

20630 Pacific Coast Highway  
Malibu, California  
6 February 1952.

Mr. William F. Friedman  
Armed Forces Security Agency  
3801 Nebraska Avenue  
Washington 25, D. C.

Dear Mr. Friedman:

This is the letter I promised to write to summarize my recollection of our conversation of 10 January. I must apologize for the long delay. It was caused first by a change in plans which forced me to go to San Francisco to see officers aboard the USS BOXER (CV-21) a couple of weeks earlier than I had planned (therefore immediately after I returned from Washington). A second delay then was caused by the death of my father in Washington, and this brought me back to Washington immediately after I had got home from San Francisco. I returned home last Saturday, and I shall try to get this letter out today.

Before I write any of my ideas, however, I believe that it would be advisable for me to state my opinion of the nature of the prejudice which influences me. I suppose that no one speaks with complete objectivity, and during the development of this letter there will appear a better and better picture of the bias which influences me. Mostly, I have no faith in my ability to tell people how to solve problems which I have not attacked technically and explicitly myself. I extend this no faith in my ability to a lack of faith in the ability of others to give sound advice to an intelligent group after only a most cursory glance at a hard problem. Put differently, I believe that the best approach to solving hard problems is to put the problems and potential solvers together with as little interference as possible and then to await results. This minimizes the importance of administration except to the extent that the administration facilitates the introduction of the problems to the potential solvers and protects the potential solvers from disturbance and heckling while they work. Many of my colleagues on SCAG and elsewhere are of a more authoritarian frame of mind, and others feel that the major contribution is the provision of facilities and the assembly of personnel. All these things have to be done, and mainly they are not competitive, so there may not be any real disagreement between various advisors in any event; however, all my remarks should be read with a full realization of a real distaste on my part for administrative direction rather than participating technical leadership and discussion in attacking mathematical or technical problems.

I shall proceed with my development. First I shall make four more or less summary statements, and later in the letter I shall expand on these statements to some extent.

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The summary statements are:

1. Under the present set up it is most difficult to transform any explicit ideas of SCAG members into the development phase.
2. The nature of the problems you now face and the development which you have already accomplished have brought you to a position where professional mathematical and professional physical and engineering ingenuity must be applied in approached much deeper and more subtle than those which were successfully used during World War II.
3. It is dangerous to try to predict the fields of mathematics and physics which will contribute most to your problems and to try to restrict major investigations to these fields.
4. In the past the most successful continuing researches have been accomplished at colleges and universities or at other institutions where broad ranges of topics come under study rather than at industrial laboratories or ad hoc development projects where problems from more narrowly circumscribed fields are attacked.

The first of these statements reflects some experience I have had trying to do work inspired by the SCAG meetings. Many interruptions come between the initial inspiration and the application to SCAG problems, and I have not yet been able to overcome all these interruptions. Generally, these interruptions are caused by three existing situations - the lack of technical publications pertaining to research on the problems (and the consequent difficulty of communication of technical ideas), the interruptions caused by the normal full time assignments of SCAG members (such as my chasing carriers all over the world), and the interest in their own normal work by AFSA personnel which prevents them from worrying too much about the whims of SCAG members. I doubt that there is any culpability connected with these things; if there is culpability I doubt that there would be any gain in trying to track it down. I do believe, however, that a constructive approach toward removing some of these interruptions is possible and desirable.

In connection with my first statement above, I might also note my personal opinion that there is not likely to be much value in advice more than we have already proffered if this advice is arrived at mainly at group meetings of one or two days each quarter augmented by more or less surreptitiously offered individual advice from the members of SCAG. I have used the word surreptitious, a shockingly strong one, not to impute improper motivation to the advisers (all of whom are devoting to SCAG time which is painfully made available at a cost to other assignments) but rather to point out that such advice from two persons offered privately may be competitive, may be submitted to two sources, and may be subjected to competitive evaluation without the knowledge of one or of both advisers. This is a direct result of the inconvenience of fully cooperative efforts.

My second statement above is one which is likely create wrong impressions and to antagonize people who do not follow carefully my expansion here. It seems to me that a great deal of daring and ingenuity went into the successful approaches to the problems you encountered during World War II, but that, as a direct result of this daring and ingenuity followed by the considerable advances which have been made since then, your science has acquired a degree of professionalism which implies a requirement for specialization and subtle approaches. During World War II, the ingenuity required was the vision to see the advantage of mechanizing the operations then attempted and of devising operations suitable

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for mechanization, but all these operations worked directly and without deep subtlety toward a solution, prepared to try all possible answers one by one if necessary. In particular, it seems to me that questions of accuracy of input data were profitably ignored during this period; however, it also seems to me to be true that in one major technical problem which we have discussed at length it must be true that the input data are not wholly accurate, for I can't help believing that the problem would have been solved long ago if there were not a disastrously incorrect value somewhere in the input data. This one example would suffice to convince me of the necessity of introducing methods which are comparatively insensitive to input errors and for which some evaluation of this sensitivity is possible. I don't believe that it is necessary to justify this conclusion on the one example, for many other justifications for this type of study can be found, but I do contend that the one example would now justify the conclusion.

