40th Annual Armament Systems
Guns-Ammunition-Rockets-Missiles
Conference and Exhibition
April 25 –28, 2005

40mm CTWS Supporting UK and France

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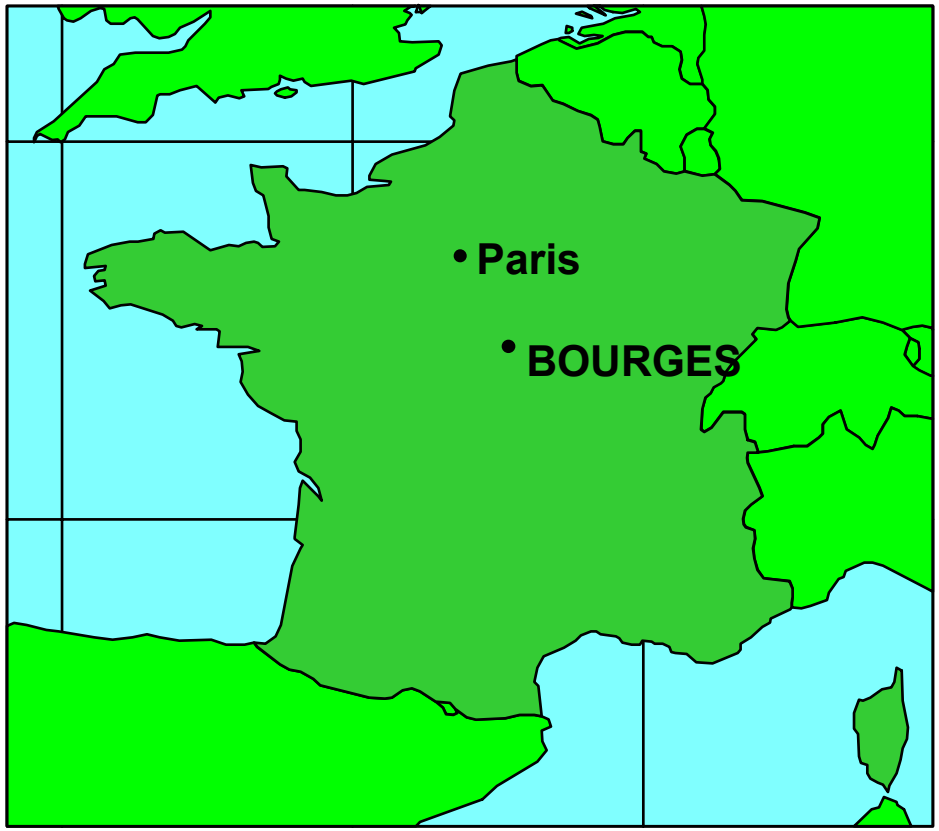
CTA International



- CTAI is a joint venture company 50/50 BAE Systems and Giat Industries.
- Dedicated team, 40 strong, British and French engineers and scientists based in Bourges, France.
- Whole company focused on development of 40mm Cased Telescoped Weapon System.
- Technology Background funded from industrial investment.

Private Venture Investment since 1994 - >€52M

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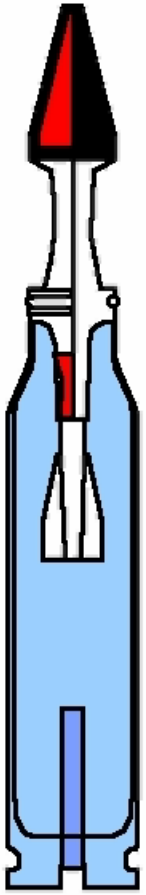
Cased Telescoped Technology

Principle of Technology

‘Telescoped’ ammunition



30% saving in volume for the same performance

30% more performance for the same volume

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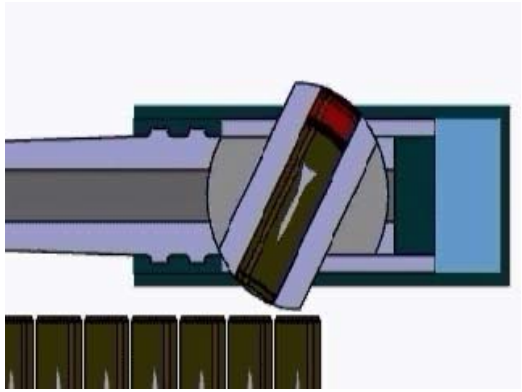
Cased Telescoped Technology

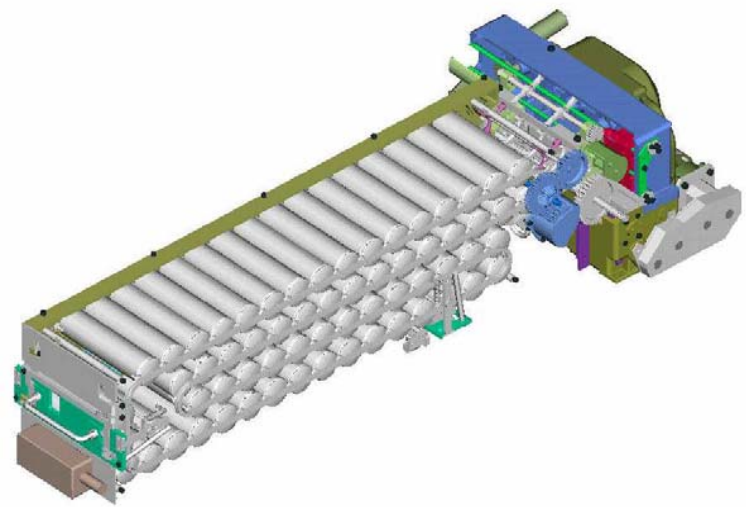
Cylindrical cartridges enable a much simpler Cannon mechanism As a consequence the overall cannon system is substantially smaller

