Advancing the Development of Portable MRI Equipment

The future of mankind may lay in accessing more and more resources from other planetary bodies. It is not impossible that space travel may take years and that people may actually live in space for extended periods of time as they do now on the Mirabel space station. One of the problems of living in a gravity free world is loss of muscle mass and loss of bone mass as well as changes in cardiovascular function. It is important to be able to monitor such physiologic changes using imaging equipment such as ultrasound, computed tomography, infrared imaging, and/or magnetic resonance imaging (MRI).

Ironically, space stations have little space to spare, so these devices would have to be small and not interfere with the functioning of other electro-magnetic devices. To solve this problem, NASA issues a new funding opportunity that seeks to encourage significant advances in the area of small MRI devices that can image the following: oxygen saturation of the blood, muscle mass, metabolic activity in muscle and bone mass density. You see this as a wonderful opportunity to use your talents to advance the field of biomedical imaging and your career. You are to write proposal in response to this funding opportunity, (which in practice would likely be for $1,000,000 over three years) following conventional NIH guidelines as follows:

1. Executive summary or Abstract: A 1-page short descriptions of the entire project.
2. Background and significance:
   a. Provide a general overview of the current state-of-the-art of "small or portable MR systems" and their ability to measure muscle mass, tissue metabolites, bone loss, and blood oxygen saturation. Discuss why MRI is a better approach than other modalities to answer the questions posed above.
   b. Discuss how muscle mass, tissue metabolites, bone loss, and blood oxygen saturation are measured today.
3. Specific Aims: Please consider what new directions can be taken in the future (i.e., with your proposal) and choose two or three specific aims which can be accomplished (potentially) within the budget restraint. Note that there is no need to provide a budget. However, you must not propose a project that would require an extraordinary amount of funding to accomplish the proposed goals.
4. Research Plan:
   a. Describe how you would improve on the design of current small field systems so they can accomplish the goals of imaging muscle mass, tissue metabolites, bone loss, and blood oxygen saturation.
   b. Discuss the statistics of validating any new method you are using. If you are redesigning any component of the system, describe how you would do this with modern design equipment.
   c. Discuss the type of body coverage you could get, the resolution, signal-to-noise ratio for your system and other relevant imaging parameters.
   d. Your description should also include the experimental approaches of how you would test your proposed solution, including the materials, methods, time-line, instrumentation needed.
   e. Consortium, Contractual Agreements (if any): With what types of specialists would you seek collaboration for your project?
   f. Expected Outcomes: What are the anticipated outcomes of your proposed experiments and evaluations?
   g. Potential Problems and Alternative Strategies: What problems do you anticipate that you are likely to encounter, and how would you would overcome those problems?