

**ALTA FORMAZIONE DELLA SICUREZZA: VENTI ANNI DI
COLLABORAZIONE DELL'ISTITUTO SUPERIORE ANTINCENDI CON
L'UNIVERSITÀ, LA RICERCA E GLI ORDINI PROFESSIONALI**



**26 novembre 2015
Istituto Superiore Antincendi**

Esodo di massa e la ricerca europea: l'ingegnerizzazione della pianificazione e della gestione dell'emergenza

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2014

- May 15, 2014: Between 16 and 24 recruits were killed and more than 119 were injured at several stadiums and other venues across Nigeria when **520,000 applicants** were invited to take the aptitude test and physical exercises in order to get one of 4,556 available positions with the Nigerian Immigration Service. As many as one million might have shown up for the event at one of its 37 sites. In many cases, security forces fired their rifles into the air for crowd control, **which triggered deadly panics**. In at least one location the release of teargas had the same effect. In several locations there was no effective queuing, and all candidates had to enter the stadium through a single door.
- October 3, 2014: At least **32 people were killed** and 26 injured in a stampede shortly after the Dasehra celebrations at the Gandhi Maidan, Patna, India.
- October 10, 2014: **At least seven people died** and 40 were injured as a result of a stampede at Qasim Bagh Stadium Multan Pakistan after the Speech of cricketer-turned-politician Imran Khan. The Opposition leader alleged that only two gates of the venue were opened at the end of the rally and the lights were also switched off, but this was later denied by the DCO and local authorities.
- November 21, 2014: **11 people died** and 40 people were injured after a stampede in a stadium in Kwekwe, Zimbabwe.
- December 31, 2014: **36 people died** and 42 people were injured after a stampede during New Year's celebrations at The Bund, in Shanghai, China.



2015

- February 8, 2015: **28 people died** after a stampede that occurred at a football game in Cairo, Egypt.
- February 17, 2015: More than **16 people died** after a stampede occurred during the Shrove Tuesday festival in Port-au-Prince, Haiti after a man was shocked by high-voltage wires.
- July 9, 2015: At least **23 people were killed** and 50 injured following a stampede at a free clothing drive in the northern Bangladeshi city of Mymensingh.
- July 14, 2015: At least **27 pilgrims** died in a stampede on the banks of the Godavari River in the southern Indian state of Andhra Pradesh. The Hindu pilgrims had gathered to take a dip in the river at the start of the Maha Pushkaralu festival.
- September 24, 2015: At least **2,262 pilgrims** were killed in Mina, Saudi Arabia in an overcrowding incident during the Hajj pilgrimage. A further 934 were injured. The overall number of pilgrims is around 2 million according to the Saudi authorities, which is far less than the number of pilgrims in previous years (Haj / Pilgrim quotas of all countries were reduced due to ongoing construction work at the main Masjid Al-Haraam).
- October 25, 2015: **Twelve girls** aged ten to fifteen were killed and another 42 were injured in a crush on a stairway while trying to escape their school building in Taloqan, Afghanistan during a major earthquake.
- November 15, 2015: **74 people were injured, 2 critically**, when a glass stairwell railing collapsed during a stampede out of the +1 Club in Paceville, Malta.