Rotating chamber and ‘push through’ concept

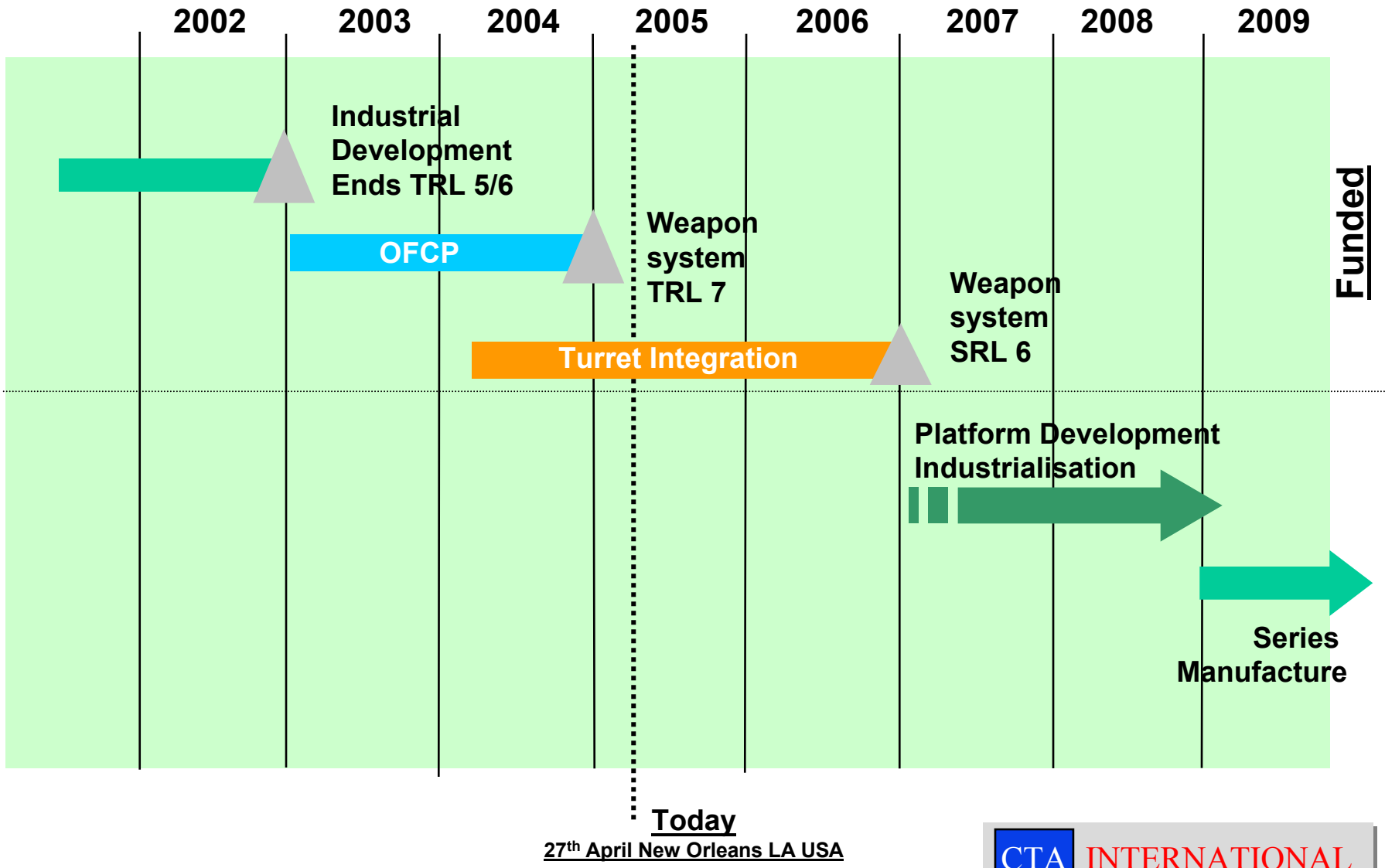


Linkless Ammunition Feed Technology

- Compact
- Reduced gunner workload
  - > Easy loading and unloading
  - > Remote operation



CTWS Route Map



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The Objective Future Cannon Programme(OFCP)

- Started in September 2002; joint funded by UK MoD, French DGA and CTAI
- Preceeded by a system lethality system trade study which selected 40mm CTWS as the optimal cannon system to satisfy the future lethality requirements of UK and France.
- In 2002 UK and French Governments co operate on 40mm CTWS
- Driven by the Requirements of:
  - UK Warrior, FRES
  - DGA VBCI, EBRC
- Objective was to demonstrate TRL7 by the end of 2004 total - budget 9M€
- Customers are committited to share deliverables with other nations

France and the UK sign deal for 40mm CTWS

The French and UK governments have signed an agreement with CTA International (CTAI) to fund a risk-reduction programme for the 40mm Case Telescoped Weapon System (CTWS).

The objective is to ensure that the design is technically secure when the two armies need to select the armament for new platforms or mid-life update programmes.

According to David Leslie, CTAI managing director: "This demonstration of support from both governments is a major milestone in CTAI's programme. The joint contracts will enable us to work closely with the procurement agencies and user groups from both countries in an environment of shared information."

The British Army is expected to select the 40mm CTWS for the projected Warrior infantry fighting vehicle (IFV) upgrade and for at least one member of the projected Future Rapid Effects System, for which the user requirements document has recently been issued.

The French Army is expected to specify the weapon for the projected Engin Blindé à Roues de Contact, which is currently at the study phase. Versions of this could include a 6 x 6 model with a 40mm CTWS installed in a remote-controlled turret (*Jane's Defence Weekly* 10 April).

