

**DEFENSIE
LA DÉFENSE**



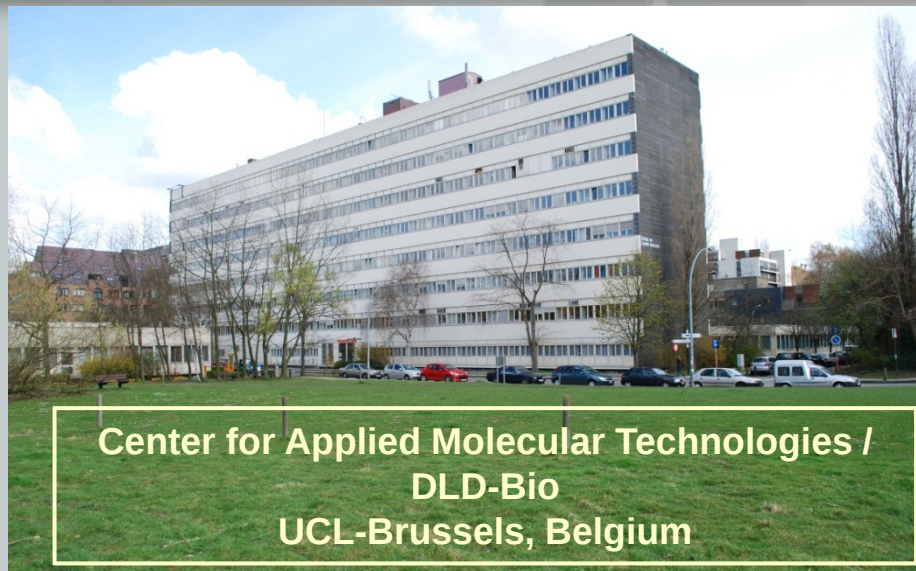
VOORRANG AAN VREDE
PRIORITÉ À LA PAIX

Université catholique de Louvain

**Project ESA IAP/ARTES20 “B-LiFE”
Biological Light Field Laboratory for Emergencies**



ESA workshop, Rome, 19 April 13



**Center for Applied Molecular Technologies /
DLD-Bio
UCL-Brussels, Belgium**

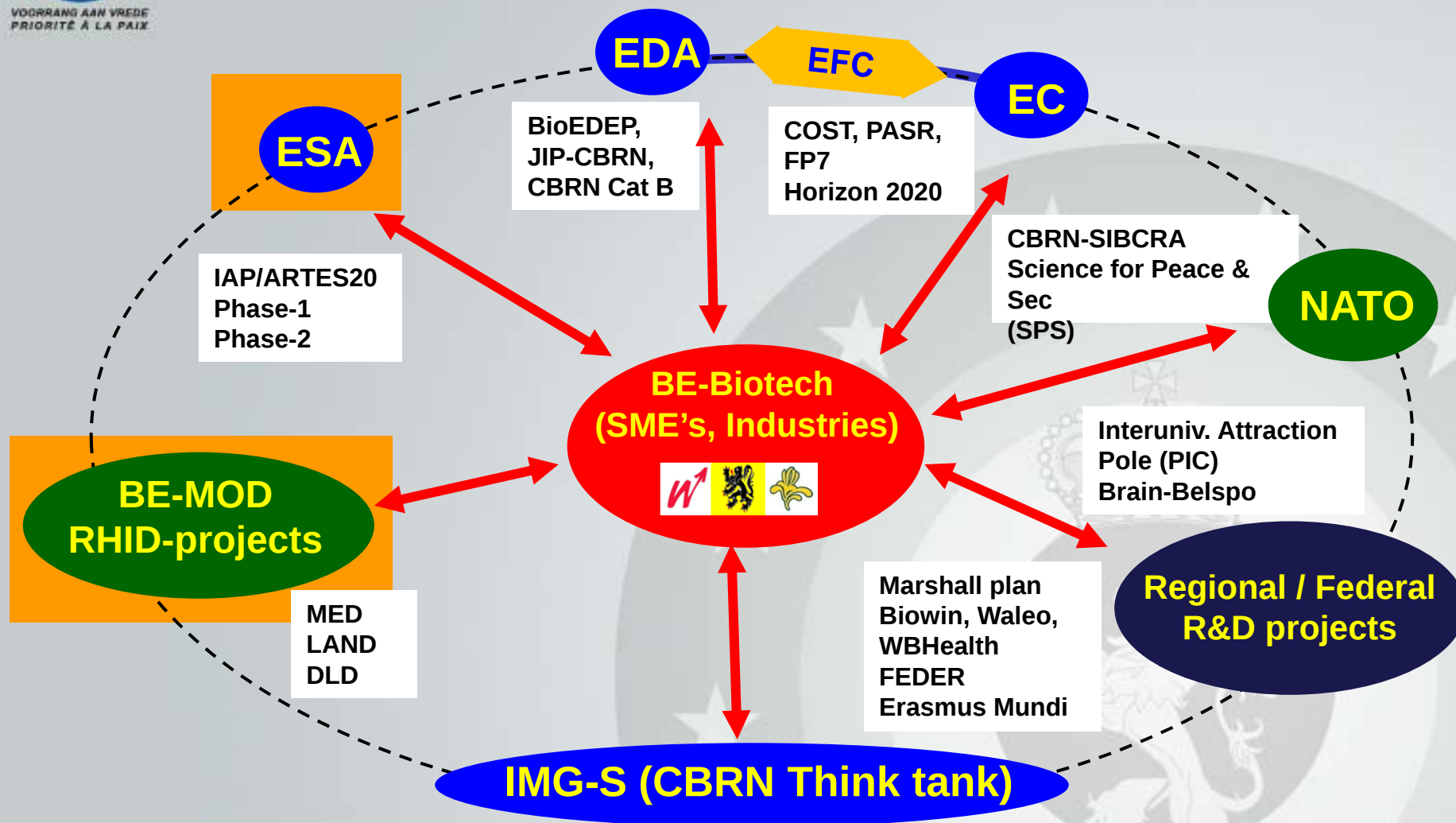
Pr. Dr. JL Gala
Med Colonel,
Director BE Mil-Acad
Biotech Platform CTMA/DLD-Bio

