Visible and active options should work in QD mode as they do in Risk mode

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Feature	Item	Functionality
	Deactivated structures listed in reports	Deactivated structures should be listed in the first block of reports
	Visible and Active status saved in scenario	Visible and active status should be saved with the scenario
P(e) calculation update	Compatibility Group	Compatibility Group input option has been removed
	Hazard Division	Pe calculations are updated based on HD
	Activity	Activity list updated to reflect latest P_e table
	Environmental Factors	Pe calculations are updated based on selected environmental factors
	Environmental Factors	Environmental list updated to reflect latest P_e table
	Environmental Factors	Correct environmental factors are greyed out for each activity based on the new Pe table
Report Generator	Input report	Option available in report generator for input report
	Input report	Input report generates an accurate report for inputs from all PESs and ESs
Overall Site Contours	Generate site contour lines for overall site	Display combined risk contours using contour generator
Path (Metric Units)	Ability to build PTRs	Application should allow user to build paths and roads in English and Metric units
Exposure Input Correlation	Set all unassigned to no correlation button	Button in the exposed personnel tab to set all unassigned values to a default of no correlation

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SUMMARY OF V2.2 UPGRADES

- The largest change was in the P_e Matrix
  - Conversion from CG (Compatibility Group) to HD (Hazard Division)
    - Followed US DoD guidance on new values for some Activities
    - Followed US DoD guidance on trends across an Activity
      - Including effects of CG differences between military and commercial Activities
  - Changes to Environmental Factors
    - Some now built in
    - More environmental factors may be added
  - Overall, somewhat less conservative than v2.1
- Complex analyses much easier
  - Barricading much simpler, more intuitive
    - Barricades can be shown
  - Active/Inactive, Visible/Invisible PES/ES
- Input Reports
- Overall Site Contours

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IMESAFR v2.1 P_e Matrix

Probability of Event Matrix (P_e)

PES used primarily for:	Source	Probability of Event (PES-year)		
		* I	* II	* III
Commercial long-term storage	Industry; not affected by CG	2.80E-05	2.80E-05	2.80E-05
Bulk loading and unloading	Industry; not affected by CG	3.08E-04 (pump) 4.57E-05 (reservoir)	3.08E-04 (pump) 4.57E-05 (reservoir)	3.08E-04 (pump) 4.57E-05 (reservoir)
Perforating gun assembly	Industry; not affected by CG	1.30E-03	1.30E-03	1.30E-03
Day magazine storage	Industry data scaled by DoD trend	2.80E-04	2.80E-04	2.80E-04
Manufacturing	Industry; not affected by CG	4.10E-03	4.10E-03	4.10E-03
AN storage	Industry; not affected by CG	4.67E-06	4.67E-06	4.67E-06
Commercial loading/unloading	DDESB TP-14 rev 4	5.71E-04	5.71E-05	1.90E-05
Assembly	DDESB TP-14 rev 4	4.74E-03	4.74E-04	1.58E-04
Demilitarization	DDESB TP-14 rev 4	2.43E-02	2.43E-03	8.11E-04
Disposal	DDESB TP-14 rev 4	2.43E-02	2.43E-03	8.11E-04
Inspection	DDESB TP-14 rev 4	8.24E-04	8.24E-05	2.75E-05
Lab	DDESB TP-14 rev 4	4.25E-03	4.25E-04	1.42E-04
Intransit Storage	Industry data scaled by DoD trend	8.85E-05	8.85E-05	8.85E-05
Repackaging	DDESB TP-14 rev 4	8.24E-04	8.24E-05	2.75E-05

* I. Includes Compatibility Groups: L, A, B, G, H, J, F
* II. Includes Compatibility Group: C
* III. Includes Compatibility Groups: D, E, N

IMESAFR v2.1 P$_e$ Matrix

Probability of Event Matrix (P$_e$)

PES used primarily for:	Applicable Environmental Factors	Probability of Event (PES-year)		
		* I	* II	* III
Commercial long-term storage	A1, A2, A6, B1, B4, D1, E1	2.80E-05	2.80E-05	2.80E-05
Bulk loading and unloading	A1, A3, A4, A6, B2, B3, B4, C1, E2	3.08E-04 (pump) 4.57E-05 (reservoir)	3.08E-04 (pump) 4.57E-05 (reservoir)	3.08E-04 (pump) 4.57E-05 (reservoir)
Perforating gun assembly	A1, A2, A3, A4, A6, B1, B2, B3, B4, C1	1.30E-03	1.30E-03	1.30E-03
Day magazine storage	A1, A2, A6, B4, C1, D1, E1	2.80E-04	2.80E-04	2.80E-04
Manufacturing	A1, A3, A4, A5, A6, B1, B3, B4, C1, D1, E1, E2	4.10E-03	4.10E-03	4.10E-03
AN storage	A1, A6, B1, B4	4.67E-06	4.67E-06	4.67E-06
Commercial loading/unloading	A1, A2, A4, A6, B1, B3, B4, C1, D1, E1	5.71E-04	5.71E-05	1.90E-05
Assembly	A1 , A3, A4, A5, A6, B1, B2, B3, B4, C1	4.74E-03	4.74E-04	1.58E-04
Demilitarization	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, D1, E1	2.43E-02	2.43E-03	8.11E-04
Disposal	A1, A2, A3, A4, A5, A6, B1, B3, B4, C1, D1, E1	2.43E-02	2.43E-03	8.11E-04
Inspection	A1, A2, A3, A4, A6, B1, B3, B4, C1, D1, E1	8.24E-04	8.24E-05	2.75E-05
Lab	A1, A2, A3, A4, A5, A6, B1, B3, B4, C1, D1, E1, E2	4.25E-03	4.25E-04	1.42E-04
Intransit Storage	A1, A2, A6, B3, B4, D1, E1	8.85E-05	8.85E-05	8.85E-05
Repackaging	A1, A2, A3, A4, A6, B1, B3, B4, C1, D1, E1	8.24E-04	8.24E-05	2.75E-05

