Improving In-Service Small Arms Systems – An Australian Experience
• **Mr Collin Galvin** – Chief Engineer Armaments Australian DoD
  - All engineering for Australian Defence Forces Small Arms up to 40mm and the Javelin Missile System.

• **Graham Evenden** – Soldier Systems Development Manager:
  - Thales Australia:
    - Employs circa 6,500 people.
    - OEM for Small Arms & Ammunition.
  - Small Arms Test & Evaluation.
  - Soldier Systems Business Development.
Abstract

- Increasing demands on Defence whilst under increasing budget pressures
- Multi national operations resulting in a need for enhanced interoperability
- Higher tempo of operations resulting in a need for increasing reliability
- No off the shelf technologically advanced solutions available providing a step capability improvement
- All of these factors has resulted in the need to do more with current systems
Areas of Best INTEROPERABILITY of 5.56mm Ammo

- **Weapon**
  - F88NZ, F88, F88SA1, F88SA2
  - “EF88” and F88SA2
  - SS109
  - M4
  - M16

- **Ammunition**
  - F1*
  - F1A1*
  - M855

- **Port Pressure (not to scale)**
  - Lower
  - Higher

* Offers Ballistic Temperature Stability (-46C - +71C, -50.8F – 159.8F)
• Interoperability
  ‣ Australian 5.56mm ammunition Natures (F1, F1A1) and US M855 ammunition types.

• Reliability
  ‣ The improved Australian 5.56mm assault rifle (AUF88SA2) – what and why.

• The Immediate Future (considering Technology)
  ‣ The Future Australian assault rifle EF88 and Project Land 125 Phase 3C.
Armaments

F1A1 – 5.56 Ball

Current F1 projectile profile optimised. Improved tip diameter (Meplat) & modified Boat tail length

Current F1 Case bridge and wall thickness optimised to increase internal case volume, to allow the use of more progressive propellant.

Propellant AR2210 manufactured within a specific sub-set of the current specification to achieve increased port pressure, while maintaining AR2210’s excellent BTI

Propellant designated as AR2210V01

Green Tip Painting applied to denote SS109 type ammunition

A new cup design with a lower base thickness to achieve optimised bridge and wall thickness on the Case.

Current F1 Cartridge components/parts optimised to meet interoperability requirements and improve performance.

Trajectory match with NATO reference, improved port pressure for optimisation in the M4 with no deterioration in performance in the F88
• Operational feedback from deployed soldiers provided the catalyst for detailed analysis of the rifle design
• Primary observation raised was failure to fully lock with a full magazine after manual cocking

**A joint investigation between Australian Government and Thales “lets make things better now!”**
The F88SA2 – Design Improvements Drivers

• The F88SA2 satisfied the original specification ARMY(AUST)6443 mid 1980s.
• The user expects more now – particularly on operations.
• Initially Australian DoD began investigations.
• As Thales built up their international Small Arms design and T&E capability the lead for the investigation and as a result design improvements responsibility was transferred to the design authority with overview by the DoD
• The Australian Soldier Modernisation Programme Land 125 Phase 3C, challenges are:
  ▸ MRBS Requirement increased from 1:500 to 1:2,500
  ▸ MRBF Requirement increased to 1:6000 Baseline and 1:10,000 desirable.
• Thales able to lever new capabilities quickly to make significant enhancements to the SA2 system – now in service.
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**Video of SA2 with no clash**
Video of SA2 with clash

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SA2 SLIDE 1
10

Armaments

The F88SA2 – Design Improvements

Smarter. Safer.
Smarter. Safer.

Slide braking video clip with compression

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1 June 2011

Armaments
**Slide braking video clip with NO compression**

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1 June 2011

**Armaments**
Smarter. Safer.

The F88SA2 – Design Improvements
The F88SA2 – Design Improvements

**Butt:**
- Additional gauging
- Revised welding and scraping process.

Reduced erroneous friction on slide.

**Gunlock:**
- Data pack tolerances of key features tightened
- Bolt face chamfer increased
- Additional gauging

Quantity and consequence of clash decreased.

**Ejection Port Cover:**
- Using a new design
- Less likely to bend and interfere with slide

Reduced erroneous friction on slide.

**Hammer Mechanism:**
- Hammer spring redesigned improved for manufacturability
- Move back to carbon steel to eliminate the gauling potential for stainless steel

More consistent hammer operation through extended life.

**Force of Spring Lock Long:**
- Raw material used is at higher end of spec
- Return to raw (uncoated) spring.

Spring consistently produces required force through extended life.
Acceptance Endurance and Environmental Testing

- 4 randomly selected weapons each fired 6,000 rounds
- 2 stoppages
- All component wear characteristics measured.
- To be extended to 12,000 rounds.
- This will help inform a usage based Maintenance Program currently being investigated the DoD
In addition to normal testing the following AQL Sample Acceptance Testing occurs:

- 150 round function tests – zero stoppages.
- Slide velocity – criteria for opening and closing - zero failures.
- Over 700,000 rounds fired in F88SA2 programme so far.
A weapon that surpasses the demanding reliability requirements set by the Australian Defence Force for the next generation – **today!**
EF88 Design is therefore a direct consequence of User Requirements
**Areas for Enhancement**

- **Modified Butt**
- **New Sight Housing**
- **New GLA**
- **New Receiver**
- **Flash Hider**
- **Fluted Barrel**

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• This stage will deliver a **tested and production ready** EF88 rifle.

• Key dates are:
  - Commenced Apr 2011.
  - Design and Testing activities complete and data ready for Government approval in Dec 2012.
  - Ready to manufacture in 2013

• The EF88 builds on the new F88SA2 now in service and incorporates successful technologies from the XF90 CD.

• High levels of backwards compatibility with current systems.
• The pace of current Small Arms technological advances confirms a need to extend life of current Austeyr System and its ammunition via enhancements.

• Land 159 is the next small arms replacement project for the Australian Defence planned for 2022.

• Move to F1A1 ammunition.

• Armaments Logistical Support Contract a joint Australian Defence Organisation and Thales initiative to provide a more efficient support to sustainment of ADF weapon system.