

NOTIFICATION OF PROPOSED RESEARCH CRUISE

GENERAL
ORGANISATION
PART A

1. Name of research ship **BELGICA** Cruise N° **2009/24**
2. Dates of cruise From **15 September 2009** to **18 September 2009**
3. Operating Authority **Belgian Navy under contract for Belgian Ministry of Science Policy Management Unit of the North Sea Mathematical Model "M.U.M.M.", 3° & 23° Linierégimentsplein, 8400 Oostende
Tel, 32(0)59 70 01 31, Facsimile 32(0)59 70 49 35
Email : bmmost@mumm.ac.be**
4. Owner **Belgian state represented by Minister for Science Policy**
5. Particulars of ship

Name	Belgica
Nationality	Belgian
Overall length	51 meters
Maximum draught	4,5 meters
Nett tonnage	232 NRT
Propulsion	Diesel
Call Sign	ORGQ
Telephone	INMARSAT 00870 76 218 73 27
Facsimile	INMARSAT 00870 32 052 18 12
Email	belgica@mumm.ac.be
6. Crew

Name of master	R. Joosen, 1LZ
N° of Crew	15
7. Scientific Personnel

Name and address of scientist in charge :

Dr. Kevin Ruddick
Management Unit of the North Sea Mathematical Models (MUMM)
Gulledelle 100
1200 Brussels
Tel +32 2 7732131,
Fax +32 2 7706972,
email: K.Ruddick@mumm.ac.be

N° of scientists	15
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(A nominal roll of all personnel other than nationals of the applicant (flag) state is required)

Dr. Kevin Ruddick (UK)	Dr. Alberto Borges (Portugal)	David Doxaran (France)
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8. Geographical area in which ship will operate (with reference in latitude and longitude).
**Belgian, French, Dutch and UK Continental Shelves
Box with corners at N 50°30', E 1°00 and N 52°00, E 3°30'**

9. Brief description of purpose of cruise

“BELCOLOUR-2” : Improvement of the quality of existing optical remote sensing products for marine, coastal and inland waters and development of new products (e.g. pCO₂ and primary production) for key applications such as aquaculture and air-sea CO₂ flux quantification ; project in the frame of the research programme for earth observation “STEREO II” (Support to The Exploitation and Research in Earth Observation) of the Belgian Science Policy (Belspo)

Other purposes : only in Belgian waters

- Monitoring program in the framework of the Joint Assessment Monitoring Program (JAMP) and the Nutrient Monitoring Program (MNP) of the Oslo and Paris Commissions as well as for national purposes.
- Monitoring of the phytoplankton of Belgian coastal waters in the framework of the EU Water Frame Directive (2000/60/EC) and the Joint Assessment Monitoring Program (JAMP) of the OSPAR commission.

10. Port of Call. Dates. Reasons.

Zeebrugge	15/09/2009	Departure : start of research cruise 2009/24
Zeebrugge	18/09/2009	Arrival : end of research cruise 2009/24

11. Any special logistic requirements at ports of call (other than water, fuel provisions, etc.) **N.A.**

NOTIFICATION OF PROPOSED RESEARCH CRUISE

DETAIL PART B

1. Name of research ship **BELGICA** Cruise N° **2009/24**
2. Date of cruise From **15 September 2009** To **19 September 2009**
3. Purpose of research and general methods. (If the research work is being taken on behalf of a research institution of a third state, it is the responsibility of that state to obtain prior permission; it is essential that written confirmation that this has been done is obtained and quoted in this application.

The objective of the BELCOLOUR-2 project is to improve the quality of existing optical remote sensing products for marine, coastal and inland waters based on new knowledge and to develop innovative products (including primary production and partial pressure of CO₂) for key applications such as aquaculture and air-sea CO₂ fluxes. The following set of parameters are measured: Inherent and apparent optical properties such as water-leaving reflectance, scattering and absorption of light, particle size distributions (LISST), water turbidity (turbidimeter and Secchi disk), chlorophyll a and total suspended matter concentrations (filtration of sampled water), partial CO₂ pressure and CTD-profiles.