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CTMA « R&D CBRN-Matrix »

Civ-Mil Joint contribution



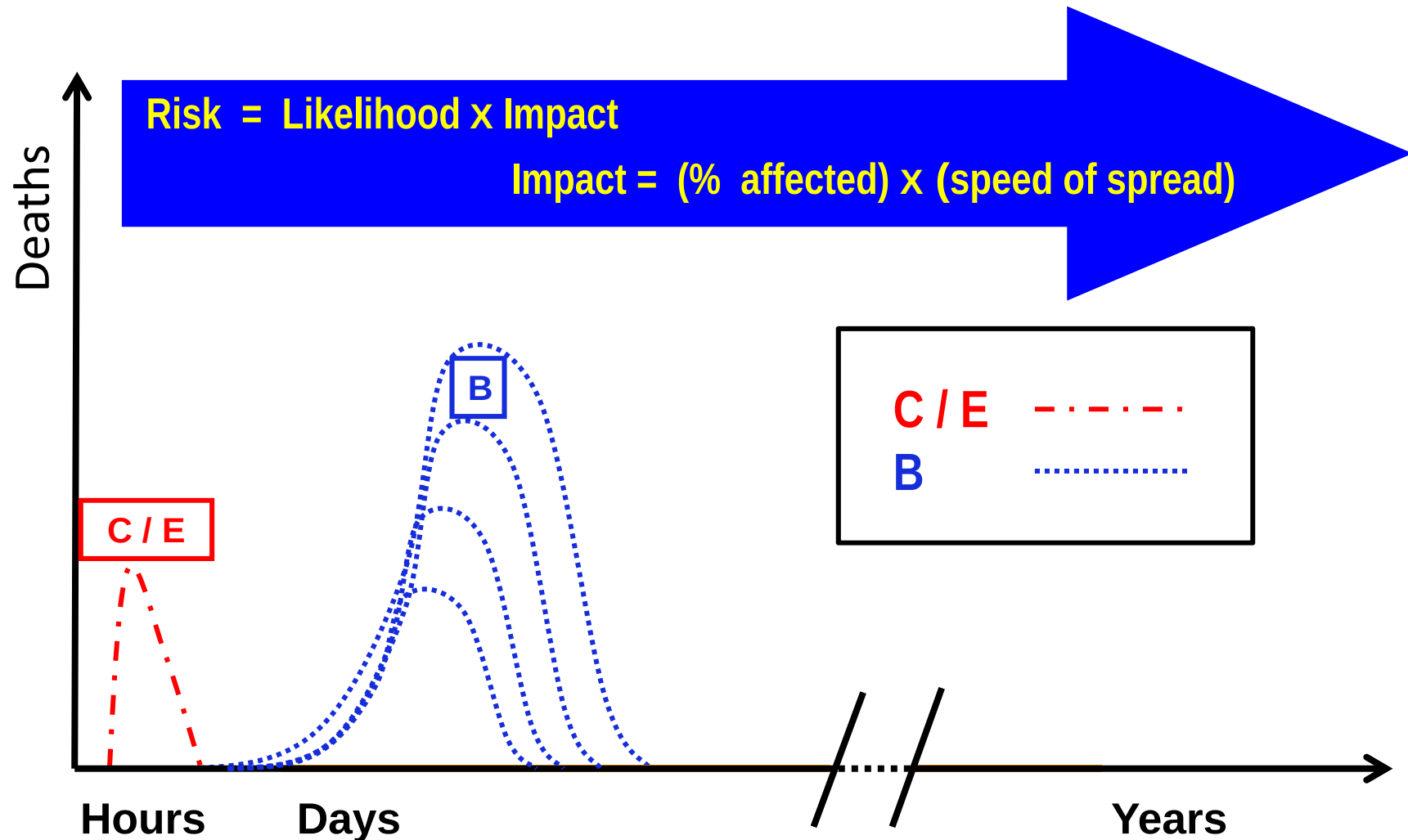
The matrix allows to **spread costs**, to **mutualize the benefits** and to **decrease the failure rate**



Genesis of B-LiFE: outline !

- CBRN Threats at a glance
- Observations
 - 1: Major biothreat crisis : from « mil » to « civ-mil » cooperation !
 - 2: Dual use testing in specialised « reach back » infrastructure
 - 3: From «reach back testing » to «on-site testing» !
 - 4: Deployability & in-field testing: new constraints and R&D activities !
 - 5: How to integrate «space-technologies» and « which ones» ? ,
- Way ahead: B-LiFE as Ops/R&D integrator

Biological agents : Mostly covert incidents with delayed lethality



Genesis of ESA IAP/ARTES20 “B-LiFE”

Biological Light Field Laboratory for Emergencies

Observation 1

B-threats are no more a « Mil-restricted topic »

Shift from « Mil» to « Civ-Mil»-driven R&D prompted by

- Globalization (missions, intercontinental trips...)
- Rapidly emerging diseases
- Risks arise from remote, poorly accessible areas with weak health care support

Anthrax : from *disease-endemic area* to *bioterrorism*

**Accidental (benign)
human infection**



...BUT



**« Weaponized
deadly anthrax »**

Outside «military field» !

