

# IEEE Sections Congress



By: Roberto de Marca, Russell Lefevre, Michael Andrews

## Humanitarian Technology Challenge



## Agenda

- **Project Overview and Status – Roberto de Marca**
- **Humanitarian Challenges and Next Steps – Russell Lefevre**
- **TA and MGA Unit Participation – Michael Andrews**

## Objective

- ***Motivate enthusiastic participation in this project***

# About the Initiative - 1

## ■ Description

- Unprecedented opportunity for focused collaboration to drive technology-based solutions to some of the greatest humanitarian challenges facing the world
- Jointly sponsored by IEEE and UN Foundation, involving:
  - IEEE Societies/Technical Councils and Regional Units
  - Non-Governmental Organizations (NGOs)
  - “Implementation” NGOs on-the-ground (e.g., World Health Organization, Red Cross)
  - Solution Developers (Corporations and others)
  - Solution Funders (Foundations and others)

## About the Initiative - 2

### ■ Driving Need

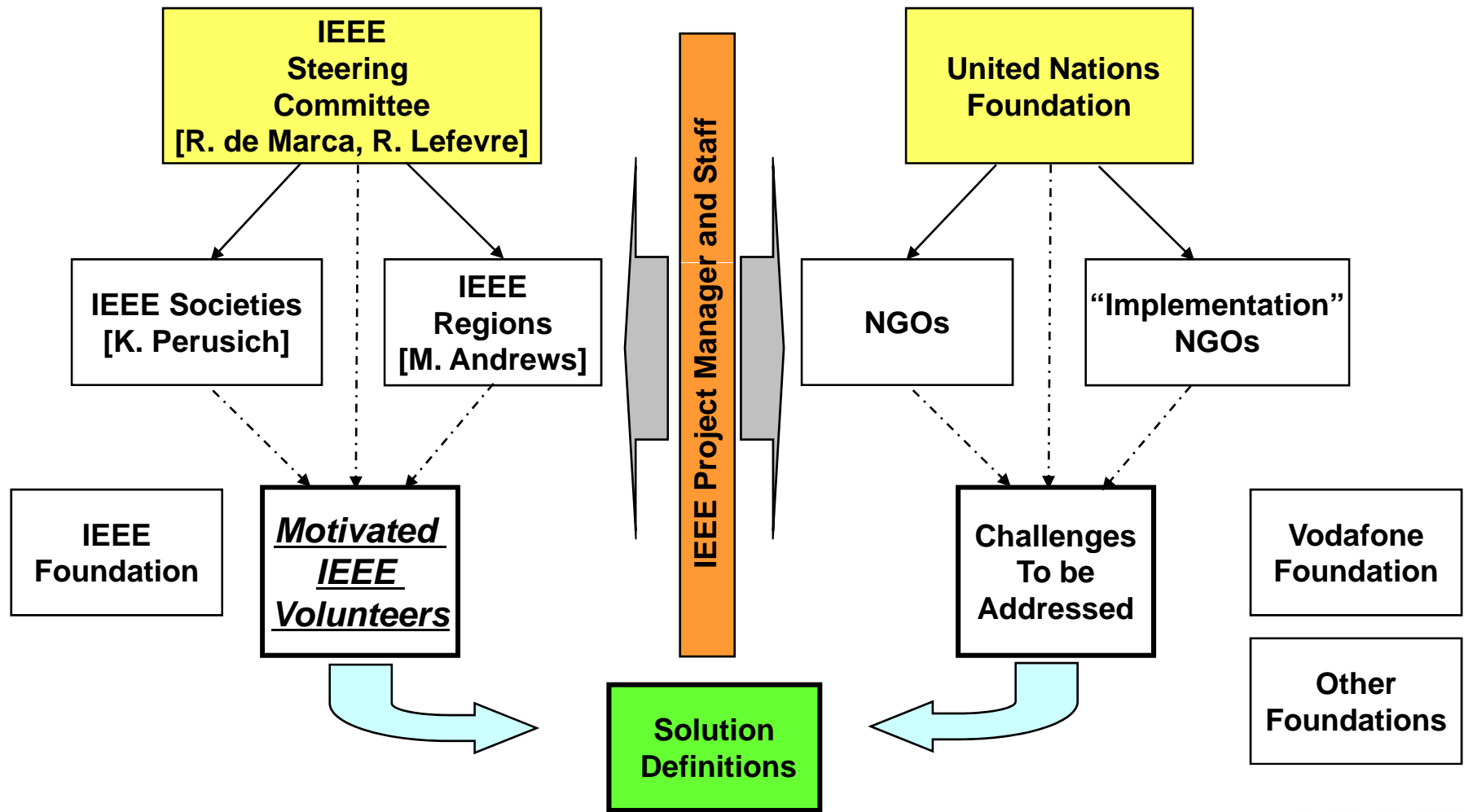
- Lack of forum/framework to bring together humanitarian organizations, first responders, technical experts, corporations and philanthropic groups to address critical issues

### ■ Desired Outcomes

- Identify three challenges and drive solutions that are implementable and sustainable
- Bring a more systematic approach to applying technology to solve world problems
- Define (repeatable) methodologies to addressing challenge oriented, large scale efforts
- Raise awareness of IEEE as global association of professionals and academics who solve technological problems that positively impact humanity

