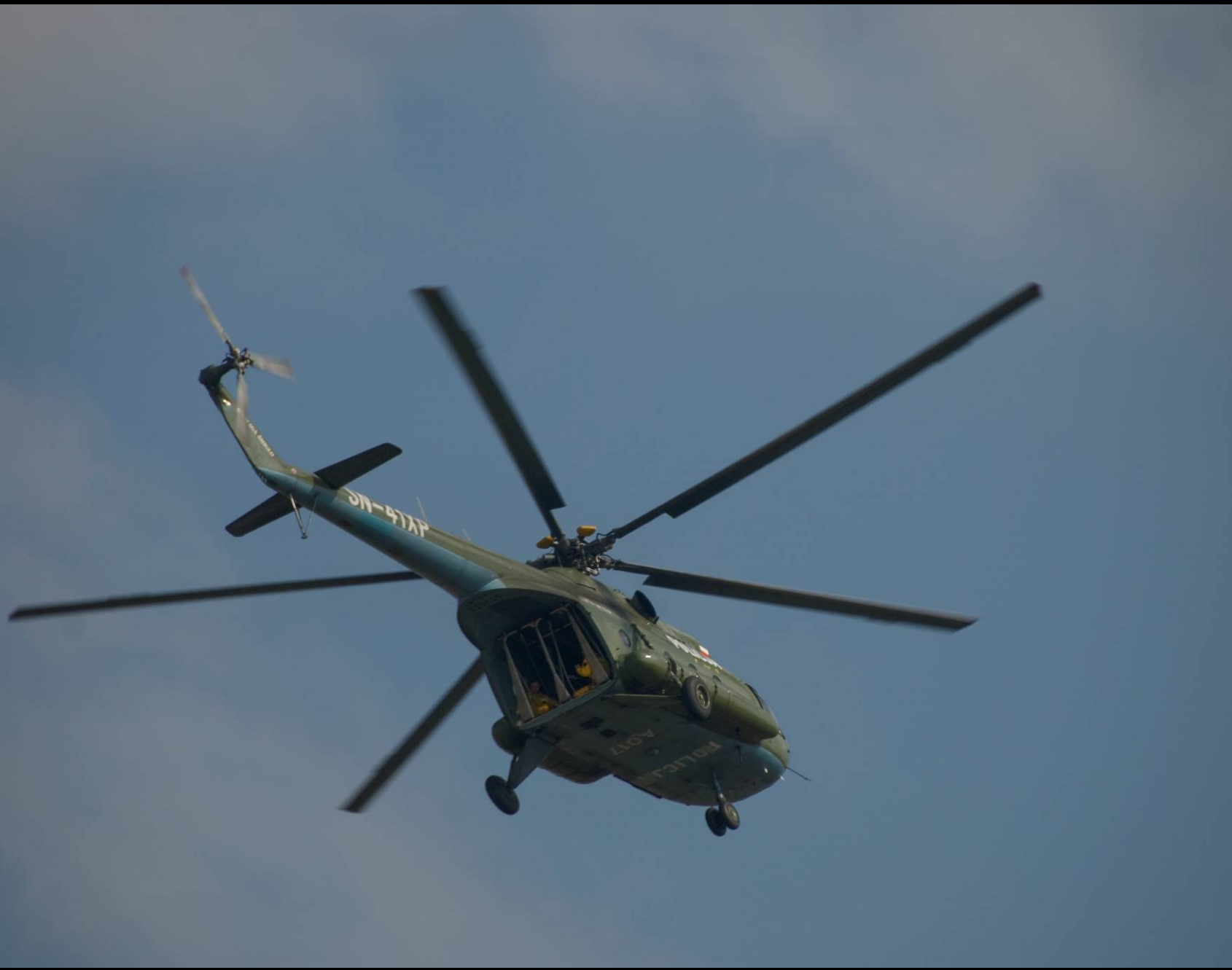
Practical experience of satellite support

Benefits from using space for civil protection in Poland

Jakub Ryzenko
PIAP & SRC

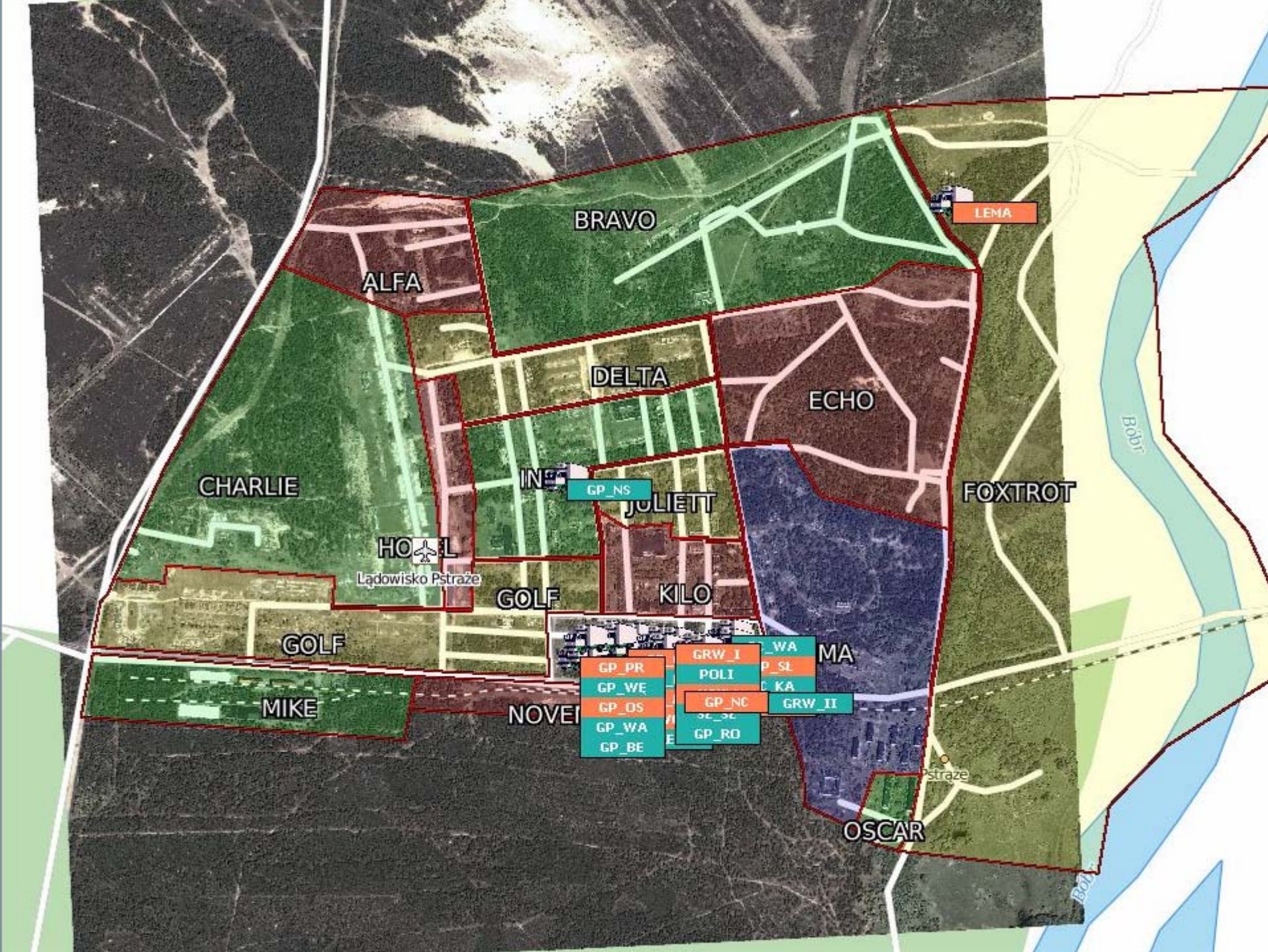

COOperation 2008




Transporter

- ★ Dedicated system developed in close cooperation with users
- ★ System integrates commercial, off-the-shelf products


581 98
220 98
RAŻ 220 90

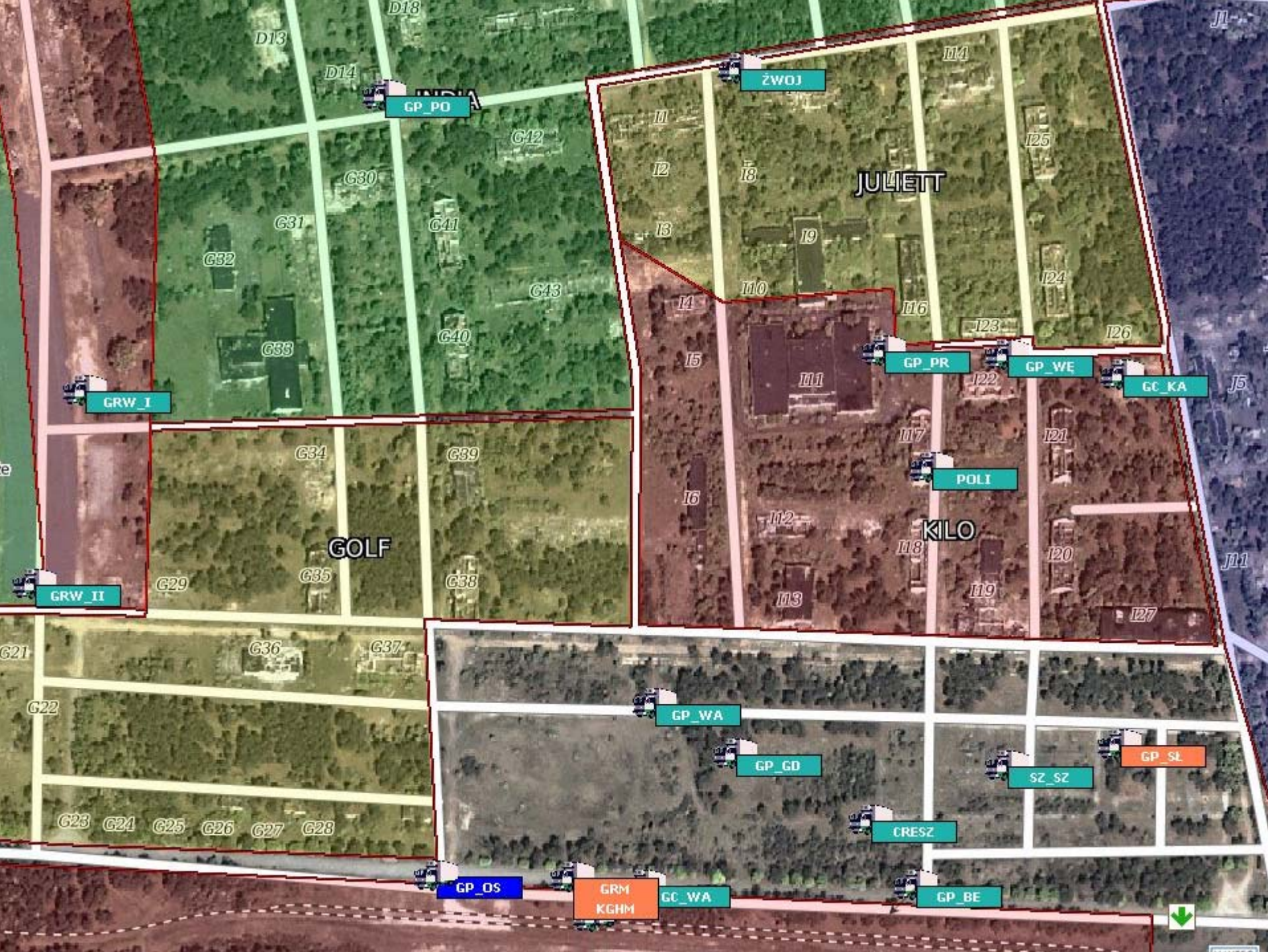

BRAVO
LEMA
ALFA
DELTA
ECHO
CHARLIE
GP_NS
JULIETT
FOXTROT
Bóbr
Lądowisko Pstraże
GOLF
KILO
GOLF
GRW_I
POLI
GP_PR
GP_WE
GP_OS
GP_WA
GP_BE
GP_NC
GRW_II
GP_RO
MIKE
OSCAR

