The Helicopter Instructor...

said that he had merely experienced "some vibration." I then
looked at the tail cone and found that the "vibration" had been
subsequent to a yawing movement.

Buyers of British helicopters come from all parts of the world,
and the problem of training a pilot who speaks no English can
be solved in one of two ways: the instructor can speak set phrases
of standard vocabulary in which he has previously sorted out by
sign language and a dictionary; or the pupil can learn set phrases
in English which the instructor will adhere to in the air. I have
used the first method with Italian pupils and the second with
Japanese. Only once has there been a minor misunderstanding
taken place. On that occasion the pupil switched off both mag-
nets instead of switching from servo to manual control. We were
at 800ft at the time and the airfield was right below, so there was
too little room for a selection of a forced-landing site.

As I said at the beginning, the training of helicopter pilots is
usually reserved for those with fixed-wing experience. The time
which these pilots take to solo averages five hours. Post-solo
duties are generally a matter of a few hours, but naturally this side
of training must be kept elastic to cope with different capabilities.
For the pupil who has never flown fixed-wing aircraft, the time
to solo would average about fifteen hours, and basic instruction
would have to cover much more thoroughly such items as the
control of air-speed with the stick. During the whole of his train-
ing and for some time afterwards the ab initio pilot would be
at a disadvantage compared with the man with fixed-wing experi-
ence. Acknowledged stages of having experience before con-
verting to helicopters may be listed as follows:—

(1) The pupil has air sense, a term which covers a lot of
things like being acquainted with the medium in which the
vehicle is flying, a knowledge of the instruments and a general appreci-
ation of the physical sensations to be experienced during vari-
ous flight manoeuvres.

(2) He has a good judgment of height, an eye for the weather
and appreciation of air movement relative to ground movement.

De-icing: A New Electrical Approach

With the introduction of lightweight generating equip-
ment, the use of electrical surface heaters is now well-
established for the protection of aircraft from icing. A
new development in this field is the surface-heater element devised
by D. Napier and Son, Ltd., the basic arrangement of which is
illustrated in the diagrams below.

The requirements for an electric heater mat, as determined by
the company, were:

(1) Great efficiency, i.e., the heat losses to the structure
should be at a minimum, and heat transfer to the external surfaces at
a maximum; (2) the resistance of the conductor element should be
capable of adjustment in the design stage, in order to give any required
power loading at any specified voltage over a wide variation of areas;
(3) the physical, electrical and mechanical properties of the heater should
be unaffected by temperatures from —60 deg C to +70 deg C, and the
heater should be non-inflammable; (4) the external surface finish should
be aerodynamically smooth and should have a high resistance to
abrasion and rain erosion; (5) the mat should be thin; (6) it should be
capable of application to any shape of surface, including those of
complex shapes by mechanical means, which normally take the form of
traversing gear linked by a suitable mechanism to the workpiece
turntable in such a way that the rate at which the spray-gun
passes across the workpiece can be controlled. In general, surfaces
of single uniform curvature, of aerofoil section, and of spinner
section, can be treated by mechanical methods, while for more
complex shapes a combination of hand and mechanical methods
is normally used.

(7) It should be possible to carry out local repairs on the
heater; (8) its weight per unit area should be a minimum.

These requirements indicated to Napier that it would be
advantageous to fabricate the heater by a spraying process, both for
insulation and for the electrical element, directly on to the
surface to be protected. Progress along these lines led to the
heater mat construction shown below, the base insulation of which
consists of a layer of a thermo-setting resin applied by a flame
spray-gun. Also applied by a flame spray-gun, the electrical
conductor consists of a metallic coating to the resistance and
pattern called for by the particular heat distribution required.
This coating is provided with suitable terminals for connection
with the electrical system. The outer insulation, of similar
material to the basic layer, is sprayed on and finally finished as a
highly polished surface.

The Napier heater mat may be applied to the surface of suitable
shapes by mechanical means, which normally take the form of
traversing gear linked by a suitable mechanism to the workpiece
turntable in such a way that the rate at which the spray-gun
passes across the workpiece can be controlled. In general, surfaces

OUTER INSULATION
SPRAYED METAL ELEMENT—
BASE INSULATION

Diagrammatic section through the heater mat as applied to a surface.

(3) The stick and rudder pedals operate in a similar manner
in both types of aircraft, hence movement of these controls
is instinctive, although their reactions tend to vary.

The sole argument which can be raised in favour of the selec-
tion of a man of no previous flying experience for training on
helicopters is that he does not have to "unlearn" anything. But
this argument is inadequate, because it takes but a few hours for
an experienced fixed-wing pilot to overcome his aeroplane in-
stincts, and previous piloting experience then becomes an enor-
mous asset. A brief list of the main differences which a fixed-
wing pilot will find when flying a helicopter can be given as
follows:

(1) There is a time-lag following movement of the stick.
(2) Engine handling is more critical.
(3) The aircraft does not stall and lose control when fuselage
air-speed is reduced below a pre-determined figure.
(4) The throttle is not closed when descending; rather is it
used to maintain constant r.p.m.
(5) Fuselage attitude does not have such a direct bearing on the
flight path.
(6) Power changes, especially at slow air-speeds, necessitate
a considerable alteration of the rudder position in order to retain
a directional heading.
(7) In the event of engine failure, the pilot must take imme-
diate action to prevent the rotor slowing down dangerously.

Finally, how does one become a helicopter instructor? There
are various requirements for the issue of instructors' certificates,
depending on past experience, but let us take the case of a pilot
who has just completed 300 hours' flying as pilot-in-charge on
fixed-wing aircraft (without doing any instructional flying), and
who has just taken up helicopter work. He must first of all carry
out 100 hours' flying as pilot-in-charge on helicopters. He then
takes a test from a member of the panel of examiners and, if
found satisfactory, is rated as an assistant instructor. For up-
grading he must complete a further 100 hours of instructional
flying on helicopters and pass a further test. He is then rated as
a full instructor.