https://en.wikipedia.org/wiki/List_of_human_crushes

Duisburg 2010





eventi socio-politici



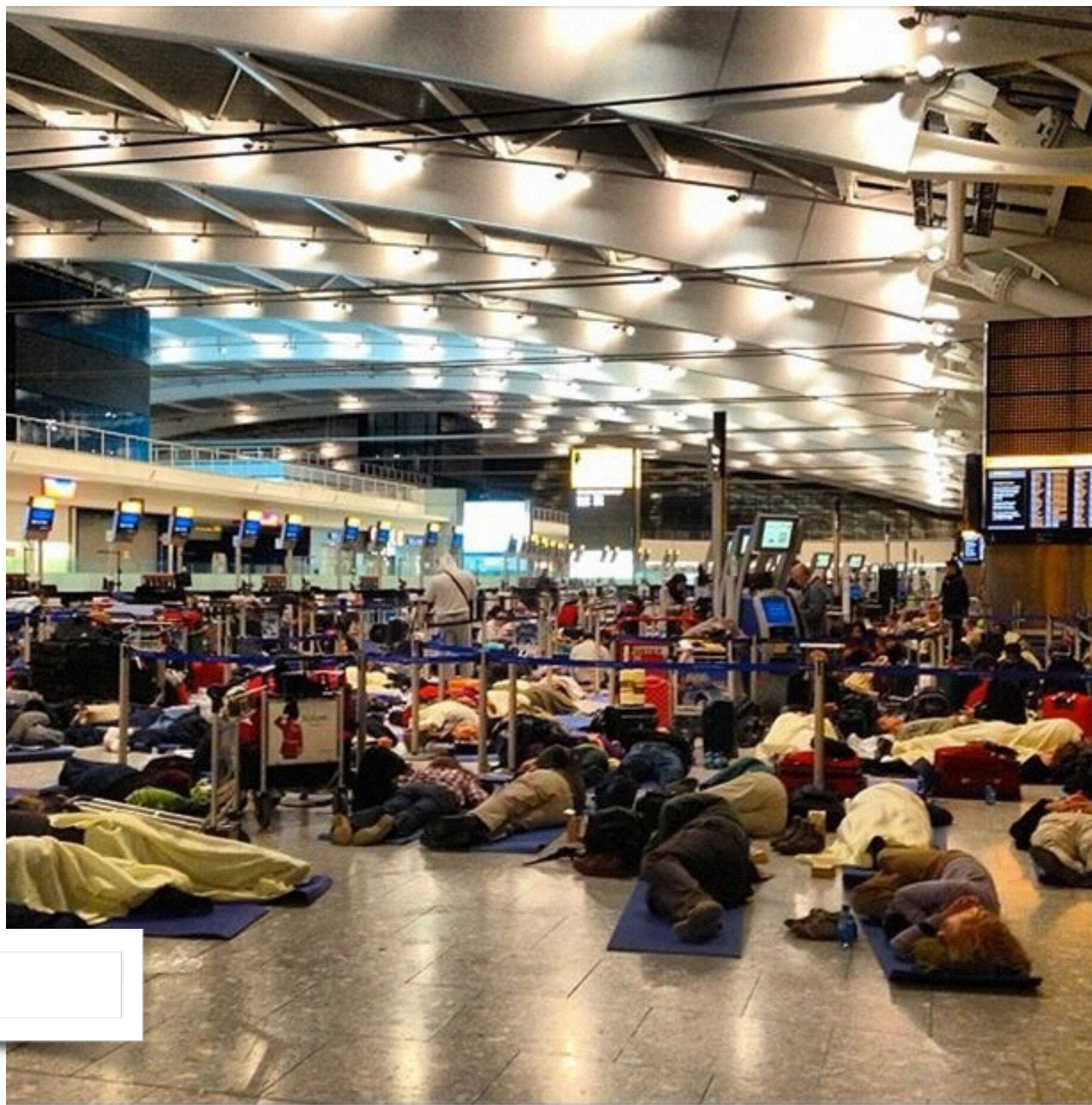
eventi occasionali



spettacoli



eventi religiosi



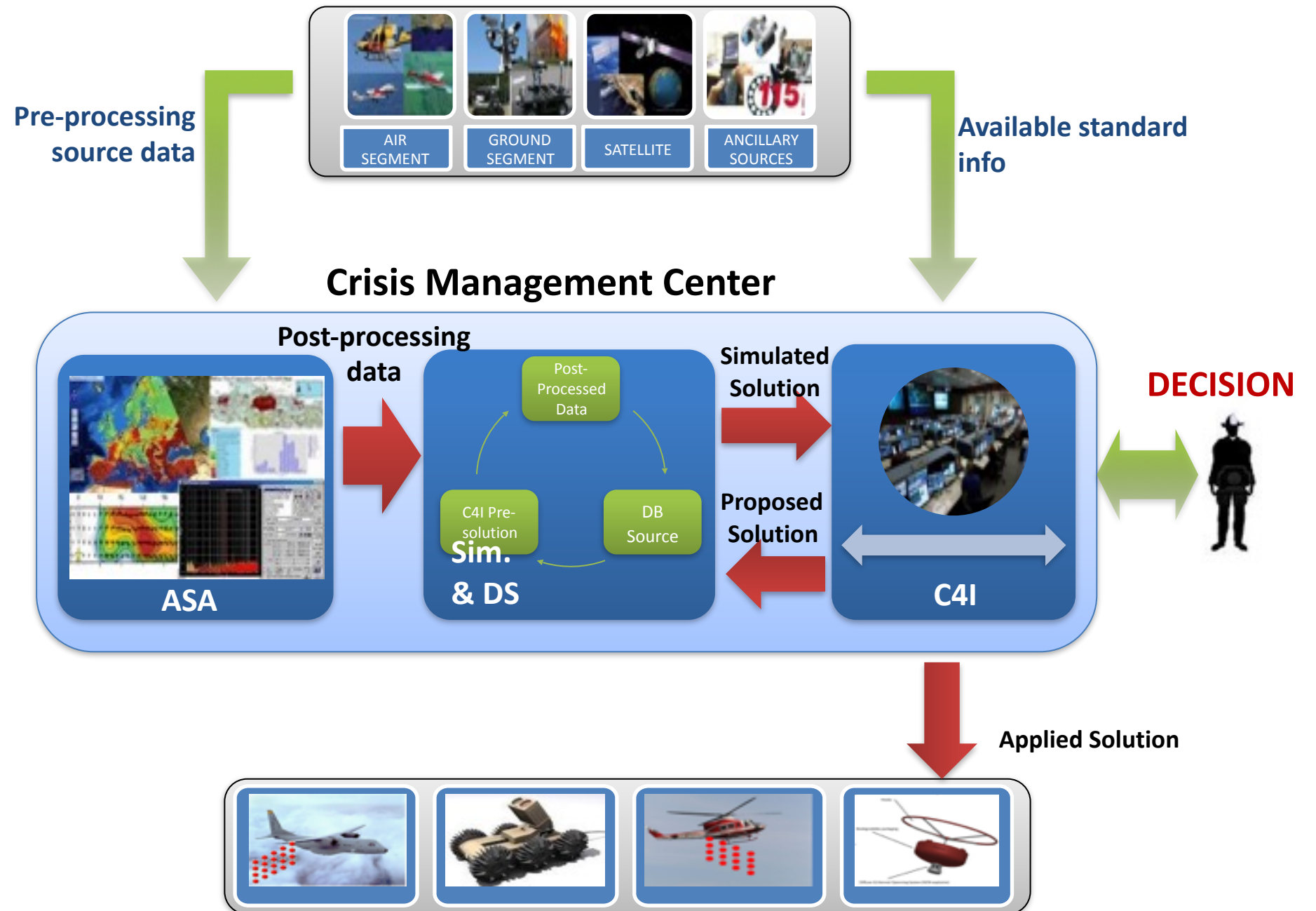
altro



identificazione dei pericoli

valutazione dei rischi