Other purposes : only in Belgian waters
see part A § 9

4. Attach chart(s) showing (on an appropriate scale) the geographical area of the intended work, positions of intended stations, tracks of survey lines, positions of moored / seabed equipment.

See Chart

5. Types of samples required, e.g. Geological / Water / Plankton / Fish / Radioactivity / Isotope

water, suspended matter, plankton

and methods by which samples will be obtained (including dredging/coring/drilling).

Niskin bottles (5 & 10l), in situ measurements (SCTD, ...), Secchi disk, LISST 100C

6. Details of moored equipment : **N.A.**

Dates		Description	Latitude	Longitude
Laying	Recovery			

7. Explosives : **N.A.**

(a) Type and Trade Name	(b) chemical content
(c) Dept of trade class and stowage	(d) Size
(e) Depth of detonation	(f) Frequency of detonation
(g) Dates of detonation	

8. Details and reference of

a) Any relevant previous/future cruises

Belgica cruise 2002/07, 2002/09, 2002, 2002/14, 2003/06, 2003/16, 2003/19 and 2003/22, 2004/10b, 2004/16, 2005/08, 2005/16, 2005/19, 2006/08, 2006/19, 2007/10, 2007/14, 2007/20, 2008/10, 2008/13b, 2008/17, 2008/20, 2008/21, 2009/12, 2009/14c, 2009/15.

b) Any previous published research data relating to the proposed cruise (attach separate sheet if necessary)

See Annex 1

9. Names and addresses of scientist of the coastal state in whose waters the proposed cruise takes place with whom previous contact has been made.

Dr Steef Peters, Instituut voor Milieuvraagstukken, Vrije Universiteit Amsterdam, De Boelelaan 1115, 1081 HV, Amsterdam, **Netherlands**
Tel: ++31 20 444 9555, Fax: +31 20 444 9553, Email: Steef.Peters@ivm.vu.nl

Dr Hubert Loisel, Laboratoire ELICO, UMR -CNRS/ULCO 8013, Maison de la Recherche en Environnement Naturel, 32 Avenue Foch, 62930 Wimereux, **France**
email: loisel@mren2.univ-littoral.fr Tél : 03 20 33 61 89 ; Fax : 03 21 99 64 01

Dr David Doxaran, Marine Optics and Remote Sensing Lab, Laboratoire d'Océanographie de Villefranche, B.P. 8, Quai de la Darse, 06238 Villefranche-sur-Mer, CEDEX, **France**
email: david.doxaran@obs-vlfr.fr Tél : +33 (0)4 93 76 37 18; Fax : +33 (0)4 93 76 38 73,

Dr. Gavin Tilstone, Remote Sensing Group, Plymouth Marine Laboratory, Prospect Place, West Hoe, PLYMOUTH PL1 3DH, **UK**, Tel : +44 1752 633 406; facsimile +44 1752 633 101; email : ghti@pml.ac.uk

10. State :

(a) Whether visits to the ship in port by scientists of the coastal state concerned will be acceptable.

YES

(b) Whether it will be acceptable to carry on board an observer from the coastal state for any part of the cruise and dates and ports of embarkation / disembarkation.

Yes, Zeebrugge Cfr. part A § 10

(c) When research data from intended cruise is likely to be made available to the coastal state and if so by what means. (If the final report is likely to be delayed beyond 12 months, interim progress reports are required.

