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The Centre for Food Innovation - Research Areas and Potential Projects

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Human Protection and Performance Division
Defence Science and Technology Organisation

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ABSTRACT

DSTO, CSIRO and UTAS are undertaking collaborative research in food science and technology through UTAS's Centre for Food Innovation (CFI). Suitable research areas and possible projects of relevance to Defence and the wider Tasmanian agri-food industry are identified and presented for possible inclusion into a CFI research portfolio. We arrived at this portfolio after consideration of government policy documents, the current Tasmanian agri-food industry, growth forecasts for the export and tourism markets, and a specialist understanding of Defence feeding needs and requirements. This document provides a snapshot of possible directions for CFI research, taken from a Defence perspective. It provides a starting point for establishing a suitable CFI research portfolio, which will evolve as the CFI takes shape.

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The Centre for Food Innovation - Research Areas and Potential Projects

Executive Summary

The Defence Science and Technology Organisation (DSTO) has entered into a collaborative research agreement, with The University of Tasmania (UTAS) and CSIRO, to work on areas of mutual interest in food science and technology within the recently formed Centre for Food Innovation (CFI). In addition to the three key research partners, the CFI has a broad stakeholder community, including federal, state and local governments and the Tasmanian agri-food industry. It is likely that the collaborative partners and stakeholder community will have different perspectives and priorities regarding the work to be undertaken within the CFI.

This document presents potential research areas and projects of relevance to Defence and the wider Tasmanian agri-food industry, which could be considered for inclusion in the CFI research portfolio. We arrived at this portfolio after consideration of government policy documents, the current Tasmanian agri-food industry, growth forecasts for the export and tourism markets, and a specialist understanding of Defence feeding needs and requirements. Possible research areas identified for the CFI include:

- dairy products,
- long-shelf-life foods such as meals, bars and snacks,
- fresh-like foods produced from vegetables, fruit, seafood and meat,
- research to support the differentiation of Tasmanian grown foods,
- development of speciality crops and novel ingredients,
- technologies for instantising foods, and
- low GI foods.

Some initial projects to be considered for the CFI are also identified.

This document provides a snapshot of possible directions for CFI research, taken from a Defence perspective. It provides a starting point for establishing a suitable CFI research portfolio, which will evolve as the CFI takes shape. It is envisaged that the CFI collaboration will include the prototyping of novel foods designed specifically for Defence needs. Successful products can then be considered for Defence feeding, extending the range of palatable, nutritious, appropriate foods available to Defence.

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1. Background

The Centre for Food Innovation (CFI) is a University of Tasmania (UTAS) entity alongside of the UTAS Faculty of Science, Engineering and Technology's Tasmanian Institute of Agriculture (TIA). As a research, development and extension centre, the CFI has overlapping interests with the University's Food Safety Centre (FSC), Australian Maritime College (AMC) and the Institute of Regional Development (IRD).

The research, development and extension activities of the CFI are focused through a Collaborative Agreement on Food Innovation (CAFI) between the Defence Science and Technology Organisation (DSTO), UTAS and CSIRO. The early and successful transition to Australian Industry of innovative food products and processes is a high priority for the CFI. Such products are expected to include extended shelf-life and fresh-like foods that are of interest to Defence for a range of rationing requirements.

DSTO's key partners in the CAFI are CSIRO's Division of Animal, Food and Health Sciences (CAFHS) and the UTAS's Faculty of Science Engineering and Technology (SET). In addition to the three key partners, the CFI also has a broad stakeholder community including federal, state and local government representatives and the Tasmanian agri-food industry. The CFI's governance, business processes and research portfolio are yet to be discussed and agreed. Understanding that each of the partners and stakeholder groups may have different expectations and priorities, this document presents a Defence perspective on research areas, and potential projects, which could be considered for inclusion in the CFI's research portfolio.

The ideas presented in this document are a snapshot of possible directions for CFI research, taken from a Defence perspective. This document provides a starting point for developing a CFI research portfolio that includes consideration of DSTO's interests in Defence Foods. It is envisaged that the research portfolio will evolve as the CFI takes shape.