Goals

- ★ Increased situational awareness
- ★ Common operation picture shared by different services involved

Polskie Biuro do spraw Przestrzeni Kosmicznej

Foresight

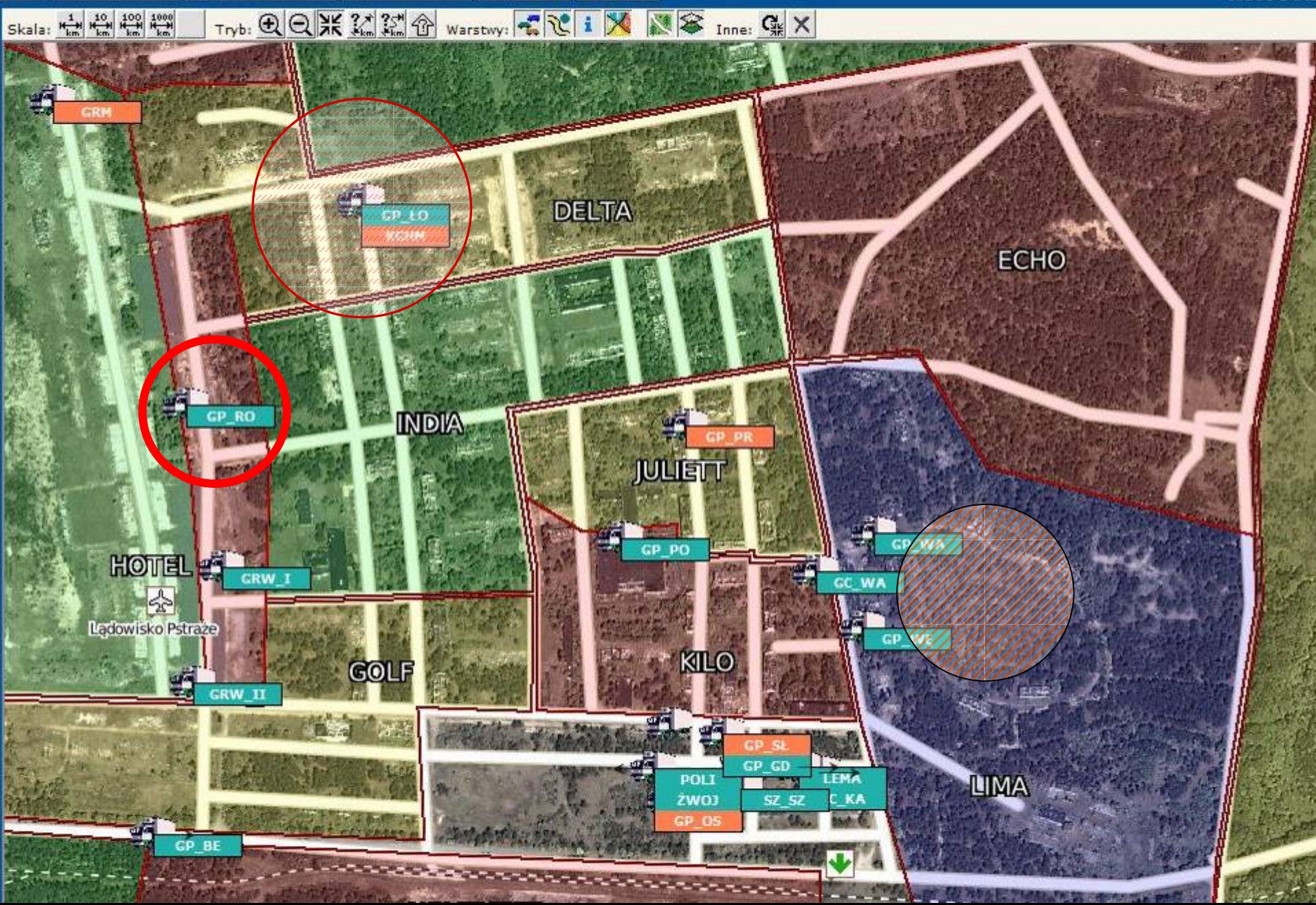

D18
D13
D14
INDIA
GP_PO
ŻWOJ
I14
I1
I25
I2
I8
JULIETT
I3
I9
I24
I10
I4
I16
I23
I26
I5
GP_PR
GP_WE
GC_KA
J5
I11
I22
GRW_I
G42
G30
G31
G41
G32
G43
G40
G33
G34
G39
I17
I21
POLI
I6
I12
KILO
GOLF
I18
I20
J11
GRW_II
G29
G35
G38
I13
I19
I27
G21
G36
G37
GP_WA
G22
GP_GD
GP_SŁ
SZ_SZ
G23
G24
G25
G26
G27
G28
CRESZ
GP_OS
GRM
KGHM
GC_WA
GP_BE

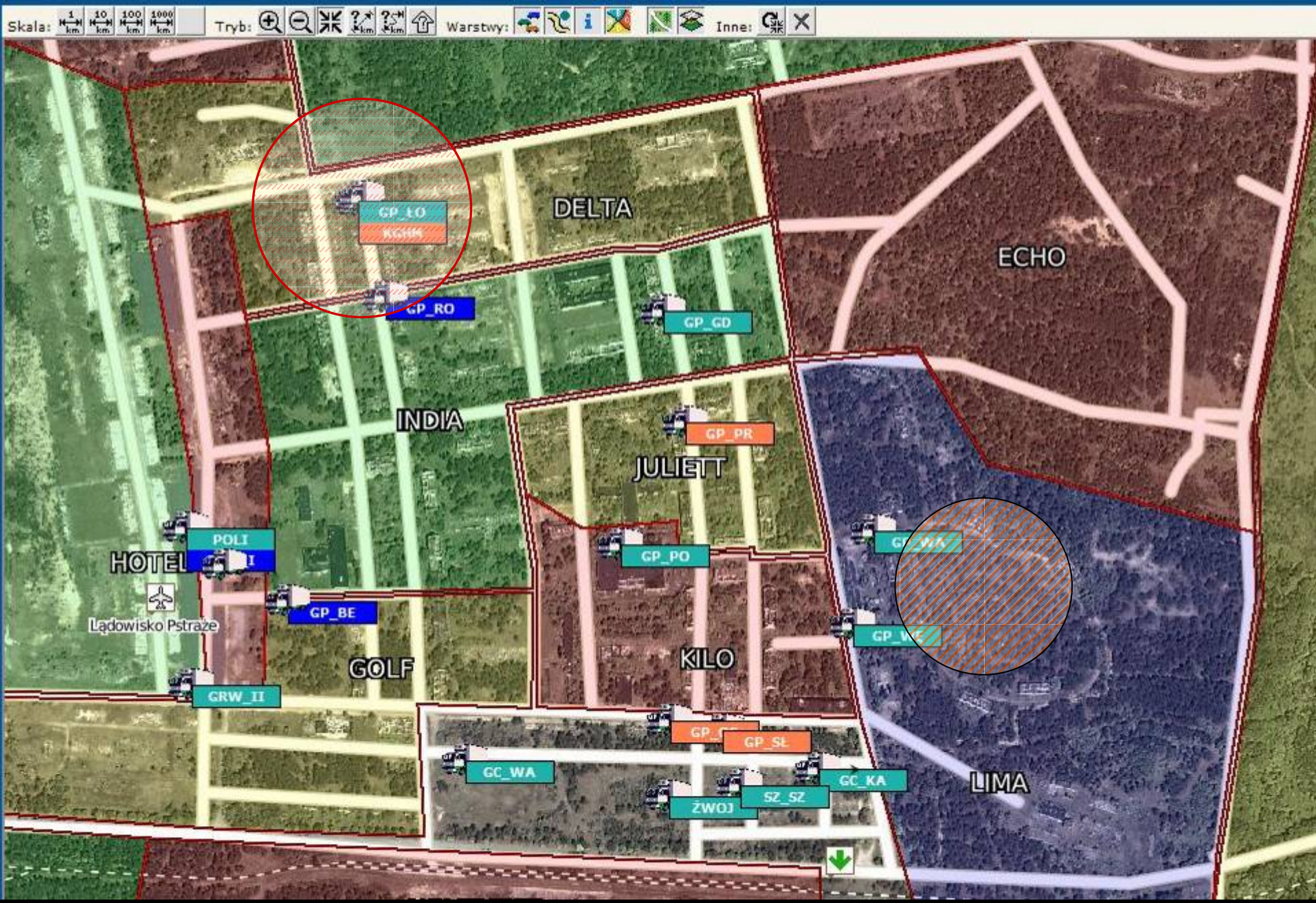
Goals

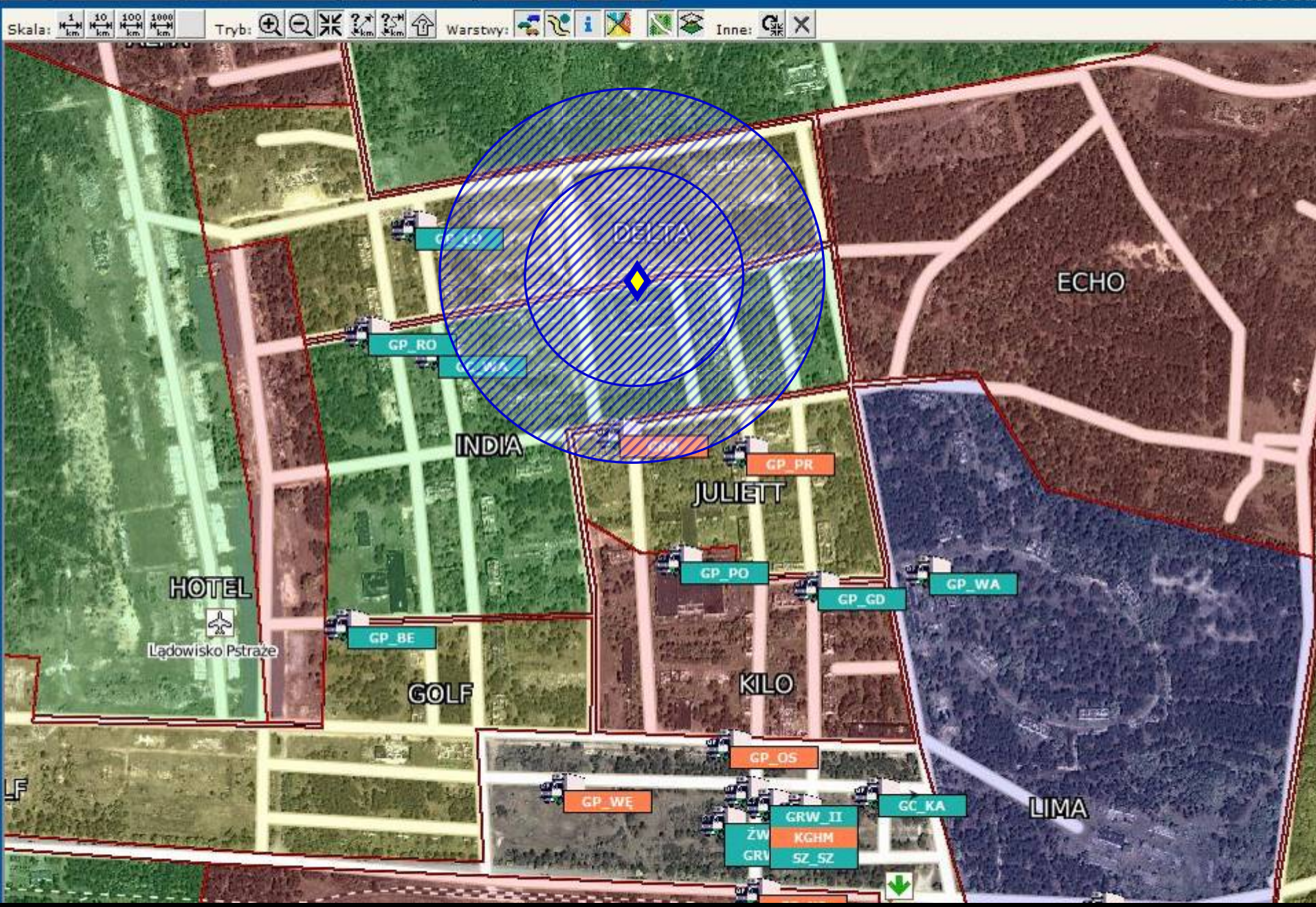
- ★ Increased situational awareness
- ★ Common operation picture shared by different actors involved