# HTC Project Management Framework

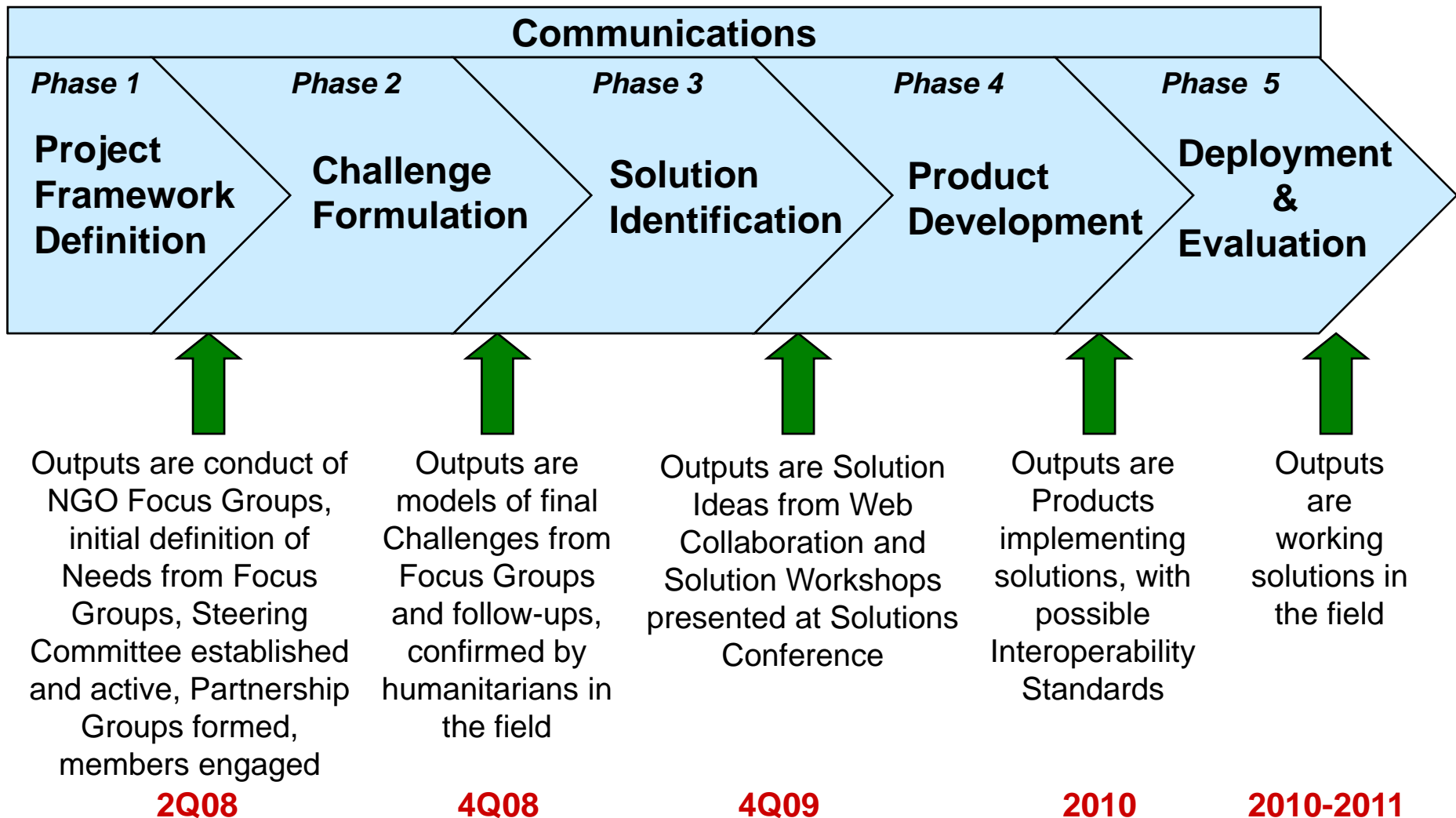
*Challenge Identification and Solution Definition Focused*



