

Improvement of productivity and quality of
welding on special steels in arctic conditions

WELDARC

©Rauno Toppila, Kimmo Keltamäki 2017

Tekes

Vipuvoimaa
EU:lta
2014–2020



Euroopan unioni
Euroopan aluekehitysrahasto

LAPIN AMK
Lapland University of Applied Sciences

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Needs ?

- Special requirements for the usage of novel steels (wear resistant and constructional steels) in arctic conditions do exists.
- Increase of usage of ultra high strength steels, that require controlled heat input, in the arctic conditions.
- Support companies RDI, in order to develop new business opportunities.
- Tightening regulations of steel constructions also increase demands for operations in the arctic.
- Increase the safety and competitive edge of Finnish engineering industry

Arctic business areas



Business opportunities in the arctic regions

Approach ?

- Reliable guide for preheating and repair welds in field conditions
- Possibility to weld in harsh conditions indoors at Cold Laboratory. (Temperature, wind chill, moisture)
- Promoting usage of new high and ultra high strength steels in energy efficient manner
- Improvement of ecoefficiency through proper material selection
- Overall increase of knowledge on arctic operations

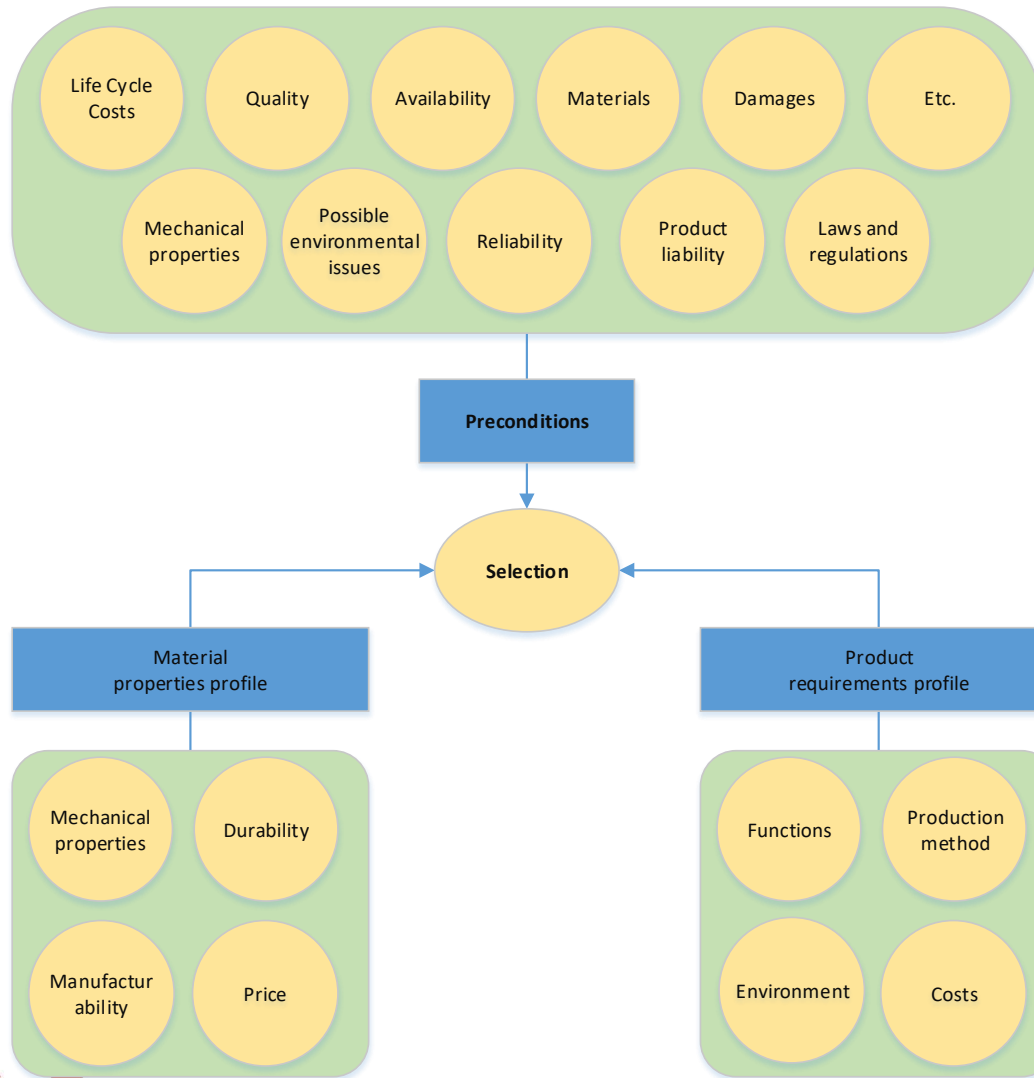
Case studies

- Research and reporting focused on case studies from companies
- Documenting of field testing in real conditions on real subjects
- Comparison of procedure in Cold Laboratory vs. in reality / field conditions
- Where applicable, test of design with prototype before full scale implementation
- Enhancement of information exchange between end users due to networking

