



## Bonaparte disaster victim identification (DVI) system

### ***Is your country prepared for a prompt and reliable identification of victims after a mass disaster?***

In the case of a mass disaster many important issues have to be addressed. An airplane crash, a tsunami or terrorist attack puts public directors and law enforcement into the spotlight where they have to restore public order and ensure public safety, investigate the causes and if applicable punish the offenders.

A task of large public value is the recovery and identification of the remains of the victims. This importance is emphasized due to legal as well as humanitarian reasons. Families yearn to know whether the victims are their loved ones. They demand from the government that it will do its utmost effort to identify and hand over the remains so they can start the mourning process and give the unfortunate loss a place in their lives.

Disaster victim identification (DVI) is greatly facilitated by the advent of modern DNA technology. Forensic laboratories worldwide are able to extract and record DNA samples from the tiniest samples. DNA has made it in principle possible that matches can be made and victims can be identified. DNA is however only part of the solution, when disaster strikes.

In the case of a massive disaster law enforcement and public aid organisations are faced with numerous problems. Identifying victims with reported missing persons is complicated by the absence of relevant DNA material as direct family members are likely to be also involved. So DNA has to be recovered from indirect sources. This means that law enforcement officers have to collect a huge amount of those sources at a rapid pace. This puts a strain on the already available capacity in the case of a disaster.

Linking victims with their closest relatives instead of their own DNA is much more difficult since they share some of their DNA but not all. In the case of mass disaster this is complicated further because complete families sharing their DNA can be involved. The quantity and quality of the collected samples have to be impeccable.

Given the expected large number of casualties the puzzle to match the victims grows exponentially. In the case of a few victims this can be done easily by the hand of a DNA professional. In the case of mass disaster with over 100 victims or maybe an even larger number of body remains, matching by hand is an unfeasible task. It is not possible to check for all the combinations in a timely manner, let alone do a check for consistency and errors. Failing to do so will lead to dissatisfaction by the public.

### **Enhancing disaster victim identification: the Dutch experience**

Facilitating this task will put the attention of public officers and law enforcement where it should be: to the victims and their families. As this problem was promptly recognized by the Dutch Ministry of Security and Justice, The Netherlands Forensic Institute (NFI) was given the task to develop a computer assisted disaster victim identification system. The system had to meet stringent requirements. It had to be designed for large scale incidents. Large numbers of samples would have to be matched promptly and reliably. Samples from very different sources had to be used: e.g. bodily remains as well as data from (inter)national DNA databases. The time for uncertainty had to be minimized and the chances for wrong matches had to be brought back to a minimum.

For this the process of collecting, handling and matching of the DNA samples was redesigned. Two parts in this design were essential. The first part of the solution was the ability to handle massive amounts of DNA samples with a throughput of just 2 days per sample.

The second part was the development of a unique piece of software, Bonaparte, that does the matchmaking in minutes instead of days. By order of and in close collaboration with the NFI, Bonaparte was developed by Smart Research, a subsidiary of the University of Nijmegen. By using an automated system human error has been eliminated. Bonaparte uses state-of-the-art mathematical probabilistic methods by which not only direct matches can be made but also the much more difficult family matches, hence giving speediness and certainty. Bonaparte is a transparent and flexible software tool.

The software has been rigorously tested and validated, but came to the real test with the airplane crash of Afriqiyah Airways on 12 May 2010 in Tripoli, Libya. 103 people were killed in this accident leaving little of the plane and its occupants.

A full, proper identification of the victims took less than 3 weeks, whereas without the new system with the same amount of personnel it was expected to last over 3 months. This was mainly due to the new matching software.

### Being prepared

Implementing a fast and reliable process for DVI can be rather straightforward given the fact that most countries already have most parts of the knowledge of DNA at hand in law enforcement agencies, forensic institutes and/or universities. Being prepared for the eventuality of a mass disaster lies in the combination of having the right processes and tooling at hand, capacity build-up and the proper training.

### NFI products and services

Depending on the capacity and knowledge a programme can be implemented to educate and train the professionals in handling DVI and use of the Bonaparte software. Best practices and lessons learned herein are offered by the NFI in collaboration with Smart Research:

- If a country has good facilities for collecting samples from a mass disaster and for DNA-typing, but lacks good matching software, we can implement the Bonaparte software and train the DNA kinship analysis experts in using it.
- If a country doesn't have sufficient experience and infrastructure, we can give advice in organizing the DVI-process with special attention to the DNA kinship analysis and the application of Bonaparte.
- If a country doesn't have the proper infrastructure and knowledge at its disposal, we can coordinate the entire DVI-process. If necessary or desirable, collaboration with (inter)national forensic laboratories can be an option as well. We can assist in building the proper infrastructure in your country to deal with DVI in the future.

### Information

For more information on disaster victim identification, its process and uses in casework, please contact:

The Netherlands Forensic Institute  
Mrs. C.J. van Dongen  
Email [c.van.dongen@nfi.minjus.nl](mailto:c.van.dongen@nfi.minjus.nl)  
Telephone +31 70 888 67 15  
Internet [www.forensicinstitute.nl](http://www.forensicinstitute.nl)

For more information on the Bonaparte software, please contact:

Smart Research  
Mr. W.G. Burgers  
Email [w.burgers@smart-research.nl](mailto:w.burgers@smart-research.nl)  
Telephone +31 24 361 42 43  
Internet [www.bonaparte-dvi.com](http://www.bonaparte-dvi.com)