1.1 Context/environment in which the CFI will operate

To set the context of research areas and potential project for the CFI, and in addition to DSTO's understanding of our Australian Defence Force (ADF) clients' requirements in food and nutrition, a number of background documents were sourced. To assist futures thinking, the 2012 revision of 'Our Future World' [1] and the federal government's paper 'Australia in the Asian Century' [2] were consulted. The upcoming Defence white paper will also be of interest when released later this year (2013). Federal and state government reports were reviewed, including the federal government's report 'Tasmanian Regional Plan 2012-2013' [3], and the recent Tasmanian state government's Regional Economic Development Plans for the three Tasmanian regions - Northern [4], North West [5] and Southern [6]. Data from the Tasmanian Department of Economic Development, Tourism and the Arts (DEDTA) was sourced (<http://www.development.tas.gov.au/home>) to confirm the key food and agricultural industries in Tasmania, and the relative size of each industry. Finally, documents specific to the Australian food industry were sought: the 2012 green paper 'National Food Plan' [7], and the final report of the 'Food Processing Industry Strategy Group' [8].

Once the Tasmanian, Australian and broader future perspectives had been considered, we reflected on the placement of the CFI within UTAS, its relationship to the Tasmanian Institute of Agriculture (TIA), and how this environment may shape the research portfolio. TIA is made up of a number of centres [9]: Dairy Centre, Extensive Agriculture Centre, Food Safety Centre, Perennial Horticulture Centre, Vegetable Centre, TIA Corporate, and the School of Agriculture. Clearly, research within the Food Safety Centre will be of great relevance to the CFI. Some programs within the other centres may also have potential areas for collaborative research. For example, on recent visits to both the Vegetable and Extensive Agriculture Centres it was evident that programs within these centres could be extended by the addition of a food science aspect. Although the Dairy Centre is keen to support collaborative work, the current research portfolio is focussed on pre-farm gate primary production aspect of dairy (breeding, nutrition, farming systems). The peak research body for dairy in Australia, Dairy Australia, manages a well-integrated national research program. Currently, other Australian research bodies are funded by Dairy Australia to progress dairy food research. TIA's Food Safety Centre has also received Dairy Australia funding. DSTO is yet to visit the remaining TIA centres, and plans to make these visits in early 2013.

Other influences on the CFI research portfolio, will be the existing areas of food research expertise within Australian institutes, and key governmental policy documents [7, 8]. A key recommendation relating to innovation in the Australian food processing industry [8] is the creation of a national food innovation hub/network by collaboration between industry, governments, research institutes and universities. Clearly the CFI could be one of these hubs, perhaps the hub for Tasmania. There may also be an expectation that the network is developed so that expensive pilot plant facilities, and to some extent expertise, are not duplicated. With this recommendation in mind, it will be important to consider the facilities and expertise already present in the food processing network, and those in which the CFI may develop and invest.

The CSIRO facilities and expertise cover many food research areas. Expertise is focused in specific areas, and often international post-graduate students engaged to extend the research coverage. Knowledge developed can be readily lost when the project is completed, as the student moves elsewhere, sometimes to another country. Of particular importance to the CFI collaboration are the extensive pilot plant facilities and the food safety expertise at CSIRO's Werribee and North Ryde sites, respectively. However, a difficulty for the CFI collaboration may be the full cost recovery business model with which CSIRO works.

DSTO's science and technology (S&T) program is closely aligned with ADF operations, the major capability and acquisition projects, and the requirements of our key clients: the Defence Materiel Organisation (DMO), the Capability Development Group (CDG), the Vice Chief of the Defence Force (VCDF), Army, Navy, Air Force and National Security. This alignment enables DSTO to deliver relevant S&T solution to ADF challenges in a timely manner. However, the strong client focus necessarily limits the resources available for pursuing longer-term research. The strong client focus can often mean that tight turnaround 'fixes' of current product challenges and quality assurance work dominate. This issue is addressed by DSTO's enabling research programme, which includes corporate (CERP) and divisional (DERP) work programs. For example, DSTO's contribution to the lead-in CFI project 'Investigation of High Pressure Processing (HPP) to produce long shelf-life foods', was

funded through the DERP. CSIRO's contribution to this project was the use of the Werribee pilot plant facilities, IP for the HPP processing, and analytical expertise.

The business model for the CFI is currently under development. DSTO's enabling research funds are subject to annual prioritisation and review. Also of note, is the inclusion in the DSTO strategic plan of specific reference to a Food and Nutrition capability which will seek external partnering for 'sustainment'. In addition, the Australian Defence Force (ADF) has ongoing requirements in food and nutrition. DSTO is well placed to meet these needs with our specialist understanding of both the current and future needs of the ADF, and the potential to leverage and adapt CFI research outcomes to the specific needs of Defence.