definizione delle misure

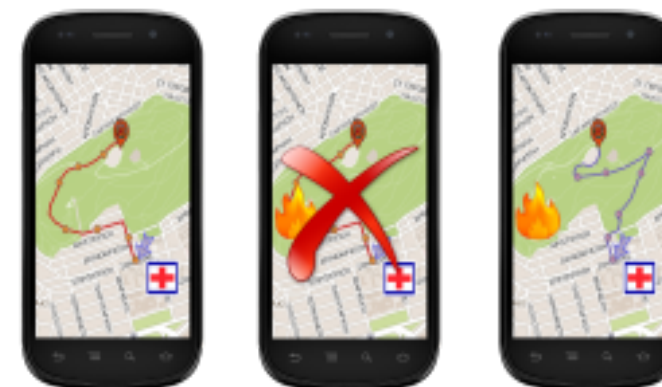


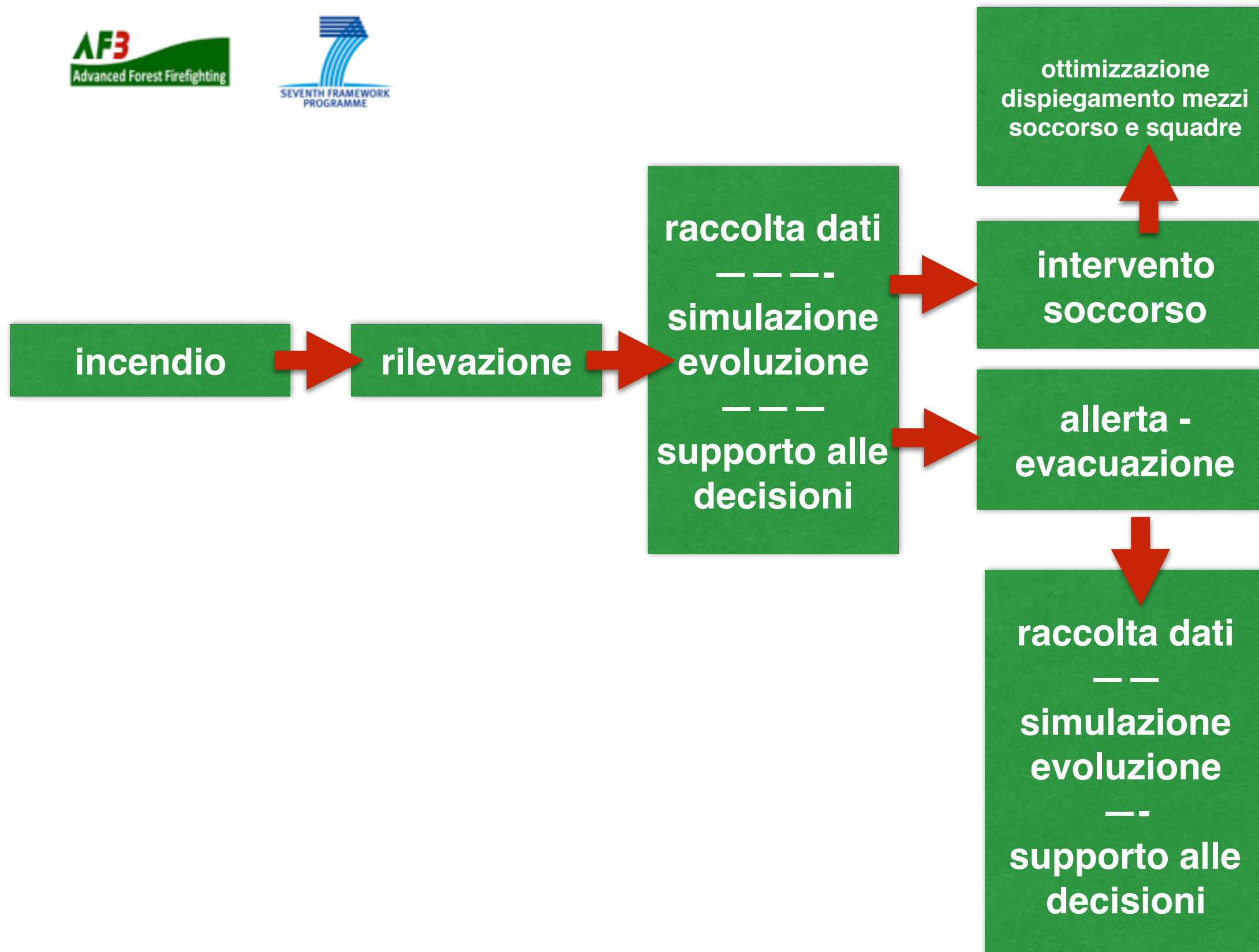
ANCILLARY SYSTEMS

AF3 GIS Map Recreation & Live Knowledge Extraction



AF3 GIS: Safe re-routing after hazardous area detected







modelli di movimento

- Density correlation
- User's choice
- Inter-person distance
- Potential
- Emptiness of next grid cell
- Conditional
- Functional analogy
- Other model link
- Acquiring knowledge
- Unimpeded flow
- Cellular automata

modelli di comportamento

- No behavior
- Implicit behavior
- Conditional (or rule)
- Artificial Intelligence
- Probabilistic

