a place of mind

Technology Development Partnerships

Thoughts and suggestions based on our experience, including the recently created Composites Research Network

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Options

1. **Catch up with current state of the art**

   Purchase knowledge and equipment from others – as a result must wait until the technology is so pervasive that it is available in standard off-the-shelf form. Knowledge of the technology comes from a passive viewpoint: marketers and approaching you.

2. **Be competitive with current state of the art**

   Knowledge of the technology comes from an active presence but passive contribution at the level of tradeshows, conventions, workshops, and other interactions with the players in the field. Purchase knowledge and equipment from others earlier in the cycle by taking some risk as an early adopter (beta site).

3. **Be at the leading edge of the state of the art**

   Be an active contributor to the process of knowledge development by engaging in industry level knowledge sharing, for example being part of standards activities, round-robin evaluations, production contributor to new technology (alpha site).

4. **Influence and lead the state of the art**

   Take risk in developing new knowledge and technology, leading the development and adoption of new technology in the field.

Originally part of a UBC submission to Industry Canada 2007

How to respond?

- Current Canadian response at the level of say NSERC, NSERC CRDs, CRIAQ is good but fragmented, not long-term and sustained
- The solution is a mix of solutions, there is no ‘one-size fits all’
- In the composites arena:
  - Western Canadian driven initiatives such as the CIC, CCMRD, and now CRN are better and more integrated

Setting The Scene: The Composites Promise

- Better performance to weight ratios
- Lower manufacturing costs for large and/or complex structures
- Better durability, hence lower maintenance costs

- With composites, the distinction between materials producer and user is blurred
  - It is this feature that provides the benefits
- This is a double-edged sword, and brings with it great responsibility and risk
- When things go well, composites are great success stories, and when things go wrong, companies go bankrupt

Setting The Scene: Composites Conundrum

- Although the composites end product is highly sophisticated, the design and manufacturing workflow is not
  - Most often empirical and company knowledge based
  - Fairly poor understanding of many of the important issues beyond the basics.
  - This is true for the biggest aerospace companies and the smallest industrial companies
- Example:
  - Most manufacturing knowledge is still know-how

