



Natural Human-Robot
Cooperation in Dynamic
Environments

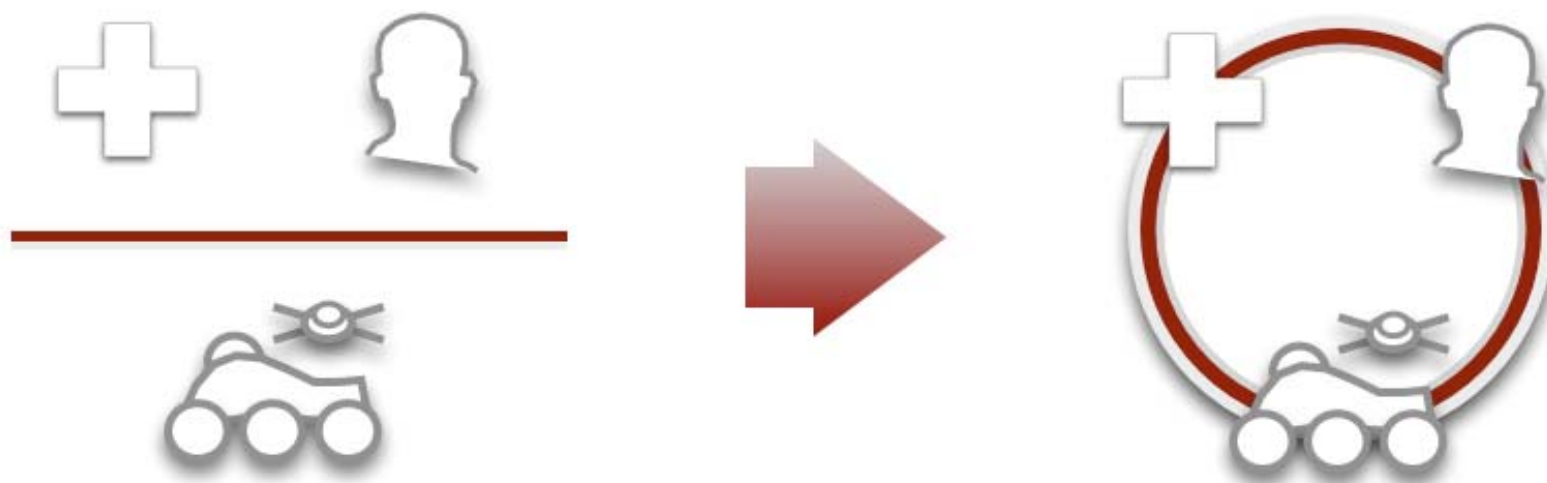
Fiora Pirri

Alcor LAB, Sapienza University of Rome

on behalf of BlueBotics, CTU, DFKI, ETHZ,
FDDO, TNO, VVFF,

A tremendous experience

NIFTi is about human-robot cooperation for rescue operations

