AARI

Arctic and Antarctic
Research Institute

THE RESULTS OF THE ICE TRIALS OF ICEBREAKING SUPPORT VESSEL *ALEKSANDR SANNIKOV*

Nina A.Krupina
Anna V. Savitckaia
Ivan A. Svistunov

15th Arctic Passion Seminar
Office of Aker Arctic Technology Inc.
Thursday, March 5th, 2020; Helsinki, Finland

ICE OPERATIONS NEAR CAPE KAMMENY - ARCTIC GATES TERMINAL

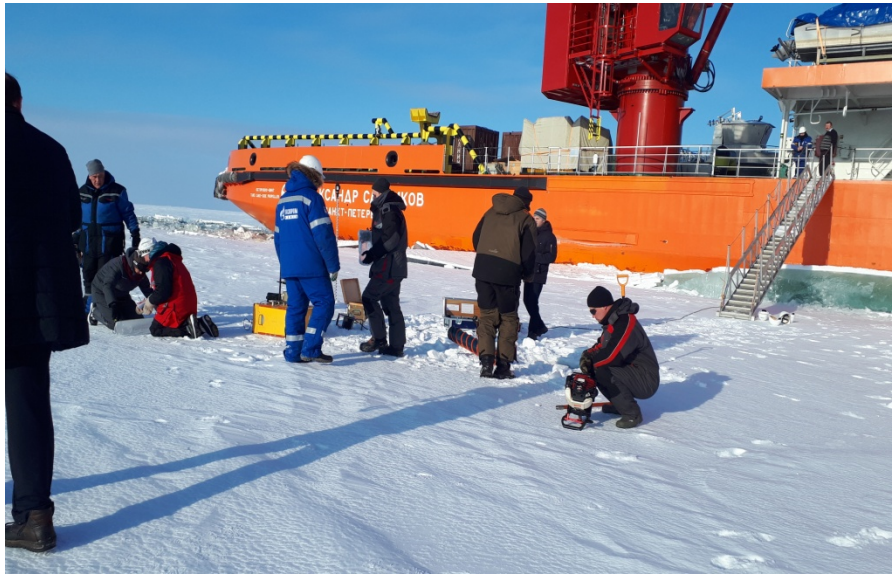
Main purpose of this vessel is support to loading operations at Arctic Gates Terminal, keep ice channel in operate condition during ice season and escort tankers to and away from the terminal

MAIN PARAMETERS OF THE VESSEL

Type	Icebreaking Support Vessel (ISV)
Year	2019
Designed by	Aker Arctic Technology Inc.
Built by	Vyborg Shipyard, Russia
Ship owner	Gaspromneft-Shipping, Russia
Length, meters	109.1
Breadth, meters	25.0
Draft, meters	8.0
Displacement, ton	13200
Shaft power	1×6500 KWt 2×7500 KWt
Propulsion system	3 Azipod
Open water speed, knots	16.0
Ice Capability, meters	2.0

CHEKING CHARACTERISTICS

- Speed in level ice (both ahead and astern);
- Speed in brash ice (both ahead and astern);
- Ability to cross ice ridges (both ahead and astern);
- Maneuverability in level ice and brash ice (both ahead and astern).



NOMENCLATURE OF WORKS

1. Analyzing of ice conditions, distance estimation of ice thickness, selection of suitable testing area.

2. Carry out the IBSV performance tests, including:

    2.1. Start and speed tests in level ice both ahead and astern;

    2.2. Turning circle tests ahead and astern in level ice with fixed rudder angles;

    2.3. Performance tests in ice ridges (ahead and astern);

    2.4. Performance tests in brash ice (ahead and astern);

3. Carry out all associated measurements on ice.

4. Carry out correction the results, taking into account the relation between actual and required ice conditions.

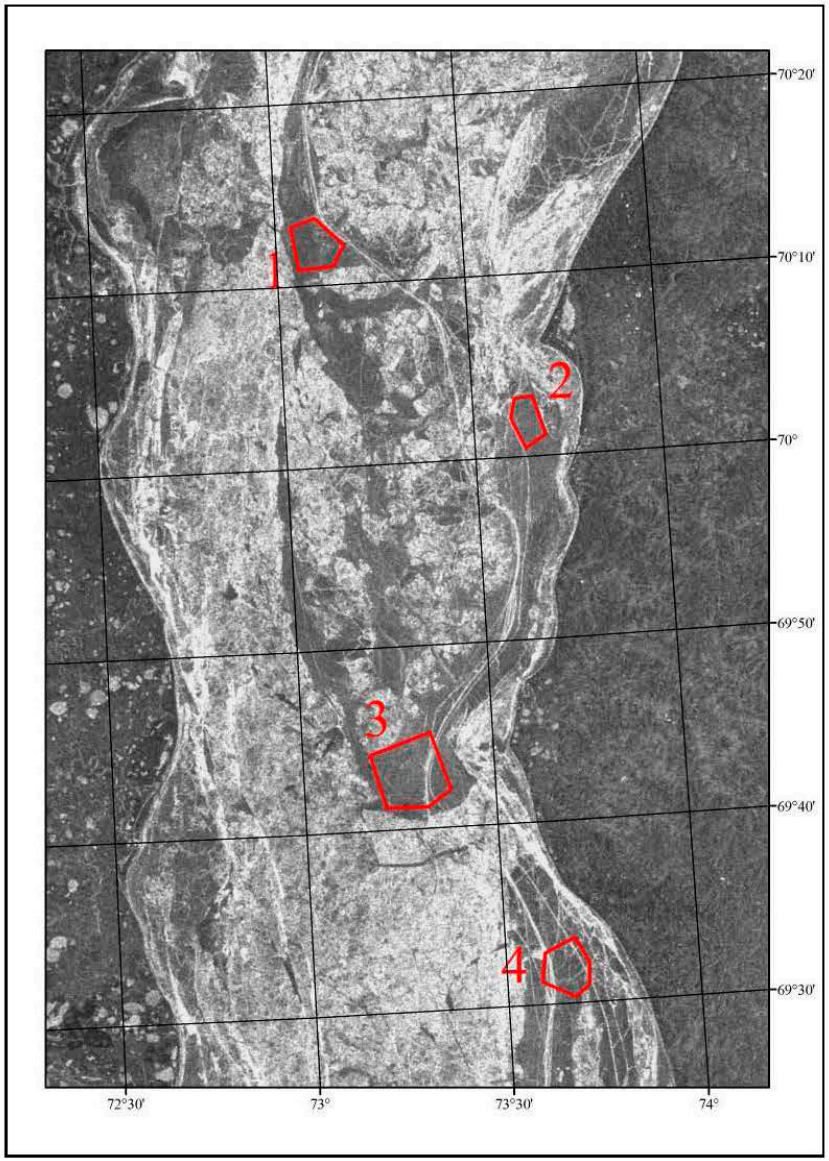
5. Analyze all obtained results and prepare the Technical Report.