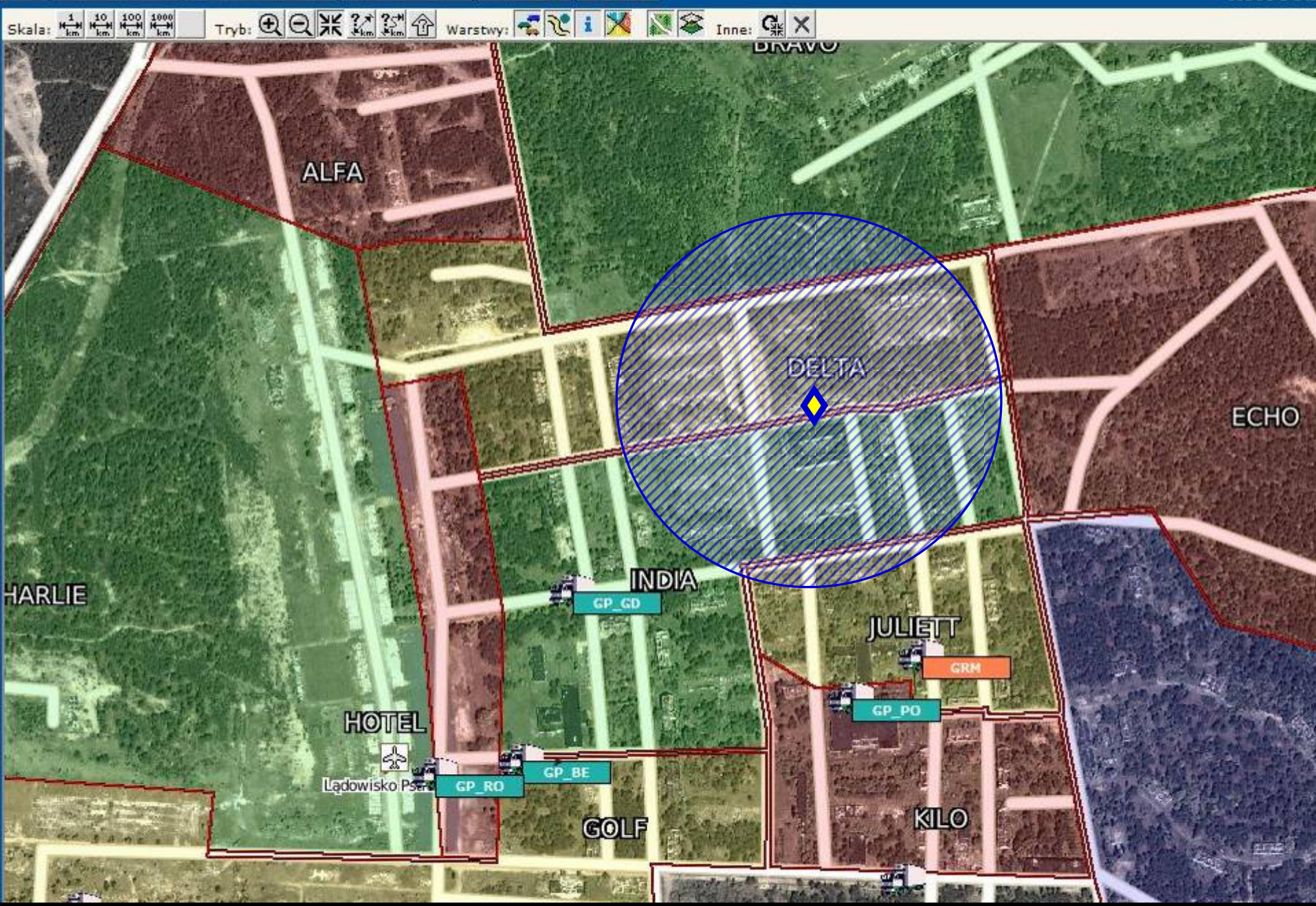

STRAŻ
STRAŻ
STRAŻ


D18
D13
D14
INDIA
GP_PO
ŻWOJ
I14
I1
I25
I2
I8
JULIETT
I3
I9
I24
I10
I4
I16
I23
I26
I5
GP_PR
GP_WE
GC_KA
J5
I11
I22
GRW_I
I17
I21
POLI
G34
G39
I6
I12
KILO
GOLF
I18
I20
J11
G29
G35
G38
GRW_II
I13
I19
I27
G21
G36
G37
G22
GP_WA
GP_GD
GP_SŁ
SZ_SZ
G23
G24
G25
G26
G27
G28
CRESZ
GP_OS
GRM
KGHM
GC_WA
GP_BE


Skala:
Tryb:
Warstwy:
Inne:
GRM
GP_LO
KOHN
DELTA
ECHO
GP_RO
INDIA
GP_PR
JULIETT
GP_PO
HOTEL
GRW_I
GC_WA
Lądowisko Pstraże
GOLF
KILO
GRW_II
GP_SL
GP_GD
POLI
ŻWOJ
GP_OS
SZ_SZ
LEMA
LIMA
GP_BE


Skala:
Tryb:
Warstwy:
Inne:
DELTA
ECHO
INDIA
JULIETT
KILO
GOLF
LIMA
HOTEL
GP_ŁO
GP_RO
GP_GD
GP_PR
GP_PO
POLI
GP_BE
Lądowisko Pstraże
GRW_II
GP_SŁ
GC_WA
GC_KA
SZ_SZ
ŻWOJ


Skala:
Tryb:
Warstwy:
Inne:
DELTA
ECHO
INDIA
JULIETT
HOTEL
GOLF
KILO
LIMA
GP_RO
GP_PR
GP_PO
GP_GD
GP_WA
GP_BE
GP_OS
GP_WE
GC_KA
GRW_II
KGHM
SZ_SZ
Lądowisko Pstrąże


Skala:
Tryb:
Warstwy:
Inne:
ALFA
DELTA
ECHO
INDIA
GP_GD
JULIETT
GRM
GP_PO
HOTEL
Lądowisko Psary
GP_RO
GP_BE
GOLF
KILO


POLICJA
SN-41XP


GRUPA RATOWNICTWA
WYSOKOŚCIOWA
FERNO


P-9
P-9
EL 8002Y


RATOWNICTWO
MEDYCZNE
VITO
P-9
AUTOFORM
CDI

Conclusions - system architecture

- ★ Ability to track all units/groups participating in operation (belonging to different services and structures) and visualise their location on satellite map greatly enhances **situational awareness**.
- ★ Ability to access exactly the same data in different locations results in a **common operational picture** for all actors involved, both different services and authorities supervising them.
- ★ Both abovementioned factors allow for significantly better **coordination of common operations**.
- ★ Automatic transmission of status information together with position information may provide for much clearer situational picture.

Conclusions – operational procedures

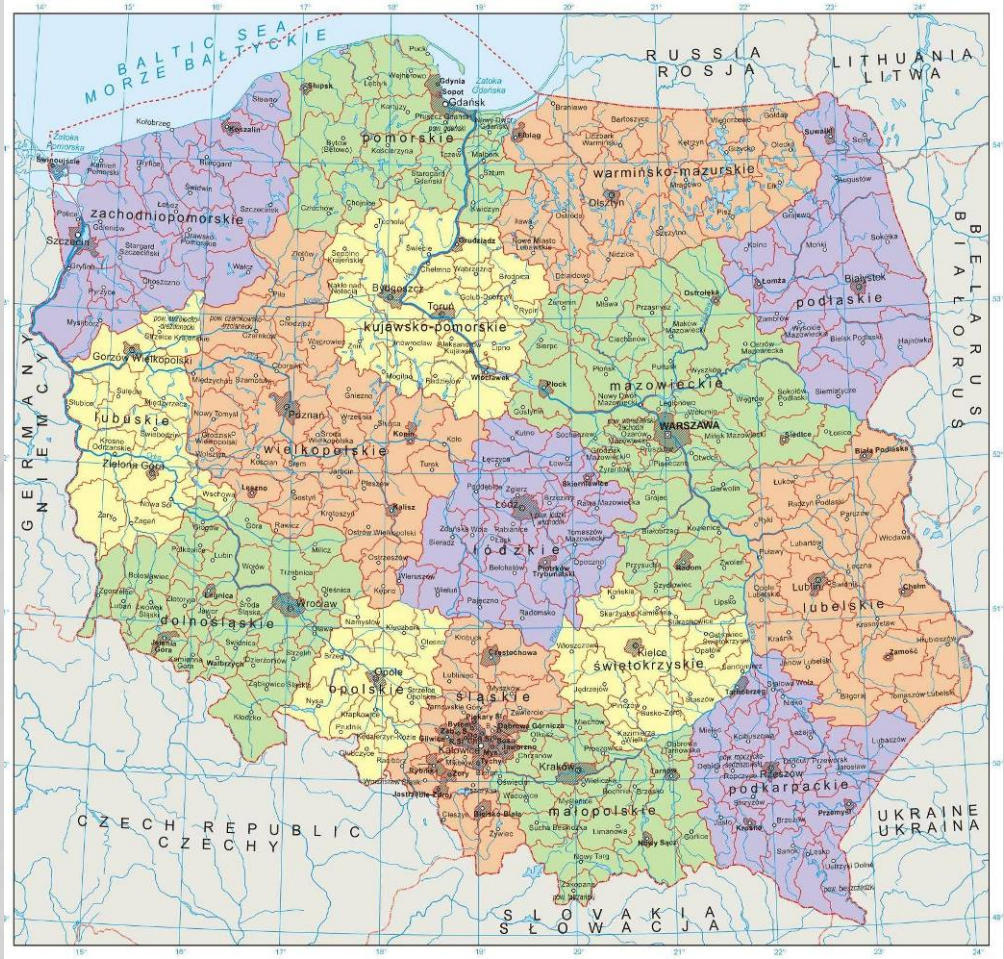
- ★ **Satellite support team** physically present in headquarter is a very effective method to ensure efficient use of available space technologies.
- ★ Geospatial products (satellite maps and analytical products) should use **standardised marking** (e.g. NATO standard symbols) to make them easily readable for users.
- ★ Standards for such products made available electronically are also necessary.
- ★ Users (commanding officers) require certain time (several hours) to get accustomed to new capabilities, understand them and use effectively.