- **Cruise report available within 2 months (on request)**

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PART C : **SCIENTIFIC EQUIPMENT**

COASTAL STATE : **THE NETHERLANDS**

INDICATE "YES" OR "NO"

<u>LIST SCIENTIFIC WORK BY FUNCTION</u>				DISTANCE FROM COAST		
				WITHIN 12 NMS	BETWEEN 12-200 NMS	CONTINENTAL SHELF WORK ONLY) BEYOND 200 NM BUT WITHIN THE CONTINENTAL MARGIN
eg. MAGNETOMETRY : GRAVITY DIVING : SEISMICS: BATHYMETRY SEABED SAMPLING TRAWLING ECHO SOUNDING : WATER SAMPLING U/W T.V. : MOORED INSTRUMENTS: TOWED INSTRUMENTS :	WATER COLUMN INCLUDING SEDIMENT SAMPLING OF THE SEABED	FISHERIES RESEARCH WITHIN FISHING LIMITS	RESEARCH CONCERNING THE NATURAL RESOURCES OF THE CONTINENTAL SHELF OR ITS PHYSICAL CHARACTERISTICS			
Niskin water bottles (5 & 10l)	YES		YES	YES	YES	
in situ measurements (SCTD, .. including OBS, PAR)	YES		YES	YES	YES	
Non toxic seawater intake	YES		YES	YES	YES	
Secchi disk	YES		YES	YES	YES	
YSI Oxygen Probe	YES		YES	YES	YES	

PART C : **SCIENTIFIC EQUIPMENT**

COASTAL STATE : **FRANCE**

INDICATE "YES" OR "NO"

<u>LIST SCIENTIFIC WORK BY FUNCTION</u>				DISTANCE FROM COAST		
				WITHIN 12 NMS	BETWEEN 12-200 NMS	CONTINENTAL SHELF WORK ONLY) BEYOND 200 NM BUT WITHIN THE CONTINENTAL MARGIN
eg. MAGNETOMETRY : GRAVITY DIVING : SEISMICS: BATHYMETRY SEABED SAMPLING TRAWLING ECHO SOUNDING : WATER SAMPLING U/W T.V. : MOORED INSTRUMENTS: TOWED INSTRUMENTS :	WATER COLUMN INCLUDING SEDIMENT SAMPLING OF THE SEABED	FISHERIES RESEARCH WITHIN FISHING LIMITS	RESEARCH CONCERNING THE NATURAL RESOURCES OF THE CONTINENTAL SHELF OR ITS PHYSICAL CHARACTERISTICS			
Niskin water bottles (5 & 10l)	YES		YES	YES	YES	
in situ measurements (SCTD, .. including OBS, PAR)	YES		YES	YES	YES	
Non toxic seawater intake	YES		YES	YES	YES	
Secchi disk	YES		YES	YES	YES	
YSI Oxygen Probe	YES		YES	YES	YES	

PART C : **SCIENTIFIC EQUIPMENT**

COASTAL STATE : **UNITED KINGDOM**

INDICATE "YES" OR "NO"

<u>LIST SCIENTIFIC WORK BY FUNCTION</u>				DISTANCE FROM COAST		
				WITHIN 12 NMS	BETWEEN 12-200 NMS	CONTINENTAL SHELF WORK ONLY) BEYOND 200 NM BUT WITHIN THE CONTINENTAL MARGIN
eg. MAGNETOMETRY : GRAVITY DIVING : SEISMICS: BATHYMETRY SEABED SAMPLING TRAWLING ECHO SOUNDING : WATER SAMPLING U/W T.V. : MOORED INSTRUMENTS: TOWED INSTRUMENTS :	WATER COLUMN INCLUDING SEDIMENT SAMPLING OF THE SEABED	FISHERIES RESEARCH WITHIN FISHING LIMITS	RESEARCH CONCERNING THE NATURAL RESOURCES OF THE CONTINENTAL SHELF OR ITS PHYSICAL CHARACTERISTICS			
Niskin water bottles (5 & 10l)	YES		YES	YES	YES	
in situ measurements (SCTD, .. including OBS, PAR)	YES		YES	YES	YES	
Non toxic seawater intake	YES		YES	YES	YES	
Secchi disk	YES		YES	YES	YES	
YSI Oxygen Probe	YES		YES	YES	YES	

Annex 1: BELCOLOUR (Publications & Reports)

Astoreca, R., V. Rousseau, K. Ruddick, B. Van Mol, J.-Y. Parent, and C. Lancelot. 2005. Optical properties of algal blooms in an eutrophicated coastal area and its relevance to remote sensing. In R. J. Frouin, M. Babin and S. Sathyendranath [eds.], SPIE international conference 5885 on Remote sensing of the coastal oceanic environment. SPIE.