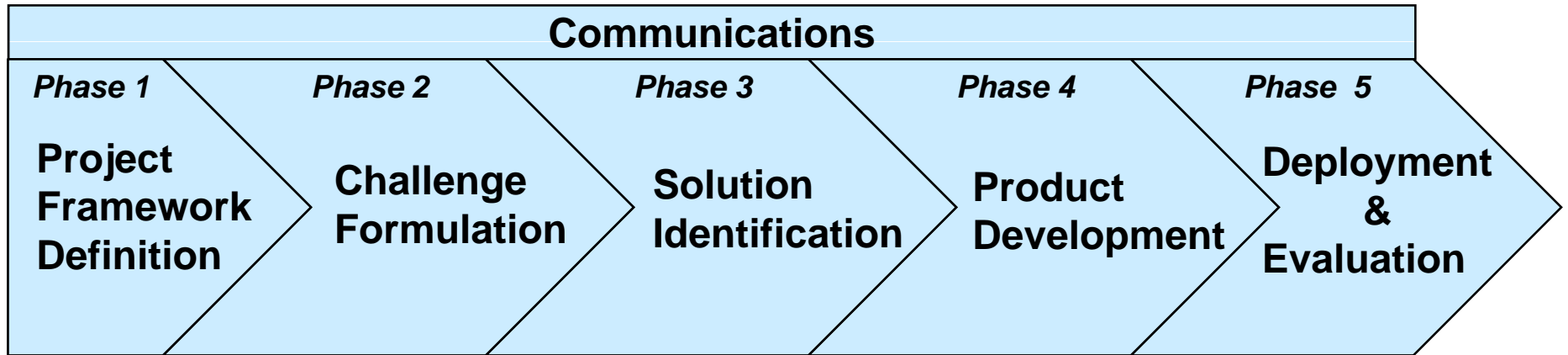
# HTC Steering Committee

- **J. Roberto de Marca (VP- IEEE TA)**
- **Russell Lefevre (Pres. IEEE-USA)**
- **Michael Andrews (Chair, Regional Unit Partn. Comm.)**
- **Karl Perusich (SSIT and Chair, Society Partn. Comm.)**
- **Paul Cheung (Univ. of Hong Kong, Region 10)**
- **Roberto Saracco (Telecom Italia, Region 8)**
- **Ana Luisa Santos (MIT Media Labs, GOLD)**
- **Lewis Terman (IEEE President)**