Confirmed industrial partners

- SSAB Europe Oy, Raahe
- Outokumpu Chrome Oy (Kemi Mine)
- Miilux Oy, Raahe
- Iin Konepaja Oy, Ii
- Telatek Service Oy, Raahe
- Metso Minerals Oy, Tampere
- Tornion Sähköpojat Oy, Tornio
- Akkoy Service Oy, Kemi
- Norrhydro Oy, Rovaniemi
- Kemppi Oy, Lahti
- Retco Oy, Pori

Material selection ?



Material selection plays a vital role in designs for Arctic conditions



Applications



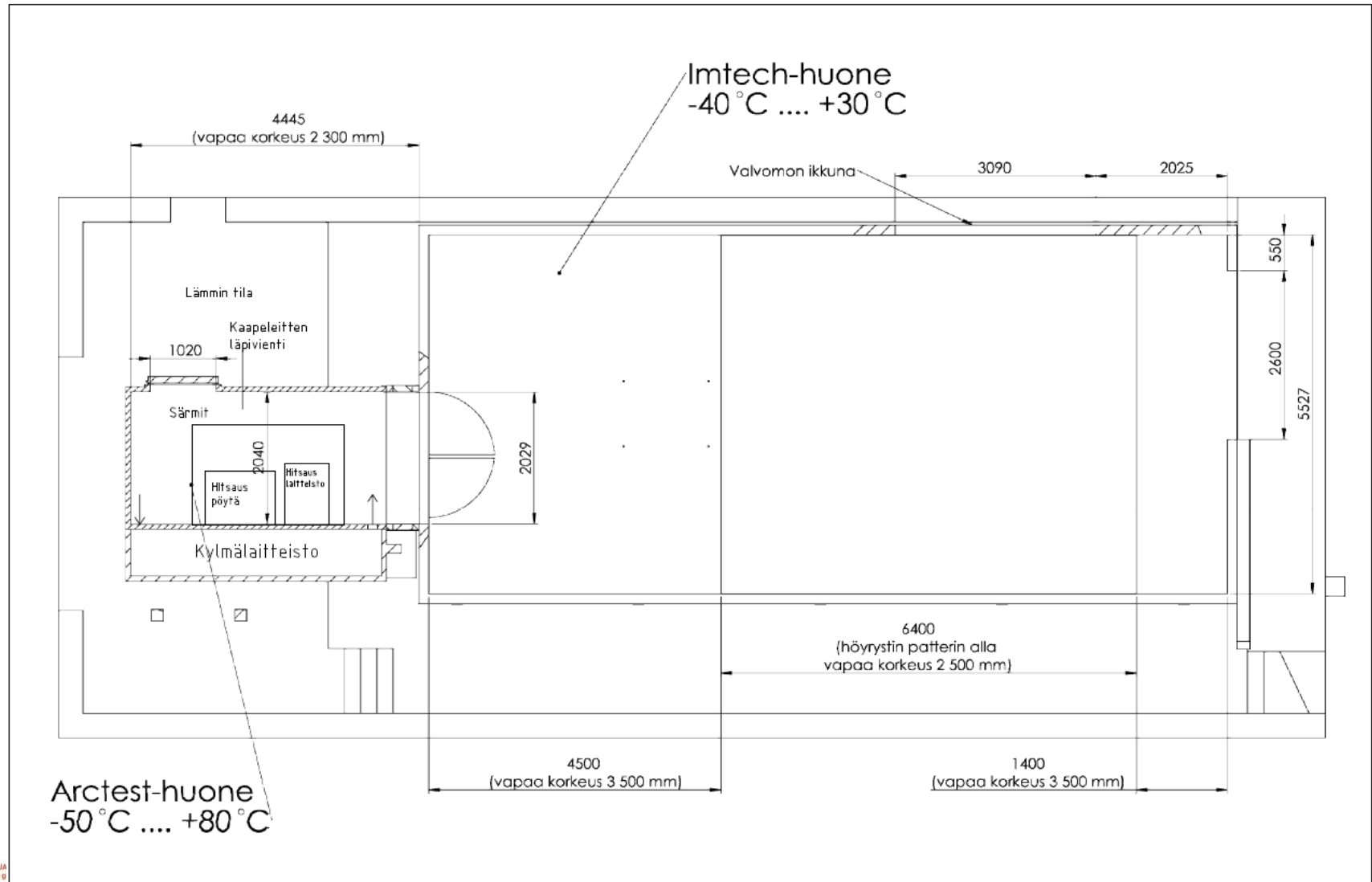
Possible benefits

- Added reliability for welding instructions for novel steels
- Increase of knowledge about arctic welding and real-time controlling of harsh conditions on laboratory scale.
- Increase the work safety
- Enhancing of national and international competitiveness of enterprises by creating new solutions
- Enhancing the export of welding technologies
- Increase in ecoefficiency of machines and constructions