Astoreca, R., K. Ruddick, B. V. Mol, V. Rousseau, J.-Y. Parent, and C. Lancelot. 2006. Variability of the inherent and apparent optical properties in a highly turbid coastal area: impact for the calibration of remote sensing algorithms. *EARSel eProceedings* 5: 1-17.

Astoreca R, V Rousseau, K Ruddick, C Knechciak, B VanMol, J-Y Parent and C Lancelot. Development and application of an algorithm for detecting *Phaeocystis globosa* blooms in the Case 2 Southern North Sea waters. *Journal of Plankton Research* (in press).

Astoreca R., V. Rousseau and C. Lancelot. 2008. Influence of Phytoplankton Blooms on the Spectral Slope of CDOM in Belgian and Adjacent Waters (Southern North Sea). *Proceedings of the Ocean Optics Conference, Barga, Italy, 6-10 October 2008*

Bertels, L., Vanderstraete, T., Van Coillie, S., Knaeps, E., Sterckx, S., Goossens, R. and Deronde, B., 2008. Mapping of coral reefs using hyperspectral CASI-data : a case study : Fordata, Tanimbar, Indonesia. *International Journal of Remote Sensing*, Vol 29, No. 8, 2359-2391.

Borges, A., K. Ruddick, L.-S. Schiettecatte, and B. Delille. 2008. Net ecosystem production and carbon dioxide fluxes in the Scheldt estuarine plume. *BMC Ecology* 8. doi:10.1186/1472-6785-8-15

De Cauwer, V., K. Ruddick, Y. Park, B. Nechad, and M. Kyramarios. 2004. Optical remote sensing in support of eutrophication monitoring in the Southern North Sea. *EARSel eProceedings* 3: 208-221.

Fettweis, M., B. Nechad, and D. Van Den Eynde. 2007. An estimate of the suspended particulate matter (SPM) transport in the southern North Sea using SeaWiFS images, in situ measurements and numerical model results. *Continental Shelf Research* 27: 1568-1583.

Gons, H. J., M. Rijkeboer, S. Bagheri, and K. G. Ruddick. 2000. Optical teledetection of chlorophyll-a in estuarine and coastal waters. *Environmental Science and Technology* 34: 5189-5192.

Gons, H. J., M. Rijkeboer, and K. G. Ruddick. 2002. A chlorophyll-retrieval algorithm for satellite imagery (Medium Resolution Imaging Spectrometer) of inland and coastal waters. *Journal of Plankton Research* 24: 947-951.

Gons, H. J., M. Rijkeboer, and K. G. Ruddick. 2005. Effect of a waveband shift on chlorophyll retrieval from MERIS imagery of inland and coastal waters. *Journal of Plankton Research* 27: 125-127.

Lacroix, G., K. Ruddick, Y. Park, N. Gypens, and C. Lancelot. 2007. Validation of the 3D biogeochemical model MIRO&CO with field nutrient and phytoplankton data and MERIS-derived surface chlorophyll a images. *Journal of Marine Systems* 64(1-4): 66-88.

Nechad, B., V. De Cauwer, Y. Park, and K. Ruddick. 2003. Suspended Particulate Matter (SPM) mapping from MERIS imagery. Calibration of a regional algorithm for the Belgian coastal waters. MERIS user workshop, 10-13th November 2003. European Space Agency.

Nechad, B., D. Van Den Eynde, M. Fettweis, and F. Francken. 2004. Suspended particulate matter mapping from multitemporal SeaWiFS imagery over the Southern North Sea - SEBAB project, p. 357-367. In P. C. Smits and L. Bruzzone [eds.], *Second International Workshop on the Analysis of multi-temporal remote sensing images (Multitemp 2003)*. Series in Remote Sensing. World Scientific Publishing.

Ovidio, F., and K. Ruddick. 2000. Ocean Color Spectrum (contribution), p. 18-19. Backscatter.