6. Issue a conclusion on compliance of IBSV with its specification requirements.

All the works were completely performed by AARI

TIME AND AREA OF ICE TRIALS

- Ob Bay,
  from Cape Kamenny to Port of Sabetta
- April 20–30, 2019



LIST OF THE PERFORMED TESTS (level ice, straight motion)

Test No.	Test area No.	Test type	Associated measurements
1	1	Ice capability at astern straight motion	Level ice thickness Snow thickness Snow density Water depth Ice temperature Ice density Ice salinity* Ice flexural strength
3	1	Ice capability at ahead straight motion	
6	2	Ice capability at astern straight motion	
7	2	Ice capability at ahead straight motion	

** Due to fresh water in Ob Bay, ice salinity was measured once as a control measurement*

LIST OF THE PERFORMED TESTS (level ice, maneuverability)

Test No.	Test area No.	Test type	Associated measurements
2	1	“Star” maneuver	Level ice thickness Snow thickness Water depth
4	1	Circulation ahead	
5	1	Circulation astern	

LIST OF THE PERFORMED TESTS
(brash ice/old channel, straight motion)

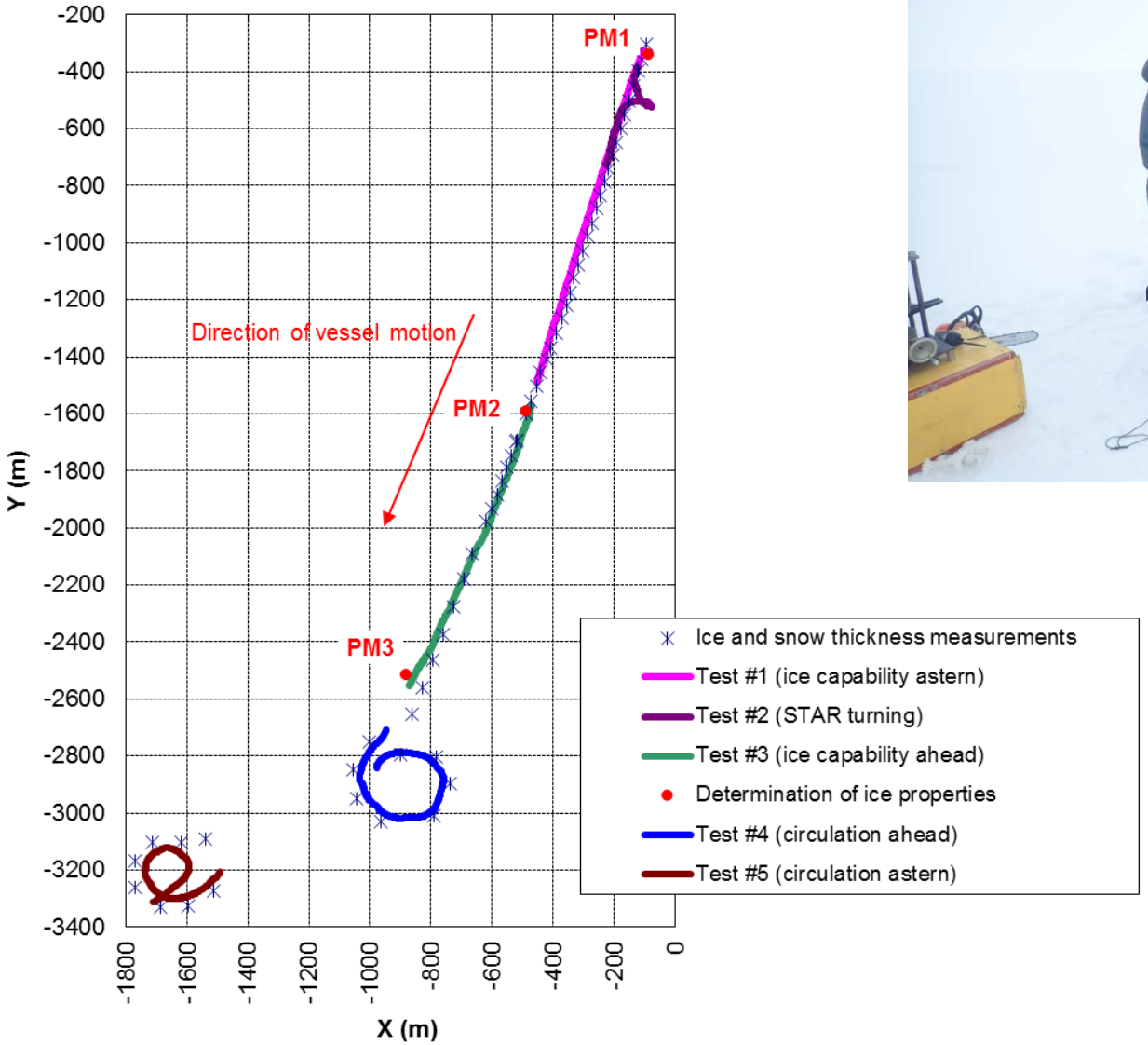
Test No.	Test area No.	Test type	Associated measurements
8	3	Ice capability in brash ice (old channel) straight ahead	Total ice thickness in ice channel; Presence of voids and slosh; Snow thickness
9	3	Ice capability in brash ice (old channel) straight astern	

LIST OF THE PERFORMED TESTS (ice ridges, straight motion)

Test No.	Test area No.	Test type	Associated measurements
10	4	Crossing ice ridge at straight continuous motion astern	Total ice thickness in ice ridge; Presence of voids and slosh; Snow thickness; Topographic survey of the upper surface of an ice ridge
11	4	Crossing ice ridge at straight continuous motion ahead	