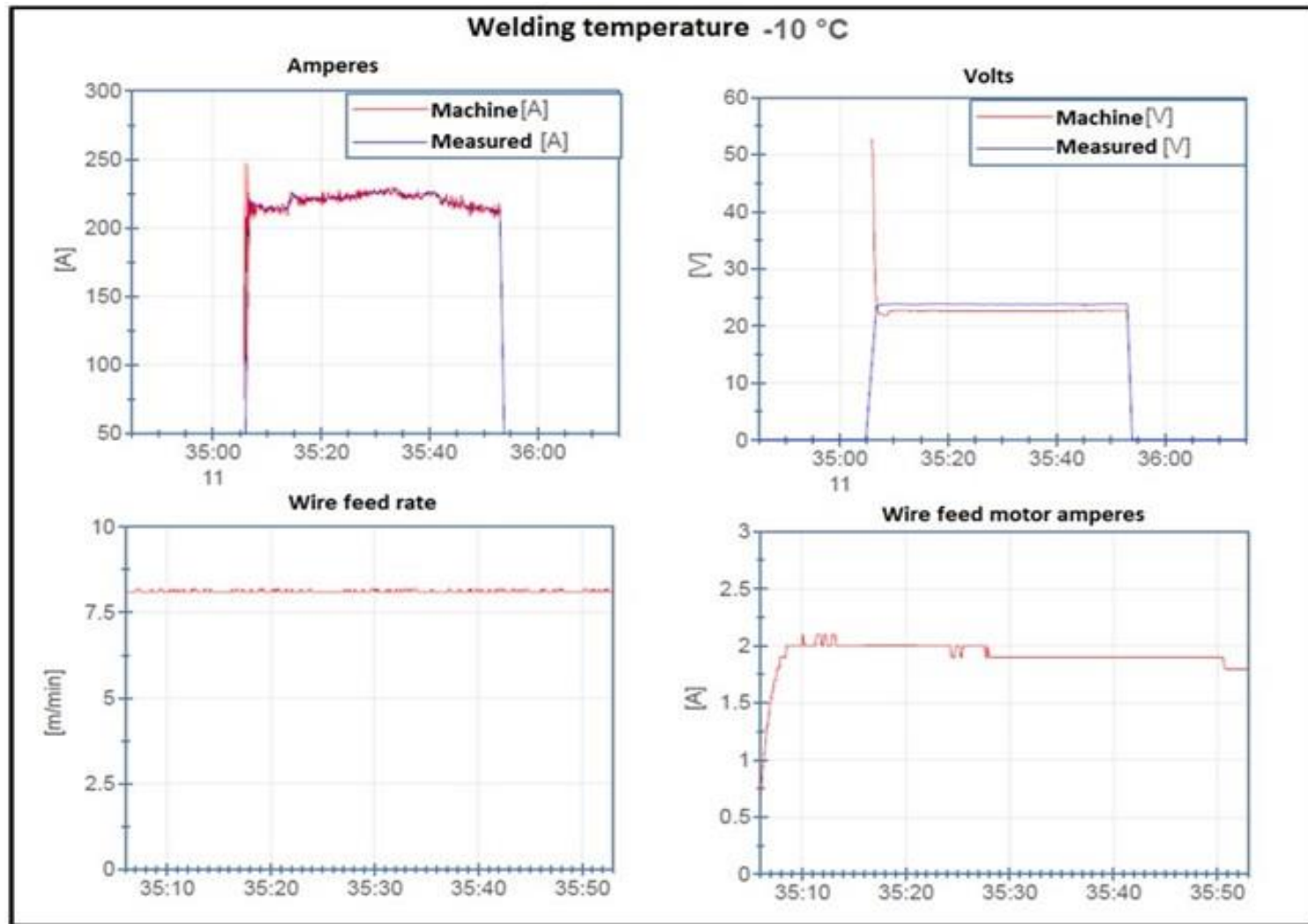
Cold laboratory as a welding environment?