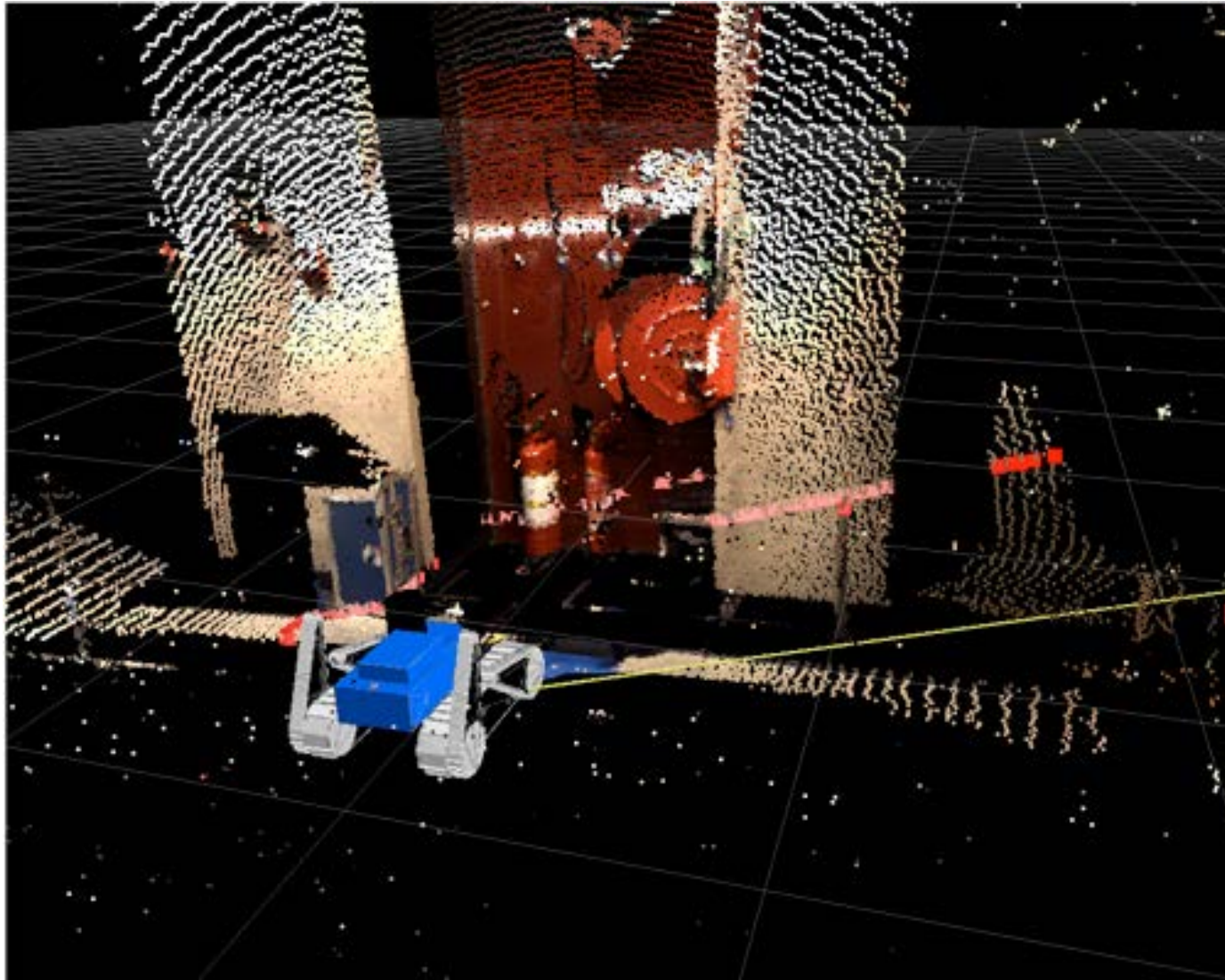


NIFTi aims to develop a unified theory of how a cognitive system can achieve natural task-driven cooperation between a human and a robot working together in a dynamic environment, with convincing instantiations on a novel robot platform for urban search & rescue.