The CTAI work will include not only the weapon but also the ammunition-handling system and the two warshot natures of ammunition: armour-piercing fin-stabilised discarding sabot and a general-purpose round of the air-bursting munition type.

Under the terms of the contract, CTAI, working with France and the UK, will bring all elements of the system to a Technical Readiness Level (TRL-7) by December 2004.

The UK Ministry of Defence has recently completed its Objective Future Cannon Programme to determine which medium-calibre weapon would be appropriate for new vehicle platforms as well as upgrades of existing platforms. According to CTAI, the findings of this study have been shared and agreed with the French government.

For trials and demonstration purposes the 40mm CTWS was recently installed in the turret of the Alvis Vehicles Warrior (*JDW* 9 March). It is also installed in both examples of the SIKA and Lancer testbeds developed to meet the now cancelled operational requirements of the UK and US armies.

Giat Industries of France and BAE Systems RO Defence of the UK jointly own CTAI, and the two companies have provided all development funding to date as a private venture.

Christopher F Foss
JDW Land Forces Editor, Paris

British Army Warrior IFV armed with a CTAI **40mm Case Telescoped Weapon System**

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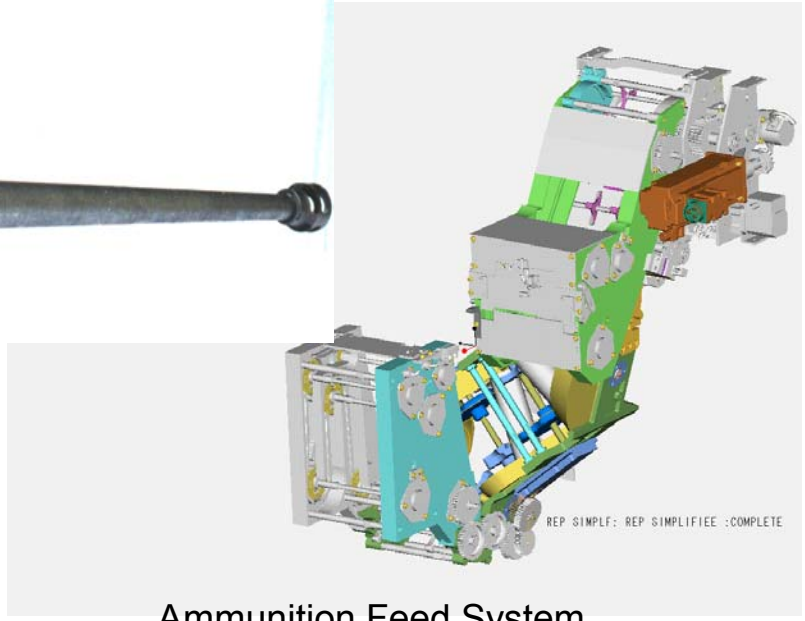
TRL 7 Definition
‘System technology prototype demo in an operational environment’

Cannon – 40mm CTWS



Ammunition Feed System

Ammunition: APFSDS, GPR-PD, TP-T

‘The System’

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‘The Environment’

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‘OFCP’ Approach – UK MoD / French DGA / CTAI

- Define Requirement
  - > Performance
  - > Use – i.e. the 48hr Battlefield Mission
  - > Maintenance and Support
- Define a set of assessment criteria
  - > Safety
  - > Environmental robustness
  - > Reliability
  - > Performance
- Develop test and assessment programme to deliver objective evidence
- Execute the programme

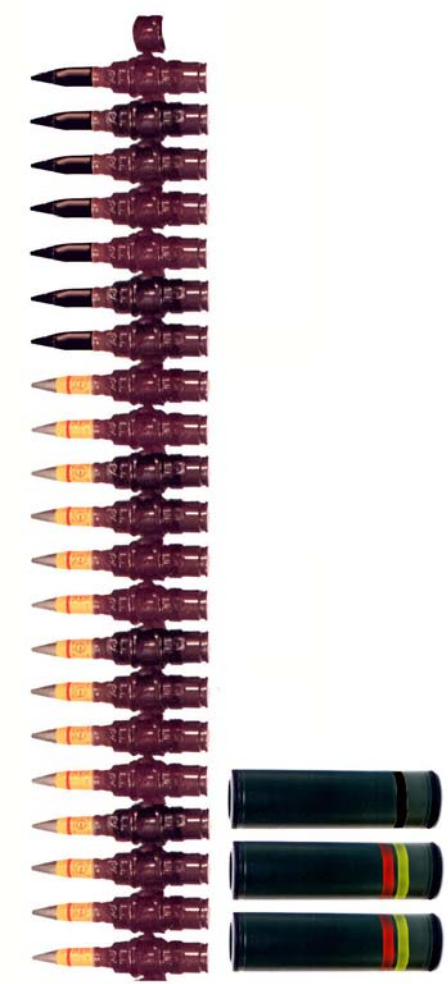
Weapon System - Performance

Requirements

- Rate of Fire 200 Shots per minute
- Fire two ammunition types selectable <3s
- Remote operation
- Low integration volume <80 litres total swept volume
- Dispersion
  - > <0,35 mil APFSDS
  - > <1 mil GPR
- Minimum Fatigue Safety Life 10,000 rounds
- Operates in safety –46°C to +63°C
- Satisfies prevailing UK MoD and French DGA safety standards
- Reliability >98%
- Supports ‘coincidence’ fire control solution