- Increase of knowledge about arctic welding and real-time controlling of harsh conditions comprises of:
 - Dividable 2 chamber test space
 - Big chamber -40°C - $+30^{\circ}\text{C}$ (12,5m x 5,5m x 2,5m)
 - Small chamber -50°C - $+80^{\circ}\text{C}$ (4,5m x 2m x 2,3m)
 - Wind conditions simultaneously 33 m/s
 - Spraying of supercooled water as an option
 - Equipped with exhaust removal equipment
 - Other tools may also be tested, such as:
 - Angle grinders, cutters, welding tractors, etc.

Cold laboratory as a welding environment?



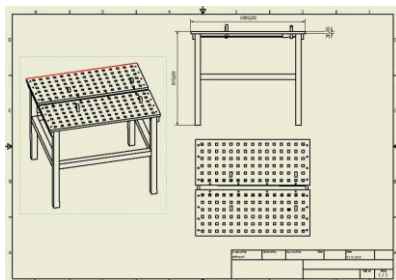
Monitoring of welding conditions



Welding equipments



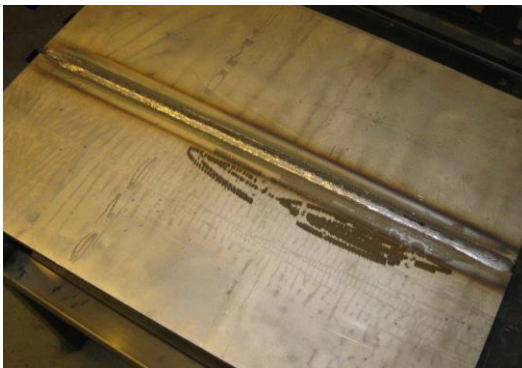
Welding table



FastMig X 450

Wise –tuoteperhe:
Wiseroot+, WiseThin+,
WisePenetration ja
WiseFusion

Retco welding tractor (kuljetin)



+Retco preheating unit

Savonia UAS: welding, testing and quality

- Hybrid welding (laser+MIG/MAG)
- Dynamic testing of welds
- Business for welding industry in arctic conditions
- Increase knowledge and know-how on welding standards, regulations and approval procedures
- Knowledge on requirements of welding automation for novel steels

Czech Technical University in Prague, CTU

- International collaboration
- Research and development of welding
- Prof. Jakub Dolejš
- Ph.D. student Kateřina Šefčíková
 - Research on welding parameters of hybrid beams
- Mechanical properties of welded joints
 - Tensile test, impact tests, hardness, FESEM
- Co-operation with SSAB in Finland, Sweden and Czech

Competition and rival possibilities

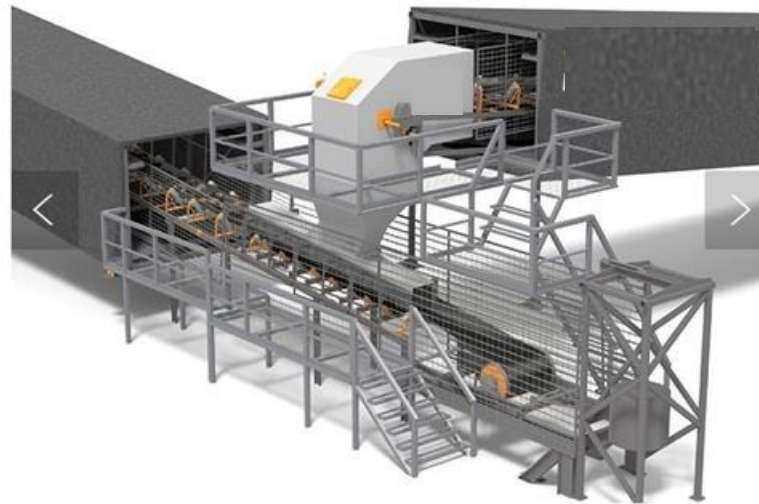


Steels in arctic conditions

laserhybrid-welding

properties
welding fillers
WPS's

Jig technology
robotizing
mechanization



Welding metallurgy in
arctic conditions vs.
Cold laboratory

dynamic testing
production simulation
Mass-tailoring

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Cold Laboratory

Lapland UAS

SSAB
Raahe

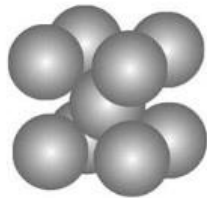
Savonia UAS

SME's in
Lapland

Accepted budget in project proposal

Rahoittaja	määrä	osuus		
TEKES/EAKR	433 424 €	87,4 %		
OMA RAHOITUS	0 €	0,0 %		
yritykset	62 500 €	12,6 %		
Yhteensä	495 924 €			

Lapland UAS
Research group



Arctic Steel and Mining – Excellence in Metallurgy

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