- What we really got

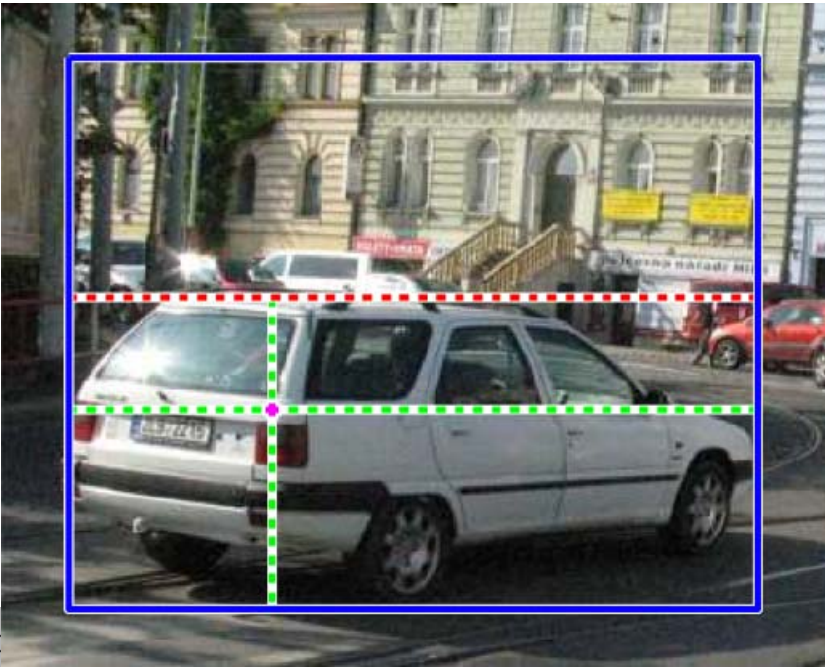
- A great working team ... The right size and very well integrated (great coordinators: implacable, inarrestable, always to the point).
- An extraordinary interaction with end-users super-active in evaluating all objectives, all results, circumstantially pointing to WHAT FOR, WHY THIS, HOW TO, AND IF.. big discussions. **User centric method works.**
- A perfect logistic provided by VVFF and FDDO. Many training areas thought for dogs and people adapted to become robot training areas. **Authentic experiments make the difference.**
- A new robot legacy has been founded: tangible results and experiences have jointly indicated to infield operators the essential contribution robots can bring, genuinely with no game or fiction. **Robot can contribute to societal changes.**
- A deep and new understanding of what is effectively needed to cooperate in emergency scenarios. Which made us ready for Mirandola. **Being ready is expected..**
- Science applied to solve problems for real, yet it has been good science. **Reality motivates good science. Good science can help people.**

Scientific Contribution



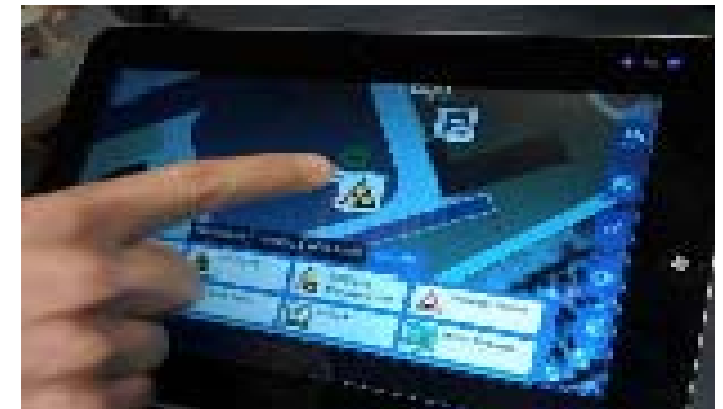
Consistent and accurate 3D Mapping

Scientific Contribution



deformable objects detector,
human body part detection
integration of IR and vision

Scientific Contribution



Awareness & persistence of information.

Easy to use and mobile interfaces for in-field roles

Scientific Contribution



Continuous system
Integration UAV+UGV, mesh
network, use case



..and autonomy on any terrain

EXPERIMENT #01 - PRATO
HARSH TERRAIN NAVIGATION

This has been NIFTi ...



The role of End-Users as partners in NIFTi

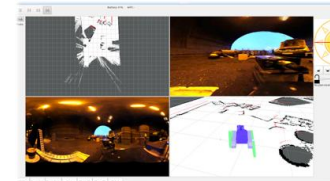
Salvatore Corrao, Tonino Guerrieri
CNVVF, Italy in collaboration with FDDO, Germany

- **End-users contributions**
- **NIFTi scenarios**
- **Joint mission at Mirandola (Italy): post-earthquake damage assessment, July 2012**
- **Lessons learned and Follow-up**

End-users contributions



- First responder experience in HAZMAT and USAR
- Scenario Design in training area facilities
- Assessing Human Factors in using Robots
- Sharing data obtained in NIFTi
- Providing real-life sites and logistics
- A real test in disaster areas after the Emilia Romagna earthquake (Italy, 2012)