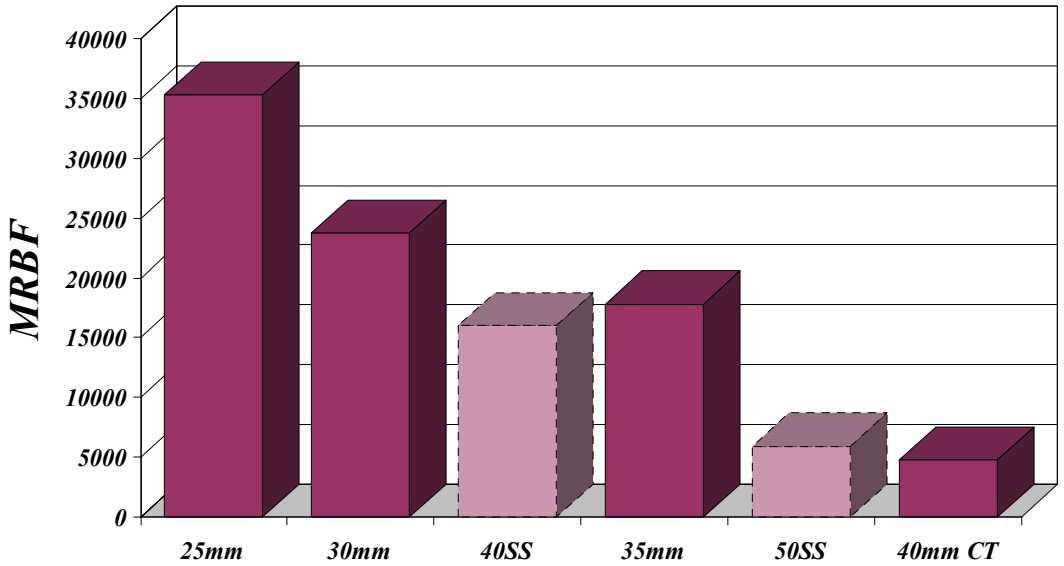
Before We Talk about Reliability!

Equivalent Stowed Kills



More 'capable' systems need to complete less cycles to complete the mission….. therefore their MRBF requirements are less.

Required MRBF for 98% Reliability Equivalent Stowed Kills



Achieving MRBF costs time, money and adds system level risk!

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OFCP - Reliability Test Programme

Weapon Safety

- Fatigue Safety Testing
- 30,000 cycles completed on all safety critical components
  - > Barrel
  - > Breech Ring
  - > Recoil system
  - > Chamber
- 3x samples of each component tested in series to destruction
- Cumulative total of 360,000 test cycles completed
- Simulation techniques developed with UK MoD DOSG

Dynamic Pressure Test Rig

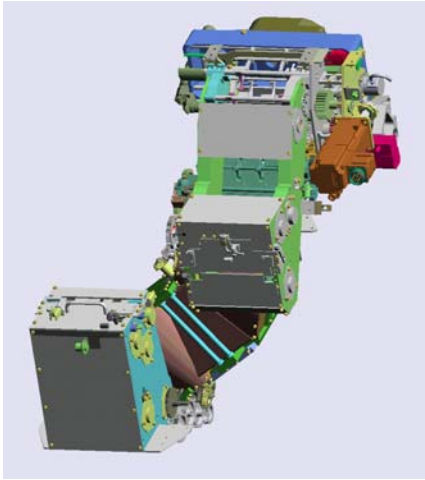
Chamber failed in fatigue

Impulse Simulator

Recoil System Ring stack Failed in Fatigue

Feed System

- Warrior Feed System
  - > Designed
  - > Built
  - > Integrated
  - > Tested
  - > Sept 2002 and Dec 2004.
- Full dynamic vibration test programme completed on full mission load.



CAD Image of OFCP Feed System

Feed System on Vibration Table November 2004

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Ammunition TRL Assessment Objectives and Approach

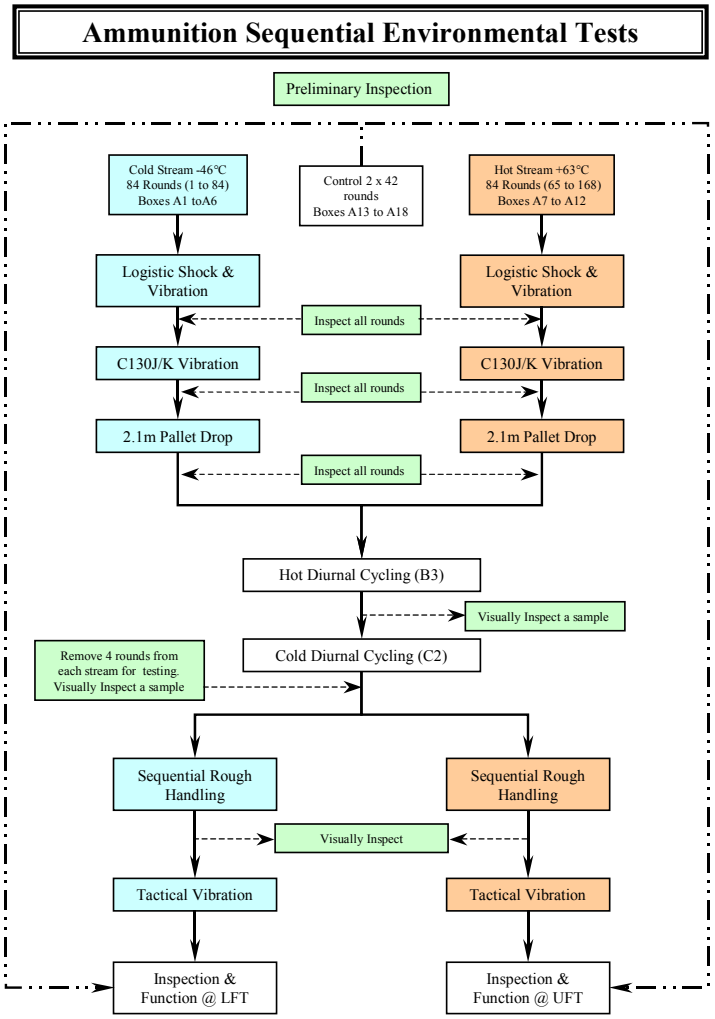
- TRL 7
  - > APFSDS
  - > TP-T
  - > GPR (PD)