2. CFI Research Areas and Potential Projects

To be sustainable the CFI will need to respond to the needs of the Tasmanian food industry, while meeting the specific interests of the three key research partners. However, the CFI will also aim to contribute to national interests, and be aware of developments and opportunities for the current and future food markets.

2.1 Market pull

Future market growth in the Tasmanian agri-food industry may come from growth in the export market, developments in the domestic market, and the needs and requirements of Defence.

2.1.1 The export market

The powerhouses of the new world economy are predicted to be China and India. Coming decades will see one billion people in Asia transition out of poverty and into the middle income bracket of between US\$6,000 and US\$30,000 [1]. There is predicted to be increased demand for protein foods (meat and dairy in particular), fresh fruit (cherries, plums and pears), and processed foods [8]. In addition, the Australian Government has a desire to support two-way investment with the Asian region in food and food processing [2]. Market feedback has shown interest from China in Australian suppliers of [8]:

- milk powder, UHT milk, cheese, butter and margarine
- seafood (oysters, live lobster, live abalone, live king crab)
- fresh fruit (citrus)
- wheat, barley, and rice
- frozen red meat (beef, veal, lamb)
- processed foods, particularly baby food, wine and beer
- fruit juice

- convenience and 'instant' foods
- confectionery
- snack products.

Although well placed to take advantage of the growth in the global food market, Tasmania's ability to compete for market share will depend to some extent on the development of transport infrastructure to enable delivery of foods into the export market [7]. In addition to transport challenges, the Tasmanian food processing industry would need to grow and mature in order to be suitably positioned to exploit the predicted opportunities in foods, and the potential export market this provides.

2.1.2 The tourism market

The demand for tourism is also predicted to increase with the burgeoning middle classes of China and India. Tourism is already a developed industry in Tasmania, contributing \$1,030M or 4.8% to Tasmanian Gross State Product (GSP). Food trails, similar to the many Tasmanian wine trails could be developed to capture and expand this opportunity for the small to medium enterprises (SMEs) of the Tasmanian food industry [4]. The CFI may play a role in the food tourism market by supporting SMEs to innovate through product development and the early adoption of emerging food processing technologies.

2.1.3 The Defence market

The Defence market for food, and hence food research can be quite distinct from the commercial market. However, novel processes with a potential for 'dual use' have been identified. Much Defence food research focuses on providing palatable and nutritious ration foods which meet the shelf-life requirement of 2 years at 30 °C. Also of importance is providing foods that help maintain the health and performance of troops, and supplying foods that are in a form appropriate for the field environment. Some recent DSTO food research projects and future research ideas include:

- Fortification of foods with stabilised components (microencapsulation), low GI foods, foods that support gut health (probiotics/prebiotics/bacteriocins), development of snack products (bars, FD fruit, HPP fruit, FD yoghurt etc.), novel ingredients from pepper berries (antioxidants), muscle recovery proteins from dairy, prototyping of new ration pack concepts/products (light weight, hot weather, modular).
- Updates of current products: reformulations (high melting point chocolate), beef jerky, fish, new FD meals, bars and snacks, cheese in flexible packaging, evaluation of commercial products.
- Adapting the research of other Defence forces (especially the US): bars (First Strike) pocket breads, pureed apple with additives (Appletizer), associated technologies such as self heating rations, HPP, PEF and other novel technologies, instantised foods and powders that reformulate as a drink.
- Investigation of intermediate shelf-life foods to meet current and potential Defence feeding needs which fall between fresh feeding and combat ration packs. Potential

areas of use for these fresh-like, intermediate shelf-life foods include situations in which setting up a field kitchen is problematic, in operations other than war such as disaster relief/humanitarian aid, and specialised capabilities such as submarines and tanks.