NIFTi scenarios

- **Road Tunnel accident:** HAZMAT rescue operations at CNVVF Operational Training School in Montelibretti (Italy)



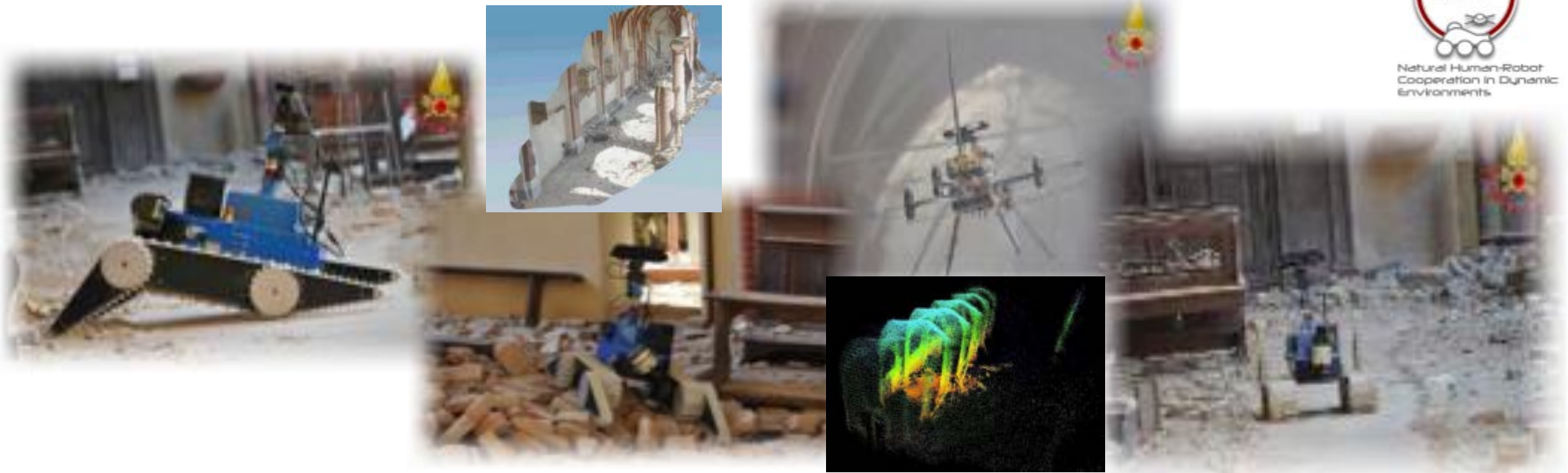
- **Railway Tunnel accident:** HAZMAT rescue operations at Fire Department, Dortmund (Germany)



- **Earthquake:** USAR rescue operations at the debris camp set up in Prato Fire Station (Italy)