APFSDS and TP-T sectioned ammunition

- Freezing of Build Standard
  - > For GPR the development of a Point Detonating fuze
- Production of test Quantities
  - > Nominally 900 rounds of each
- Completion of a sequential environmental test programme
- Completion of IM assessment
- Performance assessment

Environmental Test Programme Completed

- UK MoD DOSG test Programme based OB Proc 43060
- Sequential Environmental Test
  - > Hot Cold Streams –46°C & +63°C
  - > Logistic Shock and Vibration
  - > C130 transport
  - > 2.1m Pallet Drop
  - > Hot Diurnal Cycling
  - > Cold Diurnal Cycling
  - > Sequential Rough Handling
  - > Tactical Vibration
  - > Inspection
  - > Test Firing
- Propelling Charge Evaluation
- Noise / Muzzle Blast
- Projectile Strength of Design
- 12m Drop Test



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Ammunition Post Sequential Testing - Looks Ugly

- As always testing was not without some minor problems, but all environmental tests were completed and the firing programme concluded; 100%

Some Deterioration of Packaging

Minor Surface corrosion

…….but still Shots Great!

GPR PD Firing Oct 2004
From Warrior IFV Turret

Effective
Breaching
Brick Walls

Defeat of Armoured Concrete with Behind Armour Effects

…while sensitive
Against very light targets

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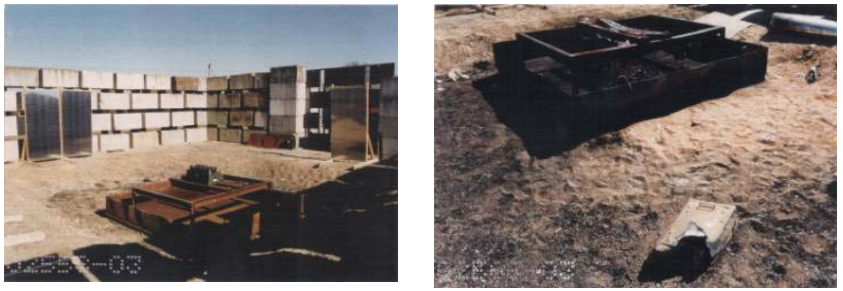
Insensitive Munition (IM) Testing

- Tested to Requirements of STANAG 4439
- Only APFSDS tested to date
- Tests completed
  - > Fuel Fire
  - > Slow heating
  - > Bullet Attack
  - > Sympathetic Reaction
  - > Shaped charge

Before **After**

Sympathetic Packaged

Sympathetic in Feed system Module



Fuel Fire; Type IV reaction

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Airburst TRL 5 Demonstration

- Completed over 200m (closed tunnel firing)
  - > Safe and Arm function confirmed
  - > Point Detonating Function Confirmed
  - > Airburst function confirmed
  - > Last multiple round trial 100% functional