Operational demonstration is a very effective method to validate crisis management systems' concepts and to convince users about their usefulness

Flood 2010

Poland

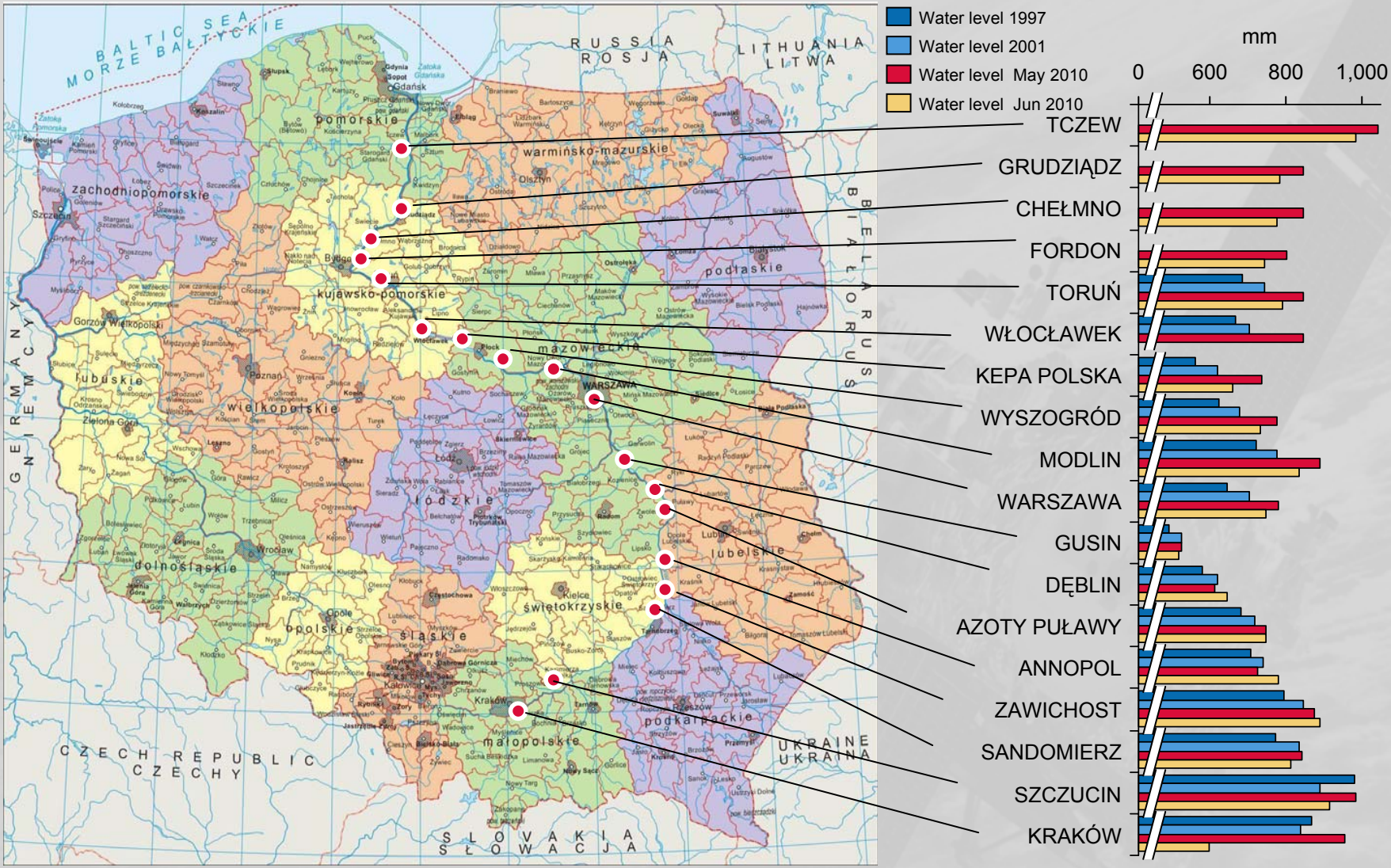
In may 2010 heavy rains raised the level of major rivers resulting in two flood waves

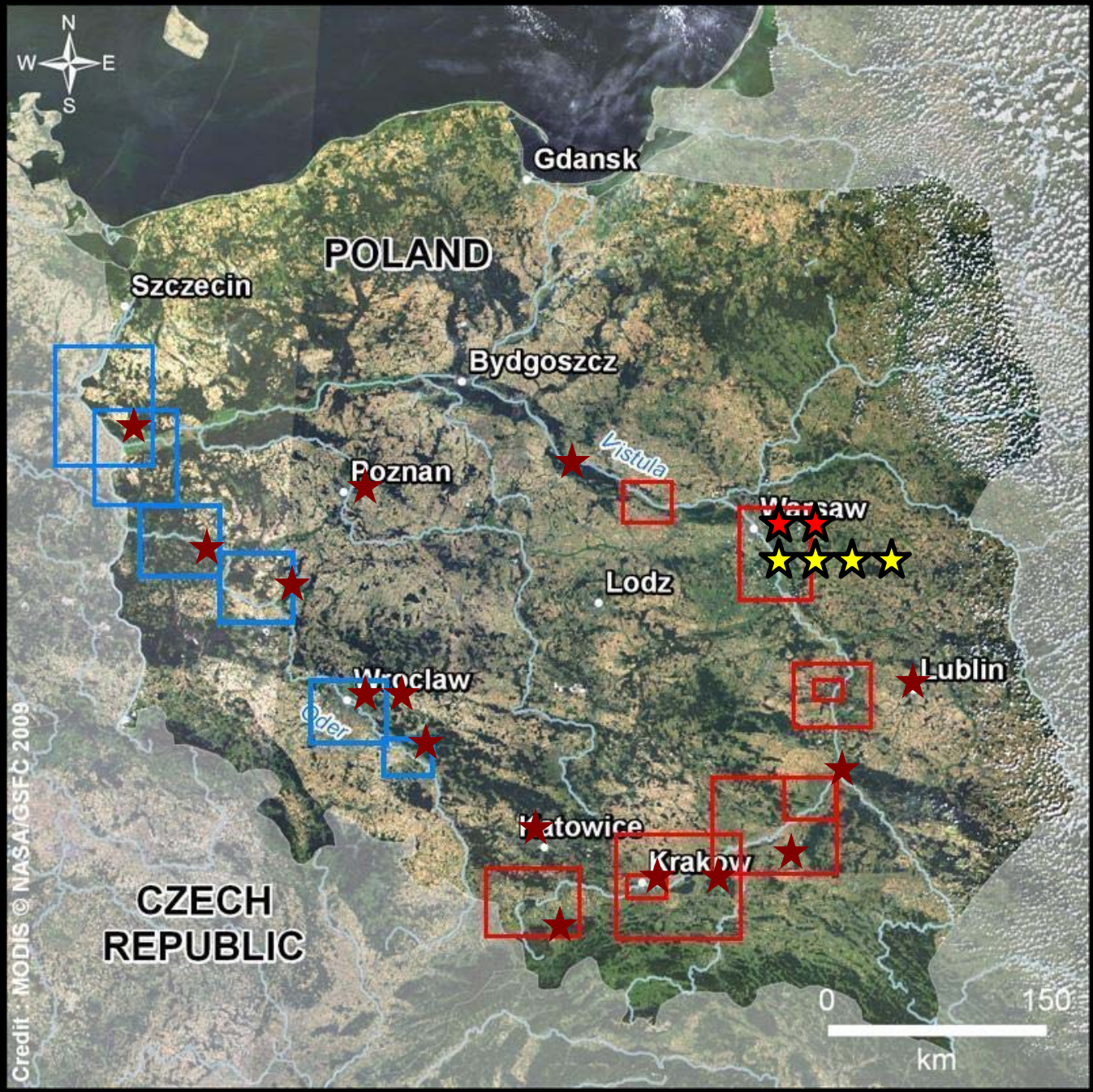


Information

- Timeframe: May/June 2010
- Location: South of Poland - Vistula, Odra and Warta rivers regions
- Situation:
  - Due to heavy rains, the level of main rivers increased quickly
  - The most struck regions were located in the Southern part of Poland
  - All National Reserve of the rescue forces of the State Fire Service were alerted and mobilized
  - Daily rainfall was equal to the average cumulative rainfall for two months
  - Two flood waves hit the interested regions
  - The first wave was higher than the century-old water (probability of such level of water is one in 100 years)
  - Heavy rains persisted over the same area during the second wave
- Consequences: damages in infrastructure, properties, casualties, long term process for revitalisation

During the first wave the gauges on the VISTULA river registered historical highest levels




N
W
E
S
Gdansk
POLAND
Szczecin
Bydgoszcz
Vistula
Poznan
Warsaw
Lodz
Lublin
Wroclaw
Oder
Katowice
Krakow
CZECH
REPUBLIC
0
150
km
Credit : MODIS © NASA/GSFC 2009

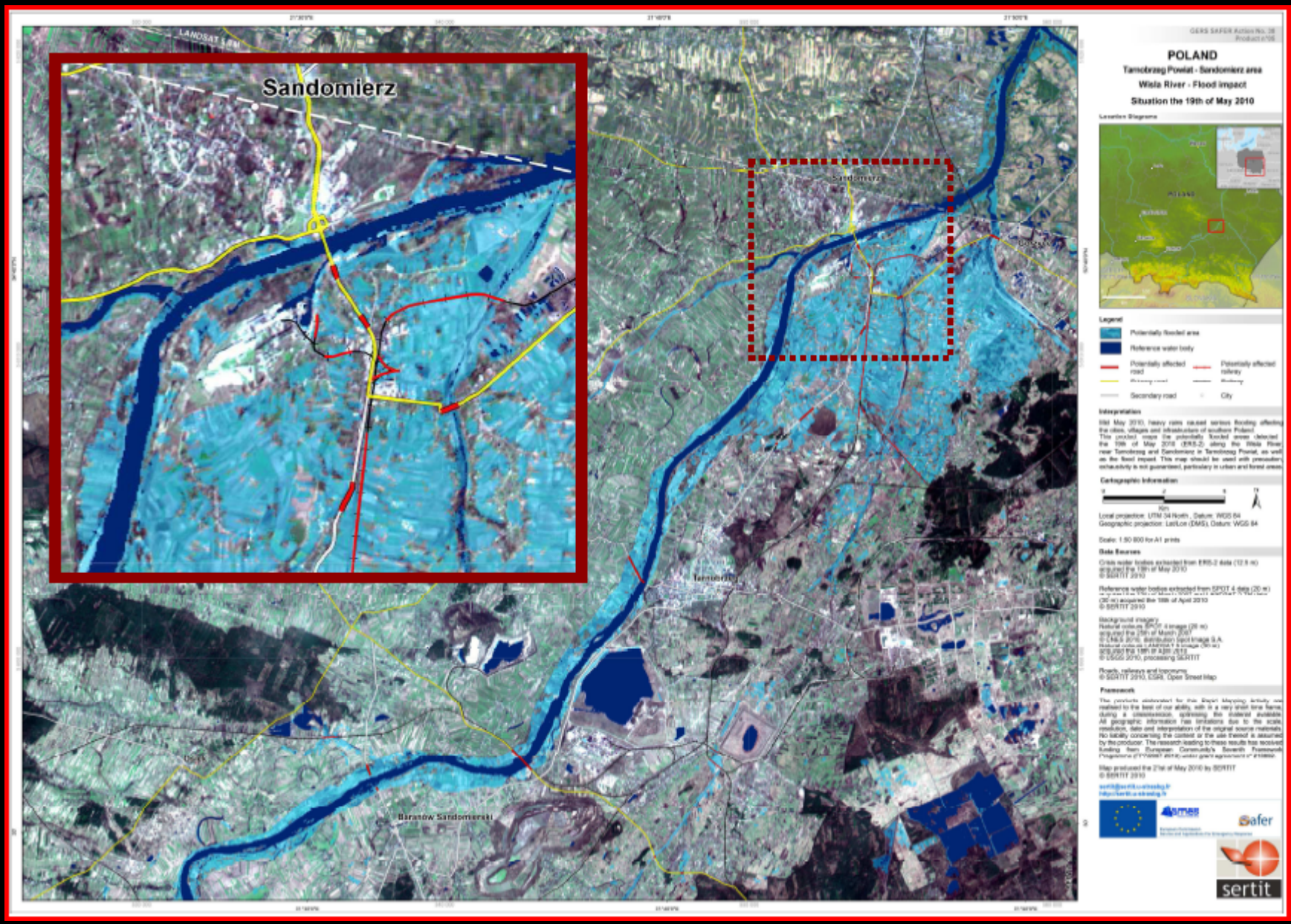
EU Safer activation

- At least 22* different institutional users of data, including:
  - Central level: Civil Protection HQ
  - Central level: Government Security Centre
  - Regional level: Crisis management centres
  - Regional level: Firefighters command centres
  - Administration: collecting data for post-flood analysis and optimal infrastructure reconstruction
  - Military units providing support in the field

* 22 users were in direct contact with National Focal Point. They actively identified needs for additional acquisitions and requested data analysis.