Ovidio, F., K. Ruddick, A. Vasilkov, and V. Burenkov. 2001. Optical remote sensing of Belgian coastal waters, p. 95-102. *Space Scientific Research in Belgium. Volume III Part 2: Earth Sciences. Federal Office for Scientific, Technical and Cultural Affairs.*

Park, Y., V. De Cauwer, B. Nechad, and K. Ruddick. 2003. Validation of MERIS water products for Belgian coastal waters: 2002-2003. MERIS and AATSR Calibration and Geophysical Validation workshop, 20-24th October 2003. European Space Agency.

Park, Y., and K. Ruddick. 2005. Model of remote-sensing reflectance including bidirectional effects for case 1 and case 2 waters. *Applied Optics* 44: 1236-1249.

Park, Y., and K. Ruddick. 2007. Detecting algae blooms in European waters. *Proceedings of the ENVISAT symposium held in Montreux, 2007. European Space Agency SP-636.*

Park, Y., B. Van Mol, and K. Ruddick. 2006. Validation of MERIS water products for Belgian coastal waters: 2002-2005. In D. Danesy [ed.], *Second Working Meeting on MERIS and AATSR Calibration and Geophysical Validation (MAVT-2006)*. ESA.

Peters, S. W. M., M. Eleveld, R. Pasterkamp, H. Van Der Woerd, M. Devolder, S. Jans, Y. Park, K. Ruddick, T. Block, C. Brockmann, R. Doerffer, H. Krasemann, R. Röttgers, W. Schönfeld, P. V. Jorgensen, G. Tilstone, V. Martinez-Vicente, G. Moore, K. Sorensen, J. Hokedal, T. M. Johnsen, E. R. Lomslund, and E. Aas. 2005. Atlas of chlorophyll-a concentration for the North Sea based on MERIS imagery of 2003. *Vrije Universiteit, Amsterdam.*

Ruddick, K., V. D. Cauwer, and B. V. Mol. 2005. Use of the near infrared similarity spectrum for the quality control of remote sensing data. In R. J. Frouin, M. Babin and S. Sathyendranath [eds.], *SPIE international conference 5885 on Remote sensing of the coastal oceanic environment*. SPIE.

Ruddick, K., V. De Cauwer, Y. Park, G. Becu, J.-P. De Blauwe, E. D. Vreker, P.-Y. Deschamps, M. Knockaert, B. Nechad, A. Pollentier, P. Roose, D. Saudemont, and D. V. Tuyckom. 2002b. Preliminary validation of MERIS water products for Belgian coastal waters. *Envisat Validation workshop, 9-13th December 2002. European Space Agency.*

Ruddick, K., G. Lacroix, C. Lancelot, B. Nechad, Y. Park, S. Peters, and B. Van Mol. 2008. Optical remote sensing of the North Sea, p. 79-90. In V. Barale and M. Gade [eds.], *Remote sensing of the European Seas*. Springer-Verlag.