DESCRIPTION OF ICE CONDITIONS

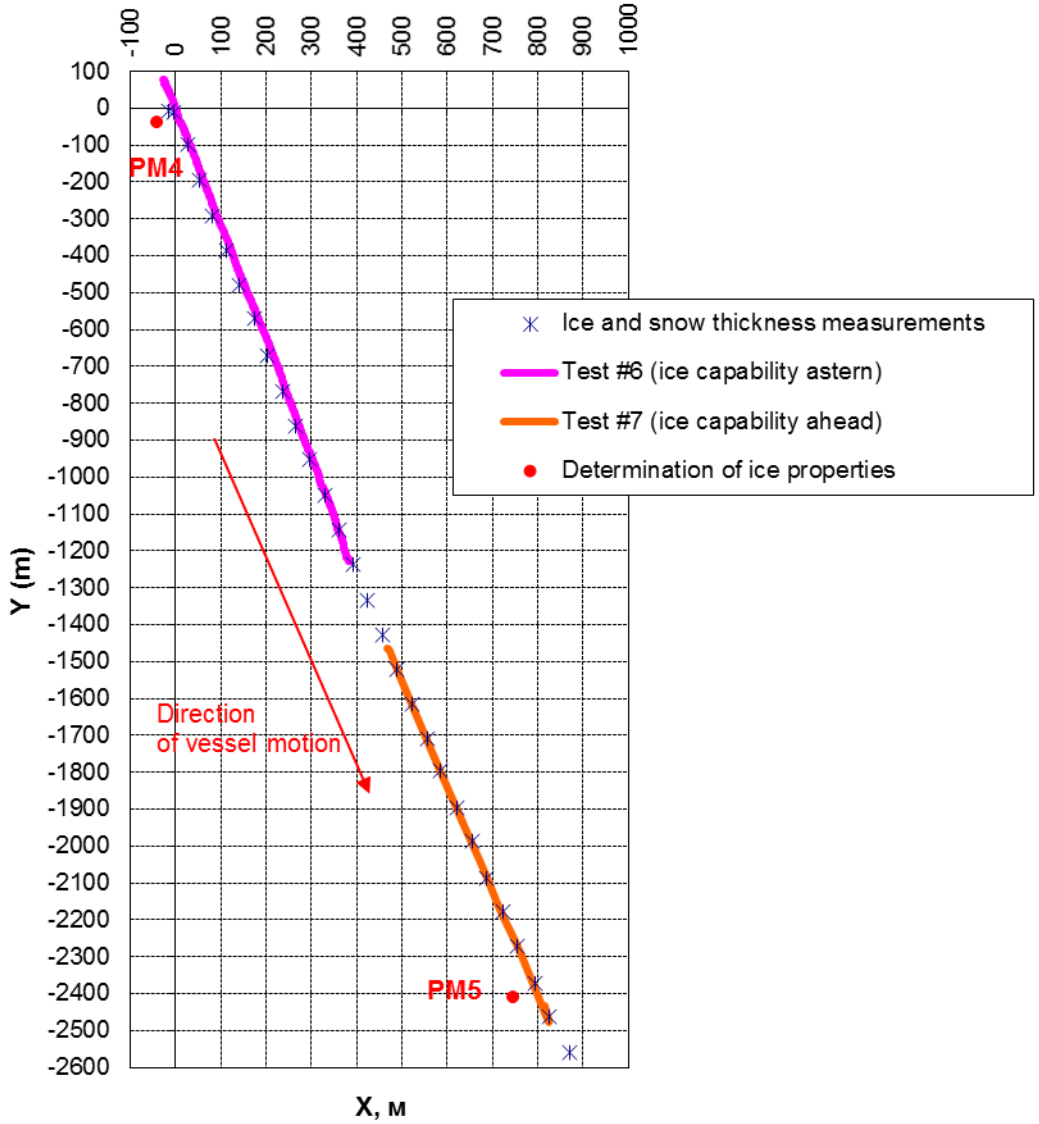
SCHEME OF TESTING AREA NO.1



GENERAL INFORMATION ABOUT ICE PARAMETERS ON TESTING AREA NO.1 (LEVEL ICE)

Parameters	Number of measurements	Average	Minimum	Maximum	Standard deviation
Ice thickness, cm	59	120	97	143	10
Snow thickness, cm	59	41	25	66	9
Snow density, kg/m^3	27	369	316	494	37
Water depth, m	44	15	14	16	0.5
Ice temperature, °C	44	–1.4	–3.5	–0.1	0.98
Ice temperature averaged by whole ice thickness, °C	4	–1.5	–	–	–
Ice density, kg/m^3	48	951	923	984	14
Ice density averaged by whole thickness, kg/m^3	4	950	–	–	–
Flexural ice strength, MPa	64	1.84	0.83	3.27	0.55
Flexural ice strength recalculated to whole ice thickness, MPa	5	0.42	–	–	–