Products distributed

- Information were distributed through dedicated national web page
  - Safer situation maps
  - Vector flood extent data in kmz for easy use in GoogleEarth
  - Geoinformation in GeoTiff format for professional GIS systems
- More than 40 000 visits encountered during the flood



GERS SAFER Action No. 38
Product n°06

POLAND

Tarnobrzeg Powiat - Sandomierz area

Wisla River - Flood impact

Situation the 19th of May 2010

Location Diagram

Legend

- Potentially flooded area
- Reference water body
- Potentially affected road
- Potentially affected railway
- Secondary road
- City

Interpretation

Mid May 2010, heavy rains caused serious flooding affecting the cities, villages and infrastructures of southern Poland. This product maps the potentially flooded areas detected the 19th of May 2010 (ERS-2) along the Wisla River near Tarnobrzeg and Sandomierz in Tarnobrzeg Powiat, as well as the flood impact. This map should be used with precaution, exhaustivity is not guaranteed, particulary in urban and forest areas.

Cartographic Information

0 2 4 8 Km

Local projection: UTM 34 North , Datum: WGS 84
Geographic projection: Lat/Lon (DMS), Datum: WGS 84

Scale: 1:50 000 for A1 prints

Data Sources

Crisis water bodies extracted from ERS-2 data (12.5 m) acquired the 19th of May 2010
© SERTIT 2010

Reference water bodies extracted from SPOT 4 data (20 m) acquired the 26th of March 2007 (20 m) acquired the 18th of April 2010
© SERTIT 2010

Background imagery:
Natural colors SPOT 4 image (20 m) acquired the 26th of March 2007
© CNES 2010, distribution Spot Image S.A.
Natural colors LANDSAT 5 image (30 m) acquired the 19th of April 2010
© USGS 2010, processing SERTIT

Roads, railways and toponyms
© SERTIT 2010, ESRI, Open Street Map

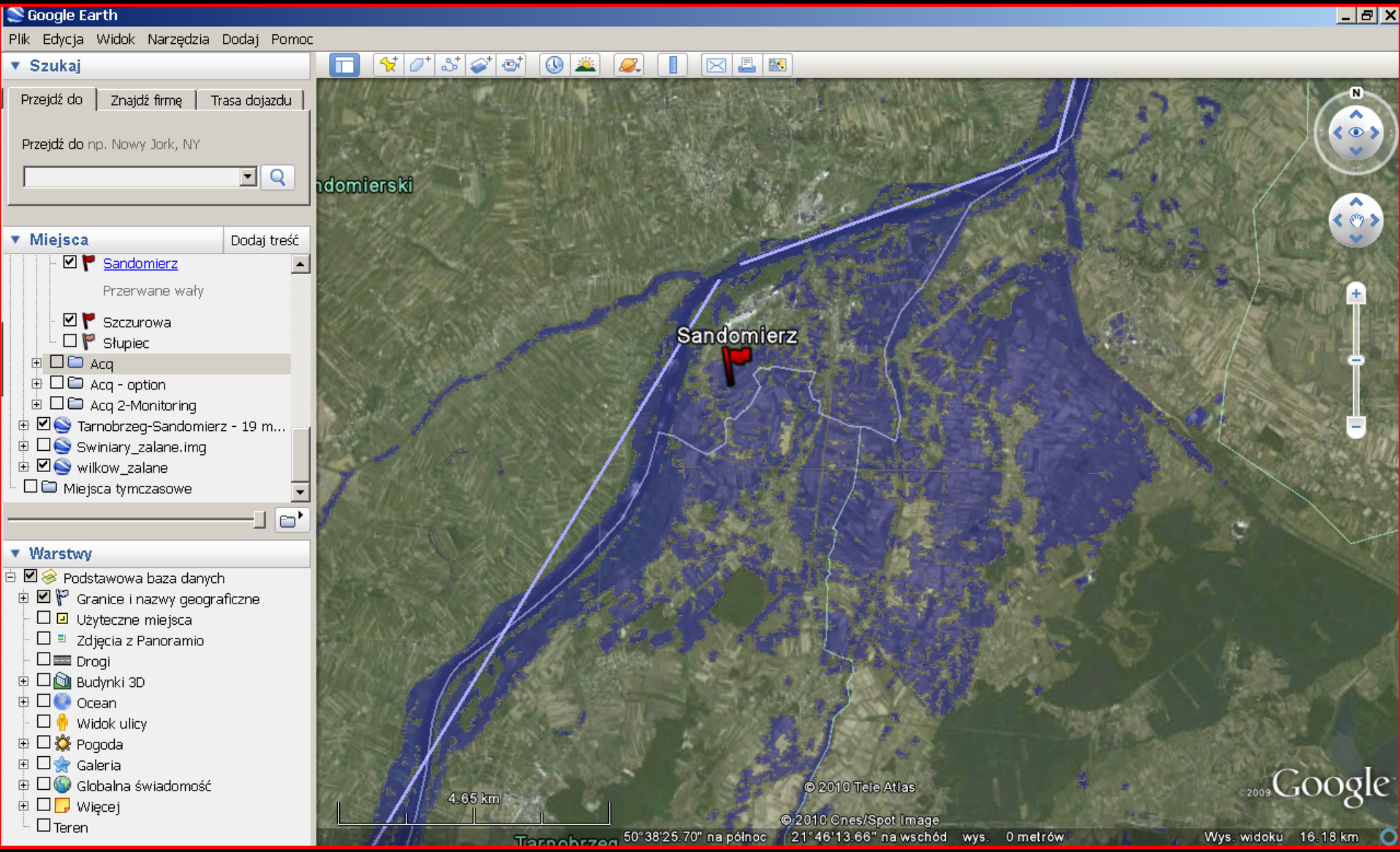
Framework

The products elaborated for this Rapid Mapping activity are realised to the best of our ability, with in a very short time frame, during a crisis/recession, optimising the material available. All geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials. No liability concerning the content or the use thereof is assumed by the producer. This research leading to these results has received funding from European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 218969.

Map produced the 21st of May 2010 by SERTIT
© SERTIT 2010

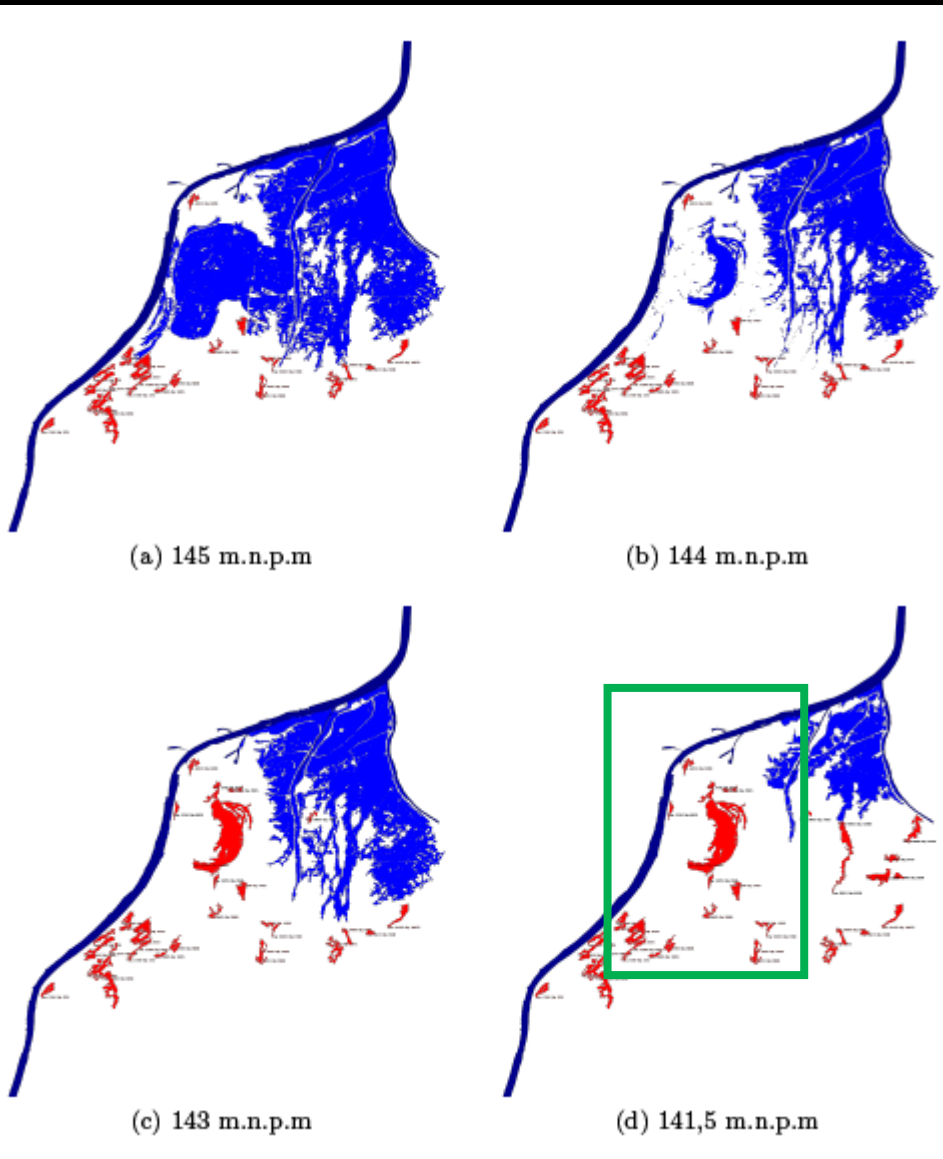
sertit@sertit.u-strasbg.fr
http://sertit.u-strasbg.fr

sertit


Google Earth
Plik Edycja Widok Narzędzia Dodaj Pomoc
Szukaj
Przejdź do
Znajdź firmę
Trasa dojazdu
Przejdź do np. Nowy Jork, NY
Miejsca
Dodaj treść
Sandomierz
Przerwane wały
Szczurowa
Słupiec
Acq
Acq - option
Acq 2-Monitoring
Tarnobrzeg-Sandomierz - 19 m...
Swiniary_zalane.img
wilkow_zalane
Miejsca tymczasowe
Warstwy
Podstawowa baza danych
Granice i nazwy geograficzne
Użyteczne miejsca
Zdjęcia z Panoramio
Drogi
Budynki 3D
Ocean
Widok ulicy
Pogoda
Galeria
Globalna świadomość
Więcej
Teren
Sandomierz
4.65 km
© 2010 Tele Atlas
© 2010 Cnes/Spot Image
©2009 Google
50°38'25.70" na północ
21°46'13.66" na wschód
wys. 0 metrów
Wys. widoku 16.18 km

Additional products

- Operational recommendations for water removal (including hydro- and geological analysis)
- Digital elevation model analysis of flooded areas
- Simulations of flood risk