- Ruddick, K., G. Lacroix, Y. Park, V. Rousseau, V. De Cauwer, and S. Sterckx. 2008. Overview of Ocean Colour: theoretical background, sensors and applicability for the detection and monitoring of harmful algae blooms (capabilities and limitations), p. 331-383. Real-time coastal observing systems for marine ecosystem dynamics and harmful algal blooms. Oceanographic Methodology Series. UNESCO publishing.
- Ruddick, K., Y. Park, R. Astoreca, A. Borges, G. Lacroix, and C. Lancelot. 2008. Application of the MERIS algal pigment products in Belgian waters. 2nd MERIS-(A)ATSR workshop. ESA SP-666.
- Ruddick, K., Y. Park, R. Astoreca, G. Neukermans, and B. Van Mol. 2008. Validation of MERIS water products in the Southern North Sea: 2002-2008. 2nd MERIS-(A)ASTR workshop. ESA SP-666.
- Ruddick, K., F. Ovidio, D. V. D. Eynde, and A. Vasilkov. 1998a. The distribution and dynamics of suspended particulate matter in Belgian coastal waters derived from AVHRR imagery, p. 626-629. Ninth Conference on Satellite Meteorology and Oceanography. American Meteorological Society.
- Ruddick, K., Y. Park, and B. Nechad. 2003b. MERIS imagery of Belgian coastal waters: mapping of Suspended Particulate Matter and Chlorophyll-a. MERIS user workshop, 10-13th November 2003. European Space Agency.
- Ruddick, K. G., V. De Cauwer, Y. Park, and G. Moore. 2006. Seaborne measurements of near infrared water-leaving reflectance - the similarity spectrum for turbid waters. *Limnol. and Oceanogr.* 51: 1167-1179.
- Ruddick, K. G., H. J. Gons, M. Rijkeboer, and G. Tilstone. 2001. Optical remote sensing of chlorophyll-a in case 2 waters using an adaptive two-band algorithm with optimal error properties. *Applied Optics* 40: 3575-3585.
- Ruddick, K. G., F. Ovidio, and M. Rijkeboer. 2000c. Atmospheric correction of SeaWiFS imagery for turbid coastal and inland waters. *Applied Optics* 39: 897-912.
- Ruddick, K. G., F. Ovidio, A. Vasilkov, C. Lancelot, V. Rousseau, and M. Rijkeboer. 1999. Optical remote sensing in support of eutrophication monitoring in Belgian waters, p. 445-452. In G. J. A. Nieuwenhuis, R. A. Vaughan and M. Molenaar [eds.], 18th EARSEL symposium on Operational remote sensing for sustainable development. A.A. Balkema, Rotterdam.
- Sterckx, S. Knaeps, E., Bollen, M., Trouw, K. Houthuys, R., 2007. Retrieval of Suspended Sediment from Advanced Hyperspectral Sensor Data in the Scheldt Estuary at Different Stages in the Tidal Cycle. *Marine Geodesy*, Vol. 30 (1-2): 97-108.
- Van Den Eynde, D., B. Nechad, M. Fettweis, and F. Francken. 2003. SPM dynamics in the Southern North Sea derived from SeaWiFS imagery, in-situ measurements and numerical modelling. INTERCOH-2003.
- Van Den Eynde, D., B. Nechad, M. Fettweis, and F. Francken. 2007. Seasonal variability of suspended particulate matter observed from SeaWiFS images near the Belgian coast, p. 291-311. In J. P.-Y. Maa, L. P. Sanford and D. H. Schoellhamer [eds.], *Estuarine and Coastal Fine Sediments Dynamics*. Elsevier.
- Van Mol, B., Y. Park, K. Ruddick, and B. Nechad. 2004. Mapping of chlorophyll and suspended particulate matter from CHRIS imagery of the Oostende core site. 2nd ESA/CHRIS Proba workshop. European Space Agency.
- Van Mol, B., and K. Ruddick. 2004. The Compact High Resolution Imaging Spectrometer (CHRIS): the future of hyperspectral satellite sensors. Imagery of Oostende coastal and inland waters. Airborne Imaging Spectroscopy workshop.
- Van Mol, B., and K. Ruddick. 2005. Total suspended matter maps from CHRIS imagery of a small inland water body in Oostende (Belgium). 3rd ESA/CHRIS Proba workshop. European Space Agency.
- Van Mol, B., K. Ruddick, R. Astoreca, Y. Park, and B. Nechad. 2007. Optical detection of a *Noctiluca scintillans* bloom. *EARSeL eProceedings* 6: 130-137.
- Vasilkov, A. P., V. I. Burenkov, and K. G. Ruddick. 1997. Variability of the spectral reflectance and transparency of river plume waters caused by hydrodynamic processes, p. 97-106. *Proceedings of the 4th Intl. Conf. on Rem. Sens. for Mar. and Coastal Env.*
- Vasilkov, A. P., V. I. Burenkov, and K. G. Ruddick. 1999. The spectral reflectance and transparency of river plume waters. *International Journal of Remote Sensing* 20: 2497-2508.