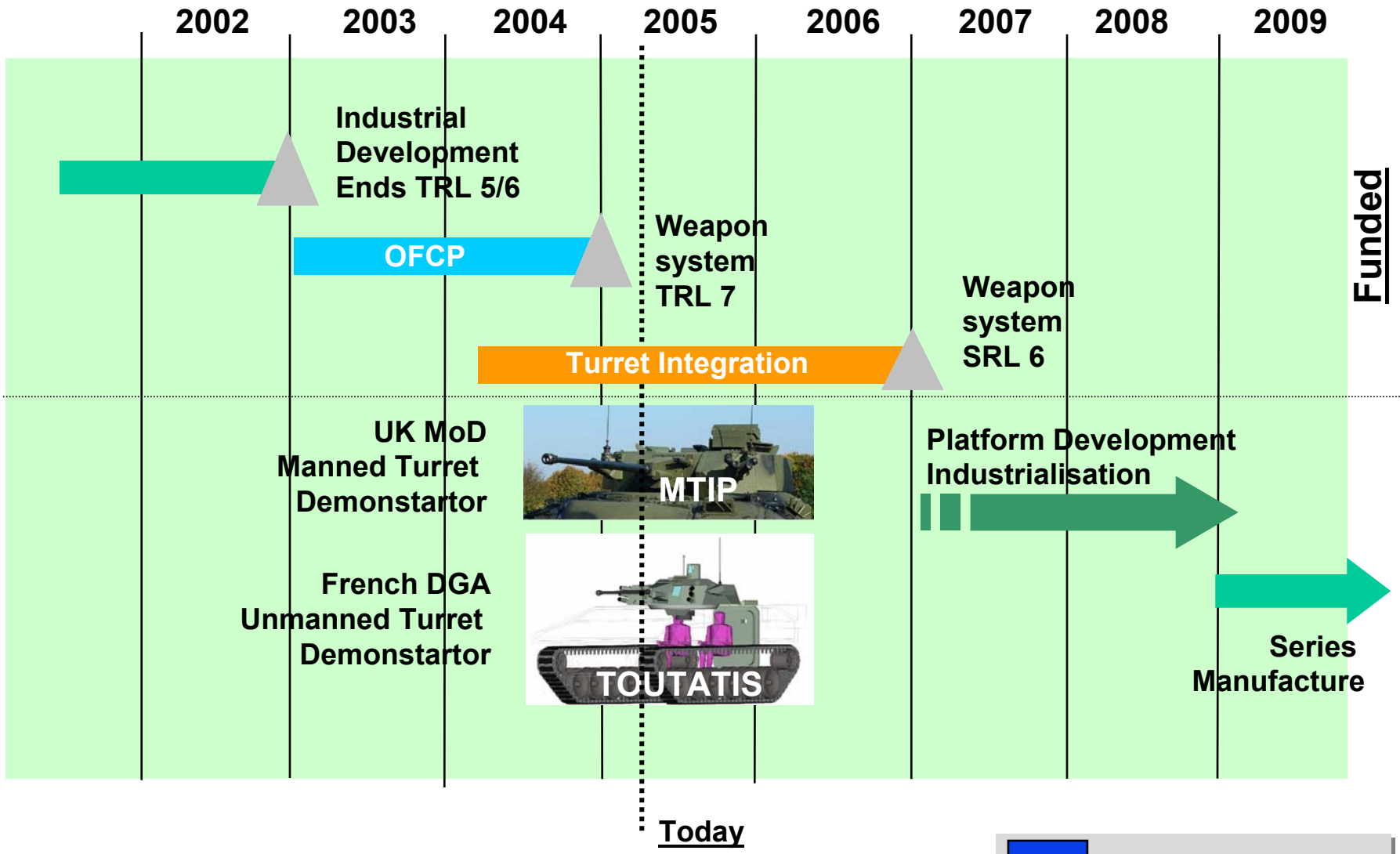
Arena Trials

Turret Integration - OFCP assessment

- BAE Systems PV investment provided opportunity to design and build a turret which was used as part of OFCP maturity assessment
- Principal objectives
- Demonstrate physical integration of weapon
- Demonstrate management of CTWS out of balance
- Demonstrate 'User' functionality of Weapon System with confines of turret.
  - > **Loading**
  - > **Unloading**
  - > **Firing**

40mm CTWS Weapon Stabilisation

CTWS Route Map



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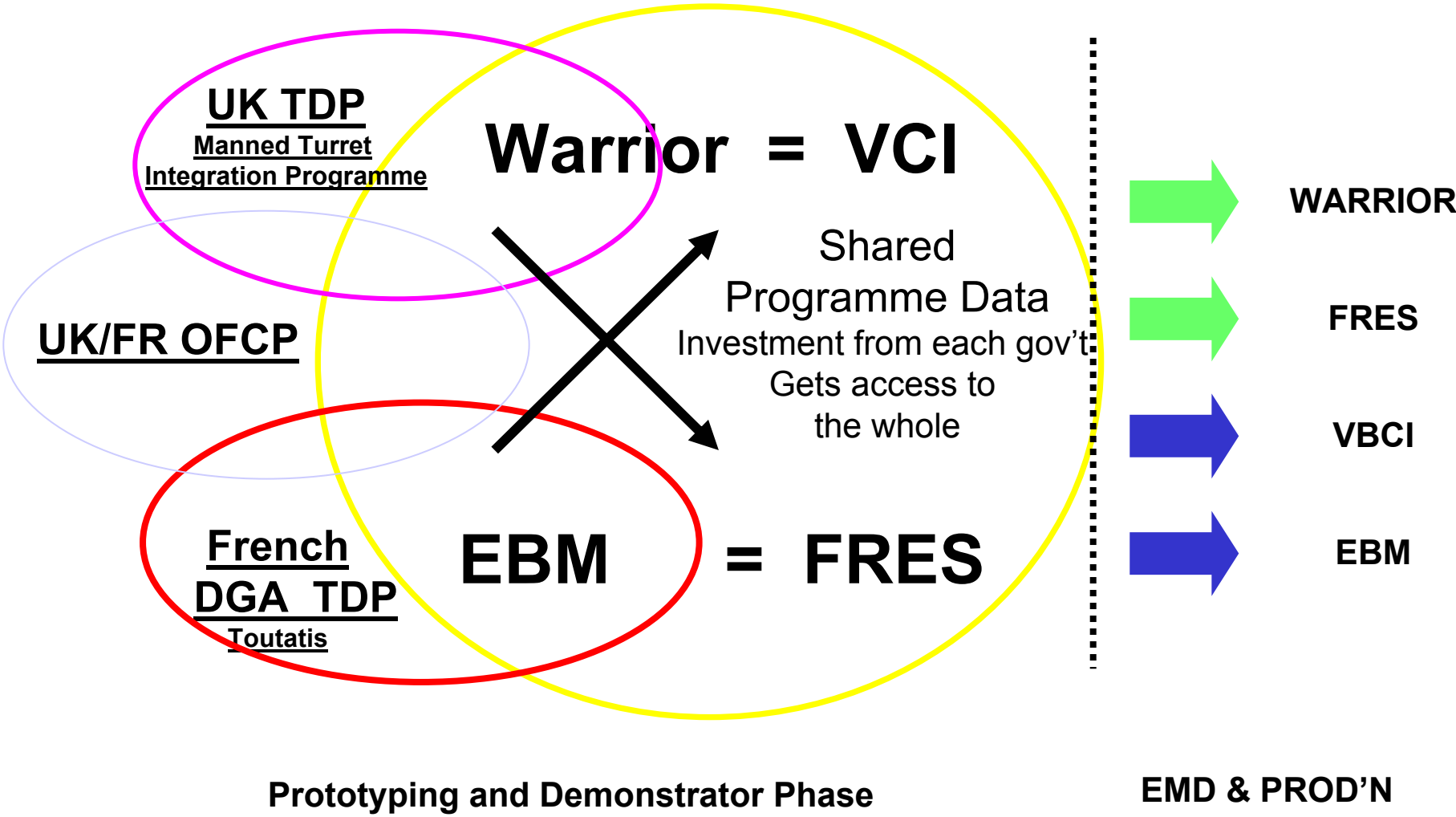
UK and French Government Collaboration



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CTAI Turret Demonstrator Programmes