*da: NIST Technical Note 1471
A Review of Building Evacuation
Models - E. D. Kuligowski R. D.
Peacock*

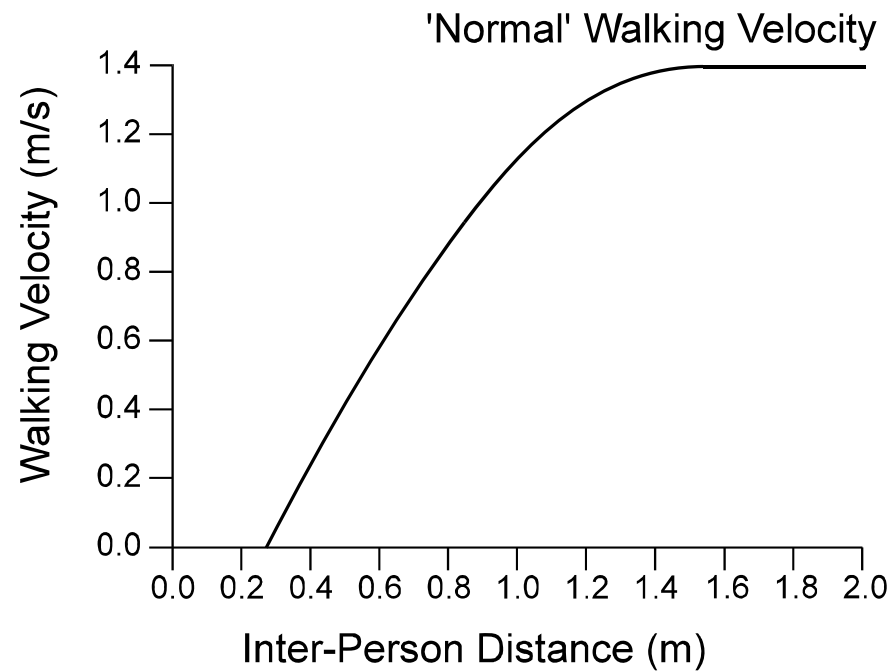
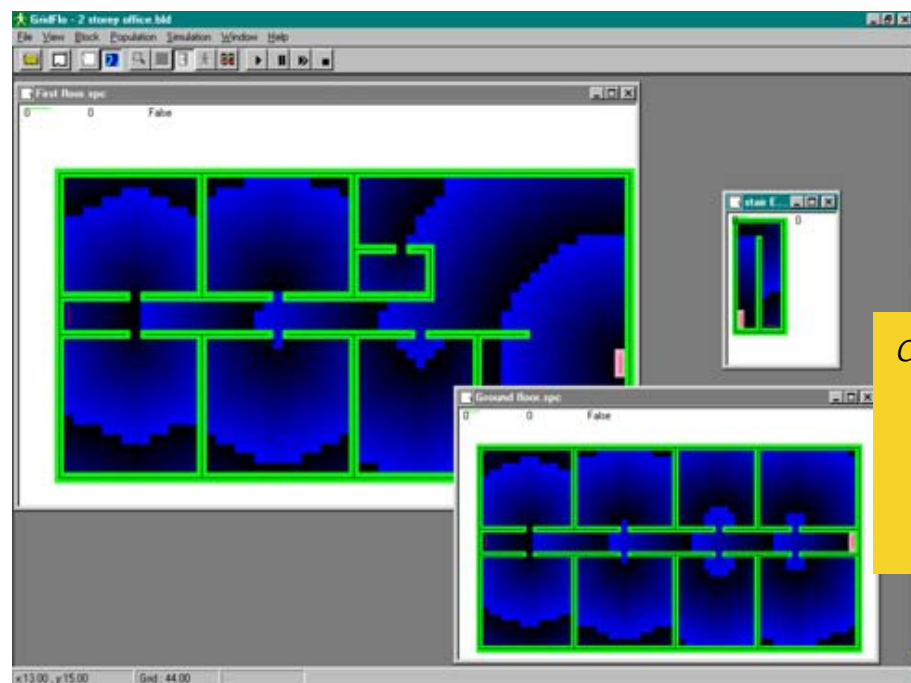