2.2 Industry push

Tasmanian's food and agricultural products¹ contributed \$1,820M or 8.2% of Tasmanian GSP, and \$527.6M in exports or 28.8% of Tasmanian exports² (<http://www.development.tas.gov.au/home>). For comparison, tourism contributes \$1,030M or 4.8% GSP, and science and research contributes \$283M or 1.3% GSP. The key food and agriculture sectors with GSP and %exports for FY09/10 were:

- Dairy \$215M and 4.75% exports
- Vegetables \$172M and 4.5% exports, including potatoes, onions, carrots brassica (cabbage, cauliflower, broccoli), beans and peas
- Salmonids \$152M and 4.2% exports, includes Atlantic salmon and ocean trout
- Red meat \$147M and 2.5% exports
- Fruit \$131M and 0.9% exports, including pome (apples and pears), stone (cherries, apricots, nectarines and plums), and berries (strawberries, raspberries, blackcurrant, blueberries)
- Wine \$75M and 0.5% exports.

Opportunities for growth in the Tasmanian food and agriculture sector will be available through a key irrigation investment project [3, 4], which is set to increase growth and productivity in the agricultural sector. This large irrigation project is expected to support growth in the dairy industry, in particular, with flow on effects potentially in the red meat industry (veal). The availability of irrigation will support dairy farming in non-traditional areas such as the Midlands and the North East of Tasmania. The irrigation scheme may also have some minor impact for dairy farming systems within Tasmania; although currently Tasmanian farms are predominantly pasture based with some grain and pelleted feeding. Irrigation investment also has potential to support growth in fruit and vegetable production, and speciality crops.

2.3 Timelines, expertise and facilities

The development of a robust, sustainable CFI research portfolio will take into account the available facilities/equipment, expertise and realistic delivery timelines. A balanced research portfolio should consider a wide range of project options, including both low risk and high

¹ Food and agriculture products cover all food and non-food products produced by the farming sector; fish from wild fisheries and aquaculture; and all related downstream processing.

² Export figures include both interstate and overseas exports.

risk/high payoff projects, and also long and short term projects. Projects could be developed using the following timelines and considerations:

- 2-5 years (2015-2018): important for CFI to get early successes with relevant products for Defence and commercial markets
- 5-10 years (2018-2023): CFI should aim to be established and have strong identity, has chosen specialist fields/equipment, and be successful in obtaining grant money
- 10-20 years (2023-2033): what foods and feeding systems will the ADF require in the longer term? What of these may also be of broader commercial interest? What technologies are likely to be important? What do our key and developing export markets need?

The expertise available to the CFI will also shape the initial research portfolio. Current expertise available to the CFI may include:

- DSTO - long shelf-life foods, specialist understanding of Defence needs, broad product development, fortification, dairy, meat, analytical chemistry, sensory evaluation, nutrition
- CSIRO - broad food science and processing expertise, pilot plants at Werribee Vic some in Qld, food safety and sensory in North Ryde (NSW) pre-existing industry partnerships
- UTAS - food safety, health sciences, agribusiness (TIA), seafood, vegetables and fruits, availability of TAFE/graduate/postgraduate students.

The Department of Innovation, Industry, Climate Change, Science, Research and Tertiary Education (DIICCSRTE formerly DIISRTE) co-funded, with UTAS, a *'consultancy that will develop a Project Scoping Document and Business Plan to progress the interests of stakeholders in the development of the food industry in the north of Tasmania.'* The consultancy was divided, to cover two main areas: the research, education and training needed to support Tasmanian food production, and a business case for pilot-scale manufacturing infrastructure to support Tasmanian food production. Both consultancies conclude in April 2013, and will have a significant influence in setting the direction of the CFI. The consultant engaged to deliver the business case for the pilot plant study will consider which facilities the CFI would best invest in, from an industry perspective. DSTO has identified some existing equipment at Scottsdale which could be made available for CFI use. These include a small pilot plant freeze dryer (FD), a fluidised bed (FB) dryer and a fermentor³. Due to Defence security requirements, this equipment would be more easily accessed if located just outside the DSTO fence line, within a CFI managed pilot plant at Scottsdale. In addition, early discussions regarding new equipment for the CFI have included high pressure processing (HPP), extrusion, extraction technology such as supercritical fluid extraction (SFE) and ultrasonics. In addition to a pilot plant, other facilities may include a product development lab, analytical support for SMEs, such as basic chemical and physical measurements, and more sophisticated analysis such as flavour profiling and sensory evaluation.

³ This DSTO equipment was purchased in 2006 for microencapsulation research between 06/09, and currently has only occasional use.