Deadly anthrax cases

Countless anthrax *copycats*



**Deliberate release
human infection**



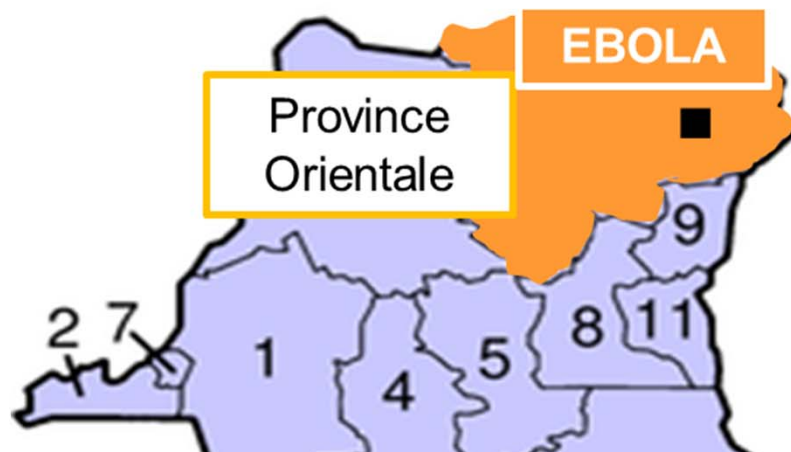
From weapons to major natural outbreaks: Variola... EBOLA and Monkeypox



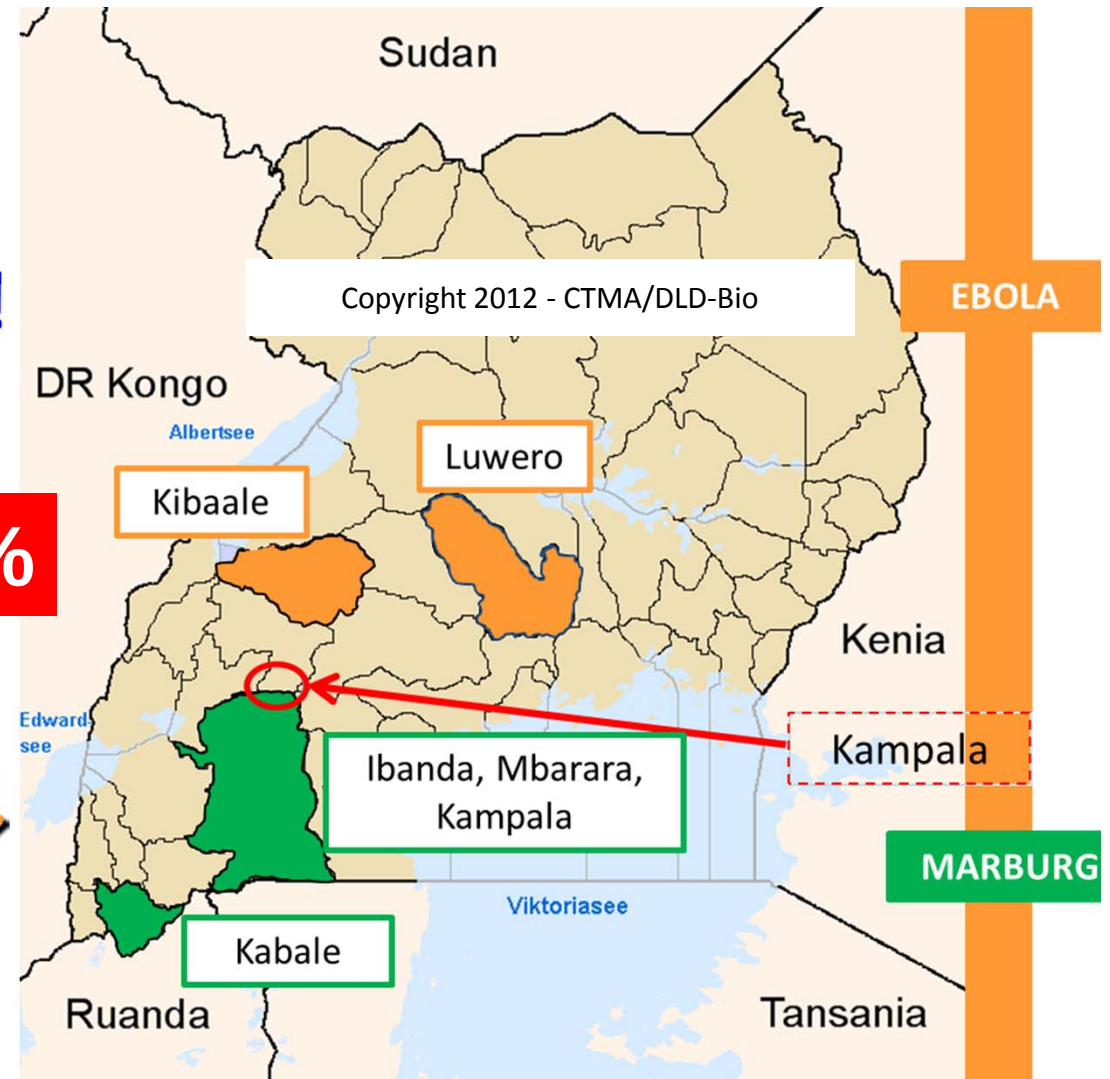
Viral Hemorrhagic Fevers in Africa : 2012

3 different outbreaks !

Death rate : 50- 70%



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Monkeypox, Chickenpox... or Smallpox ?



Some are very contagious and lethal
Need for rapid differential diagnostic tests !





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Biological Light Field Laboratory for Emergencies

Observation 2

Need for rapid, sensitive, reliable detection and
identification of B-agents



Heavy infrastructure (reach back laboratory)



Genetic-based identification: Rapid, specific, reproducible, safe !



Human,
Animal,
Environment,
Water / food

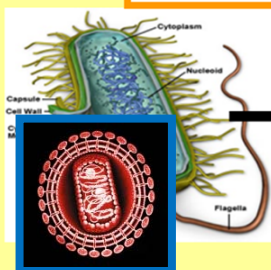


Cultivation

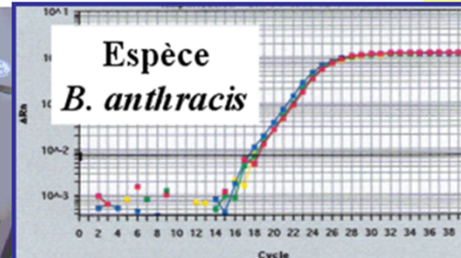


Cultivation: days, weeks, months....