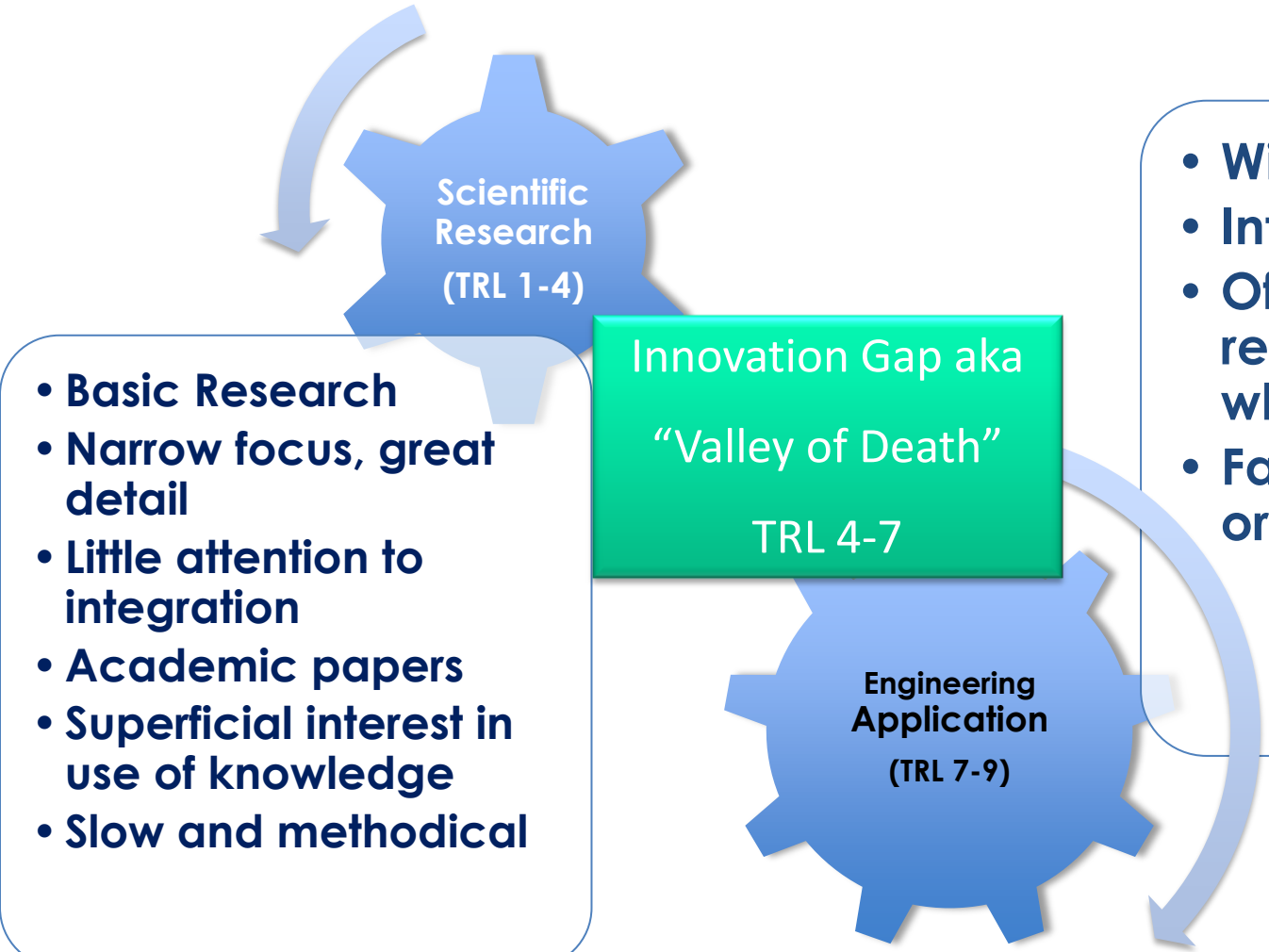
Setting the Scene

- Composites are all about risk:
  - defined as uncertainty in design
  - uncertainty in manufacturing
- Considering large and complex structures:
  - We are still woefully unable to cope with size scaling
  - We are still woefully unable to cope with production scaling
- Even worse, the supply chain is typically unable to cope with even basic composite structure
  - The effort and time spent on managing the quality and responsiveness of the composites supply chain is a serious burden
- Why have we been unable to synthesize and transition generic knowledge to practice?
  - Why are we still so dependent on know-how instead of know-why?

The Race is on

- USA, Australia, UK, EU,…
- US Example:
  - US DARPA Open Manufacturing Competition
    - $130M budget
      - UBC spin-off company Convergent is part of three separate major US defence contractor proposals under this program

Being strategic: Understanding the existing disconnect



- Basic Research
- Narrow focus, great detail
- Little attention to integration
- Academic papers
- Superficial interest in use of knowledge
- Slow and methodical

- Wide focus
- Integration is critical
- Often get the desired result without knowing why
- Fast and results-oriented

CRN Vision

- No matter how much good fundamental research might be performed, it is becoming increasingly difficult to translate and transition that knowledge into practical engineering wisdom.

- Knowledge itself provides no value: the value is in the ability to translate that knowledge into better decision making and thus less risk.