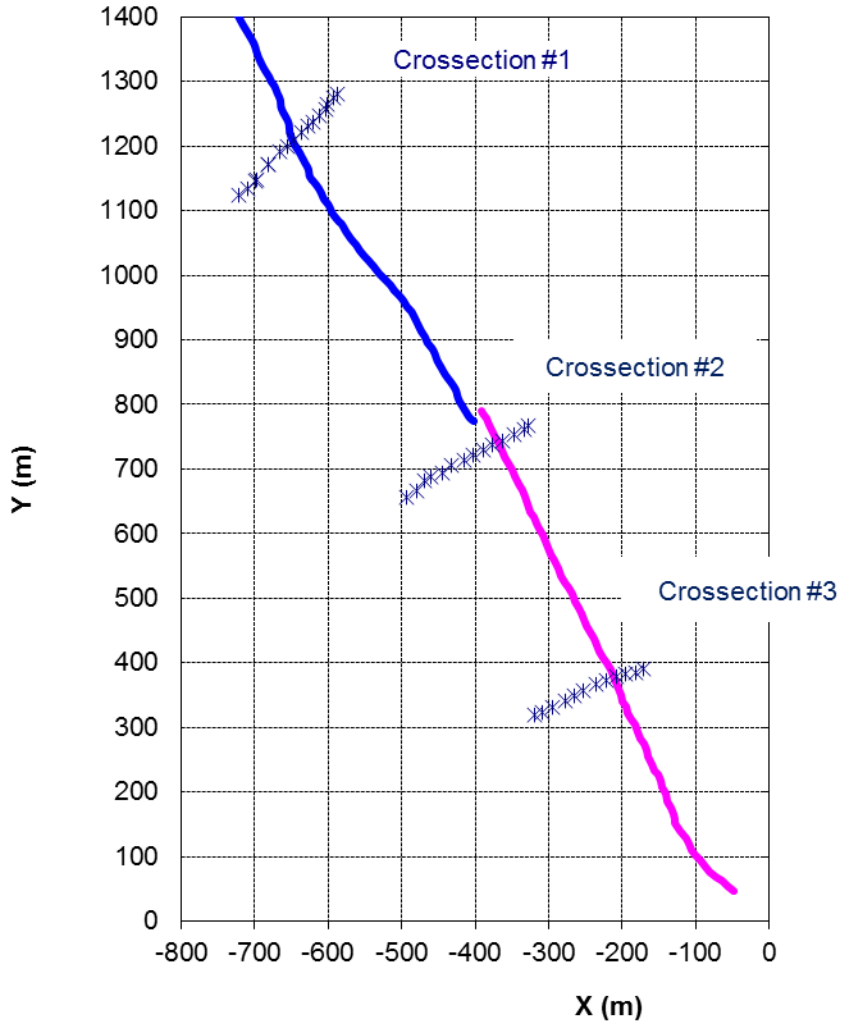
SCHEME OF TESTING AREA NO.2

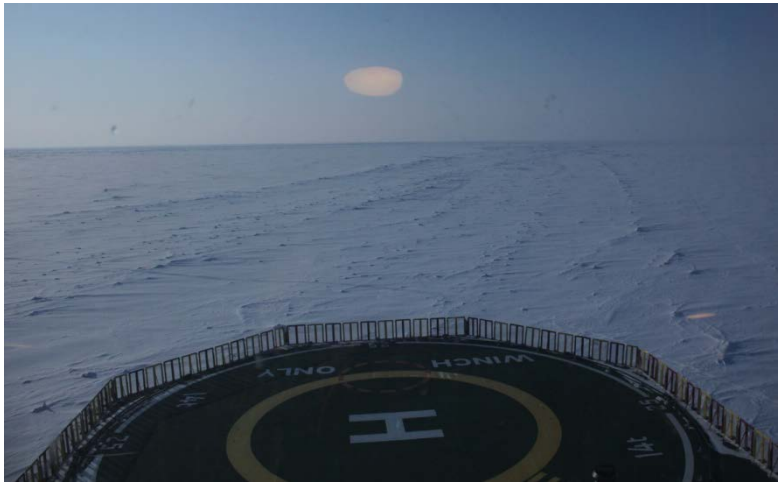


GENERAL INFORMATION ABOUT ICE PARAMETERS ON TESTING AREA NO.2 (LEVEL ICE)

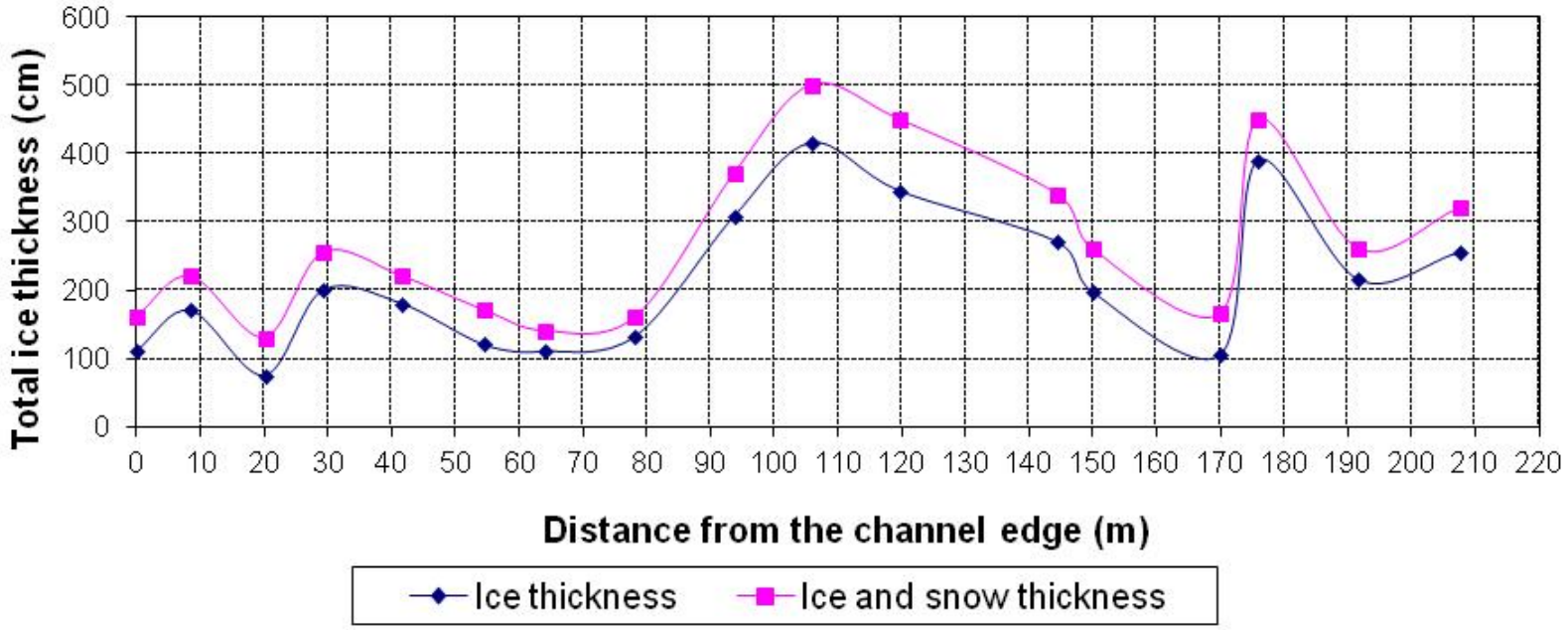
Parameters	Number of measurements	Average	Minimum	Maximum	Standard deviation
Ice thickness, cm	27	132	87	156	15
Snow thickness, cm	27	29	6	47	11
Snow density, kg/m^3	13	403	322	444	36
Water depth, m	27	21	20	21	0.3
Ice temperature, °C	13	–3.1	–4.9	–0.7	1.4
Ice temperature averaged by whole ice thickness, °C	1	–3.1	–	–	–
Ice density, kg/m^3	64	958	892	993	16
Ice density averaged by whole thickness, kg/m^3	5	956	–	–	–
Flexural ice strength, MPa	64	3.51	1.13	6.29	1.04
Flexural ice strength recalculated to whole ice thickness, MPa	4	0.74	–	–	–