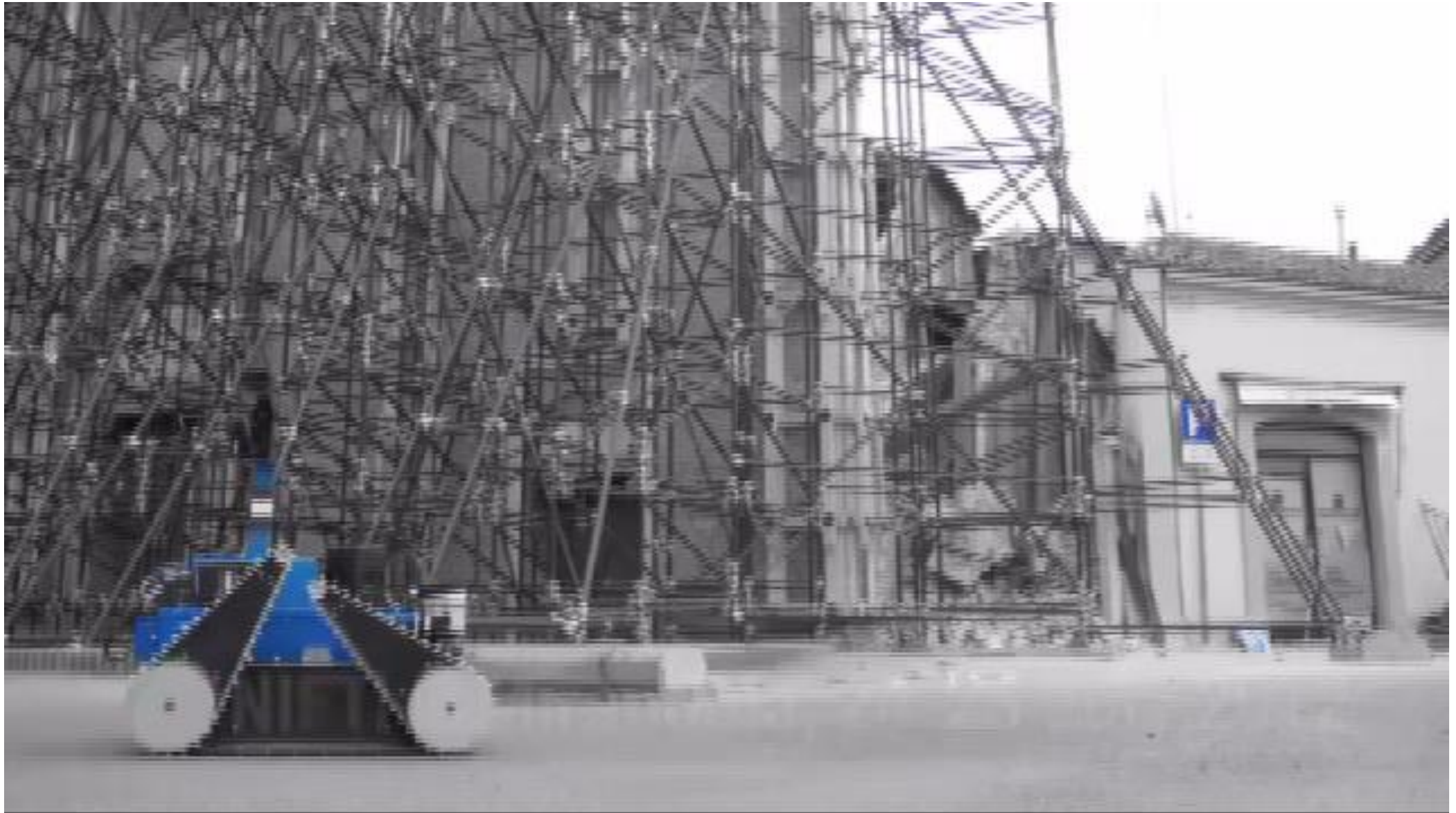


Joint mission at Mirandola (Italy)



- **No longer a simulation, but a real field test**
- **Venues:** *the Church of St. Francesco of Assisi and the Duomo of Mirandola* damaged by the earthquake (about 20 km from the epicenter of Finale Emilia in shock in May 20, 2012)
- **End-users main activities:** logistics, safety, human-robot deployment on the disaster areas, sharing data with National Heritage

Joint mission at Mirandola (Italy)



Lessons learned and Follow-up (1/2)



- Awareness of the possibilities of robot use in disaster response helping the decision making process (e.g., mapping, data sharing, real-time videos)
- Experience with HRI in disaster response at different operational levels (e.g., Advanced Command Post)
- Gained experience with technical and operational issues arising in real conditions (e.g., network, time to set up, interfaces, safety)
- Identification of additional requirements and possibilities on the human-robot-team setup (e.g., arm, manipulation)



Lessons learned and Follow-up (2/2)

...Collaboration and “persistence” continues in

EU-FP7 project TRADR:

Long Term Human-Robot Teaming for Robot
Assisted Disaster Response

<http://tradr-project.eu>