CRN Mission

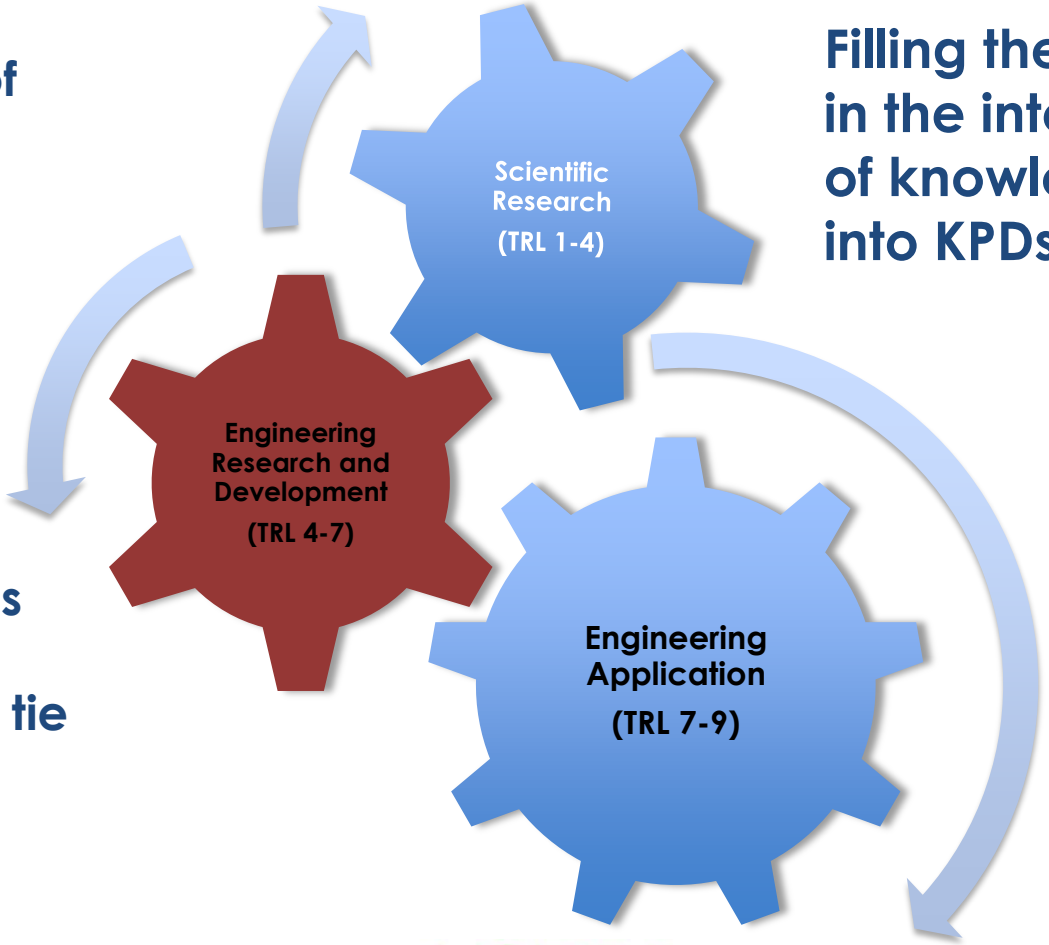
- To show that it is possible to operate and thrive in the valley of death in a sustainable and beneficial manner
  - To link ‘know-how’ and ‘know-why’ by focussing on the generation of a library of knowledge based best practice documents:
  - These ‘Knowledge in Practice’ documents (KPD) combine the best of academic and industrial capabilities in a generic form

CRN: A structured approach to managing the disconnect

Continuous creation and improvement of KPDs

KPDs capture know-how supported by know-why

KPDs are immediately recognizable as practice documents but tie back to the fundamentals



Filling the gaps in the integration of knowledge into KPDs

Customizing KPDs to own products

Provide direction and feedback to KPDs

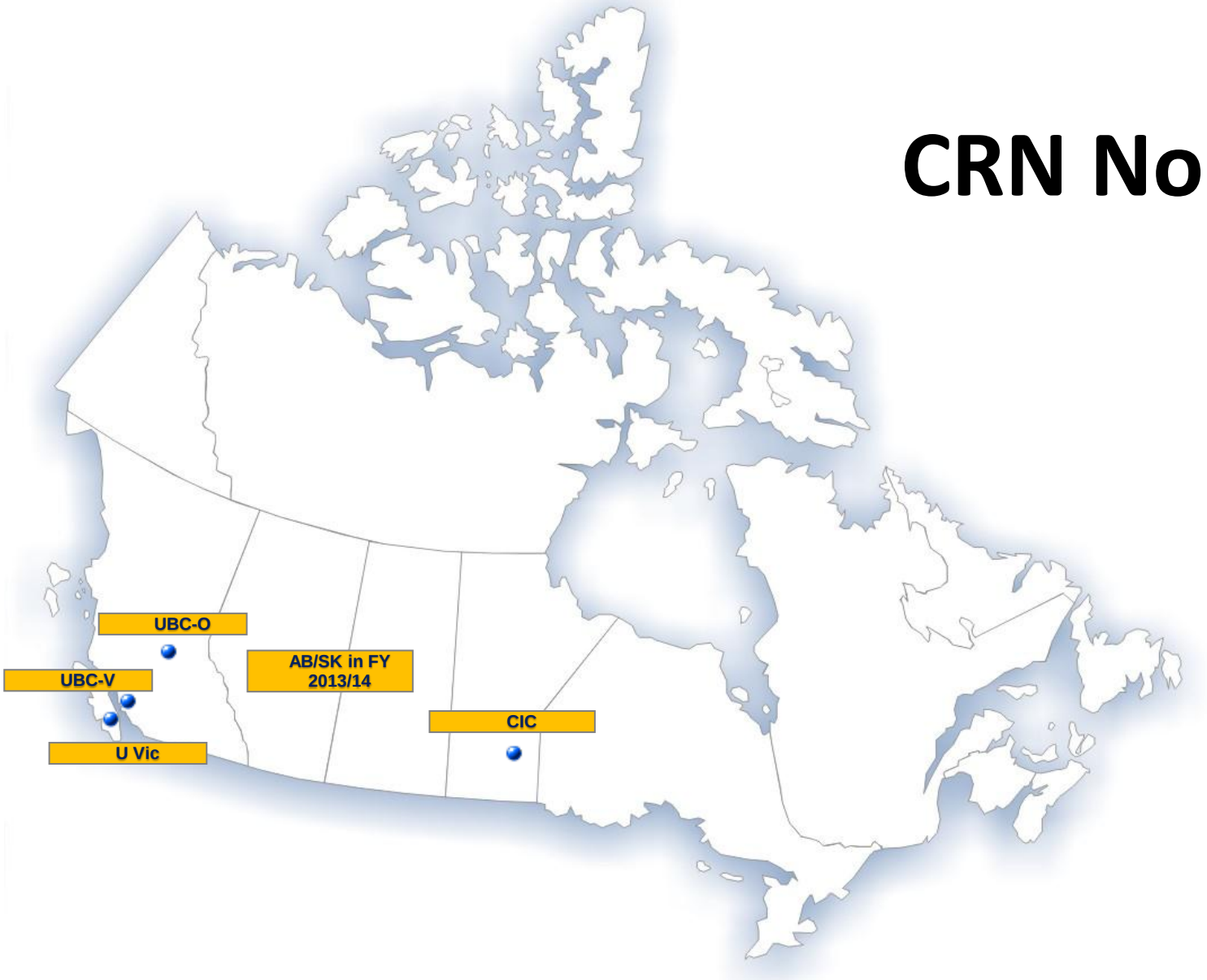
CRN: A structured approach to managing the disconnect