SCHEME OF TESTING AREA NO.3 (OLD CHANNEL)

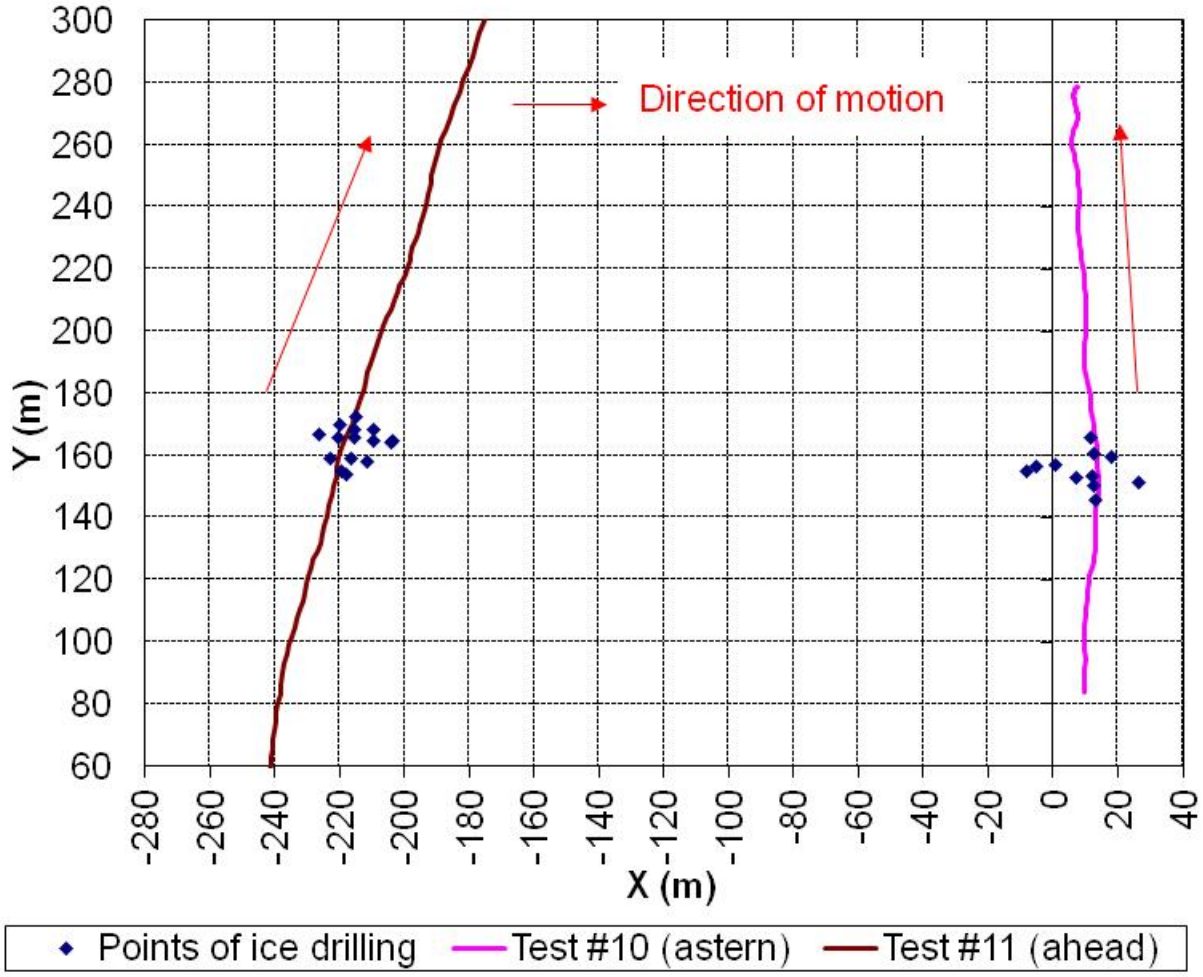




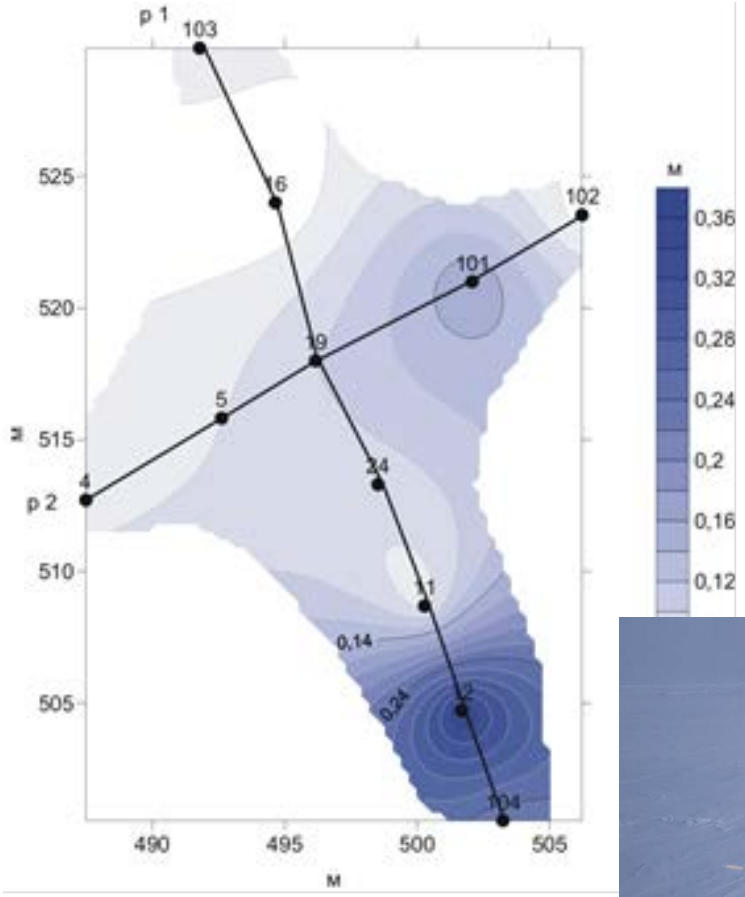
EXAMPLE OF ICE THICKNESS PROFILE ON TESTING AREA NO.3 (OLD CHANNEL)