* I. Includes Compatibility Groups: L, A, B, G, H, J, F
* II. Includes Compatibility Group: C
* III. Includes Compatibility Groups: D, E, N

IMESAFR Current v2.2 P_e Matrix

Activity	Probability of Event & Applicable Environmental Factors			
	HD 1.1	**HD 1.3**	**HD 1.5**	**HD 5.1**
Storage	2.80E-05 D	8.40E-05	2.80E-06 D	2.80E-07
Bulk loading and unloading - Pump	3.08E-04		3.08E-05	3.08E-06
Bulk loading and unloading - Reservoir	9.74E-05		3.08E-06	9.74E-08
Perforating gun assembly	1.30E-03			
Manufacturing	4.10E-03 D	4.10E-03	4.10E-04 D	4.10E-05
Storage - AN				4.67E-06
Loading and Unloading	3.15E-06	2.84E-05	3.15E-07	3.15E-08
Assembly	5.37E-05	4.83E-04		
Demilitarization	7.78E-04	2.33E-03		
Disposal	7.78E-04	2.33E-03	7.78E-05	7.78E-06
Inspection	2.05E-05	1.85E-04		
Laboratory	9.75E-05	2.93E-04		
Repackaging	2.05E-05	1.85E-04		

Universally Applicable Factors:

Environmental Factor Legend

A — Increase P_e by a factor of 10 for:

1. Operations in substandard conditions or adverse environments
2. Operations involving dangerously unserviceable items awaiting destruction
3. Initial tests of new systems
4. Operation occurring in hazardous environments with gases, fibers, acids, etc.
5. Remote operations required for operator safety
6. Heightened security levels (DHS NTAS Imminent Threat Alert)
7. Storage with multiple inventory turnover per day
8. Highly sensitive or unstable explosive

B — Increase P_e by a factor of 3 for:

1. Outdoor operations normally done indoors
2. Operations at the well-site (on land or offshore)
3. Three-shift operations
4. Heightened security levels (DHS NTAS Elevated Threat Alert)
5. Storage in an ISO container, trailer, or equivalent
6. Storage not on an explosives site, e.g., a safe haven

C — Increase P_e by a factor of 2 for:

1. Two-shift operations

D — Decrease P_e by a factor of 3 for:

1. Operations involving only water-based explosives

E — Decrease P_e by a factor of 10 for:

1. Operations without a pump (with conveyor belt, auger, bucket conveyors, pneumatic, etc.)

SOFTWARE V2.2.16

- Issues that have been resolved:
  - There is now a dialogue box to indicate when barricades are added using the bulk barricade tool
  - P_e Matrix has been updated
  - Barricade indicator lines now show for PTRs
  - Report generating issues have been resolved
- Current known issues
  - Issues canceling a PES as an ES
  - Barricade indicator lines should update when changes are made

- APT will provide some ongoing support to the IMESAFR v2.1 software. This is not funded by Sponsors/licensees. IMESAFR v2.0 support ended in 2022 and v2.1 will not be upgraded and will 'sunset' early next year.

- The long-term viability of IMESAFR requires a sizeable software development/improvement budget. Therefore, more sponsorship and/or software license funding is needed.
  - The 2022/23 funding level was/is only enough to develop, launch and support IMESAFR v2.2
  - No v2.3 development has been carried out nor is planned for this year
  - The ISP has had a meeting but has not been formally restarted

- The Sponsors have agreed to future development
  - Not all improvements identified by the ISP/Sponsor Group were implemented in v2.2
  - The Aggregation Model is nearly complete but awaits funding from the ATF

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Sponsor Tiers	Cost	Number of Licenses	Sponsorship Benefits for all Tiers	50% Off Training For Sponsorship Licenses	Advanced Tech Support[+]	Free Web-Based Upgrade Training	50% Off Licenses Above Sponsor Licenses	Votes on Priorities in IMESAFR Development Team
Platinum	US$75K/year	20	Entitles the sponsor to a number of licenses for trained users based on the chosen tier. Standard tech support. Free corporate access to "awareness sessions" and free incremental software updates. Advanced support to regulators (including assisting regulators on variance/derogation submissions from partner companies). Sponsor fees also support regulators who are unable to pay for training. Sponsors will be identified by sponsorship tier in all software material, training material, IMESAFR website, etc.	✓ Plus 50% off for any other employees	✓ (40 hrs)	✓	✓	4
Gold	US$50K/year	12		✓ Plus 50% off for any other employees	✓ (20 hrs)	✓		3
Silver	US$30K/year	5		✓				2
Bronze	US$10K/year	1		✓				1

[+] Advanced tech support includes answering questions and providing support not generally covered under standard software tech support. It does not include APT conducting analyses for sponsors, though APT offers these services through independent IMESAFR consulting contracts/agreements.

TRAINING (TENTATIVE)

- August
  - *29th-31st Full Training in Huntsville (NCETR) (Dedicated Class)*
- September
  - Week of 18th : Full Training in Belgium
  - *Week of 11th or 25th: UK CAA Class (Dedicated Class)*
  - 28th: Upgrade Training – Virtual
- October
  - Week of 23rd:Full Training in Huntsville
- November
  - TBD: Full Training in Canada
- December
  - 12th: Upgrade Training – Virtual
  - Full Training in Australia around MABS Conference