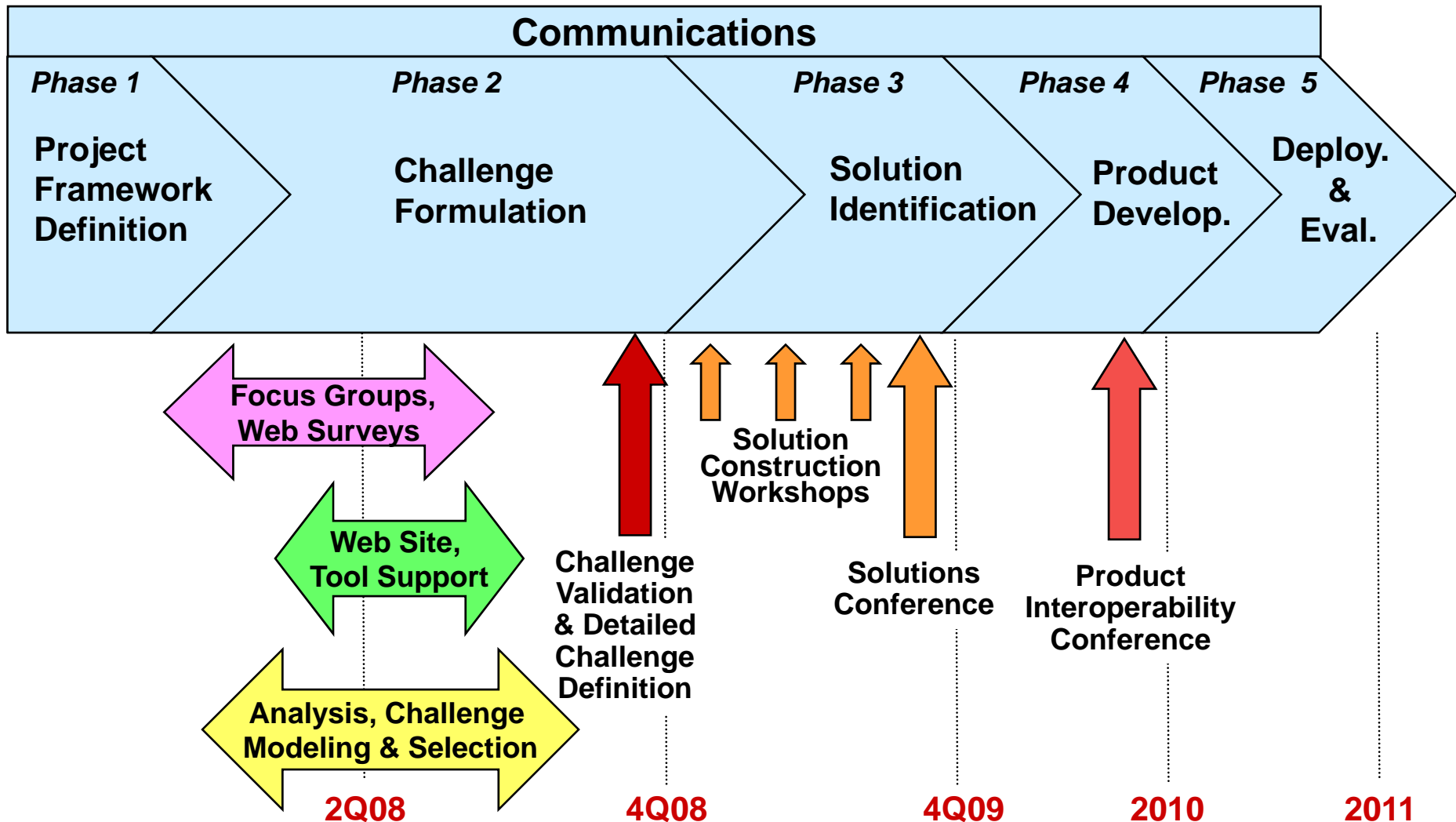
# Project Design and Deliverables



# Key Participants



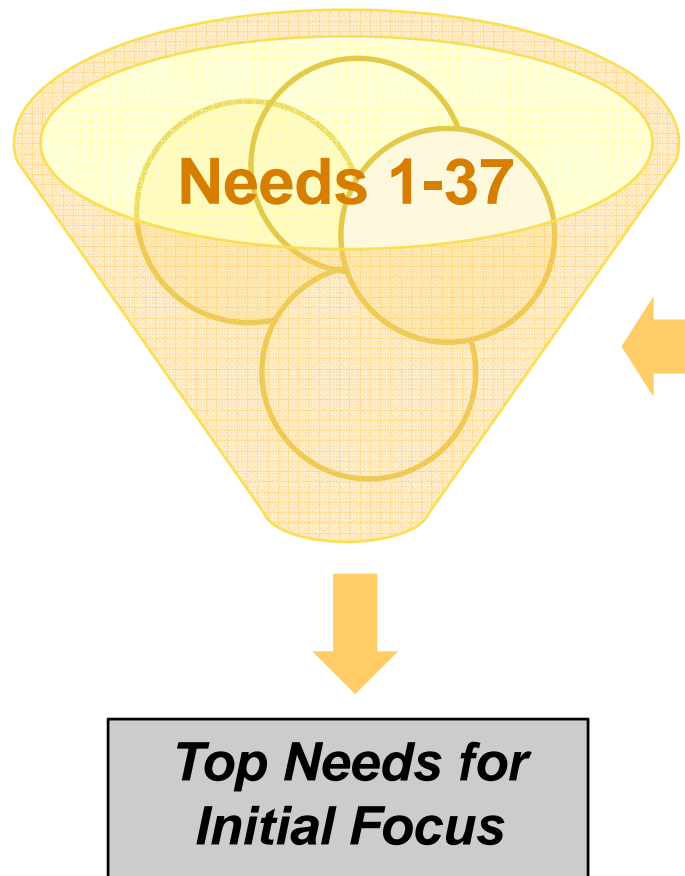
# Project Activities and Milestones



*Samples of activities that will be conducted – options may change with the nature of challenges selected*

# Project Status

Conducted Four Focus Groups with Humanitarians, Identifying 37 Critical Needs



## Prioritization Criteria

- Scope of challenge and number of people impacted by a solution
- Magnitude of anticipated benefits, e.g., cost reduction, speed of delivery, reduced mortality rate
- Breadth and complexity of potentially applicable technologies (maximize scope of volunteer participation)
- Probability of success in developing a timely, cost-effective, locally implementable and sustainable solution
- Scalability of the solution to different sizes and types of environments

## Top Needs/Challenges – 1

Pri.	Humanitarian Need/Challenge	Purpose	Related Needs
1	<p><b><u>Reliable Electricity</u></b></p> <ul style="list-style-type: none"> <li>• Low power stationary facilities</li> <li>• Rugged, mobile power supplies for emergency settings</li> <li>• Mechanical transducers</li> <li>• Passive generation devices (e.g., charge as you walk)</li> <li>• Renewable energy hubs preferred</li> </ul>	<p>Power availability for electronic devices</p>	<p>Improved Night Time Lighting</p>
2	<p><b><u>Data Connectivity of Rural District Health Offices</u></b></p> <ul style="list-style-type: none"> <li>• Two way transmission – upload, download</li> <li>• Data could be batched for daily transfer</li> <li>• Also useful for emergency/outbreak alerts</li> <li>• Less expensive service and higher bandwidth needed</li> <li>• Create maps of existing connectivity</li> <li>• Use intermediate field offices as data relay points?</li> </ul>	<p>Exchange data between central health facilities and remote field offices</p>	<p>Remote Examination and Disease Diagnosis</p>

## Top Needs/Challenges – 2

Pri.	Humanitarian Need/Challenge	Purpose	Related Needs
3	<p><b><u>Local Management and Tracking of Supply Distribution</u></b></p> <ul style="list-style-type: none"> <li>• Monitor and assess local resources – where sent, where received and how used</li> </ul>	<p>Ensure that supplies are getting to the people that need them in order to maximize impact of assistance</p>	<ul style="list-style-type: none"> <li>• Verifiable “Cold-Chain” for Heat Intolerant Pharmaceuticals</li> <li>• Inventory Management of Perishable Pharmaceuticals</li> </ul>
	<ul style="list-style-type: none"> <li>• Financial tracking of expenditures</li> </ul>		<ul style="list-style-type: none"> <li>• Global View of Resource Demand and Supply</li> </ul>
4	<p><b><u>Incident Tracking</u></b></p> <ul style="list-style-type: none"> <li>• Reporting Maternal Deaths, Spousal Abuse, etc.</li> <li>• Do not require literacy skills (use voice, visual, touch, ...)</li> <li>• Feedback loop required to show how data used</li> </ul>	<p>Determine locations and extent of medical problems to focus resources</p>	<ul style="list-style-type: none"> <li>• Identify and Collect Data on Population Vulnerabilities</li> <li>• Accurate/Timely Census/Population Data</li> </ul>

## Top Needs/Challenges – 3

Pri.	Humanitarian Need/Challenge	Purpose	Related Needs
5	<p><b><u>Patient ID and Tie to Health Records</u></b></p> <ul style="list-style-type: none"> <li>• Secure, confidential ID for patients</li> <li>• Emergency Response and Chronic Care Applications</li> <li>• Useful for routine care for migrant populations</li> </ul>	<p>Maintain consistent patient records, including when patients visit different clinics, and when patients relocate</p>	<ul style="list-style-type: none"> <li>• Vaccination Records and Vaccine Tracking</li> <li>• Electronic Medical Records</li> <li>• Patient Tracking</li> </ul>