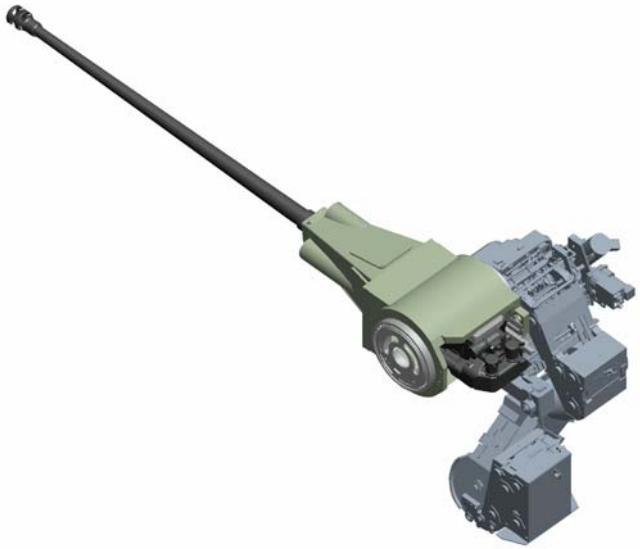
MTIP
4 Tonne Conventional Manned Turret

Toutatis
1,5 Tonne Unmanned Turret

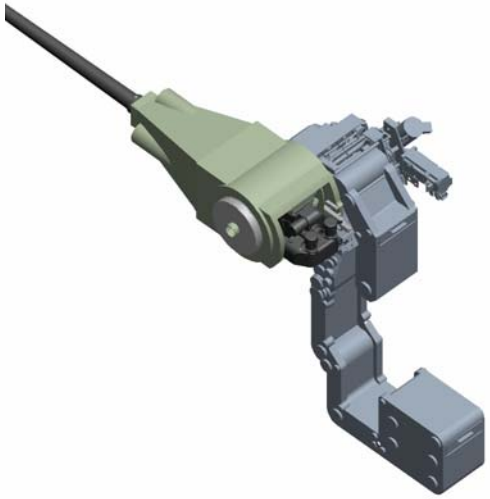
Manned vs Unmanned

Mechanical Integration Considerations

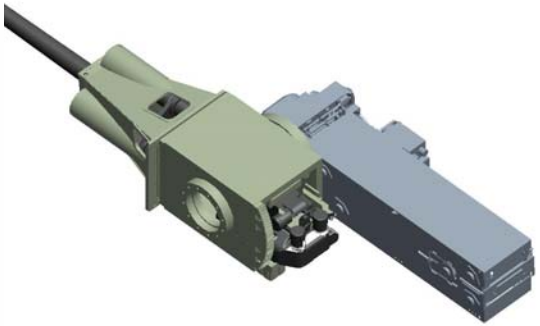
40mm CTWS Feed system Modularity



MTIP
42 Rounds
2 Natures



VBCI
70 Rounds
2 Natures



Toutatis
68 Rounds
3 Natures

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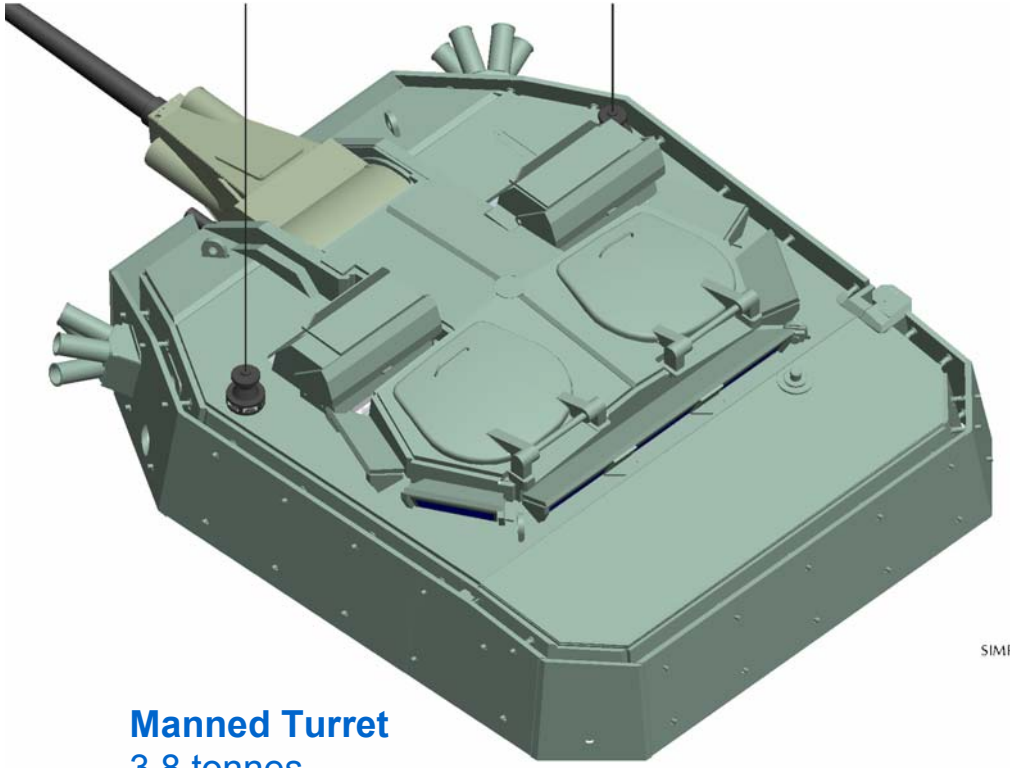
Manned vs Unmanned



Manned Turret
3,8 tonnes
Protection Level 4

Un manned Turret
1,5 tonnes
Protection Level 3

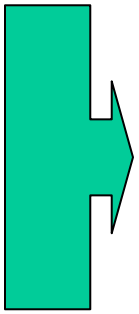
Manned vs Unmanned

Electronic Architecture Considerations

Electronic Architecture Functionality against KUR

KURs (defined by Capability demands)