2.4 A possible CFI research portfolio

A possible CFI research portfolio is presented below, Tables 1 and 2. The portfolio is one of many that could have resulted from the consideration of market pull (export, domestic/tourism, and Defence) and industry push (dairy, vegetables, seafood, meat, fruits and speciality crops). This portfolio has been constructed with Defence needs in mind, and with consideration of the current and future Tasmanian agri-food industry. Possible technologies to support the research have also been included. Mid- to long-term research areas that may be considered for the CFI, Table 1, and short-term projects, Table 2, that may be considered as lead-in projects are shown below. These focus mainly on current Defence needs.

Table 1 Possible CFI research areas – mid to long term (5-20 years)

Research Area/project	Market pull/push	Support Technologies
Dairy - milk, cheese, yoghurt, protein fractions	Tas industry, export, tourism and Defence	drying, separation, micro, analytical & sensory
Long shelf-life foods – meals, bars, snacks	Defence, tourism (bushwalking)	drying, extrusion, HPP?, micro, analytical & sensory
Fresh like foods – vegetables, fruit, meals, seafood, meat	Defence, export	HPP, other emerging technologies (TBD), micro, analytical & sensory
Differentiation of Tasmanian foods	Tas industry, tourism, export?	micro, analytical & sensory
Speciality crops and novel ingredients	Export, tourism, Defence?	separation, stabilisation, micro, analytical & sensory, clinical?
Instantising	Defence, tourism (bushwalking)	TBD
Low GI foods	Defence	TBD

Table 2 Possible CFI research projects - short term (2-5 years)

Research Area/project	Market pull/push	Support Technologies/expertise
HPP Fruit, veg and meals	Tas industry, export, Defence	HPP, micro, analytical & sensory
Beef jerky with pepper berry extract for enhanced shelf life	Defence, tourism (bushwalking)	separation, micro, analytical & sensory, clinical?
Nutrition Bar (novel ingredients?)	Defence, sports foods	extrusion? micro, analytical & sensory, clinical?
Cheese in flexible heat resistant packaging	Defence	Packaging, micro, analytical & sensory

3. Summary

DSTO has entered into a collaborative research agreement, with UTAS and CSIRO, to work on areas of mutual interest in food science and technology within the recently formed Centre for Food Innovation (CFI). In addition to the three key research partners, the CFI has a broad stakeholder community, including federal, state and local governments and the Tasmanian agri-food industry.

It is likely that the collaborative partners and stakeholder community will have different perspectives and priorities regarding the work to be undertaken within the CFI. This document presents potential research areas and projects of relevance to Defence and the wider Tasmanian agri-food industry, which could be considered for inclusion in the CFI research portfolio. We arrived at this portfolio after consideration of government policy documents, the current Tasmanian agri-food industry, growth forecasts for the export and tourism markets, and a specialist understanding of Defence feeding needs and requirements.

Although Defence needs and DSTO research interests are highlighted, a starting point for establishing a CFI research portfolio is provided. In addition to addressing the interests of the three key research partners and industry stakeholder, CFI research should also contribute to the development of the local food industry in particular, and the Australian food industry more generally.

Possible research areas identified for the CFI include:

- dairy products,
- long-shelf-life foods such as meals, bars and snacks,
- fresh-like foods produced from vegetables, fruit, seafood and meat,
- research to support the differentiation of Tasmanian grown foods,
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This document provides a snapshot of possible directions for CFI research, taken from a Defence perspective. It provides a starting point for establishing a suitable CFI research portfolio, which will evolve as the CFI takes shape. It is envisaged that the CFI collaboration will include the prototyping of novel foods designed specifically for Defence needs. Successful products can then be considered for Defence feeding, extending the range of palatable, nutritious, appropriate foods available to Defence.

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19. ABSTRACT DSTO, CSIRO and UTAS are undertaking collaborative research in food science and technology through UTAS's Centre for Food Innovation (CFI). Suitable research areas and possible projects of relevance to Defence and the wider Tasmanian agri-food industry are identified and presented for possible inclusion in a CFI research portfolio. We arrived at this portfolio after consideration of government policy documents, the current Tasmanian agri-food industry, growth forecasts for the export and tourism markets, and a specialist understanding of Defence feeding needs and requirements. This document provides a snapshot of possible directions for CFI research, taken from a Defence perspective. It provides a starting point for establishing a suitable CFI research portfolio, which will evolve as the CFI takes shape					