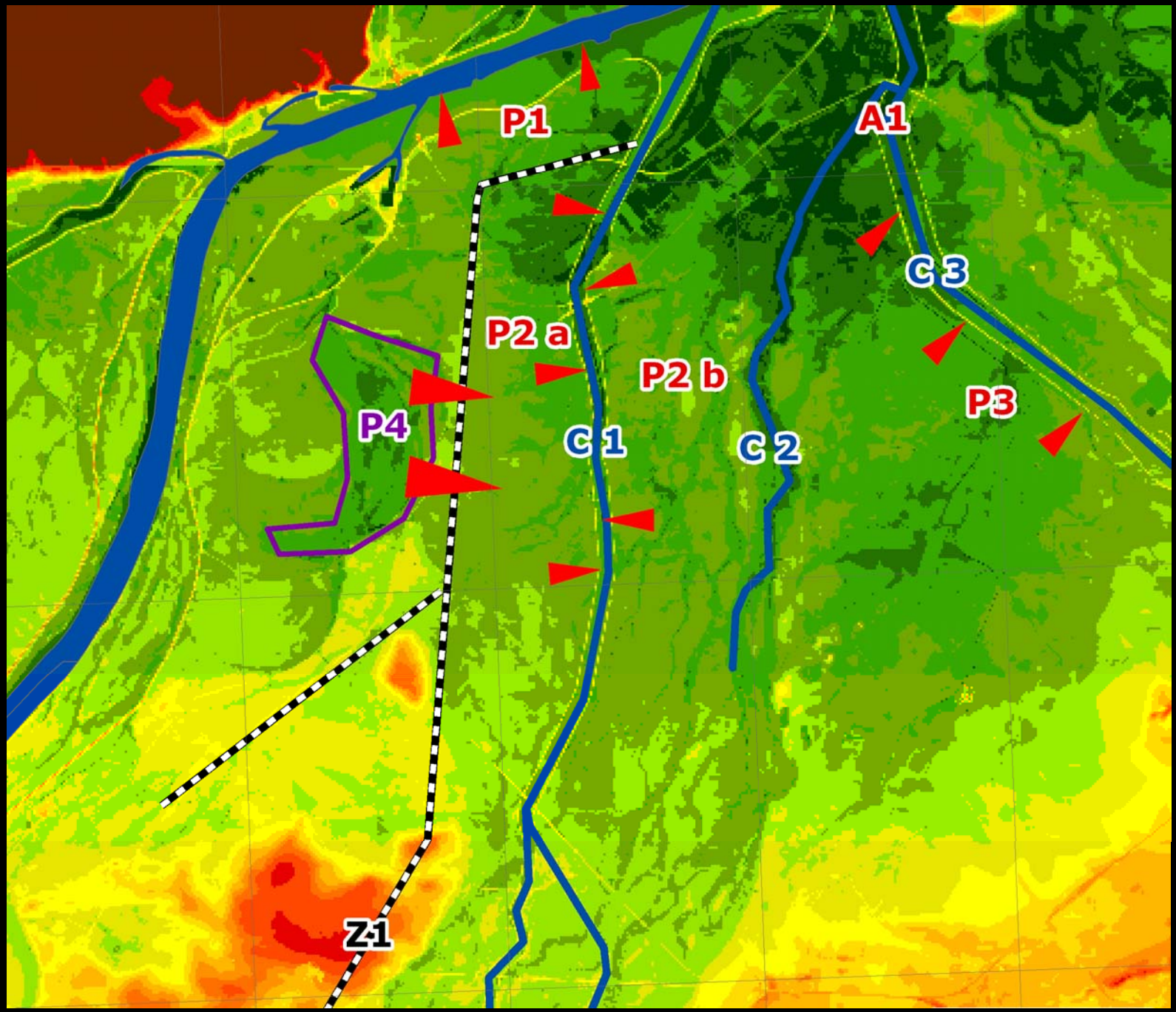


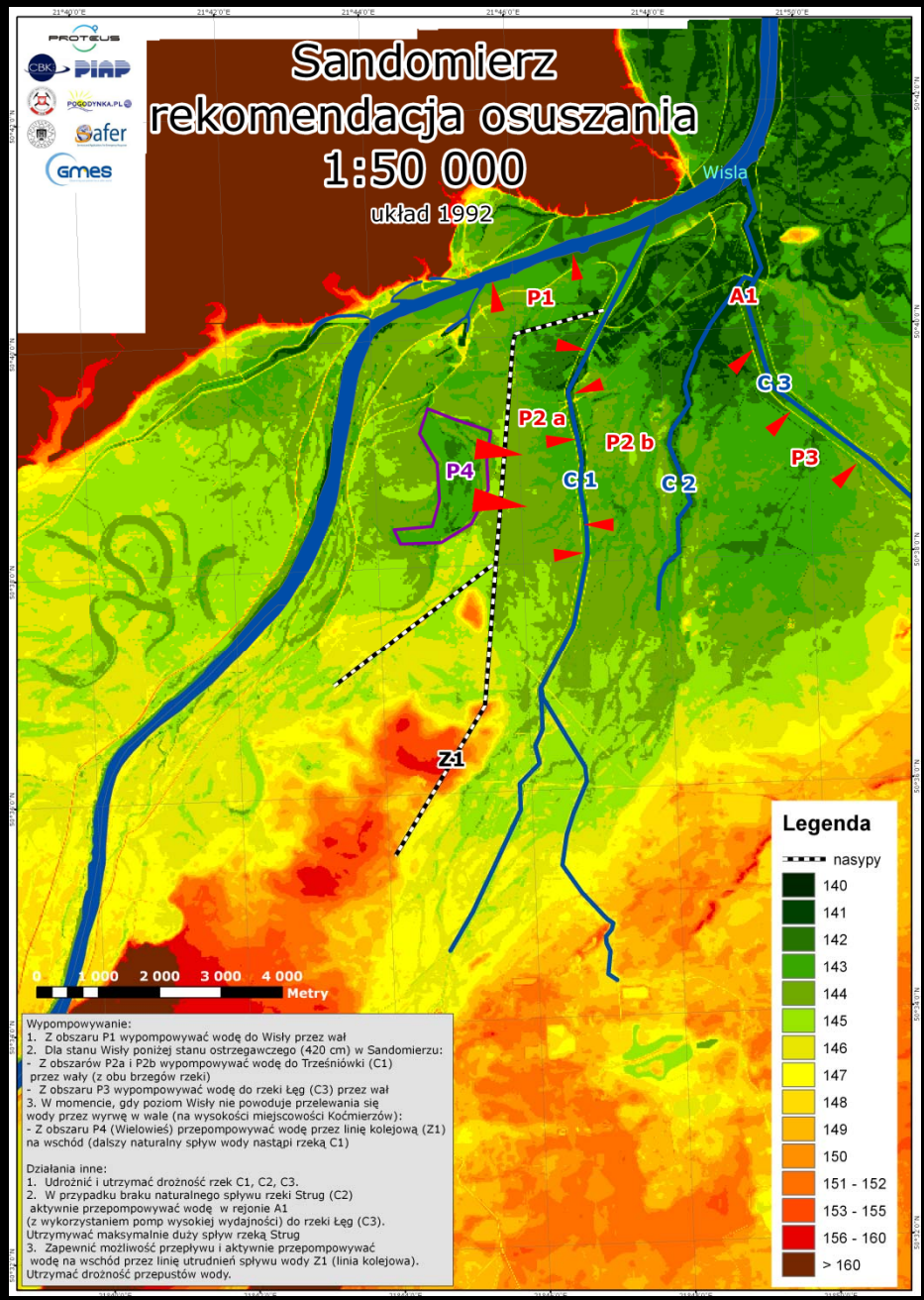
(a) 145 m.n.p.m

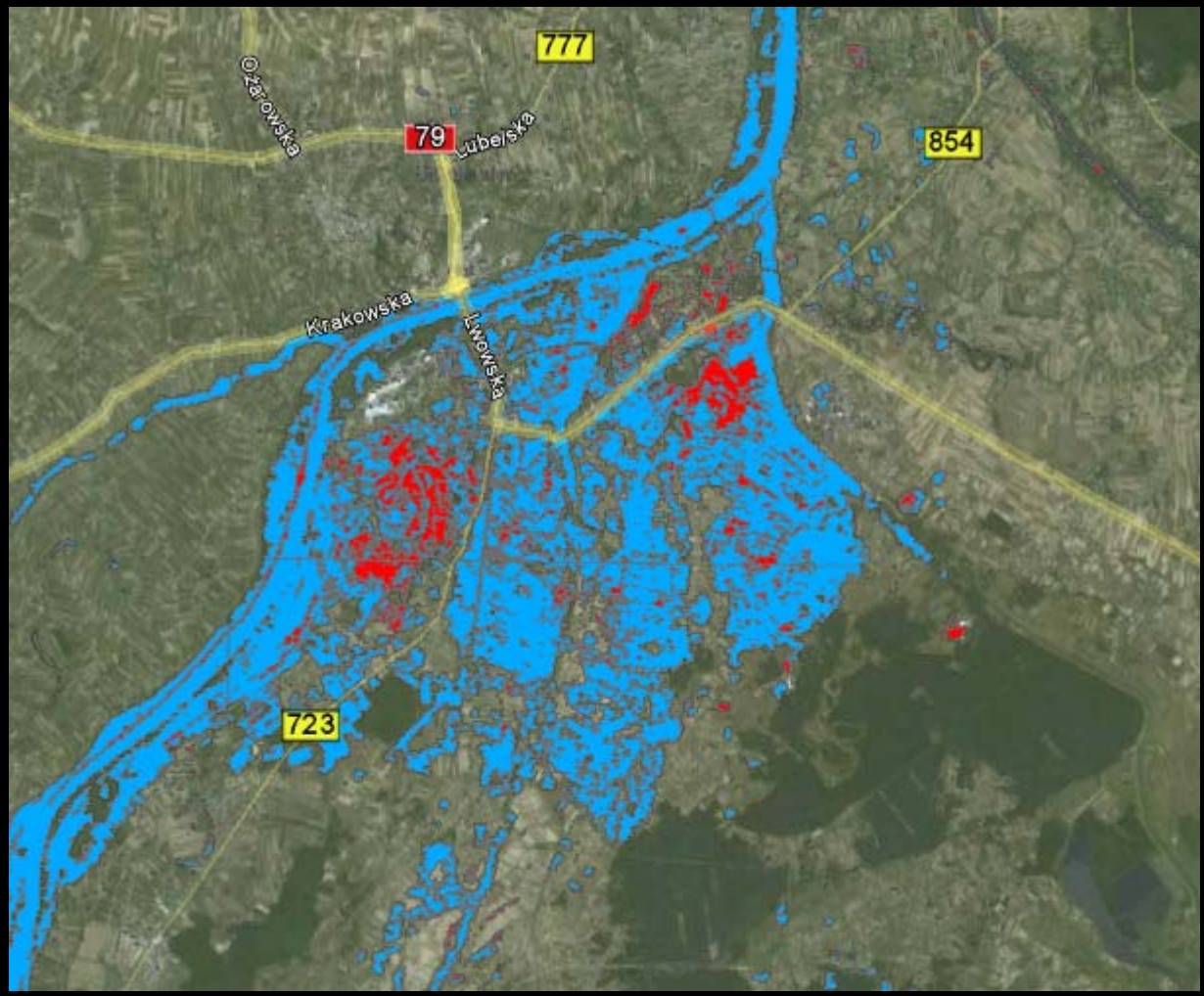
(b) 144 m.n.p.m

(c) 143 m.n.p.m

(d) 141,5 m.n.p.m


P1
A1
C 3
P2 a
P2 b
P3
P4
C 1
C 2
Z1

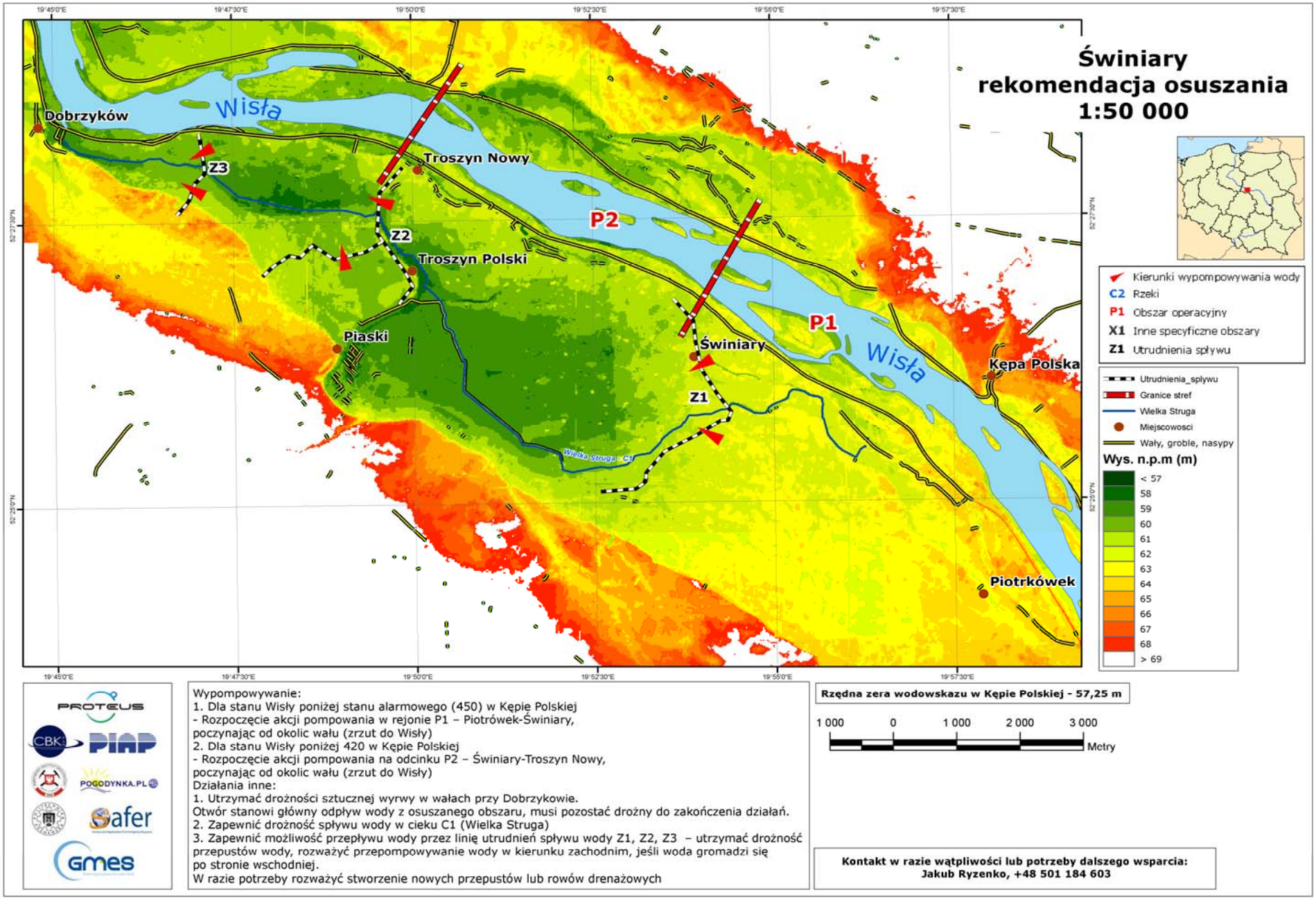

Sandomierz
rekomendacja osuszania
1:50 000
układ 1992
Wisla
P1
A1
C 3
P2 a
P2 b
P3
P4
C 1
C 2
Z1
0 1 000 2 000 3 000 4 000
Metry
Legenda
nasypy
140
141
142
143
144
145
146
147
148
149
150
151 - 152
153 - 155
156 - 160
> 160
Wypompowywanie:
1. Z obszaru P1 wypompowywać wodę do Wisły przez wał
2. Dla stanu Wisły poniżej stanu ostrzegawczego (420 cm) w Sandomierzu:
- Z obszarów P2a i P2b wypompowywać wodę do Trześniówki (C1)
przez wały (z obu brzegów rzeki)
- Z obszaru P3 wypompowywać wodę do rzeki Łęg (C3) przez wał
3. W momencie, gdy poziom Wisły nie powoduje przelewania się
wody przez wyrwę w wale (na wysokości miejscowości Koćmierzów):
- Z obszaru P4 (Wielowieś) przepompowywać wodę przez linię kolejową (Z1)
na wschód (dalszy naturalny spływ wody nastąpi rzeką C1)
Działania inne:
1. Udrożnić i utrzymać drożność rzek C1, C2, C3.
2. W przypadku braku naturalnego spływu rzeki Strug (C2)
aktywnie przepompowywać wodę w rejonie A1
(z wykorzystaniem pomp wysokiej wydajności) do rzeki Łęg (C3).
Utrzymywać maksymalnie duży spływ rzeką Strug
3. Zapewnić możliwość przepływu i aktywnie przepompowywać
wodę na wschód przez linię utrudnień spływu wody Z1 (linia kolejowa).
Utrzymać drożność przepustów wody.


777
Ożarowska
79
Lubelska
854
Krakowska
Lwowska
723

National Focal Point

- A close link between crisis coordination centres and satellite support team
- Products developed ad-hoc in response to arising needs
- Form and usefulness of products was evaluated by users before their release

Recommendations for water removal – phases of analysis



Wypompowywanie:
1. Dla stanu Wisły poniżej stanu alarmowego (450) w Kępie Polskiej
- Rozpoczęcie akcji pompowania w rejonie P1 – Piotrówek-Świniary, poczynając od okolic wału (zrzut do Wisły)
2. Dla stanu Wisły poniżej 420 w Kępie Polskiej
- Rozpoczęcie akcji pompowania na odcinku P2 – Świniary-Troszyn Nowy, poczynając od okolic wału (zrzut do Wisły)

Działania inne:
1. Utrzymać drożności sztucznej wyrwy w wałach przy Dobrzykowie. Otwór stanowi główny odpływ wody z osuszanego obszaru, musi pozostać drożny do zakończenia działań.
2. Zapewnić drożność spływu wody w cieku C1 (Wielka Struga)
3. Zapewnić możliwość przepływu wody przez linię utrudnień spływu wody Z1, Z2, Z3 – utrzymać drożność przepustów wody, rozważyć przepompowywanie wody w kierunku zachodnim, jeśli woda gromadzi się po stronie wschodniej.

W razie potrzeby rozważyć stworzenie nowych przepustów lub rowów drenażowych

Rzędna zera wodowskazu w Kępie Polskiej - 57,25 m

1 000 0 1 000 2 000 3 000 Metry

Kontakt w razie wątpliwości lub potrzeby dalszego wsparcia:
Jakub Ryzenko, +48 501 184 603

From the perspective of the Polish Civil Protection:

Preliminary conclusions

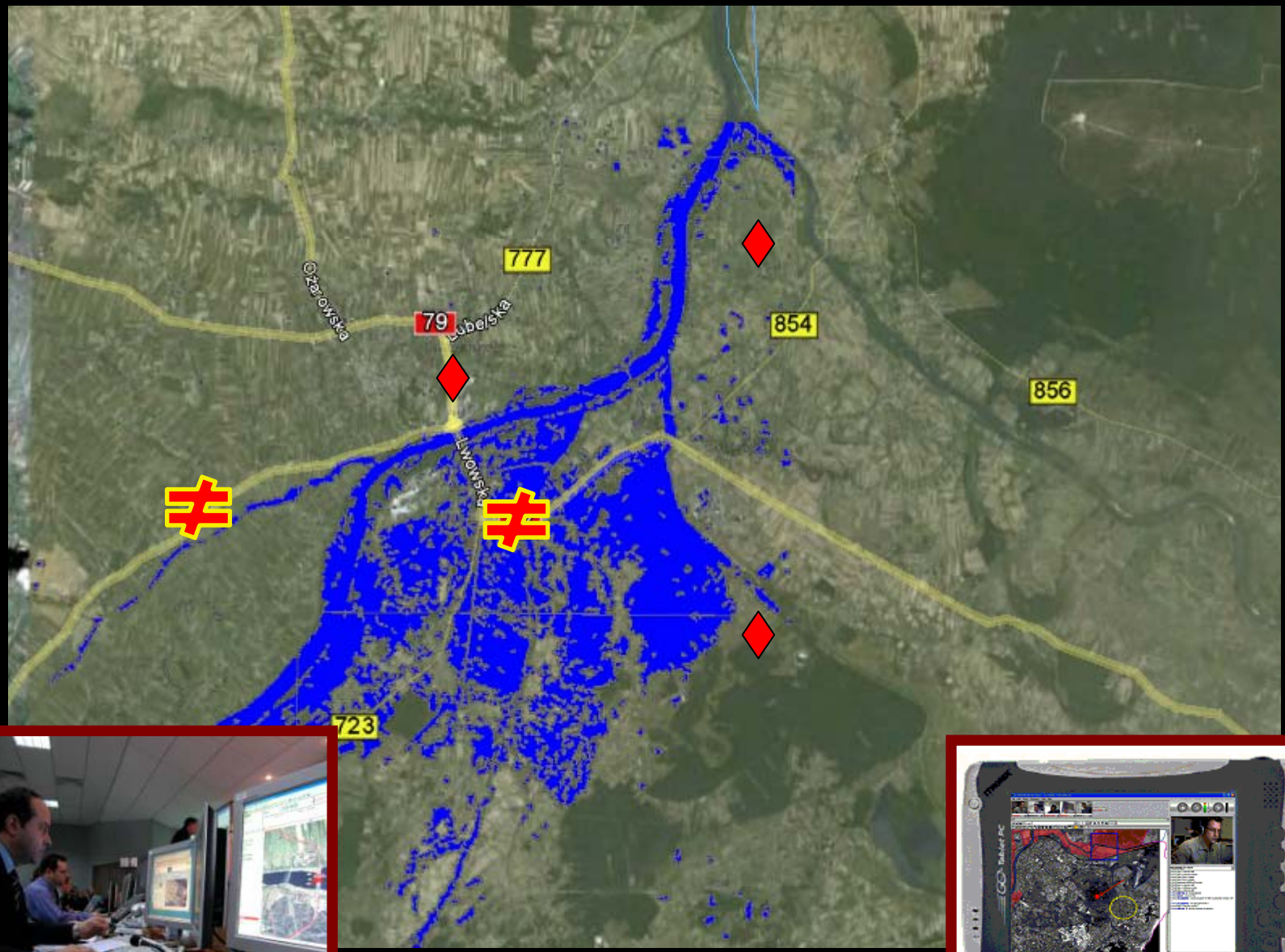
- SAFER mechanism have been activated by Poland for the very first time
- 30 SAFER products were delivered for the one of the biggest rescue operations on the territory of Poland (satellite imagery for Bielsko-Biała, Kraków, Mielec, Sandomierz, Głogów, Tarnów, Kielce, Wrocław, Wilków, Świniary, Szczurowa; relevant GIS layers)
- Relevant products such as drainage recommendations were made for the regions of Sandomierz, Wilków, Świniary, Połaniec, Kamienna,
- All the satellite and relevant products were very supportive and efficient for rescuers, crisis management and civil protection agencies in the whole chain of decision making process (evacuation, relocation and mobilizing forces, drainage, humanitarian assistance, damage assesment)