Figure A.14: GridFlow visualization of the distance mapping⁴⁶



da: NIST Technical Note 1471
A Review of Building
Evacuation Models - E. D.
Kuligowski R. D. Peacock

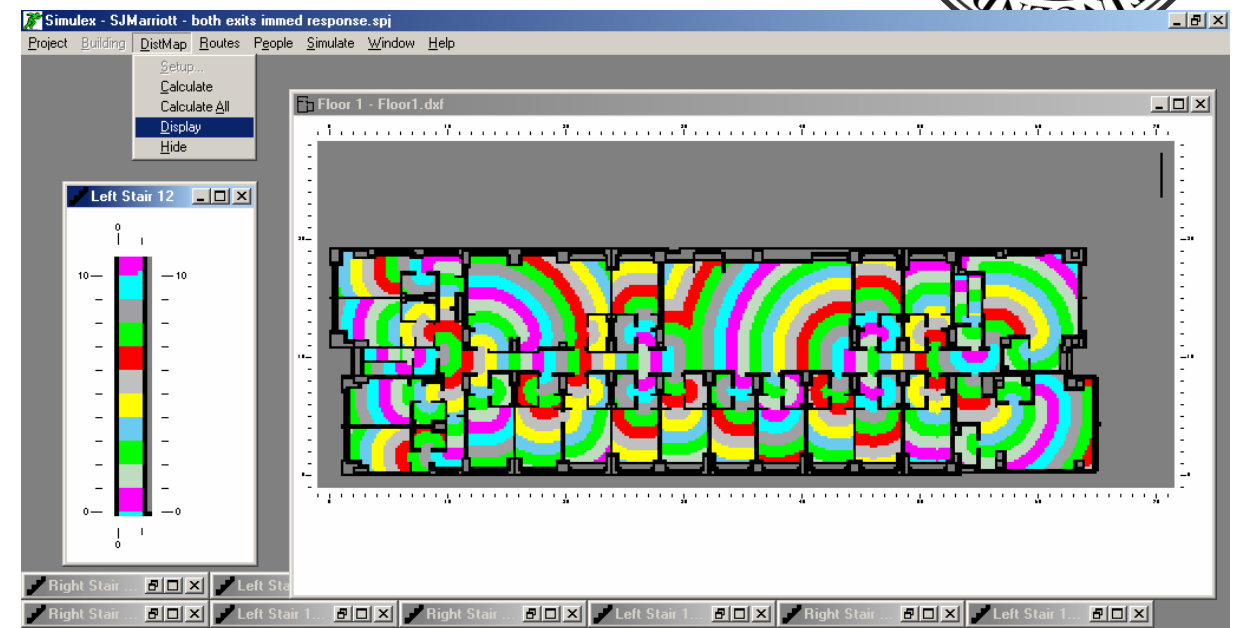


Figure A.11: Example of visualization of the distance map in Simulex

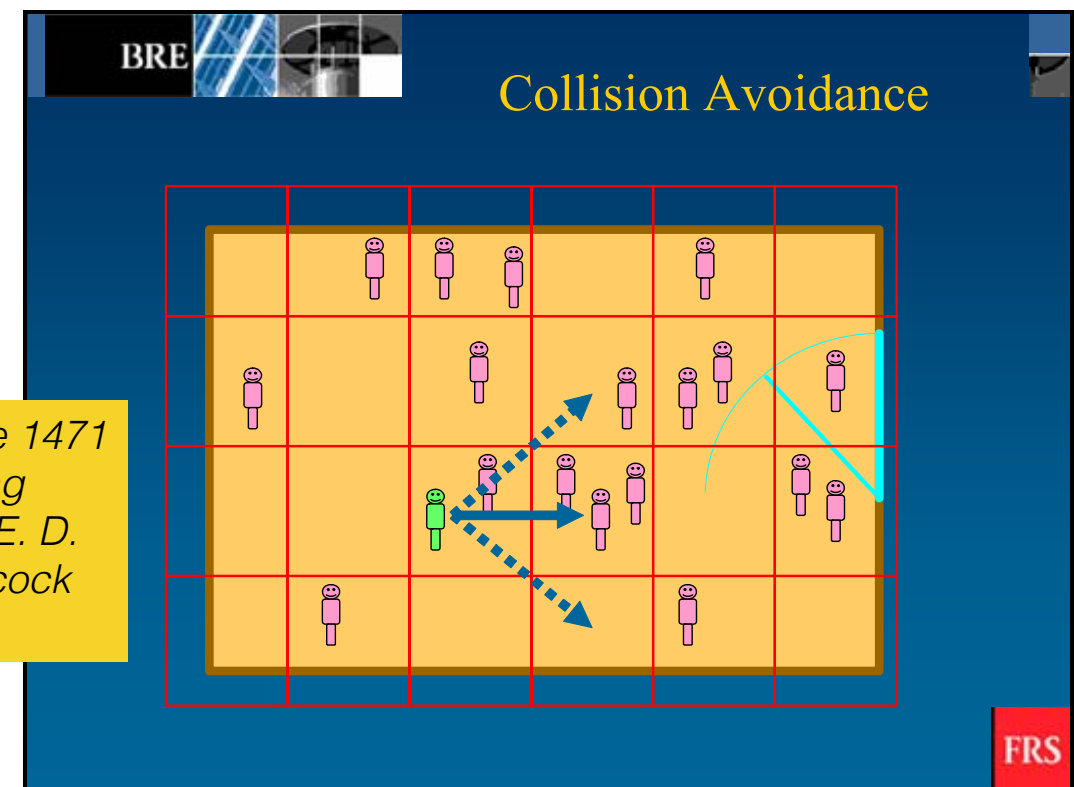


Figure A.21: Graphic of collision avoidance in CRISP⁸⁰

Table 4.1. Fuzzy IF-THEN rules

Attribute	LHS	RHS
Evacuation Participation (Decision) Model		
Perceived risk to TAZ	If minor damage is reported	He/she will perceive less risk
	If some damage is reported	He/she will perceive some risk
	If serious damage is reported	He/she will perceive high risk
	If the TAZ is reported not to be struck	He/she will perceive less risk
	If the TAZ is reported likely to be struck	He/she will perceive some risk
	If the TAZ is reported very likely to be struck	He/she will perceive high risk
Recommendation to evacuate	If the disaster's frontier is distant from the route	He/she will perceive less risk
	If the disaster's frontier is close to the route	He/she will perceive high risk
	If the recommendation to stay is mandatory	He/she will stay
	If the recommendation to stay is voluntary	He/she will probably stay
	If no specific recommendation	He/she will be neutral
	If the recommendation to evacuate is voluntary	He/she will probably evacuate
Herding behavior	If the recommendation to evacuate is mandatory	He/she will evacuate
	If most individuals have not evacuated	He/she will stay
	If about half of the individuals have evacuated	He/she will be neutral
Evacuation Route Choice Model		
Estimated delay on route	If most of the individuals have evacuated	He/she will evacuate
	If the route is reported as having no congestion	He/she will expect no delay
	If the route is reported congested	He/she will expect some delay
Perceived risk to route	If the route is reported seriously congested	He/she will expect serious delay
	If the disaster's frontier is distant from the route	He/she will perceive low risk on the route
Freeway bias	If the disaster's frontier is close to the route	He/she will perceive high risk on the route
	If most links on the route are freeway links	He/she will prefer the route
	If some of the links of the route are freeway links	He/she will be neutral
Recommendation on evacuation route	If few of the links on the route are freeway links	He/she will not prefer the route
	If the recommendation not to take the route is mandatory	He/she will not take the route
	If the recommendation not to take the route is voluntary	He/she will probably not take the route
	If no specific recommendation	He/she will be neutral
	If the recommendation to take the route is mandatory	He/she will probably take the route
	If the recommendation to take the route is voluntary	He/she will take the route

da: Integrating Supply and Demand Aspects of Transportation for Mass Evacuation under Disasters Srinivas Peeta et al - 2009 USDOT



Figure 16. Potential typology of crowds