## Top Needs/Challenges – Technology and NGO Activity – 1

Need / Challenge	Identified Technology Activity	Identified NGO Activity
<b><i>Reliable Electricity</i></b>	<ul style="list-style-type: none"> <li>▣ Low power stationary facilities</li> <li>▣ Energy harvesting from wind, wave and motion</li> <li>▣ Voltaic backpacks</li> <li>▣ Micro-generator/battery to capture kinetic energy of everyday motion</li> <li>▣ Solar charging for cell phones</li> <li>▣ Enhanced solar to battery electronic technology</li> <li>▣ Solar battery charging for vehicles</li> <li>▣ Solar charging rural kiosks</li> <li>▣ Mechanical transducers</li> </ul>	<p>None</p>
<b><i>Data Connectivity of Rural District Health Offices</i></b>	<ul style="list-style-type: none"> <li>▣ Pyroelectric detector arrays</li> <li>▣ Vehicular wireless burst switching networks</li> <li>▣ Laser communications</li> <li>▣ Antennas of varying types</li> <li>▣ Satellite communications</li> <li>▣ Cellular/PHS</li> <li>▣ PAN, Bluetooth, Wi-Fi</li> </ul>	<ul style="list-style-type: none"> <li>▣ AED – SATELLIFE global comms network used for uploading of data from PDAs</li> <li>▣ Nacer – enables remote locations to exchange data among themselves and regional centers</li> </ul>

## Top Needs/Challenges – Technology and NGO Activity – 2

Need / Challenge	Identified Technology Activity	Identified NGO Activity
<b><i>Local Management and Tracking of Supply Distribution</i></b>	<ul style="list-style-type: none"> <li>■ Activity limited to cellphone, RFID and sensor networks</li> </ul>	None
<b><i>Incident Tracking</i></b>	<ul style="list-style-type: none"> <li>■ Activity appears to be limited to antennas and propagation</li> </ul>	<ul style="list-style-type: none"> <li>■ HealthMapper (WHO application) – similar to Google Map – focus on disease surveillance, visualization of data in terms of maps, tables and charts</li> <li>■ HazardPoint – integrates environmental monitoring devices with handheld computers, GPS location technology</li> </ul>

## Top Needs/Challenges – Technology and NGO Activity – 3

Need / Challenge	Identified Technology Activity	Identified NGO Activity
<p><b><i>Patient Identification and Tie to Health Records</i></b></p>	<ul style="list-style-type: none"> <li>■ Computational intelligence for biometrics</li> <li>■ Signal/image processing and pattern recognition</li> <li>■ Implantable RFID</li> <li>■ Thumbprint access to patient records</li> <li>■ RDID Antennas</li> <li>■ PDAs and tablet PCs to record and retrieve patient information</li> </ul>	<ul style="list-style-type: none"> <li>■ TeleDoc – transit data from mobile computing devices to a central database which can also be accessed by those devices</li> <li>■ PMP4 Wireless Healthcare System               <ul style="list-style-type: none"> <li>– monitors, measures and transmits data to hand-held devices</li> <li>– information can be uploaded to central database</li> <li>– manages electronic medical files for each patient</li> </ul> </li> </ul>

## Next Steps

- **Validate prioritized challenges with humanitarians in the field**
- **Develop complete, detailed Challenge Definitions with supporting data**
- **Select 1-2 IEEE volunteers to serve as “Champions” for each of the selected challenges**
- **UN Foundation to select 1-2 Humanitarians to serve as “Champions” for each of the selected challenges**

## Next Steps

- **Complete volunteer membership on the HTC “Partnership Group”**
- **Implement a collaboration tool for geographically diverse participants to work together on solutions**

## Requirements for a Complete Challenge Definition

- **Concise and precise description of the nature, scope, causes, severity and impact of a problem:**
  - **Who is affected?**
  - **Where are they located?**
  - **Why does the problem exist?**
  - **What type of solution is needed?**
  - **When is a solution needed?**
  
- **Metrics for success, including critical milestones and timeframes**

# Requirements for a Complete Challenge Definition

- **Supporting data should include:**
  - **Measurable impact of problem today**
  - **Measurable results desired**
  - **Measurable time frame**
  - **Economic or other benefits of solution**
  - **Description of previous attempts to solve**
  - **Non-technical (sociological, political, etc.) issues that bound solutions**
  - **Economic constraints**

# Challenge Champions

- **Challenge Champions lead teams of experts identified by the IEEE and the UN Foundation.**
  - **1-2 IEEE volunteers**
  - **1-2 Humanitarian organization representatives**
- **These Challenge Champions serve as the “point persons” for each of the challenges**