Preanalytical step



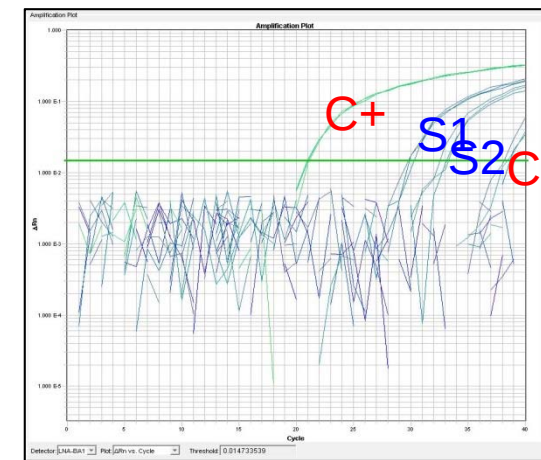
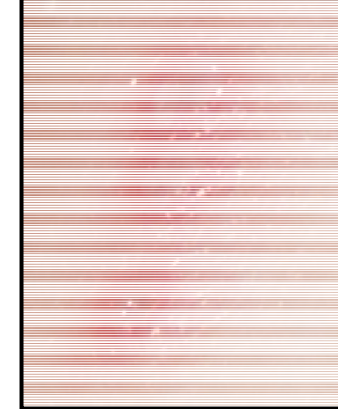
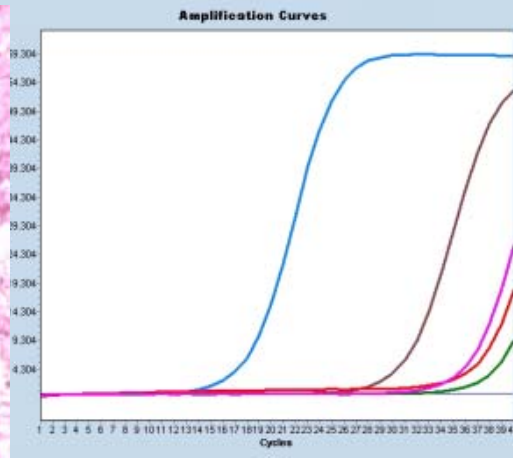
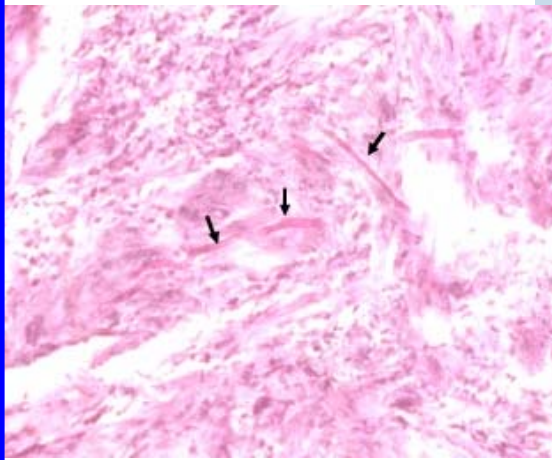
Specific genetic / protein marker



DNA-based identification

DNA-based identification: hours...

Skin lesions



Fungi?

Monkeypox – Varicella ?



Genesis of ESA IAP/ARTES20 “B-LiFE”

Biological Light Field Laboratory for Emergencies

Observation 3

CBRN threats require « rapid on-site testing»:



The concept «Light Fieldable Laboratory or LiFi »

- ✓ Size ? Specificity ? Sensitivity ? Type of Samples?
- ✓ Tools (analytical, communication, GIS/EO, Sat Navigation [GPS/GNSS], robots) ?



Interoperable platform for CRBN or Health crisis

CIVILIAN specifications



- B-specific
- Light Fieldable
- First responders (nurses, MD)
- GOARN / WHO

Identical HEART

MILITARY specifications



- Full CBRN protection ???
- Heavy shelter, slowly deployable
- Sampling team
- Ops military C2

Common Civ-Mil specifications

- Analytical equipment
- Communication, site selection, georeferencing
- Expertise (human resources)



Gensis of ESA IAP/ARTES20 “B-LiFE”