- FIREPOWER
- SURVIVABILITY
- MOBILITY
- CAPACITY
- C 3
- STA
- SUSTAINABILITY

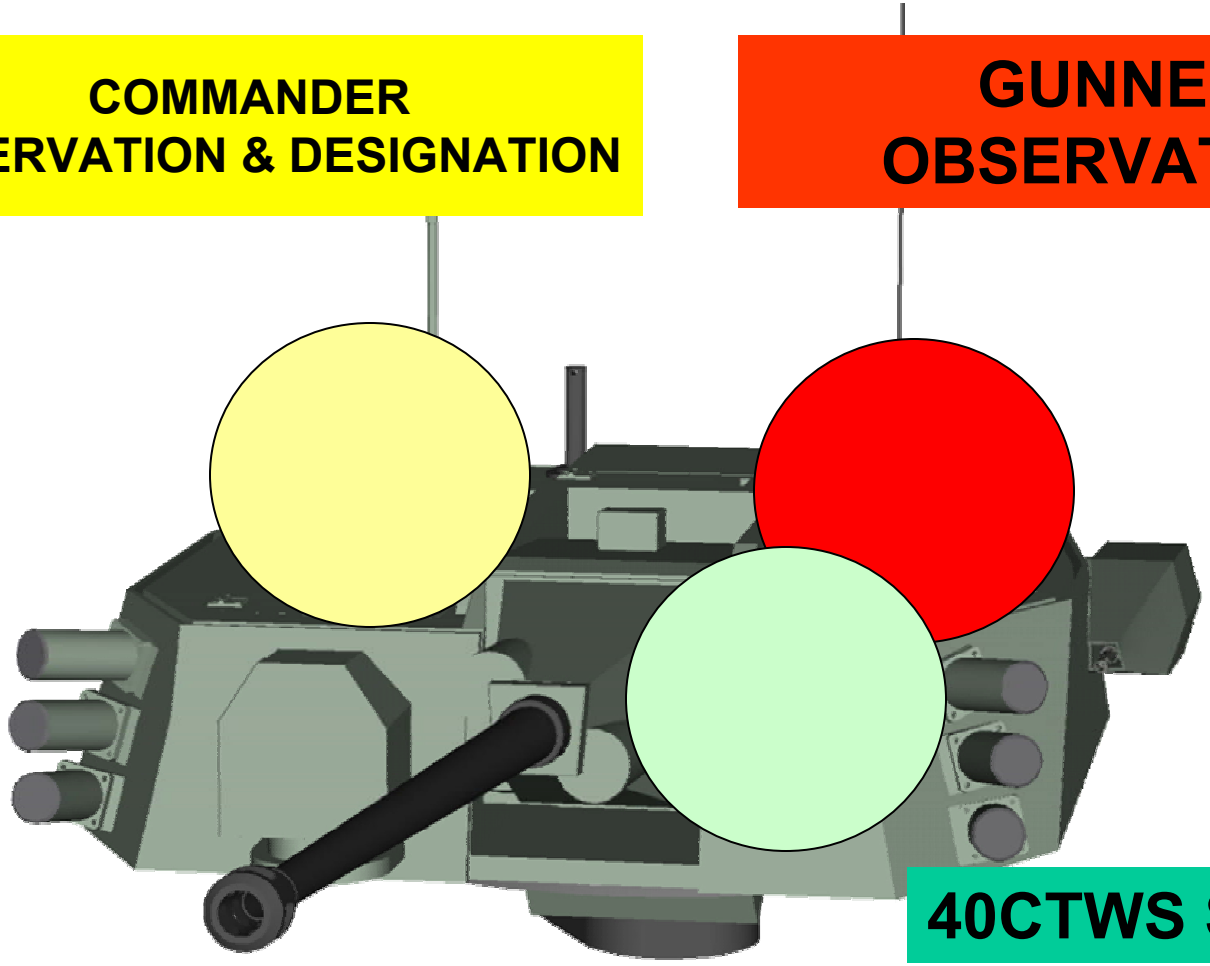


- Exploit the Data Management System
- Inform the Crew Members
- Operate the Radio Comms
- Command the movements of the Vehicle
- Use the Observation System
- Exploit the Auto-Surveillance Suit
- Exploit the IFF system
- Operate the Fire Function
- Operate the Defense Aids Suit

TOUTATIS SIGHTING SYSTEM : PRODUCT VIEW

COMMANDER OBSERVATION & DESIGNATION

GUNNER OBSERVATION



40CTWS SIGHT

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Gunner's Crew station

Unmanned

French Army Leclerc Gunner Operating Toutatis MMI prototype; Bourges March 2005

Manned

Unmanned solution ultimately demands confidence in Indirect Situational Awareness with a consequential impact on the EA.

Fire Function EA Drivers

Data Network (MILCAN)

- Bandwidth and rate
- Determinism

Video Network

- Sensors
- HD Display / Virtual reality
- Video mixing

Power Network

- Low/High
- EMC
- Autonomy
- Protection

Safety Network

- Technology
- Redundancy

‘Translating Lessons Learned into Systems Requirements’

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Black Watch Warriors prepare
to advance to set up a Forward
Operating Base to the east
of the Euphrates

Conclusions

- Highest lethality at lowest system integration burden
- Overmatch provides best insurance against Asymmetric Target Sets for the next 30 years
  - > APFSDS old generation vehicles
  - > GPR Airburst suppression
- CTWS as a weapon system technology is at TRL 7
- 2006 will see Turret Demonstrators (Manned and Unmanned) at SRL 6

CTWS an 'Enabling Technology' for all future medium calibre lethality requirements

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