# IEEE Volunteer “Challenge Champions”

## ■ Qualifications

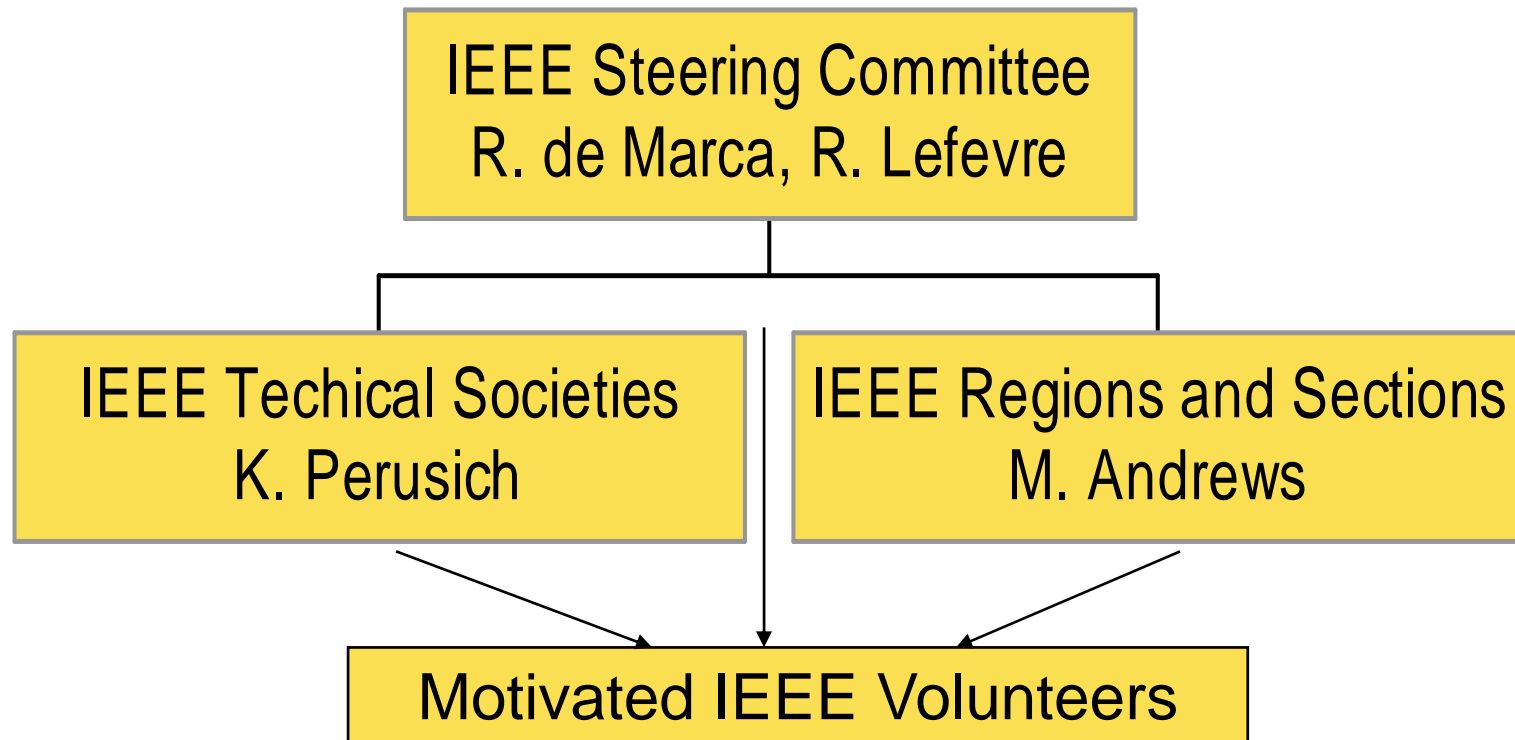
- Well known in their field, related to the challenges
- Experienced in application of technology to humanitarian issues, particularly in systems engineering
- Enthusiastic and motivational
- Capable of achieving active participation by other volunteers
- Well versed in public speaking and writing, to represent progress
- Willingness to expend significant time and effort

# IEEE Volunteer “Challenge Champions”

## ■ Responsibilities

- **Work hand-in-hand with their humanitarian/IEEE counterparts to refine and confirm challenge definition and gather supporting data**
- **Drive solution process for their challenge**
- **Actively seek maximum qualified participation in solution collaboration process**
- **Organize meetings, workshops to develop solutions**
- **Moderate web-based collaboration tool activities for their challenge**
- **Seek out other related efforts and build linkages to them**

# IEEE Volunteer Participation Framework



## HTC Technical Society Partnership Group Role

- **Identify related Society activities already underway in the defined humanitarian spaces**
- **Provide input to, and frame, Challenge Definitions**
- **Drive solutions from Society members**
- **Leverage corporate relationships for solution partnerships**

## HTC Technical Society Partnership Group Role

- **Engage IEEE Societies/Technical Councils**
- **Provide advertising channels for the project through conferences, meetings, and publications**
- **Develop creative ways to enthuse and motivate general participation by Society members**

## Participating IEEE Technical Societies

- **Antennas and Propagation**
- **Committee on Earth Observation**
- **Communications**
- **Computational Intelligence**
- **Computer Society**
- **Consumer Electronics**
- **Council on Electronic Design Automation**
- **Electromagnetic Compatibility**
- **Electron Devices**
- **Engineering in Medicine & Biology**
- **Geoscience & Remote Sensing**
- **Industry Applications**
- **Instrumentation and Measurement**
- **Microwave Theory and Techniques**
- **Nuclear and Plasma Sciences**
- **Oceanic Engineering**
- **Power and Energy**
- **Robotics and Automation**
- **Social Implications of Technology**
- **Solid State Circuits**
- **Ultrasonics, Ferroelectrics, & Frequency Control**

## IEEE Technical Society Opportunities

**You have an opportunity to become involved with your technical society to:**

- **Identify potential technical solutions**
- **Search for existing technical solutions**
- **Suggest technology development organizations or collaborations**
- **Participate in solution development**