Biological Light Field Laboratory for Emergencies

Observation 4

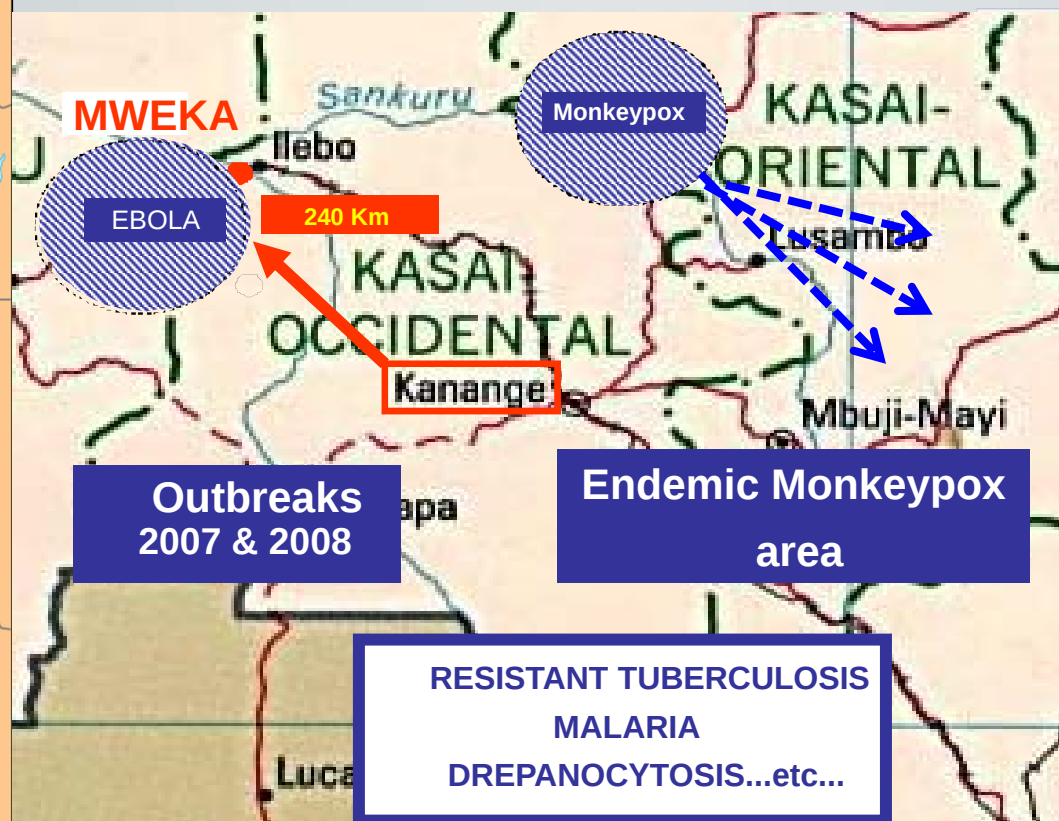
« Increased deployability » and « on-site testing » imply
facing **new constraints =**

New field for « Civ-Mil » CBRN activities»

Integration of CBRN activities and space tools



Trigger for BE-LiFi deployment in Africa ?



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Deployment in Ops conditions



No dedicated aircraft !

C130 normal rotation: 3days



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A simple tent ... or even a wooden hut.....



KUYA KUMPALA CAMP

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Light Fieldable Detection Laboratory Kananga, RDC, April 2009



Modular structure : scalability – joint intervention

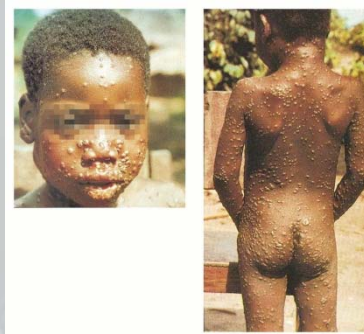
Successful monitoring of health-threatening agents nearby a Military settlement



- Ebola outbreak



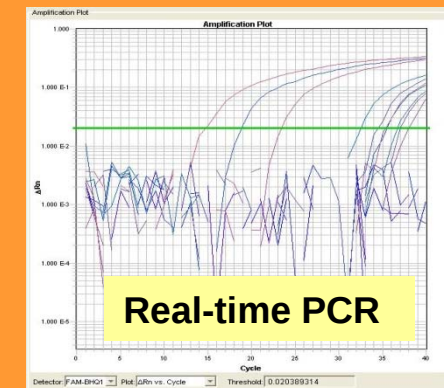
- Resistant Tuberculosis



- Monkeypox outbreak



Endpoint-PCR



Genesis of of ESA IAP/ARTES20 “B-LiFE” Biological Light Field Laboratory for Emergencies

Observation 5

Light fieldable laboratory:

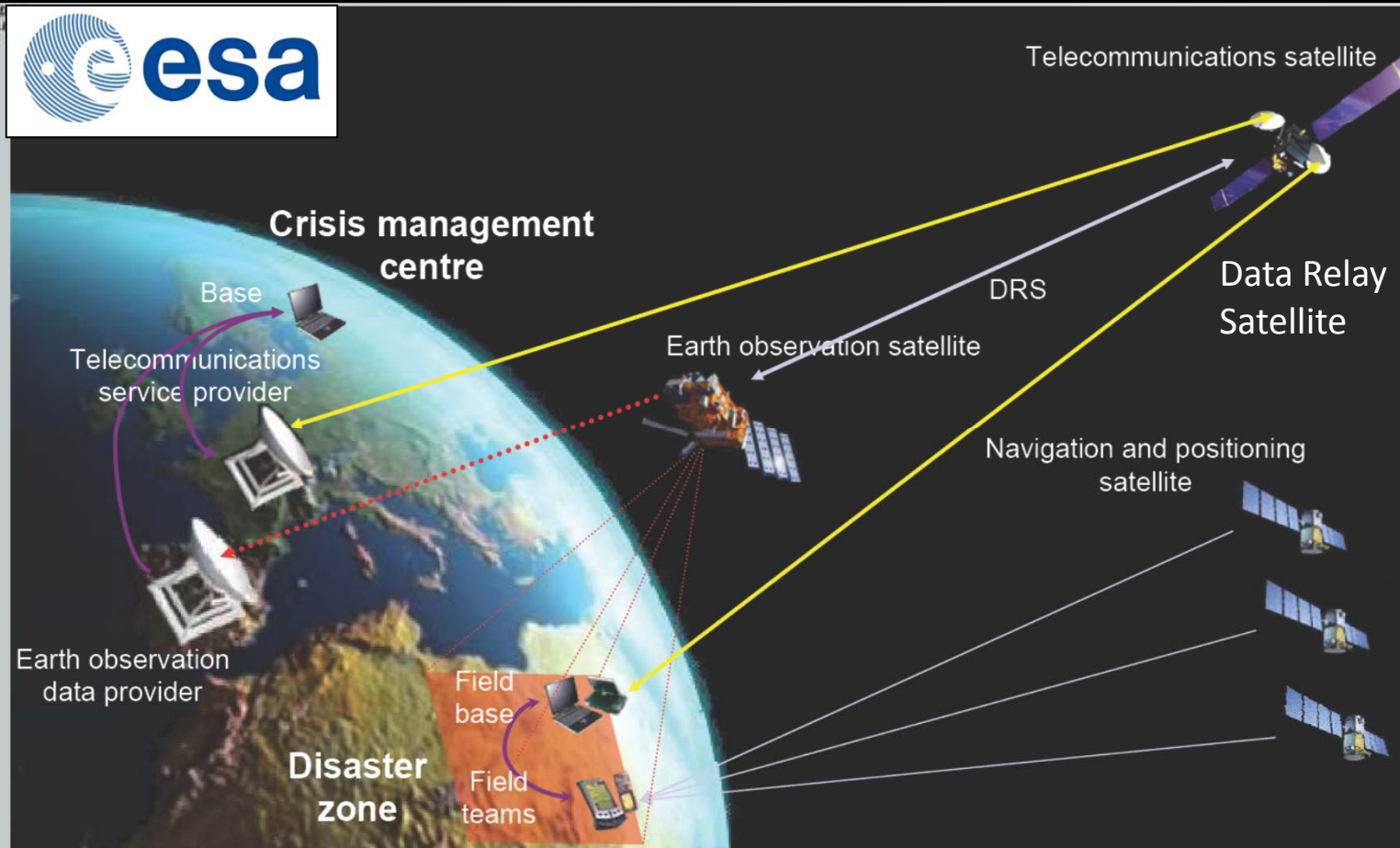
Needs for integrating CBRN and space tech:

How ? Which ones?

« B-LiFE » as test case !

Integration of Space-based technologies/ tools :

Sat Communications, Sat Navigation (GPS/GNSS), Earth observation (site selection)



IAP / ARTES20 B – LiFE

Biological **L**ight **F**ieldable Laboratory for **E**mergencies

B-LiFE / IAP-ARTES20

Biological Light Fieldable Laboratory for Emergencies

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LE GOUVERNEMENT
DU GRAND-DUCHE DE LUXEMBOURG
Ministère de l'Enseignement supérieur
et de la recherche

With the
support of

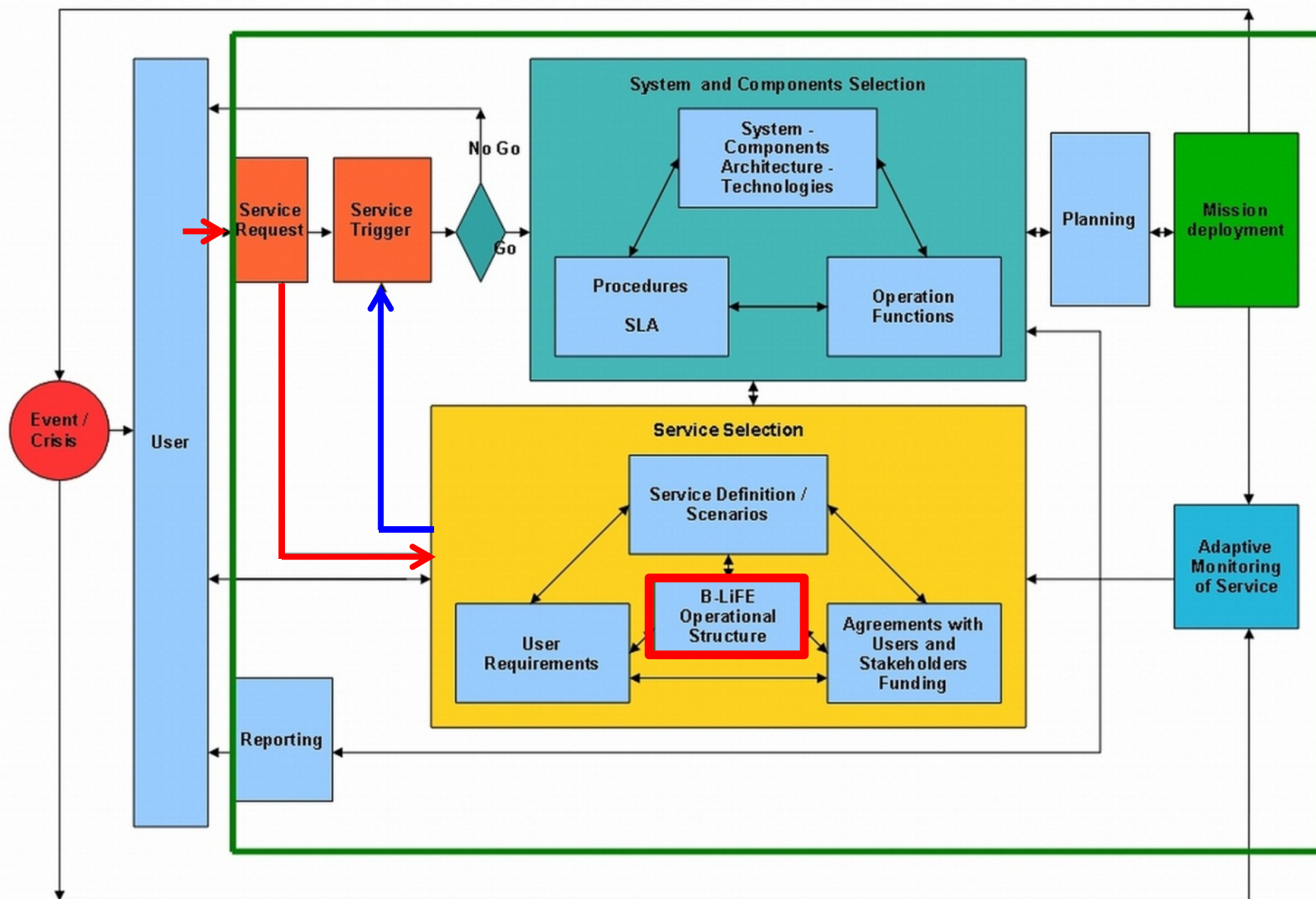


Prof Dr GALA Jean-Luc,
Med Colonel , PhD
UCL / BE-Defense

Mr Roland Gueubel
Project Manager

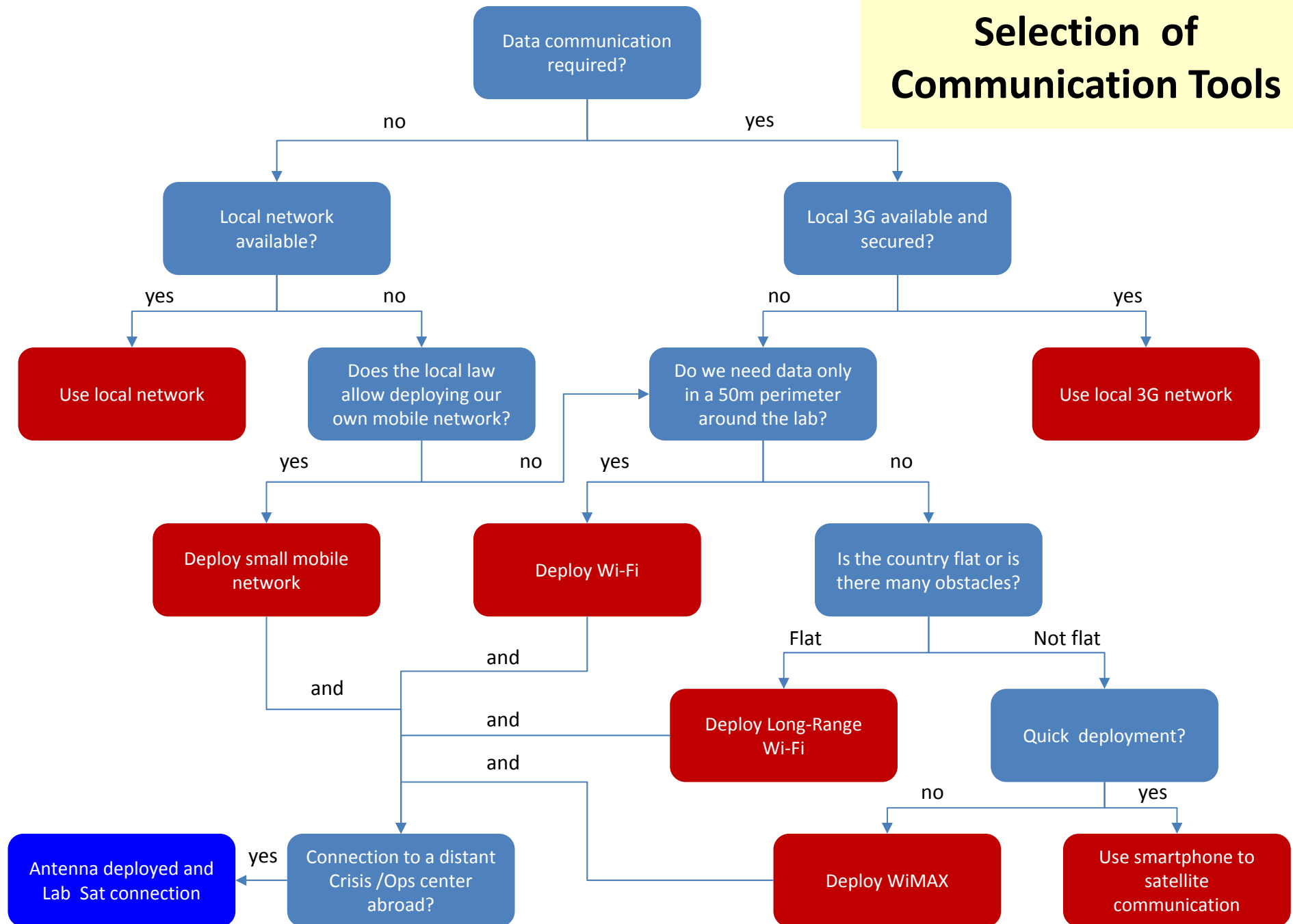
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B-LiFE Service Process Flow



Users: Private bodies, NGO's, Heath Institute, Police

Selection of Communication Tools





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B-LiFE

Proof of Concept 29 Nov 2012

(Anthrax spread in EC premises in Brussels)



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Sampling team with smartphones and dedicated applications



- Permanent Location
- Sampling Process
- Alerts Process
- Real-Time and smart communication with all necessary parties
- Direct connection to central server
- Uses all functionalities of last generation phones



Park of the fiftieth anniversary - Parc du cinquantenaire

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Id.	Sender	Creation date	Title	Type	Category	Message
10	white	29/11/2012 00:00	Alert		Sampling Problem	Strom arriving
6	adb	29/11/2012 00:00	Alert		Health Menace	Riot movement
3	white	29/11/2012 00:00	Alert		Terrorist attack	Visible Powder
2	adb	29/11/2012 00:00	Alert		Health Menace	Dead birds

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Georeferencing Samples & Sampling team

