
# Call for Proposals

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| **Long title:** | Anthropomorphic Phantom Ionising Radiation Modelling and Simulation |
| **DMTC Program:** | CBR Modelling and Simulation |
| **Issue Date:** | May 2021 |

# Contents

## 1. DISCLAIMER

**The response to this Call for Proposals will be reviewed by the CBR Modelling and Simulation (M&S) Technical Advisory Group (TAG), and if your area of expertise, research or technology is deemed to have merit in contributing to the aims of this project, we may seek further information. Having your RFP response reviewed by the Technical Advisory Group is NOT a guarantee that you will be granted funding.**

DMTC is releasing this Call for Proposals titled "*Anthropomorphic Phantom Ionising Radiation Modelling and Simulation*". This project will contribute to development and enhancement of Defence relevant capabilities in the chemical, biological or radiological (CBR) Modelling and Simulation domain.

## 2. INTRODUCTION

### 2.1. BACKGROUND

DMTC is an independent, not-for-profit company that creates, manages, directs and delivers successful industry-research collaborations involving multiple partners to enhance sovereign defence and national security capabilities, consistent with Government policy. Over more than a decade DMTC has been leading collaborative projects to advance technologies, as well as pursuing best practice governance and maintenance of ISO accredited quality systems.

With a historic focus on materials and manufacturing process improvements in the land, sea and air domains, DMTC has developed know-how in how to deliver innovation into Defence projects and has recently hosted programs in new technology areas such as Medical Countermeasures and High Altitude Sensor Systems on behalf of partner organisations wishing to utilise DMTC's proven project management and collaborative research expertise.

Recently, the Defence Science and Technology Group (DSTG) approached DMTC to lead and manage a collaborative program of work to model and understand the effects of ionising radiation doses to human tissue and organs from intense radiation sources. The aim is to determine a minimum level of physical shielding that would be necessary to avoid lethal tissue effects. This work would also be used to inform the development of new physical protection concepts.

In collaboration with DMTC, Land Division (LD) within DSTG is investigating the protection of ADF personnel required to conduct tasks near a high activity gamma source where the dose rates could lead to potential life-threatening exposures. This includes scenarios where the time spent around the source cannot be sufficiently minimised, and the distance away from the source cannot be sufficiently maximised to achieve the task objective, meaning protection using appropriate shielding must be considered.

DMTC is interested in identifying collaborative partners to undertake a program of work involving the computer modelling of ionising radiation doses to human tissue and organs from intense radiation sources and determine a minimum level of physical shielding that would be necessary to avoid lethal tissue effects. This work could also be used to inform the development of new physical protection concepts.

Leveraging off an investment of $120 000 per annum for 2 years, DMTC is seeking partners who will work collaboratively and be willing to co-invest their own resources in leveraging this opportunity.

## 2.2. PURPOSE

The purpose of this Call for Proposals in "*Anthropomorphic Phantom Ionising Radiation Modelling and Simulation*" is to:

- Identify academic and/or industrial organisations who have the capability to develop relevant computational models, and
- identify which proposal best meets the requirement of Defence.

## 2.3. ELIGIBILITY

To be eligible you must:

- have an Australian business number (ABN)
- be registered for the Goods and Services Tax (GST)

and be one of the following entities:

- an entity incorporated in Australia
- an incorporated association
- an incorporated not for profit organisation

DMTC is seeking a Proposal (template attached) from a lead organisation (preferably including other industry and/or research parties), who is the main driver of the project and is eligible to apply.

## 2.4. PROPOSED GOVERNANCE STRUCTURE

The selected project(s) will be approved, endorsed, and guided by technical and strategic panels, during the lead up to commencement and over the two-year life of the program. Day to day administrative, management, reporting and support activities will be overseen by the DMTC.

Reporting delivered to DMTC will be based upon a minimum of four (4) milestones for a two (2) year project with a Review every 6 months throughout the duration of the project.

## 2.5. DMTC INTELLECTUAL PROPERTY POLICY

DMTC's IP policy[1] closely aligns with the Defence Innovation Hub's IP Strategy[2]. DMTC has structured collaborative arrangements that facilitate innovation and allow joint industry, researcher and Defence engagement in projects without probity risks for future Defence procurements.

DMTC's IP approach streamlines adoption and utilisation of technology developed under DMTC program activities. Partner rights for utilisation of the IP created in projects are articulated in the engagement agreements, removing the need for negotiation of usage licenses after the IP has been developed.

DMTC partners at all times retain ownership of the intellectual property they bring to a project. DMTC will own the foreground IP. As most DMTC projects involve multiple industry partners, DMTC's IP policy follows the Defence Innovation Hub's Principles, whereby DMTC assumes the coordination role, and provide appropriate licences to partners to apply foreground IP.