## HTC Geographic Partnership Group Role

- **Identify related Region and Section activities already underway in the defined humanitarian spaces**
- **Provide input to, and frame, Challenge Definitions**
- **Provide “on-the ground” information that could impact the implementation, adoption and viability of a solution**
  - **Local customs**
  - **Politics and policy makers**
  - **Religious and social issues**
  - **Develop an understanding of proposed technology solutions and effectively communicate to public**

## HTC Geographic Partnership Group Role

- **Drive solutions from Region and Section members**
- **Leverage corporate relationships for solution partnerships**
- **Leverage relationships with local organizations and policy makers to facilitate solution implementation and adoption**
- **One member from each Region in the Group; Region(s) of focus may have multiple members**

# Opportunities for Participation

**Identify  
Humanitarian  
Technology Projects  
Currently Underway**

**Regional/Section  
Representative**

**IEEE Systems  
Engineering  
“Challenge  
Champion”**

**Participate in  
Solution  
Development for a  
Specific Challenge**

## Questions, Additional Information and/or to Get Involved

Roberto de Marca – HTC Chair: [r.demarca@comsoc.org](mailto:r.demarca@comsoc.org)

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Mike Andrews – MGA representative:  
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[perusich@sbcglobal.net](mailto:perusich@sbcglobal.net)

Harold Tepper – IEEE Staff HTC Project Manager:  
[h.tepper@ieee.org](mailto:h.tepper@ieee.org)

# Back-up Slides

## Additional Identified Humanitarian Needs - 1

Challenge	Purpose
<p><u><i>Fast and Inexpensive Temporary Wireless Infrastructure</i></u></p> <ul style="list-style-type: none"> <li>• Possible supplement to existing wireless infrastructure</li> <li>• Possible new install for responders, then dismantled</li> <li>• Rugged, self-sufficient</li> </ul>	Set up communications quickly after disaster
<p><u><i>Two-way Communication in Post-Disaster Situation</i></u></p> <ul style="list-style-type: none"> <li>• Inexpensive video/voice recorder for quick uploads</li> <li>• Graphic capabilities for mapping</li> </ul>	Ability to define the extent of the event, the impact and the assistance required
<p><u><i>Remote Examinations and Disease Diagnosis</i></u></p> <ul style="list-style-type: none"> <li>• High resolution – such as for eye exams</li> <li>• Walk-up kiosk to accept patient info and provide instructions</li> </ul>	Better, faster diagnosis of disease and commencement of treatment
<p><u><i>Accurate/Timely Census/Population Data</i></u></p> <ul style="list-style-type: none"> <li>• Counting of all people – well and ill</li> <li>• Useful as the denominator to calculate prevalence</li> </ul>	Improve accuracy of statistics
<p><u><i>Identify and Collect Data on Population Vulnerabilities</i></u></p> <ul style="list-style-type: none"> <li>• Nutritional deficiencies and more</li> </ul>	Identify likelihood of health crises, in order to take preventative measures
<p><u><i>Patient Tracking</i></u></p> <ul style="list-style-type: none"> <li>• Regimen, status, follow-up, outcome</li> <li>• Socio-political sensitivities</li> </ul>	Improve treatment administration, and identification of disease trends

## Additional Identified Humanitarian Needs - 2

Challenge	Purpose
<p><u><i>Electronic Medical Records (Multi-use)</i></u></p> <ul style="list-style-type: none"> <li>• Security and confidentiality</li> <li>• Covers vaccination record need and others</li> <li>• Need central storage of data for population analysis</li> </ul>	<p>Broad need – consider applications:</p> <ul style="list-style-type: none"> <li>• General census statistics</li> <li>• Individual patient medical histories</li> <li>• Disease tracking and statistics</li> <li>• Treatment tracking, assessment</li> <li>• Pharmaceutical distribution</li> <li>• Medical supplies inventory control</li> </ul>
<p><u><i>Vaccination Records and Patient Tracking</i></u></p> <ul style="list-style-type: none"> <li>• Useful for prevention and treatments (e.g. HIV)</li> <li>• Automatic reminder alerts</li> </ul>	<p>Ensure vaccines are completely and properly administered</p>
<p><u><i>Vaccination Records and Vaccine Tracking</i></u></p> <ul style="list-style-type: none"> <li>• Useful for prevention and treatments (e.g. HIV)</li> <li>• Automatic reminder alerts</li> </ul>	<p>Ensure vaccines are completely and properly administered</p>
<p><u><i>Inventory Management of Perishable Pharmaceuticals</i></u></p> <ul style="list-style-type: none"> <li>• Track quantities stocked, expiration dates</li> <li>• Especially important for HIV treatments</li> </ul>	<p>Reduce waste of expired pharmaceuticals</p>
<p><u><i>Verifiable “cold-chain” for Heat-intolerant Supplies</i></u></p> <ul style="list-style-type: none"> <li>• “Downstream” for drugs and supplies</li> <li>• “Upstream” for blood, tissue and stool samples</li> <li>• Accumulative indicator of maltreatment</li> </ul>	<p>Avoid unnecessary spoilage of medical supplies and specimens</p>
<p><u><i>Global View of Resource Demand and Supply</i></u></p> <ul style="list-style-type: none"> <li>• Integrated database of available resources</li> <li>• Decision support tool</li> </ul>	<p>Ensure that supplies are getting to the people that need them in order to maximize impact of assistance</p>