- KPDs are the missing link between academic journal papers, and industrial protocols, standards and certification regulations
- They are the precursor and support for industry led initiatives such as CMH-17, standardization efforts such as SAE, ASTM, and others
- They are the precursors for the development of customized company documents that can include further proprietary company technology
- They are excellent training materials
- They are the precursors to the development of software and other tools for technology transition and use
  - Process Simulation
  - Knowledge Systems

Current Status

- The pan-western Composites Research Network was officially announced January 2012 with an initial funding of $9.8M from the Canadian Government (WD)
  - ~$4.7M for purchase of equipment and facilities
  - ~$2.5M operational funding for first two years starting April 1st, 2012
- Distributed nodes across western Canada with main hub at UBC Vancouver
- Strong and effective linkage with other initiatives such as CIC, CCMRD, and NRC.
- The Boeing Company has agreed to join CRN as the founding Tier I member

CRN Nodes



Activities - Network

- National and International linkages will be key in the success of this vision
  - Groundwork done for linkages to all Canadian stakeholders
    - NRC IAR, AMTC, and IMI
    - CIC
    - CCMRD
    - Other Canadian universities, NSERC, CRIAQ
  - Similarly, international linkages are equally strong and in place
    - USA – be it through USAF, Boeing, FAA, NIAR/NCAMP, CMH-17 and others
    - Europe – direct connections to the likes of the National Composites Centre in UK, and pan-Canadian connections through Industry Canada to formal UK and EU initiatives
- In general, we are invested heavily to ensure national and international linkages, presence, and complementarity

IP and Liability

- CRN owns the copyright to the rich media content of the KPDs generated under the core program
  - Members, depending on Tier level, get free access
  - Western Canadian companies get appropriate free access as long as WD support is available
  - Project level activities, supplemental to the core program, are negotiated on a project basis and IP can go to companies as appropriate
- Our focus is on creating a core, generic IP asset, whilst ensuring that the individual companies can protect their own specific IP
- Liability issues managed with master agreement framework
- Early days, but so far so good

SUMMARY

- Technology development requires a very long term strategic approach
  - Need to understand the needs and issues affecting all stakeholders
  - This requires critical and open discourse
  - We need to continue building on what has worked
- Canada needs to understand what we should do differently to other jurisdictions
  - And think through the fact that if we are successful, others will not be shy to poach our best people and companies
- Technology is about people
  - In the short term, the total head count is what is measured, but in the long term it is the engineering head count that matters
- Collaboration within Canada, and within the west of Canada is absolutely essential
- We have some very successful models within the composites scene
  - Although there will be a tendency to say we are done with composites, it is only the beginning. We must continue to invest significantly
  - Long term vision with continuous, rolling short term benefits is the goal
    - CIC, CCMRD, CRN models provide better stability and continuity, and are complementary to CRIAQ