[1] DMTC IP policy: https://dmtc.com.au/wp-content/uploads/2018/03/DMTC_IP-Factsheet.pdf

[2] Defence Hub IP policy: https://www.dst.defence.gov.au/sites/default/files/basic_pages/documents/Innovation_Hub_IP_Strategy.pdf

### 2.6. CONFIDENTIALITY

DMTC will treat all applications confidentially. DMTC will share submitted proposals responding to this RFP with Australian Government stakeholders including DSTG and the members of the Technical Advisory Group.

### 2.7. CONTACT PERSON

The Contact Person for this Request for Information is:

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| Name: | Dr Matthew Byrnes |
| Title: | Program Leader – CBR Modelling and Simulation |
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| Telephone: | 03 9214 4447 |
| Email: | matthew.byrnes@dmtc.com.au |

### 2.8. LODGEMENT

Please download the proposal template to your computer to utilise the embedded excel template.

Completed proposals must be received by no later than COB July 14, 2021. Early submissions are welcomed.

Please submit applications to: matthew.byrnes@dmtc.com.au

When responding to the Call for Proposal by email, please ensure:

- "***Call for Proposals: Anthropomorphic Phantom Ionising Radiation Modelling and Simulation***" appears in the subject line of the email; and that
- Your submission is in a ***Word format***.

## 3. SCOPE

The sponsor, DSTG, aims to be an active collaborator in this capability development project and may provide access to laboratories or facilitate the loan of equipment and resources in support of project outcomes where necessary and agreed. The conduct of a series of experimental verification tests using an appropriate anthropomorphic phantom would be supported. The DSTG RANDO anthropomorphic phantom could be made available to conduct experimental verification tests if the successful applicant has access to a TLD/OSL system that is compatible with the phantom.

Your organisation's proposal response will be assessed by the DMTC Technical Advisory Group (TAG) which consists of government stakeholders. Should the TAG identify a complementary proposal, the TAG reserves the right to invite those organisations to submit a collaborative project proposal if deemed suitable.

### 3.1. REQUIREMENTS

The following set of requirements are considered essential by DSTG and it is expected that your proposal will articulate how these requirements can be achieved:

1. Select an appropriate human anatomical phantom Geant4 model for an average human male and female that is suitable for the study objectives. Preference would be given to a mesh-based and anatomically adjustable model.

2. Assess absorbed doses to radiosensitive organs critical to the development of Acute Radiation Syndrome (ARS) symptoms and estimate the whole-body absorbed dose for a set of exposure scenario descriptors outlined in Section 3.2. A comparison of the organ doses to the doses in a simulated dosimeter (calibrated to the "deep dose equivalent" ($H_p(10)$) worn at chest height on the anatomical phantom will also be made.

3. Assess the configuration and thickness of lead (Pb) equivalence required to shield each critical organ such that the absorbed does is below the relevant threshold for that organ with the shield positioned:
    a. Against the outside of the phantom body
    b. Mid-way between the phantom body and the ionising radiation source

4. DSTG has access to all data and models generated through this project in line with the DMTC's IP policy outlined in Section 2.5.

The following requirement is optional:

5. Conduct of a series of experimental verification tests using an appropriate anthropomorphic phantom.

Organs and dose limits of primary interest to the sponsor are outlined below[3]:

| Organ | Absorbed dose (Gy) |
|---|---|
| Small intestine | 6 |
| Lung | 6 |
| Bone marrow (pelvic bone, ribs and lumbar + thoracic vertebrae) | 2 |
| Testes | 6 |
| Ovaries | 3 |

[3] adapted from Table A.3.4 of "ICRP, 2007. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Ann. ICRP 37 (2-4)".

DSTG is also interested in the reporting of doses to other organs which may be considered as relevant by the researchers.

### 3.2. EXPOSURE SCENARIO DESCRIPTORS:

Below are the parameters for the radiation exposure scenarios that form the basis of this project:

1) There are three (3) radioisotope source configurations to be considered, namely:
    i. Point
    ii. As a layer (approx. 100 $cm^2$) on the floor (e.g. concrete)
    iii. Volume (approx. 1000 $cm^3$) as a layer on the floor with density of 1 $g/cm^3$
2) All phantom orientations will be in the crouching (knees on the floor) position.
3) Five (5) phantom orientations ranging from anterior-posterior to lateral relative to the point source.
4) one orientation (anterior-posterior) for each of the surface and volume sources:
    - desirable to repeat all orientations against all source configurations
5) 1 metre source to phantom midline distance.
6) Doses calculated for a 15-minute timescale using an indicative activity of 200 TBq.
7) Repeat for a minimum of two (2) gamma emitting radioisotopes, Cs137 and Co60.

Other variations in source configuration, source type, source-phantom distance/orientation and/or phantom posture may be considered where time permits and by mutual agreement.

## 4. RESPONSE

DMTC has developed a separate DMTC CBR Modelling and Simulation (M&S) proposal template for your completion. This template must be used.

## 5. NEXT STEPS

Once we receive your completed proposal, the TAG will review and prioritise ahead of selecting project partner(s).