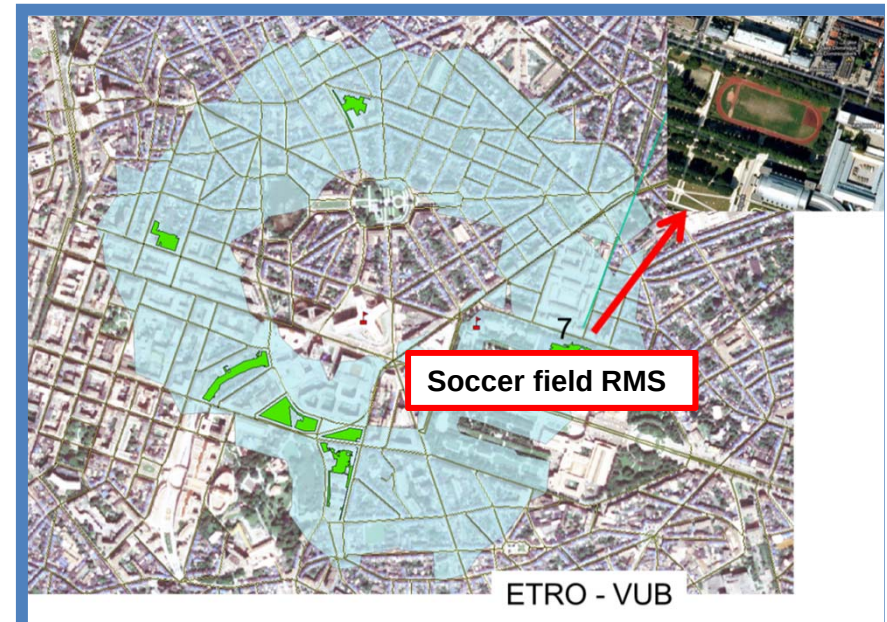
Earth Observation:

(a) Site selection

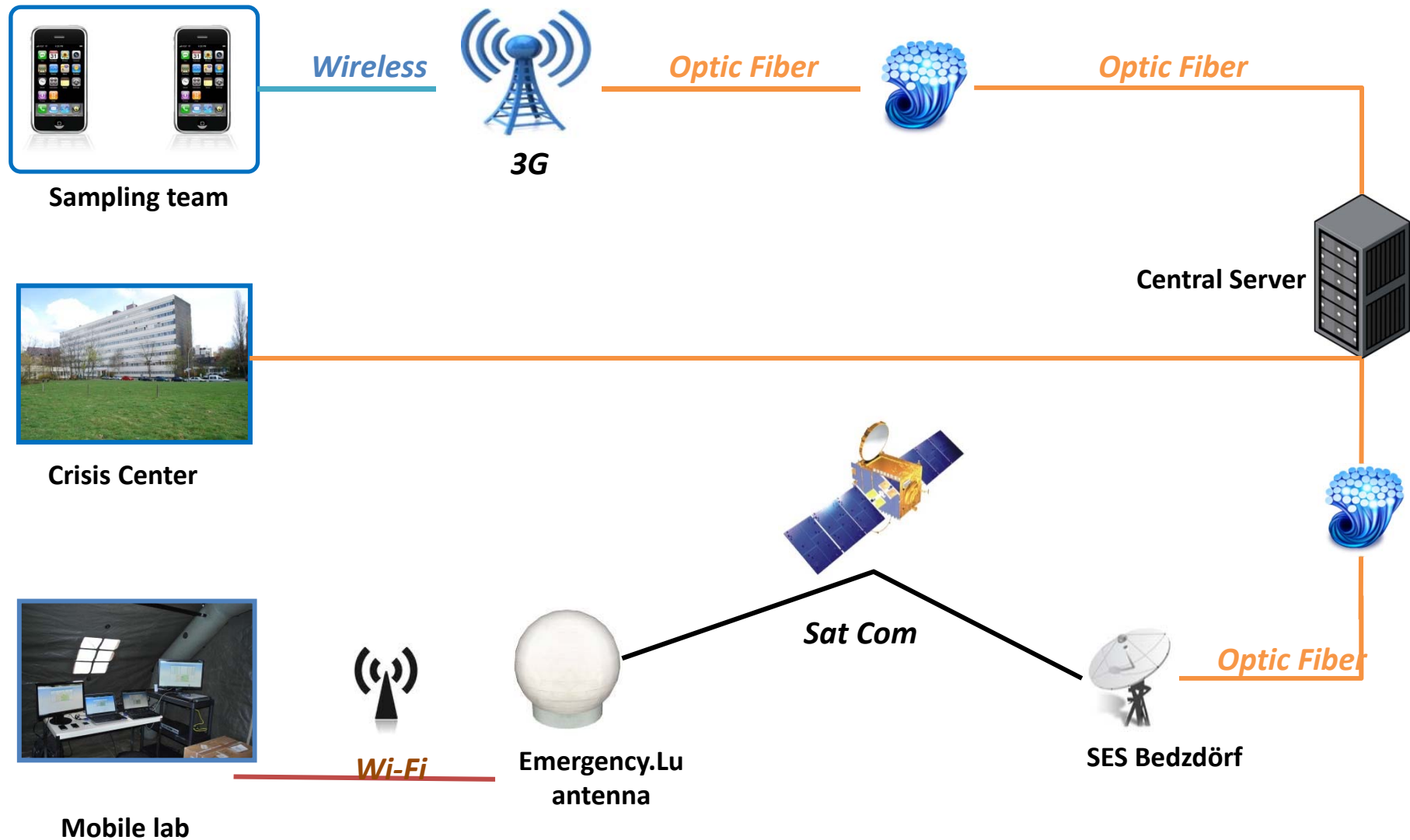
Candidate deployment sites
50-500m

(b) Sampling team guidance

Sat- and phone-guidance



B-LiFE Communication flow





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- Way ahead: **B-LiFE as Ops/R&D integrator**



B-LiFE supported by EFC

ESA

B-LiFE - IAP/ARTES20:
Biological **L**ight **F**ieldable
laboratory for
Emergencies (CTMA
Coordination)

EDA

BioEDEP: 2d generation
deployable tactical field
analysis system (project
n°6, phase 1)

FP7 EC

- **FP7-SEC-PRACTICE:**
Preparedness and **R**esilience
against **C**BRN **T**errorism
using **I**ntegrated **C**oncepts
and **E**quipment (ongoing)
- **FP7- SEC-MIRACLE:** **M**obile
Laboratory for the **R**apid
Assessment of **C**BRN Threats
Located within and outside
the **EU** (CTMA Coordination -
Kick off 2013)
- **FP7-SEC-EDEN:** **E**nd-user
driven **D**Emo for CBR**N**E
(Kick off 2013)



EFC