## Additional Identified Humanitarian Needs - 3

Challenge	Purpose
<p><u><i>Improved Night-Time Lighting</i></u></p> <ul style="list-style-type: none"> <li>• Extend clinic hours</li> <li>• More effective off-hours emergency treatment</li> </ul>	Extend effective working hours for health workers
<p><u><i>Equipment Power Usage Reduction</i></u></p> <ul style="list-style-type: none"> <li>• Cell Phones, PDAs, medical devices, lab equipment</li> <li>• As power degrades, capabilities degrade but do not disappear</li> <li>• Multi-sourcing of power (e.g., AC and battery)</li> </ul>	Improve longevity of medical and communications devices
<p><u><i>Portable Clinical Diagnostic Machines</i></u></p> <ul style="list-style-type: none"> <li>• Supplement large central facility</li> <li>• Close and convenient to patients</li> </ul>	Improve diagnosis and treatment of patients who cannot travel to central facilities
<p><u><i>Secure, Virus Free Operating Systems</i></u></p> <ul style="list-style-type: none"> <li>• Remote PCs can become virus-laden and inoperable</li> <li>• Repair requires visits that could take five days</li> <li>• Secure original software as well as updated data</li> </ul>	Keep PCs operational in remote settings
<p><u><i>Easily Repairable PCs</i></u></p> <ul style="list-style-type: none"> <li>• Focus on hardware parts replacement</li> </ul>	Keep PCs operational in remote settings
<p><u><i>Early Warning System</i></u></p> <ul style="list-style-type: none"> <li>• Extend clinic hours</li> <li>• More effective off-hours emergency treatment</li> </ul>	Notify people of impending situation so they can prepare for it

## Additional Identified Humanitarian Needs - 4

Challenge	Purpose
<u><i>Affordable Interactive Video Conferencing</i></u>	Demonstrate methods of doing things; ability to see actual conditions in field
<u><i>Interoperability of Tools and Systems and Software</i></u> <ul style="list-style-type: none"> <li>• Ability to analyze unstructured data</li> <li>• Facilitate data reconciliation and data mining</li> <li>• New analysis methods can improve predictability</li> </ul>	Share information among NGOs, Governments, etc.
<u><i>Instrumentation of Treatment Algorithms</i></u> <ul style="list-style-type: none"> <li>• Treatment protocols loaded into instruments</li> <li>• Clinical decision support</li> <li>• Input of treatment results, for updating</li> </ul>	Assist health providers with diagnoses and treatments
<u><i>Training for Sophisticated Equipment Being Deployed</i></u> <ul style="list-style-type: none"> <li>• Ongoing training on key requirement</li> </ul>	Ensure expensive, sophisticated equipment can be utilized at the field level on an ongoing basis
<u><i>Technical Support for Sophisticated Equipment</i></u> <ul style="list-style-type: none"> <li>• Routine maintenance and simple troubleshooting</li> </ul>	Ensure expensive, sophisticated equipment can be utilized at the field level on an ongoing basis
<u><i>Education of Healthcare Workers</i></u> <ul style="list-style-type: none"> <li>• Remote workers are not multi-faceted, well-trained</li> <li>• Difficult to stay up-to-date</li> </ul>	Reduce errors made by untrained health workers
<u><i>e-Learning for Health Care Workers</i></u> <ul style="list-style-type: none"> <li>• Ready access to instructions and journals</li> <li>• Facilitate sharing best-practices among peers</li> </ul>	Continuing education for those who field- administer health care

## Additional Identified Humanitarian Needs - 5

Challenge	Purpose
<p><u><i>Provide Treatment Instructions Remotely to Patients</i></u></p> <ul style="list-style-type: none"> <li>• In event patient cannot get to clinic or hospital</li> <li>• "Walk-up" kiosk to accept patient info, provide instructions</li> <li>• Emergency medical call box</li> </ul>	Enable patients to self-treat when caregivers are not available at field level
<p><u><i>Automated Tracking of Meteorological Data</i></u></p> <ul style="list-style-type: none"> <li>• Rainfall, UV exposure, particulates, allergens</li> </ul>	Disease prediction based on correlated environmental factors
<p><u><i>Security and Safety of Rescue and Relief Workers</i></u></p> <ul style="list-style-type: none"> <li>• Accumulation capabilities for repeated exposures</li> <li>• For routine use and also for emergency responders</li> </ul>	Reduce accidental contamination of workers
<p><u><i>Sterilization of Clinical Supplies</i></u></p> <ul style="list-style-type: none"> <li>• Instruments</li> <li>• Gloves (often of limited supply)</li> </ul>	Reduce risk of accidental contamination of patients
<p><u><i>Clean Water</i></u></p> <ul style="list-style-type: none"> <li>• Includes detection and purification</li> </ul>	Decrease prevalence of water-borne illnesses
<p><u><i>Hospital Readiness Assessment and Tracking</i></u></p> <ul style="list-style-type: none"> <li>• Weighted index that defines level of hospital safety</li> <li>• Requires central collection of information</li> </ul>	Maintain hospital operation after disasters
<p><u><i>Language Translation Capability</i></u></p> <ul style="list-style-type: none"> <li>• Speech-to-speech</li> <li>• Speech-to-text</li> </ul>	Ability to communicate in language native to people in field