I believe that the situation in your field now, as opposed to that existing during World War II, is completely analogous to the situation faced by Henry Kaiser when he entered the automotive field as opposed to that faced by Henry Ford when he entered. One man can not expect alone to design an automobile which will now compete for the American market, for by now a successful automobile design requires careful quantitative analysis of many problems ranging from heat engineering to chemistry. Still Mr. Ford may have been as ingenious and as daring as Mr. Kaiser, and I hope that the more sensitive people who contributed so much to the early development of your science will not feel that my remarks either date them or belittle them any more than my analogous remarks imply that the Ford Motor Company is not a major factor in current automotive development.

On the other hand, if there are people - no matter what their experience - who feel that no powerful, subtle, quantitative techniques can be developed for the problems you now face, then I must express my disagreement. I do not believe that an engineer or a physicist or a lawyer who refuses to learn algebraic group theory or the calculus of variations should be considered seriously if he claims that the probability that these or other similar subjects will contribute to your solutions is remote; nor should I listen seriously to a mathematician who refuses to learn about nuclear spins or travelling wave tubes or electron multiplier tubes but who advises not looking among physical phenomena for radical improvements in speed of the old methods.

I had supposed that SCAG would furnish a sort of forum for discussion of all sorts of things similar to the ones I mentioned in the last paragraph - mathematical, engineering and physical techniques. I believe that these discussions have been inhibited, not purposely and by an agent I do not recognize.

This discussion leads directly into the third statement I made above. You will recall that I stated that I doubt that the best attack on the problems you face would be the assembly of several dedicated young men of high intellect and good training, as you had suggested. The point I try to make here and in the fourth statement, which are inseparable, is that a successful research outfit must build up a sort of stock pile of talent and that it must have broad goals. It may be easy to predict that a talented man will produce useful knowledge, but it is certainly much harder to predict the field which will benefit most from his work. Sometimes this is hard to predict even after you know and understand the work.

I believe that your idea of dedicating the young men to the desired results would inhibit them to too great an extent. Our disagreement is probably a disagreement

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as to the extent to which this inhibition would be justified by the results which might be caused by this dedication. Certainly some aim is required for any reasonable research, and some researchers prefer narrower aims than others. For my own part, however, I find that I must have the broadest of fields of application for any considerable part of my ideas to be useful and that I must have the broadest of contacts to generate the ideas I need to obtain even this poor record. In short, I might not object to your idea of getting several dedicated young men if I were certain that we could tell that they were the right young men. However, if their training were not perfectly suited to the job in hand (and I have already stated that I believe that it is dangerous to try to define what this training is restrictively) then I do not know where they would get the contacts and the leadership and the broad outside ideas which would lead to spectacular success on your problems.

These seem to me to be the administrative difficulties you face. I do not believe that they are insuperable. I have already suggested in an earlier letter to the Chairman of SCAG one attack which should help the situation immediately - a research contract with a suitable organization with the broad outlook which I claim is necessary.

I suggested during our conversation that this sort of an attack is not enough, but that it is the only thing I can visualize as useful in the near future. I suggested then that the observation that universities had always produced good research be considered in connection with the military schools. Two of these seem to me to offer some hope, one because it is willing to try almost anything and is trying to become a good university and the other because it has a fair tradition of research and at present it has a most able president; these were the Air University at Maxwell Air Force Base, Ala., and the Naval War College at Newport, R. I. Of the two, the Air University is most immediately attractive. It is larger and has broader goals. There are present there officers of all ranks and all skills, and many of these have the typical Air Force approach of trying anything. The group at the Naval War College impresses me as being more scholarly and probably more discriminating, but they are cursed with high rank and lack of specialty schools. The government tendency of removing a successful person to a high administrative position as soon as he has developed enough experience and discrimination to be most useful in his specialty would probably work against a research program at the Naval War College except for research in the broadest fields. Still there is the historic work of Mahan (admittedly broad and general) and the work of Sims (which seems to me to have been superior in every way) and there is the obvious desire of the ~~present~~ present President (and his great competence) to introduce some research into the college. I suggested that you consider means which might be used to develop the research capabilities of one or more of these institutions for future use to you.

I offered, if you desire, to meet you at the Air University when you are here on 10 March and to discuss the set up there with some of the more aggressive officers on the staff. I shall write to them within a few days and try to make appointments.

I shall be glad at any time to try to help in any negotiations, formal or informal, with Vice Admiral Connelly of the Naval War College; I do not know what good I would be here, however. I doubt that I know enough about any of the other schools to be helpful at all.

In conclusion, I might note that I have been completely open in this letter with the possibility that feelings might be hurt. I doubt that this will be the case, but I am certain that your judgement as to whom should see the letter and your explanations to them will assure that the letter will attain its maximum value,

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if it has any value at all. I doubt that it is advisable to introduce it in a SCAG meeting, for example, but I leave that to your judgement. I enclose a copy which you might want to give to the Chairman of SCAG or which you might want to use otherwise - say for starting a fire on a cold morning.

The letter has been long and hazy and verbose; possibly even pompous. I apologize for all these; I tried to avoid them all, but seemed to lack the competence to do so. Maybe this is why I prefer technical work to technical administration. And am, no doubt, not as bad at it.

Sincerely yours,

*Tompkins.*  
C. B. Tompkins.