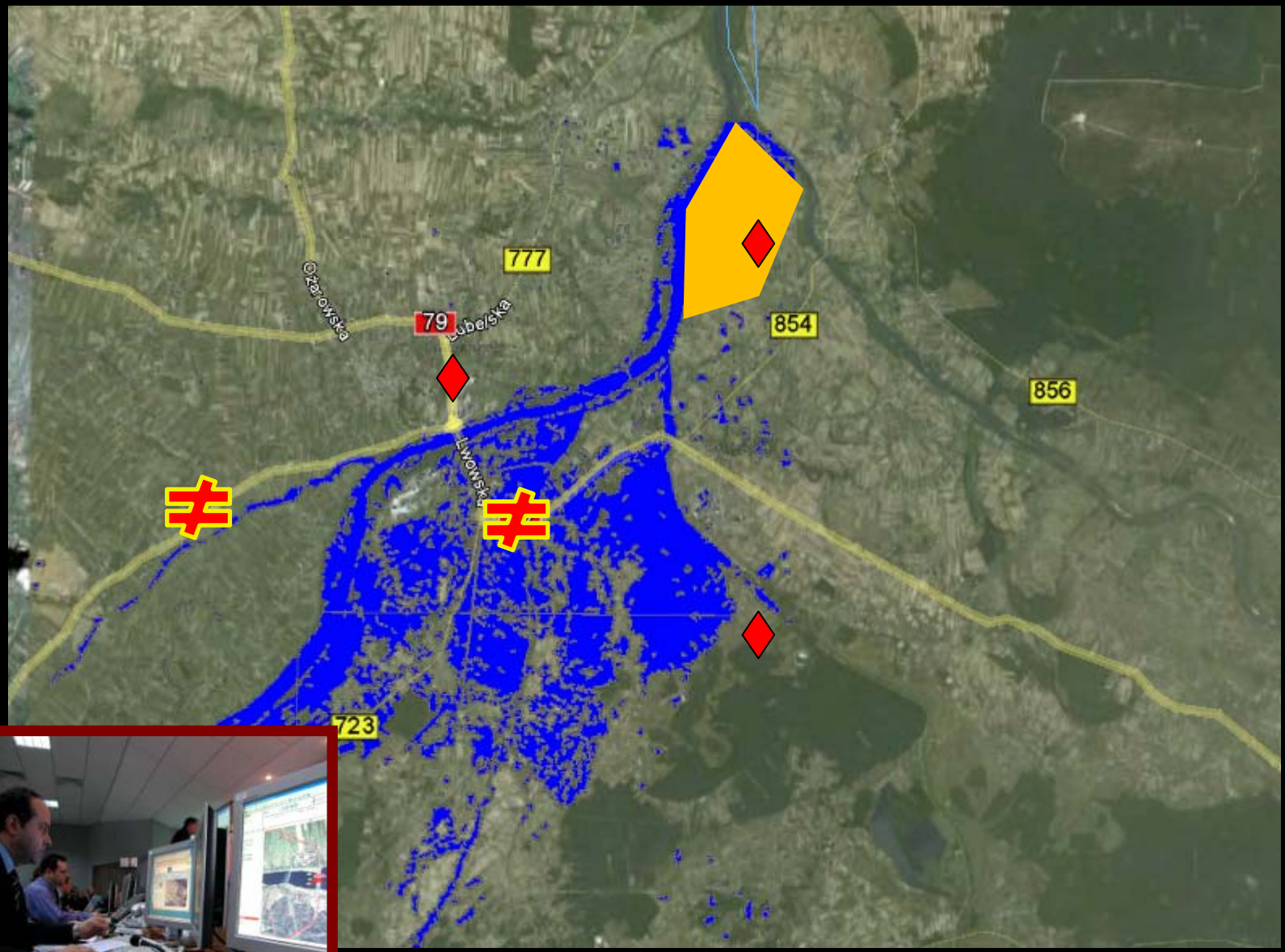
From the perspective of the Polish Civil Protection:

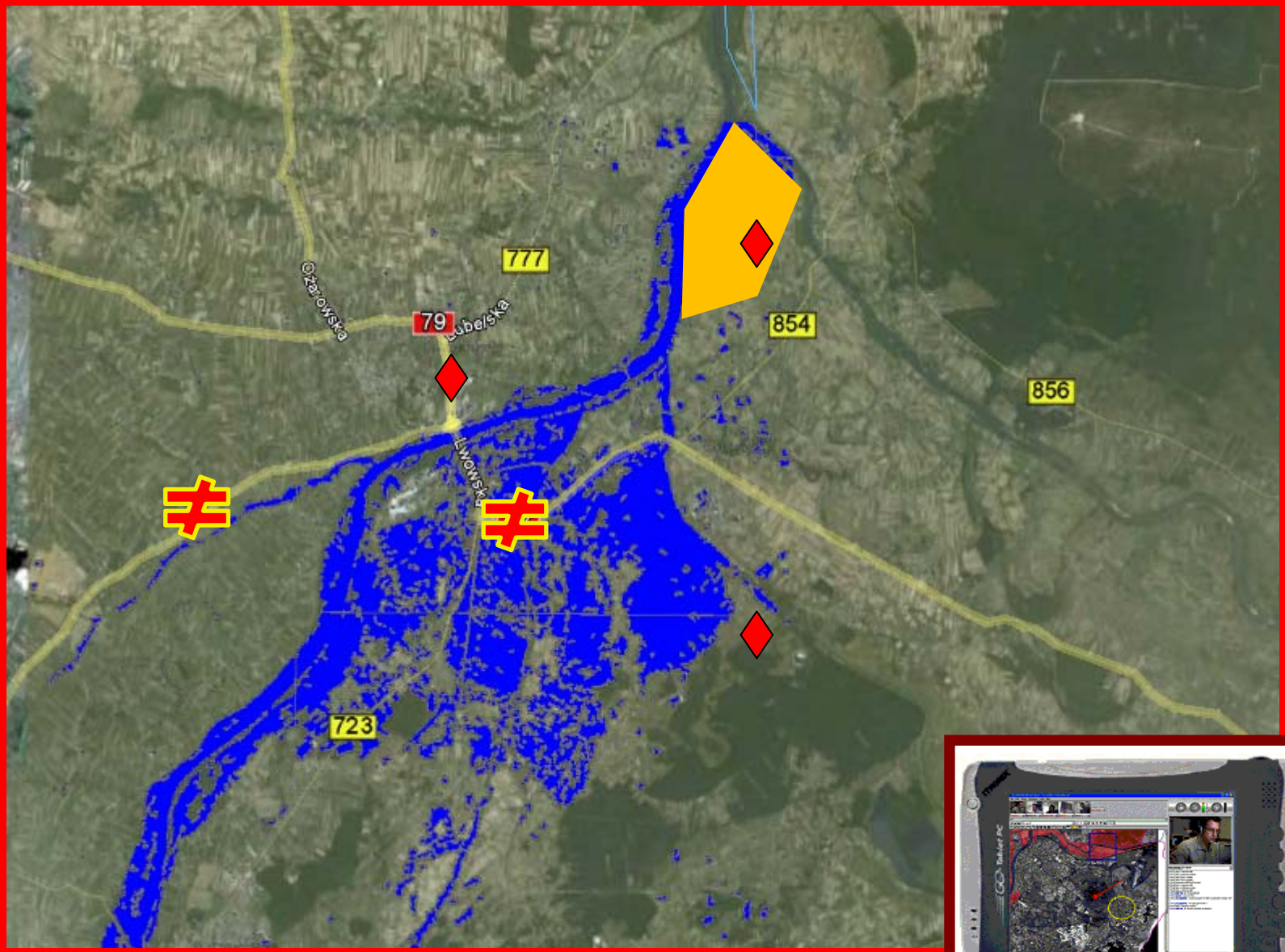
- ★ Value Added
  - Recommendations for pumping (location of the most adequate places for effective pumping)
  - Implementation in the Decision Support chain (e.g. applications like CECIS)
  - Possibility to trigger the service for non-operational issues
  - GIS products availability
  - Possibility to obtain pre-processed data (time of delivery crucial)
  - Free of charge
- ★ Shortcomings
  - Delivery of semi-finished or not completed products to accelerate the support such as archive data
  - Limitations due to inappropriate weather conditions such as clouds over AOI and problems with taking optical images for assesment of damages in infrastructure

Challenges of today

- ★ Increasing number of pre-operational services providing satellite imaginary in case of a large-scale disasters.
  - Potential users are not aware of such possibilities, do not have access to the products or are unable to effectively use them
  - Providers do not receive feedback during the crisis, limited knowledge about evolving needs
- ★ Available geospatial information is dispersed and not shared effectively
  - There is no Common Operational Picture among institutions involved in crisis/humanitarian operations
- ★ Growing number of GNSS-based (satellite positioning) tracking systems in use by emergency services
  - There is no interoperability standard to exchange location information and simple GIS information


777
79
854
856
723
Lubelska
Lwowska


777
79
854
856
723
Lwowska
Lubelska


777
79
854
856
723
Lwowska
Lubelska
Ożarowska

Logic of events related to space surrounding the Polish EU Presidency in the field of civil protection

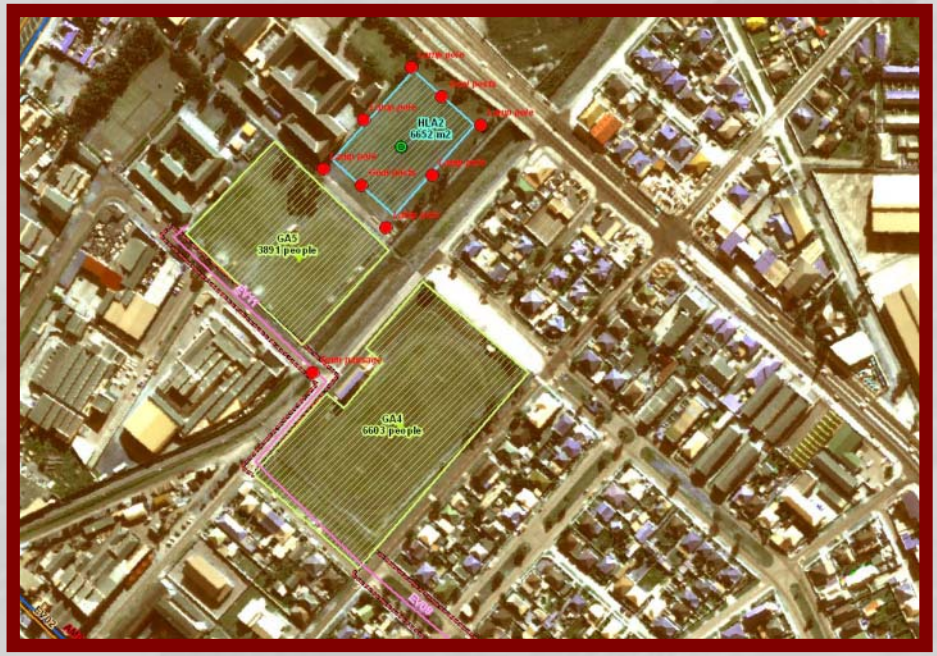
- 5-6 of May – the ESPI workshop on “Space for Civil Protection”
- 18-20 of July – the Civil Protection Workshop
- 13-16 of September – EU CARPATHEX 2011 international exercise
- 20-21 of September – the Security Research Conference (EU Framework Programme)
- 22-23 of November – Lessons Learned Conference after EU CARPATHEX 2011
- the Conclusions of the EU Home Affairs Council
- first half of 2012 – GMES Operational Capacity Workshop in Warsaw

EU CARPATHEX 2011

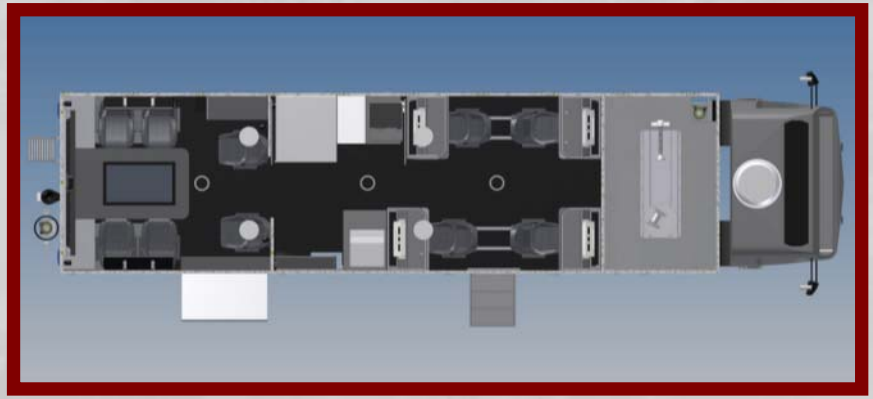
- **Two trains crash**: one full with football funs with the goods train with chemical substances - **PLATFORM**
- **Forest Fire** - sparks from the breaks system of the train light up the forest – due to the weather the fire spreads quickly. Additionally hooligans ignite the forest in different locations - **FOREST**
- **Leakage of water** from the cooling system (big tank) in the chemical factory nearby – flooding of the local village - **WATER**
- **Explosion and chemicals leakage in the chemical plant** – due to the cooling system break down - **PLANT**

Common GIS environment

Satellite maps (GMES/SAFER)



Deployable GIS team



Satellite-based access to shared GIS environment

Mobile robots in CBRN operations


Space = more safety for us all