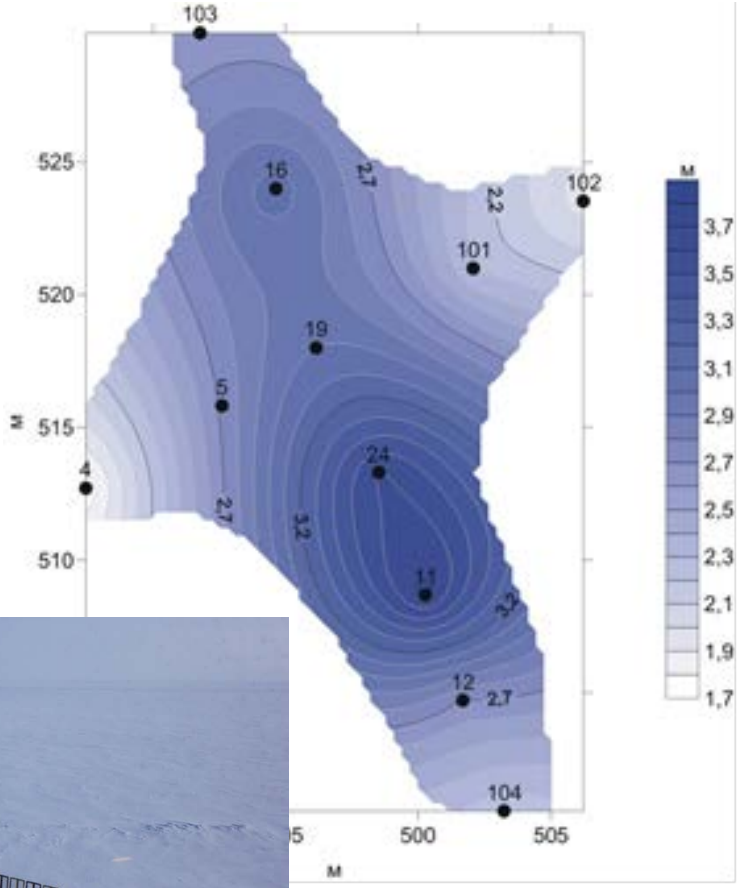


SCHEME OF TESTING AREA NO.4 (ICE RIDGES)



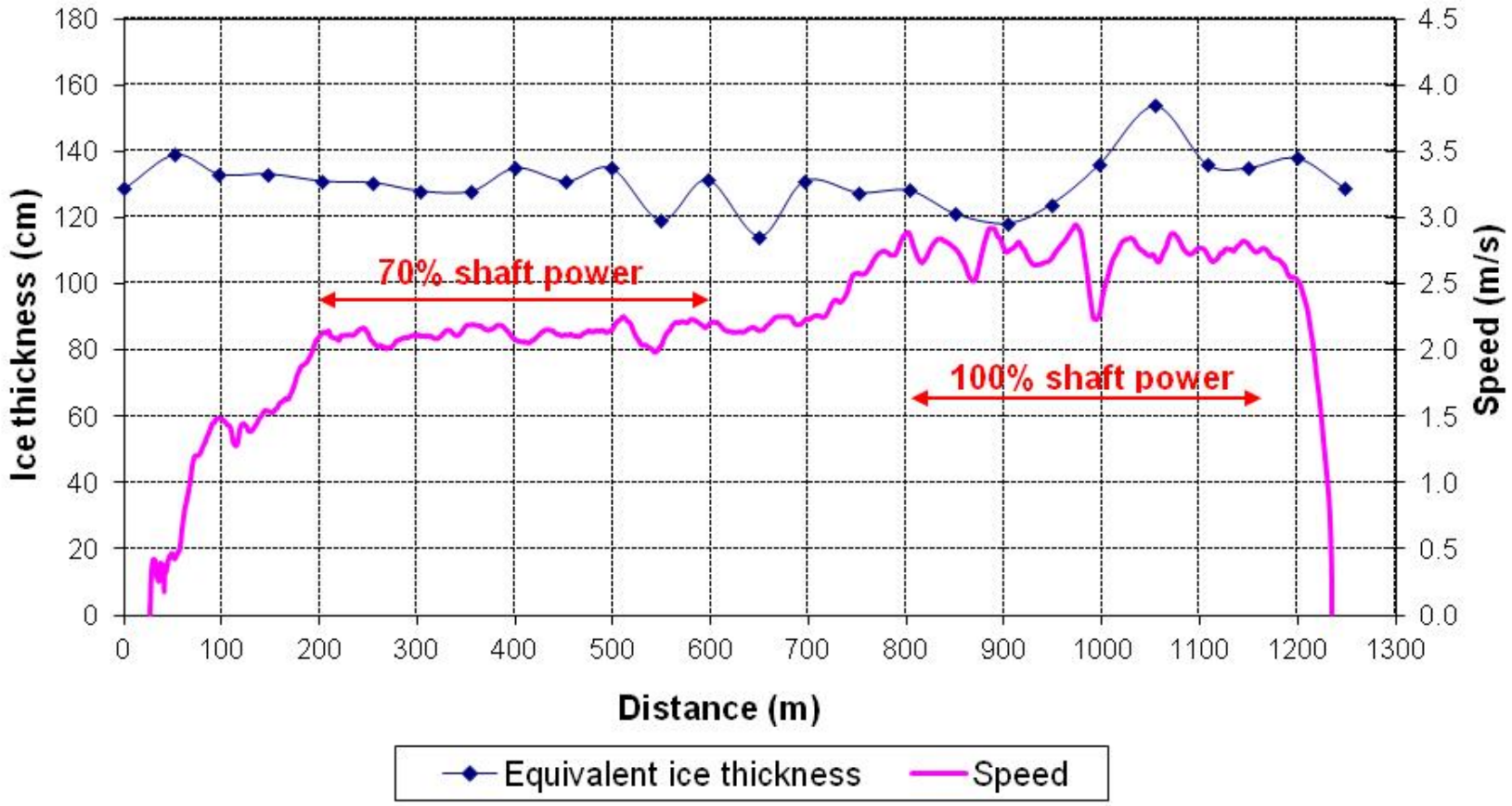
UPPER (LEFT) AND BOTTOM (RIGHT) SURFACES OF ICE RIDGE - ASTERN MOTION



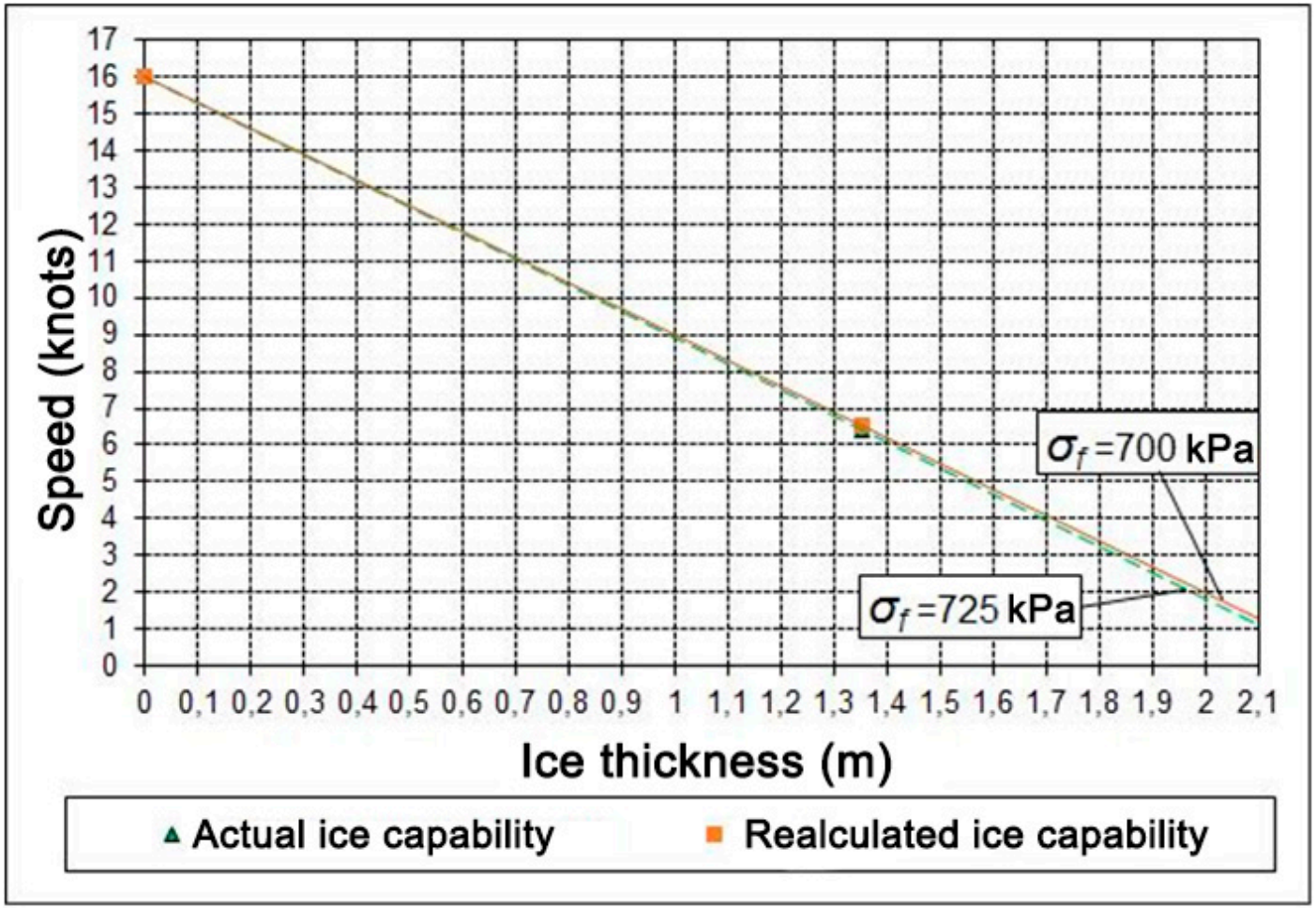


OBTAINED RESULTS

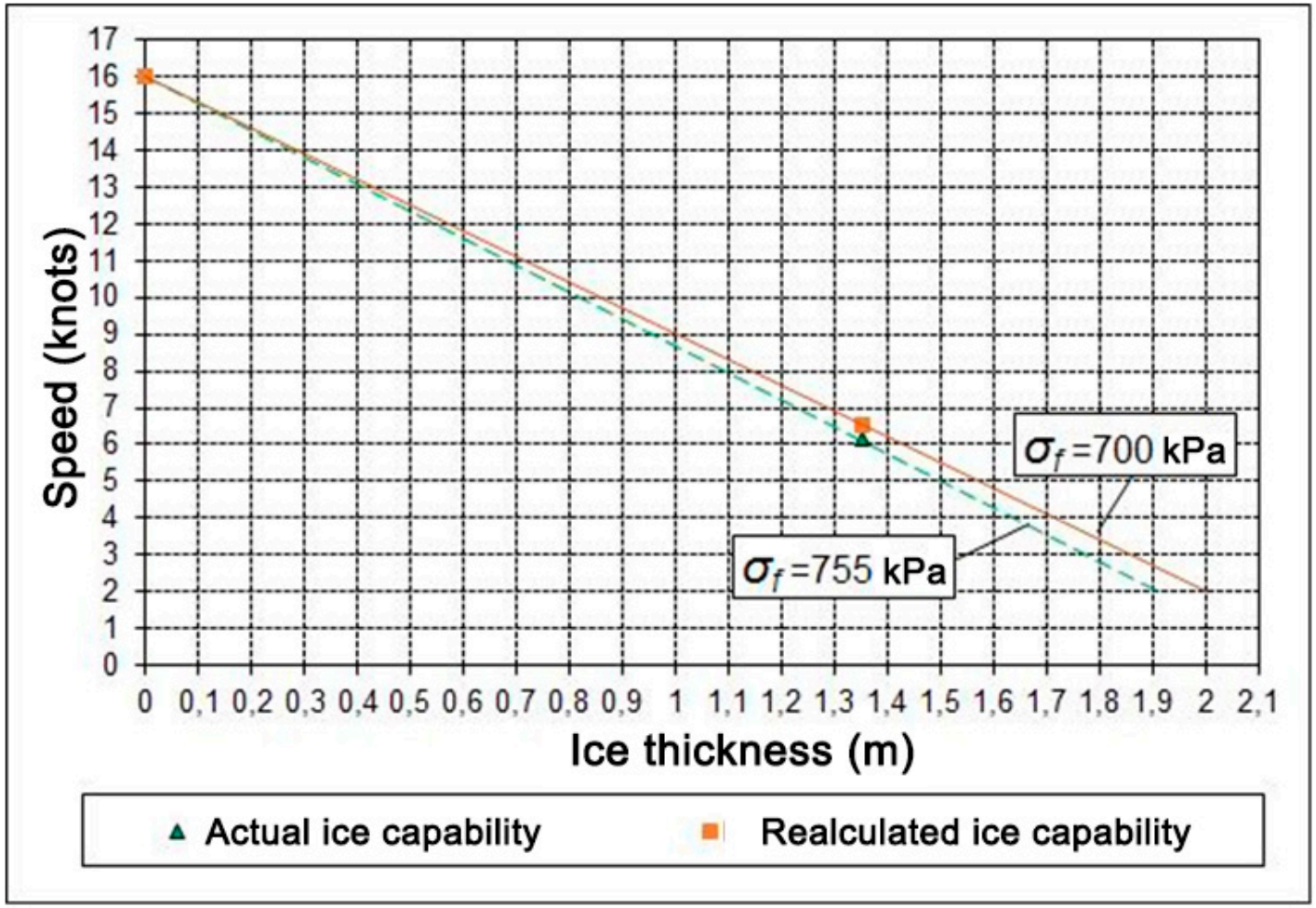
EXAMPLE OF THE RESULTS OF ICE CAPABILITY TESTS IN LEVEL ICE AT AHEAD MOTION (TESTING AREA NO.1)



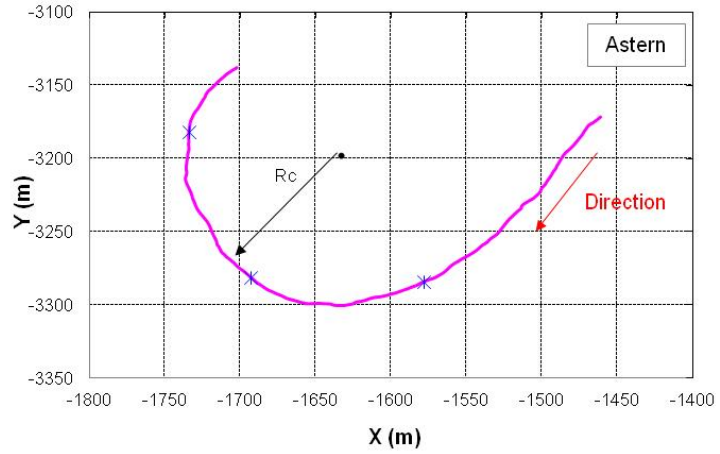
ATTAINABLE SPEED OF IBSV *ALEKSANDR SANNIKOV* AT AHEAD MOTION

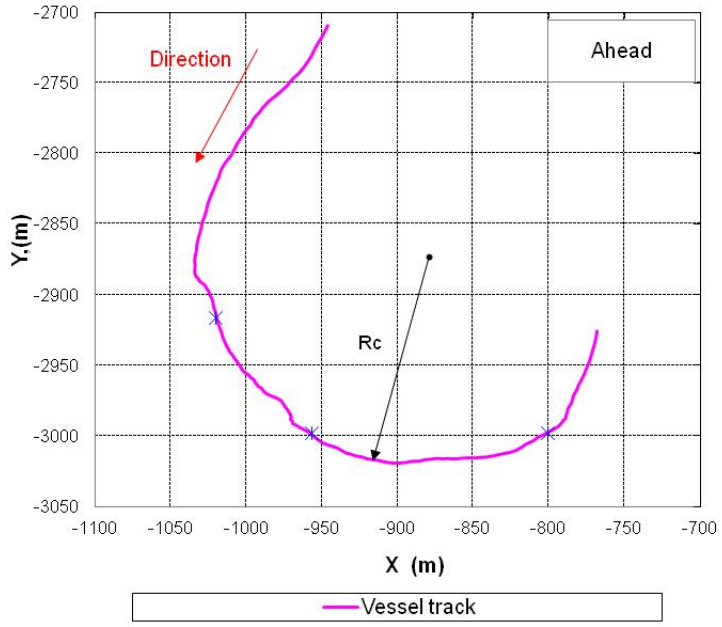


ATTAINABLE SPEED OF IBSV *ALEKSANDR SANNIKOV* AT ASTERN MOTION



CIRCULATION





Turning on port side.

Rotation angle of all Azipods – 35°.

Average ice thickness – about 122 cm, average snow thickness – about 40 cm.

Calculated circulation radius (Rc):

- astern – 102 m
- ahead – 147 m

CONCLUSIONS

1. Ice Trials of IBSV *ALEKSANDR SANNIKOV* confirmed ice capability in level ice both at ahead and astern motion.
2. IBSV *ALEKSANDR SANNIKOV* demonstrated high parameters of maneuverability in ice conditions as at circulation ahead and astern as "star" turning.
3. IBSV is capable of overcoming ice ridges with a thickness of about 5 m in a continuous motion at a speed of more than 3 knots both ahead and astern.
4. IBSV is able to move in an old channel with an average ice thickness of about 200 cm with a continuous speed of at least 1 knot.
5. In general, Ice Trials of the IBSV *ALEKSANDR SANNIKOV* fully confirmed the operational characteristics of the vessel, as stated in the specification

THANK YOU FOR YOUR ATTENTION!

www.aari.ru
38 Bering str.
Saint-Petersburg,
199397 Russia
tel.: +7(812)337-3228

olks@aari.ru; aaricoop@aari.ru